



**IPCC WGII
Fourth Assessment Report
Climate Change Impacts, Adaptation and Vulnerability
*Expert Review of First Order Draft***

Specific Comments

Chapter 1

December 5, 2005

Discussion of expert review comments and record keeping

IT IS RECOMMENDED THAT:

- AUTHORS BEGIN WORK ON THE COMMENTS IMMEDIATELY. SUBSTANTIVE COMMENTS NEED TO BE SEPARATED FROM NON-SUBSTANTIVE, AND THE TWO SHOULD BE TREATED DIFFERENTLY
- CONTACT IS MADE BETWEEN AUTHORS AND THEIR REVIEW EDITORS IN DECEMBER

Substantive comments

- The chapter writing team should discuss all substantive expert review comments, by email and/or at Merida.
- Substantive comments require full and proper consideration. The *Principles Governing IPCC Work* state that:
 - genuine controversies should be reflected adequately in the text of the Report and
 - it is the role of the Review Editors to advise the lead authors on how to handle contentious/controversial issues
- You must record the outcome of these discussions in this document, under the column 'Notes of the Writing Team'.

Non-substantive comments

- For non-substantive comments, a very brief entry should be made in the column 'Notes of the Writing Team'. The following terms are acceptable:
 - Addressed
 - Not applicable
 - Text removed
 - A tick to denote a comment has been addressed (somewhere on the document this should be stated)

General

- The record can be kept electronically, or with pen-and-paper.
- The document becomes part of the traceable account of the Working Group II Fourth Assessment. When completed to the satisfaction of the Review Editors, a copy should be returned to the TSU by the **28th February 2006**.

IPCC WGII AR4 FOD Expert Review Comments

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
1-0	A	0				<p>Co-chair and TSU comments</p> <p>This is an organized and well written chapter; however it is mainly referenced on developed countries bibliography. This skewness should be attributed to the lack of access to developing county's authors and no to the lack of studies and research. In this sense, the cryosphere section looks better balanced.</p> <p>Because of the above, coordination with other chapters, in particular the regional chapters would enable a reduction of extensive citation from developed country's authors and the improvement of information from developing country's studies. It is particularly outstanding the lack of references on the urgency to improve the observation networks and the enhancement of data sets through the inclusion of biographical as well as socio-economic information.</p> <p>(Osvaldo Canziani)</p> <p>The TAR concluded that: " climate changes have already affected a diverse set pf physical and biological systems". Can you draft a sentence that summarises the advance made in the AR4 assessment: a) is the link made to GHG warming made (or still tenuous)? b) is the TAR message the same but much (how much?) stronger? or c) are there entirely new systems/fields for which there is evidence of effects now? It is not made clear in the Exec Summary what is really new, as compared with the TAR. Length: current draft is about one-third too long. 84-page text needs reducing to 60 pages.</p> <p>All sections asked for in PAO are covered, but those on hazards and on s-economic are relatively thin (more on this below).</p> <p>All sections asked for in PAO are covered, but those on hazards and on s-economic are relatively thin (more on this below)</p> <p>p 35 Should you consider ocean acidification and its effects on marine life. I know you have already a huge range of material; but o-a is one of the best observed/recorded effects of inc T, with very many ramifications. See: UK Royal Soc report : Policy Document 12/05, June 2005 Ocean acidifcation due to increasing atmospheric carbon dioxide.</p> <p>Tables are effectively used to summarise evidence in many systems; but these are missing from: cryosphere, coastal, health, hazards and socio-economic (although the last probably does not warrant one). Suggest tables in these sections very much needed.</p> <p>Additions of tables (see above) could enable text in each subsection of 1.3 to be reduced by about 30%</p>	<p>Added statement about lack of geographical balance (Sec. 1.1).</p> <p>We conducted a systematic review of each WGII AR4 Sector and Region Chapter, Section 2, Current Sensitivity/Vulnerability and have added relevant studies to Chapter One.</p> <p>Added statement about need for improved observation networks (Sec 1.1).</p> <p>a) Link to GHG warming now clearly stated in Executive Summary. b) Differences with TAR are emphasized in Executive Summary. c) Evidence in new systems, e.g., marine and freshwater, is delineated in Executive Summary.</p> <p>Text shortened.</p> <p>Hazards section expanded with figure showing increase in damage despite normalized costs (Sec. 1.3.8).</p>

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						<p>Suggest you ask Jose Moreno (Eur chapter CLA) for info on forest fire frequency in Spain/Potrugal, which very revealing.</p> <p>Table 1.12 Forestry: see Kellomacki et al. (ACACIA project report p[. 140 ASSESSMENT OF EFFECTS CLIMATE CHANGE IN EUROPE, 2000, Ed Parry, M) regarding evidence for inceased biomass of boreal forest in N. Europe in late 20thC</p> <p>Disasters/Hazards: This section too discursive, lacks detail. Suggest reduce to half length of current text plus one solid table</p> <p>p. 61 Should not the much greater extent of information now available, as evidenced here (as compared with TAR) be made more evident in the conclusions and exec summary?</p> <p>S 1.4.4: Is there only one study of joint attribution? In which case summarise this in about half the current text space.</p> <p>S 1.4.3 Relation to anthropogenic climate change. Cannot you identify regions where relations between regional warming and global warming have been established; and for these regions, then infer that effects related to regional warming are thus related to the global trend? Isn't this a key part of the assessment? But it seems to be missing.</p> <p>S 1.4.5 and 1.4.6 Very weak in comparison with the rest of the chapter. Seems here to be treated as an after-thought. There is, in fact, extensive literature on current adaptation, but I wonder whether you have the space to assess its significance. The questions most relevant here are: Are there lessons we can learn about current adaptation, to address adaptation in the future; is adaptation possibly obscuring observed effects, i.e.leaving no observable residual impact in some situations. Where are these, and are they of a particular kind i.e. more adaptation in some situations than in others. This is a large topic. Decision needs to be made either to address this more thoroughly or more cursorily. Current half-way house seems unsatisfactory</p> <p>Case study on 2003 European summer: suggest you add graph/ statistics from Nature vol 427 analysis</p> <p>Next step: I suggest read all sector and regional chapters in FoD to extract new information on observed effects.</p> <p>General comments made by Martin Parry in Jan 2005 on ZERO-ORDER DRAFT [response in brackets] :</p> <p>1) Strive for balance by also assessing where effects are NOT observed, but where they ARE expected (eg at some ecotones?). Does this indicate resilience of the system? Or imperfect observation or knowledge of system sensivity? [more now in FoD]</p>	<p>Statement added that literature on socio-economic indicators is sparse (Sec. 1.3.9).</p> <p>Ocean acidification emphasized in Executive summary. UK Royal Society Report cited (Sec. 1.3.4).</p> <p>Tables added in Cryosphere, Coastal, and Hazards; not in Socio-economic Indicators (Sec. 1.3.1, 1.3.3, 1.3.8).</p> <p>Text reduced.</p> <p>We requested forest fire frequency studies from Jose Moreno, EUR Chapter CLA to add to Forestry Sec. 1.3.6.</p> <p>We are searching for the ACACIA reference to add to Forestry Sec. 1.3.6.</p> <p>Text reduced, detail added, and table added to Sec. 1.3.8.</p> <p>Added statement to Sec. 1.3.6 and Executive Summary that there is more documentation of responses to climate change.</p> <p>Text of Sec. 1.4.4 shortened.</p> <p>Text in Sec. 1.4.3 clarified and strengthened. Through Joint Attribution we relate regional warming to anthropogenic GHG global warming.</p>

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						<p>2) Length of text is a problem, given the breadth of your subject. Suggest a) you avoid lengthy text by summarising in tables [the tables in the terrest ecos section are excellent examples of dense reporting that would have otherwise taken many pages]. Suggest this approach for all sectors [FoD text still needs to be cut by about the same amount as in ZoD, i.e. by a third]</p> <p>3) Suggest S1.1.2 be shortened to one page of bullet points [done]</p> <p>4) Suggest S1.2.1 be summarised in half the current length [done]</p> <p>5) Sections on ice, water and coasts could be effectively summarised in tables (as done in the terr ecos section) and use much less space). [water done, but not ice, coast, health, hazards]</p> <p>6) 1.3.4 suggest this be condensed to half current length [still needs reduction]</p> <p>7) Obviously, sections on hazards and socio-economic need priority attention [still weak]</p> <p>8) Figure 1.6 could have a European inset? Suspect that plots on this map will increase massively as the literature is searched during your assessment (eg only 1 in Australia, etc?)</p> <p>9) In the health section: how much are the emerging diseases due to changing pol/econ structures?</p> <p>10) Suggest next priority is to quarry all ZoD chapters for info on current sensitivity.</p> <p>11) And then consider as a group the emerging key conclusions: NB the message may be not so much, as in TAR, is there a detectable effect but more detail on this: where is it stronger than elsewhere, where weaker (and does this indicate resilience in systems), where is it not detectable but might be expected (is this due to lag effect or adaptation), what lessons does all this tell us about sensitivity of systems to climate change, about rates of response, and about adaptation, etc etc [not precisely clear how conclusion from this assessment differs from TAR? is it the same but stronger; or is it different?]</p> <p>(Martin Parry)</p>	<p>More literature identified from Chapter 17 and other sources for Sections 1.4.5 and 1.4.6.</p> <p>New CA, Diana Liverman, brought on board for Sect. 1.4.5.</p> <p>Case Study on European Heatwave removed.</p> <p>Systematic search of all sector and region chapters done to identify relevant citations on observed effects.</p> <p>Further discussion of ‘absence of evidence’ added in Sec. 1.4.6.</p> <p>Tables added in every section.</p> <p>Text shortened.</p>

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							<p>Already addressed in FOD. Already done in FOD.</p> <p>Added tables in Cryosphere, Coasts, and Hazards.</p> <p>Sec. 1.3.4 Marine and Freshwater Ecosystems is shortened.</p> <p>Worked with CAs to improve Sec. 1.3.8 and 1.3.9.</p> <p>Regional insets developed.; they will likely be used for supporting material.</p> <p>Caveats strengthened in Sec. 1.3.7 Health, and material reviewed with CLAs and LA of Health Chapter.</p> <p>All FOF Chapters read and articles extracted systematically.</p> <p>Key messages sharpened in Executive Summary.</p>
1-1	A	0	0			<p>Overall Comments: This is a very well written chapter and is, to my mind, probably the most important chapter in the report from a policy/public perception point of view. It is about 20 pages over the specified limit and so will need overall tightening and a reduction in references. There are several sections where multiple references are given and I think these will need some hard pruning. The main problem is that is extremely Northern Hemisphere-focused. Indeed, in some sections, there is no mention at all of the other half of the globe. This imbalance largely reflects the availability of research, which is beyond the authors' control. However, there are certainly some sections for which there is relevant information from other regions that does not appear. I have tried to highlight specific research and papers from the</p>	<p>Text shortened, but not references. Some material moved to supporting material.</p> <p>Text added about geographic balance in Sec. 1.1.</p>

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						<p>Australasian region in specific comments below. I am sure that some of this imbalance will be addressed after the authors have had a chance to read the regional and sectoral chapters. Regardless of how much additional information is added, I think it would be appropriate for the imbalance to be specifically addressed in Section 1.2.2. Clearly the reference formatting needs work both in the text and final list and I have not, in general, commented on this. I have, however, included wording suggestions and noted typographical errors.</p> <p>(Lesley Hughes, Macquarie University)</p>	<p>Australasian references added.</p> <p>Text added about geographic balance in Sec. 1.2.2 Data.</p>
1-2	A	0	19			<p>(i) the general impression from the text is of fragmentation, with some sub-sections being very short (of one sentence only: p. 19, line 32 and line 37 – these can be joined to the sub-section starting on line 18;</p> <p>(Antoaneta Yotova, National Institute of Meteorology and Hydrology)</p>	Short sections combined, especially in Sec. 1.3.1 Cryosphere.
1-3	A	0				<p>I feel there is an excessive length in the description of findings on Marine and freshwater biological systems (1.3.4) and Terrestrial biological systems (1.3.5). I had finally less time I supposed in order to review the report and I had to concentrate in those aspects more interesting to me. I apologize for that. My general opinion about the structure and content (Chapters 1 and 12) is very good and I think the authors did a good job.</p> <p>(Sergio Alonso, Universitat de les Illes Balears (University of the Balearic Islands))</p>	Sec. 1.3.4 Marine and Freshwater Biological Systems shortened.
1-4	A	0				<p>Overall, I find this chapter to be well written, balanced and results are clearly summarised. Many of the references I know appear and I could not find any major gaps in this review.</p> <p>I have noted that in some parts of the report chapter features about the marine realm (about 70% of the Earth surface) are forgotten (see my specific comments). For example, the section 1.2.1 devoted on non-climatic drivers does not mention overfishing or eutrophication. The section 1.2.2.1. on remote sensing do not mention its use for assessing changes in marine ecosystems (productivity and so on). Only applications to the terrestrial realm are mentioned.</p> <p>I know that the level of confidence is defined in other assessment reports but for readers not familiar with, you should redefine the different levels of confidence from the start of the report. At least, it should be defined somewhere.</p> <p>I have noted some redundancies in some sections. For example, page 35 line 10, something is said about acidification. The same idea is written page 37 line 10 with another reference. Please avoid repetition like this as it increases the length of the report and make it less synthetic.</p> <p>I have seen throughout the paper the terms ‘climatic changes’ ‘climate changes’ ‘climate change’ ‘anthropogenic climate change’ ‘global climate change’ ‘climate</p>	<p>Added marine effects throughout, especially in Sec. 1.2.1 on non-climate drivers and 1.2.2.1 remote sensing. Added overfishing and eutrophication.</p> <p>Confidence statements sharpened.</p> <p>Confidence levels defined elsewhere in Report.</p> <p>Ocean acidification and other redundancies eliminated.</p>

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						<p>(change)’ ‘natural climate variability’ ‘greenhouse-induced warming’. Please clarify the terms. I know that some are described in the glossary of the IPCC WGI SAR. While for aquatic systems and human health, the impact of large-scale climate variability (NAO or ENSO) is considered, for terrestrial ecosystems this is not so. There are however a number of studies that have examined the impact of the NAO or ENSO on natural systems (e.g. see Stenseth et al 2002 science 297:1292 or Stenseth et al 2003 Proc R Soc Lon B). Why this is not reviewed for terrestrial ecosystems? This is also a matter of consistency. (Gregory Beaugrand, univ-lille)</p>	<p>Climate change terms defined more clearly and their use sharpened.</p> <p>ENSO and NAO studies moved from Sec. 1.4 to Sec. 1.3.5</p>
1-5	A	0				<p>This is an excellent first order draft, extremely rich in detail. It is well written and well documented. It is too long, and the best way to reduce it might be to cut out some of the anecdotal, case by case, reporting of changes and try to find more generic ways of expressing the findings. Summary tables and figures are helpful in this regard.</p> <p>The chapter is much stronger on observed changes on geophysical and biological changes (Sections 1.3.1 to 1.3.5, and much weaker on socio-economic changes, (Sections 1.3.6 to 1.3.9). Do the authors have any assessment to offer on whether this is due to the lack of literature, or a lack of changes? Some further consideration could be given to the issue of socio-economic changes.</p> <p>The chapter appears to be silent on the significance of the observed geophysical and biological changes. Is their significance primarily to demonstrate that climate change is occurring and that impacts are increasing? (I wonder why the title uses the word “changes” and not impacts”). Are there any second-order changes? For example many changes in marine, freshwater and terrestrial biological systems are reported. Are these having any secondary or knock-on effects? Do such effects carry over to socio-economic systems?</p> <p>The title includes the word “responses”, but the chapter seems to be much weaker on responses than changes. Or do I miss something? What is the difference anyway between changes and responses?</p> <p>Towards the end (Section 1.4.7 and 1.4.8) there is some discussion of adaptation responses. This is relatively weak and could be considerably expanded, but perhaps it is adequately covered in other chapters. One important point that is not discussed is the difference between adaptation in geophysical and biological and socio-economic systems. I think that there is a history of sloppy use of the word adaptation in the climate impacts literature (including the IPCC). “Adaptation” is used to apply to all three types of systems and all sorts of processes. Is the WAIS adapting? Are coral</p>	<p>Text shortened; more summaries have been added and case-by-case listings eliminated.</p> <p>CA brought on to discuss socio-economic changes further.</p> <p>Key messages have been sharpened and their significance evaluated.</p> <p>Use of term ‘responses’ clarified in Sec. 1.1.</p> <p>Adaptation terminology clarified in Sec. 1.1.</p>

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						reefs and birds adapting? Are farmers adapting? The adaptation processes are very different, to the extent that I doubt the merit of using the same word to apply to them all. At the very least some qualifiers could be used. (Ian Burton, University of Toronto)	
1-6	A	0				First at all congratulations to all of you for a ery nice and excellent work. I just found some very and few small details. I noted that many citations do not have the year along with them and that will be corrected for the final version. After looking the reference I also noted that some of them have , I guess, the the last name of the first two authors and then the "et al"; however, others have all the authors named even if the article has more than 3 (see Arendt et al 2002). I do not know if in the text some citations has the same way if so, it is somehow confusing. So I suggest to used the general used of how to refer articles. (Jorge Carrasco, Dirección Meteorológica de Chile)	Reference citations have been corrected.
1-7	A	0				In general the recomandations for chapter 1 have been followed by the authors. There is, with a very few exceptions, no major references missing, all papers cited have been published between 1999 and 2005, and the outline has been followed. However, if the maximum number of pages allowed for this chapter is 40 including the references, in its present state the chapter will be longer than 40 pages. I would tend to think that the length of this chapter has been underestimated, but should it be no more than 40 pages, I think I would reduce substantially section 1.2. which I found not convincing. Also, I would like to note that if grey litterature is not overrepresented, a few citations which appear important could not be checked because incompletely referenced (see specific comments). Generally citations were difficult to checked because of incomplete citation and incomplete reference which did not facilitate the review. In specific comments I do not indicate citation problem as there are too many. I tend to think that the coherence of this chapter would have increased if a single section would have dealt with the impact of CC on living organisms, eitherfreshwater/marine or terrestrial, wild or cultivated. (Isabelle Chuine, CNRS)	Text has been shortened. Section 1.2 Methods has been reduced. Reference citations have been corrected. The split into the different biological systems is to provide focus on each, particularly the new evidence emerging from marine and freshwater biological systems.
1-8	A	0				litterature is unevenly cited (eg year is lacking) (Bernard Clot, MeteoSwiss)	Reference citations have been corrected.
1-9	A	0				As an overall impression, this chapter is highly superficial in nature. Throughout the text, it is indicated or suggested that the period of changes examined covers somewhere between 30 and 50 years. Over this period, changes were indeed dramatic for some parameters, but those elements are not properly put in perspective. There is	Observed changes in systems and sectors are linked more directly to observed climate

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						<p>barely any quantitative information. The objective of the report and its focus would be on the observed changes directly related or closely related in response to climate change. There are very many sub-paragraphs, but extremely few of such paragraphs provide quantitative information. In most cases, there are references, but very likely, most readers will not have the ability and/or the time to search for all the information. Reducing the number of entries and discussing more in-depth fewer essential elements with supporting data would help demonstrate the topic, and make this chapter more interesting.</p> <p>Globally, there is a need for synthesizing the information. Furthermore, if there is no direct relevance to climate change, such paragraphs should be omitted.</p> <p>Reference to literature is very poor. In the document provided for review, many references are not well listed, and it would be another exercise to verify the relevance of all entries.</p> <p>(Raymond Desjardins, N/A)</p>	<p>changes.</p> <p>Assessments have been rewritten to be more quantitative.</p> <p>More supporting data are shown.</p> <p>Studies assessed in Sec. 1.3 are now directly linked to those used for the synthesis in Sec. 1.4 through the selection criteria.</p> <p>Paragraphs without references are eliminated.</p> <p>Reference citations have been corrected.</p>
1-10	A	0				<p>Systems and sectors studied hier, in chapter 1, react to any warming either natural or due to men. But warming during the last century was not regular all over the period, being first till about 1940 of natural origin and from the 70's from human influence, this last warming is the "climate change" (IPCC, 2001). Recent warming during this last period is more rapid than during the beginning of the century. As many studies refer to periods longer than the "climate change" , it must be clear that results obtained during these periods just give an idea of what could happen during the "climate change" without representing it exactly because warming was then faster than before (higher warming during 25-30 years than during 40 especially in the north of the Northern hemisphere which is often mentionned in the chapter). So I suggest to add a first paragraph at the Executive Summary (see below).</p> <p>Due to the previous point the use of the word "change" must be very clear. Or it seems to me that it is used with two different meanings in this chapter. In "climate change" it means a signifant modification but in many other pages it only means a modification (from Section1,3,1,to Section 1,3,6 particularly). Many titles begin by "Changes in..." but don't wonder if the changes they mention are significant or not. So they are putting in parallel a significant change, the one related to climate, and modifications about which the question if they are or not significant is not asked according to the text. It does not seem to me possible to obtain confident conclusions from such comparisons.</p> <p>The previous first point has a consequence for trends; they cannot be monotonic from</p>	<p>For studies that are over longer timeperiods than the most recent 30 years, caveats are added about sign-switching, rates of change, etc.</p> <p>Use of 'change' terminology has been sharpened. Selection criteria has been defined, including time-periods and significance of both climate and observed changes in system or sector.</p>

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						<p>1900 to 2000 because during 30 years or more warming stopped or even temperature decreased and because the increase of the temperature was different between the beginning of the century and the "climate change" period. A mean value of a monotonic trend computed during a century does not seem to me a correct value for the last decades. It seems to me that there is a confusion on that point all along the chapter.</p> <p>A second point regarding trends but also associated with the previous remark on the word "change". "Climate change" supposes a significant variation, from the statistical point of view, of temperature or other climatical parameter and also a significant response; otherwise it is only variability. This must be clear since the beginning of the chapter and not only in 1,2 Methods of detection (7,40-42) and Statistical techniques (14,9) because in many results, in spite of the claim at 14,9, the reader does not know if they are significant or not which means that he does not know if they really involve a "climate change".</p> <p>(Annick Douguedroit, Université de Provence)</p>	<p>See above. Sign-switching addressed explicitly where appropriate.</p> <p>Included definitions of changes earlier as well as selection criteria.</p>
1-11	A	0				<p>sections of chapter 1 are not consistent in structure: It's obvious that not all sections can be structured exactly in the same way but key messages such as "attribution to climate change", "absence of observed effects & conflicting evidence" should be included either before the "summary" or within the "summary part of the chapters in all sections of chapter 1</p> <p>The overall impression of Chapter 1 is rather eurocentric. It is clear that examples have to be used to describe climate change impacts and attribution but all sections should be checked if information can be communicated on a broader more global scale. It should be checked if figures and graphs describing regional or local impacts can be replaced by more global assessments (e.g. storm 1.3.1, forest fires a.s.o)</p> <p>As remarked in the different sections the administrative level of adaptation is almost completely neglected especially in the energy sector. There is also adaptation in tourism, especially in winter tourism as already mentioned</p> <p>(Markus Erhard, Forschungszentrum Karlsruhe)</p>	<p>Sections have been made mostly consistent in structure.</p> <p>Systematic survey of all other WGII AR4 chapters was conducted to address balance.</p> <p>Most local and regional figures removed.</p> <p>Adaptation addressed in Sec. 1.3.9.</p>
1-12	A	0				<p>Most confidence statements in the Executive Summary state a lower confidence than the reviewed literature suggests. For instance, "medium confidence" is defined in the AR4 Uncertainty Guidance Notes as having "about 5 out of 10 chance" of being correct. In other words, "medium confidence" should be used to denote statements where it is about as likely being correct as being incorrect. In the Executive Summary, however, "medium confidence" is often applied to statements where the evidence of being correct is much larger than the evidence for being incorrect. The</p>	<p>Confidence statements revised.</p>

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						<p>correct application of the AR4 Uncertainty Guidance Notes would suggest to change the following confidence statements:</p> <ul style="list-style-type: none"> * p.3, l. 7: high -> very high * p.3, l.20: high -> very high * p.3, l.22: medium -> high * p.3, l.30: high -> very high * p.3, l.34: modest -> high * p.3, l.36: modest -> high * p.3, l.40: medium -> high * p.3, l.48: high -> very high * p.4, l.11: edium -> high * p.4, l.12: medium -> very high * p.4, l.13: medium -> high * p.4, l.20: high -> very high * p.4, l.22: high -> very high * p.4, l.30: medium -> high * p.4, l.48: high -> very high * p.5, l. 9: high -> very high <p>(Hans Martin Fussel, Stanford University)</p>	
1-13	A	0				<p>The chapter is very well organized and introduced nicely the rest of the report. However, the Executive Summary seems to overlook issues related to Asia. (Savitri Garivait, The Joint Graduate School of Energy and Environment (JGSEE))</p>	<p>Checked Asia chapter for references; included where appropriate. Executive Summary does not focus on WGII regions per se.</p>
1-14	A	0				<p>This chapter overall has a broad scope, and is an important component of the WGII report. While it certainly presents some interesting results, I think the chapter as a whole would benefit from more synthesis. In several cases the results and interpretation of single studies are cited uncritically, with little attempt to synthesize the body of research on a topic, while some paragraphs lack references entirely. The overall structure would also benefit from sharpening. In several cases the same results are described and discussed in more than one section, leading to repetition. Lastly, I think overall the expressed level of confidence in many climate changes seems to be higher than in corresponding sections of the WGI report, and I have tried to draw attention to these instances where I find them.</p> <p>In many parts of the chapter the authors refer to an acceleration of climate change or its impacts. Particularly for fields where any trend is only just statistically significant, it must be much more difficult to demonstrate a statistically significant acceleration of the trend. Indeed WGI does not describe accelerating trends very much as far as I</p>	<p>More explicit synthesis included.</p> <p>Redundancies eliminated.</p> <p>Structure has been sharpened.</p> <p>We have compared confidence statements with WGI.</p> <p>‘Acceleration’ of climate change has been eliminated, especially in Cryosphere section.</p>

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						know. Therefore I wonder whether all the instances of accelerating climate trends discussed in the chapter are really statistically significant and well-substantiated. For example the introduction refers to very high confidence that the cryosphere is undergoing an 'accelerated melting'. (Nathan Gillett, University of East Anglia)	
1-15	A	0				General comment. The use of the term "vulnerable" on line 44, page 24 implies that CC will have a negative impact, but as the previous comment notes, some of the impacts will be quite positive. Accordingly, one should substitute "sensitive" for "vulnerable". There should be a global search for "vulnerable" in this chapter, and each use should be reviewed. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Use of 'vulnerable' reviewed, and 'sensitive' substituted where appropriate.
1-16	A	0				Following are the references alluded to in my comments. Most are available from my home page at http://members.cox.net/igoklany/ . I'll also be happy to send hard copies, if requested: 1. Goklany, IM. 1996. "Factors Affecting Environmental Impacts: The Effects of Technology on Long Term Trends in Cropland, Air Pollution and Water-related Diseases." <i>Ambio</i> 25: 497-503. 2. Goklany, IM. 1998. "Saving Habitat and Conserving Biodiversity on a Crowded Planet." <i>BioScience</i> 48 : 941-953. 3. Goklany, IM. 2000. "Potential Consequences of Increasing Atmospheric CO2 Concentration Compared to Other Environmental Problems." <i>Technology</i> 7S: 189-213. 4. Goklany, IM. 2001. <i>The Precautionary Principle: A Critical Appraisal of Environmental Risk Assessment</i> (Cato Institute, Washington, DC). 5. Goklany, IM. 2001a. "Precaution Without Perversity: A Comprehensive Application of the Precautionary Principle to Genetically Modified Crops." <i>Biotechnology Law Report</i> 21 (June 2001): 377-396 6. "From Precautionary Principle to Risk-Risk Analysis." <i>Nature Biotechnology</i> 20 (November 2002): 1075 7. Goklany, IM. 2003. "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," <i>Energy & Environment</i> 14: 797-822.. 8. Goklany, IM. 2005. "A Climate Policy for the Short and Medium Term: Stabilization or Adaptation?" <i>Energy & Environment</i> 16: 667-680. 9. Goklany, IM. 2005b. "Integrated Strategies to Reduce Vulnerability and Advance Adaptation, Mitigation, and Sustainable Development," accepted by <i>Mitigation and Adaptation Strategies for Global Change</i> .	References checked and cited where appropriate. In most cases, studies were not of observed changes.

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						<p>10. Goklany, IM. 2005c. "Is Climate Change the 21st Century's Most Urgent Environmental Problem?" Lindenwood University, Economic Policy Lecture 7 (St. Charles, MO, Lindenwood University, 2005). Also forthcoming in SOCIETY (Transaction : Social Science and Modern Society)</p> <p>(Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	
1-17	A	0				<p>I compared Chapter 1 with a few Chapters of WG-1 IPCC that I was reviewing. I noted a striking difference in the level of referencing. Many statements in chapter 1 of WG2 are not backed by references. Sometimes the entire paragraph has not a single reference. Apparently these statements are obvious but then we may skip them (or leave only for executive summary).</p> <p>The absence of the scientists from the former USSR among the contributors and lead authors biased the Chapter. Numerous studies that report environmental changes in this region (where the largest climatic changes in the last few decades were reported (cf., Ch. 3 and Ch.4 of the WG1 report) are omitted. Serious efforts should be made to fix this gap.</p> <p>(Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)</p>	<p>References are now cited in every paragraph.</p> <p>Efforts made to extract references from WGII Chapter 3 (Water) and contact Russian authors for translations of abstracts.</p>
1-18	A	0				<p>The tables of observed changes need a consistent format. I prefer the format shown in Table 1.8 (location, time period, species/indicator, observed change, author). For some tables there will need to be modifications, but overall the order of information should be similar in all tables.</p> <p>(Kimberly Hall, Michigan State University)</p>	<p>Tables have been made consistent.</p>
1-19	A	0				<p>Good chapter, well integrated, good sections on evidence. Need to segregate within decadal and between decadal change</p> <p>(Stephen J. Hawkins, The Marine Biological Association of the UK)</p>	<p>Timescales of climate variability clarified throughout chapter.</p>
1-20	A	0				<p>Regarding the overall structure I am concerned that in the discussion of hydrology and water resources under observed changes that there is little discussion of the concept of Intensification of the global water cycle and its significance for sustainability of water resources - on the one hand, for areas that are likely to get wetter in a warming climate this will mitigate increases in ET with the net result that water supplies will enjoy some protection in the future. On the other hand, there a potential negative consequences in area that will likely become drier under this intensified water cycle AND there are potential negative consequences for more intense episodic precipitation. In Addition I think that there should be mention of the fact that intensification of the water cycle may also result in increased water vapor in the atmosphere and that this feedback will amplify warming. These arguments and evidence for an intensifying water cycle are noted in Huntington (In</p>	<p>Added discussion of intensification of global water cycle, including evidence from precipitation, evapotranspiration, and water vapor.</p>

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						Press): Huntington, T. G. In Press, Evidence for intensification of the global water cycle: review and synthesis, Journal of Hydrology. (Thomas Huntington, U.S. Geological Survey)	Reference obtained.
1-21	A	0				general comment on coastal area and coral reefs. In general, many examples for non-climate stresses (in the case of coastal area and coral reefs, artificial construction, over-fishing, nutrient input, increasing (by agriculture) or decreasing (by dams) sediment supply, pollutants.. are shown. I understand these non-climate factors put cumulative stresses to coastal areas and coral reefs. However, the scope of IPCC is not for environmental issues in general, but for global climate change, and the readers want to know how these local stresses act to degrade the coastal area and coral reefs in combination with global environmental changes. (Hajime Kayanne, University of Tokyo)	In Coastal and Coral Reefs Sections, interactions between climate change and non-climate stresses are more clearly defined. Focus on climate change is made explicit.
1-22	A	0				Overall, this is excellent work. I believe the tone of the chapter is often such that it seems that scientists are looking to prove a point rather than adopting the more objective approach of testing for a signal of climate change. Some revision to recognize that the latter approach is actually widely used would make the findings sound less like advocacy and more like objectivity. I think this is important. This report will probably define the debate for at least the 5 years after it is published, which means to the end of Kyoto and into whatever comes after. The findings that can be reported here are sufficiently alarming to stand entirely on their merits. So, I recommend that some consideration be given to adopting a more "scientific" tone in a few places in this chapter. But this is a minor concern: the work is superb and I have no substantial complaints about it save one: that the likely contributions of land use change to some phenomena that are too easily attributed to climate be recognized. Land use change may not be proven to affect some of these trends, but it certainly contributed to some of them and we weaken the case for controlling climate change by failing to recognize a few uncertainties of this nature more explicitly. (Jeremy Kerr, University of Ottawa)	Care has been taken to maintain objectivity throughout the chapter. Focus is on testing to see if climate change signal in observed changes in systems and sectors is robust. 'Land-use' caveats have been added/emphasized where appropriate.
1-23	A	0				Overall Comments: 1. This chapter must be re-written to include observations of anomalous(extreme) weather & climate events of last few years of both summer and winter seasons in both the hemispheres. These observations should be discussed in the context of recent global warming and climate change metric vs. natural climate variability as evidenced by large-scale circulation changes. Among the important changes in last few years are: Mean temperature of earth's surface (land-water combined) has been slowly declining since the warmest year of 1998, this warmest year being attributed to the impact of 1997/98 El Nino. Also mean temperature over USA and Canada has declined following 1998 (see AMS Bulletin, June 2005, Fig.	This chapter focuses on observed changes in regard to long-term (>= 20 years) trends in climate (including both means and extremes) not on climate and climate variability itself. That is handled in WGI. More discussion of large-scale climate

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						<p>6.1 & 6.6, p. S44, S48); summer 2004 was one of the coldest over N America in many years. Some discussion is required re: declining temperatures over North America and almost no temperature change over Australia and southwest Pacific. Refer to a paper by Stanhill "Global dimming--" Weather (UK), January 2005</p> <p>Overall Comments:2. The discussion on Arctic cryosphere reduction and temperature increase must be accompanied by observed changes over Antarctica where mean temperature has declined in last 25 years and snow/ice has increased resulting in increased growth of ice sheets over eastern Antarctica. The discussion should focus on why Antarctic changes are almost opposite to changes over the Arctic. Refer to paper by Chelyk et al, Climatic Change, 2004, 63,p.201-221. This paper documents significant cooling at Greenland coastal stations and also at the summit of Greenland ice sheets.</p> <p>Overall Comments:3. It is now clear that many of the climate change impacts are either beneficial or not deleterious to human societies. This aspect of climate change must be brought out. Specifically, Agriculture & Forestry and Human Health issues are not being impacted adversely at this point in time. If anything, there is a definite beneficial change in these two areas as a result of improved technology, improved standard of living world-wide and beneficial climate change impact. (Madhav Khandekar, Retired research scientist and consulting meteorologist)</p>	<p>variability systems has now been included in Sections 1.2 and 1.3 where appropriate.</p> <p>Global dimming paper has been located.</p> <p>Included observed changes in Antarctica.</p> <p>Effort has been made to include all types of changes, whether perceived ot be 'positive' or 'negative.'</p>
1-24	A	0				<p>1. This Chapter, as the title suggests, is meant to assess observed changes in the earth's climate system in recent years and in particular since TAR (Third Assessment Report) 2001. The authors of the chapter have used a large number of reported studies in literature (peer-reviewd as well as other studies) to document changes in the climate system. The authors have completely ignored the fact that there are large datasets on observed changes available in various national and international data centres and very few of these datasets have been analyzed and reported in published studies. There is a definite need to include some of major climate events and anomalies of the last few years as revealed by the datasets and discuss these in the context of present debate on global warming and Climate change. Without an adequate discussion of observed changes based on available weather & climate data, the text of the chapter appears meaningless. The Chapter must be re-written to include various examples of weather/climate anomalies of recent years in the context of "human-induced" climate change.</p> <p>2. The authors of the chapter have predominantly used references which support the hypothesis of human-induced climate change, while ignoring a number of published</p>	<p>This chapter focuses on observed changes in systems and sectors, not on climate data per se. See WGI for discussion of cliamte changes and recent major climate events.</p> <p>Appropriate chapters of WGI are referred to.</p> <p>Studies were included from a wide range of literature. Please provide references for</p>

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						<p>studies which have questioned this hypothesis and have provided alternative view of climate change. It is essential to include several of these studies to provide a balanced and a meaningful assessment of observed changes.</p> <p>3. The authors have listed several observed changes in the Executive Summary with a strong suggestion that most of the changes are deleterious to human society. There are several examples and studies which suggest beneficial effects of climate change (e.g., increased agriculture & forestry due to increased precipitation and CO2 on a global scale; milder winters in high latitude countries of Northern Hemisphere making winter season more comfortable with less energy use for house heating etc.). The Executive Summary must include examples of beneficial effects of climate change.</p> <p>4. The Chapter can be and must be condensed by deleting/reducing several sections which are of minor importance (e.g., section 1.2.3 "methods" and section 1.3.5.2 "changes in phenology"). The discussion on such sections should be shortened so as to highlight only the most important & critical climate change impacts which can be deleterious to human society, either at present or in future, 20 to 25 years from now. See additional comments for various sections. (Madhav Khandekar, Retired research scientist and consulting meteorologist)</p>	<p>further studies mentioned in comment.</p> <p>Executive Summary lists changes of a variety of types.</p> <p>Text has been shortened.</p> <p>This chapter does not focus on projected impacts, only observed ones.</p>
1-25	A	0				<p>It is unclear what the purpose of this chapter is, in view of the detailed chapters on various topics. If this chapter is to provide a welcome overview of WG-2 analyses, then it should better incorporate the conclusions of various chapters rather than reviewing snippets of particular literature in the various areas. If it is to remain true to its title, documentation of observed changes, it might be useful to use the summary format of chapter 5, changes observed by degree of certainty that they are linked to climate change. (C. Gregory Knight, Pennsylvania State University)</p>	<p>We have checked the table in Chapter 5, as suggested. The synthesis in Sec. 1.4 links the changes in systems and sectors that are assessed to climate change.</p>
1-26	A	0				<p>Drought in Bulgaria, A Contemporary Analog for Climate Change (2004; eds. C. G. Knight, I. Raev, M. P. Staneva), Aldershot, UK: Ashgate) may be useful to the authors as an example of using a contemporary period of drought to suggest concerns about plausible future climate impacts, especially on water, but natural and managed ecosystems. (C. Gregory Knight, Pennsylvania State University)</p>	<p>This chapter is focused on recent climate changes, not on studying current climate variability and not on characterizing potential future impacts. Reference was checked to see if it documents an observed change, rather than a period of drought under current climate variability.</p>
1-27	A	0				<p>The human health section of the chapter could be better conceptualised. If it was renamed "Disease and vector ecology" or "Disease and vector systems" it would better describe the literature available and be more informative. It would also allow inclusion of the relevant literature from animal, and even plant diseases (pests,</p>	<p>Health section (Sec. 1.3.7) revised according to reviewer's suggestions.</p>

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						<p>vectors). The non disease health outcomes are also addressed in other sections of this chapter. Thus the literature on pollen related diseases is all in pollen phenology discussion on biological terrestrial systems - and there are no empirical papers that directly link climate change with allergen-related health outcomes as yet. The literature on heat stress is confined to studies of climate data on the observed changes in the frequency of temperature extremes.</p> <p>There conclusions of this chapter should be consistent with the conclusions on early effects in other chapters. In particular, conclusions should be consistent with those in chapter 8 where they are addressed in some detail.</p> <p>A large gap in this chapter is the literature/evidence on animal diseases, particularly vectorborne animal diseases. This issue was raised and discussed at LA2. Some important publications that address changes in the latitudinal distribution of zoonoses and vectors are missing - for example Purse, B.V., P.S. Mellor, D.J. Rogers, A.R. Samuel, P.P.C. Mertens, and M. Baylis, 2005: Climate change and the recent emergence of bluetongue in Europe. Nature Reviews Microbiology, 3, pp. 171.</p> <p>Cross reference to chapter 8, section 8.2.9</p> <p>This chapter is well written and well structured, given the complexity of the material addressed.</p> <p>(Sari Kovats, London School of Hygiene and Tropical Medicine)</p>	<p>Information about wildlife and plant diseases has been added.</p> <p>Conclusions have been checked for consistency with Chapter 8 Health.</p> <p>Obtained references.</p>
1-28	A	0				<p>As an LA on WGIII (Mitigation) and on buildings (Chap 6) I see no definition of adaptation except in Ch 18 and from the TAR. Often for the built environment adaptation and mitigation overlap (e.g. building regs). Reference to TAR and Chapt 18 defs here would be useful.</p> <p>There are a number of references to the 2003 heat wave in Europe. Deaths in winter due to cold in the vulnerable, in fuel poverty, outnumber summer deaths and the reduction in the winter deaths could outnumber heat wave deaths, but the aim should be to reduce both.</p> <p>(Geoffrey Levermore, Manchester University)</p>	<p>Current WGII definitions of adaptation have been referenced.</p> <p>Box on EU Heatwave of 2003 have been removed.</p>
1-29	A	0				<p>Throughout the full chapter there is absolute lack of recognition of certain scales of variation, particularly longer than the 3-7 year ENSO frequency. Although some mentions are made of the PDO and NAO, both displaying frequencies notably longer, this is a very active field of research, particularly in the most recent years. Many events occur in decadal, interdecadal or multidecadal frequencies.</p> <p>Most of the documented changes in the marine environment along the full chapter are referring basically to the post mid-1970s regime shift, the most documented multiannual trend reversal. However, there are considerable evidences that a new shift occurred during recent years, this time of opposite sign to the former one. We</p>	<p>Definition of time-scales of climate variation has been sharpened in Sec. 1.2.</p> <p>A brief discussion of the recent climate shift was added and very recent trends are noted, but this topic is covered primarily in WGI.</p> <p>Links to WGI Chapter 5 are made explicitly.</p>

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						<p>should expect to see along the immediate future years a cooling trend similar to that which took place between the 1940s and the mid-1970s. If this would result to be the case, many of the processes described along the chapter will have to be revised; moreover, it would be very inconvenient that it was not anticipated somehow in this report.</p> <p>Further, hopefully will believe that such cooling (if happens) could be a result of actions not taken. It would be much more appropriate, in my view, to state the corresponding reservations at this time.</p> <p>The point is even less understandable because decadal variation and climatic regime shifts are discussed in Chapter 5 of WG1 (see para 5.3.3.1 and 5.3.3.2); why are they are not incorporated here?</p> <p>(Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)</p>	
1-30	A	0				<p>The overall discussion is well organized and evidences of the matter generally well described and documented. References are generally consistent, but some should be added as discussed in the next lines.</p> <p>Citation in the text NOT properly reported. In most of the cases years are missing.</p> <p>(Giampiero Maracchi, Institute of Biometeorology)</p>	<p>Noted.</p> <p>Citations corrected</p>
1-31	A	0				<p>General: The writing team should be congratulated on achieving a major improvement in this chapter. It is now well-structured and a fascinating read. It is a significant synthesis of material.</p> <p>The Executive Summary is accessible and accurate and is a good model for other chapters.</p> <p>(Merylyn McKenzie Hedger, Environment Agency)</p>	<p>Thank you!</p>
1-32	A	0				<p>This may be the most important chapter in AR4. Congratulations on a remarkable synthesis.</p> <p>As the insurance industry is not monolithic, this section could be improved by recognizing the different types of insurance and associated impacts of concern (property, business interruption, liability, life, health, etc.)</p> <p>Some of our recent publications might be of use. These include: http://eetd.lbl.gov/emills/PUBS/Insurance_Science.html and http://eetd.lbl.gov/EMills/PUBS/PDF/ceres-insure_report.pdf and http://eetd.lbl.gov/EMills/PUBS/Insurance_Emerging_Markets.html</p> <p>I'm happy to see the advent of liaison authors to WG1. Although I have not read the WGI FOD's it appears that there are rather few cross references in this chapter. I encourage you to establish more cross references as you develop this chapter.</p> <p>It would be valuable to have a summary table that compactly lists all of the observed impacts, associated confidence levels, and perhaps the "sign" (positive or adverse).</p>	<p>Discussion included of different types of insurance.</p> <p>References checked.</p> <p>More cross-references to both WGI and WGII Chapters added.</p> <p>Changes for entire chapter are too many to</p>

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						Table 1.14 (or a simplified version) is probably also appropriate for the Executive Summary. (Evan Mills, Lawrence Berkeley National Laboratory)	be summarized in one table. Summary table added to Technical Summary.
1-33	A	0				The chapter contains much useful information in the tables. They each need to be further organized according to a clear and appropriate organizing principle; e.g., for terrestrial ecosystems, either by taxa or location. For example, Table 1.9 jumps from butterflies, to birds, and then back to spittlebugs; and from Europe to N. America to Britain to Costa Rica and then back to Britain. The biggest potential problem in this chapter is the tendency for it to read in some places like an accumulation of observations rather than providing an overall perspective of what the various changes mean in a broader context. It might be useful for the authors to come up with an outline of each subsection and each paragraph, and try to see how the different paragraphs actually fit together. (David Rind, NASA/GISS)	Tables have been re-organized to be more consistent. Effort has been made to synthesize and assess throughout the chapter, rather than to list observations.
1-34	A	0				In many cases term "forest fires" could be added by peat fires very often accompanying forest fires in highly palydified boreal and tropical zones having extremely high negative effect on the environment. Release of longterm stored carbon from burned peat to the atmosphere could have very high feedback to climate warming. (Andrey Sirin, Institute of Forest Science Russian Academy of Sciences)	We ask that the reviewer please provide actual references for trends in peat fires.
1-35	A	0				I think this chapter has the potential to be one of the most important in the whole of the IPCC AR4 report across the three working groups. The authors have done an excellent job but because the implications of the attribution statement are SO important I think some extra care needs to be taken in the presentation of "joint attribution". Most of the chapter consists of a discussion of observed changes in systems and sectors. Many different aspects are covered and the implication a reader might draw from many of them is that they are indicators of anthropogenic climate change. An example chosen at random is 1.3.3.3 and fig 1.5 on wave height in the Pacific - it would be very difficult from this data alone to conclude anything about whether increased greenhouse gas emissions have caused an increase in significant open water wave height in the vicinity of Rarotonga. The detailed discussion of this issue belongs in WGI but WGII concludes here that "The increasing volatility of the Pacific Region's weather and climate is already apparent". Many other such examples from the chapter could be chosen (eg whether changes in	Joint attribution statements have been sharpened. Linkages have been made more stongly via selection criteria for studies assessed in Sec. 1.3 to be included in the synthesis in Sec. 1.4. Wave heights are assessed in WGII since they are an important component of coastal storm impacts. WGI Chapter cross-referenced.

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						<p>wine vintage can be linked to anthropogenic climate change). The point is that in my opinion the chapter should make a clear separation between these aspects of the report and the joint attribution statement which depends on the meta analyses described in 1.4. It seems to me that the "high confidence" of "joint attribution" should NOT depend on a subjective cumulative confidence that might be derived from reading 1.3. This is because of the myriad confounding non-climate factors that could influence responses (eg the wine vintage) and the difficulty (greatest with records of just a few decades) of separating out climate variability from climate change (eg the Tongan wave heights).</p> <p>Coming to 1.4 the evidence for the "high confidence" statement comes principally from two meta analyses, the analysis of Root et al (fig 1.13) and the analysis described in Table 1.14 and Figure 1.12. My problem with the presentation of the analysis of fig 1.13 is that it relies on two trends. Two coincident trends could be fortuitous but the "unambiguous detection and attribution" relies, I would presume, on the high degree of correlation between PATTERNS of changes in temperature and of responses. I think this needs to be brought out more. Alternatively I would question the use of "unambiguous" if it depends on two trends.</p> <p>Table 1.14 presents important information supporting the "joint attribution" statement. Is this going to be published ? The evidence would be strengthened if there were more entries in the negative changes in temperature row. Whereas the annual temperature trends in fig 1.12 are almost all positive the MAM temperature trends shown in WGI Chap 3 Fig 3.2.10 of the FOD have regions of cooling over land areas which makes me wonder whether looking at spring temperatures here (as in 1.13) might be illuminating.</p> <p>In conclusion I think that the "joint attribution statement" (page 5, lines 16-19) has the potential to being one of the most important statements to come out of AR4. However I do not think the report AS IT STANDS fully supports "high confidence" in this statement. In my opinion, the SOD could achieve this by careful demarcation between the non-attribution and attribution sections of the chapter and by refinement of the presentation of the meta analyses in 1.4.</p> <p>The current structure of the chapter is not ideal. 1.4.7 and 1.4.8 don't seem to belong</p>	<p>Multiple drivers considered in Sec. 1.2.</p> <p>The joint attribution statement depends on the synthesis of selected studies based on the criteria in Sec. 1.4</p> <p>Chapter 1 has assessed of the relationship between the significant observed changes in sectors and systems and the regions/gridboxes that have significant and attributable warming, as part of our synthesis of published studies. Results indicate a highly significant result when integrated over the globe, that supports joint attribution statements.</p> <p>The presence of two trends and distributions and their statistical evaluation has been taken into account.</p> <p>‘Unambiguous’ has been removed.</p> <p>Comment on spring temperatures is useful; will be considered if time permits.</p> <p>Sec. 1.3 changes are not attributed to ghg climate forcing; Sec. 1.4 is where joint</p>

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						to 1.4. 1.4.5 discusses links with the NAO but doesn't seem to bear directly on the joint attribution studies described earlier. The chapter really divides into two; a qualitative description of a variety of responses and how they might be linked to climate factors and a description of quantitative joint attribution analyses. I think this distinction is important because any attribution statement must rest on the quantitative analyses not on a subjective interpretation of a mass of data on changes in responses. Section 1.3 is not sufficiently rigorous to be used to support an attribution statement - phrases like changing climate and climate variability are used loosely (note the discussion in WGI Chap 9 FOD section 9.1.1 - what do we mean by climate change and climate variability ?). Joint attribution makes first a link between variations in the response and variations in the climate and then makes the link between those variations in climate and emissions of greenhouse gases and other human-induced factors. For the latter step, in WGI we have to be very careful to define what we mean by climate change and climate variability. It would help I think if section 1.3 focused on establishing links between variations (including trends) in the response and variations (including trends) in the climate and avoided any confusion with the 2nd stage of joint attribution. An example where confusion can arise is in the phrase "climate variability is unlikely to be the direct cause of amphibian decline" (Page 53 line 43) -does this mean that amphibian decline is due to non-climate factors or that amphibian decline is due to externally forced climate change (not internal climate variability) ? References need sorting out. Many refs in text are incomplete missing years (Peter Stott, Met Office)	attribution is handled. The linkage is through the selection criteria for studies considered in Sec. 1.3 to be brought forward to Sec. 1.4. Structure of Sec. 1.4 was revised. Definitions of climate variability and change sharpened in Sec. 1.2. Use of climate terms checked in Sec. 1.3. References fixed.
1-36	A	0				Although this is an extremely difficult Chapter to write, touching on almost all impacts treated at depth later in the Report, it nonetheless emerges as a rather diffuse and over long chapter. Considerable shortening would be desirable, especially in the first section. Differences in writing styles are significant. Section 1.4 is the best written section. The Chapter improves considerably as it proceeds; but the first sections 1.1-1.2 do not encapsulate the essence of the material very well. (John Sweeney, National University of Ireland, Maynooth)	Sections 1.1 and 1.2 are shortened and sharpened.
1-37	A	0				This chapter is way too long. (Richard S.J. Tol, Uni. Hamburg)	Text shortened.
1-38	A	0				The entire chapter has been very carefully formulated. Although the overwhelming number of case studies clearly proves that there is compelling evidence of the impacts of climate change, a clear statement in this regard is missing in this chapter. Whenever there is study pointing to the opposite direction (for whatever reason), the general statement has been weakend. The conclusion in recent reviews on the impacts	Joint attribution statement has been sharpened.

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						<p>of climate change speak a much clearer language than this chapter of the report. If you need another reference with a clear statement on climate change impacts, you might be interested in the letter to be published in the December issue of TREE, which already is available online at: http://www.sciencedirect.com/science?_ob=IssueURL&_tockey=%23TOC%236081%239999%2399999999%2399999%23FLA%23&_auth=y&view=c&_acct=C000056361&_version=1&_urlVersion=0&_userid=2148698&md5=2e3debecf9b69416c240186c6e89617b</p> <p>Regarding the fact, that the number of studies reporting change in the unexpected direction, is rather limited (see Table 1.14), a closer look for the reasons why they report different trends (e.g. methodological or local reasons, selection of species, etc.) might be interesting, and put more weight on the general conclusions drawn from those publications with changes in the expected direction. (Gian-Reto Walther, Institute of Geobotany)</p>	<p>Reference found.</p> <p>Reasons for changes in unexpected directions have been added.</p>
1-39	A	0				<p>Chapter structure - in general the chapter structure and approximate lengths of the respective sections seemed appropriate and consistent with the plenary outline. Structure did not seem to be excessively constrained by the plenary outline. Is there any scope for including some discussion of important areas of research that have been neglected or where information is lacking, and important directions for future or continued research or monitoring?</p> <p>Chapter content and completeness - the content and literature sources seemed appropriate and comprehensive, with a suitable emphasis placed on references since the TAR. I have provided a number of potential additional recent references (above) for section 1.3.5 (terrestrial biological systems) (Robert Wilson, Universidad Rey Juan Carlos)</p>	<p>Directions for further research added to Sec. 1.4.</p> <p>References checked.</p>
1-40	A	0				<p>The treatment of disasters and hazards in chapter 1 should cross reference the sections in chapter 20 (especially section 20.5). I understand that the purpose of chapter 1 is primarily to summarize data that track climate change and associated changes in physical and natural systems. Therefore it might be better not to treat “hazards and disasters” at all in chapter 1, but only refer to “extreme events.” Understanding of disasters cannot be divorced from consideration of the characteristics of vulnerable systems (including people, their livelihoods, and their assets). (Ben Wisner, London School of Economics & Benfield Hazard Research Centre)</p>	<p>Cross-reference to Chapter 20.</p> <p>It is clarified that the section on Disasters and Hazards Sec. 1.3.8 focuses on extreme weather-related events.</p>
1-41	A	1	1	109	50	<p>References are not similarly cited, nor similarly written in the reference list. There are lots of unintended omissions, which make the text sometimes really difficult to understand. There are lots of misprints. There is still a lot to do for a proofreader.</p>	<p>References have been corrected.</p>

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						However, the FOD is now much better than what I read for TAR. The style is sometimes too literature-like. It could be reduced much, if things would be said only once and clearly. (Kaija Hakala, MTT Agrifood Research Finland)	Text shortened; repeated sections deleted.
1-42	A	1	35	1	39	Methodological information is useful, but unclear as to how it fits within the identified purpose of this chapter as identified in section 1.1. I see in in the outline but not in the purpose. In addition, what is new in terms of methodologies relative to that which was available for the TAR? There appears to be a lot of overlap and even duplication of text with that which is contained in section 1.4. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Sec. 1.2 Methods has been shortened and repeats removed with Sec. 1.4.
1-43	A	1	43			"Hydrology": because it is neither system nor sector, but science, to be replaced elsewhere by "Water systems" (Antoaneta Yotova, National Institute of Meteorology and Hydrology)	We can't change outline. Current section title includes both science (hydrology) and water resources (impact area).
1-44	A	1	61			Table 1.11. _ Agricultural crop production and livestock: In sub-section 8 c)Livestock, in the first row reference 13 made to data from Asia (Tibet). Since "beef". means flesh of a steer cow or other animal when killed " what means the mixing of beef increase in production, in relation to sheep, cattle and mutton production. Clarification is needed. (Osvaldo Canziani, IPCC)	Agricultural table corrected for use of meat and livestock.
1-45	A	1		5		The executive summary should be complete rewritten. This is ideology, not science. (Richard S.J. Tol, Uni. Hamburg)	Executive Summary (ES) rewritten.
1-46	A	3	0	5		The use of bold text is not always useful. Under some headings other statements are more or equally important than the initial bolded statement. (Paul J. Hanson, Oak Ridge National Laboratory)	Use of bold text has been considered in the rewritten Executive Summary.
1-47	A	3	0			Sentences in Executive summary are sometimes a copy of the summary of each section although some sections have summary and some have none. This tends to increase the number of pages. (Kiminori Itoh, Yokohama National University)	Repeats have been eliminated.
1-48	A	3	0	5		The Executive Summary must include definitive statements on beneficial aspects of climate change, as indicated above. The item "Terrestrial biological systems--" must be condensed or even deleted, as it is of relatively minor importance. The item "Human health--" discusses health outcomes related to ENSO phenomena. This is irrelevant here,since ENSO events have been occurring for hundreds of years and present climate change has not altered ENSO phases in any significant manner. The item "Disasters and hazards--" must include a statement that increased catastrophe losses are primarily due to societal changes and not due to global warming OR climate change. The item "Documented evidence of --" should(must) be deleted. The	This chapter documents changes; it does not characterize them as beneficial or otherwise. There is a great deal of evidence of observed changes in terrestrial biological systems that is summarized in the chapter and in the ES. ES Health statements now focus on changes not on ENSO effects. Effects of exposure now included in Disasters and Hazards ES.

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						argument that AR4 cites many more studies is specious and consensus-driven. The best documented evidence of climate change must be through analysis of observed data on world-wide weather/climate events & anomalies.. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	ES has been rewritten. Chapter assesses observed data on changes related to climate trends, not events or anomalies.
1-49	A	3	1			The executive summary is very likely what most readers will be interested in. They will probably not have the time (and the patience?) to go through the report unless they are directly involved in or concerned by one or several topics. The executive summary contains actually little information from a quantitative point of view. It is strange to observe that the first entry in this executive summary deals with non-climate driving forces, in a report that has a focus on climate change. In the « cryosphere » entry, it would be preferable to deal with climate change rather than with global warming. In the « hydrology and water resources », the rise and decrease in some lake level may be also related to human activities. In the « coastal processes and zones » entry, is the human factor (excessive construction and removal of natural barriers) not the major driver of change, exacerbating the lesser effect of climate change? In the « agriculture and forestry » entry, it is rather surprising to see viniculture as the best example of change. This certainly is not the world's most important crop. It may be better to discuss the number of degree-days. There is nothing regarding the spread of insects and diseases. The « disasters and hazards » entry must be rewritten. It is not clear (Raymond Desjardins, N/A)	ES rewritten to include more quantitative statements. ES now leads with climate change, not non-climate driving forces. Cryosphere text changed to climate change; and specific effects of 'global warming' highlighted. Hydrology text changed to include human activities. Coastal text changed to include human activities caveat. Viniculture example kept, as important example. Degree days represented by phenology and crop cycle duration text. Insects evidence checked. Disasters ES text rewritten.
1-50	A	3	1	3	2	Executive Summary. Add "Climate Driving Forces": Recent climate change, particularly temperature increase, most often begins during the 70's; it succeeded a natural warming ending before the mid century and followed by stable or decreasing temperature (high confidence). Other climatic drivers besides temperature rarely present regional significant change during the last decades. Climatic drivers can influence directly systems and sectors and indirectly through modifications due to socio-economic processes. (Annick Douguedroit, Université de Provence)	Climate forces added to beginning of ES.
1-51	A	3	1	5	35	Comments on Executive Summary. The Summary seems to be determined to emphasize the negative aspects of climate change. A more even handed and balanced approach is needed to reflect the diversity of impacts, including their consequences both for humans and the rest of nature. Among the items that ought to have been in	ES documents changes as observed. It does not make judgments about whether they are 'positive' or 'negative.'

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						the Executive Summary is that satellite measurements indicate that NPP has increased, perhaps partly due to higher CO2 levels (see pp. 11-12). See also comments 54, 60, 63, 64, 65. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Greater diversity of changes now highlighted. NPP change considered.
1-52	A	3	1	5	35	The executive summary needs a more consistent format. For some topics, the first sentence (in bold) states the main point of the paragraph, with the rest of the text providing support, and this is the format I prefer. In some others (e.g., hydrology and water resources), there is no apparent difference in the importance of the information between the bold and non-bold sections. The hydrology section also uses the term "modest" confidence, which I assume should be changed to "medium". (Kimberly Hall, Michigan State University)	ES rewritten in more consistent format, with summary statements in bold.
1-53	A	3	1	5	35	Executive summary: comprehensive and clear though it would be helpful in some sections to indicate a time frame over which change has occurred eg coral reefs, lengthening of growing season, increased incidence of vector-borne diseases (Lesley Hughes, Macquarie University)	Timeframe added – 1970s to 2005.
1-54	A	3	1	5	35	It is noted that this executive summary does not address a) impacts of climate change on social systems b) the impact of heat waves on human health. It is expected that chapter one addresses the most important observed changes and responses in naturally managed systems and both issues raised above seem to be quite relevant. (Klaus Radunsky, Umweltbundesamt GmbH)	Human systems now highlighted. Heatwaves considered.
1-55	A	3	1	5	35	Should think strategically about the order in which the executive summary messages are being presented. I would suggest that they should be in the same order as the purpose of the chapter as presented in 1.1 Introduction (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Questions changed in text to reflect ES.
1-56	A	3	1	5		I am somewhat surprised by the large number of high confidence findings for two reasons. First, the assignment of the observed changes to climate changes or to other natural or anthropogenic causes is not easy. Second, the evaluation of confidence levels has to take into account the uncertainties in the observed climatic changes (WG1) as well. Especially for those changes that are related to changes in precipitation this also seems to be difficult to do. (Rob Swart, MNP)	Confidence statements reduced. Statement about lower confidence in Joint Attribution now stated explicitly in the text. Confidence statements in Hydrology ES checked.
1-57	A	3	1	5		Cynthia has asked me to look at the way uncertainties are covered. I think that the usage of the confidence scale is appropriate. Since the majority of the findings is apparently high confidence (see next comment), it may be interesting to diversify the assessment of the main findings and summarize them at the same time by putting the various observed changes due to climatic change into cells of the qualitative scheme of the Uncertainty Guidance Note, thus distinguishing between level of agreement	We will try this exercise.

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						between the authors and level of information available.. (Rob Swart, MNP)	
1-58	A	3	3	3	12	It would be informative to precede this paragraph on non-climate driving forces by a paragraph indicating the totality of what is considered to be part of the climate system, plus the internal climate drivers. (Claire Parkinson, NASA Goddard Space Flight Center)	Done.
1-59	A	3	3			this section or title of section only focuses on non-climate driving forces. It seems there are little information for climate change impact assessment. In this sense please cover both climate driving forces and non-climate driving forces in this section. (Bangzhong Wang, China Meteorological Administration)	Done.
1-60	A	3	5	3	12	A strange way to start. Why not start with climate which is what the chapter is about? (Ian Burton, University of Toronto)	Done.
1-61	A	3	5	3	12	In introducing socio-economic processes reference might be made to the growth of vulnerability and the relative lack of socio-economic adaptation. Some clarification of terms and definitions is needed and some idea of the scope and limits of the chapter. (Ian Burton, University of Toronto)	Adaptation and vulnerability processes added. Terms clarified in chapter.
1-62	A	3	5	3	5	It would be opportune to add, after non-climatic drivers, the following: and their feedbacks. (Osvaldo Canziani, IPCC)	Text changed.
1-63	A	3	5	5	35	Is the meaning of 'sectors and systems' sufficiently clear to a non-specialist? Is is sufficiently specific? Perhaps 'natural and managed systems' as in the title would be somewhat clearer. Or what about replacing 'responses of sectors and systems' with 'environmental and societal responses'? (Nathan Gillett, University of East Anglia)	Systems and Sectors kept; defined in chapter. Other phrases used in text.
1-64	A	3	5			Substitute "factors" for "drivers" (Indur Goklany, Office of Policy Analysis, Department of the Interior)	'Drivers' is the common term in the literature.
1-65	A	3	5			Some explanation of what is meant with "climatic" and "non climatic driver" is recommended. In the highly complex climatic systems where many components are linked by feedback processes, it is not so obvious to define what is and what is not "climatic", what is inside and what is outside the system. An example: the CO2 concentration is a climatic or a nonclimatic driver? (Piero Lionello, Univ. of Lecce)	Climate and non-climate drivers explained more fully. CO2 has been removed as a non-climate driver.
1-66	A	3	5	3	6	First sentence in ES is convoluted. (Merylyn McKenzie Hedger, Environment Agency)	Text rewritten.
1-67	A	3	5	3	7	This is an empty statement. You have high confidence that things are complex. Wow. (Richard S.J. Tol, Uni. Hamburg)	Text rewritten.

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1-68	A	3	7	3	12	The urban heat island would be better described as a result of land-use change and land-cover modification than as a climate variable. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Urban heat island removed in ES.
1-69	A	3	9			Insert "economic development, human and social capital, and the propensity for technological change," before "land use change" (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Processes listed focus on physical changes. Technological change already listed.
1-70	A	3	10			Executive Summary. Add "forestry to bushes" (Annick Douguedroit, Université de Provence)	Example removed.
1-71	A	3	10			Taking into account the serious phenomenon relating to the forest fires in certain arid and semi arid zones, particularly in North Africa, i propose to add to land use change "irreversible modification of the land after the forest fires in certain arid and semi-arid zones". (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Not included in ES – too detailed.
1-72	A	3	11	3	11	are of major importance for what? (Isabelle Chuine, CNRS)	Text added: 'for influencing changes in systems and sectors independently and in conjunction with climate.
1-73	A	3	11	3	11	It is important to not inadvertently imply that socioeconomic responses all lead to increased observed impacts, and that some responses may be dampening the effects (e.g. those discussed in section 1.4.7). Extensive human efforts such as improved building codes may be dampening observed climate impacts. After "...importance." suggest adding "As adaptation is itself a potential response to changing climate, it, too can be expected to dampen observed impacts." (Evan Mills, Lawrence Berkeley National Laboratory)	Text added.
1-74	A	3	11	3	11	It is important to not inadvertently imply that socioeconomic responses all lead to increased observed impacts, and that some responses may be dampening the effects (e.g. those discussed in section 1.4.7). Extensive human efforts such as improved building codes may be dampening observed climate impacts. After "...importance." suggest adding "As adaptation is itself a potential response to changing climate, it, too can be expected to dampen observed impacts." (Evan Mills, Lawrence Berkeley National Laboratory)	Repeat.
1-75	A	3	16	4	43	One would expect that Chapter 1 would be an introduction to the topics covered in the remainder of the report and would discuss the methodology for, and remaining challenges to, assessing impacts, vulnerability and adaptation. However, this portion of the Executive Summary provides results only and reads like a mini-SPM. The draft devotes 9 pages to the topic of detection of observed changes and 10 pages to larger-scale aggregation and attribution, which contains discussions of remaining	Chapter One is focused on observed changes only. Methods are covered in Chapter Two. There will be an Introduction to the whole volume before Chapter One. Joint Attribution statement moved to the

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						challenges, but none of this appears in the Executive Summary. Also, terms such as "abundant evidence," "well-documented" and "overwhelming majority" are used with no indication of the support for those terms. If all of this evidence is available, it would seem that this portion of the Executive Summary should contain more than the one quantitative measure (the 10 degree poleward migration of plankton in the North Atlantic) that is presented. It would be far more enlightening to say XX% of studies examining global warming impacts on terrestrial species show a consistent pattern than leaving the reader to guess what is meant by overwhelming majority. (Lenny Bernstein, IPIECA)	beginning of the ES. Some more quantitative measures have been added.
1-76	A	3	16	3	26	As for Cryosphere, the statement on "Arctic mammals" seems inappropriate. I understand that the sea ice reduction affects the arctic mammals, but the cause of the sea ice reduction is known to be difficult to attribute to the anthropogenic global warming: 1) Polyakov et al., "Long-term ice variability in Arctic Marginal Seas," J. Climate, 16, 2078-2085 (2003); 2) Polyakov et al., "Variability and trends of air temperature and pressure in the maritime Arctic 1875-2000," J. Climate, 16, 2067-2077 (2003)). The sea ice reduction, according to Polyakov et al., correlates with NAO. And, only a small portion of NAO can be interpreted by the increase in CO2 concentration. Even if a large part of the global temperature increase can be attributed to the anthropogenic CO2 concentration increase, the sea ice reduction in Arctic regions is the case where such attribution is most difficult as Polyakov et al. point out. I think that cautious considerations should be made when you attribute one phenomenon to a particular cause. Otherwise, wrong (or ineffective) countermeasures will be employed. (Kiminori Itoh, Yokohama National University)	Disagree. Checked w/WGI and reconsidered wording.
1-77	A	3	16			The Antarctic continent? (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Only Antarctic Peninsula is mentioned rather than whole of Antarctica because climate changes and impacts are unclear for the rest of the continent. Included also Amundsen Sea sector of West Antarctica as well based on findings of CH1.
1-78	A	3	16	3	26	I believe that there are some more profound impacts/adaptation message that could have been taken from the Arctic Climate Impacts Assessment related to the cryosphere. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Reviewer lacks specific information. ACIA is used where appropriate.
1-79	A	3	16	3	16	Remove or change word "accelerated" in accelerated melting. Leave either just melting or use wording "substantial melting". High level of confidence in the "accelerated melting" mentioned on line 16 is somewhat inconsistent with	OK., "accelerated" has been eliminated.

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						conclusion about medium level of confidence in "accelerated trend" (line 21, page 3). Accelerated trend means that there high confidence in the knowledge of the second temporal derivative, while there are still uncertainties and variability in the magnutude of trends which is the first derivative in time. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	
1-80	A	3	17	3	17	The observed formation of glacier-lakes, bringing an additional hazard to mountain / valley communities, from the Himalayas to the Andes, suggests a reference. Therefore, after "avalanches" add "glacier-lakes" etc. (Osvaldo Canziani, IPCC)	Not relevant. Glacial floods already includes lakes.
1-81	A	3	17			Executive Summary. Add documented in, add: " decreasing of glacier tongues" (Annick Douguedroit, Université de Provence)	Not an impact, covered in WGI
1-82	A	3	17	2	17	The inclusion of Arctic mammals and Antarctic Peninsula fauna in this list causes some confusion and needs some clarification. For example, what impacts on Arctic mammals as a result of accelerated melting in the cryosphere have been documented. Similarly for the Antarctic Peninsula fauna. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Details are provided in 1.3.1
1-83	A	3	18	3	18	The Executive Summary states that changes in Antarctic Peninsular fauna have been documented, but I fail to find that information in the underlying chapter. (Lenny Bernstein, IPIECA)	OK, will check, make sure it is included in 1.3.1
1-84	A	3	18	3	18	include "flora" for the Antarctic peninsula -> "..., Antarctic Peninsula flora and fauna, ..." (Gian-Reto Walther, Institute of Geobotany)	OK, "flora" now included and specific references for section 1.3.1 added from CH15.
1-85	A	3	19			the relocation of ski centres is an adaptation and not a change in the cryosphere. (Ian Burton, University of Toronto)	OK, rephrased.
1-86	A	3	20			Executive Summary. Viticulture instead of Viniculture which does not concern grapes for wine. (Annick Douguedroit, Université de Provence)	WRONGLY PLACED. Corresponds to section 1.3.6
1-87	A	3	20	3	21	Replace "Some of these changes..." with "Some, but not all, changes..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Ignored, same meaning is evident
1-88	A	3	20	3	20	Since you're stating that this can be observed in at least some areas (not all areas), Isn't this "very high confidence"? (Evan Mills, Lawrence Berkeley National Laboratory)	Disagree. General phrase referred to most areas of the world.
1-89	A	3	21	3	21	Remove word "enhanced" in enhanced warming. Leave just warming. I do not think there is substantial amount of evidence to tell about enhanced warming. Similar to comment #1. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	OK. Eliminated "enhanced".
1-90	A	3	21	3	21	Remove or change word "accelerated" in accelerated trend. Leave either just trend or	OK, eliminated accelerated.

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						use wording "substantial trend". (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	
1-91	A	3	22	3	22	I would say "high confidence" instead of "medium confidence". Changes in the cryosphere are well documented, e.g. from remote sensing. (Heiko Balzter, Centre for Ecology and Hydrology)	OK. Eliminated whole sentence.
1-92	A	3	22	3	26	I think the confidence level may be overstated here. The authors express very high confidence that there is an 'accelerated melting... including ... ice shelves... snow cover'. Leaving aside the issue of whether whether the melting is accelerating, my understanding is that ice shelves have only undergone pronounced melting on the Antarctic Peninsula, and not elsewhere in Antarctica. Also I thought that observations of snow cover only show a clear trend in Spring. (Nathan Gillett, University of East Anglia)	Disagreed.
1-93	A	3	22	3	26	The overview of the process is too general: to which systems and sectors the Authors refer? (Giampiero Maracchi, Institute of Biometeorology)	OK, reworded to "these changes".
1-94	A	3	23	3	23	Should observed sea-level rise also be listed as an indicator of melting land-ice? (Evan Mills, Lawrence Berkeley National Laboratory)	NO, it is a WGI issue.
1-95	A	3	24	3	24	It is not just accelerated melting, but in the case of permafrost, accelerated degradation in response to global warming is also having an impact. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Leave as is. Permafrost degradation is essentially a consequence of "melting".
1-96	A	3	24	3	24	Similar to comment 1. Remove word "accelerated" (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	OK, done.
1-97	A	3	28			Delete the word 'also'. (Paul J. Hanson, Oak Ridge National Laboratory)	
1-98	A	3	28		36	Paragraph pertains only to catastrophic events (not to small-scale ones) (Evan Mills, Lawrence Berkeley National Laboratory)	Scales delineated.
1-99	A	3	30	3	32	The draft Executive Summary states: "... there are documented increase(s) in flash floods and landslides due to intensive and heavy rains in mountain areas during the warm season (high confidence)." I fail to find convincing support for the statement in the underlying chapter. Table 1.4a contains several references to increased flooding, most of which are attributed, at least in part, to snow melt or ice jam breakup. There is only one reference in the table to increased landslides. Pg. 27, lines 22-23 discusses the May 2004 landslides in Haiti and the Dominican Republic, but also states that increasing damages due to landslides may be caused by growing populations and regional development. Delete this statement unless it can be more clearly supported in the underlying chapter. (Lenny Bernstein, IPIECA)	Text removed.

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1-100	A	3	30	3	32	This phrase needs up dating. In fact in the last 20 (and even more) years there is documented evidence on increase in extreme precipitation events, leading to the exacerbation of floods, flash-floods and landslides in mountain areas. (Osvaldo Canziani, IPCC)	Text changed.
1-101	A	3	30			Insert after "...20 years," the following: "which, however, is not a long enough period to determine whether changes are due to natural variability or manmade causes such as enhanced radiative forcing due to greenhouse gases," (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Text changed.
1-102	A	3	30	3	32	This could easily arise from land use change. This is a common issue in this chapter. (Jeremy Kerr, University of Ottawa)	Human activities caveat added to ES Hydrology.
1-103	A	3	30			landslides is mainly one kind of geological disaster due to intensive and heavy rain in specific regions. When talking about hydrology and water resources, the best way is the deletion of this here. (Bangzhong Wang, China Meteorological Administration)	Landslides removed.
1-104	A	3	31	3	32	The authors express high confidence that there has been an increase in flash floods and landslides, and that this trend is due to (presumably a trend in) 'intensive and heavy rain in mountain areas'. But in WGI chapter 9, we say that it is only 'about as likely as not' that there has been increases in heavy rainfall consistent with anthropogenic forcing. Therefore I think the confidence level on this statement should be substantially downgraded, probably to a level where the statement is not worth including at all. (Nathan Gillett, University of East Anglia)	Text made compatible with WGI.
1-105	A	3	31			"increases" not "increase" (Lesley Hughes, Macquarie University)	Text revised.
1-106	A	3	31	3	32	A major reason for the increase in flash floods and landslides due to intensive and heavy rain in mountain areas is the fact that a greater proportion of precipitation falls as rain and less as snow due to warmer temperatures. => "...during the extended/prolonged warm season ..." (Gian-Reto Walther, Institute of Geobotany)	Flash floods removed.
1-107	A	3	33	3	34	"conincide with recent global rainfall trends". There have not been any statistically significant recent global rainfall trends, and even the sign of the trend depends on which dataset is used, and what period is considered. (Nathan Gillett, University of East Anglia)	Text made consistent with WGI.
1-108	A	3	34	3		what is the difference between medium confidence and modest confidence? (Ian Burton, University of Toronto)	Changed to medium confidence.
1-109	A	3	35			Can "epishelf" be defined? (Evan Mills, Lawrence Berkeley National Laboratory)	'epishelf' removed.

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1-110	A	3	38	3	45	The draft Executive Summary mentions sea level rise as the only cause for coastal erosion and wetlands losses. However, the underlying chapter (Section 1.3.3) presents ample evidence that other factors such as sediment starvation and groundwater pumping are important contributors to these problems. These other factors need to be mentioned to present a fair and accurate picture of the problem. Many coastal areas would have severe problems even if sea level rise stopped, but the other causes remained. (Lenny Bernstein, IPIECA)	Statement on human activities added to Coastal ES section.
1-111	A	3	38	3	45	This paragraph is poorly written and its meaning not clear. (Ian Burton, University of Toronto)	Revised.
1-112	A	3	38	3	38	The distinction between coastal and inland wetlands seems appropriate. Therefore the qualificative "coastal" shall precede the word "wetland". (Osvaldo Canziani, IPCC)	Text changed.
1-113	A	3	38	3	45	The description of coastal zones and processes is very approximate (Giampiero Maracchi, Institute of Biometeorology)	More quantitative statements are not possible at this time.
1-114	A	3	38	3	39	First sentence on coasts seems to conflict with 1.3.3 page 30, lines 47-49 (Merylyn McKenzie Hedger, Environment Agency)	Agreement of ES and Coastal section checked.
1-115	A	3	41			I would recommend not using word like 'apparent' throughout the report. (Gregory Beaugrand, univ-lille)	Wording changed.
1-116	A	3	42	3	42	How do the authors know that (internal) interdecadal climate variability has contributed to an increase in extreme high water levels? I don't remember seeing evidence for this in the chapter. How do the authors know that that natural variability has not reduced extreme high water levels from what they otherwise would have been? (Nathan Gillett, University of East Anglia)	Text rewritten.
1-117	A	3	42	3	45	Could confidence level be attached to this sentence. It seems to call out for one (Jeremy Kerr, University of Ottawa)	Confidence statements only used for major physical systems statement, not individual sections.
1-118	A	3	44	3	44	What does it means modern storms. The WMO Guidelines on Hydrology quotes a series of remarkable precipitation events running from 38mm in one single minute, in Guadalupe Is., 26 November 1970 to 1870mm in 24 hours (La Reunion, 15-16 May 1952). Does modern then mean more frequent? It is suggested replace modern by storm and storm surge's climate change exacerbated processes. (Osvaldo Canziani, IPCC)	Text changed.
1-119	A	3	44			Executive Summary. From modern storms, add: "and tropical cyclones" (Annick Douguedroit, Université de Provence)	Text changed.

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1-120	A	3	44	3	44	Please clarify the wording "damage to fixed structures from MODERN storms" (Klaus Radunsky, Umweltbundesamt GmbH)	Text changed.
1-121	A	3	47	4	4	No reference is made on the observed effect of increased seawater acidification due to increasing CO2 concentration in the atmosphere. (Osvaldo Canziani, IPCC)	Ocean acidification added to ES.
1-122	A	3	47	3	49	This is a misleading statement. You have high confidence that changes have been associated with rising temperatures. You should assess the credibility of these associations, not the fact that there are any. There are people who believe that the world is flat (high confidence). (Richard S.J. Tol, Uni. Hamburg)	Confidence statement removed.
1-123	A	3	47	3	47	I suggest replacing "observed responses" in the headline with "changes". (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Text changed.
1-124	A	3	49	3	49	Change the paragraph:.... Climate change by increased sea surface temperatures and circulation. In my opinion was more precise and can include a possible cause for documented poleward movements of plankton (Ricardo Anadon, University of Oviedo)	Text changed.
1-125	A	3	49	3	50	We know it is warmer and that there has been damage to some coral reefs, but do we know with "high confidence" that climate change has contributed significantly to that damage? Add just before "high confidence" on line 50 the following: "... , some of which is reversible..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Confidence statement removed.
1-126	A	3	49	3	49	The juxtaposition "Climate change, in tandem with other human impacts" implies that ALL climate changes that have impacted marine and freshwater system are of anthropogenic origin. Surely that would be an overstatement. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Removed 'other.'
1-127	A	3	50			Isn't this "very high confidence"? (Evan Mills, Lawrence Berkeley National Laboratory)	Confidence statement removed.
1-128	A	4	2	4	2	Include in the paragraph, The observed changes of the abundance and distribution of exploited species can be related to observed changes in climate and plankton communities (medium confidence) (Ricardo Anadon, University of Oviedo)	Plankton added.
1-129	A	4	5			It would be helpful to insert comments on phenology in marine systems and changes in fish and benthos (Stephen J. Hawkins, The Marine Biological Association of the UK)	Phenology and benthos added.
1-130	A	4	6	4	8	The support for the statement "... the overwhelming majority of studies examining global warming impacts on terrestrial species reveal a consistent pattern of change (high confidence)." has not been presented. The underlying chapter presents a long	Authors judge wide range and multiple cases to justify wording.

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						list of studies showing change, but in only in a limited number of cases does it discuss studies that shown no or inconsistent change. The meta-analysis of bird arrival dates discussed on Pg. 48, lines 9-11, states that of 983 series, 39% were significantly earlier and 2% significantly later. Pg. 53, lines 18-19 state: However, there are also a lot of examples of relatively stable treeline positions in the last half century." Pg. 73, line 48 to Pg. 74, line 4 discusses a meta-analysis for 1700 species, of which only 279 showed the diagnostic fingerprint representative of climate change. In the EU COST725 study (Pg 74, lines 6-23), 78% of 542 plant species showed advances in leafing, flowering and fruiting dates, but only 30% showed significant advances. In each meta-analysis, the majority of studies show either no significant change or change in an inconsistent direction. The chapter needs to explain why these studies represent overwhelming evidence of a consistent pattern of change. (Lenny Bernstein, IPIECA)	
1-131	A	4	6	4	16	The lost of 70% of the Adelie penguin from a population near the USA research base at Palmer Station in Antarctica should be mentioned (Sc Am, January 2004) (Osvaldo Canziani, IPCC)	Too specific for the Exec Summary
1-132	A	4	6	4	8	This statement doesn't tell the reader much. Consistent change with respect to what? (Paul J. Hanson, Oak Ridge National Laboratory)	Executive Summary rewritten
1-133	A	4	6	4	14	What about human systems? E.g. agricultural practices, hunting patterns, etc. (Evan Mills, Lawrence Berkeley National Laboratory)	Executive Summary rewritten
1-134	A	4	6	4	8	The heading should have a much more explicit and stronger wording. My suggestion is: "Terrestrial Biological Systems: The overwhelming majority of studies examining global warming impacts on terrestrial species reveal consistent responses to regional climate trends (high confidence). (Camille Parmesan, University of Texas at Austin)	Executive Summary rewritten
1-135	A	4	6	4	7	Need to clarify what is meant by pattern of change. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Executive Summary rewritten
1-136	A	4	6	4	8	Ditto. You should assess the quality of these studies; instead, you say that all studies agree; this may well be because there are so few studies, and less quality ones. (Richard S.J. Tol, Uni. Hamburg)	Executive Summary rewritten
1-137	A	4	6	4	7	I suggest that the phrase "global warming impacts" in this headline be replaced with "warming impacts". The studies that are summarized here are presumably local, and presumably describe local responses to local climate change. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Addressed.
1-138	A	4	10	4	11	Rewrite the sentence beginning on line 10 as follows: "In the past few decades, the abundance and distribution of certain species has changed probably because of	Section rewritten.

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						climate change (including changes in CO2), with decreases in some species and increases in others." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-139	A	4	10	4	12	I would argue that declines and retractions associated with climate change comes with medium confidence (as stated) but that range expansions at polewards and upper range boundaries comes with high confidence (it is extremely hard to find any reasonable alternative source of attribution, other than climate) (Chris Thomas, University of York)	Section rewritten, though comment very valuable.
1-140	A	4	10	4	11	Disappearance of certain species due to Climate Change seems to be extremely strong statement. Need a striking example or better several examples of species that disappeared due to changing climate. Such a strong statements are considered as an exaggeration when they are not properly supported by proven and important examples. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	Section rewritten.
1-141	A	4	11	4	12	Both of the confidence statements on lines 11 & 12 (population decreases and extirpations and poleward/upward movement) should be changed from "medium" confidence to "high" confidence (Camille Parmesan, University of Texas at Austin)	Section rewritten.
1-142	A	4	12			My understanding is that the word "adaptation" in the IPCC context refers to human adaptation to climate change impacts. Although the biological adaptations observed in wild species are very important, I think it may be confusing to use the same term, especially in the summary. Also, biological adaptation can be seen in both migratory and non-migratory species. (Kimberly Hall, Michigan State University)	Section rewritten.
1-143	A	4	12	4	12	movement of wild plant and animals poleward and upward in elevation (medium confidence) -> why MEDIUM and not HIGH confidence? (Gian-Reto Walther, Institute of Geobotany)	Section rewritten.
1-144	A	4	13	4	14	I could not find strong evidence of the fact that non climate related factors was limiting migration and adaptation in section 1.3.5. This section states that non climate related factors limit migration and adaptation capabilities (1.3.5.8) for example for high elevation or high latitude species, but I could not find a single citation to assert this statement. Thus I would not state this in the executive summary. (Isabelle Chuine, CNRS)	Sentence striked.
1-145	A	4	13			I am not sure it is accurate to say "In most cases" here, since in the high latitudes, where the major changes have apparently taken place, the land is sparsely populated and human infrastructure is quite limited. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.

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1-146	A	4	13			Non-climate related factors" is too vague a statement. Biological factors such as fecundity or establishment? Anthropogenic factors such as land use or fragmentation? (Paul J. Hanson, Oak Ridge National Laboratory)	Section rewritten.
1-147	A	4	18	4	23	Reference to extreme events (droughts, floods, heat waves) effects on agriculture are included in the regional chapters. For instance the severe droughts and floods in different parts of Latin America adversely affecting crops (as it was the case of 8 million Ha of the fertile Pampas inundated in 2001-2002, or the recent severe tropical storms in Mexico and Central America) should be mentioned. (Osvaldo Canziani, IPCC)	Focus on this chapter is on trends in climate, not on individual events.
1-148	A	4	18	4	25	Forest infestations may deserve mention here. (Evan Mills, Lawrence Berkeley National Laboratory)	Addition of pests considered in ES for this section.
1-149	A	4	20	4	20	Recent warming sounds better here than "enhanced" and "accelarated" warming and trends mentioned above. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	'Enhanced' and 'accelerated' removed.
1-150	A	4	21			Executive Summary. related to warming, add: "in the margin of the viticulture areas" . See comments below on Box 1,3 (Annick Douguedroit, Université de Provence)	Not added.
1-151	A	4	21			"in most regions" should be inserted at the end of the sentence. (Hans Martin Fussel, Stanford University)	Add text.
1-152	A	4	22			Reductions in crop yield in the Sahel are due to a number of factors, of which reduced rainfall is only one. Causes include wars and overpopulation which leads to overexploitation of existing resources. Accordingly, change "responsible for ..." to "have contributed to..." It should also be noted that there has been a slight recovery in rainfalls since 1990 (see Box 1.2). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Changed to 'have contributed to'. lower crop yields in Sahel.
1-153	A	4	23			In most regions should be inserted at the beginning of the sentence. (Hans Martin Fussel, Stanford University)	Add text.
1-154	A	4	23			Add after the period: "On the other hand, cereal yields have more than doubled since 1961 for both developing and developed countries as well as the world as a whole." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	ES revised, text changed; no longer relevant.
1-155	A	4	23	4	25	This statement could be construed to imply that agriculture and forestry show equal vulnerability to recent extremes of heat and drought. This is not true. In general, established forests are less vulnerable to heat and drought than are annually propagated agricultural plants. (Paul J. Hanson, Oak Ridge National Laboratory)	Text kept.
1-156	A	4	23	4	23	Add "gradual" in the following sentence: "Effects of gradual regional climate changes	Not included because term 'gradual' is

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						to-date are of limited economic consequence..." (Gian-Reto Walther, Institute of Geobotany)	vague.
1-157	A	4	24			Add the word 'sectors' following "agriculture and forestry". (Paul J. Hanson, Oak Ridge National Laboratory)	Added.
1-158	A	4	27	4	33	No reference is made of the surface ozone ill effects on human health and comfort. Global warming increases surface ozone 's generation. (Osvaldo Canziani, IPCC)	Please provide references of observed changes related to increases in ozone.
1-159	A	4	27	4	33	missing 'heat waves' as impact on human health which is mentioned later in the chapter (see Box 1.1, page 8) (Markus Erhard, Forschungszentrum Karlsruhe)	Heatwaves now a bullet.
1-160	A	4	27			What about direct mortality in heat waves? The 2003 heat wave in Europe can not be directly attributed to climate change, but it is consistent with predicted changes and worthy of mention. (Kimberly Hall, Michigan State University)	Section rewritten.
1-161	A	4	27	4	33	Executive summary. Conclusions on health effects are not consistent with the literature. The evidence for the effect of CC on cholera is weak (see comments below). No evidence is presented for effects on other "waterborne" diseases. There is medium confidence for evidence of tick vector movements in Europe. Maybe higher confidence about some mosquito changes in distribution and seasonal activity? (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section rewritten with Sari Kovats as a contributing author.
1-162	A	4	30			Add after "pollen-borne diseases" the following: "...although their contribution to total global burden of disease is relatively minor". (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.
1-163	A	4	30			I suppose "polen-related" is better than "pollen-borne", I.e. it is the pollen itself that causes the problem not something being carried by the pollen. (Evan Mills, Lawrence Berkeley National Laboratory)	Addressed .
1-164	A	4	33			the last sentence of the paragraph is ambiguous, as it can be interpreted temporall (Hans Martin Fussel, Stanford University)	Section rewritten .
1-165	A	4	33			Add after "human health", the following: "although other existing health problems predominate." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten .
1-166	A	4	33			It should be checked, but I believe that the numbers of humans physically (as opposed to economically impacted - next bullet) impacted by natural hazards is rising faster than population in the developing world. (Evan Mills, Lawrence Berkeley National Laboratory)	Interesting point. Section rewritten.
1-167	A	4	33	4	33	Unclear as to what is really meant by the statement "An increased vulnerability is apparent in poorer countries". As presented it seems to sit there by itself - an add-on.	Section rewritten .

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						Should add to it to provide some context and linking it to the previous statements in the paragraph (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	
1-168	A	4	35	4	43	The cautious interpretation of disaster loss statistics is right, but there is a substantial literature which takes a different view, Munich Re. for example. While it is true that “the dominant signal remains that of the significant increases in the values of exposure at risk (but this is not a very clear way of putting it) perhaps it is worth noting that this increase in exposure can be seen as a failure to adapt adequately to current risks, or maladaptation. (Ian Burton, University of Toronto)	Will check for TOD. Text rewritten. Statement no longer present in ES.
1-169	A	4	35	4	43	The exacerbation of weather and climate hazards and disasters stems out from huge amount of heat energy accumulated in the oceans of the world. Energy in the amount of app. 1023 Joules means a higher evaporation rate and, consequently an important injection of condensation latent heat in the atmosphere enhancing instability. (Ref Barnett T, D.W. Pierce, R. Schnur: “Detection of Anthropogenic change in the World’s Oceans” Science 293, 13 April 2001). Increase sea surface temperatures is a consequence of heat accumulation. (Osvaldo Canziani, IPCC)	Germain to WGI.
1-170	A	4	35			The first sentence on line 35 should address trends in human fatalities due to extreme events. It should be as follows: "According to EM-DAT, the OFDA-CRED International Disaster Database, cumulative deaths per year and death rates worldwide due to weather related extreme events have decline since the early decades of the 20th century. [Source; Goklany 2005c, as updated; NOTE: unless citations are provided within the comment, citations are provided at the end of these comments.] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.
1-171	A	4	35			Modify the first part of the current first sentence of this paragraph as follows: "ON THE OTHER HAND, DATA FROM INSURANCE COMPANIES REVEALS RAPIDLY RISING MONETARY COSTS ASSOCIATED WITH EXTREME WEATHER EVENTS since the 1970s, the dominant signal..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.
1-172	A	4	35			Controversial among hurricane experts (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Section rewritten.
1-173	A	4	35	4	43	Refers only to economic losses and ignores other impacts on society. (John Twigg, Benfield Hazard Research Centre)	Section rewritten.
1-174	A	4	36			Is the choice of the word "dominant" supported? Figure 2 in the aforementioned article shows losses rising many times faster than population, GDP, or insurance premiums.	Will check for TOD. See page 4, line 35. Text rewritten.

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						(Evan Mills, Lawrence Berkeley National Laboratory)	
1-175	A	4	37	4	37	"exposure at risk" is a term I couldn't quite understand. The executive summary especially should be easily understood. (Jeremy Kerr, University of Ottawa)	Will address in TOD. Will address in TOD. Text rewritten. No longer relevant.
1-176	A	4	38			Consider inserting "Observed trends in non-weather-related losses from natural disasters as well as human-caused disasters are significantly more gradual than those from weather-related events. [see: Science Vol. 308, Issue 5737, pp.1040-1044] (Evan Mills, Lawrence Berkeley National Laboratory)	Good point. Will consider for TOD. Section focuses on weather-related disasters and does not consider non-weather-related events and losses.
1-177	A	4	40		43	the last sentence of the paragraph should be split into two sentences, e.g.: "Over the past years, the destructiveness (...) of tropical cyclones in both the Atlantic and Northwest Pacific has been observed. This increase in hurricane destructiveness is strongly correlated to increases in sea surface temperature during the same time period." (Hans Martin Fussel, Stanford University)	Section rewritten
1-178	A	4	41	4	43	The "doubling in 'destructiveness'" presumable refers to the Emanuel paper. Emanuel doesn't document 'destructiveness', but rather change over time in a "power dissipation index", which is presumably at best an indicator of potential destructiveness rather than actual destructiveness. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten.
1-179	A	4	42	4	42	Please replace the word "destructiveness" with "intensity", as this incorrectly implies that losses or damages from hurricanes have been increasing. Although the word is included in the title, the article deals with intensity or potential destructiveness. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Replaced with "power dissipation." Done.
1-180	A	4	43			Add at the end of this para, the following: "However, 30 years is not a long enough period to determine whether changes are due to natural variability or enhanced radiative forcing due to greenhouse gases. Regardless of any changes in the intensity and/or frequency of such events, data from 1900 to 2004 indicates a downward trend in average annual deaths and death rates for the United States from the first decade of the 1900s through 2000-2004. Property losses have increased in real terms, but apparently because a wealthier and larger coastal population has put put increasing amounts of property at risk." {Sources: [1] Goklany (2000), as updated, [2] R.A. Pielke, Jr. and C.W. Landsea, "Normalized hurricane damage in the United States: 1925-1995," Weather and Forecasting 13: 621-631 (1998).} (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Bullet rewritten. Reference cited in Disasters and Hazards section.
1-181	A	4	43			A statement of degree of confidence is needed at this point. (Paul J. Hanson, Oak Ridge National Laboratory)	Confidence level given for lead statements.
1-182	A	4	45			the "Absence of Evidence" part of the subtitle seems misleading. My interpretation of	Sub-section title removed.

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						the following text is that there is a lack of studies in some regions rather than a lack of evidence in those regions for which studies are available. (Hans Martin Fussel, Stanford University)	
1-183	A	4	47	5	4	This number appears to represent references that have related observed changes to climate; do you not want to include the references that did not find any changes (analysis of evidence of no change)? (David Rind, NASA/GISS)	Numbers of studies removed.
1-184	A	4	47	5	4	I personally don't think that counts of papers provide a reliable indication that there is more evidence to document. Such changes could as easily be the result of science management decisions (e.g., by granting councils who might have decided to place more emphasis on the study of various environmental change issues). (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Numbers of studies removed.
1-185	A	5	1			Needs to tally new studies in public health. (Kimberly Hall, Michigan State University)	Numbers of studies removed.
1-186	A	5	1	5	4	Health/disease/vector studies are not included in this list. There are several, especially for highland malaria, although many were published before 2001 - it is not clear whether this list is for all publications or only post TAR ones. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Numbers of studies removed.
1-187	A	5	6	5	9	This sentence seems a bit unintelligible to a non-specialist. It amounts to the same thing as saying that overall significant responses to temperature change have been observed. (Nathan Gillett, University of East Anglia)	Text has been changed. No longer relevant.
1-188	A	5	6	4	14	I don't much like the use of the word "response" in this kind of context. The use of this word implies that climate change is the known cause of the change in the documented system. Presumably the reason for doing this kind of meta-analysis is to assess whether hypothesis climate change might be the cause of observed changes in a range of systems. Depending upon the extent that observed changes are consistent with anticipated changes, one might conclude that many systems are responding to climate change - but one shouldn't use language that implies this conclusion before the evidence is assessed. Note that this comment applies more broadly to this Chapter (e.g., see also comment 2). (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Text has been changed. No longer relevant
1-189	A	5	11	5	14	Reading the corresponding section this sentence is clear but at first reading it was not very clear "many locations... for which there are no observations of changes" could have meant "there are no observations made in these regions" or "there are no changes observed" to me. (Isabelle Chuine, CNRS)	Text has been changed. No longer relevant

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1-190	A	5	11			The sentence starting "Inductive analysis" is misleading, and could be read to suggest that studies relevant to detecting change have been conducted in all of the geographic areas where changes have been observed, and that there "are no observations" of change. My guess is that in many regions, there are no observations of change because no or few studies have been conducted. (Kimberly Hall, Michigan State University)	Text has been changed. No longer relevant.
1-191	A	5	11	5	14	The phrase, "there are no observations of changes in systems or sectors" is potentially ambiguous. I would recommend changing "observations of" to something like "data concerning", to clarify that the statement refers to systems without data rather than systems with data that indicate no changes in response to warming. (Robert Wilson, Universidad Rey Juan Carlos)	Text has been changed. No longer relevant.
1-192	A	5	13	5	14	Please clarify - do you mean to say that there are many locations with warming and biological data showing no change? Or do you mean that there are many locations with temperature data (warming?) and no corresponding biological data, so we don't know whether changes are occurring or not. (Camille Parmesan, University of Texas at Austin)	Text has been changed. No longer relevant
1-193	A	5	16	5	22	This draft text describes the joint attribution required to attribute observed local and regional changes to human induced climate change, then assigns high confidence to the conclusion that human induced climate change is responsible for the observed changes. However, the underlying chapter presents only two joint attribution studies. While WG I has ascribed global warming to human activities, it has also pointed out the difficulties in assessing regional climate change. Climate can change for a variety of reasons and the smaller the area studied the more difficult it is to ascribe a cause. The case for assigning high confidence to this conclusion has not been made. (Lenny Bernstein, IPIECA)	Synthesis of numerous studies in chapter brought forward from Section 1.3 to 1.4 is now clarified. So ES statement is supported.
1-194	A	5	16	5	22	The lines beginning with "observed responses --" should be deleted. The argument is not convincing (see comments later) and further attribution is supposed to be discussed extensively elsewhere in WGI. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Synthesis of numerous studies in chapter brought forward from Section 1.3 to 1.4 and now clarified. So ES statement is now supported.
1-195	A	5	16			Scientific base is not strong. Literature is thin. To what extent should warming be attributed to anthropogenic factors? (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Joint attribution better explained in text. So ES statement is now supported.
1-196	A	5	16	5	22	The attribution of observed responses to anthropogenic climate change is too strong: natural climate change is also responsible but much less discussed in the paragraph (Giampiero Maracchi, Institute of Biometeorology)	Joint attribution better explained in text. So ES statement is now supported.
1-197	A	5	16	5	19	Ditto. Yes, there are studies like that. Please assess their quality. (Richard S.J. Tol, Uni. Hamburg)	Studies of joint attribution are assessed in chapter.

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1-198	A	5	20	5	22	<p>I think this considerable overstates the case. There are two difficulties here. First, the regions in which observed changes are in accord with expected responses to climate change (NOTE THE WORDING) are probably not same regions in which we have detected anthropogenic climate change. This statement implicitly (and I submit, dishonestly) suggests that the regions are the same. Secondly, I object to the disingenious term "joint attribution". One may have detected a response to climate change in an impacted system (meaning that some fraction, certainly not all, of its variability is explained by climate variability in a manner that is consistent with expectations). One might also have detected an anthropogenic signal in climate data (meaning that some fraction, but certainly not all, of climate variability is explained by anthropogenic forcing). However, putting these two pieces of information together is non-trivial - one can certainly not infer directly from these two bits of information that a response to anthropogenic forcing of the climate system has been detected in the impacted system. One would have to perform an end-to-end study in order to draw such a conclusion. Unfortunately, this concept has not been, although Stone and Allen (2005, Climatic Change, 71, 303-318) do discuss this concept in the context of understanding the causes of changes in extremes. In any case, I urge strongly that the "joint attribution" language be toned down, and that the limitations of a two-stage process be carefully discussed in this Chapter.</p> <p>(Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)</p>	Explanation of joint attribution has been sharpened in text, so ES is now better supported.
1-199	A	5	24	5	36	<p>Analysed from a decision makers' point of view, the umbrella of this section on Vulnerability and Adaptation, has a relatively lower value than would result from focusing the emphasis of vulnerability and adaptation on other geophysical variable affected by the Earth's warming. This is no doubt the case of sea level rise for the small islands and low coastal areas. Statistically-wise other climate variables also show noticeable changes, as mentioned in previous bullets. Observations on precipitation, population rates, etc, have clearly defined trends affecting food production and health, important elements in decision making because affect people 's vulnerability and bring clearer messages for starting adaptation strategies. Hence, this bullet should be revised consequently even in spite of what is mentioned in page 16 lines 36 to 39. The IPCC products shall be increasingly oriented to satisfy decision making needs.</p> <p>(Osvaldo Canziani, IPCC)</p>	Section on Vulnerability and Adaptation removed in ES.
1-200	A	5	24	5	35	<p>There are no confidence statements within this paragraph which detracts from the importance of statements that should be included in this paragraph. Unclear as to what is new under vulnerability and adaptation from results assessed in the TAR.</p> <p>(Roger Brian Street, Meteorological Service of Canada, Environment Canada)</p>	Section on Vulnerability and Adaptation removed in ES.

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1-201	A	5	26	5	28	This sentence is confusing. Do you mean there is greater observed sensitivity of response (greater response) within natural systems (cryosphere, & marine & terrestrial biosphere) than in human systems (agriculture and health)??? I believe this is supported by observational studies. Or, do you mean that WITHIN these natural systems, that some subsets (sectors) are showing greater response than others??? If the former, please state so more directly. If the latter, then the first sentence doesn't connect with the later text on developing countries & health. The connection between the header sentence and the next few sentences isn't clear in any case. (Camille Parmesan, University of Texas at Austin)	Section on Vulnerability and Adaptation removed in ES.
1-202	A	5	30	5	34	This sentence on developing countries likely being more vulnerable (logical as it seems), perhaps should be reconsidered in view of the inadequacies of the U.S. response to Hurricane Katrina in 2005. (Claire Parkinson, NASA Goddard Space Flight Center)	Section on Vulnerability and Adaptation removed in ES.
1-203	A	5	31	5	32	Although developing countries may be more vulnerable to future climate change, in fact current evidence shows that perhaps mid-latitude countries (developed) countries are also vulnerable to the early effects (certainly for evidence of early effects) for 2 reasons- 1) there are temperature thresholds for activity that are clearly being exceeded, 3) the signal to noise ratio is less, as some other determinants of disease are better controlled so that the relative impact of climate warming is more apparent. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section on Vulnerability and Adaptation removed in ES.
1-204	A	5	33			I propose to add " an insufficiency in management and use of available human resources". (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Section on Vulnerability and Adaptation removed in ES.
1-205	A	5	34			yes adaptation occurs in both biological and human systems but the processes are very different. A key question is; how much adaptation has occurred and how much can occur? In other words what are the limits to adaptation in biological and human systems? Perhaps that it not a topic for this chapter. (Ian Burton, University of Toronto)	Section on Vulnerability and Adaptation removed in ES.
1-206	A	5	34			Substitute "...often constrained financial and technological capacity to adapt to changing climate" with the following: "insufficient economic and human resources which constrains their current ability to obtain and exercise available technological options to adapt to climate variability and climate change. This adaptive capacity may be enhanced through measures to advance sustainable development and measures targeted at reducing their vulnerability to climate-sensitive threats that are barriers to	Section on Vulnerability and Adaptation removed in ES.

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						such development." [Source: Goklany (2005b.) (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-207	A	5	34			Insert after the period the following: "On the other hand, developed countries have a greater adaptive capacity; moreover for low to moderate climate change the consequences for human systems in the temperate to upper latitudes could be largely favorable." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section on Vulnerability and Adaptation removed in ES.
1-208	A	5	38			Introduction: at the end of the introduction, it is indicated that the chapter evaluates the existing evidence in regard to six questions. A major weakness of the report is that there is no section providing the best answer to the 6 questions raised in the introduction. Summarizing the findings and answering the questions would make a much more relevant conclusion to the chapter than the present statements and concluding remarks. (Raymond Desjardins, N/A)	Section added at end of chapter, answering these questions.
1-209	A	5	38	7	30	The Introduction (1.1) states that this chapter will focus on research published after the TAR, yet many studies included in the TAR are cited here (in both tables and text). I can understand how referencing older work would at times be unavoidable in the text, but the tables should remove these citations, and repeats should be avoided in the text. In addition, it would probably be helpful to many people if a reference to where similar studies are cited in the TAR was included as a note associated with each table. (Kimberly Hall, Michigan State University)	Studies from TAR removed.
1-210	A	5	43			Where do responses end and where does adaptation start? (Ian Burton, University of Toronto)	'Responses' defined in Section 1.1.
1-211	A	5	43			Section 1.1: that analyse, add: "significant" responses. See the previous general comment on the chapter (line 2); for the reasons detailed before I think it is necessary to introduce the importance of "significant" responses to climate change which supposes a significant climatical variation. (Annick Douguedroit, Université de Provence)	'Significant' added.
1-212	A	5	48	5	50	Since the beginning of this sentence mentions "joint attribution", the end of the sentence should be expanded to: "anthropogenic climate change forcing as well as natural forcings." (Claire Parkinson, NASA Goddard Space Flight Center)	Added.
1-213	A	5	48	5	49	See my previous comment - it would be better to find another term to describe the two-stage detection process that "joint attribution" refers to. Why not call it what it is - sequential detection. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Chapter Authors have decided to keep the term 'Joint Attribution.'

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1-214	A	5	50	6	3	Inclusion of studies which do not show evidence of climate change impacts is important and this principle should be retained throughout AR4. Past IPCC assessments have been inconsistent in their treatment of such studies. The Chapter author team is to be commended highlighting this point, and for the discussion of publication biases summarized in Figure 1.3. (Lenny Bernstein, IPIECA)	Thanks.
1-215	A	5	50	5	50	I suggest changing 'anthropogenic climate change forcing' to 'anthropogenic climate forcing'. (Nathan Gillett, University of East Anglia)	Done.
1-216	A	6	0	7		Scope & goals of this chapter must be re-defined to include analysis of observed major weather/climate events of recent years and their assessment in the context of climate change. Section 1.1.2 must be modified per above comments. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Not focus of chapter. Role of climate variability defined more clearly in Section 1.2.
1-217	A	6	13			I proposes to add " Sahel and North of Africa". (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	North Africa was not cited in TAR in regard to observed changes.
1-218	A	6	19	6	19	Why are impacts on managed systems not included here? The title of the chapter suggests that these are discussed, moreover, there is plenty of information on socio-economic impacts in TAR WG2. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Section on TAR changes in human systems added.
1-219	A	6	31	6	32	There is low confidence in the observations of increases in extreme precipitation. (Nathan Gillett, University of East Anglia)	Extreme precipitation statement removed.
1-220	A	6	38			Page 6, line 38 Changes in biological systems / Phenology COMMENT: Insects: it should be mentioned that for the same species, a temperature increase will lead to more generations per year (e.g. Cammell and Knight 1992), or it may lead to a shift of a species phenology, like observed for a new population of the defoliator pine processionary moth presently causing large economic and ecological impacts in Portugal (WAY, M.J., CAMMELL, M.E., PAIVA, M.R. 1999. Natural biological control of the pine processionary moth <i>Thaumetopoea pityocampa</i> by the argentine ant <i>Linepithema humile</i> in Portugal (Port.). <i>Agric. and Forest Entomol.</i> , 1, 27-31) (Maria Rosa Paiva, Universidade Nova de Lisboa)	Statement reflects TAR.
1-221	A	6	46	6	49	May be it should said why the focus is particularly on Temperature rise. Because precipitation regimes are more difficult to predict? (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Rationale for choice of temperature given.
1-222	A	7	33			I found this section overall difficult to follow and not convincing mainly because I found the section structure sometimes awkward, lots of citations are not referenced and the phrasing is a bit awkward (see specific comments below).	Section 1.2 rewritten.

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						(Isabelle Chuine, CNRS)	
1-223	A	7	33	7	50	Section 1.2: Methods of detection---" What is the purpose of this section? This Chapter text does not use any of this, so why include? (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Section rewritten.
1-224	A	7	35			The first paragraph in section 1.2 is very clear, but the second one goes into detail too quickly. When a method is listed, it should be linked to at least one example of the type of change it could be used to measure. It is also very important to note that many of our assessments of change rely upon data collected for other purposes because often these are the only sources of long-term datasets (i.e., 20 years ago, few people were designing studies to measure responses to climate change). (Kimberly Hall, Michigan State University)	Section rewritten.
1-225	A	7	39	7	43	I found this statement to be very useful. It might be considered for inclusion in the executive summary. (Paul J. Hanson, Oak Ridge National Laboratory)	Thanks. The line is now on page 7, line 14-17.
1-226	A	7	40	7	43	Note that WG1 Chap 9 have changed their definition of detection to be a significant positive amplitude of a signal of forced climate change in the observed record (Peter Stott, Met Office)	OK.
1-227	A	7	41	7	41	phrasing problem (Isabelle Chuine, CNRS)	Section rewritten.
1-228	A	7	45	8	1	When the last phrase mentions a combination of detection methods and that information on other causal factors is needed, it would be interesting to weigh the value of socio-economic changes to find out whether these changes are related to climate changes (i.e. warming), as it is the case of biotoxins' affecting human health. Human system 's behaviour is an important causal factor. (Osvaldo Canziani, IPCC)	Section rewritten.
1-229	A	7	45	8	1	"There are several main methods of change detection, including the use of satellite data". The authors are confusing detection of changes "demonstrating that an observed change is significantly different than that which can be explained by natural internal variability" with the observation of changes (using e.g. satellite or in situ data). Observational methods should be discussed in a separate section if they are to be included. (Nathan Gillett, University of East Anglia)	Section rewritten.
1-230	A	7	45	7	46	Modify "... assessment of these as possible responses ..." as follows: "...attribution of these as probable responses ..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.
1-231	A	7	47	7	47	What is meant by on-site measurements? Are these in-situ measurements? (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Will check in TOD. No longer in FGD.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
1-232	A	7	48	7	50	The first sentence on line 48 states that each method has advantages and disadvantages. However, the following two sentences, on satellite measurements and on-site measurements, only give disadvantages. I recommend changing the second and third sentences to: "Satellite measurements, for instance, often provide global coverage on a daily or near daily basis, but they have a short period of record. On-site measurements, on the other hand, sometimes include much longer records, but are subject to methodological inconsistencies." (Claire Parkinson, NASA Goddard Space Flight Center)	Section rewritten.
1-233	A	7	49	7	50	With respect to satellite measurements the problems are that the length of record is relatively short and there is difficulty ensuring the homogeneity of the record (GCOS). I would suggest that some more clarification is necessary regarding the methodological inconsistencies to which "on-site" measurements are subject. Adding 1-2 examples would be helpful in clarifying this statement. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section rewritten.
1-234	A	7	50			Insert before a new sentence after the period, as follows: "Here too the data are frequently of insufficient duration to estimate whether the changes are within the bounds of natural variability and the extent to which climate change is a probable cause for the change." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten.
1-235	A	8	0	9		Why include Box 1.1 with details of European Heat Wave of summer 2003? Is it because it conforms to human-induced global warming hypothesis? In reality, the NH (Northern Hemisphere) winter months December 2002 to January 2003 were more severe and more widespread globally: There were reports of hundreds of people killed in Vietnam & Bangladesh; 200 people killed in Moscow and in Poland due to severe cold, Baltic Sea had extensive ice cover; deep freeze and heavy snowfall caused disaster in Mongolia and there were long and severe cold spells in eastern and central Canada. NH Winter of 2002-2003 was more widespread globally than European heat wave of summer 2003. Why not include examples of extreme winter weather events along with European heat wave of 2003? (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Box has been cut.
1-236	A	8	1	8	1	Unclear as to whether explicit consideration of other casual factors is needed for detection or attribution (see page 15 lines 8-10). As indicated, detection is the process of demonstrating that an observed change is significantly different... (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section rewritten
1-237	A	8	4			Section 1.2.1 The start of this section is laborious. A few numbers regarding the extent of e.g. land-use change that may affect some climatic variables (that should be identified) would help the reader to grasp the message better	Will consider in TOD. Text rewritten in FGD.

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						(Raymond Desjardins, N/A)	
1-238	A	8	6			Section 1.2.1. Climate and non-climate drivers of change: I was surprised that overfishing which is a very important driver for marine ecosystems was not mentioned in this section. Fishing often decreases the resilience of the stocks and makes some species to react quicker to changes in hydro-climatic variability. I am sure that the authors knows about papers such as Pauly and colleagues (e.g. Pauly et al. (Pauly et al (2003) The future for fisheries. Science. 302: 1359-1361). I suggest that this important non-climate driver be mentioned. These are factors specific to the marine realm or at least aquatic ecosystems. (Gregory Beaugrand, univ-lille)	Add in TOD. Overfishing mentioned as a non-climate driver in the ES. Caveat mentioned in Section 1.3.4 Marine and Freshwater Biological Systems.
1-239	A	8	6	8	14	description of non climatic drivers is redundant to description in section 1.2.1.2 (Markus Erhard, Forschungszentrum Karlsruhe)	Removed.
1-240	A	8	6			Comment on para. See comments 2 and 3 above. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed above
1-241	A	8	9			If something is influencing a "climate variable", why do you call the effect indirect? I suggest using a term other than "climate variable" to describe albedo and soil moisture if changes in these factors are not considered changes in climate. The same sentence is in the Exec. Summary. (Kimberly Hall, Michigan State University)	Interesting point.
1-242	A	8	11			Same as comment n°1 (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Unclear.
1-243	A	8	11	8	14	The list of other impacts is incomplete. Changes in the nutrient cycles and alien invasions, particularly, have impacts that may well be as far-reaching as climate change; and are subtle and not well understood. (Richard S.J. Tol, Uni. Hamburg)	Table redone.
1-244	A	8	15			Need to mention non-native species (Stephen J. Hawkins, The Marine Biological Association of the UK)	Addressed .
1-245	A	8	16	8	42	ENSO, NAO should be added as climate drivers. (Xiaoqi Chen, College of Environmental Sciences)	Added .
1-246	A	8	16			Section 1.2.1.1 the use of the word climate is too general. (Raymond Desjardins, N/A)	.Term retained.
1-247	A	8	16	8	42	Section 1,2,1,1,; I think that somewhere in the text and may be here two characteristics of the warming must be underlined. The first influences the location of certain impacts and the second makes very uncertain the link with the "climate change". In the extra-tropical Northern hemisphere, which is often quoted in the text, temperature decreases from the tropics towards the North pole which means from the south to the	Text rewritten. Major climate variability systems addressed more fully.

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						north. So during a global warming happens a shift of the previous temperature towards the north; on mountains it shifts upward; so natural phenomena and ecosystems are threatened on their south boundary or at their lower location on mountains when they will gain new areas at their northern boundary and upper on mountains if possible. The shifts is easier when it concerns natural phenomena out of the influence of non-climatic drivers as snow for example or animals, birds, fishes etc. than for trees. This is important if you remember how short is the length of the "climate change" (less than 30 years). The second point I would like to underline in 1,2,1,1, concerns the different climatic indices like NAO, ENSO, PDO .. Their links with the climate change is yet not established. The recent long period of positive indices of the NAO coincides with the period of the "climate change" but the physical links is not established. This is just mentionned in the course of a sentence (page 35 lines 22-23) included only in the section 1,3,4, not in the others sections when all comments on results make as if a correlation (without mentioning if it si significant or not) with NAO, ENSO etc; means a signal of "climate change". I shall not detailed later all the pages were such supposed relations are mentionned. (Annick Douguedroit, Université de Provence)	
1-248	A	8	18	8	42	examples for 'other climatic parameters' should be mentioned e.g. water vapour / moisture (Markus Erhard, Forschungszentrum Karlsruhe)	Table revised.
1-249	A	8	19	8	20	" during the ice age" is awkward. Ecosystems distribution changes ont only during ice age, and major vegetation change usually occur between a glacial maximum and a climate optimum. (Isabelle Chuine, CNRS)	Good point. Will address in TOD. CHANGED.
1-250	A	8	19	8	20	The dramatic changes in the distribution of ecosystems during the ice ages illustrate the way that climate determines the distribution of natural ecosystems' might be replaced by something like "climatic conditions are very well represented by the distribution of unmanaged vegetation types showing the close interaction between both climate and plant life forms (biomes, Holdridge)" Holdridge, L.R. 1967. Life Zone Ecology , Tropical Science Center, San José, Costa Rica (Markus Erhard, Forschungszentrum Karlsruhe)	Good point Will address in TOD. Text rewritten based on Chuine's suggestion.
1-251	A	8	19	8	20	this change should be described as a catastrophic event; the implication as written is that this model will be invoked over the near term; surely, more subtle changes such as selection on gentotype then perhaps species for terrestrial plants is more likely in the near time span leading to changes in structure within the smae vegetation types? (Kevin Percy, Canadian Forest Service)	Will address in Tod. Text rewritten based on Chuine's suggestion.
1-252	A	8	27			"the" instead of "these"	Fixed.

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						(Lesley Hughes, Macquarie University)	
1-253	A	8	27	8	27	"determining these distribution" ==> "determining the distribution" (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Fixed.
1-254	A	8	28	8	28	Replace "rainfall" by "precipitation". That's more general. (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Good suggestion. Now on page 8, line 42. Will fix in TOD. Authors use 'rainfall' to indicate non-frozen precipitation in order to be readable for policy-makers.
1-255	A	8	32	8	32	Insert 'ratio' after 'signal-to-noise'. (Nathan Gillett, University of East Anglia)	Will fix in TOD. Text rewritten.
1-256	A	8	32	8	34	It's debatable whether, as stated, the mean temperature and seasonal cycle of temperature "show the clearest signals of change". Another candidate might be tropical, mid-latitude, and polar glaciers. (Claire Parkinson, NASA Goddard Space Flight Center)	Will address in TOD. Now page 8, line 47. Now page 9. Text left as is. Melting of glaciers is an effect of temperature change.
1-257	A	8	32	8	32	Change "signal-to-noise" to: "signal-to-noise ratio". (Claire Parkinson, NASA Goddard Space Flight Center)	Will address in TOD. Text rewritten.
1-258	A	8	34	8	35	The anthropogenic signal in precipitation is also smaller (compared to the naturally-forced signal) and more uncertain. (Nathan Gillett, University of East Anglia)	Will address in TOD (page 8, line 49). Text rewritten.
1-259	A	8	34	8	35	Phrase "Precipitation has much larger variability than temperature on most space and time scales.." needs editing. Although general idea is clear, it is not quite correct to compare different physical parameters that have very different meaning and units. I would suggest the following wording "Precipitation has much large variability on most space and time scales, and it is therefore much more difficult to identify it as a clear driver of changes in systems." (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	Good Suggestion. Page 8 line 49. Will address in TOD. Text rewritten.
1-260	A	8	34	8	35	The sense of the statement is correct, buy how does one quantify this statement? Maybe it would be better to say that precipitation is less uniform in space and time than temperature. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Same as above. Same as above. Text rewritten.
1-261	A	8	35	8	35	What is meant by "identify as a clear driver of changes in the system"? Is this detection or attribution? (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Same as above. Text rewritten.
1-262	A	8	36			The transition to the sentence about "Box 1.1" is very abrupt -- I suggest another sentence introducing the relevance of the box content. (Kimberly Hall, Michigan State University)	Box has been removed.
1-263	A	8	36	8	37	I don't see how Box 1.1 relates to the subject of this paragraph. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Box has been removed.

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1-264	A	8	40	8	42	Also CO2 affects photosynthesis, and THEREBY aids vegetation growth (Kaija Hakala, MTT Agrifood Research Finland)	Will address in TOD (page 9, line 14). Text rewritten. No longer relevant.
1-265	A	8	40	8	40	I would also include total ozone and tropospheric ozone as climate factors (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	Will address in TOD (page 9, line 14). Tropospheric Ozone listed in FGD table
1-266	A	8	41	8	41	Replace "it" by "in" (John Sweeney, National University of Ireland, Maynooth)	Done.
1-267	A	8	41	8	41	This piece of text "acidity it the oceans, " need correction. Probably should be " in the oceans" (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	Done.
1-268	A	8	44	9	8	Box 1.1 is too brief to describe the role of the heat wave as a climate driver in details, so, it may be better to put it in other chapters. (Xiaoqiu Chen, College of Environmental Sciences)	Fixed.
1-269	A	8	45			Box 1.1. Also add effects on primary productivity ---Ciais et al. 2005, Nature 437:529-533. Why no mention of estimates of increased human mortality when compared to typical summer rates? (Kimberly Hall, Michigan State University)	Box removed.
1-270	A	8	45			Words on the effect in buildings, especially Paris, can be provided by me or WGIII Chap 6 if required. (Geoffrey Levermore, Manchester University)	Box removed.
1-271	A	8	45	9	6	Attribution of 2003 heat wave to climate change is restrictive: the discussion is still open if it was a signal of changing climate or concurrence of different causes. Too much emphasis has been devolved to a single case event. No other heat waves of the same intensity and length have been detected in the following or previous 2 - 3 years. (Giampiero Maracchi, Institute of Biometeorology)	Box removed.
1-272	A	8	47			Box 1.1: Heat wave in Europe, summer 2003: the authors do not mention the Chuine et al. (2004) Grape ripening as a past climate indicator. Nature. 432: 289-290. It is not mentioned in the whole text but I think it should be. Using French records of grape-harvest dates in Burgundy, spring summer temperature for the period 1370-2003 were reconstructed. The exceptional nature of the 2003 heat wave in Europe is revealed. This study can also be considered as a good example of the impact of climate on grape ripening. (Gregory Beaugrand, univ-lille)	Box removed.
1-273	A	8	49	8	50	Another study showed that the 2003 heat wave was the hottest since 1370 (Chuine I, Yiou P, Viovy N, Seguin B, Daux V, Le Roy Ladurie E. 2004 Nature 432:289-290. (Isabelle Chuine, CNRS)	Box removed.
1-274	A	8	49			I have also heard the event characterized as having a 1:10,000 to 1:46,000 year return	Box removed.

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						period, and being 6 standard deviations from the norm. (Evan Mills, Lawrence Berkeley National Laboratory)	
1-275	A	9	0	9		Table 1.1; I am not sure if it is foreseen, but I guess that a glossary will be provided. Some terms should be defined such as reforestation, afforestation (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-276	A	9	2	9	2	Previous comment continued ... The assessment contained in the FOD of the response to Question 9.1 reads "Experiments of this type indicate that it is very likely that anthropogenic forcing is responsible for a substantial fraction of the summer warming trend observed over Europe in recent decades, and thus an increase in the likelihood of extremely warm summers. These experiments indicate that human influences may have more than doubled the risk of European mean summer temperatures as hot as those in 2003. More detailed modelling work will be required to estimate the change in risk for specific impacts, such as a successive number of very warm nights in an urban area such as Paris, the type of meteorological indicator most closely related to increased mortality in the summer of 2003." (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Box removed.
1-277	A	9	2	9	2	It would be good if the wording used here to assess the likelihood that anthropogenic forcing has influenced the risk of a similar European heat wave were consistent with that used in Question 9.1 of WG1 Chapter 9. In that question, we do not assess this particular risk using the IPCC calibrated language because the Stott et al study focussed primarily on the risk of a related event (the likelihood of an extremely warm summer, rather than the likelihood of a heatwave). (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Box removed.
1-278	A	9	6	9	6	Include a cross-link to Question 9.1, Chapter 9, WG1. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Box removed.
1-279	A	9	10			Comment on Section 1.2.1.2 and Table 1.1. This section needs to be expanded, per the previous comment, to address additional socio-economic factors which both contribute to the changes and modulate these changes through adaptive responses, especially in human systems. I would note that observation, and attribution, of changes in human (or human-dominated) systems are complicated by the fact that humans have the capacity to -- and often do -- initiate response measures. The extent and success of these measures -- and the complications it causes for the detection and attribution of change -- depends to a large degree on the affected society's adaptive capacity, which is determined by a host of factors including the level of economic development, social and human capital, propensity to implement existing or devise new response technologies, which, in turn, depend on its institutions and incentives prevalent in that society (Goklany 2005b). Note that these factors influence more	Text on socio-economic factors added. Further information is given in the different systems and sectors.

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						than land use change (see p. 10, first para). [Citation provided at the end. NOTE: If a citation alluded to in the comment is not provided, it can be found in the list at the end of these comments.] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-280	A	9	11	9	12	How doe land-use change differ from land-cover modification? (Paul J. Hanson, Oak Ridge National Laboratory)	Land use and land cover have different definitions.
1-281	A	9	11			Table 1.1. Direct and indirect effects of non-climate drivers, Examples: Afforestation Direct effects on systems/sectors: Restoration of ecosystems COMMENT: This statement is wrong because it is not possible to generalized. OFTEN afforestation is conducted with fast growing exotic species (e.g. Eucalyptus spp. in southern Europe, Populus spp. in central Europe), which DO NOT contribute to ecosystem restoration – on the contrary , they generally replace slow growing native species. (Maria Rosa Paiva, Universidade Nova de Lisboa)	References added to statements. Have changed table ecosystems changed to vegetation cover
1-282	A	9	12			add after pollution "(mainly in megacities and large industrialized areas) (Jorge Carrasco, Dirección Meteorológica de Chile)	OK Will change
1-283	A	9	12			I propose to add "forest fires" (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Agree Fire added to table
1-284	A	9	13			"...directly, and also indirectly,..." (Lesley Hughes, Macquarie University)	Changed.
1-285	A	9	16	9	16	These references are missing (Walker et al, Janssen et al 2004) (Isabelle Chuine, CNRS)	Will add later.
1-286	A	9	19			Table 1.1. Eutrophication and fishing not mentioned (aquatic ecosystems)? (Gregory Beaugrand, univ-lille)	Amend in TOD.
1-287	A	9	19			Table 1.1 The title is non-climate drivers but CO2 is included. Please explain. Also the impact of an invasive species (spread of disease, elimination of native species) can be a climate effect, perhaps called an indirect climate driver or a secondary effect? (Ian Burton, University of Toronto)	Added.
1-288	A	9	19	10	1	Table 1.1 Second row, fourth column: it is suggested to replace evaporation with evotranspiration Eight row: add VOC's and surface ozone in the second column add impact on human health and biomes, in the third column add acidic deposition / precipitation in the fourth column. (Osvaldo Canziani, IPCC)	Agree, changed.

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1-289	A	9	19			<p>In the discussion throughout the chapter, there are references to climatic and non-climatic factors of changes. This deserves some comments. Climatic factors are essentially referred to as « climate ». However, the relative importance of specific factors such as net radiation, precipitation, temperature, evapotranspiration, should be addressed in more detail. They are the main climatic drivers. Solar radiation is barely mentioned but not discussed. Among the non-climate factors, the physical processes are more detailed but the explanation in Table 1.1 is still very general.</p> <p>Human factor is indirectly mentioned, through land use change, land cover modification and pollution. It is noteworthy that the world's population evolved rapidly over the last 50 years, from some 2.5 billion in 1950, to 4 billion around the early 70's, to 6 billion by the turn of the century.</p> <p>The human factor is therefore particularly important, both directly and indirectly. Directly, because producing food for the growing population affects climate through the emission of greenhouse gases. Indirectly, because human activities affect the natural and managed ecosystems in such a way that even moderate changes in climate will have much greater economic impacts : a recent example is that of the hurricanes in southern US. If wetlands and river had not been modified to the extent they were, the natural system would have been probably able to resist more efficiently against the wave action. Straightening riverbeds in agroecosystems has a similar effect.</p> <p>Rainfall over an extensive area accumulates more rapidly in the river than when there were woodlots to slow down the waterflow. Such changes are not fully discussed, and it would be very worthwhile to consider this in a separate section. The human factor appears at places but not with its paramount importance.</p> <p>(Raymond Desjardins, N/A)</p>	Agree with comments.
1-290	A	9	19	10	1	table 1.1 last line: other greenhouse gases (non-CO2) should be mentioned too (Markus Erhard, Forschungszentrum Karlsruhe)	Agree, changed.
1-291	A	9	19			<p>As much as possible, the "effects" statements should tell the direction of change --- e.g., increase or decrease in albedo, not change in albedo. Also, in the pollution row, direct effects, I would change species mortality to "extinction", and add increased human illness.</p> <p>(Kimberly Hall, Michigan State University)</p>	Added text on socio-economic factors.
1-292	A	9	19	10		<p>On Table 1.1. As for pollution, soot (or black carbon) should be important besides sulphate aerosol.</p> <p>(Kiminori Itoh, Yokohama National University)</p>	Agree, changed
1-293	A	9	19			Perhaps a column could be added to the table indicating whether each items is expected to compound or dampen the effects of climate change. The third column	Not enough space.

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						already accomplishes this in some instances. (Evan Mills, Lawrence Berkeley National Laboratory)	
1-294	A	9	19			Table 1.1. (continued) Invasive species- Eucalyptus, tamarisk COMMENT: This statement is inaccurate / wrong, generally Eucalyptus IS NOT an invasive species in most parts of the world where it was introduced. (Maria Rosa Paiva, Universidade Nova de Lisboa)	Will check for TOD. Eucalyptus has been deleted.
1-295	A	9	19			Box 1.1 - pg 9 lines 3-4: Add reference to Meehl & Tebaldi, Science 2004 - More intense heat waves in the 20th c. (Camille Parmesan, University of Texas at Austin)	OK.
1-296	A	9	19	10	1	What about "eutrophication" as important non-climate driver? (Gian-Reto Walther, Institute of Geobotany)	To be discussed with group.
1-297	A	9	20			Table 1.1, second row, remove "lower evaporation" and add "loss of carbon" in the Effects on climate column (advice from a verbal enquiry to Andy Pitman, WG Gp I) (Lesley Hughes, Macquarie University)	Agree, will amend.
1-298	A	9				Table 1.1 I propose to add under land cover modification a new line with -second cell : "forest fires" -third cell : "destruction of ecosystem, increase runoff, declines in wildlife habitat"- fourth cell: albedo change, carbon emission, change in water and energy balance. (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Agree and done.
1-299	A	9				Table 1.1: Please change: 1) Land-use change -> Urbanization -> Effects on climate: Change in albedo, urban heat island, local precipitation reduction, downwind precipitation increase. 2) Pollution -> Direct effects on systems/sectors: Add: deterioration of air and water quality. -> Effects on climate: Instead of "sulphate aerosol cooling" better use "direct and indirect aerosol effects", as pollution also includes e.g., soot and dust particles. (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Agree, will implement if possible.
1-300	A	10	0			Table 1.1. Invasive species: marine examples: Carcinus, Elminius; Effects on climate: change in ecosystem processes. (Stephen J. Hawkins, The Marine Biological Association of the UK)	OK
1-301	A	10	0			several references on this page are not included in the reference list at the end of chapter. Ex: Kalnay/Kai, 2004; Pielke (2002a,b), NASA 2004; Vose et al, 2004, Parker 2004 (Madhav Khandekar, Retired research scientist and consulting meteorologist)	OK.
1-302	A	10	0	10		Table 1.1 (pollution): should tropospheric ozone be added here as perhaps the most pervasive ground level air pollutant contributing to radiative forcing? (Kevin Percy, Canadian Forest Service)	Agree.

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1-303	A	10	1	10	1	CO2 mentioned as Climate driver (page 8 line 40) and non-climate driver (Table 1.1 page 10, last row). (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	Will adjust.
1-304	A	10	1			Interesting to see only ONE example of an invasive species in this list...??? What are the selection criteria for the inclusion of a species in this list? (Gian-Reto Walther, Institute of Geobotany)	Removed.
1-305	A	10	9	10	10	What were the results of those studies? (David Rind, NASA/GISS)	Will respond.
1-306	A	10	9	10	9	Suggest calling it the atmospheric greenhouse process. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK.
1-307	A	10	10	10	11	All the references are missing (Isabelle Chuine, CNRS)	OK..
1-308	A	10	11	10	11	Suggest saying that they "...report that the impacts of land-use change on climate is greatest in Southeast Asia..." (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK.
1-309	A	10	11	10	11	"the impact on climate" of what? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Point taken.
1-310	A	10	12	10	14	Note that the effects of land use and land cover changes are not unidirectional. Sometimes they can relieve public health problems. Malaria, for example, is less prevalent in urban areas (see http://www.cdc.gov/malaria/travel/). Urbanization enables cheaper and easier distribution of natural gas as a household fuel, thereby helping displace dung, wood and coal, whose air pollution effects are worse (Goklany 1996). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Agree.
1-311	A	10	12	10	15	Something seems to be missing from this sentence as it refers land-use and land-cover changes also strongly magnifying the effects of extreme climatic events on two areas/outcomes but lists only one. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Thanks, will correct.
1-312	A	10	13			Reference for impact of land use cover on climate: Zhao M & Pitman AJ (2002) The impact of land cover change and increasing carbon dioxide on the extreme and frequency of maximum temperature and convective precipitation. Geophys. Res. Letts, 29: 2-1- 2-4. (Lesley Hughes, Macquarie University)	Thanks.
1-313	A	10	15	10	17	It should be noted that intensification is a double edged sword. On one hand it could, through inappropriate use of nitrogenous fertilizers, add to GHG emissions; on the other hand, by increasing agricultural productivity, it could reduce the extent of cultivation and, with it, loss of soil carbon (Goklany 1998, 2000, 2005b).	Agree.

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						(Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-314	A	10	16			this doesn't affect only 'soils" but terrestrial ecosystems in general (Markus Erhard, Forschungszentrum Karlsruhe)	OK
1-315	A	10	19	10	19	The paper Cheng and Castro (2003) is not included in the references (Sergio Alonso, Universitat de les Illes Balears (University of the Balearic Islands))	Will add ref if possible.
1-316	A	10	19	10	26	The question of the effect of urbanization on climate change is discussed at some length in WG I's FOD. (Chapter 3, pages 9-10). This discussion should be reviewed and summarized, rather than selecting three references and presenting an independent assessment of the issue. WG I's conclusion (Pg. 3-3, lines 33-37) reads: "A number of recent studies indicate that the effects of urbanization and land-use change on the land-based temperature record (since 1950) are negligible as far as hemispheric- and continental-scale averages are concerned, because the very real local effects are accounted for. Increasing evidence suggests that urban heat island effects extend to changes in precipitation, cloud and also DTR (diurnal temperature range) with the latter detectable as a "weekend effect" owing to the alleviation of pollution and other effects on weekends." (Lenny Bernstein, IPIECA)	Agree. UHI effects removed in text.
1-317	A	10	19	10	26	All the references are missing (Isabelle Chuine, CNRS)	Thanks. References added.
1-318	A	10	19			I would mention some other reference to the Urban Heat Island effects, and add some comments about the measurement devices affected by that (in many countries many meteorological stations are located in urban areas or airports): Lin XC, Yu SQ (2005): Interdecadal changes of temperature in the Beijing region and its heat island effect. CHINESE JOURNAL OF GEOPHYSICS-CHINESE EDITION 48 (1): 39-45 JAN 2005. Zhang JY, Dong WJ, Wu LY, Wei JF, Chen PY, Lee DK (2005): Impact of land use changes on surface warming in China . ADVANCES IN ATMOSPHERIC SCIENCES 22 (3): 343-348 MAY 2005 Chung U, Choi J, Yun JI (2004): Urbanization effect on the observed change in mean monthly temperatures between 1951-1980 and 1971-2000 in Korea. CLIMATIC CHANGE 66 (1-2): 127-136 SEP 2004. There is also the neglected problem of the definition of average temperature: until a few decades ago it was considered to be the average between the maximum and the minimum daily temperature, while today in many countries is the average out of 48 or more measurement. How that impacts the trend analysis? Some clarification should be given. (Walter Dragoni, Università di Perugia)	Agree. UHI effects removed in text.

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1-319	A	10	19			<p>I would mention some other reference to the Urban Heat Island effects, and add some comments about the measurement devices affected by that (in many countries many meteorological stations are located in urban areas or airports):</p> <p>Lin XC, Yu SQ (2005): Interdecadal changes of temperature in the Beijing region and its heat island effect. CHINESE JOURNAL OF GEOPHYSICS-CHINESE EDITION 48 (1): 39-45 JAN 2005.</p> <p>Zhang JY, Dong WJ, Wu LY, Wei JF, Chen PY, Lee DK (2005): Impact of land use changes on surface warming in China . ADVANCES IN ATMOSPHERIC SCIENCES 22 (3): 343-348 MAY 2005</p> <p>Chung U, Choi J, Yun JI (2004): Urbanization effect on the observed change in mean monthly temperatures between 1951-1980 and 1971-2000 in Korea. CLIMATIC CHANGE 66 (1-2): 127-136 SEP 2004.</p> <p>There is also the neglected problem of the definition of average temperature: until a few decades ago it was considered to be the average between the maximum and the minimum daily temperature, while today in many countries is the average out of 48 or more measurement. How that impacts the trend analysis? Some clarification should be given.</p> <p>(Walter Dragoni, Università di Perugia)</p>	See 316.
1-320	A	10	19			<p>it might be worth to mention not only urbanization but also impact of air transportation on climate</p> <p>(Markus Erhard, Forschungszentrum Karlsruhe)</p>	Included in pollution.
1-321	A	10	19	10	26	<p>This paragraph is somewhat confused. Presumably the first two studies cited refer to local effects on the climate around cities (diurnal temperature range has decreased globally) - this should be made clear. However, the latter study refers to the implications of urbanisation for observations of global temperature change. I suspect that Parker would not argue that urbanisation has little effect on local climate, but that it has a small effect on global climate trends in the observed record.</p> <p>(Nathan Gillett, University of East Anglia)</p>	Point taken.
1-322	A	10	19	10	26	<p>This section on urban heat island effects seems to contradict what is written in WGI chapter 2 (section 2.5.6, pg 45 lines 47-57) and chapter 3 (pg. 3, lines 33-37; section 3.2.2.2, pg 9-10). WGI gives exact analyses of the heat island effect and concludes that urban areas have little impact on global trends. But, this parag. of WGII implies that there is no scientific consensus and that an urban effect could be considerable.</p> <p>(Camille Parmesan, University of Texas at Austin)</p>	Handled by WG1.
1-323	A	10	20			<p>Within Table 1.1 CO2 is suggested to enhance the global greenhouse effect. While this is true of CO2 in the atmosphere, thought the point of the table was to suggest the</p>	CO2 removed from table.

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						impact on vegetation. Increasing atmospheric CO2 will enhance vegetation photosynthesis and potentially reduce the global greenhouse effect to some degree. (Paul J. Hanson, Oak Ridge National Laboratory)	
1-324	A	10	20			Invasive species row: perhaps I'm just being a sensitive Australian but I wouldn't have thought that eucalypts should be highlighted here as one of only 2 examples of invasive species. They are clearly not the world's worst pests! (Lesley Hughes, Macquarie University)	Others added.
1-325	A	10	21			I believe there is some dispute over the results of Kalnay and Cai, cited here. See Trenberth KE (2004) Rural land-use cover and climate. Nature 427, 213 (15th Jan, 2004) (Lesley Hughes, Macquarie University)	OK Text changed.
1-326	A	10	21	10	23	There is a detailed critique of the Kalnay and Cai study in WG1 Chap 3 FOD page 10 lines 18-31 which concludes that this conclusion is not valid (Peter Stott, Met Office)	OK.
1-327	A	10	22	10	22	Are you sure that an increase in the diurnal temperature range is what is meant here? (David Rind, NASA/GISS)	Removed.
1-328	A	10	23	10	26	WG1 Chap 3 concludes that hemispheric and continental scale temperature averages are not affected by urban warming because the very real but local effects are accounted for (Peter Stott, Met Office)	OK.
1-329	A	10	24	10	26	It is not clear to me how this concluding sentence settles or clarifies the issues that are being alluded to in this paragraph. Presumably Ch 3, WG1, would have a useful assessment that could be drawn upon. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK.
1-330	A	10	29	11	4	This subsection 1.2.2 takes for granted the availability of geophysical data. The current degree of GCOS's implementation, particularly in developing regions, shows that every possible action to improve the data is necessary, should IPCC really and effectively aim to global and not only Northern Hemisphere's assessments, then such a deficiency has to be clearly stated; in this chapter very particularly. GCOS's implementation will provide the data from the terrestrial and oceanic dominions which, like PAR, hydrological data (river flow, snow cover, etc), are badly needed for this chapter's aim. (Osvaldo Canziani, IPCC)	AM: We agree and modified text accordingly.
1-331	A	10	29	13	43	This section may be divided into "conventional data" and "remote sensing data". (Xiaoqiu Chen, College of Environmental Sciences)	AM: Will be divided into ground based observations / data and remote sensing.
1-332	A	10	29			I found the structure and the writing of this section awkward. Especially I do not understand why section 1.2.2.2 "Analysis of no change" is not in section 1.2.3	Structure is improved and 1.2.3.2 is now devoted to analysis of no change including

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						"Methods". The problem comes from the fact that section 1.2.2.2 presents two kinds of studies differing by the type of data analysed, but does not present types of analyses to detect no change. I suggest to change the title of section 1.2.2 for example by "ground observations" since 1.2.2.1. is entitled "remote sensing " (Isabelle Chuine, CNRS)	data and methods.
1-333	A	10	29			Section 1.2.2 (data) and 1.2.3 (methods) can be merged. Text can be shortened by eliminating redundant information (e.g. statistical analyses) in 1.2.3.1 and 1.2.4.1 (Markus Erhard, Forschungszentrum Karlsruhe)	Text is dramatically shortened now.
1-334	A	10	29	16	45	More detailed description of data generally used in the studies assessed would be desired specially on station data which are not discussed in any further detail (while remote sensing data are). (Giampiero Maracchi, Institute of Biometeorology)	We agree that more data description would be useful, however due to space constraints we now refer to the respective subsections (1.3)
1-335	A	10	31			First, if there is a subsection on remote sensing, it seems that 1.2.2 should have a subsection be called "direct observation" or something similar. Also, the first sentence in 1.2.2 is misleading - the rigor of your analysis depends on the quality of your data, not its spatial extent (I'm assuming here the author meant extent, rather than scale --or if s/he is promoting use of multi-scaled studies, that should be clarified). I agree that more and more evidence, in a wide variety of location, is more convincing, but not a pre-requisite for "rigorous analysis." Finally, the subsection on analysis of evidence of no change requires more of an introduction. All of the chapter's six focal questions focus on change, not analysis of evidence of no change. Provide the context that makes this discussion meaningful to the reader. (Kimberly Hall, Michigan State University)	See comment to 1-332.
1-336	A	10	31	10	31	Need to clarify what is meant by "long temporal records and broad spatial scales". I believe that what is meant is long temporal records of observations taken over broad spatial scales are needed. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworded.
1-337	A	10	35	10	36	Many of these data sets exist but are not widely accessible as they are stored rather than archived, or exist only in paper or restricted formats rather than digital and easily accessed (GCOS) (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Agree, idea is included.
1-338	A	11	1	11	2	"Recently, however, the search..." implies that we are looking to prove that climate change exists and has an effect. This is the same as saying we operate with that agenda. This should be rephrased to indicate less mission and more objectivity, something to the effect that we are testing for climate change effects more widely. (Jeremy Kerr, University of Ottawa)	Section is reworded accordingly.
1-339	A	11	1	11	2	"the search for evidence" - I'm a bit worried about the wording here. It hints that the	Section is reworded accordingly.

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						evidence is there (i.e., a particular result is presupposed). It would be better to use somewhat more neutral wording. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	
1-340	A	11	5	11	8	<p>I would suggest the following replacement + new references</p> <p>This makes quantitative direct inter-comparison and calibration among sensors difficult and requires careful implementation of data processing and spectral normalization techniques (Trishchenko et al. 2002a; Trishchenko et al. 2002b; Cihlar et al 2004). Significant progress in this direction has enabled to conduct an assessment of changes in Northern Hemisphere forest productivity (Zhou, Tucker et al. 2001) (see Section 1.3.6), although an additional verification and analysis are still required to determine the manitude of changes more precisely (Lanfredi et al., 2003; Simoniello et al., 2004; Stockli and Vidale, 2004).</p> <p>Cihlar, J; Latifovic, R; Chen, J; Trishchenko, A; Du, Y; Fedosejevs, G; Guindon, B. 2004 Systematic Corrections of AVHRR Image Composites for Temporal Studies; Remote Sensing of Environment 89, 2004; pages 217-233</p> <p>Lanfredi, M., Simoniello, T., and Macchiato, M. 2002. Comment on “Variations in northern vegetation activity inferred from satellite data of vegetation index during 1981 to 1999” by L. Zhou et al., Journal of Geophysical Research, Vol. 108(D12), 4346, doi:10.1029/2002JD003046, 2003</p> <p>Simoniello, T., Cuomo, V., Lanfredi, M., Lasaponara, R., and Macchiato, M. 2004. On the relevance of accurate correction and validation procedures in the analysis of AVHRR-NDVI time series for long-term monitoring. Journal of Geophysical Research, Vol. 109, D20107, doi:10.1029/2004JD004819</p> <p>Stockli, R., and Vidale, P.L. 2004. European plant phenology and climate as seen in a 20-year AVHRR land-surface parameter dataset, International Journal of Remote Sensing. Vol. 25(17), pp.3303-3330.</p> <p>Trishchenko, A; Cihlar, J; Li, Z 2002. Effects of Spectral Response Function on Surface Reflectance and NDVI Measured with Moderate Resolution Satellite Sensors. Remote Sensing of Environment 81, 1, 2002; pages 1-18</p> <p>Trishchenko, A; Fedosejevs, G; Li, Z; Cihlar, J. 2002. Trends and Uncertainties in Thermal Calibration of the AVHRR Radiometers Onboard NOAA-9 to -16; JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 107, NO. D24, 4778, doi:10.1029/2002JD002353, 2002</p> <p>(Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))</p>	Very useful and constructive remark, which has been addressed.
1-341	A	11	6	11	33	Fig 1.1 I guess that this figure can be improved mainly colors (Jorge Carrasco, Dirección Meteorológica de Chile)	Figure 1.1 is removed.
1-342	A	11	6	11	33	Fig 1.1. I didn't find this figure particularly clear or helpful	Figure 1.1 is removed.

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						(Lesley Hughes, Macquarie University)	
1-343	A	11	6	11	27	Figure 1.1. Change HH to Disease and Vector systems. Temporal extent would then 1 to 100 years, and It should be multi-site and single site. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Figure 1.1 is removed.
1-344	A	11	6	11	33	This figure is not clear. For example, crops are presented as having time scales of more than 10 years and up to about 100 years and spatial scales from a single site up to continental scale. It's hard to understand what this means; e.g., certainly no single crop extends over an entire continent, but if the meaning is that a crop can be grown throughout the continent, then probably it can be grown on more than one continent also. I recommend either providing more explanation or deleting the figure. (Claire Parkinson, NASA Goddard Space Flight Center)	Figure 1.1 is removed.
1-345	A	11	8			I don't find this figure very useful and suggest it should be re-thought or deleted. My main complaint is that it seems to mix the temporal scale of individual observations with the temporal scale of a useful dataset. Early on, the text notes that detecting climate change is a signal to noise ratio question, which suggests that you often need a time series of observations. For some groups this approach is reflected in the figure ---i.e., the scale for phenology starts at around 12 years (note: the spatial scale for phenology data should include a single site). However, I don't understand the meaning of a 1 month temporal extent for cryosphere, or indeed the short (<5-10 yr) temporal extents for any group. These seem to reflect the temporal scale of single observations (?), such as a melting of permafrost or bleaching of coral reefs, but like an early blooming plant, most of these events would have to be compared to a time series of the frequency of similar events to demonstrate that they are indeed unusual. I suggest a more useful figure or table would address the "quantities of data" question, perhaps including the typical temporal and spatial scale in simple categories, and introduce the reader to the various areas of research that will be reported in the later tables. (Kimberly Hall, Michigan State University)	Figure 1.1 is removed.
1-346	A	11	29			Figure 1.1 The figure is confusing, can it be clarified? (Ian Burton, University of Toronto)	Figure 1.1 is removed.
1-347	A	11	29			Figure 1.1 and its legend. Check the terminology. Is it MF or FM? (Raymond Desjardins, N/A)	Figure 1.1 is removed.
1-348	A	11	29			Fig 1.1 I'm not convinced that this chart that this chart is useful, and the spatial and temporal scales it depicts seem somewhat arbitrary. For example, why changes in glaciers, ice sheets and ice shelves seen on timescales of 0.1 year, but changes in floods and tropical cyclones are only observed on timescales of ~7 yr. (Nathan Gillett, University of East Anglia)	Figure 1.1 is removed.

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1-349	A	11	29			Fig. 1.1. MF: include marine ecosystems (Southward et al 2005). Southward, A.J., Langmead, O., Hardman-Mountford, N.J., Aiken, J., Boalch, G.T., Dando, P.R., Genner, M.J., Joint, I., Kendall, M., Halliday, N.C., Harris, R.P., Leaper, R., Mieszkowska, N., Pingree, R.D., Richardson, A.J., Sims, D.W., Smith, T., Walne, A.W., Hawkins, S.J. 2005. Long-term oceanographic and ecological research in the western English Channel. <i>Advances in Marine Biology</i> , 47: 1-105 (Stephen J. Hawkins, The Marine Biological Association of the UK)	Figure 1.1 is removed.
1-350	A	11	29			Fig. 1.1. Temporal and spatial scales of observed changes in systems and sectors: CR, Cryosphere; HY, Hydrology and Water Resources, etc... COMMENT: Why is the parameter CO – Coastal geomorphology only considered at continent and country scale, and not at regional and multi site scale, where most alterations are observable? (Maria Rosa Paiva, Universidade Nova de Lisboa)	Figure 1.1 is removed.
1-351	A	11	29			Figure 1.1 is not effective in conveying the desired ideas. The ideas are right, but the diagram is too busy and does not succeed overall. Consideration should be given to an alternative, perhaps simpler approach. (John Sweeney, National University of Ireland, Maynooth)	Figure 1.1 is removed.
1-352	A	11	36			Section 1.2.2.1. remote sensing. No mention to any application of remote sensing for Marine Ecosystems. I suggest the authors fill this gap. See for example the work of the IOCCG working group. At least talk about CZCS (see Fig. 1.6.) (Gregory Beaugrand, univ-lille)	OK. We will address
1-353	A	11	36	12	36	Remote sensing data should be described according to their spatial and temporal resolutions and their applications in detecting system and sector changes in 1.3. Fig. 1.2 does not show the data but the result of NPP estimate, therefore, it should not appear in this section. (Xiaoqiu Chen, College of Environmental Sciences)	Good suggestion, but not enough space for the first point. The second has been addressed. Figure included as derived from remote sensing products.
1-354	A	11	41	11	41	I suppose 'remote sending' is remote sensing (Sergio Alonso, Universitat de les Illes Balears (University of the Balearic Islands))	Addressed.
1-355	A	11	41	11	41	remote sensing' instead of 'remote sending' (Markus Erhard, Forschungszentrum Karlsruhe)	Addressed.
1-356	A	11	41			remote sensing (Lesley Hughes, Macquarie University)	Addressed.
1-357	A	11	41	11	41	Typo: replace "remote sending" by "remote sensing". (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Addressed.
1-358	A	11	41	11	41	"sending" ==> "sensing" (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Addressed.
1-359	A	11	44	11	48	I am not sure that there have been many studies documenting land use changes from	Addressed.

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						these coarse resolution sensors. Rather, land cover changes have been documented that could be attributed to land use changes given ancilliary information. Further, the NOAA AVHRR series of sensors are capable of detecting some drastic but important land cover changes such as very large clear cuts, burnt area (could be also indicator of land use in areas of slash and burn agriculture), and regrowth. These sensors have a 20 year+ time series and hence the statement made is perhaps too pessimistic. (Richard Fernandes, Natural Resources Canada, Government of Canada)	
1-360	A	11	45	11	45	"MODIS on board AQUA" should be: "MODIS onboard Aqua and Terra". (Claire Parkinson, NASA Goddard Space Flight Center)	Addressed.
1-361	A	12	0			What is the purpose of Figure 1.2? It seems to support beneficial impact of climate change. If so, mention this specifically. Sections 1.2.2.2 must also include examples of changes which are diametrically opposite to what is prescribed in a 'warmer climate', for ex. some winter season extreme weather events have been observed with increased frequency in recent years in some regions. The Atlantic Canadian provinces from Labrador to Sable Island south of Nova Scotia have experienced longer winter season, heavier snowfalls and more winter blizzards in last five years. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Addressed.
1-362	A	12	0	16	0	Rigorous section on data and methods welcomed to avoid problems during Governmental review (Merylyn McKenzie Hedger, Environment Agency)	Addressed
1-363	A	12	6	12	8	Satellite measurements, no matter how well calibrated, do not measure forest productivity. Such estimates come from models using input data from satellites. This document should be clear on the distinction between measured NPP components and modeled estimates of NPP. Figure 1.2 is appropriately presented as a figure depicting 'estimated' NPP. (Paul J. Hanson, Oak Ridge National Laboratory)	Addressed.
1-364	A	12	31			Fig 1.2 is briefly mentioned, but not discussed. I suggest removing it unless more discussion is included. One question prompted by the figure which is not addressed in the text - why does NPP decrease in the North of Siberia and Canada? This might be where one would expect an increase due to warming temperatures. (Nathan Gillett, University of East Anglia)	Addressed.
1-365	A	12	32	1	32	Shouldn't "... mean fraction of photosynthetically active radiation..." be written as "...mean fraction of absorbed photosynthetically active radiation..."? (Knut Nadelhoffer, University of Michigan)	Addressed.
1-366	A	12	38	13	43	The three paragraphs deal with methods and repeat the content in 1.2.3.2, so they should not be included in the section "data". (Xiaoqiu Chen, College of Environmental Sciences)	Addressed.

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1-367	A	12	38			I do not understand the purpose of this section. The difference between the two types of studies presented seem too small to be discussed here. I suggest reducing it substantially and keep only the last paragraph. Moreover, this section presents rather methods of analyses as it states (Method 1, Method 2) than data. It should then appear under section 1.2.3. Methods (Isabelle Chuine, CNRS)	Addressed.
1-368	A	12	38			Section 1.2.2.2 start of the paragraph needs rewriting (Raymond Desjardins, N/A)	Addressed.
1-369	A	12	38	13	43	The analysis of evidence of no change is one of the key factors in the studies: more details are needed to specify the importance and the role of the analysis (Giampiero Maracchi, Institute of Biometeorology)	Section rewritten.
1-370	A	12	38			Section 1.2.2.2: This entire section can be cut (Camille Parmesan, University of Texas at Austin)	Section rewritten.
1-371	A	12	38	13	43	Section 1.2.2.2 . (page 12-13) This section draws two false dichotomies, both of which stem from the biases of chapter 1 authors and not from peer-reviewed literature. It claims that there are two methodologies. It claims the first method is exemplified by Menzel & Dose (2005) and is the more general and inclusive of the two. It claims the second method is exemplified by Parmesan & Yohe (2003). This second "method" is described as being more restrictive because (they claim) it confined analysis to areas where climate change is known to be occurring and was not inclusive of all species for which there were data. This distinction is false, and the description of methodologies of the Parmesan and Yohe study is incorrect. The Parmesan & Yohe study was NOT restricted to areas where climate is changing, it WAS inclusive of all species regardless of whether a change was detected. No synthetic analyses of which I am aware have restricted themselves to sites known to be undergoing particular climate trends. Therefore, the framework that is drawn up here, distinguishing between studies on the grounds of restriction to areas with changing climate, is an incorrect way to classify published studies. Having drawn up this false dichotomy, the following paragraph spanning pp 12-13 then lists "different" questions that can be tackled using the two approaches that are, in fact, not different. If we read these two questions carefully, they are in fact identical, merely phrased with slightly different wording. Neither the categorization of the studies nor the use that could be made of the alleged categories makes sense. Further, they fail to point out a true dichotomy in the literature (i.e. one perceived by many biologists) of single-species/single-location studies vs multi-species/regional to continental scale studies. These two categories really do give you different pictures of biological change, with the former being more biased towards showing strong	Section rewritten

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						response to climate change than the latter. (Camille Parmesan, University of Texas at Austin)	
1-372	A	12	40	12	48	The distinction between the two approaches discussed here is not very clear. In both cases there is reference to sites experiencing climate change. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten
1-373	A	12	41	12	42	Not sure I understand the phrase "that are able to examine evidence of no change" as it does not appear, based on my interpretation of this phrase, to fit with the rest of the paragraph. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section rewritten.
1-374	A	12	45	12	48	This sole sentence describing Figure 1.3 does not mention a key aspect of Figure 1.3, which regards whether a study is likely to be published. I recommend adding the following two sentences after the sentence on lines 45-48: "Studies are most likely to be published when climate and system changes are found and are in the expected direction. Studies are least likely to be published when no changes are found, with a result that the 'no change' case is underrepresented in the published literature." (Claire Parkinson, NASA Goddard Space Flight Center)	Section rewritten.
1-375	A	12	50	13	43	The logic in this section is seriously flawed. First, the networks I am aware of (Method 1) are not representative of taxa, regions, or biological communities as a whole, and the selection of a subset of species and sites to monitor represents a bias. The use of networks may eliminate reporting bias to other researchers in the network, but still it would be harder to publish results that show no change, so others using network-based data still may encounter a publication bias. Even more importantly, the number (or %) of non-changing species in a network is typically not taken from any sort of systematic or random sample; especially for networks with a long history, which provide the most useful information for studies of climate change, it is likely that species were chosen for monitoring based on their tendency to vary between years. Thus, it is inappropriate to extrapolate from these data, or from data under method 2 (suites of species & processes, reporting data on changing and non-changing species, where still the researchers did not randomly choose which species to monitor) about the number of non-changing species at a locality, region, or the planet. It would be a rare exception where this would be possible. Although I'm not sure that this section is the best place to discuss it, I think it is important to point out that Method 2 type studies are MOST subject to positive publishing bias if the researcher tries to draw conclusions about representativeness of change from the data sites, rather than focusing on patterns within the suite of traits or species that do show change, and limiting inferences to that group. I did not find the figure helpful, and suggest deleting it and replacing with a few lines of text. Finally, the relevance of	Section rewritten.

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						resilience and thresholds to documenting observations of species response to climate is not described, so can be deleted here. (Kimberly Hall, Michigan State University)	
1-376	A	12	50	12	50	What are "network species"? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten.
1-377	A	13	0	16		Section 1.2.3 Methods: This section provides general discussion on methods, statistical analysis, meta-analysis etc. What is the purpose of this section here? The rest of the text (Section 1.3 and various subsections) essentially summarizes studies in various areas like cryosphere, hydrology etc. without any direct reference to methodology etc. Only section 1.4 has some discussion on these issues with few examples of application. It is suggested that this section 1.2.3 and pages 13-16 be completely deleted from here while adding in section 1.4 more details of methodology (Meta-analysis etc) with appropriate references. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Section rewritten.
1-378	A	13	30			Fig. 1.3. I do believe that this is true for publication. To me, I would think that this is more related to mediatisation. (Gregory Beaugrand, univ-lille)	Figure cut.
1-379	A	13	30			Fig 1.3 This diagram is unclear. What is its purpose? In particular the text in the different boxes conveys different types of information - one box has 'Same direction as expected', another has 'Lack of research funding'. Is there really no analysis of regions with no climate change and no system changes? Generally I think the diagram does not contribute enough useful information to warrant its inclusion. If it is to be retained, I suggest that it focus solely on publication biases, with the text in the boxes replaced by the information on publication biases. (Nathan Gillett, University of East Anglia)	Figure cut.
1-380	A	13	30			fig.1.3. How has the information for this figure been collected? How has the link between outcomes of a study and probability of its publication been assessed? (Piero Lionello, Univ. of Lecce)	Figure cut.
1-381	A	13	34	13	38	The use of Method 1 and Method 2 in this paragraph does not help, even more so when the next section (1.2.3.) is entitled Methods. The statements regarding publishing biases should be drawn out into a separate paragraph as it only adds confusion to the message regarding the strengths and weakness of the approaches (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section rewritten.
1-382	A	13	40			Presumably it is also the case that research that fails to find a significant, directional effect is also less likely to be submitted for publication at all. (Lesley Hughes, Macquarie University)	Section rewritten.
1-383	A	13	42			"... which at times may not be the case."	Section rewritten.

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						COMMENT: This sentence denotes little scientific experience, it is next to impossible to examine all the species in an area., perhaps as a compromise : "... which would rarely be possible." (Maria Rosa Paiva, Universidade Nova de Lisboa)	
1-384	A	13	46	13	46	Having this section entitled "Methods" is somewhat confusing considering that section 1.2 is entitled Methodologies and the previous section 1.2.2. also refers to methods. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section names changed .
1-385	A	13	48			remove "attribute" (Lesley Hughes, Macquarie University)	Change in TOD (Page 12, line 10) DONE in FGD.
1-386	A	13	49			"...correlation, or time series methods..." (Lesley Hughes, Macquarie University)	Change in TOD. Page 12, line 11. DONE. NOW IN FGD.
1-387	A	14	5	14	35	This section does not convey much useful information in my view. It simply states that some researchers examine continuous or discontinuous data, some examine trends and some correlations, without really giving any insight into the relative merits of the techniques, or the studies which use them. (Nathan Gillett, University of East Anglia)	Section rewritten.
1-388	A	14	7	14	35	The discussion of statistical techniques is strongly geared toward phenology data, and does not provide much background for interpreting many of the other types of changes identified in this chapter. (Kimberly Hall, Michigan State University)	Section rewritten.
1-389	A	14	10	14	15	These sentences are incorrect. Wide geographic area and multiple taxa do not inherently increase the reliability of results. The validity -- and therefore likelihood of corroboration, if that is what the authors mean by "reliability" -- is dependent upon the quality of the raw data and the analyses. Thus, it is more difficult to produce reliable results with disparate data from multiple taxa or large areas. One could argue that single-site, intensively studied single species studies are more reliable because of greater control of potentially confounding variables. (Kimberly Hall, Michigan State University)	Addressed.
1-390	A	14	12	14	25	The Bradley, Leopold et al. (1999) paper is not a good example for this discussion, since it uses regression analysis to project trends across a time period with a 29-year data void (data used are from 1936-1947 and 1976-1998). In such situations, regression should not be used, but rather statistical comparisons of the two period means, as subsequently outlined in lines 18-23. (Mark Schwartz, University of Wisconsin-Milwaukee)	Fix in TOD. (Page 12 line 28). Bradley is no longer cited in FGD.
1-391	A	14	15	14	16	While the second and third paragraphs of this section (1.2.3.1.) are interesting I think that the first should be redrafted to cover more statistical techniques	Will change in TOD. Sections have been rewritten for the FGD.

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						(decomposition of the variability in a time series: singular spectrum analysis decomposes the signal into a trend, a pseudo-cyclical or cyclical variability, year-to-year variability, discontinuity analysis such as split moving window boundary analysis identifies rapid changes, D2 to the centroid technique identifies exceptional events, epoch analysis examines the link between a physical event and a biological event). (Gregory Beaugrand, univ-lille)	
1-392	A	14	16			Anything can be estimated using either Classical or Bayesian techniques. (Richard S.J. Tol, Uni. Hamburg)	Add classical statistics!
1-393	A	14	18	14	21	I think it would be appropriate to include some words discussing the appropriateness of this approach. Can we have confidence in tests of hypothesis if the data used to perform the test are the same data that are first used to develop the hypothesis? This is, ineffect, what is done if the data are assess for step changes, and a test is subsequently performed to determine whether there is a significant change before and after the step that has already been noticed in the data. This is okay as exploratory data analysis, but it does not provide a confirmatory result. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Good point. Add in TOD. Section has been rewritten in the FGD.
1-394	A	14	29	14	31	phrasing problem (Isabelle Chuine, CNRS)	Changei n TOD. Section rewritten.
1-395	A	14	29	14	30	Incomplete sentence. (Paul J. Hanson, Oak Ridge National Laboratory)	Changed.
1-396	A	14	31	14	35	I do not understand the purpose of these two sentences here. (Isabelle Chuine, CNRS)	Clarify in TOD (Page 12, line 36-39). Section rewritten/no longer present in FGD.
1-397	A	14	33	14	35	I think a bit more explanation is required here, to describe what is a proportional hazards model, and whether analyses performed with such a model are different from the three common approaches. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Clarify in TOD. Section rewritten/no longer present in FGD
1-398	A	14	34	14	35	Some mention should be made of the need to have data and adjust for confounders in these types of statistical analyses. The paper by Kovats et al. 2001, describes the necessary adjustments that should be made before any causal association could be inferred. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Add in TOD. Section rewritten/no longer present in FGD.
1-399	A	14	37			Meta-analyses should be part of section 1.2.3.1. (Isabelle Chuine, CNRS)	Moved to section 1.4.1.1
1-400	A	14	39	14	40	"combining quantitative findings" is a bit awkward. One should rather read "data" instead of "factor" I think. (Isabelle Chuine, CNRS)	Address in TOD: Section 1.4.1.1. Phrase no longer present in FGD.

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1-401	A	14	39	15	4	The typical goal of a meta-analysis is to not just combine data, but to estimate a general result. A key point with respect to criteria is that your criteria should reflect the hypothesis being tested with the analysis, and (in part) the criteria used determine your scope of inference (Kimberly Hall, Michigan State University)	Addressed.
1-402	A	14	42			Typo with the references (Stephen J. Hawkins, The Marine Biological Association of the UK)	Addressed.
1-403	A	14	42	14	43	Root et al 2003 does not meet the criteria of a "meta-analysis" because it explicitly excluded values of phenological change that were not statistically different from zero. This is a repeat of a criticism I made on the ZOD. (Camille Parmesan, University of Texas at Austin)	Addressed in TOD. Meta-analysis is a statistical method of combining quantitative findings from multiple studies investigating similar factors for the purpose of finding a general result. The methods used in the various studies, however, need not be similar. The criteria for inclusion of studies in a meta-analysis are determined <i>a priori</i> and rigorously followed to avoid investigator effect.
1-404	A	14	43	14	43	"cherry picking" is awkward, "investigator effect" may be more suitable? (Isabelle Chuine, CNRS)	OK.
1-405	A	14	45			It is not clear on which basis a time span = 20 years is considered long enough for a trend to be noted. To me a time span of 20 years seems to be a rather short span: that should be discussed, proved or changed. (Walter Dragoni, Università di Perugia)	Address in TOD. Disagree. Authors feel that two decades is long enough to begin to note trends – especially when the trend is noted across several species or systems.
1-406	A	14	48	14	48	Menzel 2005 : problem of citation (citation inadequate) and reference (Isabelle Chuine, CNRS)	Fixed.
1-407	A	14	48	15	4	There appears to be mis-interpretation of what constitutes a meta-analysis. Meta-analysis is a specific category of statistical techniques (in use in social and clinical sciences for decades). Root et al. 2005 did not include meta-analysis; it was a large scale assessment, and re-analysis, of primary data. Likewise, for the following sentence, meta-analysis does not involve the re-analysis of original data. The analysis of large scale, multi-site or aggregate data should not be confused with the well-defined, long-established approaches of statistical meta-analysis. This last section (page 15, line 1-4) is confusing --was some text left out? I have not yet seen Menzel et al. (2005), but I am guessing that the authors went back to original data sources to include data on species showing no change, an important endeavor, but not by definition a meta-analysis; I'm assuming this work also involved combining results from different published studies to be included in this category.	Section on meta-analysis rewritten.

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						(Kimberly Hall, Michigan State University)	
1-408	A	14	48	14	49	For the reasons in comment #15, network data is of limited use for assessment of no change and, therefore, resilience. It is not clear how thresholds are relevant. (Kimberly Hall, Michigan State University)	Section cut
1-409	A	14	49	14	49	the sense of "evidence of no change, resilience and threshold" is not clear to me at all (Isabelle Chuine, CNRS)	Section cut
1-410	A	14	50	15	1	As above, taking out data showing "no change" violates the framework of a statistical meta-analysis (Camille Parmesan, University of Texas at Austin)	Needs to be addressed in TOD. See above
1-411	A	14	50	15	1	Add Walther 2004 (review paper on plants) to the references mentioned here. Full reference: Walther, G.-R. 2004. Plants in a warmer world. Perspectives in Plant Ecology, Evolution and Systematics 6, 169-185. (Gian-Reto Walther, Institute of Geobotany)	Section rewritten and moved to 1.4.
1-412	A	15	0			A brief statement regarding the definition of attribution and joint attribution could be included in the executive summary. (Paul J. Hanson, Oak Ridge National Laboratory)	Address in TOD. Text rewritten.
1-413	A	15	3	15	3	reference problem (Isabelle Chuine, CNRS)	Fixed.
1-414	A	15	3	15	4	Parmesan and Yohe (2003) should be cited here as an analysis of frequency of no change (Camille Parmesan, University of Texas at Austin)	Addressed. Information now moved to 1.4.
1-415	A	15	6			Comment on Section 1.2.3.3. [A] There is an important step missing here, particularly from the policy perspective, namely estimating what fraction of the observed change is due to natural variability, and what fraction due to climate change. This, I believe, should precede the joint attribution described in lines 33 to 35. [B] How long a period of record is needed before one can be confident that observed changes are due to climate change, and if climate change, then not due to natural variability? See comment 5, above, for instance. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten and moved to 1.4.
1-416	A	15	6			The use of the word "attribution" is very unfortunate, as it suggests an analogue with attribution of climate change. However, climatologists use population data and test it against process-based models that were validated and are believed to include all drivers. Ecologists use sample data (with suspect sampling methods) and test it against half-baked theories that are known to ignore important drivers. (Richard S.J. Tol, Uni. Hamburg)	Comment not constructive.

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1-417	A	15	16			SECTION 1.2.4.1: Publishing bias is clearly important for estimating the percentage of species that show changes in response to observed changes in regional climate. However, it is much less important for estimating the percentage of species that respond in the expected (as opposed to the unexpected) direction to observed climate change. On p. 16, 1.19 at the end of the subsection, a sentence such as the following should thus be inserted: "The publishing bias is relatively unimportant if the meta-analysis is restricted to species that show some change in connection with regional climate change (Root, Price et al., 2005). (Hans Martin Fussel, Stanford University)	Sections on publishing bias have been rewritten.
1-418	A	15	18	15	35	More discussion of joint attribution should be included here. Firstly, attribution of changes in systems need not be carried out using the 'joint attribution' methodology. For example, if the system concerned is something that can be well-resolved within a climate model, such as sea ice, then the usual direct attribution method can be applied. As climate models become more complex, including features such as biosphere models, or forest fires, direct attribution of more variables will become possible. Second, it should be made clear that the 'joint attribution' method described is not as rigorous as the usual direct attribution. For example, if year-to-year temperature variations at a point explain, say, 5% of the variance in some impact variable (and this link can be demonstrated to be statistically significant), and anthropogenic forcing explains 5% of the variance in those temperatures (again assume that this link is statistically significant in the data available), then the impact variable in question would be 'jointly attributed' using this method, even though anthropogenic climate change would only explain 0.25% of the variance of the impact variable of interest, and this link may not be statistically significant in the available data. To take an extreme example, change in some impact variable could be attributed to anthropogenic forcing using the 'joint attribution' method, even if the trends were in inconsistent directions. (Nathan Gillett, University of East Anglia)	Considered in TOD. Text rewritten.
1-419	A	15	18	15	19	I agree that attribution in this case is difficult, but the detection and attribution process does not necessarily need to be two-stage. See comment 8 on "end-to-end" attribution. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Comment considered but not accepted.
1-420	A	15	25	15	25	First, there is no flood in 1997. Instead a big flood event was occurred in 1998. Second, even though, flood in 1987 is considered as one of the extreme floods in Bangladesh, its impacts especially in term of flooding extents are much smaller in comparison with 1988 or 1998 flood. If you mention inundated are almost 70%, you	Unclear. These lines do not talk about a flood.

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						should not include 1987. It is mentioned here that inundated areas during 1987, 1988 and 1998 floods are 39%, 62% and 68% respectively. (Mohammed Karim, Ibaraki University)	
1-421	A	15	33	15	33	See my previous comments - it would be better to find another term to describe the two-stage detection process that "joint attribution" refers to. Why not call it what it is - sequential detection. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Comments considered but not accepted.
1-422	A	15	38			Section 1.2.4 start of the paragraph needs rewriting (Raymond Desjardins, N/A)	Section cut
1-423	A	15	38	16	45	Section 1.2.4 needs to be strengthened in terms of material on confidence in methods and results. Although it does attempt to explore confidence, it primarily continues to focus on impacts rather making it difficult to ascertain how this section differs from others talking about observed changes. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section cut
1-424	A	15	43	15	43	Does this statement that identified links are inherently correlational (i.e., based on empirical evidence?) unstate that situation? Are there instances where other information, such as an understanding of the physiology of the organism being studied, could be used to strengthen inferences? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section cut
1-425	A	15	45			See comment 4 about use of word "adaptation." (Kimberly Hall, Michigan State University)	Unclear.
1-426	A	16	6	16	7	The statements on locations of data from Parmesan and Yohe (2003) are incorrect. The sign-switching analysis referred to here was largely from Europe for the temporal and spatial data, but nearly all from North America for the community data. (Camille Parmesan, University of Texas at Austin)	Section cut and discussion of paper rewritten in section 1.4.1.1
1-427	A	16	6	16	7	This is an important point that should also be considered in other places where this paper is referenced. (Mark Schwartz, University of Wisconsin-Milwaukee)	Addressed.
1-428	A	16	7			There is a comment here as to the possible lack of representativeness for the entire Northern Hemisphere. As mentioned above, it would be much more appropriate for the reader to be made aware that the real problem is the lack of representativeness of the entire globe! (Lesley Hughes, Macquarie University)	Section cut.
1-429	A	16	9	16	19	Neither of the studies cited actually address attribution according to the definition on the previous pages where "the observed local climate change must be attributed to anthropogenic causes with a similar degree of confidence", i.e., Parmesan and Yohe (2003) and Dose and Menzel (2004) do not address anthropogenic vs. natural	Section cut and rewritten in section 1.4.1.1

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						forcings on climate. The only large scale ecological study to do this, Root et al. 2005, is not cited here, nor is the regional attribution of forest fires paper by Gillett et al. (2004). And what is the point of the publishing bias statement? Again, bias depends on the question asked and scope of inference, and even by combining positive, negative, and no change results, we do not yet have the broad coverage of taxa, regions, etc. to "establish general findings." (Kimberly Hall, Michigan State University)	
1-430	A	16	10	16	11	Not sure what is meant by "unique" fingerprint --is the point that evidence of change in relatively undisturbed habitats is the most valuable due to fewer stressors? (Kimberly Hall, Michigan State University)	Section rewritten.
1-431	A	16	10	16	11	How do we know that such responses are unique to climate change? Might other factors (e.g., changes in soil fertility resulting from land management practices) affect the responses that are mentioned? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten and moved to chapter section 1.4
1-432	A	16	11	16	11	Whereas the term "'fingerprint' of climate change" has become increasingly well-known among experts working on climate impact studies, the general audience might be less familiar with this term. Hence, I suggest to include the reference of the original publication which has introduced this term in ecological climate impact research, when this term is used in the report. -> Suggestion for rewording the following sentence: "Identifying a unique climate change 'fingerprint' (Walther et al. 2001), such as earlier blooming dates, ..." Full reference of Walther et al. 2001: Walther, G.-R., Burga, C.A. & Edwards, P.J. (eds.) 2001. "Fingerprints" of Climate Change - Adapted behaviour and shifting species ranges. Kluwer Academic/Plenum Publishers, New York. (Gian-Reto Walther, Institute of Geobotany)	Walther is cited elsewhere in chapter.
1-433	A	16	13	16	14	"Attribution to climate change is bolstered by empirical or modelling studies that illustrate a response to climate in the observed direction". Surely this is a fundamental requirement for attribution. Or would any correlation with a climate variable linked to climate change count as attribution? (Nathan Gillett, University of East Anglia)	Section rewritten and moved to 1.4.
1-434	A	16	13	16	14	This sentence is not very clear - does this add anything to the previous two sentences? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten and moved to 1.4.
1-435	A	16	14	16	16	Should be a separate section on publishing biases (see earlier comment of page 13, line 38) rather than bits and pieces in various sections and paragraphs. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section rewritten and moved to 1.4.
1-436	A	16	16	16	18	Add point that evidence of early effects may be clearer (and more likely) in vector (biological) systems than human systems, where there are less (human made)	Section rewritten and moved to 1.4.

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						determinants affecting the outcome. See Kovats et al. 2001. (Sari Kovats, London School of Hygiene and Tropical Medicine)	
1-437	A	16	17			Bayes' Theorem was published in 1763. (Richard S.J. Tol, Uni. Hamburg)	Yes, but new methods of analysis have been utilized since then.
1-438	A	16	21	16	33	Not clear here whether you are talking of biological adaptation, or human strategy to adapt. Should be specified and defined upfront (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Clarified, section has been cut.
1-439	A	16	23	16	24	phrasing problem (Isabelle Chuine, CNRS)	Addresseed in section 1.3.8
1-440	A	16	23	16	27	See comment 4 about use of word "adaptation." The study on non-stationarity (can you use a more easily understood phrase?) apparently focused on European flowering plants; quite possible other taxa like insects or birds would be more likely to show a variation in response to a particular amount of e.g. temperature change over time. Make the sentence more specific to the data upon which it is based to avoid over-generalization. (Kimberly Hall, Michigan State University)	Section cut
1-441	A	16	23	16	33	It should be made clear that in human systems, there will be no "signal" if adaptation is successful. Thus, it may not be possible in some systems (e.g. human health outcomes) to distinguish between Case A: no effect (of CC) and no adaptation, and Case B: effect of CC and successful adaptation. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section cut
1-442	A	16	24	16	26	meaning not clear (Isabelle Chuine, CNRS)	Section cut
1-443	A	16	32			Not just "premiums" but also deductibles, exclusions, and availability. Same comment on page 82, line 39. (Evan Mills, Lawrence Berkeley National Laboratory)	Section cut
1-444	A	16	35	15	36	It's not obvious that the availability of insurance does not actually add to risky behavior, like building in flood plains, hurricane-prone areas (due to "moral hazard"). I would retain the start of the first sentence, and replace the remainder, as follows: "Adaptation likely plays a role in disasters and hazards. Average deaths per year from climate and weather related events (i.e., drought, extreme temperature, famine, flood, slides, wave/surge; wild fires, wind storm) declined worldwide by over 95 percent between the 1930s and 2000-2003, while death rates declined overall by 98.5 percent [Goklany 2005c, based on EM-DAT, the OFDA/CRED database; this database probably missed a number of events in the early years, which suggests an even stronger downward trend. If famines are excluded then both deaths and death rates peaked during the 1920s]. Similarly, long term data from the United States on	Will address in TOD. Text rewritten.

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						cumulative deaths and death rates due to hurricanes, floods, lightning and tornados show that they peaked in the 1970s, and have since declined by over 50 percent for deaths, and 64 percent for death rates [Goklany 2000 and personal communication]. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-445	A	16	39	16	41	sentence unclear and awkward (Isabelle Chuine, CNRS)	Section cut
1-446	A	16	39			Insert after the period on line 39, the following: "Accordingly, it is important, as a start, to try to separate out what fraction of the losses are due to climate change and what fraction due to increased property at risk because of greater, wealthier and better-insured populations (Pielke and Landsea 1998, Goklany 2000). A supplementary approach to test ..." This would also modify the next sentence somewhat. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section cut
1-447	A	16	42	16	42	In view of the potential magnitude of terrorist and other human-caused threats, I would replace "the principal non-climatic hazards are geological" by: "the principal natural non-climatic hazards are geological." (Claire Parkinson, NASA Goddard Space Flight Center)	Section cut
1-448	A	16	44			Figures 1 and 2 Science Vol. 308, Issue 5737, pp.1040-1044] include 2099 non-weather-related events and 12117 weather-related events. -- Munich Re data. (Evan Mills, Lawrence Berkeley National Laboratory)	ADAPTATION
1-449	A	16	48			Section 1.3. I have several general comments on the main results section of the chapter. Length of sections - certain systems have a longer length relative to the number of examples referred to (1. Cryosphere, 3. Coastal processes, 8. Disasters and Hazards), and these may be potential areas to shorten if there are space constraints. The structure of sections is generally consistent, although there could be more consistency for example in the use of introductions and summaries (check these for repetition within sections). Section 1.3. Treatment of Conflicting Evidence and Non-Climate Driving Forces. Some sections (e.g. 3, 4, 5) do not have explicit sections on Absence of Evidence / Conflicting Studies, although they do refer to a number of systems where non-climate driving forces lead to responses of a direction or magnitude that might not be predicted by climate factors alone. The importance of non-climate driving forces in leading to apparently conflicting results could be stated more explicitly in these sections. Section 1.3. Presentation. Since the chapter should have a broad readership, I would urge the authors to be careful in their use of technical terms (e.g. in the description of individual examples from the literature), and in the presentation of results in Tables -	OK. A Cryosphere table will be added and the Cryosphere section shortened.

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						there may need to be more consistency in the amount of information that is presented per study and the description of the results or structure of the Tables. There are large numbers of references in all of these sections, and there is probably scope to improve readability in some areas, for example by having clearer process-based structures in which the specific systems in the references themselves are described in less detail. (Robert Wilson, Universidad Rey Juan Carlos)	
1-450	A	17	0	24		1.3.1 Cryosphere: Here various studies showing cryosphere reduction are listed, several examples discussed in brief and a map (Figure 1.4) showing world-wide cryosphere reduction locations is included. No analysis is provided as to why this reduction may be occurring. Several peer-reviewed studies published in last five years assess physical mechanism of cryosphere reduction, these studies must be suitably referenced here. Also several recent studies on Antarctica document declining temperature over Antarctica and increasing snow/ice and ice sheets. These studies must be referenced as well. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Fig. 1.4 to be eliminated. Proper references to WGI to be included regarding cryosphere reduction and growth and their causes.
1-451	A	17	3	17	7	Studies that take account of reporting bias are rare (Peter Stott, Met Office)	GENERAL COMMENT. Refers to 1.3 Introduction. No specific suggestion is made.
1-452	A	17	10	24	47	Cryosphere sub-section: it is very descriptive and extensive. Its length may be reduced through appropriate coordination with the regional chapters. Some of the information relative to evidence of vulnerability and adaptation as well as data on potential melting rates and estimates of glaciers / ice shelves duration are important in development planning and crops relocation in some arid regions. This is the case in the Patagonian Plateau (average annual precipitation 200mm), showing important developments in irrigated crops. This paragraph 's information should be cross-cut with the respective regional chapters, where potential sustainable development trajectories, based on irrigation, should be reported. (Osvaldo Canziani, IPCC)	OK, section reduced, and tables included. More links with regional chapters included. No reported impacts on water resources were found for Patagonia.
1-453	A	17	10	73	15	This lengthy section is where most pruning should be considered, possibly reduced in half. (John Sweeney, National University of Ireland, Maynooth)	OK, substantial reduction made in section 1.3, including 1.3.1 cryosphere.
1-454	A	17	11			Section 1.3.1 more links to other chapters should be included e.g. ice outbreaks for water section etc. A section like "1.3.2.5 Absence of observed effects & conflicting evidence" see page 30 is missing here: Introducing this section would help to demonstrate that there is no conflicting evidence in respect to the cryosphere and global warming and observation which seems to be contradictory on the first view (e.g. glacier retreat and glacier growth) can be described here both to be consistent	OK, links with other chapters included. Reference to cryosphere growth evidence and link to climate change is made.

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						with global warming in one or two sentences (Markus Erhard, Forschungszentrum Karlsruhe)	
1-455	A	17	15	17	16	"There is abundant evidence that all these cryospheric components are undergoing generalized recession in response to global warming". This seems too strong a statement to me. For example most continental ice sheets are not receding, and sea ice is not receding in the southern hemisphere. (Nathan Gillett, University of East Anglia)	OK, changed "all" by "vast majority".
1-456	A	17	15	17	16	The statement that "There is abundant evidence that all these cryospheric components are undergoing generalized recession in response to global warming" is not valid for Antarctic sea ice, which has experienced some growth since the late 1970s. The statement could be corrected by changing "all" to "most of" or "overall". (Claire Parkinson, NASA Goddard Space Flight Center)	OK, changed to "vast majority".
1-457	A	17	17	17	18	I would remove this phrase "Moreover, the recession shows an accelerated trend in recent decades, consistent with the enhanced observed warming" or support it with strong quantitative argument and reference. Accelerated trends and enhanced warming corresponds to 2n-order time derivative. Do we really have reliable estimates for 2nd derivatives of climate parameters? (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	OK, statement on acceleration was downgraded, and evidence for acceleration, where available, is included in the section.
1-458	A	17	18	17	18	"accelerated trends" - Some of the records that are available to assess change in the cryosphere are only a couple of decades long, so is it appropriate to generalize by talking about accelerated trends in recent decades? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, less emphasis made on "accelerated".
1-459	A	17	20			Section 1,3,1: The word "change" is used for the first times with an ambiguous meaning, with the meaning of a simple modification. I shall not underline all the same cases lower in the text, up to the end of Section 1,3,1,6 (Annick Douguedroit, Université de Provence)	Change used in chapter as simple modification.
1-460	A	17	22	17	22	Unclear as to where the evidence is for this statement "A main effect of the reduction of both polar and non-polar cryospheric components is the contribution to eustatic sea-level rise". It is an impact, but I would suggest that it needs a reference validating that it is a main effect (or clarify what is meant by "main" effect). (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK, sentence modified, reference added.
1-461	A	17	26	17	42	Although focus is identified as being on the effects of cryospheric change on environmental and human systems, there is a lot being said about changes in the cryosphere that should be dealt with in more detail by WGI (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK, tables added related to impacts, more references made to WGI.
1-462	A	17	26	17	28	This needs to be supported with a reference or cross-links to Ch 3. I'm concerned about whether there are observations taken at altitude that back this up.	OK, links to CH3, to regional chapters and to WGI are made. There are abundant

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						(Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	references of glacier changes at altitude.
1-463	A	17	28	17	29	There haven't been many years yet since the 1990s. Is "with an accelerating trend since the 1990s" what was really meant? If so, it should probably be changed to: "with an apparent accelerating trend in 2000-2004 (or other appropriate range). (Claire Parkinson, NASA Goddard Space Flight Center)	OK, changed. Acceleration is meant since late 1980's-early 1990's compared to previous period.
1-464	A	17	29	17	29	I would remove this text "with a general accelerating trend since the 1990s." 15 years in a climate sense is too short period to make such a definite conclusion. It may be true, by the way, but period is too short to make scientifically flawless statement. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	OK, text changed. A case is made for acceleration since there is evidence from several records.
1-465	A	17	30	17	35	The draft asserts: "There is ample evidence suggesting that the 20th century recession of mountain glaciers is outside the range of normal climate variability of the last several millenia." It then provides one numerical example and a reference to results from "several Alpine glaciers." Given the large number of alpine glaciers, the evidence presented is not ample. Much more data needs to be presented in support of this assertion. If the evidence is presented in WG I, Chapter 4, a reference needs to be made to that source, as is done in Figure 1.4. (Lenny Bernstein, IPIECA)	OK, clear reference to WGI is made. Figure 1.4 is now eliminated.
1-466	A	17	30	17	34	Would be good to cite studies of other glaciers here in addition to Haeberli and Holzhauser as otherwise evidence for mountain glacier recession looks rather thin (Peter Stott, Met Office)	OK, text has been changed. Other references added in subsection 1.3.1.1.
1-467	A	17	34			Durgerov (2003) and Oerlemans (2005) should be cited here in reference to studies showing recession of mountain glaciers worldwide. Why note one specific glacier when there are recent studies showing trends in hundreds of glaciers? Dyurgerov, M., 2003. Mountain and subpolar glaciers show an increase in sensitivity to climate warming and intensification of the water cycle. <i>J. Hydrol.</i> 282, 164-176. Oerlemans, J.H. 2005. Extracting a Climate Signal from 169 Glacier Records. <i>Science</i> 5722:675-677. (Thomas Huntington, U.S. Geological Survey)	OK, text changed and new more general references included.
1-468	A	17	37			Comment on para. Over what period has has the Arctic experienced "nearly twice the... warming"? This portion should be rewritten with greater precision. Certainly the Arctic has seen a warming since the the 1960s, but one cannot discuss CC only in the context of the past few decades. One need a longer term perspective. Such data as are available indicate that today's temperatures are no warmer than what they were during the 1930s. There was a rapid warming in the 1920s & 30s, followed by cooling through the 1960s, followed by the current warming. [See, for instance, GISTEMP data, maintained by Jim Hansen et al. at: http://data.giss.nasa.gov/gistemp/tabledata/ZonAnn.Ts.txt , for trends for 64 N to	OK, references checked and more precise statements and references to WGI are made.

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						90N]. Thus it's not clear that the current warming is out of the range of natural variability. See also the following references, for instance: [1] Polyakov, I.V., Alekseev, G.V., Bekryaev, R.V., Bhatt, U., Colony, R.L., Johnson, M.A., Karklin, V.P., Makshtas, A.P., Walsh, D. and Yulin A.V. 2002. Observationally based assessment of polar amplification of global warming. Geophysical Research Letters 29: 10.1029/2001GL011111. [2] Polyakov, I.V., Bekryaev, R.V., Alekseev, G.V., Bhatt, U.S., Colony, R.L., Johnson, M.A., Makshtas, A.P. and Walsh, D. 2003. Variability and trends of air temperature and pressure in the maritime Arctic, 1875-2000. Journal of Climate 16: 2067-2077. [3] Przybylak, R. 2000. Temporal and spatial variation of surface air temperature over the period of instrumental observations in the Arctic. International Journal of Climatology 20: 587-614. [4] Przybylak, R. 2002. Changes in seasonal and annual high-frequency air temperature variability in the Arctic from 1951-1990. International Journal of Climatology 22: 1017-1032. [5] Taurisano, A., Boggild, C.E. and Karlsen, H.G. 2004. A century of climate variability and climate gradients from coast to ice sheet in West Greenland. Geografiska Annaler 86A: 217-224. [6] Chylek, P., Box, J.E. and Lesins, G. 2004. Global warming and the Greenland ice sheet. Climatic Change 63: 201-221. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-469	A	17	37	17	39	What is the reference point for "twice" and "five times the global warming" --is it the global average value? Please clarify. (Kimberly Hall, Michigan State University)	OK, clarified.
1-470	A	17	37			the following expression is not clear "The Arctic has experienced nearly twice the global warming" We have to give the reference or make comparison.. (I think it refers to the last five decades) (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	OK, clarified.
1-471	A	17	37	17	37	This needs to be supported with references or cross-links to WG1 Ch3. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, done.
1-472	A	17	38	17	39	I would recommend providing trends for the total Antarctic, and not just the Peninsula. Also see comment 1, above. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	OK, done, as well as making clear references to WGI.
1-473	A	17	39	17	41	Has precipitation increased in the Arctic and the Antarctic Peninsula? I'm not aware of studies showing this. If there are some, references should be included. (Nathan Gillett, University of East Anglia)	Yes, references included.
1-474	A	17	39	17	41	A reference for this sentence would be helpful. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK, done.
1-475	A	17	42			Comment on Figure 1.4 and accompanying text. What is the length of the record over	Figure 1.4 is now eliminated. Tables

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						which these trends have been observed? The text should also provide information as to whether the trends are strong enough and the records are of sufficient length to determine whether they are due to man-made factors, rather than natural variability, etc. Are there areas where there has been a cryospheric enhancement, for example, as reported recently in: Johannessen et al. 2005. Recent Ice-Sheet Growth in the Interior of Greenland, published online October 20 2005; 10.1126/science.1115356 (Science Express Reports). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	included with detailed description of impacts (not changes), including impacts from cryospheric growth, if available.
1-476	A	17	44	17	50	What message is this paragraph trying to convey? Is it needed? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, eliminated and reference made to WGI.
1-477	A	17	49	17	50	For the statements related to the cryosphere responding to other external and internal forcing factors and related to these responses being subject to various feedback mechanisms, examples would be helpful. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Paragraph eliminated, reference made to WGI.
1-478	A	18	1			Figure 1.4 Based on the work of Hodgkins et al. (2002, 2005) and Huntington et al., (2003) I think you should include the symbol for lake and river ice over the Northeastern USA. Hodgkins, G.A., I.C. James, and T.G. Huntington. 2002. Historical changes in lake ice-out dates as indicators of climate change in New England. Intl. J. Climatology 22:1819-1827. Hodgkins, G A, R. W. Dudley, and T. G. Huntington. 2005 Changes in the number and timing of ice-affected flow days on New England rivers, 1930-2000. Climatic Change 71: 319-340 Huntington, T. G., G. A. Hodgkins, R. W. Dudley, 2003, Historical trend in river ice thickness and coherence in hydroclimatological trends in Maine. Climatic Change 61: 217-236. (Thomas Huntington, U.S. Geological Survey)	Not applicable. Figure 1.4 now eliminated. This are WGI issues, not impacts.
1-479	A	18	2	18	23	Better to show also locations of cryosphere increase and no change (Peter Stott, Met Office)	Figure 1.4 now eliminated. A table has been prepared listing impacts, and including impacts due to cryosphere increase, growth or no change, if available.
1-480	A	18	3			Fig. 1.4. This figure is really interesting but it is a shame that the few areas discussed in the text in which no change or even an accumulation have been detected are not added in the map. Such a map is really informative but should be balanced. (Gregory Beaugrand, univ-lille)	Figure 1.4 now eliminated. A table has been prepared listing impacts, and including impacts due to cryosphere increase, growth or no change, if available.
1-481	A	18	22			Figure 1.4 on page 18 does not include published changes in glaciers on Heard	Fig. 1.4 removed. Impacts of reduced snow

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						Island, which is mentioned in Chapter 11, or changes in snow cover in Australia's south east also mentioned in Chapter 11. May also need to re-evaluate the first two paragraphs of page 21 in relation to this. (Lynda Chambers, Bureau of Meteorology Research Centre)	cover in Australia included.
1-482	A	18	22			Figure 1.4 should include also areas with glacier growth and increasing snowfall in Antarctic. Title should then be changed to "changes in cryosphere" instead of "reduction in cryosphere". The aspect of glacier growth in some areas is mentioned in the chapter both should be more described in the overall context of global climate change and the regional impacts. It is important to communicate "both sides of the coin" both triggered by global warming (warming and increased precipitation) It might be worth to put a table structured like table 1.3 page 26 into the chapter (Markus Erhard, Forschungszentrum Karlsruhe)	Fig. 1.4 removed. Cryosphere growth is mentioned clearly where appropriate. Table with quantitative cryosphere impacts is included.
1-483	A	18	22			Figure 1.4 shows cryosphere reductions. However, areas of cryosphere increase are also occurring in areas such as western Norway due to significant changes in circulation frequencies. In the interests of balance, and to avoid accusations of subjectivity, these might also be included and the title of the diagram altered accordingly. (John Sweeney, National University of Ireland, Maynooth)	Fig. 1.4 removed.
1-484	A	18	27	18	30	Similar to comments on Fig. 1.1 ---I don't understand the meaning of a daily response time, and would like an example of something that is measured at this scale. (Kimberly Hall, Michigan State University)	OK, reference made to WG1.
1-485	A	18	33	18	34	the Little Ice Age (LIA, which culminated in 1850 - 1900): in the literature the little ice age culminates in the 18th century and ends around 1850 sometimes 1860. (Markus Erhard, Forschungszentrum Karlsruhe)	OK.
1-486	A	18	33	18	33	Replace "culminated" by "terminated". (John Sweeney, National University of Ireland, Maynooth)	OK.
1-487	A	18	34			should be Meier et al, 2003 (Mark Dyurgerov, University of Colorado)	OK.
1-488	A	18	35	18	39	Why is this an "although" sentence ? Recent decades could be a continuation of recovery from earlier natural forcing rather than a response to anthropogenic forcing. Modelling studies can help to partition 20th century cryosphere changes into anthropogenic and natural components. (Peter Stott, Met Office)	OK, clarified.
1-489	A	18	41	18	43	In addition to climate, the cryosphere responds to external forcings such as geothermal heating and earthquakes. Landslides and rockfalls triggered by earthquakes can produce large changes in glaciers, snow cover and frozen ground, particularly in steep mountain regions.' This information is not relevant for global	OK, deleted.

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						climate change (Markus Erhard, Forschungszentrum Karlsruhe)	
1-490	A	18				Fig 4 This figure isn't very useful, since it doesn't tell the reader anything about how large the observed reductions are. Moreover, since it only shows regions of cryospheric reductions, no impression of given of how many sites have reductions compared to those with no change or an increase. Although I'm not an expert on the cryosphere data, I'm surprised to see reductions in Labrador and the Davis Strait, since I thought these regions had been cooling over the 20th century. (Nathan Gillett, University of East Anglia)	Fig. 1.4 eliminated.
1-491	A	19	0			Most of the discussion centers on evidence supporting declining extent of the cryosphere from warming. Some discussion might be included about evidence that shows the opposite trends and why they are not inconsistent with the overall global pattern of warming. (Paul J. Hanson, Oak Ridge National Laboratory)	OK, cases of cryosphere growth are properly mentioned.
1-492	A	19	3	19	5	How affects soot emission glacier retreat? The path of impacts (Immission/deposition) should be mentioned here (Markus Erhard, Forschungszentrum Karlsruhe)	No, this is a WGI issue.
1-493	A	19	3	19	5	Line 3, should be "shows an influence of decreased albedo." In the sentence starting on line 5, should the increase of snow/ice albedo be changed to decrease? (Kimberly Hall, Michigan State University)	OK.
1-494	A	19	4			Is the albedo influence on cryosphere reduction negative or positive? No direction of change is indicated. (Lesley Hughes, Macquarie University)	OK, added.
1-495	A	19	5	19	6	Sentence doesn't seem to make sense: How can increased albedo increase the melting process? (Markus Erhard, Forschungszentrum Karlsruhe)	OK, corrected.
1-496	A	19	5	19	5	"artificial increase" should be "artificial decrease" or "artificial alteration". (Claire Parkinson, NASA Goddard Space Flight Center)	OK, corrected.
1-497	A	19	5	19	5	Presumably what is meant here is an artificial decrease of albedo (David Rind, NASA/GISS)	OK, corrected.
1-498	A	19	5	19	6	Phrase" There are local examples of artificial increase of snow and ice albedo for producing enhanced melting" is somewhat confusing and not supported by reference. (Alexander P. Trishchenko, Canada Centre for Remote Sensing (CCRS))	OK, corrected and references added.
1-499	A	19	10	20	1	Section 1,3,1,1,Which results correspond to the "climate change" period? And which ones are significant? (Annick Douguedroit, Université de Provence)	All correspond to the "climate change" period. Clarified in text.
1-500	A	19	12	19	14	example for glacier growth should be mentioned e.g. Norway (EEA 2004); EEA	OK, mentioned, but in the last few years

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						(2004): Impacts of Europe's Changing Climate. An indicator-based assessment. EEA report No. 2/2004. EEA, Copenhagen, 2004. ISBN 92-9167-692-6; 107 pp. http://reports.eea.eu.int/climate_report_2_2004/en (Markus Erhard, Forschungszentrum Karlsruhe)	even Norwegian glaciers started retreating.
1-501	A	19	22			Juen in press instead of Juen In press (Jorge Carrasco, Dirección Meteorológica de Chile)	OK.
1-502	A	19	27	19	27	Pena and Escobar reference is anterior to 1999 and should not be cited here if I understood correctly (Isabelle Chuine, CNRS)	No. It can be cited since it was not cited in TAR.
1-503	A	19	27	19	28	why is the link to climate change not fully established? (Markus Erhard, Forschungszentrum Karlsruhe)	Sentence changed.
1-504	A	19	29	17	29	Helpful to explain the term "glacial acceleration". (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK. "flow" added.
1-505	A	19	30			Rignot ??? Year is missing (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, corrected.
1-506	A	19	30	19	30	citation problem (Isabelle Chuine, CNRS)	OK, corrected.
1-507	A	19	32	19	35	floods are already mentioned above ("GLOFs") all other effects are mainly due to changes in permafrost not by glacier retreat and are already or should be listed below in the 'permafrost' part of the section (see "slope stability problems" p22 line 8) (Markus Erhard, Forschungszentrum Karlsruhe)	OK, kept only ice avalanches.
1-508	A	19	39			Please cite original papers for example: Curry, R.G., R.R. Dickson, and I. Yashayaev. 2003. A change in the freshwater balance of the Atlantic Ocean over the past four decades. Nature 426:826-829. Curry, R.G., and C. Mauritzen. 2005. Dilution of the northern North Atlantic Ocean in recent decades. Science 303:1772-1774. (Thomas Huntington, U.S. Geological Survey)	OK.
1-509	A	19	44	19	45	should be Meier et al, 2003 (Mark Dyurgerov, University of Colorado)	OK.
1-510	A	19	47			should be (Dyurgerov and Meier, 2005) (Mark Dyurgerov, University of Colorado)	OK.
1-511	A	19	47	19	48	I didn't exactly understand the rate of glacier loss given. Is this this the glacier loss in one year (2002-2003)? Or is this based on a trend to that year? (Nathan Gillett, University of East Anglia)	Yes, 1 year. Sentence changed.
1-512	A	19	47	19	48	To avoid having a reader misinterpret this as saying something about the magnitude of sea level rise, after "1 m/y" put "of the individual glacier's thickness".	OK, sentence changed.

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						Alternatively, give an average for the volume of water lost per glacier. (Claire Parkinson, NASA Goddard Space Flight Center)	
1-513	A	19	48	19	48	Use of "1 m/yr water equivalent" as glacier loss within "sea level rise" subsection is confusing. At first I thought it was a misprint. Of course what is mean is that the average glacier is thinning by 1 m/yr water equivalent, but it should be made clear, otherwise some reader will misread it. "The average glacier has been thinning by about 1 m/yr water equivalent" is a better statement. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	OK, sentence changed.
1-514	A	19	48	19	49	Please check and clarify the numbers (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	OK, sentence changed.
1-515	A	19	48	19	48	Should this be 1 mm/yr rather than 1m/yr ? (Peter Stott, Met Office)	It is 1 m/yr. Sentence changed.
1-516	A	19	48	19	48	"1 m/y of water equivalent" - as a lay reader, I don't know how to interpret this figure. How does this relate to change in mass, or volume of water contained in glaciers? (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, sentence changed.
1-517	A	20	1		2	should be; Glacier contribution to sea-level rise, 1961-2003 is 0.51 mm/yr, rising to 0.93 mm/yr in the decade 1994-2003 (Dyurgerov an Meier, 2005). [glaciers outside GRIS and Antarctic]. The same result was sent to W1, G. Kaser (Mark Dyurgerov, University of Colorado)	OK.
1-518	A	20	1	20	2	Confusing - has the sea-level rise increased from 0.3 to 0.6 from the 1990s to the early 2000s, has it increased to 0.6 from a value of 0.3 that prevailed pre-1990s, or has the increase been anywhere from 0.3 to 0.6 relative to the pre-1990s? (David Rind, NASA/GISS)	OK, clarified.
1-519	A	20	4	20	10	Impact on the earth's gravitational field and crustal uplift COMMENT: This paragraph is controversial since it might be argued that "other causes" could have been responsible for an acceleration of J2, which then led to an accelerated melting of glaciers and ice caps. (Maria Rosa Paiva, Universidade Nova de Lisboa)	OK, sentence modified and clarified.
1-520	A	20	6			After Munk is a year missing? (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, completed.
1-521	A	20	12	20	15	Which mountains should be mentioned. (Xiaoqiu Chen, College of Environmental Sciences)	OK, added.
1-522	A	20	12	19	19	these impacts might be summarized. Most probably there are no significant impacts of revegetation of former glacierized areas on regional level (high confidence) and paragraph can be removed if text must be shortened (Markus Erhard, Forschungszentrum Karlsruhe)	No. "Greening" of the Arctic and Antarctic Peninsula is widespread. References added.
1-523	A	20	13	20	15	The on-analog nature of this melting should be emphasized here. These ice core	OK, mentioned.

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						records had not melted for up to 10,000 years, and all of a sudden, between the 1970s and 1990s, they started melting. An important point to highlight. (David Rind, NASA/GISS)	
1-524	A	20	15			Thompson; Bolius submitted, my understanding is that reference must be at least in press (Jorge Carrasco, Dirección Meteorológica de Chile)	Reference is now deleted.
1-525	A	20	15			This is just one example of the use of 'submitted' or 'in preparation' citations. This is not acceptable. Such citations must be removed from the IPCC documents until they are at least officially 'in press'. (Paul J. Hanson, Oak Ridge National Laboratory)	OK, fixed.
1-526	A	20	17			very long (Antoaneta Yotova, National Institute of Meteorology and Hydrology)	Sentence changed, Arctic and Antarctic Peninsula greening references added.
1-527	A	20	19			See Frenot Y et al (2005) Biological Reviews 80: 45-72 for a general review of biological invasions in the Antarctic, including recent changes (Lesley Hughes, Macquarie University)	OK, reference added.
1-528	A	20	21	20	24	Which mountains should be mentioned. (Xiaoqiu Chen, College of Environmental Sciences)	OK, added.
1-529	A	20	21			Comment on Tourism. Replace the sentence on lines 23 and 24 with the following: "ALTHOUGH the scenic impact due to glacier retreat will affect LOCAL tourism in many mountain regions of the world, on a global scale tourism is probably a zero sum game with declines in one area being made up by increases elsewhere." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Sentence modified. This section only refers to impacts due to glacier wasting. "Positive" impacts on tourism due to warming do not correspond in this section.
1-530	A	20	21	20	24	there is lack of consistency when assessing the impact on tourism, considering that this chapter deals with the physical and biological systems. This section may be moved into the specific section or chapter related to impacts on tourism sector due to climate change. (Bangzhong Wang, China Meteorological Administration)	Disagree. The chapter and section deal with "systems and sectors", including impacts on human activities.
1-531	A	20	33	20	34	Change "significant acceleration of inland glaciers" to: "significant acceleration of the flow of inland glaciers". (Claire Parkinson, NASA Goddard Space Flight Center)	OK.
1-532	A	20	36			Comment on Section 1.3.1.3. See comments 29 and 30. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	OK, growth of inland East Antarctica and inland Greenland mentioned.
1-533	A	20	39			put year after Thomas (Jorge Carrasco, Dirección Meteorológica de Chile)	OK.
1-534	A	20	41	20	43	Here I would suggest adding the concept of surface melt-induced lubrication at the base of the glacier may be accelerating the movement (Zwally et al. 2002). Zwally, H.J., W. Abdalati, T. Herring, K. Larson, J. Saba, and K. Steffen. 2002.	OK, added.

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						Surface Melt-Induced Acceleration of Greenland Ice-Sheet Flow. Science 297:218-222. (Thomas Huntington, U.S. Geological Survey)	
1-535	A	20	46	21	20	section 1.3.1.4 Text should be updated: There is no information on snow pack in the section (only snow cover) and there are more examples on impacts of snow pack / snow cover on winter tourism (e.g. Alps, Beniston M. 2000: Environmental Change in Mountains and Uplands. Arnold Publishers, London, and Oxford University Press, New York, 172 pp. Beniston M. 2003: Climatic change in mountain regions: A review of possible impacts. Climatic Change 59: 5-31. Beniston M. 2004: Climatic Change and its Impacts – An overview focusing on Switzerland. Advances in global change research Vol. 19. Kluwer Academic Publishers. Dordrecht, The Netherlands 286pp. Breiling M. 1998: The Role of Snow Cover in Austrian Economy During 1965 and 1995 and Possible Consequences Under a Situation of Temperature Change. Conference Japanese Society of Snow and Ice. October 1998. http://www.breiling.org/publ/Niigata.pdf Elsasser H., Messerli P. 2001: The Vulnerability of the Snow Industry in the Swiss Alps. In: Mountain Research and Development Vol. 21 No 4 Nov 2001, S. 335-339 http://www.giub.unibe.ch/wg/English/Aktuell/mrdsnow.pdf http://sinus.unibe.ch/wg/Aktuell/mrdsnow.pdf Steininger K. W., Weck-Hannemann H. (Eds.) 2002: Global Environmental Change in Alpine Regions: Recognition, Impact, Adaptation and Mitigation. Edward Elgar Publishing Inc., Cheltenham, UK. 271pp. (Markus Erhard, Forschungszentrum Karlsruhe)	OK, some of these references added.
1-536	A	20	46	21	4	Papers by Beniston discuss a decreasing trend in snow precipitation of the Swiss Alps with dramatic consequences on the snow cover over the Alps and on the winter tourism activities in Switzerland (Giampiero Maracchi, Institute of Biometeorology)	OK, added.
1-537	A	20	48	20		Section 1,3,1,4, the decrease of snow cover regards also its beginning because of the warming. (Annick Douguedroit, Université de Provence)	Literature was checked but no evidence of autumn snow cover decrease was found.
1-538	A	20	48	20	50	See also Laternser et al. (2003) and Scherrer et al. (2004) for citations for decreases in snow cover extent. Laternser, M., and M. Schneebeli. 2003. Long-term snow climate trends of the Swiss	OK, Alps added.

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						Alps (1931-99)*. Int. J. Climatol. 23:733 - 750. Scherrer, S.C., C. Appenzeller, and M. Latenser. 2004. Trends in Swiss Alpine snow days: The role of local- and large-scale climate variability. Geophys. Res. Lett. 31:L13215, doi:10.1029/2004GL020255. (Thomas Huntington, U.S. Geological Survey)	
1-539	A	21	2	21	3	Contradiction!!!! Satellites and in situ data report a century-long reduction in snow cover extent over Eurasia particular in spring. Brown 2000; Robinson et al. 1993; Groisman et al. 1994, 2005 (Ch. 4, WG1 report). (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	There is a spring decrease in snow cover which reflects warming, but a mid-winter increase which reflects increased precipitation.
1-540	A	21	2	21	9	You may want to elaborate on the potential effects of changes in lake ice out date: Changes in lake ice-out date can have important effects on lake ecology, such as the rate of summer oxygen depletion (Stewart, 1976) and the abundance and productivity of phytoplankton (Maeda and Ichimura, 1973) and organisms at higher trophic levels (Porter et al., 1996). And river ice out date: Changes in river ice dynamics may also have ecological effects on aquatic biota (Scrimgeour et al, 1994; Schindler, 2001) and on riparian vegetation (Prowse and Beltaos, 2002). Maeda O, Ichimura SE. 1973. On the high density of a phytoplankton population found in a lake under ice. Int. Revue Ges. Hydrobiol. 58: 673-685. Porter KG, Saunders PA, Haberyan KA, Macubbin AE, Jacobsen TR, Hodson RE. 1996. Annual cycle of autotrophic and heterotrophic production in a small, monomictic Piedmont Lake (Lake Oglethorpe): Analog for the effects of climatic warming on dimictic lakes. Limnol. Oceanogr. 41: 1041-1051. Prowse, T.D., and S. Beltaos. 2002. Climatic control of river-ice hydrology: a review. Hydrol. Process. 16:805–822. Schindler, D. W.: 2001, The cumulative effects of climate warming and other stresses on Canadian freshwaters in the new millenium, Can. J. Fish. Aquat. Sci., 58, 18-29. Scrimgeour, G. J., Prowse, T. D., Culp, J. M., and Chambers, P. A.: 1994, 'Ecological effects of river ice breakup: a review and perspective', Freshwater Biology 32, 261-275. Stewart KM. 1976. Oxygen deficits, clarity and eutrophication in some Madison lakes. Int. Revue Ges. Hydrobiol. 61: 563-579. (Thomas Huntington, U.S. Geological Survey)	OK. Added in section 1.3.1.7.
1-541	A	21	4			See Nicholls N (2005) Climate Variability, climate change, and the Australian snow	OK, added.

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						season. Aust Meterol. Magazine, in press. This paper documents a 40% decline in snow cover in the Australian Alps over past 40 yrs. (Lesley Hughes, Macquarie University)	
1-542	A	21	7	21	8	<p>I think you might want to add Hodgkins et al (2003) for northeastern North America, Déry et al. (2005) central Canada, Burn et al. 2004, Liard Basin, Woo and Thorne (2003) Mackenzie River, Cunderlik and Burn, (2004) southern British Colombia; and Yang (2002) for Siberia. Page 21, Line 11-12 ;</p> <p>I think that Yang et al. (2002) reporting earlier stream flow on the Lena River should be included and the sentence modified accordingly. Burn, D.H., Cunderlik, J.M., Pietroniro, A., 2004. Hydrological trends and variability in the Liard River basin. Hydrological Sciences Journal 49, 69–83. Cunderlik, J.M., Burn, D.H., 2004. Linkages between regional trends in monthly maximum flows and selected climatic variables. J. Hydrologic Engrg. 9, 246-256. Déry, S.J., M. Stieglitz, E.C. McKenna, and E.F. Wood. 2005. Characteristics and trends in river discharge into Hudson, James, and Ungava Bays, 1964-2000. Journal of Climate 18:1540-1557. Hodgkins, G A, R. W. Dudley, and T. G. Huntington. 2003, Changes in the timing of high river flows in New England over the 20th century. J. Hydrol. 278:242-250. Woo, M.K., Thorne, R., 2003. Streamflow in the Mackenzie Basin, Canada. Arctic 56, 3 Vörösmarty, C.J., and D. Sahagian. 2000. Anthropogenic disturbance of the terrestrial water cycle. BioScience 50: 753-765. Yang, D., D. L. Kane, L. Hinzman, X. Zhang, T. Zhang, and H. Ye, 2002, Siberian Lena River hydrologic regime and recent change, J. Geophys. Res., 107(D23), 4694, doi:10.1029/2002JD002542</p> <p>(Thomas Huntington, U.S. Geological Survey)</p>	OK, most have been added.
1-543	A	21	11	21	12	<p>There are more references about the earlier snowmelt onset in Russia but "a lack of evidence in earlier snowmelt changes" in Eurasia is an exaggeration that indicates the lack of the access to Russian, Central Asian, and Chinese publications on the topic. (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)</p>	OK, sentence has been modified.
1-544	A	21	14			<p>Comment on "Ski Areas". See comment 31. (Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	Only negative impacts due to snow disappearance have been found in the literature.
1-545	A	21	14	21	20	<p>One report of effects of changes in snow cover on ski areas (reduction in numbers of ski areas) is Hamilton et al., (2003).</p>	OK, added.

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						Hamilton, L.C., D.E. Rohall, C. Brown, G. Hayward, and B.D. Keim. 2003. Warming winters and New Hampshire's lost ski areas: An Integrated Case Study. International Journal of Sociology and Social Policy 23: 52-73. (Thomas Huntington, U.S. Geological Survey)	
1-546	A	21	15	21	20	Why just Chile here ? Surely there must be better evidence from European Alps ? (Peter Stott, Met Office)	OK, references added for the Alps and the US.
1-547	A	21	15	21	15	Does this refer to European Alps ? (Peter Stott, Met Office)	Yes, Switzerland + Austria added.
1-548	A	21	19			Change Carrasco 2005 by Carrasco et al 2005 (Jorge Carrasco, Dirección Meteorológica de Chile)	OK.
1-549	A	21	19			SECTION 1.3.1.4: On p.21,1.19, the statement of a "rise" from "2600 m a.s.l." to "2395 m a.s.l" i (Hans Martin Fussel, Stanford University)	Clarified, it was just a misinterpretation and text is fine.
1-550	A	21	20	21	20	How does enhanced pollution affect the snowline? Is this a cooling influence (sulphate aerosol), or a warming? (Nathan Gillett, University of East Anglia)	"Pollution" deleted, ther is really no evidence for it.
1-551	A	21	22	21	33	You may wish to cite Camill (2005) for permafrost warming in Canada, and Romanovsky et al. (2002) for impacts of permafrost warming. You may also want to cite Romanovsky and Osterkamp (2002) for impacts of permafrost degradation. You should note that coastal permafrost degradation will likely accentuate rates of coastal erosion (high confidence) (Beaulieu, and Allard, 2003; Nat. Res. of Canda, 2000 – and many other refs). Camill, P. 2005. Permafrost thaw accelerates in boreal peatlands during late-20th century climate warming. Clim. Change 68:135 - 152. Romanovsky, V. E., and T. E. Osterkamp, Changes and Impacts in Permafrost Response on Economic Development, Environmental Security and Natural Resources, edited by R. Paepe, and V. Melnikinova, pp. 297– 315, Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. Natural Resources Canada (2000): Sensitivities to climate change in Canada; publication of the Government of Canada’s Climate Change Impacts and Adaptation Program Beaulieu, N. and Allard, M. (2003) The impact of climate change on an emerging coastline affected by discontinuous permafrost: Manitounuk Strait, Northern Québec. Canadian Journal of Earth Sciences, 40, 1393-1404. (Thomas Huntington, U.S. Geological Survey)	OK, references added to section 1.3.1.5.

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1-552	A	21	24	21		Section 1,3,1,5,"trend and degradation during the last century": see previous general comments on the chapter (line2). (Annick Douguedroit, Université de Provence)	I do not understand what the reviewer wants to point out.
1-553	A	21	27	21	27	"partial evidence for acceleration". What does this mean? Is this significant? Reference? (Nathan Gillett, University of East Anglia)	OK, substantiated.
1-554	A	21	30			which regions should be given. (Xiaoqiu Chen, College of Environmental Sciences)	OK, done.
1-555	A	21	42	21	42	... and Siberia (Smith et al. 2005, Science). (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	OK, added.
1-556	A	21	46	21	48	Add at the end of this para, the following: "However, the rate of CO2 concentration increases in the atmosphere has not kept pace with increased CO2 emissions, and CH4 concentrations have, at least, temporarily leveled off after a rapid growth since the start of industrialization. [See data on the CDIAC website]. Neither of these suggest increases in the release of these gases from the biosphere as a whole." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Not applicable, it is a WGI issue. In any case, paragraph was changed to reflect a possible future increase and reference has been added.
1-557	A	21	46	21	48	I do not agree entirely with this statement; there is sufficient empirical evidence that CO2 release is likely to be enhanced with wetland increase concomitant with temperature increase. I am not a wetland expert and I know that the title of the chapter is "Observed" changes, but I think given the magnitude of C stored in wetlands and permafrost terrain, that this subsection should be augmented with examples of potential magnitude (Kevin Percy, Canadian Forest Service)	OK, sentence changed and reference added.
1-558	A	22	4	22	6	The reader won't be able to judge from this whether the problem is serious because the Arctic is a very large place. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, geographical locations added.
1-559	A	22	6			Year are missing after Tutubalina and Hinkel (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, fixed.
1-560	A	22	12			Year are missing after Gruber and Schar. By the way delete the latter J and S, only last name are used in citation (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, fixed.
1-561	A	22	12	22	14	What are the active layer depths a percentage of? Is this a percentage of the depth of soil? This should be made clearer. (Nathan Gillett, University of East Anglia)	OK, clarified.
1-562	A	22	19	22	19	"can have a relevant effect" ==> "can affect" (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, done.
1-563	A	22	26			It would be helpful to know about the magnitude of these reductions in sea ice.	OK, magnitude mentioned.

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						(Lesley Hughes, Macquarie University)	
1-564	A	22	26	22	26	"in summer" ==> "in September"?? The minimum extend typically occurs in September at the end of the warm season. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, modified.
1-565	A	22	27	22	28	The same satellite record that has revealed statistically significant decreases in Arctic sea ice coverage since the late 1970s has also revealed statistically significant increases in Antarctic sea ice coverage over the same time period, although with much lesser magnitude. Replace "In the Antarctic as a whole, sea-ice trends are not significant" by: "In the Antarctic as a whole, sea ice coverage has increased somewhat since the late 1970s, although at a much lesser rate than the ice cover decreases in the Arctic." (Claire Parkinson, NASA Goddard Space Flight Center)	OK, modified.
1-566	A	22	30	22	37	There seems to be impacts on arctic mammals (ACIA report). May be worth to be mentioned in this paragraph. (Markus Erhard, Forschungszentrum Karlsruhe)	OK, added.
1-567	A	22	31	22	33	There seems to be a confusion between the Arctic and the Antarctic here. (Nathan Gillett, University of East Anglia)	OK, fixed.
1-568	A	22	33	22	33	But sea ice area has not reduced in the Antarctic. (Nathan Gillett, University of East Anglia)	Clarified.
1-569	A	22	34			Year is missing after Atkinson (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, fixed.
1-570	A	22	40	22	42	The opening of waters in the Arctic also has geopolitical implications - whose waters are these (numerous nations are claiming them). Further, with the many miles of coastline becoming accessible, they present a credible risk for terrorist intrusion. While these are not 'scientific' issues, neither is shipping which is mentioned. (David Rind, NASA/GISS)	OK, added.
1-571	A	22	42			...at the moment. Possibility of renewed transarctic interchange' (Stephen J. Hawkins, The Marine Biological Association of the UK)	OK, added.
1-572	A	22	44	22	50	The literatures should be given. Russian scientists reported this hypothesis in 2001. (Xiaoqiu Chen, College of Environmental Sciences)	New recent reference added, as well as quoting WGI for greater detail.
1-573	A	22	44	20	50	It is certainly the case that increased freshwater flux to the Nordic Seas might be expected to give rise to a decrease in the overturning circulation. However, it is also the case that a decrease in the circulation would also be expected to give rise to an increase in the salinity difference. Without doing a detailed budget of the circulation it is hard to tell which is cause and which is effect. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	OK, added and reference made to WGI.
1-574	A	22	44			Recommend looking at Richard Kerr's news article in Science, "Confronting the	OK. Text has been changed to reflect

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						Bogeyman of the Climate System" in Science, 21 October 2005, pp. 432-433. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	uncertainties.
1-575	A	22	45	22	50	Also paper by Wu et al - see WG1 chap 9 for more references. (Peter Stott, Met Office)	OK, added. Proper refernce to WGI is also made.
1-576	A	22	47			Page 22. Ocean freshening and circulation. What is missing in that section is the lack of quantification. How much weakening is expected ? And when ? And link with modelling results (see the review of Rahmstorf 2002 Nature 419: 207-214). I suppose that this is covered in the IPCC WGI FAR but as it is mentioned that this information should be added. (Gregory Beaugrand, univ-lille)	Ok, text has changed and completed, with some quantification and proper reference to WGI.
1-577	A	22	47			Year is missing after Dickson (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, added.
1-578	A	22	47			(Dickson, date?) (Stephen J. Hawkins, The Marine Biological Association of the UK)	OK, added.
1-579	A	22	49			Year is missing after Hansen (Jorge Carrasco, Dirección Meteorológica de Chile)	Reference is now deleted.
1-580	A	22	50	22		inflow of warm Atlantic water (Markus Erhard, Forschungszentrum Karlsruhe)	OK, added.
1-581	A	23	6	23	7	"lake and river ice is very sensitive to changes in snow cover" Isn't it (night) temperature which controls lake and river ice dynamic instead of snow cover? (Markus Erhard, Forschungszentrum Karlsruhe)	Both atmospheric temperature and snow cover are important. Reworded and clarified.
1-582	A	23	7	23	9	The names of the lakes and rivers should be mentioned. (Xiaoqiu Chen, College of Environmental Sciences)	OK, specific continents are mentioned and reference to WGI is made.
1-583	A	23	9	23	9	Bonsal - an example of an incomplete ref in text - there are many more ! (Peter Stott, Met Office)	OK, fixed.
1-584	A	23	11			Too small paragraph (delete or add a few sentences). (Gregory Beaugrand, univ-lille)	OK, now expanded.
1-585	A	23	11	23	13	lack of evidence: delete (Xiaoqiu Chen, College of Environmental Sciences)	OK, references presented and text expanded.
1-586	A	23	11	23	18	There is no need for subtitles "impacts of ..." The information is partly redundant (break up events in river ice). "Impacts of frozen lakes" can be merged with the paragraph above (p23 line 4 - 9) (Markus Erhard, Forschungszentrum Karlsruhe)	OK, paragraphs joined.
1-587	A	23	11			What sort of changes in lake thermal structure have been seen? (there is a general tendency in this section to mention changes without offering any detail about either direction or magnitude). (Lesley Hughes, Macquarie University)	OK, table is prepared indicating specific trends.

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1-588	A	23	11	23	13	The statement that "Changes in lake thermal structure and quality/quantity of under-ice habitat have been reported" seems very incomplete. It would be preferable to indicate in which direction the changes have been. (Claire Parkinson, NASA Goddard Space Flight Center)	OK, table is prepared indicating specific trends.
1-589	A	23	11	23	11	Should this not read: impact of unfrozen lakes? (David Rind, NASA/GISS)	OK, subtitle has been changed.
1-590	A	23	12	23	13	I guess that something more will be add in this sub section. If Wrona is a reference the year is missing (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, added.
1-591	A	23	15	23	18	similar with river snow melting and lack of evidence: delete (Xiaoqiu Chen, College of Environmental Sciences)	Section expanded and more evidence found.
1-592	A	23	20	24	28	This section contains few specific examples of adaption and vulnerabilities, and is overly qualitative in my view. (Nathan Gillett, University of East Anglia)	OK, modified and shortened.
1-593	A	23	22	23	30	Would suggest that the examples given do not really speak to the adaptibility of communities living in the Arctic. Look to the ACIA for more appropriate examples of their adaptability. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	OK, more appropriate examples included.
1-594	A	23	25			Add just prior to the period, the following: ..., particularly if it leads to faster and more expensive replacement of existing facilities." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Not needed, it is implicit in the statement and the text says "associated economic costs can be high".
1-595	A	23	28	23	28	Artificial snow is produced already now in skiing resorts. This is a trivial and unimportant effect of climate change. (Kaija Hakala, MTT Agrifood Research Finland)	Disagree, it is happening already but could dramatically affect economy of ski centers under future enhanced warming.
1-596	A	23	32	23	40	This whole paragraph discusses cryospheric changes in regions where noone lives - why discuss in the section on adaption and vulnerability? (Nathan Gillett, University of East Anglia)	Correct, paragraph was eliminated.
1-597	A	23	34	23	35	temperate glaciers are highly sensitive to changes in atmospheric warming especially in summer (e.g. summer 2003 in Europe) since they are close to or at the melting point see e.g. http://www.grid.unep.ch/product/publication/earlywarning_briefs.php (Markus Erhard, Forschungszentrum Karlsruhe)	Whole paragraph was eliminated since it referred to vulnerability of cryospheric components and not to vulnerability of humans.
1-598	A	23	39	22	40	Has precipitation increased over Greenland? If so, has a link to climate change been demonstrated? (seems unlikely). (Nathan Gillett, University of East Anglia)	Whole paragraph was eliminated since it referred to vulnerability of cryospheric components and not to vulnerability of humans.
1-599	A	23	40			Add the reference from comment 30. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Whole paragraph was eliminated since it referred to vulnerability of cryospheric

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							components and not to vulnerability of humans.
1-600	A	23	40			(Mosley-Thompson 1999, 20th?) (Stephen J. Hawkins, The Marine Biological Association of the UK)	Whole paragraph was eliminated since it referred to vulnerability of cryospheric components and not to vulnerability of humans.
1-601	A	23	42	23	44	The first and second halves of this sentence don't seem to fit together. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	OK, sentences modified.
1-602	A	23	45	23	46	On line 46 substitute "local" for "the", and the following before the period on line 46: "... , although this dependence is less today than it used to be with the increase in trade and commerce between indigenous and other populations." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	OK, added.
1-603	A	23	47			Should also note that vulnerabilities in the Arctic also derive from its harsh climate, which could be tempered somewhat by warming, and note that extreme cold is a factor in mortality and mortality in the northern climates. The increase in life expectancies in indigenous populations could partly be due to warming. [See, e.g., Feigin, V.L., Nikitin, Yu.P., Bots, M.L., Vinogradova, T.E. and Grobbee, D.E. , "A population-based study of the associations of stroke occurrence with weather parameters in Siberia, Russia (1982-92)," European Journal of Neurology 7: 171-178 (2000); Braga, A.L.F., Zanobetti, A. and Schwartz, J. , "The effect of weather on respiratory and cardiovascular deaths in 12 U.S. cities," Environmental Health Perspectives 110: 859-863 (2002); Nafstad, P., Skrondal, A. and Bjertness, E. , "Mortality and temperature in Oslo, Norway. 1990-1995," European Journal of Epidemiology 17: 621-627 (2001); Donaldson, G.C., Keatinge, W.R. and Nayha, S., "Changes in summer temperature and heat-related mortality since 1971 in North Carolina, South Finland, and Southeast England," Environmental Research 91: 1-7.(2003); Keatinge, W.R., Donaldson, G.C., Cordioli, E., Martinelli, M., Kunst, A.E., Mackenbach, J.P., Nayha, S. and Vuori, I., "Heat related mortality in warm and cold regions of Europe: Observational study," British Medical Journal 321: 670-673 (2000); Keatinge, W.R., "Winter mortality and its causes," Int J Circumpolar Health 61(4): 292-299 (2002); Stewart S; McIntyre, K., Capewell, S., & McMurray, J.J. "Heart failure in a cold climate. Seasonal variation in heart failure-related morbidity and mortality," J Am Coll Cardiol Mar 39(5):760-66 (2002); Eng H., & Mercer, J.B. "The relationship between mortality caused by cardiovascular diseases and two climatic factors in densely populated areas in Norway and Ireland," J Cardiovasc Risk 7(5):369-75 (2000); Mercer, J.B. "Cold--an underrated risk factor for health," Environ Res 92(1):8-13 (2003).	OK, added.

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						(Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-604	A	23	48			Year after Chapin (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, fixed.
1-605	A	23	48	23	49	"High diversity of activities in the past has ... tended to give way to a concentration on a smaller number of species and sectors." There is an implication here that this is somehow linked to climate change. It's not clear that this is true. To some extent it is a natural result of the law of competitive advantage. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	Agreed. Sentence removed.
1-606	A	24	0	24		Summary section 1.3.1.9: The conclusion that " cryosphere reduction is occurring in response to global warming" is too simplistic and naive. Several studies now show that the Arctic is dominated by LFO (Low Frequency Oscillation) of large-scale atmospheric circulations with a period of 60-70 years and the Arctic temperature and associated changes in the cryosphere are strogly governed by this LFO. Further, modern glacier retreat on Kilimanjaro is now assessed to be due to drastic drop in atmopsheric moisture at the end of 19th century and not due to global warming (see paper from Int'l J of Climatology, 2004,p.329-339). Among other papers to be referred here: Polyakov et al, EOS, 83,2002,p.547; J. of Climate, 2003, p. 2067-2077: Schlesinger & Ramankutty, Nature, 367, 24 February 1994, p.723: Papers on Antarctic climate to be referred here: Davis/Hanna et al, Science on line, DOI: 10.1126/science, 1110662(2005); Zwally et al, J of Geophy. Research, 2002, "Variability of Antarctic sea-ice", Doran et al, Nature online, 13 January 2002,DOI:10.1038/nature 710 "Antarctic climate cooling --" (Madhav Khandekar, Retired research scientist and consulting meteorologist)	OK, sentence has been modified. Note that the conclusion states "most of the cryospheric components in polar regions and in mountain areas are undergoing generalized recession in response to global warming" - it says most, not all.
1-607	A	24	0	27		1.3.2 Hydrology & water resources: Table 1.3 and related discussion appears too general with no specific linkage to global warming/climate change being cited. Some of the observed variations in runoff and stremflow could be due to interannual variability resulting from earth's mean temperature change in 20th century, warmer between 1910-1945, cooler between 1945-1975 and warmer in recent 25 years. This should be discussed here. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	For links to global warming see WGI.
1-608	A	24	5			Year after Chapin (Jorge Carrasco, Dirección Meteorológica de Chile)	OK, added.
1-609	A	24	7	24	7	The draft states "...native populations fear for their livelihoods..." but further down the page, (lines 45-47) the summary states that these populations "have a significant degree of adaptation both based in deep empirical knowledge held by native cultures and based on modern technological means available at present." While all cultures	OK, sentence modified.

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						fear change, isn't the summary statement a better indicator of the reality of the situation faced by native populations in the Arctic? Delete the emotive language about fear, explain the challenge created by climate change, then describe the adaptive capacity these populations have. (Lenny Bernstein, IPIECA)	
1-610	A	24	11			Year after Nichols (Jorge Carrasco, Dirección Meteorológica de Chile)	OK.
1-611	A	24	18	24	20	From general to specific (if not trivial). Goes too deep into national political issues of PERU. Omit. (Kaija Hakala, MTT Agrifood Research Finland)	OK, paragraph removed.
1-612	A	24	20	24	20	Is it inadequate mitigation or adaptation measures in Peru? (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Paragraph has now been removed.
1-613	A	24	22	24	28	Could be omitted (trivial). (Kaija Hakala, MTT Agrifood Research Finland)	It is not considered to be trivial, references have now been added.
1-614	A	24	25	24	26	Are there really well-documented examples or rituals, cults and political mobilisation in response to melting which has been linked to anthropogenic climate change? If so, examples should be cited. Otherwise, perhaps don't include. (Nathan Gillett, University of East Anglia)	References have now been added.
1-615	A	24	25	24	25	Supply refs for these examples of rituals and cults and political mobilization (Peter Stott, Met Office)	References have now been added.
1-616	A	24	32	24	33	Again, I think this sentence may overstate things, given that the largest cryospheric component (the Antarctic ice sheet) is not undergoing recession. (Nathan Gillett, University of East Anglia)	Disagree. There is now evidence for reduction of Antarctic ice as a whole (Velicogna, I. and J. Wahr. 2006. Measurements of Time-Variable Gravity Show Mass Loss in Antarctica. Science DOI: 10.1126/science.1123785.), in spite of inland growing of the interior of East Antarctica (e.g. Davis, C.H., Li, Y., McConnell, J.R., Frey, M.M., Hanna, E.. 2005. Snowfall-Driven Growth in East Antarctic Ice Sheet Mitigates Recent Sea-Level Rise. Science, Vol. 308. no. 5730, pp. 1898 – 1901.). Appropriate references have been quoted in subsection 1.3.1.3.
1-617	A	24	35	24	35	Are there reference to observations of glaciers disappearing and decrease of glacial runoff (Peter Stott, Met Office)	Yes, there are many references of glaciers disappearing. However, there is no clear evidence of associated decrease of glacial

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							runoff., as quoted in subsection 1.3.1.4. Thus, sentence has been removed.
1-618	A	24	36			"thermokarst" - Define where first used. (Nathan Gillett, University of East Anglia)	OK, definition added in 1.3.1.5.
1-619	A	24	38	24		Section 1,3,1,9, add "regional" ocean freshening (Annick Douguedroit, Université de Provence)	OK, added.
1-620	A	24	38	24	39	I don't think there have been conclusive observations of changes in the thermohaline circulation in response to enhanced melting. Which studies are referred to here? (Nathan Gillett, University of East Anglia)	There is new evidence presented in Bryden, H.L., H.R. Longworth, S.A. Cunningham. 2005. Slowing of the Atlantic meridional overturning circulation at 25° N. Nature 438, 655-657. This reference is now added in subsection 1.3.1.6.
1-621	A	24	38	24	39	It is stated that "ocean freshening and decrease of the thermohaline circulation" are an "observed impact of cryosphere reduction". I would have to say this is unproved. Without a good budget of the sinking regions it is impossible to tell whether the increased meltwater from glaciers is enough to account for a decrease in the thermohaline circulation or not. It is certainly consistent, but by no means "observed". (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	There is new evidence presented in Bryden, H.L., H.R. Longworth, S.A. Cunningham. 2005. Slowing of the Atlantic meridional overturning circulation at 25° N. Nature 438, 655-657. This reference is now added in subsection 1.3.1.6.
1-622	A	24	43	24	47	I realize this is a PC statement, but one does wonder whether the empirical knowledge will prove to be a benefit or a burden as the climate enters a non-analog situation. Sure, they will recognize something as 'new', but will they still try to follow traditional approaches to deal with it? (David Rind, NASA/GISS)	OK, agree. Sentence has been modified.
1-623	A	24	45	24	46	"Deep empirical knowledge" is an overromantic expression. (Kaija Hakala, MTT Agrifood Research Finland)	OK, sentence has been modified.
1-624	A	25	1	25	2	For many geophysical reasons and clearer understanding of the processes involved, the first sentence should read as follows: The hydrological cycle at regional scales is affected and modulated by weather, climate, and the catchments characteristics. (Osvaldo Canziani, IPCC)	TR <ul style="list-style-type: none"> • For non-substantive comments, a very brief entry should be made in the column 'Notes of the Writing Team'. The following terms are acceptable: <ul style="list-style-type: none"> ○ (A) Addressed ○ (NA) Not applicable ○ (TR)Text removed ○ (✓) A tick to denote a

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							comment has been addressed (somewhere on the document this should be stated)
1-625	A	25	3			In general, the hydrology section provides a lot of good information, but it needs to be restructured so that it presents a clearer picture. Instead of organizing the section by hydrological variable (runoff, streamflow, etc.), it could start with a map (e.g., Fig. 7 from Dai et al. 2004) showing areas of the world that are drying and those that are becoming wetter (with reference to the appropriate chapter in WGI). Then the section should be reorganized by regions that are getting drier and regions that are getting wetter, with the supporting evidence organized by region and hydrological variable. This will allow you to assess the evidence in support of your finding that 'areas most affected by increasing droughts are located in arid and semi-arid regions.' Dai, A., K.E.Trenberth, and T. Qian (2004). "A global data set of Palmer Drought Severity Index for 1870-2002: Relationship with soil moisture and effect of surface warming." J. Hydrometeorology: 5. 1117-1130. (David Rind, NASA/GISS)	NA
1-626	A	25	3			In developed countries, urban sprawl is more important than urbanisation. River regulation also plays an important role, as does deforestation and draining of wetlands. (Richard S.J. Tol, Uni. Hamburg)	TR
1-627	A	25	4			is placing "increasing" stress (Markus Erhard, Forschungszentrum Karlsruhe)	TR
1-628	A	25	10			In view of the importance of evaporation and evotranspiration (as shown by the increase of heat energy in the ocean of the world and the recycling of precipitation in pluvius forest), these variables shall be included in the climate variables listing. (Osvaldo Canziani, IPCC)	A
1-629	A	25	11	25	11	I'm not aware that any of the other variables listed are used in detection and attribution research, and the number of studies using precipitation is very limited. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	A
1-630	A	25	12	25	15	Aren't these distinctions of timescale artificial? For example we might be interested in decadal variability at the global scale if we are trying to distinguish an externally forced signal? Long term changes at the local level may be important for local impacts. (Nathan Gillett, University of East Anglia)	
1-631	A	25	12	25	15	While it is clear what the 3 spatial scales are it is not clear what the 3 temporal scales	TR

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						are - long-term, inter-annual, inter-decadal, short-term makes 4 (Peter Stott, Met Office)	
1-632	A	25	20			I propose to add "forest fires" (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	NA
1-633	A	25	24			On the other hand, the hydrologic cycle is projected to be accelerated and run-off into northern waters has apparently increased (see the very next sub-section). This does not suggest a water shortage and this may or may not result in worse water quality, depending on a host of other factors. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	NA
1-634	A	25	24			Another good example of the influence of anthropogenic activities on water availability in the context of climate change is discussed in Jiongxin (2005) Jiongxin, X. 2005. The water fluxes of the Yellow River to the sea in the past 50 Years, in response to climate change and human activities. Environ. Manage. 35:620 - 631. (Thomas Huntington, U.S. Geological Survey)	A
1-635	A	25	30	25	48	Gedney et al., Detection and attribution of changes in 20th century continental runoff, submitted to Nature, 2005 should be referenced and discussed in this section. This is the only formal detection and attribution study of runoff studies I have seen. (Nathan Gillett, University of East Anglia)	A
1-636	A	25	32	30	42	May want to mention Milly et al. (2002), Nature 415, 514-517 who also report an increasing trend of great flood events in Arctic rivers that is consistent with climate models. (I now see that this is mentioned later, but it is not in the references). (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	A
1-637	A	25	32	25	39	See also Gedney et al, 2005, Nature submitted (referenced in WGI Chap 9) which shows a significant anthropogenic influence on runoff via reduced transpiration (Peter Stott, Met Office)	A
1-638	A	25	33	27	1	Comments on Table 1.3 and associated text. Most of the studies listed in the table provide relatively short term trends, but this report is supposed to be about "climate change". Accordingly, I recommend including more studies that have longer records (see, for instance, Winsor et al. 2001, New et al. 2001, Kunkel 2003, Kunkel et al. 2003, McCabe and Wolock 2002). It would be appropriate to also look at paleo reconstructions that can provide a longer perspective on climate change (see, e.g., Ni et al. 2002, Gray et al. 2003). Frankly, 12-years (or even 40 or 50 years) worth of data, for example, is not particularly helpful in shedding light on "climate change". At best, all that can do is generate a hypothesis. {Ref: [1] Winsor, P., Rodhe, J. and	A

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						<p>Omstedt, A. 2001. Baltic Sea ocean climate: an analysis of 100 yr of hydrographic data with focus on the freshwater budget. <i>Climate Research</i> 18: 5-15. [2] New, M., Todd, M., Hulme, M. and Jones, P. 2001. Precipitation measurements and trends in the twentieth century. <i>International Journal of Climatology</i> 21: 1899-1922. [3] Kunkel, K.E. 2003. North American trends in extreme precipitation. <i>Natural Hazards</i> 29: 291-305. [4] Kunkel, K.E., Easterling, D.R., Redmond, K. and Hubbard, K. 2003. Temporal variations of extreme precipitation events in the United States: 1895-2000. <i>Geophysical Research Letters</i> 30: 10.1029/2003GL018052. [5] McCabe, G.J. and Wolock, D.M. 2002. Trends and temperature sensitivity of moisture conditions in the conterminous United States. <i>Climate Research</i> 20: 19-29. [6] Ni, F., Cavazos, T., Hughes, M.K., Comrie, A.C. and Funkhouser, G. 2002. Cool-season precipitation in the southwestern USA since AD 1000: Comparison of linear and nonlinear techniques for reconstruction. <i>International Journal of Climatology</i> 22: 1645-1662. [7] Gray, S.T., Betancourt, J.L., Fastie, C.L. and Jackson, S.T. 2003. Patterns and sources of multidecadal oscillations in drought-sensitive tree-ring records from the central and southern Rocky Mountains. <i>Geophysical Research Letters</i> 30: 10.1029/2002GL016154.</p> <p>(Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	
1-639	A	25	35	25	36	<p>"small secular trends for most rivers". What does this mean? Small trends consistent with internal variability? Significant upward trends?</p> <p>(Nathan Gillett, University of East Anglia)</p>	TR
1-640	A	25	36			<p>Year after Lammers</p> <p>(Jorge Carrasco, Dirección Meteorológica de Chile)</p>	A
1-641	A	25	37			<p>Year after Labat</p> <p>(Jorge Carrasco, Dirección Meteorológica de Chile)</p>	A
1-642	A	25	48	25	48	<p>Define what UNDP stands for.</p> <p>(Claire Parkinson, NASA Goddard Space Flight Center)</p>	TR
1-643	A	26	0			<p>Table 1.4(a). In the row on South America, since the Paraná and Paraguay rivers make part of the River Plate basin, the references in the third column should be drafted properly.</p> <p>(Osvaldo Canziani, IPCC)</p>	A
1-644	A	26	0			<p>Table 1.3.: row 1, Arctic. "Additional 2500 km³ of water including 1500 km³ from the territory of Russia". This may be correct only in case the WATER balance residual (not only river runoff!) is substantially different from zero, considering uncertainty as well! Or, another words, water balance is not in the balance, say runoff is much larger than precipitation plus evapotranspiration. I am aware that not such data available (!). Note, that increases in river runoff (NOT THE WATER</p>	A

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						BALANCE!), stated by Peterson et al in Science 2002 uses data from 1936, and shows huge interannual variability in 10 or so pan Arctic river discharge, but not statistically significant trend, compare with variability! (Mark Dyurgerov, University of Colorado)	
1-645	A	26	0			The comment that increased stream flow was found for parts of the US during the latter half of the 21st century is not very compelling. What is the mean response of stream flow across North America? Up, down or no detectable change? Do we have insufficient data to evaluate such trends? (Paul J. Hanson, Oak Ridge National Laboratory)	A
1-646	A	26	1	27	4	The tables a and b are built by different principles, make them logically similar, please. (Kaija Hakala, MTT Agrifood Research Finland)	A
1-647	A	26	1	29		Tables 1.3, 1.4 - The wide variety of responses detailed in these tables evidently differ according to process and location. Would it be possible to structure the tables or group the examples according to the likely process responsible (e.g. increases in runoff at high latitudes associated with ice melt, increases in runoff associated with increased precipitation, decreases in runoff associated with reduced precipitation), thus making it easier to draw clear messages from the tables? (Robert Wilson, Universidad Rey Juan Carlos)	A
1-648	A	26	1	26	3	Regarding the first entry listed for North America (stream flow change). Is it clear that this can be attributed to increased precipitation? Changes in evaporation, transpiration, ground water pumping, etc., could also affect streamflow. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	A
1-649	A	26	2		3	Table 1.3 year of reference are missing for some citations (Jorge Carrasco, Dirección Meteorológica de Chile)	A
1-650	A	26	2	26	2	Table 1.3 may need to include references about changes in the Arctic slope of Eurasia (with possible original references to 1. Peterson et al. 2002, Science; and 2. Georgievsky V.Yu., I. A. Shiklomanov and A. L. Shalygin, 2002: Long-term variations in the runoff over the Russian territory. Scientific Report of the State Hydrological Institute, St. Petersburg, Russia, 85 pp. or similar publications. (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	A
1-651	A	26	2	26	2	Under "Europe", presumably the large river of Russia will be defined (David Rind, NASA/GISS)	TR
1-652	A	26	3			Table 1.3 does not include reductions in streamflow documented for south-western Australia (see section 11.6 case studies in chapter 11). (Lynda Chambers, Bureau of Meteorology Research Centre)	A
1-653	A	26	3			Table 1.3 The description of changes needs to be more specific. For example, in	A

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						North America, there is reduced and also increased streamflows. You need to specify the region. In the same way, there is a mention of an increase and a decrease of annual runoff in Russia. Be more specific. (Raymond Desjardins, N/A)	
1-654	A	26	3			Also, in the table, it is necessary to have the same headings for parts a and b. Table 1.3b needs more details to be meaningful. (Raymond Desjardins, N/A)	A
1-655	A	26	3			Table 1,3. The title is "Observed variations and trends in...":two remarks. The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	A
1-656	A	26	3			The European entries in Table 1.3 are interesting. Rivers in Western Europe are much better documented than rivers in Russia. What can be said about Rhine, Elbe, Rhone, Thames? (Richard S.J. Tol, Uni. Hamburg)	NA
1-657	A	26	4			Table 1.3.b presentation should be homogenized with Table 1.3.a (Isabelle Chuine, CNRS)	A
1-658	A	26	4			Additional comments on Table 1.3. What is meant by "last decades"? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	A
1-659	A	26	4			Table 1.3 b: The third column has become offset so that the references don't line up with the correct information. (Lesley Hughes, Macquarie University)	A
1-660	A	26	4			TABLE 1.3 I think it is a mistake to cite to Groisman et al (2004) for trends in North American stream flow in this table. There are more recent and more comprehensive papers that specifically test for trends in streamflow. Groisman et al (2004) is simply a recap of (Groisman et al., 2001) that was discussed in the TAR along side Lins and Slack 1999 in this context. It was noted at that time that those papers came to very different conclusions about whether agreed upon increases in precipitation had resulted in increases in stream discharge at the highest flow quantiles. – Here in the FAR once again the authors note the conflicting results on Page 30 in the FAR lines 5- 7. For evidence of increases in streamflow in North America I believe that the FAR should cite the more recent papers (Mauget, 2004; McCabe and Wolock, 2002; Gagnon and Gough, 2002; Walter et al. 2004). Waler et al. 2004 in particular covers most of continental USA and shows very clear long term trends toward increasing river runoff over time. In addition, the FAR may wish to cite Zhang et al. (2001) and Burn and Hag Elnur (2002) that report no consistent increases in discharge for most	A

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						<p>Canadian Rivers that they studied in the latter half of the 20th century.</p> <p>Burn, D.H., and M.A. Hag Elnur. 2002. Detection of hydrologic trends and variability. <i>J. Hydrol.</i> 256:107-122.</p> <p>Mauget, S. 2004. Low frequency streamflow regimes over the central United States: 1939-1998. <i>Climatic Change.</i> 63:121-144.</p> <p>McCabe, G.J., and D.M. Wolock. 2002. A step increase in streamflow in the conterminous United States. <i>Geophys. Res. Lett.</i> 29(24), 2185, doi:10.1029/2002GL015999,2002. 29:38-1 to 38-4.</p> <p>Gagnon AS, Gough WA. 2002. Hydro–Climatic Trends in the Hudson Bay Region, Canada. <i>Can. Water Resour. J.</i> 27: 245–262.</p> <p>Walter, M.T., Wilks, D.S., Parlange, J.-Y., Schneider, R.L., 2004. Increasing evapotranspiration from the conterminous United States. <i>J. Hydrometeorology</i> 5, 405–408.</p> <p>Zhang, X., K.D. Harvey, W.D. Hogg, and T.R. Yuzyk. 2001. Trends in Canadian stream flow. <i>Wat. Resour. Res.</i> 37:987-998.</p> <p>Two recent papers illustrate the complexity of stream flow response to climate change in large river systems where anthropogenic factors like large-scale diversions for consumptive uses like irrigation, impoundments, are well documented. For the Yellow River (Jiongxin, 2005) and the Lake Chad Basin (Coe and Foley, 2001) warming and drying trends are partially responsible for significant decreases in runoff during the latter half of the 20th century.</p> <p>Jiongxin, X., 2005. The water fluxes of the Yellow River to the sea in the past 50 Years, in response to climate change and human activities. <i>Environ. Manage.</i> 35:620 - 631.</p> <p>Coe, M.T., and J.A. Foley. 2001. Human and natural impacts on the water resources of the Lake Chad Basin. <i>J. Geophys. Res.</i> 106:3349-3356.</p> <p>(Thomas Huntington, U.S. Geological Survey)</p>	
1-661	A	26		27		<p>Table needs to be redone and lined up better, with references and comments matching the years in a more obvious way</p> <p>(David Rind, NASA/GISS)</p>	A
1-662	A	27	0	30		<p>1.3.2.3 -- 1.3.2.7: The issue of extreme weather events and linkage to global warming is being debated extensively at present and there is no consensus on this (see Energy & Environment,2004,p.521-525;also E&E 2005,p.327-331). Many items in Table 1.4 need to be thoroughly checked and analyzed; for ex. Lawson (2003) concludes that winter blizzards on the Canadian Prairies have significantly declined in recent years, Graham & Diaz (2001) refer to Pacific ocean winter storms which have not traveled</p>	A

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						to N American land areas, Dai et al (2004) do not provide causal mechanism for world-wide droughts; Shabbar & Skinner (2004) show Canadian Praire droughts linked with SST over Pacific Ocean and NOT to global warming, Danielle (2004) and Fauchereau et al (2003) refer to floods/droughts linked to ENSO but not to global warming/climate change. Table 1.4 entries must be suitably analyzed before being simply listed. Summary (1.3.2.7) must be revised accordingly. ENSO impacts must not be lumped with global warming/climate change impacts. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-663	A	27	0			Table 1.3 column text for Smith 2005 needs aligning correctly. (Kim Ritman, Bureau of Rural Sciences)	A
1-664	A	27	3			Section 1.3.2.2 It is not clear how more pumping results from CC. It may result from more intensive agriculture with irrigation. (Raymond Desjardins, N/A)	A
1-665	A	27	3			Table 1.3 (continued), Authors COMMENT: The reference Smith 2005 refers to Artic Lakes, and not to "Three closed lakes in Australia", as indicated; the previous reference, R.N. Jones 2001, is missing from the References list. (Maria Rosa Paiva, Universidade Nova de Lisboa)	A
1-666	A	27	3	27	14	These are not really "effects" of changes in groundwater but empirical observation of groundwater changes (David Rind, NASA/GISS)	A
1-667	A	27	8			Year after Chen, same pag 32, line 38 (Jorge Carrasco, Dirección Meteorológica de Chile)	A
1-668	A	27	9			"other" not "others" (Lesley Hughes, Macquarie University)	A
1-669	A	27	16			Comments on Section 1.3.2.3. From the human point of view the among the most important consequences of extreme events are mortality and property loss. Accordingly, it should be noted here that aggregate deaths and death rates due to such events has apparently declined, according to the information in the EM-DAT database. See comments 13, 14 and 15 (Indur Goklany, Office of Policy Analysis, Department of the Interior)	NA
1-670	A	27	20	27	21	When providing the example on the very heavy rains on Haiti and Dominican Republic, in May 2004, reference shall be made on the more disastrous effect on Haiti due to prevalence of naked soils because of brutal deforestation (New Scientist, 2004) (Osvaldo Canziani, IPCC)	TR
1-671	A	27	22			I propose to add "The floods from November 10, 2001 in Algiers caused the death of almost 1000 people and the damage exceeding one billion dollar"	TR

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						(Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	
1-672	A	27	23			Section 1,3,2,3,:growing population, add: deforestation, and regional development (Annick Douguedroit, Université de Provence)	TR
1-673	A	27	24	27	27	This statement contradicts WGI ch. 3 section 3.8.2.2, which states that while FREQUENCY of rainy days was equally high in periods 1880-1910 as during 1980-1990s, VERY HEAVY precip events (floods) are significantly more frequent in the past 20 years compared to the entire data record (late 1800s). (See WGI, ch. 3, pg 67, lines 16-23) (Camille Parmesan, University of Texas at Austin)	TR
1-674	A	27				LAKE LEVELS There are a few published papers about Lake levels in Central Italy which I think should be considered in the table. These papers show a decrease of the levels of most of the Lakes in the area or a decrease of the discharge of the effluents. This is due both to climatic fluctuations (rainfall decrease) and overexploitation (water withdrawal from the lake, overpumping from the aquifers feeding the lakes). Some references are the following: Capelli G., Mazza R. (2005): Water criticality in the Colli Albani (Rome, Italy). <i>Giornale di Geologia Applicata</i> , vol. 1 – anno 2005, ISSN 1826-1256, pp. 113 – 121. Dragoni W., Evangelisti C., Gnucci L. Valigi D. (2002): Impact of Climatic Variations on Bolsena Lake. <i>International Conference RESIDENCE TIMES IN LAKES: SCIENCE, MANAGEMENT, EDUCATION</i> , Bolsena (Viterbo - Italy) September 29th - October 3rd 2002, pp.182 - 186. http://www.unipg.it/~laghi05/files/2002_bolsena.pdf Dragoni W., Lotti F., Piscopo V., Sibi A. (2002): Bilancio idrogeologico del lago di Vico (Lazio – Italia). <i>Proc. Int. Conf. on RESIDENCE TIMES IN LAKES: SCIENCE, MANAGEMENT, EDUCATION</i> , Bolsena (Viterbo - Italy) September 29th - October 3rd 2002, pp.96 - 104. http://www.unipg.it/~laghi05/files/2002_vico.pdf Dragoni W. (2004): <i>Il Lago Trasimeno e le Variazioni Climatiche - The Lake Trasimeno and the Climatic Variations.</i> (in Italian and English) Progetto informativo dell'assessorato all'Ambiente della Provincia di Perugia, Servizio Gestione e Difesa Idraulica, pp 60 . http://www.unipg.it/~laghi05/files/2004_trasimeno.pdf (Walter Dragoni, Università di Perugia)	A
1-675	A	28	0	28		Table 1.4 please define all abbreviations, in the table (PDSI)	A

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						(Hayley Fowler, Newcastle University)	
1-676	A	28	0	28		These studies in these tables should be broken down into correct categories to distinguish studies of rainfall patterns, and other climate indices, from the non-climate indices. Especially for droughts, which can be defined a range of ways (from rainfall studies, to drought indices- the latter should be specified).. Studies that look at "disasters" and mention fatalities should be in section on disasters, and this section should be restricted to studies on climate/weather indices. (Sari Kovats, London School of Hygiene and Tropical Medicine)	A
1-677	A	28	0	29		All tables - the time periods should be specified in terms of years. (Sari Kovats, London School of Hygiene and Tropical Medicine)	A
1-678	A	28	5	28	6	Is it possible to give quantitative results, such as frequency, amplitude, trends? (Xiaoqiu Chen, College of Environmental Sciences)	NA
1-679	A	28	5			Table 1.4: the title is "Observed changes in "; The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	A
1-680	A	28	5			Table 1.4: The last observed change (the magnitude of extreme rainfall has increased two-fold) is not attributed to a reference. I assume that it from my own work and specifically from the papers: Fowler, H.J. and Kilsby, C.G. 2003. Implications of changes in seasonal and annual extreme rainfall. Geophysical Research Letters, 30(13), 1720, doi:10.1029/2003GL017327. Fowler, H.J. and Kilsby, C.G. 2003. A regional frequency analysis of United Kingdom extreme rainfall from 1961 to 2000. International Journal of Climatology, 23(11), 1313-1334. (Hayley Fowler, Newcastle University)	A
1-681	A	28	5			Table 1.4: as above, last column is offset. (Lesley Hughes, Macquarie University)	A
1-682	A	28	7			Table 1.4.b presentation should be homogenized with Table 1.4.a (Isabelle Chuine, CNRS)	A
1-683	A	28	7	29	1	Some of the items in the column 'change' do not appear to be changes at all, but just statements about the climatology ('High streamflow events associated with heavy and very heavy precipitation'). Remove references to studies which do not describe changes. Are we to believe that the changes in flooding from the Dartmoth Flood Observatory homepage are really significant? (Changes in the recurrence interval of floods with recurrence intervals > 100 yr must be hard to measure). (Nathan Gillett, University of East Anglia)	A

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1-684	A	28	7	28	7	Amazing statement about drying in Western Russia (reference to Wang 2003) contradicts all available results about increase of precipitation in this region (Groisman and Rankova 2001), drought indices in this region (Mescherskaya and Blazhevich 1997 updated; Groisman et al. 2005b from Ch. 3 WG1 report), and a record high level of the Caspian Sea in recent decades (cf., NEESPI Science Plan Executive Summary at http://neespi.org). At the same time, the drying of Eastern Asia reported by precipitation data and drought indices (same references and Dai et al. 2004b ref. from Ch.3 WG1 report) is omitted. (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	NA
1-685	A	28	17	31		The sentences on these lines need to be supported with appropriate references. Presumably, these sentences are supported by the WGI report. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	?
1-686	A	28		29		Comment on Table 1.4. See comment 42. Longer records are better. Would recommend more references to paleo studies. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	NA
1-687	A	28		29		Same problem as previous table - reference, location and observed change need to be lined up better (David Rind, NASA/GISS)	A
1-688	A	29	0	30		Box 1.2 Sahel Drought: Highlighting Sahel drought, which appears to be governed primarily by natural variability, is misleading here. Other regions of the world (ex. North American Great Plains) have experienced droughts of 40 consecutive years or more in the past, so why highlight Sahel drought only? section 1.3.2.5, p.30, here other large lakes in Canada (ex. Lake Manitoba, Great Slave Lake) and elsewhere in the world, where no impact of climate change is evident, should also be mentioned. Section 1.3.2.7 Summary, p. 30: Here human activity on ground should be differentiated from human-added CO2 in the atmosphere, indicating that climate change on a local/regional scale may be occurring more due to human activity on ground and not due to human-added CO2. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	TR
1-689	A	29	1	29	16	No information on the effects of changes in Sahel drought has been given. The Box 1.2 may be moved to WGI AR4. (Xiaoqiu Chen, College of Environmental Sciences)	TR
1-690	A	29	8	29	8	Box 1.2: Replace "...since the early 1970s" with "...since at least 1968." [References: (United Nations Conference on Desertification. 1977. Desertification: Its causes and consequences. Pergamon Press, Oxford, UK); (United Nations Environment Program. 1997. World Atlas of Desertification, 2nd Edition. Edward Arnold, London, UK).]	TR

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						(Patrick Gonzalez, The Nature Conservancy)	
1-691	A	29	10	29	12	Box 1.2: Replace the entire sentence "Sea surface temperature changes...2002" with "Analyses of historical rainfall and coupled atmosphere-ocean-land-vegetation model output indicates that the Sahel drought results from sea surface temperature anomalies amplified by a reduction of Sahel vegetation cover (Zeng, Neelin et al. 1999; Giannini, Saravanan et al. 2003; Zeng 2003.)" References: (Giannini, A., R. Saravanan, and P. Chang. 2003. Oceanic forcing of Sahel rainfall on interannual to interdecadal time scales. Science 302: 1027-1030); (Zeng, N., J.D. Neelin, K.-M. Lau, and C.J. Tucker. 1999. Enhancement of interdecadal climate variability in the Sahel by vegetation interaction. Science 286: 1537-1540); (Zeng, N. 2003. Drought in the Sahel. Science 302: 999-1000). The draft sentence did not take into account the extensive and detailed research that demonstrates that both sea surface temperature anomalies and vegetation cover reduction are necessary to explain the Sahel drought. (Patrick Gonzalez, The Nature Conservancy)	TR
1-692	A	29	12	29	12	the word 'heat wave' should presumably be replaced by 'drought' (David Rind, NASA/GISS)	TR
1-693	A	29	12	29	12	I don't understand the reference to a heat wave in the context of this discussion of Sahel rainfall changes. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	TR
1-694	A	29	15	20	15	I am not sure whether submitted paper should be cited (Isabelle Chuine, CNRS)	NA
1-695	A	29	24			Table 1.4 presentation should be homogenized with Table 1.3. and 1.2 (Isabelle Chuine, CNRS)	A
1-696	A	29	24			Table 1,4: twice the same number for two different tables. the title is "Observed changes in "; no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	A
1-697	A	29	24			Table 1.4: columns offset (Lesley Hughes, Macquarie University)	A
1-698	A	29	24			With regard to Table 1.4a – in particular the reports on trends in floods. – I do not think it is fair to cite only those papers that have shown an increase in flooding when there are several that show no increase in flooding including Mudlesee et al. 2003; McCabe and Wollock, 2002; Lindstrom and Bergstrom, 2004; Vogel et al., 2002, Zhang et al., 2001). This should be discussed in the first paragraph of page 30 Section 1.3.2.5. Lindstrom, G., and S. Bergstrom. 2004. Runoff trends in Sweden 1807-2002. Hydrol.	A

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						<p>Sci. J. 49:69-83.</p> <p>McCabe, G.J., and D.M. Wolock. 2002. A step increase in streamflow in the conterminous United States. <i>Geophys. Res. Lett.</i> 29(24), 2185, doi:10.1029/2002GL015999,2002. 29:38-1 to 38-4.</p> <p>Mudelsee, M., M. Börngen, G. Tetzlaff1, and U. Grünewald. 2003. No upward trends in the occurrence of extreme floods in central Europe. <i>Nature</i> 425: 166 - 169.</p> <p>Vogel, R., Zafirakou-Koulouris, A., Matalas, N.C., 2002. Frequency of record-breaking floods in the United States. <i>Water Resour. Res.</i> 37, 1723-1731.</p> <p>Zhang, X., Harvey, K.D., Hogg, W.D., Yuzyk, T.R., 2001b. Trends in Canadian stream flow. <i>Wat. Resour. Res.</i> 37, 987-998.</p> <p>(Thomas Huntington, U.S. Geological Survey)</p>	
1-699	A	29	26	29	26	<p>The tables are presently pretty difficult to read. It is not clear if they are meant to be a comprehensive overview, or whether they represent a more selective overview of the literature. They also take a lot of space, and I wonder if they are really doing an effective job of communicating observed changes.</p> <p>(Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)</p>	A
1-700	A	30	0	34		<p>1.3.3 Coastal processes and zones: Many coastal processes and impacts are predominantly governed by human activity re:coastal management, with no apparent linkage to climate change issues. IPCC 2001 catagorically states "no significant acceleration in the rate of sea-level rise in 20th century". Among the recent studies, not mentioned here, are those by Morner N.-A., <i>Global & Planetary Chnage</i>, Vol. 40, 2004, p. 49-54 & p.177-182. Both these studies allay any fear of accelerating sea-level rise anywhere. Summary (1.3.3.6) must be revised accordingly.</p> <p>(Madhav Khandekar, Retired research scientist and consulting meteorologist)</p>	Addresseed in rewritten text of section 1.3.3
1-701	A	30	1			<p>Section 1.3.2.5 The St Lawrence originates from the Great Lakes. Change for North America's Great Lakes.</p> <p>(Raymond Desjardins, N/A)</p>	A
1-702	A	30	3	30	5	<p>Aral Sea can hardly be seen as a large lake, it has been drained more or less empty. Because of the huge dominating impact by man, we can't talk about climate change impacts here.</p> <p>(Kaija Hakala, MTT Agrifood Research Finland)</p>	A
1-703	A	30	4	30	4	<p>This basin is often referred to as the St.Lawrence River Great Lakes Basin.</p> <p>(Roger Brian Street, Meteorological Service of Canada, Environment Canada)</p>	A
1-704	A	30	5	30	6	<p>the increasing trend in runoff presumably does not occur in North America (according to Table 1.3) so is it appropriate to say "global scale"?</p> <p>(David Rind, NASA/GISS)</p>	Text changed

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1-705	A	30	7	30	11	glacier growth in Karakorum: this is an issue of section 1.3.1 and should be discussed there. Here examples from flood trends should be used see e.g. publications from Pfister et al. for Europe http://www.wsu.hist.unibe.ch/index.php?id=164 , http://www.wsu.hist.unibe.ch/downloads/state_of_the_art.pdf , or publications from re-insurance companies like MuRe or SwissRe (Markus Erhard, Forschungszentrum Karlsruhe)	NA
1-706	A	30	7			<p>I believe that it is wrong to cite Kunkel 2003 in the context of whether there has been an increase in flooding or not. I believe that you should cite the recent papers that address flooding DIRECTLY from a stream discharge perspective like (Mudelsee et al. 2003; McCabe and Wollock, 2002; Lindstrom and Bergstrom, 2004; Vogel et al., 2002, Zhang et al., 2001) rather than INDIRECTLY from precipitation like Kunkel (2003). You may also wish to cite Huntington (In Press – J. Hydrology) where many of these papers are noted in the context of an overall intensification of the hydrologic cycle.</p> <p>Huntington, T. G. In Press, Evidence for intensification of the global water cycle: review and synthesis, Journal of Hydrology.</p> <p>Lindstrom, G., and S. Bergstrom. 2004. Runoff trends in Sweden 1807-2002. Hydrol. Sci. J. 49:69-83.</p> <p>McCabe, G.J., and D.M. Wollock. 2002. A step increase in streamflow in the conterminous United States. Geophys. Res. Lett. 29(24), 2185, doi:10.1029/2002GL015999,2002. 29:38-1 to 38-4.</p> <p>Mudelsee, M., M. Börngen, G. Tetzlaff, and U. Grünewald. 2003. No upward trends in the occurrence of extreme floods in central Europe. Nature 425: 166 - 169.</p> <p>Vogel, R., Zafirakou-Koulouris, A., Matalas, N.C., 2002. Frequency of record-breaking floods in the United States. Water Resour. Res. 37, 1723-1731.</p> <p>Zhang, X., Harvey, K.D., Hogg, W.D., Yuzyk, T.R., 2001b. Trends in Canadian stream flow. Wat. Resour. Res. 37, 987-998.</p> <p>(Thomas Huntington, U.S. Geological Survey)</p>	A
1-707	A	30	7	30	7	<p>With reference to the statement "...whether these data are affected by human activities.". Is it the data that is affected or is it the occurrence of floods that are affected?</p> <p>(Roger Brian Street, Meteorological Service of Canada, Environment Canada)</p>	TR
1-708	A	30	11			<p>Reference should be Fowler and Archer (in press, as not yet published)</p> <p>(Hayley Fowler, Newcastle University)</p>	A
1-709	A	30	11			<p>Also worth noting that this increase in DTR is in contrast to trends seen in most of the rest of the globe.</p>	A

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						(Hayley Fowler, Newcastle University)	
1-710	A	30	13	30	27	The AR4 goal is, inter alia, advice for decision making. The last decades increase in extreme events (i.e. heat waves, floods/droughts) suggests that reference to action for establishing early warning and alert hydrometeorological national/provincial systems, should be included in this sub-section. (Osvaldo Canziani, IPCC)	NA
1-711	A	30	22	30	24	The new European Water Framework Directive has been recognised as having an important holistic role for climate change impacts on water resources, water quality and biodiversity, see, Wilby R.L. Orr, H.G. Hedger, M. 2006, Risks posed by climate change to delivery of Water Framework Directive objectives, in press (will send to TSU). (Merylyn McKenzie Hedger, Environment Agency)	TR
1-712	A	30	25	30	27	References? (Nathan Gillett, University of East Anglia)	A
1-713	A	30	35			Section 1,3,2,7,.. the observed (add hier significant; is it?) increasing trend (Annick Douguedroit, Université de Provence)	A
1-714	A	30	35	30	36	Insert "recent" before "observed" on line 35. Moreover, it should be noted that we do not know that these increases are not within the range of natural variability. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	A
1-715	A	30	35	30	37	Note that Gedney et al, 2005, Nature submitted (referenced in WGI chap 9) explains increased runoff by reduced transpiration from increased CO2 (Peter Stott, Met Office)	A
1-716	A	30	45			Section 1.3.3 needs to be rewritten in order to clarify the role of climate, and the role of the human factor on the climate and how these are affecting coastal processes. At several places in this section, the human factor is prevalent and therefore, it is not clear what the impact of climate change may be. (Raymond Desjardins, N/A)	Text rewritten to clarify roles of climate and human processes.
1-717	A	30	45			section 1.3.3 coastal erosions: a mape showing distribution of global sea level rise and/or a table summarizing the effects for coastal erosion would help to understand the complex interactions (Markus Erhard, Forschungszentrum Karlsruhe)	Covered in AR4 Chapter 5; see Church et al. 2004, Fig.9. Table added.
1-718	A	30	45			Would it be helpful to give a better indication of the regional variability in sea level rise? At least Northern Hemisphere vs Southern, Pacific vs other oceans? (Lesley Hughes, Macquarie University)	See Church et al. 2004, Fig. 9.
1-719	A	30	47	49		a reference for the first sentence in this chapter would be helpful (Markus Erhard, Forschungszentrum Karlsruhe)	References added.
1-720	A	30	47	35	2	Might want to mention at some point in here that changes in sea level pressure (the	Comment considered, but judged not

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						so-called inverse barometer effect, Ponte, R. M., 1993: Variability in a Homogeneous Global Ocean Forced by Barometric Pressure. Dynamics of Atmospheres and Oceans, 18, 209-234.) 1 mb of pressure change can give 1 cm of sea level change. This effect can therefore confound some of the measurements of sea level rise locally. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	important. See Pugli and Maul (1999).
1-721	A	31	5	31	5	ADB: what does it mean? (Giampiero Maracchi, Institute of Biometeorology)	It is a reference. ADB 2005. Date added.
1-722	A	31	6			Year after Church (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-723	A	31	6	31	8	Sentence needs to be rewritten (Lesley Hughes, Macquarie University)	Fixed.
1-724	A	31	6	31	8	These lines are confused/confusing. (Claire Parkinson, NASA Goddard Space Flight Center)	Fixed.
1-725	A	31	7			(2004) instead of 2004 (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-726	A	31	8	12		The paragraph is written in such a way that one might think that only the PDO and the NAO are relevant; there are many indices today that are related to variations in the physical environment, and there are several scales. The point raised here should probably be that the variation in sea level is related to short term (high frequency) variation, such as the ENSO and longer (decadal, interdecadal and multidecadal scales) (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	Fixed.
1-727	A	31	25			Year after Syvitski, same in line 36 (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-728	A	31	26			Year after Gornitz (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-729	A	31	36	31	39	The sentence about Venice is not correct because it suggests that ground water pumping is the only reason for subsidence, while the whole region is subjected to natural subsidence, about 1mm/year. In fact, both sea level rise and natural subsidence produce a comparable contribution. The 1.9 mm value of the long term sea level rise needs a reference and the specification of the time scale considered. In my view this estimate is extremely controversial. Tide gauge record in Trieste (about 100km from Venice) shows large inter-decadal variations with decadal trends in the range from -5 to +5mm /year, for the whole 20th century. This is confirmed also by Tsimplis and Baker (2000), which show that the Mediterranean Sea level does not follow regularly the global trend.	Reference is given.

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						<p>A more correct sentence would be "In Venice, Italy, groundwater pumping (Carbognin et al 1976) greatly increased the subsidence already present because of plate subduction (Carminati et al 2005) . This local loss of ground level is superimposed to sea level rise which, however, in the Mediterranean sea presents large spatial and inter-decadal variability (e.g Fenoglio-Marc 2002, Tsimplis and Baker 2000). Subsidence (both natural and due to groundwater pumping) is the main cause of the increased frequency of floods (Camuffo and Sturaro, 2004). If the effect of sea level rise and subsidence are filtered from the observed values, the frequency of extreme floods shows large inter-decadal fluctuations, but no clear residual trend (Lionello 2002)"</p> <p>Refs: - Carbognin L., Gatto P., Mozzi G., Gambolati G., Ricceri G., 1976: New trend in the subsidence of Venice. Publ. I.A.H.S. 121, 65-81. - Carminati E., Doglioni C. and Scroccas D. (2005) Long term natural subsidence of Venice: evaluation of its causes and magnitude. In: "Flooding and Environmental Challenges for Venice and its Lagoon: State of Knowledge 2003" Meeting (Cambridge, September 2003), C.\,Fletcher and T.\,Spencer (Eds.), Cambridge University Press, Cambridge, UK , 21-28 - Fenoglio-Marc L. 2002: Long term sea level change in the Mediterranean Sea from multi-satellite altimetry and tide gauges Physics and Chemistry of the Earth, Vol.27 , pp. 1419-1431, - Lionello P. (2005) Extreme surges in the Gulf of Venice: present and future climate. In: "Flooding and Environmental Challenges for Venice and its Lagoon: State of Knowledge 2003" Meeting (Cambridge, September 2003), C.\,Fletcher and T.\,Spencer (Eds.), Cambridge University Press, Cambridge, UK, 59-70 - Tsimplis M.N. and T.F. Baker, Sea level drop in the Mediterranean Sea: An indicator of deep water salinity and temperature changes? Geophys. Res. Let., 27(12), 1731-1734, 2000.</p> <p>(Piero Lionello, Univ. of Lecce)</p>	<p>Added to text.</p> <p>Fixed.</p>
1-730	A	31	36	31	39	<p>Venice. The assumption that more aqua alta are the result of sea level rise is too simplistic. The reasons are complex and relate also to long-term modifications of the inlets to the lagoon, changes in lagoon bathymetry and wetland loss and modification. and see next comment. (Thomas SPENCER, Cambridge University)</p>	Fixed.
1-731	A	31	39	31	42	<p>Global warming impact on coral reefs should be mentioned here (regardless of whether Wong 2003 did)</p>	Covered in Section 1.3.4.1

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						(David Rind, NASA/GISS)	
1-732	A	31	40			“.. and damaging of coral reefs by pollution, ...” COMMENT: Destructive fishing using explosives should be mentioned as a prime cause of reef destruction. (Maria Rosa Paiva, Universidade Nova de Lisboa)	Fixed.
1-733	A	31	46	32	43	Selected locations are discussed here and as elsewhere the rationale for choosing them is not strikingly apparent. In general the selection of specific places appears to partly reflect the authors' familiarity with such work and may not always be a representative choice for the point being made. It might be better to summarise the key processes and then include locations as examples only. (John Sweeney, National University of Ireland, Maynooth)	1.3.3.1 Rewrote to make smoother and more coherent.
1-734	A	31	49			Year after Zhang, same in pag 32 line 1 and line 7, pag 33 line 23 (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-735	A	32	2			Unit "m" should be used instead of "ft". (Xiaoqi Chen, College of Environmental Sciences)	Fixed
1-736	A	32	2	32	2	quote in SI units not ft/yr (Peter Stott, Met Office)	Fixed
1-737	A	32	5			Year after Penland (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-738	A	32	13			Year after Orviku (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-739	A	32	29			Year after Restrepo (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-740	A	32	39			"Most beaches in Alexandria, Egypt..." (Lesley Hughes, Macquarie University)	Fixed
1-741	A	32	43			Year after Frihy (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-742	A	32	43	32	43	There is any evidence of coastal erosion along the Mediterranean coasts (Spain, France, Italy, former Yugoslavia) or this part of the Mediterranean is not affected by it? What is the effect of sediments at the mouth of Po river? (Giampiero Maracchi, Institute of Biometeorology)	No evidence.
1-743	A	32	45			Section 1.3.3.2. See Table 11.2.1.1.in Chapt 11 for information on wetlands in Northern Territory - saltwater intrusion into freshwater swamps. (Lesley Hughes, Macquarie University)	Reference obtained and added.
1-744	A	32	47		49	Year after Boesch,Keamey and Hartig (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-745	A	32	47	32	50	Should the Everglades be included here?	

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						(Nathan Gillett, University of East Anglia)	
1-746	A	33	1		16	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-747	A	33	5	33	7	What is 'coastal squeeze'? What are salt marsh losses in south-east England related to, if not the factors mentioned? (Nathan Gillett, University of East Anglia)	Fixed.
1-748	A	33	19			Waves are mentioned in the section 1.3.3.3, but not in its title. Change the title to "Changes in storm surges, flood heights and areas, and waves " (Piero Lionello, Univ. of Lecce)	Fixed.
1-749	A	33	19	32	23	The whole section 1.3.3.3 is not well focused as it considers simultaneously the effects of changes of storminess (Fig.1.5 what is the reference for this figure???), sea level (Woodworth and Blackman 2004) and subsidence (Venice). The difference between these three factors should be made clear. I recommend an initial sentence as "The vulnerability of the coastal zone to storm surges and waves depends on soil subsidence, sea level rise, and changes in storminess. Often, these three factors act together and the effect of their superposition has strong regional characteristics" (Piero Lionello, Univ. of Lecce)	Fixed.
1-750	A	33	19	32	23	about waves, you might consider adding the following text: "In the Mediterranean Sea, in the period 1958-2001 (Lionello and Sanna, 2005) a study based on model simulations forced by the wind fields of the ERA-40 (ECMWF Re-Analysis) suggest a statistically significant negative trend in the winter significant wave height mean value. Wind wave extremes show significant trends only in small regions: a negative trend in part of the central and western Mediterranean (Ionian Sea and Alboran Sea) and a positive trend near the coast of France (Lionello et al. 2005)" The references are: Lionello P. and A.Sanna (2005) Mediterranean wave climate variability and its links with NAO and Indian Monsoon Clim.Dyn. DOI: 10.1007/s00382-005-0025-4 Lionello P., Bhend J., Buzzi A., Della-Marta P.M., Krichak S., Jansà A., Maheras P., Sanna A., Trigo I.F., Trigo R. (2005). Cyclones in the Mediterranean region: climatology and effects on the environment. In P.Lionello, P.Malanotte-Rizzoli, R.Boscolo (eds) Mediterranean Climate Variability. Amsterdam: Elsevier (NETHERLANDS). in press (Piero Lionello, Univ. of Lecce)	Fixed; added.
1-751	A	33	23	33	25	Some discussion on the findings of P. Lionello must be introduced at this point on	See above.

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						surges in the Adriatic sea (Giampiero Maracchi, Institute of Biometeorology)	
1-752	A	33	23	33	25	Add references and their discussion: Fenoglio-Marc L., Long-term sea level change in the Mediterranean Sea from multi-satellite altimetry and tide gauges. Physics and Chemistry of the Earth, 27, 1419-1431 (2002). Samuel, S., K. Haines, S. Josey and P.G. Myers, Response of the Mediterranean Sea thermohaline circulation to observed changes in the winter wind stress field in the period 1980-1993. J. Geophys. Res., 104, 7771-7784, 1999. Tsimplis M.N. and S.A. Josey, Forcing of the Mediterranean Sea by atmospheric oscillations over the North Atlantic. Geophys. Res. Let., 28(5) 803-806,2001 Vignudelli S., G.P. Gasparini, M. Astraldi and M.E. Schiano, A possible influence of the North Atlantic Oscillation on the circulation of the Western Mediterranean Sea. Geophys. Research Let., 26, 623-626, 1999. Lionello P., E.Elvini, A.Nizzero (2003): Ocean waves and storm surges in the Adriatic Sea: intercomparison between the present and doubled CO2 climate scenarios, Clim. Research., 23, 217-231 (Giampiero Maracchi, Institute of Biometeorology)	This more properly belongs to IPCC AR4 WGI Chapter 5.
1-753	A	33	23	33	27	This interpretation of the Venice problem is different from that on page 33. Even this is not the whole story - channel dredging is only part of the story. See chapters in Fletcher CA and Spencer T (eds) 2005. Environmental Challenges to Venice and its lagoon (CUP) (Thomas SPENCER, Cambridge University)	This has been changed. See above.
1-754	A	33	32	33	35	I don't think there is enough information in Figure 1.5 to draw conclusions. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Figure has been removed.
1-755	A	33	35	33	36	There have been significant changes in Atlantic wave climate also. These are mentioned in a later section, (page 69, line 45) but it might be appropriate to include mention of them here also. (John Sweeney, National University of Ireland, Maynooth)	Added.
1-756	A	34	1			Figure 1,5: I don't understand what does "Significant" means in the title. (Annick Douguedroit, Université de Provence)	Figure deleted.
1-757	A	34	1	34	23	The picture seems to be based on very scarce data, and could be omitted. (Kaija Hakala, MTT Agrifood Research Finland)	Figure deleted.
1-758	A	34	22			Fig. 1.5 is very specific only covering local trends. Is there are more comprehensive figure on trends in coastal erosions on regional or global level? (Markus Erhard, Forschungszentrum Karlsruhe)	Figure deleted.
1-759	A	34	22	34		Fig. 1.5. This is an example of how the lack of recognition of longer scales of variation may have effects on the work. The full period considered in the graph is posterior to the most recognized regime shift, which occurred during 1975	Figure deleted.

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						(Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	
1-760	A	34	22			Figure 1.5: I presume that each marker represents a single storm. Might clarify in caption (Evan Mills, Lawrence Berkeley National Laboratory)	Figure deleted.
1-761	A	34	26	34	26	The title "absence of evidence" is somewhat vague and may lead to misinterpretation. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Comment added.
1-762	A	34	28	34	29	Contradicts pg 33, ln 3-4. (Nathan Gillett, University of East Anglia)	Fixed.
1-763	A	34	28			see comment above re saltwater intrusion (Lesley Hughes, Macquarie University)	Fixed.
1-764	A	34	31			Section 1.3.3.5 this paragraph is meaningless unless more quantitative information is provided (Raymond Desjardins, N/A)	More quantitative information added.
1-765	A	34	31	34	41	It would be more appropriate to focus more on the evidence of adaptation and vulnerabilities rather than the impacts. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Fixed.
1-766	A	34	33	34	41	This paragraph doesn't tell us that much. For example the first sentence reports that Mimura and Nunn have carried out a study without reporting its results. The last sentence tells us nothing about changes. More overall assessment is needed. (Nathan Gillett, University of East Anglia)	Fixed.
1-767	A	34	33	34	35	These two studies looked at adaptation --what are examples of adaptations observed? (Kimberly Hall, Michigan State University)	Fixed.
1-768	A	34	33	34	33	The statement that Mimura and Nunn "have documented trends in adaptation" is unsatisfying without some indication of what those trends were. Please add some indication, however brief. (Claire Parkinson, NASA Goddard Space Flight Center)	Fixed.
1-769	A	34	43			Section 1.3.3.6 this summary deals more with humans than climate change. It does not mention adaptation... (Raymond Desjardins, N/A)	Text rewritten and now includes adaptation.
1-770	A	34				Fig 1.5 - How reliable are these measurements? What is the uncertainty? (Nathan Gillett, University of East Anglia)	Figure deleted.
1-771	A	35	0	45		1.3.4 Marine & freshwater biological systems: This section can be and must be condensed to no more than five or six pages. As stated in the beginning of the section, ENSO, NAO and other large-scale circulation pattern and their changes can and do mask any climate change related impacts on marine and freshwater biological systems. This section should highlight only significant changes that can be delineated from the background of ENSO, NAO et al impacts. Figure 1.7 could be deleted as it	It is very difficult to totally separate climate warming from existing natural oscillations. It is also thought that global warming will materialise through existing climate channels. There is evidence to relate the current trends in the NAO to climate

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						does not convey significant information on climate change impact. Also Table 1.6 could be deleted, since the change identified could be due to decadal or natural long-term change with no linkage to recent global warming. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	warming. I strongly disagree with the comments on fig 1.7 and table 1.6. Along with biogeographical changes these are some of the strongest evidence of climate impacts yet published on marine biological systems as it contains information on over 66 species and over 50 years of time. The trends are highly significant and related to climate warming. Figure replaced.
1-772	A	35	2			Modify the last sentence to read as follows: "As a consequence, these trends COULD to be exacerbated UNLESS APPROPRIATE MEASURES ARE TAKEN." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Section rewritten
1-773	A	35	5	40		For Section 1.3.4 there are many partial references (i.e., only the name, but not the year) that makes it very difficult to review, since many authors have published more than one paper. Further, several quotations are incomplete, including just one of the two or more authors; again, this makes it difficult to follow. (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	Fixed
1-774	A	35	5			Section 1.3.4. This section departs somewhat from the structure used in the preceding sections. Although it would not seem necessary to structure it in exactly the same way as the other sections, I think it would benefit from a short concluding summary, maybe coupled with a slight reduction in the introductory section on Page 35. (Robert Wilson, Universidad Rey Juan Carlos)	O.K.
1-775	A	35	7	35	10	a reference for the second sentence of this paragraph would be helpful (Markus Erhard, Forschungszentrum Karlsruhe)	Added.
1-776	A	35	7	35	8	To avoid controversies over whether the entire marine pelagic system is one ecological system, this sentence could reasonably be abbreviated to: "The marine pelagic realm occupies 70% of the planetary surface." (Claire Parkinson, NASA Goddard Space Flight Center)	O.K. Suggest we alter this sentence
1-777	A	35	12	35	12	Include a modification of paragraph ... for some marine organisms.....and changes in dissolution rates of carbonates of sinking particles and in the sediment. This processes can raise the ocean pH and its capacity to store CO2(Feely, Sabine et al 2004) (Ricardo Anadon, University of Oviedo)	Added references.
1-778	A	35	12			Perhaps the authors could also talk about the Royal Society report on 'ocean acidification due to increasing carbon dioxide' (mentioned page 37 line 12) and also	The Royal Society report has been referenced. The paragraph can be extended

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						the paper by Orr et al. (2005) (Nature: vol 437 page 681-686). I am saying that because the consequences of ocean acidification will not be the same among organisms. Organisms using aragonite may be more affected than organisms that use calcite. This should be mentioned. (Gregory Beaugrand, univ-lille)	if this is thought nessessary. (See also comment above). The Orr paper is an experimental modelling study and not an 'observed' change in the marine environment. My original reemit was to only reference 'observed changes in the marine environment'.
1-779	A	35	14			The human introduction of non-native species should be considered (Stachowicz et al 2002) (Stephen J. Hawkins, The Marine Biological Association of the UK)	The original reemit was to describe observed changes due to climate warming so I did not make reference to 'human-introductions'. Text added: 'Other driving forces of change that are operative in marine and freshwater biological systems are overfishing, human-introductions of non-indigenous species and pollution
1-780	A	35	16		25	I regret being reiterative, but the treatment of scales of natural variation longer than ENSO frequencies is really poor. Beyond the mere mention of the PDO or the NAO, there is no intent whatsoever to put the results of this extremely active field of research in recent years in perspective within the purposes of the IPCC Report. (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	Addressed.
1-781	A	35	17	35	17	Should also cite Orr et al, Nature, 437, 681-686 which shows effects of pH neutralization (or acidification) on aragonitic organisms. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	The Orr paper is an experimental modelling study and not an 'observed' change in the marine environment. My original reemit was to only reference 'observed changes in the marine environment'.
1-782	A	35	21			Sims, D.W., Genner, M.J., Southward, A.J., Hawkins, S.J., 2001. Timing of squid migration reflects North Atlantic climate variability. Proceedings of the Royal Society of London Series B, 268, 2607-2611. (Stephen J. Hawkins, The Marine Biological Association of the UK)	Not observed change.
1-783	A	35	27	35	32	The structure and focus of this paragraph on coral reefs seems inconsistent with the rest of the paragraphs in this section. As written, the para appears to be a general description of coral reef values and threats, but there is no obvious link to climate change provided. It would seem more appropriate to introduce coral reefs in terms of their susceptibility to climate change, as is done for other biological systems in this section. Further, the listing of non-climatic stresses is not accurate or complete. While	Will revise in TOD. Text rewritten for FGD.

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						pollution is a major non-climatic stress to coral reefs worldwide, SCUBA diving and other tourism activities are only of the most minor consequence in all but a relatively small number of localised sites. However, destructive fishing (cyanide fishing and blast fishing) and over-fishing (these could collectively be called "unsustainable fishing practices") are a serious threat to coral reefs on a global scale. (Paul Marshall, Great Barrier Reef Marine Park Authority)	
1-784	A	35	28	35	28	include a new problem in the paragraph:economic, cultural and aesthetic value and act as sink of atmospheric CO2. (Ricardo Anadon, University of Oviedo)	Will revise in TOD. Text rewritten.
1-785	A	35	31	35	32	"Besides pollution, scuba diving by tourists also places stress on coral reefs" should be complemented with "coral bleaching by climate change (Markus Erhard, Forschungszentrum Karlsruhe)	The coral section will be revised in TOD. Text rewritten.
1-786	A	35	31	35	32	How does scuba diving stress reefs? (Nathan Gillett, University of East Anglia)	The coral section will be revised in TOD. Text rewritten.
1-787	A	35	31	35	32	Scuba diving seems trivial in this context. (Kaija Hakala, MTT Agrifood Research Finland)	The coral section will be revised in TOD. Text rewritten. Scuba diving no longer present in FGD.
1-788	A	35	31	35	31	Add "degradation" to: "Besides degradation and pollution, ..." (Gian-Reto Walther, Institute of Geobotany)	The coral section will be revised in TOD. Text rewritten. No longer relevant.
1-789	A	35	34	35	39	References? (Nathan Gillett, University of East Anglia)	Fixed.
1-790	A	35	34		39	Beyond regional climatic effects, there have been natural global climate effects reported on the abundance of fisheries populations. (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	This is correct and the appropriate references have already been cited (e.g. Stenseth et al., Drinkwater et al).
1-791	A	35	37	35	37	Include a more specific comment on timing of plankton growth and larval survival: Some results shows relations between changes in plankton timing and/or composition on larval fish survival and recruitment (Beaugrand et al, 2003; Platt et al, 2003). These observed results can be related with early phytoplankton blooms (Platt et al, 2003) or changes in the recurrence of coastal mesoscale circulation processes (Llope et al, in press). REFERENCES (Beaugrand, G., Brander, K.M., Lindley, J.A., Souissi, S., Reid, P.C., 2003 Plankton effect on cod recruitment in the North Sea. Nature, 426: 661-664. Platt, T., Fuentes-Yaco, C., Frank, K.T. 2003 Spring algal bloom and larval fish survival. Nature, 423: 398-399; Llope, M., Anadón, R., Viesca, L., Quevedo, M., González-Quirós, R., Stenseth, N.C., in press. Hydrographic dynamics in the southern Bay of Biscay: integrating multi-scale physical variability over the last decade (1993-2003). J. Geophys.Res. (Ricardo Anadon, University of Oviedo)	The Beaugrand reference has already been cited. The other references are not relevant or are in press. The Platt study for example is a very limited time-series and is not an 'observed' change to climate warming. It was related to localised hydro-climatic conditions.

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1-792	A	35	37			the authors should add a reference to the Pauly's work (see reference above) or another similar paper. (Gregory Beaugrand, univ-lille)	Need full reference.
1-793	A	35	39			Genner, M.J., Sims, D.W., Wearmouth, V.J., Southall, E.J., Southward, A.J., Henderson, P.A., Hawkins, S.J., 2004. Regional climatic warming drives long-term community changes of British marine fish. Proceedings of the Royal Society of London, Biological Sciences, 271, 655-661. (Stephen J. Hawkins, The Marine Biological Association of the UK)	This reference has already been cited on page 41.
1-794	A	35	43	35	43	"on millenium time scales." should be changed into "on annual to millenium time scales.". There are sufficient publications which record annual changes, in particular, in lake sediments on the last 2000 -3000 years. Therefore, there is enough data to support a more firm statement. (Oscar Abbink, TNO B&O)	Will change in next draft.
1-795	A	35	45			I am surprised that the authors added a reference to an unpublished work (submitted paper). (Gregory Beaugrand, univ-lille)	Need to check on the status of the paper
1-796	A	35	45			Year after Schindler (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-797	A	36	1	36	50	Could be reduced to one third, repetition and trivial information. (Kaija Hakala, MTT Agrifood Research Finland)	Do not agree that this is trivial information.
1-798	A	36	1			As suggested for the overview paragraph on coral reefs (above), this more comprensive section on coral reefs (1.3.4.1) would benefit considerably from substantial restructuring to provide a more explicit focus on climate change. Corals, and therefore coral reefs, are acutely sensitive to elevated temperatures, making them one of the most sensitive and vulnerable of biological systems. Changes to coral reefs have already been observed worldwide due to unusually high sea temperatures. These facts should be the main theme of this section. The impacts of other non-climatic stressors are also critically important influences on the current state and future prospects of coral reefs, but these should be discussed in relation to the implications of climate change. (Paul Marshall, Great Barrier Reef Marine Park Authority)	Addresseed to some degree, but this reviewer has a biased view of the effects of climate change on corals.
1-799	A	36	2			section 1.3.4.2: Wording throughout this section should be altered from vague reference to "changes" to specify the direction and type of change. (Camille Parmesan, University of Texas at Austin)	This section is already at a maximum word-count with a lot of references cited. It is therefore not really possible to expand all the quoted references in a more specific sense.
1-800	A	36	3			Comments on para. How are these percentages and "seriously degraded"	Section edited.

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						determined? The second sentence seems to be agenda-driven. I recommend eliminating this para. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-801	A	36	3	36	4	How are these percentages arrived at? How robust are these figures and what degree of confidence can one have in them? How are 'seriously degraded' and 'imminent risk of collapse' defined? Can these statements be defended? (Thomas SPENCER, Cambridge University)	Will address in next draft
1-802	A	36	4			Year after Wilkinson (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-803	A	36	8		50	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed
1-804	A	36	19			See Box 11.1 in Chapt 11 on the Great Barrier Reef, including details about recent bleaching events (Lesley Hughes, Macquarie University)	OK
1-805	A	36	19	36	37	coral bleaching is described in several chapters (chapters 1, 4, 6 and each regional chapters (e.g. chapter 11, page 15, lines 9-29)), but seems not to be referred to with each other. I agree that bleaching is the most important signature of the global warming, and should be appeared in several chapters. However, within the limit of pages, they can be integrated in some parts, or at least referred to with each other. (Hajime Kayanne, University of Tokyo)	Good suggestion. See TSU for cross chapter case study..
1-806	A	36	19	22	24	The statement that 16% of the world's reefs were killed by coral bleaching in 1998 is consistent with the cited source. However, less than 5% of reefs suffered serious mortality in the Great Barrier Reef in this year, indicating that Australia was not a major contributor to the global statistics on reef mortality. It is more correct to not mention Australia specifically, but rather to state that the most damage occurred in the western Pacific and Indian Ocean regions (in accord with Wilkinson 2004). (Paul Marshall, Great Barrier Reef Marine Park Authority)	Addressed
1-807	A	36	22	36	24	Presumably this was linked to El Nino. If so, say so. (Nathan Gillett, University of East Anglia)	OK
1-808	A	36	26	36	29	the time frame should be explicitly stated here - that a bleached coral dies if it does not re-establish symbiosis with an algae within 2-4 weeks. (Camille Parmesan, University of Texas at Austin)	Will be addressed in next draft. (page 32, line 37)
1-809	A	36	37			This is possibly the right place to add a reference to the work performed by Baker et al (2004) [Nature: 2004. vol 430 page 741]. This study suggests that some coral species could adapt to warmer temperature by selecting more thermophilic zooxanthellae. The authors already mentioned the study but saying nothing about adaptation.	Reference cited in the preceeding paragraph

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						(Gregory Beaugrand, univ-lille)	
1-810	A	36	39			This paragraph mixes two unrelated topics: disease and future community composition due to climate change. These should be separated, or at least linked more sensibly. Further, the relevance of climate change (mainly temperature) to diseases should be the main focus of the first part of this paragraph - currently the role of climate change is not mentioned at all. (Paul Marshall, Great Barrier Reef Marine Park Authority)	Unclear comment
1-811	A	36	42	36	44	I am not aware of any conclusive evidence of a global shift toward "weedy" species on coral reefs. Even if such a trend is demonstrable, I would be surprised if it could be attributed with any level of confidence to changes in storm intensity, when causality is likely to be highly confounded by the effects of other stresses such as bleaching-induced mortality (increased temperatures), pollution and destructive fishing practices. (Paul Marshall, Great Barrier Reef Marine Park Authority)	Comment is unclear. Does the reviewer have a problem with the methods of the various references cited.
1-812	A	36	46	36	50	The balance exhibited in this paragraph -- dismissing the "canary in the coal mine" analogy for coral reefs while expressing the uncertain future for these ecosystems -- should be retained in future drafts. (Lenny Bernstein, IPIECA)	Removed analogy due to conflict in reviews.
1-813	A	36	46	36	47	It does not seem to be necessary or helpful to introduce and then discredit the "canary" metaphor. In any case, this metaphor is often used to illustrate the role of coral reefs as sentinel ecosystems, showing the first signs of impacts of climate change. As such, reefs do not have to "disappear" in order for the metaphor to work - their deterioration is an ample warning of the potential impacts of climate change on biological systems. (Paul Marshall, Great Barrier Reef Marine Park Authority)	Removed analogy due to conflicting reviews.
1-814	A	36	46	36	50	Did those references conclude that the present level of ecosystem goods and services could not be maintained? (David Rind, NASA/GISS)	Section cut
1-815	A	36	47			It should be noted in this paragraph that: (A) some corals may be able to adapt to changes in temperature [References: [1] Gates, R.D. and Edmunds, P.J. 1999. The physiological mechanisms of acclimatization in tropical reef corals. American Zoologist 39: 30-43. [2] Adjeroud, M., Augustin, D., Galzin, R. and Salvat, B. 2002. Natural disturbances and interannual variability of coral reef communities on the outer slope of Tiahura (Moorea, French Polynesia): 1991 to 1997. Marine Ecology Progress Series 237: 121-131. [3] Rowan, R. 2004. Thermal adaptation in reef coral symbionts. Nature 430: 742. [4] Baker, A.C., Starger, C.J., McClanahan, T.R. and Glynn, P.W. 2004. Corals' adaptive response to climate change. Nature 430: 74.].	This has been noted.

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						See also comment 2. (B) Corals are susceptible to warm as well as cold extremes [Refs: [1] Yu, K.-F., Zhao, J.-X., Liu, T.-S., Wei, G.-J., Wang, P.X. and Collerson, K.D. 2004. High-frequency winter cooling and reef coral mortality during the Holocene climatic optimum. <i>Earth and Planetary Science Letters</i> 224: 143-155. [2] Coles, S.L. and Fadlallah, Y.H. 1990. Reef coral survival and mortality at low temperatures in the Arabian Gulf: New species-specific lower temperature limits. <i>Coral Reefs</i> 9: 231-237. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-816	A	36	47			It should also be noted that some studies have also measured a net increase in the growth rate of coral at higher temperatures [see, e.g., (1) Lough, J.B. and Barnes, D.J. 2000. Environmental controls on growth of the massive coral <i>Porites</i> . <i>Journal of Experimental Marine Biology and Ecology</i> 245: 225-243. (2) Bessat, F. and Buigues, D. 2001. Two centuries of variation in coral growth in a massive <i>Porites</i> colony from Moorea (French Polynesia): a response of ocean-atmosphere variability from south central Pacific. <i>Palaeogeography, Palaeoclimatology, Palaeoecology</i> 175: 381-392. (3) Carricart-Ganivet, J.P., 2004. Sea surface temperature and the growth of the West Atlantic reef-building coral <i>Montastraea annularis</i> . <i>Journal of Experimental Marine Biology & Ecology</i> 302: 249-260]. A modeling study undertaken by McNeil et al. (2004) to account for changes in the coral calcification rate due to both the saturation state of CaCO ₃ in seawater and the sea surface temperature suggests that annual average coral reef calcification rates will increase with future ocean warming and eventually exceed pre-industrial rates by about 35% by 2100. Their results suggest that present coral reef calcification rates are equivalent to levels in the late 19th century and does not support previous suggestions of large and potentially catastrophic decreases in the future. [Ref: McNeil, B.I., R.J. Matear & D.J. Barnes, 2004. Coral reef calcification and climate change: the effect of ocean warming. <i>Geophysical Research Letters</i> 31 L22309, doi: 10.1029/2004GL021541.} [See also Riebesell, U. 2004. Effects of CO ₂ enrichment on marine phytoplankton. <i>Journal of Oceanography</i> 60: 719-729.] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Studies are experimental and modeling
1-817	A	37	2			Section 1.3.4.2 this section needs to be reorganized so that all information related to one basin is put and discussed as one piece. For example, on p. 38, the North Atlantic is discussed on top of the page, followed by the Pacific, then the Southern Ocean and then returning to the North Atlantic. This does not make sense. (Raymond Desjardins, N/A)	This does make sense as the final paragraph details the major climate impact evidence which all comes from the North Atlantic. This is because the North Atlantic has the longest and most spatial time-series in place. This can be changed under the editor's

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							discretion.
1-818	A	37	9			No references cited. (Beaugrand et al, Sims et al) (Stephen J. Hawkins, The Marine Biological Association of the UK)	This is an introductory paragraph, all the relevant references are cited on pages 39-41
1-819	A	37	10	37	13	Add statement on impacts. E.g. Calcification of hard-shell organisms is sensitive to ocean ph, and acidity may reach threshold level beyond which calcification cannot occur (there's exact data for many corals). (Camille Parmesan, University of Texas at Austin)	Good suggestion. Add in TOD.
1-820	A	37	12			In brackets read (Royal Society, Policy document 12/05, June 2005) (Osvaldo Canziani, IPCC)	Changed
1-821	A	37	12	37	13	What is the reference "Society 2005"? (Robert Wilson, Universidad Rey Juan Carlos)	Changed
1-822	A	37	13			'Society' should be replaced by 'The Royal Society'. A similar sentence about that has already been said page 35 line 11. (Gregory Beaugrand, univ-lille)	Changed
1-823	A	37	13		14	If the described event occurred after the mid-1970s, it is possible that, at least in part, it could be related to regime warming. If not stated somehow, and if there is a new regime shift as proposed during recent years, then we should expect cooling (or at the least absence of warming) along several years in the future. If so, it may be later assumed that such climate behavior could be the result of preventive actions; they might, however, be not. (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	Address in TOD. The focus of Chapter One is on observed changes; it does not make predictive statements, even for the near term.
1-824	A	37	14			Year after Gregg (Jorge Carrasco, Dirección Meteorológica de Chile)	Changed
1-825	A	37	15	37	15	Include a comment about detection of changes in oligotrophic areas and a new reference:(Fig 1.6.). Expansion of the oligotrophic areas of subtropical gyres of the North Atlantic and Pacific were detected with satellite imagery, but not in other subtropical oceans (McClain et al, 2004). REFERENCE: McClain, C.R., Signorini, S.R., Christian, J.R. 2004. Subtropical gyre variability observed by ocean-color satellites. Deep-Sea Res. II, 51: 281-301 (Ricardo Anadon, University of Oviedo)	Not sure whether this is relevant, the time-series is too short for conclusive evidence, this goes for many studies via satellite imagery. These changes could be the result of natural regional hydro-climatic variability and not evidence of sustained climate warming.
1-826	A	37	17			I like this set of figures very much, but think it would be helpful to re-do the color scheme so that there are fewer total categories, but you can actually tell them apart (and I have what looks like orange both above and below the red). The reds are so compressed that you can't distinguish them anyway, so use some of the variation in the yellow-green-blue zone. (Kimberly Hall, Michigan State University)	Figures re-organized
1-827	A	38	3	38	5	Words are missing here. Is it meant to say "CHANGES IN phytoplankton &	Agree. Add 'changes in'.

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						zooplankton..."?? (Camille Parmesan, University of Texas at Austin)	
1-828	A	38	5	38	6	revise from "...occurrence of sub-tropical species in temperate waters" to "poleward shifts of tropical, temperate and arctic biomes" (Camille Parmesan, University of Texas at Austin)	It must be noted that there is not a poleward shift in all regional areas that's why I have used the current wording. For example, polar species are actually moving south around the Newfoundland shelf area. This is related to the freshening and cooling of the Labrador Current. In summary, climate warming is not spatially homogenous particularly in the North Atlantic where we see opposite trends in the NE Atlantic and NW Atlantic.
1-829	A	38	7	38	7	What changes in N Sea ecosystems? Specify (Camille Parmesan, University of Texas at Austin)	Changed to 'North Sea ecosystem functioning and productivity'
1-830	A	38	7	38	7	Change "community shifts" to "shifts from cold-adapted to warm-adapted communities" (specify change) (Camille Parmesan, University of Texas at Austin)	Agree. Added these changes.
1-831	A	38	8		38	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Changed
1-832	A	38	8	38	11	number of references can be reduced significantly, especially the older ones (this comment also affects the rest of chapter 1.3.4) (Markus Erhard, Forschungszentrum Karlsruhe)	Unclear comment
1-833	A	38	13			Sims, D.W., Genner, M.J., Southward, A.J., Hawkins, S.J., 2001. Timing of squid migration reflects North Atlantic climate variability. Proceedings of the Royal Society of London Series B, 268, 2607-2611. Sims, D.W., Wearmouth, V.J., Genner, M.J., Southward, A.J., Hawkins, S.J., 2004. Low-temperature-driven early spawning migration of a temperate marine fish. Journal of Animal Ecology 73, 333-341. ATTRILL, M.J.; POWER, M. 2002. Climatic influence on a marine fish assemblage. Nature, 417(6886), 275-278, 2002 (Stephen J. Hawkins, The Marine Biological Association of the UK)	The Attrill paper has already been quoted on page 41. Not observed changes.
1-834	A	38	13	38	13	Reference to "mismatch" made no sense to me. I also couldn't easily get it from the figure referred to here. This needs to be rephrased so it is much more easily understood within the text. Also, the figure legend here does not mention "mismatch", nor do any labelled graph axes. What is mismatched?	I disagree with these comments. Mismatch is a well known and common ecological term defining the mismatch in timing between different trophic levels, e.g.

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						(Jeremy Kerr, University of Ottawa)	primary production, secondary production.
1-835	A	38	17			Shifts in the rocky shore species in N.Atlantic (Southward et al 1995, Herbert et al 2003): Southward, A. J. (1995). The importance of long time-series in understanding the variability of natural systems. Helgolander Meeresuntersuchungen 49, 329-333; Herbert, R. J. H., Hawkins, S.J., Sheader, M., Southward, A.J. 2003. Range extension and reproduction of the barnacle <i>Balanus perforatus</i> in the eastern English Channel. Journal of the Marine Biological Association of the United Kingdom, 83, 73-82; (Stephen J. Hawkins, The Marine Biological Association of the UK)	These are small-scale local studies, I feel I have already quoted the relevant literature.
1-836	A	38	18		29	Short term changes in the abundance and distribution of marine populations have been mostly related to ENSO events, but longer term variations have been found to be related to the decadal, interdecadal and multidecadal variation. (Daniel Lluch-Belda, Centro Interdisciplinario de Ciencias Marinas del IPN)	O.K. I do not disagree with this.
1-837	A	38	18	38	29	Specify changes. What changes have been found by Pacific researchers? What are zooplankton communities doing? What "biological changes" are associated with El Nino? (Camille Parmesan, University of Texas at Austin)	This section is already at a maximum word-count with a lot of references cited. It is therefore not really possible to expand all the quoted references in a more specific sense. There are many 'biological changes' related to El nino' the reader with have to read the review papers cited for more detailed information.
1-838	A	38	19			"in response of higher/warmer temperatures" instead of "in response of warmer temperature change" (Markus Erhard, Forschungszentrum Karlsruhe)	O.K. This should be changed.
1-839	A	38	19			Once again, a "shift" is referred to but not its direction. Needs clarification. (Lesley Hughes, Macquarie University)	This refers to significant community shifts.
1-840	A	38	26			Pacific Decadal Oscillation has already defined as PDO (Jorge Carrasco, Dirección Meteorológica de Chile)	Not in this section of the chapter
1-841	A	38	28	38	29	Is it the SSTs or changes in upwelling and thermocline depth that the biology responds most to? (Nathan Gillett, University of East Anglia)	They respond to both, but upwelling changes tend to be more short-term events, whereas sustained regional warming has a longer-term impact.
1-842	A	38	31	38	31	It is important to indicate the time frame of the "progressive warming in the Southern Ocean", plus to indicate whether this progressive warming is for the whole Southern Ocean or perhaps just for the region of the Bellingshausen and Amundsen seas. This is especially important in view of the published papers on cooling over the Antarctic continent in recent decades.	There is indeed evidence that the Antarctic continent has been cooling in some areas, however, the Southern Ocean has been warming.

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						(Claire Parkinson, NASA Goddard Space Flight Center)	
1-843	A	38	34			The phrasing here suggests a decline in marine diseases, but I suspect this is not what was meant. (Kimberly Hall, Michigan State University)	Agree. We should change this to ‘and an increase in thr incidences of marine diseases’
1-844	A	38	36	38	46	This paragraph more logically should follow the North Atlantic paragraph at the top of the page, rather than being placed after excursions to the Pacific and Southern Ocean (David Rind, NASA/GISS)	This does make sense as the final paragraph details the major climate impact evidence which all comes from the North Atlantic. This is because the North Atlantic has the longest and most spatial time-series in place.
1-845	A	39	1			Figure 1,7 with a title "Changes in...". Two remarks. In a and b Cylindrotheca presents no change at all; it is stable. In b the case of Ceratius fusus shows a trend (significant?) which, in fact, seems to be possibly divided into two periods, one till the 70's, stable, and a second after, decreasing, which corresponds with the period of the "climate change". A test could check the hypothesis. (Annick Douguedroit, Université de Provence)	This is already known. See original paper.
1-846	A	39	45			Year after Edward and Richardson (Jorge Carrasco, Dirección Meteorológica de Chile)	Changed
1-847	A	39	48	39	48	Managed fisheries? I think that managed means something like fish ponds or structures (also in the sea), where fish is grown with fodder, but his chapter seems to talk only about fishing in the sea. (Kaija Hakala, MTT Agrifood Research Finland)	Changed to fisheries.
1-848	A	39	50	40	4	Section 1,3,4,3, instead of 1,3,3,3, (Annick Douguedroit, Université de Provence)	Changed.
1-849	A	39				Fig.1.7. Panels a and b should be removed. This appears in the original paper as an example to justify or validate the technique but should not be put in the present report. Panel C is a good summary of the paper and should be kept. (Gregory Beaugrand, univ-lille)	Figure removed.
1-850	A	40	2			Also before. El Niño Southern Oscillation, as others oscillation, has already been defined with its acronymous; so it is no necessary to do it again (Jorge Carrasco, Dirección Meteorológica de Chile)	O.K.
1-851	A	40	3		29	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Changed
1-852	A	40	6	40	32	All examples of changes in biota in the oceans are from the northern oceans. While this is not my area I would be surprised if there was absolutely nothing at all known from south of the equator. The southern Atlantic Ocean is listed in the 3rd column of Table 1.5 but it is not clear which references are relevant to it. (Lesley Hughes, Macquarie University)	This is because the North Atlantic has the longest and most spatially extensive time-series in place and systematic monitoring. Table fixed.

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1-853	A	40	8	40	8	Include a new reference that summarise the changes in distribution distribution change of fish species and other groups in the Iberian Atlantic and Mediterranean. Anadón, R., Duarte, C.M., Fariña, A.C. 2005. Impactos sobre los ecosistemas marinos y el sector Pesquero. In: Evaluación preliminar de los Impactos en España por efecto del Cambio Climático [Moreno, J.M. (ed.), Ministerio de Medio Ambiente, Madrid, Spain, pp.147-182 (Ricardo Anadon, University of Oviedo)	Check for TOD. References checked by the Contributing Author.
1-854	A	40	16	40	16	Be more specific about where the cooling and freshening in the northwest Atlantic have occurred. This is especially important in view of the decreased sea ice cover in the vicinity. (Claire Parkinson, NASA Goddard Space Flight Center)	We will add the areas – sub-polar gyre, Labrador Sea, Labrador current, etc. in TOD. Regions added in FGD.
1-855	A	40	16			For the North Sea see also: Nehring, S. (1998): Establishment of thermophilic phytoplankton species in the North Sea - biological indicators of climatic changes? – ICES Journal of Marine Science 55: 818-823 (Gian-Reto Walther, Institute of Geobotany)	I feel I have already quoted the relevant literature. I am familiar with this study, but find other studies are more conclusive as they cover a more wider spatial area. The reference can be added under the editor's discretion.
1-856	A	40	24	40	24	what does 'eventual recruitment success' have to do with a poor food environment? (David Rind, NASA/GISS)	To avoid any confusion we added '...poor food environment for cod larvae and hence eventual decline in overall recruitment'.
1-857	A	40	24	40	25	Phrase "and hence eventual recruitment success". Should this be "reduced eventual recruitment success"? (Robert Wilson, Universidad Rey Juan Carlos)	See comment above.
1-858	A	40	25	40	26	Do we actually have good evidence that this species change is "caused" by warming (as opposed to being correlated with it as a result of changes in nutrient input)? (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	The changes observed in this study were significantly correlated with changes in temperature. See original paper.
1-859	A	40	25			The word success should be changed to failure. (Kimberly Hall, Michigan State University)	See comments above.
1-860	A	40	25			dual (Lesley Hughes, Macquarie University)	Change
1-861	A	40	31			"...speed with which..." (Lesley Hughes, Macquarie University)	Change
1-862	A	40	35			Include in table 1.5. as references related with detected changes in marine organisms and ecosystems that can be associated with the Climate Change; Key changes: pelagic productivity - North Atlantic Llope et al, 2004 (ref. in n° 5); Llope et al, 2004 [Refernce: Llope, M., Viesca, L., Rodriguez, N., Anadón, R. 2004. Is the	I feel I have already quoted the relevant references. However, I agree that this well known

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						pelagic ecosystem in coastal waters being affected by the Climate Change?. In: Portugal-Spain Seminar IGBP 2004, Evora, Portugal] and McClain et al 2004 (ref in 6) ----- Rocky intertidal/macroalgae - North Atlantic , Arrontes, 2002 [Reference. Arrontes, J. 2002 Mechanisms of range expansion in the intertidal brown alga <i>Fucus serratus</i> in northern Spain. <i>Mar.Biol.</i> 141: 1059-1067] Discuss the observed changes as result in upwelling change -----Marine pathogens and invasive species - North Atlantic, Include Anadón et al, 2005 (ref. in 7) that summarise the observed changes in Spain ----- Fish Biogeography NE Atlantic Brito et al 2001 [Brito, A., Falcón, J.M., Aguilar, A., Pascual, P. 2001 Fauna vertebrada marina. In: <i>Naturaleza de las islas Canarias. Ecología y Conservación</i> , Esquivel, J.M. (ed.). Pub. Turquesa, Sta. Cruz de Tenerife. pp 219-229] Brito et al 1996 [Brito, A., Lozano, I.J., Falcón, J.M., Rodríguez, F.M., Mena, J. 1996 Análisis biogeográfico de la ictiofauna de las Islas Canarias. In: <i>Oceanografía y Recursos Marinos en el Atlántico Centro Oriental</i> . Llinás, O., González, J.A., Rueda, J.M. (ed.). Las Palmas. pp 241-270] Quero et al 1998 [Quero, J.C., Du Buit, M.H., Vayne, J.J., 1998 Les observations de poissons tropicaux et le réchauffement des eaux dans l' Atlantique européen. <i>Oceanol. Acta</i> , 21: 345-351] Stebbing et al 2002 [Stebbing, A.R.D., Turk, S.M.T., Wheeler, A., Clarke, K.R. 2002 Immigration of southern fish species of the South-west England linked to warming in the North Atlantic (1960-2001). <i>J.Mar.Biol.Ass.UK</i> , 82: 177-180] (Ricardo Anadon, University of Oviedo)	reference should be added: Quero et al 1998 [Quero, J.C., Du Buit, M.H., Vayne, J.J., 1998 Les observations de poissons tropicaux et le réchauffement des eaux dans l' Atlantique européen. <i>Oceanol. Acta</i> , 21: 345-351
1-863	A	40	35			Table 1.5 It would be nice to have headings in the same order as in the previous tables. This would add consistency to the chapter. (Raymond Desjardins, N/A)	We feel key changes are a more effective first column in some instances.
1-864	A	40	35			Table 1,5: The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	For a measure of statistical confidence for the numerous studies cited the reader will have to read the appropriate references.
1-865	A	40	35			Table 1.5: see Chapt 11 (especially Table 11.2.1.1), Hughes (2003) <i>Austral Ecology</i> Climate change in Australia: trends, projections and impacts 28: 423-443 and Chambers LE et al (2005) <i>Climate change and its impact of Australia's avifauna</i> . <i>Emu</i> 105, 1-20 for some examples of shifts in ocean biota in the Australasian region (Lesley Hughes, Macquarie University)	Will address in next draft.
1-866	A	40	35			All the years of citations are missing in the table 1.5 (Giampiero Maracchi, Institute of Biometeorology)	Fixed
1-867	A	40	35	41	1	Table 1.5: In the first entry of this table, subdivide the references according to the locations in the third column. Similarly do that for each of the other entries with more than one location given.	The table corrected.

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						(Claire Parkinson, NASA Goddard Space Flight Center)	
1-868	A	41	0			<p>Table 1.5. References for Rocky shore/intertidal communities: Southward, A.J., Langmead, O., Hardman-Mountford, N.J., Aiken, J., Boalch, G.T., Dando, P.R., Genner, M.J., Joint, I., Kendall, M., Halliday, N.C., Harris, R.P., Leaper, R., Mieszkowska, N., Pingree, R.D., Richardson, A.J., Sims, D.W., Smith, T., Walne, A.W., Hawkins, S.J. 2005. Long-term oceanographic and ecological research in the western English Channel. <i>Advances in Marine Biology</i>, 47: 1-10; Herbert, R. J. H., Hawkins, S.J., Shearer, M., Southward, A.J. 2003. Range extension and reproduction of the barnacle <i>Balanus perforatus</i> in the eastern English Channel. <i>Journal of the Marine Biological Association of the United Kingdom</i>, 83, 73-82; Southward, A. J. and Crisp, D. J. (1956). Fluctuations in the distribution and abundance of intertidal barnacles. <i>Journal of the Marine Biological Association of the United Kingdom</i> 35, 211-229. Southward, A. J. and Crisp, D. J. (1954). Recent changes in the distribution of the intertidal barnacles <i>Chthamalus stellatus</i> Poli and <i>Balanus balanoides</i> L. in the British Isles. <i>Journal of Animal Ecology</i> 23, 163-177. Southward, A. J. (1963). The distribution of some plankton animals in the English Channel and Approaches. III. Theories about long-term biological changes, including fish. <i>Journal of the Marine Biological Association of the United Kingdom</i> 43, 1-29. Southward, A. J. (1991). 40 Years of changes in species composition and population density of barnacles on a rocky shore near Plymouth. <i>Journal of the Marine Biological Association of the United Kingdom</i> 71, 495-513. Southward, A. J. (1995). The importance of long time-series in understanding the variability of natural systems. <i>Helgolander Meeresuntersuchungen</i> 49, 329-333. Hawkins, S.J., Southward, A.J., Genner, M.J., 2003. Detection of environmental change in a marine ecosystem – evidence from the western English Channel. <i>Science of the Total Environment</i>, 310, 245-246; References for Fish Populations and recruitment success: Hawkins, S.J., Southward, A.J., Genner, M.J., 2003. Detection of environmental change in a marine ecosystem – evidence from the western English Channel. <i>Science of the Total Environment</i>, 310, 245-246</p> <p>(Stephen J. Hawkins, The Marine Biological Association of the UK)</p>	<p>Add in TOD:</p> <p>Southward, A.J., Langmead, O., Hardman-Mountford, N.J., Aiken, J., Boalch, G.T., Dando, P.R., Genner, M.J., Joint, I., Kendall, M., Halliday, N.C., Harris, R.P., Leaper, R., Mieszkowska, N., Pingree, R.D., Richardson, A.J., Sims, D.W., Smith, T., Walne, A.W., Hawkins, S.J. 2005. Long-term oceanographic and ecological research in the western English Channel. <i>Advances in Marine Biology</i>, 47: 1-10.</p> <p>This is a good summary of the work done in the English Channel and summarises the other studies.</p>
1-869	A	41	0			<p>Table 1.5 -> Marine pathogens and invasive species: Add: Nehring, S. (2003): Alien species in the North Sea: invasion success and climate warming. <i>Ocean Challenge</i> 13 (3): 12-16. (Gian-Reto Walther, Institute of Geobotany)</p>	<p>Considered for TOD. Key references already noted.</p>

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1-870	A	41	4			Section 1.3.4.4 the introduction needs to be rewritten to avoid repetitions. Be more specific about « 10 days/150 years ». (Raymond Desjardins, N/A)	I rewrote this, and was more specific.
1-871	A	41	6	43	3	information in section 1.3.4.4 overlaps with section 1.3.2. physical and chemical constrains of freshwater ecosystems should be described in 1.3.2. This part of 1.3.4 should therefore be transferred and merged (not simply removed!) with 1.3.2 and sections should be cited instead. Most information on these pages is extremely useful for supporting the issues described in section 1.3.2. (Markus Erhard, Forschungszentrum Karlsruhe)	Physical and chemical sections moved to 1.3.2
1-872	A	41	6	41	16	Please add Hodgkins et al, (2005) for another example of advance in timing of river ice-out. And please add Huntington et al., (2002) for example of warming stream water temperature and decrease in river ice thickness. Hodgkins, G A, R. W. Dudley, and T. G. Huntington. 2005, Changes in the number and timing of ice-affected flow days on New England rivers, 1930-2000. Climatic Change. 71:319-340. Huntington, T. G., G. A. Hodgkins, R. W. Dudley, 2003, Historical trend in river ice thickness and coherence in hydroclimatological trends in Maine. Climatic Change, 61:217-236. (Thomas Huntington, U.S. Geological Survey)	Incorporated these references.
1-873	A	41	6	41	9	Combine these two sentences, so as not to repeat "lakes and rivers around the world are warming". (Claire Parkinson, NASA Goddard Space Flight Center)	I deleted the second sentence.
1-874	A	41	10	41	11	reference to 10 days/150years or 9 days/150 years is obscure and hard to understand. What is the meaning? (Jeremy Kerr, University of Ottawa)	Changed the wording of this sentence to make it clearer.
1-875	A	41	13	41	13	Water temperatures are 'also' warming due to climatic changes - for what other reason are they warming? (David Rind, NASA/GISS)	I deleted this sentence.
1-876	A	42	1		50	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-877	A	42	9			Section 1.3.4.5 in « Community composition », if widespread were observed since the mid 1800's, is this related to climate change? (Raymond Desjardins, N/A)	Added 'due to climate shifts' to clarify that these changes were climate-related.
1-878	A	42	26	43	3	Oxygen saturation also decreases with increasing temperature. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	Yes, this is true. This is why the decrease in oxygen levels is due to temperature, rather than increased oxygen demand. The lower

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							levels will
1-879	A	42	27	42	28	At least in Finland the problem is too much nutrients in surface waters, leading to late summer blue-green algal blooms, often harmful to people. See Box 1.4 p. 67. (Kaija Hakala, MTT Agrifood Research Finland)	This comment is reflected in the section on productivity/abundance, which indicates that some freshwaters are experiencing increased biomass and/or productivity.
1-880	A	42	34			Is this temperature range correct? (0-25 C). If so, how is weathering influenced by more moderate change? (Kimberly Hall, Michigan State University)	To clarify how what appears to be a large change in temperature is relevant, I have added the words “(such as could occur on ground no longer covered by snow)”
1-881	A	43	1	83	31	Year after some last name(references) are missing (Jorge Carrasco, Dirección Meteorológica de Chile)	Fixed.
1-882	A	43	23			Another submitted paper? By O'Reilly. (Gregory Beaugrand, univ-lille)	Expect this will be in press by the time this is completed.
1-883	A	44	5			Under this section on changes in rivers I believe that you could add (as you did for changes in lakes in the preceding section) that there are changes in phenology such that anadromous fish are now migrating earlier apparently in response to warmer temperatures (Juanes et al., 2004; Huntington et al., 2003). Juanes, F., S. Gephard, and K.F. Beland. 2004. Long-term changes in migration timing of adult Atlantic salmon (<i>Salmo salar</i>) at the southern edge of the species distribution. Canadian Journal of Fisheries and Aquatic Sciences 61:2392-2400. Huntington, T. G., G. A. Hodgkins, R. W. Dudley, 2003, Historical trend in river ice thickness and coherence in hydroclimatological trends in Maine. Climatic Change, 61:217-236. (Thomas Huntington, U.S. Geological Survey)	Juanes et al 2004 is already cited. I added Huntington et al 2003.
1-884	A	44	7	44	11	Nothing is said about how river flow has changed. Generally this paragraph seems unnecessary. (Nathan Gillett, University of East Anglia)	I added this sentence ‘Information on the effect of climate change on hydrology can be found in Section 1.3.2.’ so that anyone wondering about why I didn’t address flow issues (which is a sensible question to ask) knows that flow issues haven’t been ignored in this report and knows where to go to find out about hydrological changes due to climate.
1-885	A	44	13	44	27	Hickling et al., 2005 (already cited) have reported a polewards shift in the distributions of dragonflies and damselflies (Odonata) in Britain. These insects are associated with freshwater for all stages of the life cycle, except as foraging adults.	Incorporated this information.

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						(Chris Thomas, University of York)	
1-886	A	44	14	44	14	"Environmental changes" is in the topic sentence here but every sentence in this paragraph refers to the much less vague notion of "warming". Recommend altering "environmental change" to something more specific and meaningful to what follows in the paragraph. (Jeremy Kerr, University of Ottawa)	Changed to 'Climate-related changes'
1-887	A	44	19			Table 1,6: same remarks as in 19 (Annick Douguedroit, Université de Provence)	See response to previous comments.
1-888	A	44	19			Section 1,3,4,6,: the only place from 1,3,3 to 1,3,6 where "significant changes " are mentioned; (Annick Douguedroit, Université de Provence)	The entire section is comprised of statistically significant changes. I removed the term 'significant' here so that it doesn't stand out so much. Otherwise, I would have to put it into essentially every other sentence.
1-889	A	44	28	44	29	Would have been useful to include, as in the previous sections, a section for on adaptation and vulnerability for marine and freshwater biological systems as well as a summary. Not having such material leaves the wrong message and leaves one wanting/wondering why. (Roger Brian Streeet, Meteorological Service of Canada, Environment Canada)	Added a brief summary section.
1-890	A	44	30			Table 1.6: why are not references cited as in other tables? (Isabelle Chuine, CNRS)	Added references
1-891	A	44	30	45	1	Table.1.6 information concerning glacier and water temperatures and chemistry should be transferred and/or merged with tables in the other sections (cryosphere 1.3.1, freshwater 1.3.2 ...) (Markus Erhard, Forschungszentrum Karlsruhe)	Moved to 1.3.2
1-892	A	44	30			Section 1.3.5 See previous comment for relevant references for responses of species and ecosystems in Australasia. This whole section is completely Northern Hemisphere-focused. (Lesley Hughes, Macquarie University)	Address in TOD. More Southern Hemisphere references added.
1-893	A	44	30	45	1	Table 1.6: This table should include a "References" column as in Table 1.5, pp. 40-41. (Claire Parkinson, NASA Goddard Space Flight Center)	Added references
1-894	A	44		45		Table 1.6 No references are given. Where does this information come from? (Nathan Gillett, University of East Anglia)	Added references
1-895	A	45	0	56		1.3.5 Terrestrial biological systems: This section should be condensed as well. Many changes in phenology could be due to interannual variability and not necessarily due to impact of recent global warming. Regional global warming (or global cooling) can	AM: Section is shortened now by 3 pages. Documentation of changes in ecosystems is

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						and does influence timing of seasonal activities of animals and plants. There is no dispute about climate change at present; what is being disputed is whether the climate change on a global scale is more due to natural process or due to human activity. Documenting changes in seasonal activity of animals and plants does not resolve this dispute. This section should be condensed to provide only the highlights. Further, the summary (1.3.5.9) must include a definitive statement about positive(beneficial) impact of climate change like upward migration of plants and longer growing season. The change in phenology appears to be more beneficial than harmful at this point in time. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	not intended to solve a climatologically based dispute. Summary is enlarged by further effects.
1-896	A	45	3			Section 1.3.5 Vegetation growth is also much affected by the nature of the soil. (Raymond Desjardins, N/A)	AM: We agree, soil is included in second line of paragraph 1.3.5 now.
1-897	A	45	3	56	9	Section 1.3.5. Overall I thought this section included a good, comprehensive set of recent studies of climate-related responses in terrestrial biological systems - I have suggested additional references where appropriate. I feel however that it might be possible to shorten it somewhat and make it more powerful by emphasising more the common conclusions or common processes among examples or taxonomic systems, slotting the examples into this framework. For example, in section 1.3.5.1 (morphology) the toad and birds eggs examples (Page 46, lines 15-18) might better be placed in Section 1.3.5.3 (reproduction). (Robert Wilson, Universidad Rey Juan Carlos)	AM: Section is shrotened now by 3 pages.
1-898	A	45	5	45	7	This may be a minor point but plant populations rather than plants migrate and adapt. Individual plants can only survive (physiological or morphological adjustments) or die in the face of unexpected environmental change. (Paul J. Hanson, Oak Ridge National Laboratory)	AM: We agree and changed text accordingly.
1-899	A	45	6	45	7	species can respond by adaptation, migration or both. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	AM: IPCC agreed to reserve the term 'adaptation' for human activities.
1-900	A	45	6	45	6	"notably". Recommend change to "If these conditions change beyond species' tolerances, than those species will need to respond either by migration, adaption, or both". (Jeremy Kerr, University of Ottawa)	AM: IPCC agreed to reserve the term 'adaptation' for human activities.
1-901	A	45	7	45	7	"respond by adaptation AND migration" (Isabelle Chuine, CNRS)	AM: IPCC agreed to reserve the term 'adaptation' for human activities.
1-902	A	45	7	45	8	Again, I believe that the statement "...will become extinct" is not accurate sensationalist; ecosystems will be driven by the responses of dominant species, largely through action at the genotype (stage 1) and specie selection stages. Species may under extreme scenarios become "ecologically extinct" within a part of their	TR/ AM: Encorporated idea and included (local) populations

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						former range, however. (Kevin Percy, Canadian Forest Service)	
1-903	A	45	7	45	8	not just "local" populations – makes it sound trivial when it can affect a large part, or even the entirety of a species' range, Delete the word "local". (Chris Thomas, University of York)	TR/AM: Agree, we fixed it by putting 'local' in brackets
1-904	A	45	9			"...ecosystems have responded..." (Lesley Hughes, Macquarie University)	TR/AM: Agree, is fixed.
1-905	A	45	10	45	10	Not clear whether changing climate refers to natural internal variability, naturally forced climate variability or anthropogenically forced climate change (Peter Stott, Met Office)	TR: The cause is not important here.
1-906	A	45	11	45	15	This part of the para is really awkward and weird. Should be rewritten to be more direct and less stilted. (Jeremy Kerr, University of Ottawa)	TR/ AM: Reworded
1-907	A	45	11	45	11	Cross reference here - to the separate discussion of vector (or health relevant) species distribution in later section. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Address in TOD. Section rewritten.
1-908	A	45	13			A number of references to papers in section 1.3.5 have no year listed (e.g. Hughes – page 45 line 13). (Lynda Chambers, Bureau of Meteorology Research Centre)	Fixed.
1-909	A	45	13	45	15	problem of citation and reference (Isabelle Chuine, CNRS)	Fixed.
1-910	A	45	13			Poor reference formats including missing dates... (Paul J. Hanson, Oak Ridge National Laboratory)	Fixed.
1-911	A	45	14	45		Table 1.7 column entitled lengthening," d/a", I don't know what it means. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	AM: Table headers are improved.
1-912	A	45	14			In this instance and in others I am confused by the citations of "Munk" and "Nöthiger" associated with references to the articles by Walther, Parmesan and Root. (Robert Wilson, Universidad Rey Juan Carlos)	Fixed.
1-913	A	45	17	45	26	references are missing in this paragraph (Isabelle Chuine, CNRS)	AM: Paragraph is deleted.
1-914	A	45	17	46	7	This review of the factors that dictate differences in ecosystem and vegetation responses to climate change underplays considerably the controlling influence of habitat productivity (and particularly mineral nutrient availability) as determinants of both resistance and resilience to extreme events and slow forcing. See Leps et al, Vegetatio 511,53-63 (1982), MacGillivray et al, Functional Ecology 9, 640-649 (1995), Grime et al, Science 289,762-765, (2000). (John Grime, Buxton Climate Change Impacts Laboratory)	TR: No room.

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1-915	A	45	17			remove "the" before vegetation (Lesley Hughes, Macquarie University)	AM: Paragraph is removed
1-916	A	45	17	45	20	Topic sentence lists limits to plant growth but excludes, glaringly, nutrients. Second sentence then says that nutrients are one of two key limiting factors to plant growth. Nutrients should be mentioned in the first sentence. (Jeremy Kerr, University of Ottawa)	TR: Removed paragraph due to space limitations
1-917	A	45	18	45	20	the positive effects should be followed with an insert to clearly indicate that potential enhancement may be reduced or offset due to natural (insects, disease) and non-natural (ie ozone expected to attain damaging levels on up to 50% of world's forest) disturbance. The response measured will be the product of positive and negative influences water and elemental cycles (mainly N and C) (Kevin Percy, Canadian Forest Service)	Removed paragraph due to space limitations
1-918	A	45	19			Not all studies show increasing growth with increasing temperatures. This section needs to be expanded to provide a complete picture of the range or responses to be expected from warming. (Paul J. Hanson, Oak Ridge National Laboratory)	Removed paragraph due to space limitations
1-919	A	45	23			Section 1,3,5 hurricanes or tropical storms which is supposed to include hurricanes, typhoons etc..? (Annick Douguedroit, Université de Provence)	Removed paragraph due to space limitations
1-920	A	45	25	45	25	Since a trend in the NAO has been observed over recent decades the distinction between climate trends and the NAO is not clear here (Peter Stott, Met Office)	Removed paragraph due to space limitations
1-921	A	45	28	45	29	phrasing problem, I do not understand the meaning if this sentence (Isabelle Chuine, CNRS)	Agree, sentence is modified.
1-922	A	45	28	45	31	There is evidence that the date of the 1st frost in the autumn/winter period has retreated to later in the year – with the effect of lengthening the growing season (Easterling, 2002) – this would seem to be a climatic driver on the autumn phenology – in contrast to the text of this package. Menzel and Fabian (1999) report an average of 5 days delay in onset of leaf coloring in the initiation of autumn senescence over a 30 year period. Easterling, D.R. 2002. Recent changes in frost days and the frost-free season in the United States. Bull. Amer. Met. Soc. 83:1327-1332. Menzel, A., and P. Fabian. 1999. Growing season extended in Europe. Nature 397:659. (Thomas Huntington, U.S. Geological Survey)	AM: In temperate zones (e.g. mid Europe) autumn leaf colouring occurs before first frost. Anyhow, sentence removed.
1-923	A	45	30	45	31	Reference to autumn phenology is too vague and general. Where and in what taxa	AM: Sentence removed.

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						has autumn phenology been attributed to pollutants? (Kimberly Hall, Michigan State University)	
1-924	A	45	31	45	33	this sentence seems out of purpose for me here ("plants and animals...") (Isabelle Chuine, CNRS)	AM: The paragraph summarises (possible) non-climatic drivers.
1-925	A	45	31	45	32	replace "triggered" with "altered"; replace "higher" by increased levels of (Kevin Percy, Canadian Forest Service)	AM: Frist part removed, second suggestions incorporated
1-926	A	45	33			Add "In plants" before "Species composition".... (Kimberly Hall, Michigan State University)	TR: Disagree
1-927	A	45	33	46	1	Whereas all the previous and following sentences in this section are joined by references, this sentence stands on ist own. If you want to add here also a reference, you might use Walther 2004. Full reference see comment to Page 14 Line 50. (Gian-Reto Walther, Institute of Geobotany)	AM: Various references possible, however general statement for confounding factors
1-928	A	45	35	45	35	Wildfires could increase due to anthropogenic climate change - see Gillett et al paper (Peter Stott, Met Office)	AM: Discussion on non-climate drivers on ecosystems changes, therefore reason for altered wildfires not essential here.
1-929	A	46	1	46	2	Method 3 has apparently been lost from this version of the text. (Kimberly Hall, Michigan State University)	Fixed.
1-930	A	46	1	46	2	Reference for "habitat fragmentation" - the best reference here is probably Warren, M.S. et al. (2001) Rapid responses of British butterflies to opposing forces of climate and habitat change. Nature 414, 65-69. This shows that, despite a recent expansion of the climatically suitable range for southerly distributed species in the UK, most species (especially habitat specialists) showed declines in distribution size associated with habitat loss and fragmentation. Only mobile or generalist species were able to expand their distributions in response to improving climatic conditions, with a consequent shift in community composition towards a greater proportion of mobile generalists, and a reduced proportion of sedentary specialist species. (Robert Wilson, Universidad Rey Juan Carlos)	AM: We included the reference.
1-931	A	46	2	46	3	Reference for "e.g., at higher elevations" could be Wilson, R.J. et al. (2005) Changes to the elevational limits and extent of species ranges associated with climate change. Ecology Letters 8, 1138-1146. We showed that over 30 years of climate warming the lower elevational limits of 16 butterfly species in a mountain range increased, constraining the species to progressively smaller areas that are limited by the upper elevational limits of the mountains. Another reference could be Peñuelas & Boada 2003 concerning changes to the elevational distribution of beech trees in the Montseny mountains in NE Spain. (Robert Wilson, Universidad Rey Juan Carlos)	AM: We included the reference
1-932	A	46	3	46	4	Pounds et al have a new paper in press in Nature that documents further global	PT: Paper is cited in a later section.

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						amphibian species' extinctions associated with local warming. (Camille Parmesan, University of Texas at Austin)	
1-933	A	46	7	46	7	post-WWII may be clear for some people, but I don't think it's commonly known everywhere in the world. (Kaija Hakala, MTT Agrifood Research Finland)	AM: is changed.
1-934	A	46	7	46		don't mention the war. Perhaps "in the past 50 years" would do. (Chris Thomas, University of York)	AM: Agree. Changed.
1-935	A	46	9	46	31	The morphological + physiological changes in vertebrates have links with food production (milk and meat). Since Chapter 5 Food, Fiber, and Forest Products, considers the relationship between productivity and climate change, appropriate cross-reference will favour decision making interest in Chapter 1. (Osvaldo Canziani, IPCC) To Bernard	Moved to 1.3.6
1-936	A	46	9			Section 1.3.5.1 the discussion about egg size is not really convincing. (Raymond Desjardins, N/A)	Two studies report finding...
1-937	A	46	9	46	32	Where are the data on plant and plant process changes? Lots of work has been done in this area. (Paul J. Hanson, Oak Ridge National Laboratory)	Added.
1-938	A	46	14	46	15	"report some changes in toad reproduction...". This can mean anything and so means nothing in particular. Should be more specific or should omit entirely. (Jeremy Kerr, University of Ottawa)	Addressed in TOD. Phrase no longer included.
1-939	A	46	16	46	16	Awkward start to this sentence. Can more direct language be used instead? "Egg sizes among birds are changing..." (Jeremy Kerr, University of Ottawa)	Disagree.
1-940	A	46	18	46	23	phrasing problem. The fact that some studies found decreasing body size with increasing temperature while others found the reverse trend should appear more clearly (Isabelle Chuine, CNRS)	Addressed.
1-941	A	46	18			"Following Bergmann's rule ..." COMMENT: Please note that Bergmann's rule had been considered as applicable to homeotherms and to some aquatic heterotherms only (and not to animals); in general terrestrial heterotherms, like the common toad Bufo bufo, which has a wide European distribution, show an opposite trend, being larger in southern (warmer) regions than in northern ones. As more studies are conducted, exceptions to the rule appear to be more frequent, however the main principle seems to hold (Meiri, S., Dayan, T. 2003. On the validity of Bergmann's rule. Journal of Biogeography. Vol. 30, 3: 331-351) (Maria Rosa Paiva, Universidade Nova de Lisboa)	Fixed.
1-942	A	46	20	43	23	I am not sure whether submitted paper should be cited	TR: We can.

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						(Isabelle Chuine, CNRS)	
1-943	A	46	22	46	23	Wouldn't the increase in food supply be reinforced by a reduction in energy demand (because of greater warmth)? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	TR: Yes, that is what the sentence now says.
1-944	A	46	27			“Northwards range extension...” COMMENT: The northwards and altitudinal range expansion of the pine processionary moth, a defoliator causing economic and ecological impacts to pine stands / production, and health problems to humans, constitutes a serious European problem. Please see / quote the official site of the European project PROMOTH. (Maria Rosa Paiva, Universidade Nova de Lisboa)	Will cross reference in TOD. Chapter does not cite websites in the text.
1-945	A	46	29	46	30	Wrong Simmons paper cited. Simmons and Thomas 2004 (cited in references) are responsible for the study of changed wing morphology and flight duration in bush crickets. Simmons, Barnard et al is not relevant here. (Chris Thomas, University of York)	Fixed
1-946	A	46	31			Reference should be "Simmons & Thomas 2004" not "Simmons, Barnard et al. 2004" (Robert Wilson, Universidad Rey Juan Carlos)	Fixed
1-947	A	46	33	51	24	Some new results of remote sensing phenology on the global or hemisphere scale should be introduced as independent part, such as the works of Zhang XY, et al (2004, GCB 10:1133-1145), Botta A, et al (2000, GCB, 6: 709-725), Zhou L et al (2001). (Xiaoqiu Chen, College of Environmental Sciences)	AM: More remote sensing references included now.
1-948	A	46	33	51	15	Phenology section seems to lack focus. It comes across as thorough but could use a bit more obvious organization. I think some of this section could be abbreviated as well. To some extent, citing the impressive meta-analyses that have been done in this area (by Root, Parmesan, and others) could cover the primary literature that has also been cited. (Jeremy Kerr, University of Ottawa)	Agree and made requested changes
1-949	A	46	35	47		You may want to add that the timing of the decrease in the Bowen Ratio has been used to infer an advance in the timing of leaf out (Fitzgerrald et al., 2001) – This would be a 4th method in this paragraph. Fitzjarrald, D.R., O.C. Acevedo, and K.E. Moore. 2001. Climatic consequences of leaf presence in the eastern United States. J. Climate 14:598–613. (Thomas Huntington, U.S. Geological Survey)	AM: We agree, however space is restricted and would need one or two long sentences to explain Bowen ratio to all readers.
1-950	A	46	35	46	35	In Merriam-Webster's 2003 dictionary, phenology is defined as: "a branch of science dealing with the relations between climate and periodic biological phenomena (as bird migration or plant flowering)." That definition doesn't restrict phenology just to "the timing of seasonal activities of animals and plants", as is done on p. 46. I	TR: The study of the seasonal timing of life cycle events (changes in plants and animals)—that is the usual definition, which the text does a great job of paraphrasing.

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						recommend revising the definition on p. 46 to be more in line with the dictionary definition. (Claire Parkinson, NASA Goddard Space Flight Center)	
1-951	A	46	37	46	37	"RECORDED changes...." (Isabelle Chuine, CNRS)	AM: Changed as suggested
1-952	A	46	37			"shooting"; do you mean shoot elongation? (Kevin Percy, Canadian Forest Service)	AM: Term is deleted.
1-953	A	46	40	46	42	Length of growing season is most often defined as period, when temperatures exceed 5oC permanently. (Kaija Hakala, MTT Agrifood Research Finland)	AM: Definition of the growing season is removed.
1-954	A	46	40	46	42	"The length of the growing season is ..." COMMENT: This definition is incorrect since it applies only to temperate/ cold systems, and not to Mediterranean and all other systems in warmer regions, where the vast majority of plants are evergreen. (Maria Rosa Paiva, Universidade Nova de Lisboa)	AM: Recorded growing season changes are now restricted to appropriate regions.
1-955	A	46	42			Reword as "the period of green leaf display of deciduous plant species." (Paul J. Hanson, Oak Ridge National Laboratory)	AM: Definition of the growing season is removed.
1-956	A	46	44			litterature is unevenly cited (eg year is lacking) (Bernard Clot, MeteoSwiss)	Fixed.
1-957	A	46	48			"Three methods" are mentioned. The third one seems to be lacking in the following comments/lines(?) (Bernard Clot, MeteoSwiss)	Fixed.
1-958	A	46	48	46	50	Item #3 in the promised list of methods is missing. (Paul J. Hanson, Oak Ridge National Laboratory)	Fixed.
1-959	A	46	48	47	2	Either change "Three" to "Two" at the start of the sentence or add a third method. (Claire Parkinson, NASA Goddard Space Flight Center)	Fixed.
1-960	A	46	48	47	3	"THREE different methods provide similar results ..." in the following only "(1)" and "(2)" are explained further. (Gian-Reto Walther, Institute of Geobotany)	Fixed.
1-961	A	46	48	47	3	"Three different methods.." Please make clear what the third method is (Robert Wilson, Universidad Rey Juan Carlos)	Fized.
1-962	A	46	49			PEÑUELAS J, FILELLA I. 2001. Phenology: Responses to a warming world. Science 294: 793-795. detailed the three different methods providing similar results (Josep Peñuelas, CSI-CREAF Barcelona)	Already cited
1-963	A	46		51		section 1.5.3.2., p. 51 to 54 – section 1.5.3.4), so the latter have to be shortened avoiding repetitions and very general statements; (Antoaneta Yotova, National Institute of Meteorology and Hydrology)	Shortened significantly
1-964	A	47	0			Table 1.8 Please add the following case: Location-Washington, DC and 35 km radius	AM: Ref. is included. In general, single site

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						area; Period-1970-1999; Species / Indicator-First flowering of 100 plant species; Observed change- -2.4 days; Author: (Abu-Asab, Peterson, et al. 2001). Reference: (Abu-Asab, M.S., P. M. Peterson, S.G. Shetler, and S.S. Orli. 2001. Earlier plant flowering in spring as a response to global warming in the Washington, DC, area. Biodiversity and Conservation 10: 597-612.) (Patrick Gonzalez, The Nature Conservancy)	studies will be summarised in supplementary material
1-965	A	47	1	47	2	A line of text appears to be missing here (David Rind, NASA/GISS)	Technical difficulty
1-966	A	47	5	47	9	So what were the observed NDVI responses? Is there a reference for these statements? (Paul J. Hanson, Oak Ridge National Laboratory)	AM: Will be included in Table 1.7
1-967	A	47	7	47	7	phenophases? This term lacks definition and should be used in a way that makes its meaning obvious or it should be defined explicitly. (Jeremy Kerr, University of Ottawa)	AM: Is changed to "Observed events"
1-968	A	47	9	47	11	earlier leaf fall of birch is inconsistent with the preceding statement that growing season is longer (Isabelle Chuine, CNRS)	Disagree—isn't inconsistent
1-969	A	47	9	47	10	Reference for "lengthening of the growing season of 32 days in Spain" should be "Peñuelas, Filella et al 2002" not "Stefanescu, Penuelas et al 2003" (Robert Wilson, Universidad Rey Juan Carlos)	AM: Changed (technical difficulties)
1-970	A	47	10			The right reference here is PEÑUELAS J., FILELLA I. COMAS P. 2002. Changed plant and animal life cycles from 1952-2000 in the Mediterranean region. Global Change Biology 8: 531-544. not Stefanescu et al (Josep Peñuelas, CSI-CREAF Barcelona)	AM: Changed (technical difficulties)
1-971	A	47	11			Is this supposed to be earlier leaf fall (i.e., suggesting shorter growing season, not longer)? (Kimberly Hall, Michigan State University)	AM: Yes, balanced description of findings includes extremes.
1-972	A	47	11	47		I have not read Kozlov and Berlina, but is it correct that birch leaves are falling EARLIER? (Chris Thomas, University of York)	AM: Yes, correct citation.
1-973	A	47	14	47	15	Two examples of Germany should be merged. The lengthening should be given uniformly by days/a or days/decade. (Xiaoqiu Chen, College of Environmental Sciences)	AM: the two examples are merged now.
1-974	A	47	14			Table 1,7: The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not.	AM: The climate change period is not defined. Results consist of stations with significant and not significant changes (see

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						(Annick Douguedroit, Université de Provence)	subheader uncertainties).
1-975	A	47	14	56	9	References in http://neespi.org provide extensive information about phenological changes in northern Eurasia. In particular, Groisman et al. (2005b; ch.3 WG1) provide the data on lengthening of growing season throughout Russia. Currently, the Chapter authors did not do very well reaching the bio-ecologists (or their publications) in this part of the world. The entire text misses reports about this large part of the northern extratropics where largest (Bene!) changes in climate have occurred during the past century. (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	Studies of changes in Northern Eurasia were assessed and relevant ones added to chapter. See Delbart, 2006. Address in TOD
1-976	A	47	14	47	14	Legend should make it clear what "phases" actually means. Legend is very sparse. (Jeremy Kerr, University of Ottawa)	AM: Legend is enlarged now.
1-977	A	47	14			Discussion and Table 1.7. It would be useful to add a note highlighting the more important (i.e health relevant) species, e.g. Betula pollen is very allergenic [there is a WHO report on this topic -Huynen et al. 2003] (Sari Kovats, London School of Hygiene and Tropical Medicine)	Sari Kovats has rewritten health section
1-978	A	47	20	47	22	I think that a general audience will find Fig 1.8 to which this text refers to be confusing; The text claims a positive influence of T on phenology which is well proved; However, the graph shows a trend of negative anomaly in phenology over time. This may be an artifact of using the T/NOA (barometric pressure) ratio; I am not familiar with it and it is not explained in the text or in the Figure caption; the coincidence in the life form data is very interesting but difficult to interpret as displayed (Kevin Percy, Canadian Forest Service)	AM: Legend / axis labels of Fig. 1.8 are improved.
1-979	A	47	21	47	21	summarise over what period leaf folding and unflowering have advanced by 1-3 days per decade (Peter Stott, Met Office)	AM: Is included now (3-5 decades)
1-980	A	47	23	47	23	Reference of Fig.1.8. seems incorrect (Isabelle Chuine, CNRS)	AM: Is corrected
1-981	A	47	26	48		Table 1,8: The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	AM: The climate change period is not defined. Different lengths can not be adjusted without any new analyses. Results consist of stations with significant and not significant changes (see subheader uncertainties).
1-982	A	47	26			Table 1.8: You may want to add anadromous fish migration dates: (Juanes et al., 2004; Huntington et al., 2003). Fish are now migrating earlier. Juanes, F., S. Gephard, and K.F. Beland. 2004. Long-term changes in migration	Added.

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						<p>timing of adult Atlantic salmon (<i>Salmo salar</i>) at the southern edge of the species distribution. Canadian Journal of Fisheries and Aquatic Sciences 61:2392-2400.</p> <p>Huntington, T. G., G. A. Hodgkins, R. W. Dudley, 2003, Historical trend in river ice thickness and coherence in hydroclimatological trends in Maine. Climatic Change, 61:217-236.</p> <p>(Thomas Huntington, U.S. Geological Survey)</p>	
1-983	A	47	26	47	26	<p>Under "observed changes" the unit d/a (presumably days advanced) should be defined</p> <p>(David Rind, NASA/GISS)</p>	AM: All results are reported in days / decade now.
1-984	A	47	26	48		<p>Table 1.8. A further possible reference is Scheifinger, H, Koch, E, & Winkler, H (2005) Results of a first look into the Austrian animal phenological records. METEOROLOGISCHE ZEITSCHRIFT (2005) 14 (2): 203-209</p> <p>(Robert Wilson, Universidad Rey Juan Carlos)</p>	Address in TOD. Address in TOD. Reference checked.
1-985	A	48	0			<p>I see no reason to limit coverage of phenology to data collected in networks. Coverage in Tables should not include studies that appeared in the TAR. Use the same time period for all phenology studies --e.g., amount of change/10 years or per degree C.</p> <p>(Kimberly Hall, Michigan State University)</p>	AM: we are limited in space, all studies are presented in supplementary material.
1-986	A	48	21			<p>Insert the following: "Such changes suggest that these species have a certain adaptive capacity that enables them these responses.</p> <p>(Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	TR: Discussed in intro to section 1.3.5
1-987	A	49	2			<p>I find Fig. 1.8.a bit misleading. One cannot assert that phenophases correlate well with temperature and NAO by simply showing evolution of 4 phenophases with temperature and NAO. Providing R2 of relationships between a large amount of phenophases and NAO or temperature would be more appropriate.</p> <p>(Isabelle Chuine, CNRS)</p>	AM: R2 are included now.
1-988	A	49	2	49	24	<p>Can't tell colours apart for spring arrival in birds and hatching in flycatchers in fig 1.8</p> <p>(Peter Stott, Met Office)</p>	AM: Figure has better quality now.
1-989	A	49	3	49	20	<p>The right-hand y-axis label is unclear. If the y-axis numbers are the spring temperature anomaly in Celsius divided by the NAO index, as the scale seems to indicate, then the first sentence of the caption should be revised to state that. On the other hand, if that's not what it means, then the y-axis label should be revised.</p> <p>(Claire Parkinson, NASA Goddard Space Flight Center)</p>	AM: Right-hand axis is for both (T and NAO), adjusted.
1-990	A	49	26			<p>Fig. 1,8:the title is: "Anomalies... correlate well.." but there is no any coefficient of correlation in the caption nor in the text; so how can it be affirmed that "Anomalies... correlate well"? No trend drawn but, as on Fig. 1,7 the series seem to be possibly</p>	AM: Trend tests would go far beyond cited ref., we included R ²

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						divided into two periods, one till the 70's, stable, and a second after, decreasing, which corresponds with the period of the "climate change". A test could check the hypothesis. (Annick Douguedroit, Université de Provence)	
1-991	A	49	26			The references are incomplete in the Figure 1.8 caption. (Paul J. Hanson, Oak Ridge National Laboratory)	Ref corrected
1-992	A	49	37	49	37	Reference for the study on reindeer phenology? (Kimberly Hall, Michigan State University)	Will address in TOD.
1-993	A	49	41	49	42	"earlier activity" in what? "counter examples do exist" in what? (Isabelle Chuine, CNRS)	Will address in TOD. Breeding activity now specified.
1-994	A	49	41	49	42	This sentence probably belongs under the section "Uncertainties/Variations" (Thomas Huntington, U.S. Geological Survey)	PT--Disagree
1-995	A	49	45			The year for Stefanescu et al is 2003: STEFANESCU C, PEÑUELAS J., FILELLA I., 2003. The effects of climatic change on the phenology of butterflies in the Northwest Mediterranean Basin. Global Change Biology 9, 1494-1506. (Josep Peñuelas, CSI-CREAF Barcelona)	Fixed.
1-996	A	49	46	49	47	Hickling et al is not the correct reference for this statement. Hickling studied Odonata distributions. (Chris Thomas, University of York)	Odonata are invertibrates, but perhaps "dragonflies" should be included in this statement.)
1-997	A	50	2			PEÑUELAS J., FILELLA I. COMAS P. 2002. Changed plant and animal life cycles from 1952-2000 in the Mediterranean region. Global Change Biology 8: 531-544. (Josep Peñuelas, CSI-CREAF Barcelona)	Fixed.
1-998	A	50	3	50	5	Do these studies explicitly compare the responses of early season and late season species within the same taxa and/or same locale? I'm assuming this statement is based on data for plants, and this should be clarified to avoid over-generalization. My understanding is that there is not strong evidence for this pattern in animals. (Kimberly Hall, Michigan State University)	We inserted plants / birds in this sentence.
1-999	A	50	5	50	9	Are these differences in response what one would expect? That might be important in relating them to climate change. (David Rind, NASA/GISS)	These differences can't be deduced / expected.
1-1000	A	50	9	50	10	This sentence is inappropriate here (Isabelle Chuine, CNRS)	Section reworked
1-1001	A	50	12	50	36	Other literatures should be cited, for example, Chmielewski & Roetzer (2001), Agricultural and Forest Meteorology 108: 101-112; Chen et al (2005), Global Change Biology, 11: 1118-1130. (Xiaoqiu Chen, College of Environmental Sciences)	AM: References included

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1-1002	A	50	14			A good reference showing that regional trends in phenology can vary is the following one: PEÑUELAS J., FILELLA I. COMAS P. 2002. Changed plant and animal life cycles from 1952-2000 in the Mediterranean region. <i>Global Change Biology</i> 8: 531-544. (Josep Peñuelas, CSI-CREAF Barcelona)	Already cited
1-1003	A	50	23	50	29	This paragraph should appear in the preceding sub-section "uncertainties/variations" (Isabelle Chuine, CNRS)	AM: 2 short paragraphs are merged
1-1004	A	50	24	50	20	These statements on bird migration are incorrect; contrary studies are not cited. Other studies have found significant changes in both long-distance and short distance migrants (Ledeneva et al. 2004, Bradley et al. 1999). The differential susceptibility of long and short distance migrants to climate change impacts on their migratory schedules is still uncertain. (Kimberly Hall, Michigan State University)	Text changed.
1-1005	A	50	32	50	33	sentence unclear. "Last century" is not precise (Isabelle Chuine, CNRS)	Disagree
1-1006	A	50	33	50	36	Section 1,3,5,2 This affirmation is very important because it fits the project of establishing significant relations between warming during the "climate change" period and changes in terrestrial biological systems; it could be stressed. (Annick Douguedroit, Université de Provence)	AM: New publication inserted to stress.
1-1007	A	50	38	51	4	The paper of Chmielewski & Roetzer (2001, <i>Agricultural and Forest Meteorology</i> 108: 101-112) on the relationship between spring phenology and NAO in Europe should be cited. (Xiaoqiu Chen, College of Environmental Sciences)	Done
1-1008	A	50	38			Section of signal: only the NAO is mentioned, despite there being a fairly well established literature on the role of ENSO is affecting ecosystem dynamics etc in the tropics, especially role of droughts in tropical rainforests (Lesley Hughes, Macquarie University)	Rewritten to address these concerns.
1-1009	A	50	45	50	49	My guess is that the correlations with the NAO arise largely because of its effects on local temperatures. This might be discussed. (Nathan Gillett, University of East Anglia)	We just do not have the space, unfortunately.
1-1010	A	50	49	50	49	The NAO doesn't 'alter' anything - it is an empirical index of storm track changes. One could say consistent with the altered NAO, the speed and pattern of spring arrival in Europe has changed... (David Rind, NASA/GISS)	Done
1-1011	A	51	1	58		Terrestrial ecology session seems to have a slightly different tone, more reporting on trends and less on assigning positive or negative consequences to them. Perhaps this	Taken into account when paragraph was rewritten

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						is because the results are honestly more mixed here, but I felt that the overall tone of this section was one that would withstand criticism from the skeptics better than the marine section, which could be accused of climate "cherry picking"- or perhaps "bad apple" picking by someone intent on poking holes in the theory. The only comment for this section is that one might want to take a look at whether the temperature-fire relationship is really temperature alone/ The Gillett et al. paper does not, for example, look at changes in fuelstock, or proximity to roads (the latter parameter was found to have a major impact on fires in tropical regions by George Hurtt). (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	
1-1012	A	51	6	51	15	The paper of Chmielewski (2005) on climate change and frost hazard for fruit trees (Annalen der Meteorologie 41 (2) 488-491) should be cited. (Xiaoqi Chen, College of Environmental Sciences)	To Ag Chapter
1-1013	A	51	6	51	15	I found this paragraph a bit short and sometimes unclear. Saying that phenological changes may not have major ecological consequences is going a bit to far I think as if we do not have so far a fair amount of evidences that such changes do have ecological consequences, there are some indications that they may have such consequences. There are quite a few studies which show that phenology is a major adaptive trait that affect fitness, survival and species distribution, and another bunch of studies showing the consequences of desynchronisation of plants/animals phenology. Consequences of phenology change on ecosystem productivity should be discussed here rather than in the next paragraph even if also discussed in section 1.5.3.7. (Isabelle Chuine, CNRS)	AM: Consequences and adaptation are left out due to space restrictions and a strong focus on observed changes.
1-1014	A	51	7	51	8	This sentence is unclear and misleading (Isabelle Chuine, CNRS)	Section removed
1-1015	A	51	7	51	8	How is the example given related to a synchronous phenological change? (David Rind, NASA/GISS)	Section removed
1-1016	A	51	7	51	9	The first cited study is for Central Europe only. If there is an additional citation (for the rest of Europe) it is not clear which paper it is. (Mark Schwartz, University of Wisconsin-Milwaukee)	Section removed
1-1017	A	51	8	51	9	The example provided to illustrate the former statement is inappropriate. Citation problem. (Isabelle Chuine, CNRS)	Section removed
1-1018	A	51	9	51	12	Section 1.3.5.2 provides also nice examples of consequences of phenological mismatch (Isabelle Chuine, CNRS)	Moved mismatch to 1.3.5.5
1-1019	A	51	12			A good reference for this statement is PEÑUELAS J, FILELLA I. 2001. Phenology:	Section removed

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						Responses to a warming world. Science 294: 793-795 (Josep Peñuelas, CSI-CREAF Barcelona)	
1-1020	A	51	12	51	13	Growing season length is a major and general determinant of species' distribution in non-tropical areas and thus, does not only affect species with low adaptive capacity. Hence, changes in growing season length does affect species composition more generally. A example for a particular species group which profit from prolonged growing season length is given by evergreen broad-leaved species (e.g. Walther, G.-R. 2002. Weakening of climatic constraints with global warming and its consequences for evergreen broad-leaved species. Folia Geobotanica 37, 129-139) (Gian-Reto Walther, Institute of Geobotany)	Moved to distribution section
1-1021	A	51	17	51	24	Unclear as to how the provide text could be seen as adaptation when it speaks to impacts. Only the last sentence refers to adaptive capacity and impacts of limitations to that capacity. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section removed
1-1022	A	51	18			This paragraph is misleading. Talking about adaptation concerning phenology would be genetic adaptation which is not discussed here. I suggest the statements of this paragraph be discussed in the former paragraph "consequences" (Isabelle Chuine, CNRS)	Section removed
1-1023	A	51	23	51	24	this sentence is too definitive in my view; mention should be made of the genotypic plasticity within many species and an innate ability to adapt within certain limits (Kevin Percy, Canadian Forest Service)	Section removed
1-1024	A	51	26			I am surprised that so few studies are reported concerning the impact of climate change on terrestrial species reproduction. There are at least quite a few studies which have adressed consequences of climate change on bird reproduction and reproductive success which are not cited here (see Moller, Fiedler & Berthod 2004 Birds and climate change), and I suspect other studies concerning amphibians reproduction. (Isabelle Chuine, CNRS)	Address in TOD. Section rewritten.
1-1025	A	51	26	51	32	Section 1.3.5.3 "Changes in reproduction". This section is important because changes in fecundity can be one of the mechanisms for the changes in species distributions referred to in the following section (1.3.5.4). The morphological and phenological changes reported on pages 46 to 51 are relevant here. The possible role of changes in reproductive success and recruitment at the lower latitudinal margins of tree species is discussed by Hampe, A. & Petit, R. (2005) Ecology Letters 8: 461-467, with examples from the recent literature. Changes in habitat use by species associated with changing climate or temperature are also important in this context. Davies, Z.G., Wilson, R.J., et al. (in press in Journal of Animal Ecology) show how egg-laying rate	Address in TOD. Section rewritten.

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						and microhabitat selection depend on temperature, and that habitat used for egg-laying in a butterfly species has changed over 20 years, increasing population size. Related references are Roy, D.B. & Thomas, J.A. (2003) <i>Oecologia</i> 134, 439-444, & Crozier, L. (2004) <i>Oecologia</i> 141, 148-157. (Robert Wilson, Universidad Rey Juan Carlos)	
1-1026	A	51	28			The statement here conflicts with a later statement (on allergenicity) on page 67, lines 35-38. Are these really the only new observations related to reproduction? (Kimberly Hall, Michigan State University)	“& pollen allergenicity” deleted
1-1027	A	51	28	51	29	The evidence of changes on pollen allergenicity should be discussed in more detail and more critically. Cf discussion in chapter 8, and page 67 line 36 of this chapter. A pollen expert needs to review this literature. (Sari Kovats, London School of Hygiene and Tropical Medicine)	“& pollen allergenicity” deleted
1-1028	A	51	30	51	32	How are reduced hunting time and decreased reproductive success linked together? (Kaija Hakala, MTT Agrifood Research Finland)	Address in TOD. Text rewritten.
1-1029	A	51	30	51	32	The time available for hunting is not a causitive factor in the mammals condition; if anything, it is a parenthetical remark (unless it's meant to imply that because the time available for hunting has been reduced, hunters can't be responsible for what's happening to the mammals - which doesn't really follow, they could just hunt faster (or better)). (David Rind, NASA/GISS)	Hunting comment needs to be clarified. This has to do with winter ice. Address in TOD. Text rewritten.
1-1030	A	51	34	52	6	This is a very clear section, but mention could be made at the end of the drivers in addition to climate change e.g. habitat loss and fragmentation, as shown by Warren et al. (2001) (reference in Point 7 above) and the consequent changes in species composition away from sedentary specialist species and towards mobile generalist species. (Robert Wilson, Universidad Rey Juan Carlos)	Clarified the issue in the rewritten paragraph.
1-1031	A	51	38	51	39	A reference reporting the inherent resilience of treeline forests is provided with Walther 2004 (see full reference in comment to Page 14 Line 50). (Gian-Reto Walther, Institute of Geobotany)	AM: Added
1-1032	A	51	39	51	40	Add references to: "...inherent resilience of [...] the magnitude of elevational shifts of SOME alpine species lags behind the isothermal shift (Grabherr et al. 1994, but see Walther et al. 2005). Full references: Grabherr, G., Gottfried, M. & Pauli, H. 1994. Climate effects on mountain plants. <i>Nature</i> 369:448. Walther, G.-R., Beißner, S. & Burga, C.A. 2005. Trends in the upward shift of alpine plants. <i>Journal of Vegetation Science</i> 16, 541-548. (Gian-Reto Walther, Institute of Geobotany)	AM: Added
1-1033	A	51	41			the section of species distribution is also thorough. I have a serious concern here that	Added a more explanatory sentence.

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						<p>actual attribution of the distribution changes to climate change is uncertain in many of the studies that have been cited. In speaking with butterfly natural history experts, I have been struck by the outright disbelief they sometimes have for observations of range shifts among butterflies being attributed to climate change. Certainly, land use changes could easily account for many of the range shifts observed among butterflies in western Europe and could contribute, weakly or strongly, to population extinctions and colonizations of Euphydryas in western North America. These are specific examples but highlight an underlying weakness in this section. The report is intended to provide an assessment of the area, not only list the many outstanding studies that have been done. By way of "value-added" here, it would be very useful and contribute positively to the thoroughness of this section if some note could be made about the likelihood of the changes here being a function of climate versus land use. To my mind, land use change is the gorilla in the room in this section and it is mostly ignored. Climate change skeptics, a hopefully dying breed (I betray my own biases!), could easily and correctly argue that this section seems one-sided in favour of pure climate effects.</p> <p>(Jeremy Kerr, University of Ottawa)</p>	
1-1034	A	51	42	51	44	<p>Section 1,3,5,2 add " as mentionned in 1,2,1- climate drivers" ?.</p> <p>(Annick Douguedroit, Université de Provence)</p>	Not clear
1-1035	A	51	42	52	6	<p>Here it might be wise to point out that boundary populations are also affected by Allee effects. See for example the limitation of <i>Brachypodium pinnatum</i> at its northern boundary by breeding system not climate (Buckland et al Journal of Applied Ecology 38,301-309, (2001)).</p> <p>(John Grime, Buxton Climate Change Impacts Laboratory)</p>	Address in TOD. Reference checked.
1-1036	A	51	47	51	49	<p>As this sentence addresses the northward expansion of plant species, the following references should be added: Walther, G.-R., Berger, S. & Sykes, M.T. 2005. An ecological 'footprint' of climate change. Proc. R. Soc. B 272, 1427-1432 AND the review of plant species range shifts: Walther 2004 see comment to Page 14, Line 50 for full reference. Furthermore it is questionable whether the formulation "likely to be" is really necessary in this context or whether the observed shifts simply "is" attributable to increases in temperatures.</p> <p>(Gian-Reto Walther, Institute of Geobotany)</p>	Already in table 1.9
1-1037	A	51	49			<p>The CBD 2003 reference appeared to be missing from the reference list.</p> <p>(Paul J. Hanson, Oak Ridge National Laboratory)</p>	Is dropped
1-1038	A	52	0			<p>Table 1.9 Please add to the "Treeline" case: Location-California; Author-(Millar, Westfall, et al. 2004). Reference: (Millar, C.I., R.D. Westfall, D.L. Delany, J.C. King, and L.J. Grau. 2004. Response of subalpine conifers in the Sierra Nevada, California,</p>	Ref. has been added

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						U.S.A., to 20th-Century warming and decadal climate variability. Arctic, Antarctic, and Alpine Research 36: 181-200.) (Patrick Gonzalez, The Nature Conservancy)	
1-1039	A	52	0			Table 1.9 Please add the following two cases: 1. Species/Indicator-126 tree and shrub species of the Sahel, Sudan, and Guinean ecological zones; Location-Senegal, West Africa; Observed changes-35-50 km latitudinal shift of ecological zones in the period 1945-1993; Author-(Gonzalez 2001); Climate link-1855-1993 decrease in annual precipitation. Reference: (Gonzalez, P. 2001. Desertification and a shift of forest species in the West African Sahel. Climate Research 17: 217-228.) 2. Species/indicator-Pinus ponderosa, Pinus edulis, Juniperus monosperma; Location-New Mexico, USA; Observed changes-2 km shift of arid Pinus edulis-Juniperus monosperma woodland into moister Pinus ponderosa forest in the period 1954-1963, persisting to 1998; Author-(Allen and Breshears 1998); Climate link-drought 1953-1957. Reference: (Allen, C.D. and D.D. Breshears. 1998. Drought-induced shift of a forest-woodland ecotone: Rapid landscape response to climate variation. Proceedings of the National Academy of Sciences of the USA 95: 14 839-14 842.) (Patrick Gonzalez, The Nature Conservancy)	Ref. has been added; second one is prior to 1999.
1-1040	A	52	1	52	5	The case studies mentioned in this context can be extended by one additional study supporting the very same results for Switzerland. Hence, this sentence might be reworded in the following way: " In Europe, for example in the Netherlands (Tamis, Van 't Zelfde et al. 2001), Norway (EEA), and Switzerland (Walther & Grundmann 2001), thermophilic (warmth-demanding) plant species have become more frequent compared with 30 years ago (in the Netherlands, by around 60%), whereas there has been a small decline in the presence of traditionally cold-tolerant species." Full reference for Walther & Grundmann 2001: Walther, G.-R. & Grundmann, A. 2001. Trends of vegetation change in colline and submontane climax forests in Switzerland. Bulletin of the Geobotanical Institute ETH 67, 3-12. (Gian-Reto Walther, Institute of Geobotany)	AM: Two references already underline this statement.
1-1041	A	52	9			Table 1.9 could be further enhanced by inclusion of some of the Australia examples listed in Chapter 11. (Lynda Chambers, Bureau of Meteorology Research Centre)	Done
1-1042	A	52	9			Table 1,9: The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	Periods are those used by the studies
1-1043	A	52	9			Table 1.9 What does 'most likely climate' mean in the right column? (Nathan Gillett, University of East Anglia)	Changed

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1-1044	A	52	9			Comments on Table 1.9. This table should clarify for each of the entries whether the changes are only in the northern/higher margins or also in the southern/lower margins (and, of course, the direction of changes).. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Due to space constraints, this is unfortunately not possible.
1-1045	A	52	9			How are patterns of plant species change over time distinguished from normal patterns of succession? (Paul J. Hanson, Oak Ridge National Laboratory)	AM: Species' ranges are not affected by succession which occurs at single sites.
1-1046	A	52	9			Table 1.9: once again, these examples are exclusively from the Northern Hemisphere (Lesley Hughes, Macquarie University)	Agreed. Many Australian examples now included.
1-1047	A	52	9			Table 1.9. Tick studies are missing here - Lindgren et al. and papers from Czech Republic (see Chapter 8), (Sari Kovats, London School of Hygiene and Tropical Medicine)	Included.
1-1048	A	52	9			Table 1.9: Row 2: Add citation to Parmesan 2003 (gives the links to climate change). Parmesan, C. 2003. Butterflies as bio-indicators of climate change impacts. ch. 24 In Evolution and Ecology Taking Flight: Butterflies as Model Systems, C.L Boggs, W.B.Watt, and P.R., Ehrlich (eds). University of Chicago Press, pp. 541-560. (Camille Parmesan, University of Texas at Austin) TR to get PT Parmesan chapter in book	Included.
1-1049	A	52	9			Table 1.9: Row 1, Correction - Change "34 butterfly species" to "57 butterfly species" (Camille Parmesan, University of Texas at Austin)	Deleted because in TAR)
1-1050	A	52	9	52		Thomas and Lennon example. "Winter temperatures" should be replaced by "Increased temperatures". Thomas and Lennon do not distinguish between impact of warming at different seasons. (Chris Thomas, University of York)	PT Agree--Will Fix (PN: Was deleted)
1-1051	A	52	9	52		Table 1.9: Konvicka et al example. Point out that these are butterflies. (Chris Thomas, University of York)	PT Agree- will fix (pn: fixed)
1-1052	A	52	9	52		Table 1.9: Crozier example – also a butterfly. (Chris Thomas, University of York)	PT (pn: fixed)
1-1053	A	52	9	53	1	Remove the checkerspot example (Euphydryas editha) from the Table, as it is already included in Parmesan et al. 1999 study and not really new for the 4AR (-> published in 1996). But, instead, add here e.g. the results of Ott (2001) on the expansion of Odonata in Germany and Europe. Ott, J. 2001. Expansion of Mediterranean Odonata in Germany and Europe - consequences of climatic changes. In: Walther, G.-R. et al. (eds.) 'Fingerprints' of Climate Change. Kluwer Academic/Plenum Publishers, New York, pp. 89-111. (Gian-Reto Walther, Institute of Geobotany) AM send copies to PT	Address in TOD. Text rewritten.

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1-1054	A	52	9			Table 1.9. Further references for the tenth example in the table (<i>Atalopedes campestris</i>) are Crozier, L.G. 2003 <i>Oecologia</i> 135: 648-656 and Crozier, L.G. 2004 <i>Oecologia</i> 141, 148-157. Further examples are Wilson, R.J., Gutiérrez, D. et al. (2005) <i>Ecology Letters</i> 8, 1138-1146 that shows average upward shifts of 210 m in the lower elevational limits of 16 butterfly species in Central Spain between 1967-73 and 2004, associated with a 1.3°C increase in annual mean temperature. Also Brommer, J. (2004) <i>Annales Zoologici Fennici</i> 41, 391-397, that shows an increase in upper latitudinal limit of 18.8 km for 116 bird species in Finland between 1974-79 and 1986-89. An example in which bird distributions did not show altitudinal increases is Archaux, F. (2004) <i>Ibis</i> 146, 138-144. (Robert Wilson, Universidad Rey Juan Carlos)	PT check and add is correct Address in TOD. References checked.
1-1055	A	52	12	52	13	It would seem to be more accurate to say "Based on current information, more areas have seen their species richness increase, while fewer have seen declines" based on the following sentence (starting on line 13, "...The net effect...") This should be reflected in the Executive Summary. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Rewrote paragraph appropriately
1-1056	A	52	13	52	14	Did the remaining nine see their species richness decrease or stay the same? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Paragraph had to be shortened due to space limits
1-1057	A	53	0			Table 1.9 -> Alpine plants: "Elevational shift of 1-4 m/decade" goes back to the paper of Grabherr et al. 1994, which should be cited in this table, when the according values are given. In addition, a new study has just been published providing newer results on the upward shift of alpine plants: see Walther et al. 2005, the full reference is provided in the comments to Page 51 Line 39. (Gian-Reto Walther, Institute of Geobotany)	Walter study now cited)
1-1058	A	53	1	53		Table 1.9: Walther/Ilex example. Why "Coherent synchronous"? I think that "Poleward shift.." will do. (Chris Thomas, University of York)	Is deleted now.
1-1059	A	53	1	53		Table 1.9: additional example: Wilson, R. J. D Gutiérrez et al. <i>Ecology Letters</i> , 2005. 16 mountain butterflies in central Spain (Sierra de Guadarrama). Lower elevation boundaries moved uphill by an average of 212 m in 35 years, associated with regional warming of 1.3 degC, equivalent to approximately 225m. (Chris Thomas, University of York)	PT Address in TOD. Reference checked.
1-1060	A	53	1	53		Table 1.9: additional example: Rachael Hickling, David B. Roy, Jane K. Hill, Richard Fox and Chris D. Thomas. The distributions of a wide range of taxonomic groups are expanding polewards. <i>Global Change Biology</i> , in press. This paper shows that, in Britain: Dragonflies and damselflies, Grasshoppers and allies, Butterflies, Spiders, freshwater fish, Woodlice, Ground beetles, Millipedes, Longhorn beetles,	Included)

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						Soldier beetles and allies, and Aquatic bugs have moved significantly northwards over a 25 year period. Out of a total of 329 species analysed across 16 taxa, 275 species shifted northwards at their range margin, 52 species shifted southwards, and 2 species' range margins did not move, with an average northwards shift across all species of 31 to 60 km (depending on level of sub-sampling of data). (Chris Thomas, University of York)	
1-1061	A	53	3			What about animals in mountains? (Kimberly Hall, Michigan State University)	Section restructured. Some animal studies cited.
1-1062	A	53	4	53	4	Also cite (Millar, Westfall, et al. 2004). Reference: (Millar, C.I., R.D. Westfall, D.L. Delany, J.C. King, and L.J. Grau. 2004. Response of subalpine conifers in the Sierra Nevada, California, U.S.A., to 20th-Century warming and decadal climate variability. Arctic, Antarctic, and Alpine Research 36: 181-200.) (Patrick Gonzalez, The Nature Conservancy)	AM: There is now a link to Tab. 1.9
1-1063	A	53	4	53	4	Add the aforementioned reference (Walther, Beißner et al. 2005) to this sentence. (Gian-Reto Walther, Institute of Geobotany)	Ref. added
1-1064	A	53	15			The Grabherr et al reference is 1994 - does not fit the post-1999 guidelines for citations (Lesley Hughes, Macquarie University)	Is deleted now
1-1065	A	53	20	53	20	Better explanation of "time-lag effects" should be necessary at this point (Giampiero Maracchi, Institute of Biometeorology)	Paragraph rewritten to account for this comment.
1-1066	A	53	20	53	21	"time lag effects" have been outlined in detail in the studies e.g. of Walther 2004 (see comment to Page 15 Line 50 for full reference) and Holtmeier, F.-K. & Broll, G., 2005. Sensitivity and response of northern hemisphere altitudinal and polar treelines to environmental change at landscape and local scales. Global Ecology & Biogeography 14 (5), 395-410. (Gian-Reto Walther, Institute of Geobotany)	Key studies are cited.
1-1067	A	53	23			Jump et al. 2006 (submitted) reported increases in the width of tree rings near the upper treeline and decreases in the lower altitudinal range. Alistair S Jump*, Jenny M Hunt, Josep Peñuelas 2006 Rapid climate change-related growth decline at the southern range-edge of Fagus sylvatica L. and Alistair S Jump*, Jenny M Hunt, Josep Peñuelas 2006 Contrasting patterns of growth and establishment at the rising tree lines of Turó de l'Home (Josep Peñuelas, CSI-CREAF Barcelona)	Shortened paragraph and just do not have space to address this point.
1-1068	A	53	25	53	26	This statement is incorrect and conflicts with ch. 4 pg 51 lines 6-13. In many regions (Europe, the Himalayas, and Asia), high mountain vegetation composition (including treeline) is greatly influenced by human grazing practices and logging for timber and firewood.	Rewrote to take comment into account.

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						(Camille Parmesan, University of Texas at Austin)	
1-1069	A	53	26	53	30	I would not assert in this report that " species endemic or of high importance for plant diversity are vulnerable to climate change because of enhanced response to higher CO2 levels... and severe climatic conditions", this is very much controversial. (Isabelle Chuine, CNRS)	Deleted sentence
1-1070	A	53	30	53	32	The importance of "surrogate habitats" for alpine species (i.e. micro-scale regions with different microclimate) has been outlined in particular in Walther et al. 2005 (Walther, G.-R., Beißner, S. & Pott, R. 2005. Climate change and high mountain vegetation shifts. In: Broll, G. & Keplin, B. (eds.) Mountain Ecosystems - Studies in Treeline Ecology. Springer, Heidelberg, pp. 77-96. (Gian-Reto Walther, Institute of Geobotany)	AM: Surrogate habitats are now included.
1-1071	A	53	34			Update this section to include Pounds et al in press, Nature on amphibian extinctions (Camille Parmesan, University of Texas at Austin)	Included ref.
1-1072	A	53	34	54	1	The role of climate variability in extinctions of populations of the butterfly Euphydryas editha is shown by Mclaughlin, J.F., Hellmann, J.J. et al. (2002) PNAS 99, 6070-6074 (see also Mclaughlin, Hellmann et al. 2002 Oecologia 132, 538-548 that shows the potential importance of topographical variation in buffering population size against changes in precipitation) (Robert Wilson, Universidad Rey Juan Carlos)	Included ref.
1-1073	A	53	35			For what "could" the consequence be extinction? What is meant by "longer time frames"? Should mention if there any unequivocal examples of climate change caused extinctions, and the degree of confidence in that example? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Para. rewritten accordingly
1-1074	A	53	37	53	38	Ron, Duellman et al (2003), however, note that the reasons for the presumed extinction are obscure. That should be noted. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Added
1-1075	A	53	39	53	43	"interaction between drought and disease has been noted" and "synergy between UVB radiation and other factors have been hypothesized" as the causes of extinction? Please specify. (Isabelle Chuine, CNRS)	The para. is understandable as it is.
1-1076	A	53	39	53	40	In fact, Alexander and Eischeid (2001) investigated trends for Colorado (U.S.A.), Puerto Rico, Costa Rica-Panama, and Queensland (Australia) and concluded that "unusual climate, as measured by regional estimates of temperature and precipitation is unlikely to be the direct cause of amphibian declines, but it may have indirectly contributed to them." This would be amore accurate rendering of their finding. (Indur Goklany, Office of Policy Analysis, Department of the Interior) Find recent cons bio. Article	Addressed.

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1-1077	A	53	42			UVB radiation (Lesley Hughes, Macquarie University)	Right
1-1078	A	53	43	54	1	amphibian decline seems to be triggered by infectious diseases see e.g http://news.bbc.co.uk/1/hi/sci/tech/4262384.stm Therefore attribution to climate change is very unlikely (Markus Erhard, Forschungszentrum Karlsruhe)	Recent publication indicates temp change is a major factor.
1-1079	A	53	43	54	1	Is there anything else that could be the cause of amphibian decline? And why can't climate variability be a factor? (David Rind, NASA/GISS)	State that there are synergistic effects involved. PT
1-1080	A	53	43	54	1	When using the term "climate variability" need to be clear what this means - does this exclude the possibility that forced climate change could cause amphibian decline ? (Peter Stott, Met Office)	Disagree
1-1081	A	54	3	54	6	This paragraph should appear in section 1.3.5.6. (Isabelle Chuine, CNRS)	Deleted
1-1082	A	54	8			What about animal invasions? (Kimberly Hall, Michigan State University)	PT (pn: needs to be addressed. Are thier examples of animal invasions? (page 44, line 16-25)
1-1083	A	54	8	54	15	Can the authors provide additional information regarding how the rate of spread of an invasive species can be attributed to climate change as apposed to just the normal progression of the invasion? (Paul J. Hanson, Oak Ridge National Laboratory)	Check for TOD. Section has been rewritten.
1-1084	A	54	8			The climate linked invasions need to be assessed in more details. (Giampiero Maracchi, Institute of Biometeorology)	Details have been added
1-1085	A	54	9	54	15	this could also differentiate between the rapid northward spread of weeds of productive continuously disturbed corridors eg <i>Lactuca serriola</i> and the inertia of long-lived perennials of unproductive habitats. There is a growing suspicion that in the latter spread may rely upon extreme events that make closed unproductive vegetation only briefly and occasionally invisable. (Davis et al, Journal of Ecology 99,528-534,(2000). (John Grime, Buxton Climate Change Impacts Laboratory)	AM: Included.
1-1086	A	54	17			Section 1.3.5.5 The fragmentation of habitats is not the result of climate change! In the discussion about agriculture, it would be preferable to address agroecosystems rather than agriculture. An agroecosystem is a human-modified system that was adjusted for food production. This would make more sense in the line of the chapter. If you are discussing trends, there was a paper published by Campbell et al in 2002 in the Canadian Journal of Plant Science (Vol 82, pp. 45-57) on « Production of annual crops on Canada's prairies : trends during 1976-1998 ». This paper provides	Topic moved to agriculture section.

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						information regarding the effect of climatic factors. (Raymond Desjardins, N/A)	
1-1087	A	54	17			Species community changes and ecosystem processes (Stephen J. Hawkins, The Marine Biological Association of the UK)	AM: Changed as suggested
1-1088	A	54	17	54	37	The discussion is too generic: ecosystems and species communities are fundamental rings of the chain: their changes must be discussed in much more detail with help of the appropriate literature (Giampiero Maracchi, Institute of Biometeorology)	AM: Asked for literature
1-1089	A	54	25	54	25	The reported statement "the effect on cold-tolerant species is still limited" is in contrast with the statement (reported in Cap. 4, pag. 17, lines 43-44) "Despite the increase in abundance of thermophilic plants, a remarkably small decline in the presence of traditionally cold-tolerant species is observed". In addition, "a trend of variation forced by an increasing drought has been recorded in all plant communities above the timberline in the Apennines" (Petriccione B., 2003: Short-term changes in key plant communities of Central Apennines (Italy). Acta Botanica Gallica, 150). In the Apennines, species composition has changed with 10-20% of total no. of species in the last 9-16 years. in particular, in alpine tundra, high-mountain mesophil and snow-bed grassland the following phenomena have been recorded, in agreement with the foreseen or observed phenomena in other alpine or arctic areas (Chapin et al., 1996, Theurillat & Guisan, 2001, Welker et al., 2001): (a) a coverage increase (or appearance) of chamaephytic, drought- and stress-tolerant species and (b) a coverage decrease (or disappearance) of hemicriptophytic, microtherm, mesophil and competitive species. These phenomena could be linked to the observed climate change occurred during the last century (in particular in the last 20 years) in the Central Apennines, consistent mainly, on the mountains, in a strong reduction of duration of snow-cover and in an increase of minimum yearly temperatures. (Bruno Petriccione, National Forest Service)	AM: The two sentences are not contradictory. We don't have access to this journal.
1-1090	A	54	27	54	32	The logic of combining the first sentence of this para to its second sentence is not immediately apparent, particularly since the previous page had not -- to my surprise - - noted a single extinction that could be definitely attributed to climate change (although there is no shortage of hypotheses) and notes that, if anything, species richness is more likely to have increased, etc. Moreover, the following subsection notes northward/upward range expansions, increases in productivity, etc. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	AM: Section rephrased.
1-1091	A	54	27	54	28	The sentence is too generic: to which species are the Authors referring to? I suggest to discuss more specifically the cited IPCC and Hare findings. (Giampiero Maracchi, Institute of Biometeorology)	AM :Sentence deleted.

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1-1092	A	54	28	54	28	What IPCC ref is this? Refs generally need sorting out (Peter Stott, Met Office)	AM :Sentence deleted
1-1093	A	54	29	54	37	These statements are hard to follow - please clarify. (Kimberly Hall, Michigan State University)	AM: Statement is clear.
1-1094	A	54	29	54	32	“Although most changes ...” COMMENT: After habitat destruction and modification, invasive species constitute the second cause of both biodiversity economic losses (See: Foin et al. 1998. Bioscience 48: 177-184; YFF Review. 1998. Invasive Species. A Yale Forest Forum Series Publication (University of Yale), Vol.1 (2). Invasive species should be here mentioned. (Maria Rosa Paiva, Universidade Nova de Lisboa)	AM: Link to incasive species is made now.
1-1095	A	54	34	54	37	This paragraph should appear in section 1.3.5.2 in "Consequences" (Isabelle Chuine, CNRS)	AM: As we deleted the consequences, we leave paragraph here.
1-1096	A	54	34			"Examples of.." (Lesley Hughes, Macquarie University)	AM: Done.
1-1097	A	54	41	54	41	Citation problem. Thomas et al 2001 only studied four insect species, they did not quite review evolutionary changes due to cliamte change. (Isabelle Chuine, CNRS)	Address in TOD. Now page 45, line 8. Wrong reference was cited. Corrected for FGD.
1-1098	A	54	41			A recent example of genetic adaptation to warming is Umina PA et al (2005) Science 308: 691-693 (Lesley Hughes, Macquarie University)	AM: Will be included !
1-1099	A	54	41			The Thomas reference, not currently in the bibliography, is Thomas, C.D. (2005) Recent evolutionary effects of climate change. Pp 75-88 in Climate Change and Biodiversity, Eds T.E. Lovejoy and L. Hannah, Yale University Press, New Haven and London. (Robert Wilson, Universidad Rey Juan Carlos)	PT / TR : (pn: changed in new version)
1-1100	A	54	44	54	44	Citation problem, Thomas, Blondel et al 2001 studied fitness cost of mismatching in birds not insect habitat evolution. (Isabelle Chuine, CNRS)	Clarify in TOD. But this is the only Thomas 2001. Corrected in FGD.
1-1101	A	54	44	54		Wrong reference. This should be “Thomas, Bodsworth et al, 2001”. Thomas, Blondel citation should be deleted from this section. (Chris Thomas, University of York)	Need this full citation)
1-1102	A	54	44			The reference should be Thomas, Bodsworth et al. 2001 not Thomas, Blondel et al. (Robert Wilson, Universidad Rey Juan Carlos)	Need this full citation)

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1-1103	A	54	46	54	48	I do not know Berthod Gwinner et al. 2003 reference, but according to Pulido & Berthod 2004 In Moller, Fiedler and Berthod Birds and climate change, there is to date only three studies that have investigated evolutionary change of migratory behaviour in response to climate change: Brown& Brown 2000, Moller 2004, Pulido & Berthod 2004 (Isabelle Chuine, CNRS)	Beware of catagorical statements.
1-1104	A	54	48	54	48	This sentence should appear earlier in the pragraph when the authors talk about Thomas et al work on insect evolutionary response to climate change. (Isabelle Chuine, CNRS)	Needs to be addressed.
1-1105	A	55	1	55		Thomas and Simmons is a 2004 publication. (Chris Thomas, University of York)	Fixed
1-1106	A	55	5	55	24	The primary productivity is a very important aspect on responses of terrestrial ecosystem to climate change. There have been lot of research works on it which are not cited in this section. (Xiaoqiu Chen, College of Environmental Sciences)	Section expanded in agriculture and forestry section)
1-1107	A	55	5	55	6	The statement that the survival of bird species wintering in Europe has increased should also be in the Exec Summary. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Suggestion considered, but trend not taken as key example.
1-1108	A	55	5			section 1.3.5.7: Oechel's work showing Alaska tundra changing from C-sink to C-source should be mentioned here (ie increase in summer NPP more than offset by increase in winter decomposition) (Camille Parmesan, University of Texas at Austin)	Address in TOD. References checked.
1-1109	A	55	7	55	24	terrestrial ecosystems may turn from sink to source might also be discussed see case study UK: P. Bellamy et al. (2005): Carbon losses from all soils across England and Wales 1978–2003 Nature 437, p245 (Markus Erhard, Forschungszentrum Karlsruhe)	Address in TOD.
1-1110	A	55	7	55	11	but see e.g. Körner, C., Asshoff, R. et al. 2005. Science 309, 1360-1362...! (Gian-Reto Walther, Institute of Geobotany)	Address in TOD. References checked.
1-1111	A	55	11	55	12	The increased greenness of Eurasia and North America should be noted in the Executive Summary. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Satellite data time series do not run long enough to show defined trends for ES.
1-1112	A	55	14			broadly (Lesley Hughes, Macquarie University)	Section rewritten.
1-1113	A	55	15	55	17	Within Section 1.3.5.7 model-based estimates of productivity are inappropriately presented as measured changes in NPP. These data must be presented as estimates derived from models using measured trends in satelite data, etc.	Section rewritten.

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						(Paul J. Hanson, Oak Ridge National Laboratory)	
1-1114	A	55	15	56	9	Section 1.3.5.9. I felt that the concluding section could have been made shorter and clearer by summarising the main observed changes that are common between systems (i.e. earlier phenology, longer seasons, distribution expansions at higher elevations and latitudes, some evidence for declines at lower elevational or latitudinal limits to species ranges, vulnerability of species with restricted distributions), rather than re-capping specific systems separated taxonomically (cf. migratory birds, endemic mountain plants). The key point needs to be made that changes in phenology and distribution lead to changed associations between species in space and time, leading to unpredictable responses. Some mention could also be made of regional differences in trends. (Robert Wilson, Universidad Rey Juan Carlos)	AM: Section is reworded
1-1115	A	55	17	55	19	The text should be clear that the Janssens et al. article describes the current rate of European terrestrial biosphere C storage not a trend associated with climatic change. (Paul J. Hanson, Oak Ridge National Laboratory)	Section rewritten.
1-1116	A	55	19	55	19	New paragraph at "Uncertainties" (Jeremy Kerr, University of Ottawa)	Section moved
1-1117	A	55	20	55	21	Edit the sentence "A regional-scale..." to the more precise "A network of Amazon forest inventory plots show a carbon accumulation rate of 1 t C/ha/y in the period 1979-2003 (Baker, Philips et al. 2004)." (Patrick Gonzalez, The Nature Conservancy)	Addressed
1-1118	A	55	21	55	21	Add the sentence "In humid evergreen tropical forest in Costa Rica, annual growth in the period 1984-2000 varied inversely with the annual means of daily minimum temperature, because of increased respiration at night (Clark, Piper et al. 2003). Reference: (Clark, D.A., S.C. Piper, C.D. Keeling, and D.B. Clark. 2003. Tropical rain forest tree growth and atmospheric carbon dynamics linked to interannual temperature variation during 1984-2000. Proceedings of the National Academy of Sciences of the USA 100: 5852-5857.) (Patrick Gonzalez, The Nature Conservancy)	Done
1-1119	A	55	26			Shouldn't this section be addressing human adaptation & vulnerability to changes in wild animal and plant species? (Not adaptation/vulnerability of the wild species). (Kimberly Hall, Michigan State University)	Section Removed.
1-1120	A	55	36	55	39	There have been evidence on it in Canada (Beaubien & Freeland, 2000, IJB 44: 53-59). (Xiaoqiu Chen, College of Environmental Sciences)	AM: Study has some methodological problems
1-1121	A	55	36	55	39	"however earlier plant springvariability" has nothing to do, so far I understand it, with the first part of the sentence that " there is no evidence so far that temperature	AM: However is deleted.

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						response rates of plants did change". (Isabelle Chuine, CNRS)	
1-1122	A	55	41	55	43	As noticed earlier, this statement is not supported by any cited references. (Isabelle Chuine, CNRS)	Sectoin removed.
1-1123	A	55	41	55	43	There should be a discussion of the effect (or lack of it) of higher CO2 levels on the likelihood of adaptation by plant species, e.g., by shifting the optimum temperatures (for photosynthesis and other biological processes) upward. See Chapter 5.2.1.2, and Idso et al. (2003: 5-11). [Ref: Idso et al. 2003. The Specter of Species Extinction. The Marshall Institute, Washington, DC. Available at http://www.co2science.org/scripts/Template/0_CO2ScienceB2C/pdf/extinction.pdf] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	AM: CO2 effects on photosynthesis seem to be limited in time (Körner, Hattenschwiler). Section removed.
1-1124	A	55	41	55	43	This paragraph needs a reference. (Paul J. Hanson, Oak Ridge National Laboratory)	Section removed.
1-1125	A	55	41	55	43	Sedentary species and habitat specialists may generally be more vulnerable than widespread, generalist or more mobile species - this is true for both animals and plants. To tie section 1.3.5 in with other sections of the report, it might be worth considering differences in vulnerability between different regions or biomes. (Robert Wilson, Universidad Rey Juan Carlos)	AM: Tried to reword accordingly.
1-1126	A	55	44			Jump and Peñuelas (2005) argue that in fragmented landscapes, rapid climate change has the potential to overwhelm the capacity for adaptation in many plant populations and dramatically alter their genetic composition. The consequences are likely to include unpredictable changes in the presence and abundance of species within communities and a reduction in their ability to resist and recover from further environmental perturbations, such as pest and disease outbreaks and extreme climatic events. Overall, a range-wide increase in extinction risk is likely to result. JUMP A, PEÑUELAS J. 2005. Runnig to stand still: adaptation and the response of plants to rapid climate change. Ecology Letters 8: 1010-1020. (Josep Peñuelas, CSI-CREAF Barcelona)	AM : Included
1-1127	A	55	45	56	9	Section 1,3,5,9 Summary: It claims that strong impacts of "climate change" have been determined; the claim is quite stronger than the results previously presented in Section 1,3,5 except if they are significant even if they have not been presented as significant. (Annick Douguedroit, Université de Provence)	AM :Summary reworded
1-1128	A	55	45			section 1.3.5.9: This section should be either cut or be revised to represent a more comprehensive summary of terrestrial biological response to climate change. (Camille Parmesan, University of Texas at Austin)	AM :Summary reworded

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
1-1129	A	55	47	56	9	The summary includes only one animal example. (Kimberly Hall, Michigan State University)	Addressed
1-1130	A	55	47	55	48	The overwhelming majority of studies showing warming impacts will be dependent on the desire of the authors to publish results. Published evidence for no change may not be available because there was no story to tell. Spatially distributed monitoring programs should be established to provide unbiased observations on evidence for biological change that might be attributed to climate modifications. (Paul J. Hanson, Oak Ridge National Laboratory)	AM: Analysis of evidence of no change are included.
1-1131	A	55	47	56	9	Early in the chapter, there is reference to a need to quantify natural variability and put observed pattern changes in nature in the context of this variability. But this is not done here nor is this problem acknowledged. I think it would be useful to recognize that some kind of recognition of natural variability is missing from most of these studies. An additional point here is that many of the observations of species range shifts are really qualitative. "Shifting north" is unconvincing evidence of climate change impacts, particularly since some areas of North America (for instance) where species seem to be shifting north have not experienced much climate change. This is a glaring weakness in many (but by no means all) of these studies. I think it should be recognized, although it could be a bit painful to do so. (Jeremy Kerr, University of Ottawa)	AM: Differentiation between significant changes and substantial / relevant changes without significance level will be made.
1-1132	A	55	47	55	48	Does this refer to overall trends or to spatio-temporal patterns of change being consistent with spatio-temporal patterns expected from observed climate change ? (Peter Stott, Met Office)	AM :Summary reworded
1-1133	A	55	48			The phrase "Uncertainty over the response of plant species to climate change is modest" is very confusing (Robert Wilson, Universidad Rey Juan Carlos)	AM :Summary reworded
1-1134	A	55	49	55	50	Species diversity means little that we can analyse scientifically. Plant traits and PFT's are the cutting edge ! (John Grime, Buxton Climate Change Impacts Laboratory)	AM :Summary reworded
1-1135	A	55	50	56	2	May be I missed it, but in the foregoing there wasn't a single example (that I recall) which provided a documented case of a climate change related disappearance. (There were a few examples of range extensions and a lot of speculation of disappearances.) What is this claim of disappearance based on? By the way, does disappearance = extinction, or are we talking about local disappearances. This should be written with greater precision, and backed up with evidence that has been evaluated critically. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	AM :Summary reworded
1-1136	A	56	0	62		1.3.6 Agriculture & forestry: This section, once again, appears to emphasize the negative/harmful impact of climate change while ignoring or downplaying the	Disagreee: both negative and positive aspects of observed changes have been

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						beneficial/positive impact. It must be accepted that both Agriculture & forestry have expanded with increased grain yield world-wide and more robust growth of forestry resulting from increased CO2 levels and generally higher precipitation over major forest regions like the Amazon and the Indonesian archipelago. Major grain producing regions of the world, N America (Canada & USA), EU (European Union), India, China and Australia all have recorded increased grain production despite observed increase in mean temperature over these regions. The Sahel region is probably affected by regional climate change however, Sahel is not world's major grain producing region. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	presented when available information from literature exists
1-1137	A	56	0			Discussion on agroclimatic indices could be added at this point and of their changes (Giampiero Maracchi, Institute of Biometeorology)	Agreed, but not applicable because of length constraints
1-1138	A	56	4	56	5	The statement -- that NPP has increased by 6% with the largest increase in tropical ecosystems -- should be in the Executive Summary. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Less than 20 years of observations
1-1139	A	56	4	56	5	Again, the NPP increase of 6% is an estimate based on good models and satellite-based indicators of vegetation activity. (Paul J. Hanson, Oak Ridge National Laboratory)	Less than 20 years of observations
1-1140	A	56	4	56	5	This result, that the largest increases in NPP came in tropical ecosystems, seems surprising, as the tropical regions were already plenty warm enough. It would therefore be nice to have some explanation given; e.g., perhaps there was an increase in beneficial rainfall. (In contrast, the results mentioned on p. 58, lines 45-48, from global crop models and observations are consistent with what might be expected, with declines in crops in developing countries, many of which are in tropical regions.) (Claire Parkinson, NASA Goddard Space Flight Center)	Increase due to increased solar radiation: will address in TOD. Addressed.
1-1141	A	56	6	56	7	The sentence "All indicators ... are already apparent worldwide" strikes me as repetitive of "The overwhelming majority... consistent pattern of change" for lines 47-48 on Page55. (Robert Wilson, Universidad Rey Juan Carlos)	Section revised .
1-1142	A	56	12			Section 1.3.6.1 in this section it is necessary to introduce the relation between degree-days and yield. On the other hand, how to deal with the regular introduction of new cultivars? (Raymond Desjardins, N/A)	Agreed, but not applicable because of length constraints.
1-1143	A	56	12			Section 1.3.6 the last paragraph on page 56 is too general and does not convey any message. (Raymond Desjardins, N/A)	Agreed, text removed.

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1-1144	A	56	12	62	6	Discuss results reported in te papers published in the book "Increasing climate variability and change" Ed Salinger, Sivakumar, Motha (Springer, 2005) (Giampiero Maracchi, Institute of Biometeorology)	Agreed, but not applicable because of length constraints.
1-1145	A	56	23			Modify the first sentence to read as follows: "The yield per hectare of all crops has increased..." This is true for all crops, including cash crops. This statement should also be in the Exec Summary. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed.
1-1146	A	56	25			Add to the reference on line 25: Goklany (1998, 1999, 2003) (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Agreed, but not applicable because of length constraints.
1-1147	A	56	32	56	34	A reference is needed for this statement. (Paul J. Hanson, Oak Ridge National Laboratory)	Addressed.
1-1148	A	56	32	56	32	Is this table 1.12 ? (Peter Stott, Met Office)	No, but text has been modified since FOD.
1-1149	A	56	34			Section 1,3,6 ".where it lengthens the potential growing season"; but the main aspect is the reduction in length of the effective growing season due to higher temperature which hasten the arrival of the ripeness. See Section 1,4,1, page 74, line 15-16 " the systematic summary of more than 100000 trends revealed that 78% of all leafing, flowering and fruiting records advanced (30%significantly)": this is the correct view on the question. See also the evolution of the wine harvest in the south-east of France (see complementary figures and references sent in a second e-mail). (Annick Douguedroit, Université de Provence)	Agreed.
1-1150	A	56	34			With respect to the Sahel, see comment 9, and also Box 1.2, which notes that rainfall, while still low, is higher since 1990. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Agreed.
1-1151	A	56	36			Section 1,3,6 It is especially detectable in the date of the wine harvest in the south-east of France and the more favorable climatic conditions in the northern margin of its area in Europe. (Annick Douguedroit, Université de Provence)	Agreed, but not applicable because of length constraints.
1-1152	A	57	0	57	17	Rice production in India has grown almost four-fold since 1950, from 20 M tons to over 90 M tons in 1999, see paper by R. Selvaraju, Int'l J of Climatology, 2003, p. 187-206. The rice growing region of India has warmed by about 1C in last fifty years, however rice production has steadily increased due to improved technology and the production has declined only during El Nino years when Monsoon rainfall is reduced. This aspect must be highlighted here. Rice production in other countries of southeast Asia, Malaysia, Vietnam has also presumably increased because of improved technolgy and increased Monsoon precipitation. The paper by Selvaraju and related discussion on increased grain production in India as well as elsewhere must be	Addressed.

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						included here. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1153	A	57	4	57	4	Table 1.11a is missing (Peter Stott, Met Office)	Addressed.
1-1154	A	57	9	57	23	Literature on animal diseases is missing here (see comment above). (Sari Kovats, London School of Hygiene and Tropical Medicine)	Agreed : the group is searching to fill this gap.
1-1155	A	57	12			Add "not including direct CO2 effects" after "climate" (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed.
1-1156	A	57	18	57	20	this sentence seems contradictory with the first sentence of this paragraph saying that no change on crop yield attributable to climate change has been reported for US. Please specify if the change in the yields is positive or negative. (Isabelle Chuine, CNRS)	Addressed.
1-1157	A	57	18	57	20	What sign is the influence on yields? Is this an increase or a decrease? Secondly, given that I suspect that temperature trends over the US over the stated 16-year period are not significant, or only marginally significant, I am surprised that a statistically significant effect of climate change on crop yields can be proven. Should we necessarily believe these results? Are they corroborated by other studies? (Nathan Gillett, University of East Anglia)	Addressed.
1-1158	A	57	18	57	19	Is this a positive effect (increased production)? (David Rind, NASA/GISS)	Addressed.
1-1159	A	57	19	57	19	Are we talking about increase or decrease of yields? (Kaija Hakala, MTT Agrifood Research Finland)	Addressed.
1-1160	A	57	25			Section 1.3.6.2 needs rewriting. Furthermore, the coverage of the forest system is poor. Much work was carried out under BOREAS, and several reports were released. None of them is cited. Yet the boreal forest covers a large part of the earth. (Raymond Desjardins, N/A)	Addressed.
1-1161	A	57	27	57	35	I believe that the idea here is to say that although warming and increase CO2 can lead to an increase in productivity, climate warming can also change disturbance regime (fire, insect and windthrow) which may be factors that can rule out the potential increase. if so the paragraph should be made clearer. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Addressed
1-1162	A	57	27			Modify the very beginning of this line as follows: "Figure 1.2 provides generalized evidence of increases in forest productivity due an extended growing period in the higher latitudes, together with warming ..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed
1-1163	A	57	27	57	27	Reports about changes in forest fire frequency in Russia (Korovin and Zukkert 2003; Conard et al. 2002, Climatic Change) should be included/cited somehow (this is also	Addressed

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						relevant to page 62 line 5 information). (Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	
1-1164	A	57	27	57	35	A discussion of warming effects on C losses due to enhanced decomposition seems to be missing from Section 1.3.6.2. (Paul J. Hanson, Oak Ridge National Laboratory)	Agreed, but not applicable because of length constraints
1-1165	A	57	27	57	35	The authors have chosen to cite a very limited selection of literature relative to what is available on observed changes in forested ecosystems and in the forest sector. I would suggest taking a look at Chapter 04 and Chapter 05 and/or the regional chapters to ensure complementarity (Aynsleie Ogden, Government of Yukon)	Addressed
1-1166	A	57	27	57	35	“Generalized evidence ..” COMMENT: Evidence of forest productivity increase applies to northern latitudes only. On the contrary, for Southern Europe and other regions, due to the causes mentioned in this paragraph, mainly wild fires and increased importance of pests and diseases, a reversed tendency might be the outcome. (Maria Rosa Paiva, Universidade Nova de Lisboa)	Addressed
1-1167	A	57	31	57	35	The fact that climate variability is the dominant factor affecting wild fire doesn't mean that forest fire occurrence will necessarily increase with and increase in Temperature. For instance Lefort-P; Gauthier-S; Bergeron-Y. 2003. Forest-Science., 49:509-521; are showing that there is a decrease in fire danger in eastern Canada since the beginning of the 20's which is also associated with a decrease in area burned. (see also and Lesieur et al. 2002. Can. J. For. Res. 32: 1996-2009) Also, there is a danger in pooling the data for an entire country. There is currently very large variation in the area burned in different regions of Canada, so there will probably still be very large variation in predicted burned area within the country. Finally the period between 1940 and 1970 appears to have been a period of relatively low frequency of fire. therefore when baseline for comparisons is that particular period an increase in the only probable outcome. there are also a number of study that show that indicates a tendency to decrease area burned recently (Bergeron et al. 2001 Can. J. For. Res. 31: 384-391; Bergeron et al. 2004 Ambio 33: 356-360 for a review); see also many papers from Martin Girardin and coll. Girardin M P, Tardif J (2005) Sensitivity of tree growth to the atmospheric vertical profile in the Boreal Plains of Manitoba. Canadian Journal of Forest Research 35, 48-64. Girardin MP, Tardif J, Bergeron Y (2002) Canadian Journal of Forest Research 32, 206-216. Girardin MP, Tardif J, Flannigan MD, Wotton BM, Bergeron Y (2004a) Canadian Journal of Forest Research 34, 103-119.	Addressed

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						Girardin, MP, Tardif J, Flannigan MD, Bergeron Y (2004b) <i>Climate Dynamics</i> 23, 99-115. Girardin MP, Tardif JC, Flannigan MD, Bergeron Y (in press). <i>Journal of Climate</i> 00, 00-00. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	
1-1168	A	57	31			I proposed to add "occurrence in South Mediterranean, North Africa," (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Addressed
1-1169	A	57	34	57	35	"Climate variability" is being used here to mean a link between climate and wildfires but note potential confusion in readers' mind between (natural) climate variability and forced climate change (Peter Stott, Met Office)	Addressed
1-1170	A	57	35			considering the repeated large forest fires during the warm season in the South Mediterranean and North Africa, I propose to add "the forest fire occurrence appears to be related particularly to heat waves in the warm season". (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Addressed
1-1171	A	57	37			Section 1.3.6.3 needs rewriting the paragraph starting with « changes in vulnerability... » on p. 58 seems to be contradictory with the previous statements (Raymond Desjardins, N/A)	Addressed
1-1172	A	57	39			do you mean that there is no documented evidence? If there is a little it is important that it be cited. (Ian Burton, University of Toronto)	Addressed
1-1173	A	57	39	57	41	There is evidence of research on developing crops that might be better suited to future conditions under climate change. See Goklany (2001a, and references therein). In particular, they include genetically modified crops that would be more tolerant of poor climatic and soil conditions -- specifically, cereals which are tolerant to aluminum (so that they can grow in acidic soils), drought, high salinity levels, submergence, chilling and freezing; crops that could combat pests that might multiply under climate change (e.g., insects, nematodes, bacteria, viruses, and fungi) ; rice with the property of being able to close stomata more readily, which ought to increase water use efficiency and net photosynthetic efficiency; rice with the alternative C4 pathway for photosynthesis, which could be especially useful if there is significant warming because the C4 pathway is more efficient at higher temperatures (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Agreed, but subject to be addressed in ch 05
1-1174	A	57	39	57	44	I would agree that there is little evidence of proactive adaptation in the forest sector;	Addressed

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						however, there are many examples of 'reactive' adaptation -- for example: massive forest insect outbreaks that are linked to climate warming are driving forest management activities in British Columbia and the Yukon (Aynslye Ogden, Government of Yukon)	
1-1175	A	57	44			Section 1,3,6,3,: add "except that progressive reduction of the yields have been observed with increasing drought". See results obtained in Morocco in the references sent in a second attachment. (Annick Douguedroit, Université de Provence)	Agreed, but not applicable because of length constraints
1-1176	A	58	0	58		Figure 1.9 and the paper by Gillete et al , GRL, 2004 need to be closely examined in the context of other papers on forest/wild fires in N America. A comprehensive paper by Stocks et al " Large forest fires in Canada, 1959-1997" J of Geophysical Research, 2002, 107, FER X-1 to X-12 does not show increasing trend in forest fires in recent 25 years as claimed by Gillet et al. Further, forest fires in western Canada (and northwestern USA) are governed by several mechanisms like forest management, fuel, summer rains, dry lighteneing etc. and NOT just by mean temperature alone as asserted by Gillete al. Also see AMS Bulletin, June 2004, p. S39 (State of the climate in 2003) which shows forest fire activity in three west coast US states to be influenced primarily by the ENSO phase. Figure 1.9 does not appear to be representative of real forest fire situation in N America and specifically over Canada and USA. Also note that forest fires in western Canada were at minimal during summer 2005 primarily because of increased summer rains over western Canada in 2005. This fact should be mentioned. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Addressed
1-1177	A	58	1	58	34	It is clear that hotter weather without rain induces forest fires. This picture could be omitted. (Kaija Hakala, MTT Agrifood Research Finland)	Figure deleted.
1-1178	A	58	26			Fig. 1,9:the title is: "Area...and temperature trends.." but there is no trend on the figure but only the successive values of different series. And the same remark as the one done to Fig.1,7 and 1,8 can be done hier: the series seem to be possibly divided into two periods, one till the 70's, stable, and a second after, decreasing, which corresponds with the period of the "climate change". A test could check the hypothesis. (Annick Douguedroit, Université de Provence)	Addressed
1-1179	A	58	26			Figure 1.9: Canadian data might be replaced by global data e.g. from global fire monitoring center http://www.fire.uni-freiburg.de/ or global forest fire assessment http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/006/ad653e/ad653e22.htm	Figure deleted

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						(Markus Erhard, Forschungszentrum Karlsruhe)	
1-1180	A	58	28			The units should be 10 ⁵ km ² (i.e. the 5 should be superscript). (Nathan Gillett, University of East Anglia)	Addressed
1-1181	A	58	28			The reference should be to the Stocks et al. (2001) paper describing the Canadian Large Fire Database, not to Van Wagner. (Nathan Gillett, University of East Anglia)	Addressed
1-1182	A	58	45	59	2	Section 1,3,6,3: it could be mentionned also the difference between plants in C3 and C4 which disadvantage the tropical countries. (Annick Douguedroit, Université de Provence)	Agreed, but not applicable because of length constraints
1-1183	A	59	0	59		1.3.6.4 summary: The summary paints a negative (and a bleak) picture of climate change impact on present and future agriculture & forestry sector, while the reality is exactly opposite. Overall, agriculture has improved in recent years and grain yields of rice, wheat and lentils have increased significantly worldwide. Also forestry has enriched. These aspects must be highlighted. Why is "risk of frost" mentioned here? IPCC 2001 clearly states "fewer cold days and frost days " due to warming of the earth,s temperature. The risk of frost should be minimal. The Box 1.3 Wine & Recent Warming should be deleted, since wine is NOT a staple food for people living in Asia and Africa where 70% of the present world population lives. Some of the entries in Tables 1.10 through 1.12 can be deleted so as to condense the Tables. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Disagree: both negative and positive aspects of observed changes have been presented with existing available information from literature Frost is diminished by warming from a climatological point of view: for perennial crops or forests, the risk may increase because of the advance in sensitive stages (flowering) phenology Wine has been selected as the most sensitive production to climate (positive, up to now, if we refer to your first statement) Tables have been modified
1-1184	A	59	1			So what accounts for the 50 percent increase in the Philippines' cereal yield per hectare since 1990? This emphasizes the importance of non-CC related factors, particularly, management, infrastructure and technology over that of climate change in determining agricultural productivity. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed
1-1185	A	59	9	59	12	"insect expansion" do you mean range extension and increased reproduction (more generations per year)? (Kevin Percy, Canadian Forest Service)	Addressed
1-1186	A	59	11			"in agreement" ; this can be interpreted with great latitude and should be more specific; by agreement, is it implied that trends in say temp. and fires are merely paralell presenting evidence based upon correlation, or, is there a proven statistical dependance of one upon the other? (Kevin Percy, Canadian Forest Service)	Addressed
1-1187	A	59	18	59	43	The whole box 1.3. is badly written, and too much text for just one small example. (Kaija Hakala, MTT Agrifood Research Finland)	Wine has been selected as the most sensitive production to climate. Writing has been

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							improved as far as possible
1-1188	A	59	19			Box 1.3 Very tricky subject! This is a case of non-climate drivers if ever I saw one. (Ian Burton, University of Toronto)	Disagree. Grapevines are climate-sensitive.
1-1189	A	59	19			Box 1,3: two remarks. Alsace is on the northern boundary of the wineyard area and its wine had a rather high rate of acidity which decreased with the warming; this is important for Alsace because the rate was too high but does not much matter for more southern areas where the acidity is lower. Second point: the potential growing season lengthens but the wine harvest is earlier because the grapes ripen faster. See complementary figures and references sent in a second attachment) (Annick Douguedroit, Université de Provence)	Agreed, but not applicable because of length constraints
1-1190	A	59	19			Comment on Box 1.3. Should note that viniculture was thriving in Britain during the Medieval Warm Period, (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Addressed
1-1191	A	59	28	59	29	Couldn't understand this sentence at all. This whole para could use a rewrite - it's awkward and sometimes not fully formed. (Jeremy Kerr, University of Ottawa)	Addressed
1-1192	A	60	1	60	2	The case study of China (Schwartz & Chen, 2002, Climate Research, 21: 157-164) should be added. (Xiaoqiu Chen, College of Environmental Sciences)	Addressed
1-1193	A	60	1			Table 1.10 There is a lack of consistency when you consider the period of study and the observed change, it is difficult to accept the statements. For example, in the first entry, the period is 50 years, and the change would be 3 days/10 years. Does it mean that the total change is 20 days over 50 years???	Addressed
1-1194	A	60	1			Table 1,11: Title: "Observed changes.." The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	Addressed
1-1195	A	60	1			Table 1.10 . One of the indices ought to be atmospheric CO2 concentrations! (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Maybe, but it is not taken as a climatic variable in this chapter.
1-1196	A	60	1	61	1	Report phenology changes in some standard unit (i.e., days/10 years). See plant section, and try to reduce overlap between these tables and the earlier ones. (Kimberly Hall, Michigan State University)	Addressed
1-1197	A	60	1			Table 1.10: I realise I am beginning to sound very repetitive but all examples in this table are Northern Hemisphere (Lesley Hughes, Macquarie University)	The table has been omitted. Please send southern hemisphere references.

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1-1198	A	61	1			Table 1.11 Same problem as in Table 1.10 : look at the 4th entry. Advance of the beginning of the growing season is 2.3 days/year. As this is reported for a 30-year period, does it mean that the growing season starts 78 days earlier in Germany. Nonsense!! (Raymond Desjardins, N/A)	Addressed
1-1199	A	61	1	62		Table 1,12: Title: "Observed changes.." The length of the series are different one from the others but no specific mention is made about what happens during the "climate change" period when it is longer than this period; no mention if the results are significant or not. (Annick Douguedroit, Université de Provence)	Addressed
1-1200	A	61	4	61	4	There is no contents in this part "a" of the table. (Kaija Hakala, MTT Agrifood Research Finland)	Addressed
1-1201	A	61	6	61	6	Advance of maize sowing dates by 20 weeks? A missprint? Here could also be added the reference Moonen et al., where according to Table 1.10 (p. 60) also sowing dates had become earlier. (Kaija Hakala, MTT Agrifood Research Finland)	Addressed
1-1202	A	62	0			Table 1.12 if forest fires appears in that Table, studies showing a decrease should also be presented; (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Addressed
1-1203	A	62	0	68		1.3.7 Human health: This section is once again written in general terms with little specifics about recent human health hazards. In last five years, the most important world-wide human health hazards were due to SARS and the present scare about Avian/bird flu, both of these health hazards are due to societal changes and not linked in any way to global warming or climate change. The discussion re: ENSO and human health is misleading and must be deleted or modified substantially. ENSO impacts on human health are well-known and have no relation to global warming/climate change issues. Malaria and Dengue fever were historically linked to human activity and their impact on local ecology and NOT to warm wather or climate change. Malaria was prevalent in Europe hundreds of years ago, even during the Little Ice Age (see P Reiter, "Climate change & mosquito-borne disease", Environmental health perspectives, V. 109, 2001, p. 141-161). In tropical countries and also in Europe and North America, cold stress is more hazardous to health than heat stress. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Section rewritten
1-1204	A	62	1			The content of Table 1.12 hasn't necessarily been attributed to climatic change. This point should be made clear in the Table caption. (Paul J. Hanson, Oak Ridge National Laboratory)	Table cut.

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1-1205	A	62	1			Table 1.12 The Arctic Climate Impact Assessment Scientific Report 2005 Cambridge university Press Cambridge UK, can be cited for likely increases in area burned in Alaska and Russia – in addition to Canada – see Chapter 14 G. Juday. (Thomas Huntington, U.S. Geological Survey)	Table cut
1-1206	A	62	3			Jump et al. 2006 (submitted) reported increases in the width of tree rings near the upper treeline and decreases in the lower altitudinal range. Alistair S Jump*, Jenny M Hunt, Josep Peñuelas 2006 Rapid climate change-related growth decline at the southern range-edge of Fagus sylvatica L. and Alistair S Jump*, Jenny M Hunt, Josep Peñuelas 2006 Contrasting patterns of growth and establishment at the rising tree lines of Turó de l'Home. The data refers to the last century, southern Europe. There is also the work by OGAYA R, PEÑUELAS J. 2005. Decreased mushroom production in a holm oak forest in response to an experimental drought. Forestry 78(3): 279-283. which is worth mentioning here (Josep Peñuelas, CSI-CREAF Barcelona)	Tree rings used as a climate proxy, not observed change. Last reference not relevant to chapter.
1-1207	A	62	7			General comment on Section 1.3.7. The previous comment applies to each of the subsections within Section 1.3.7. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Unclear.
1-1208	A	62	7			If not already done, you should take a look at the CRED data on trends in numbers of health-related events (Evan Mills, Lawrence Berkeley National Laboratory)	Will do for TOD. Please be more specific about what dataset.
1-1209	A	62	7			Although itself a synthesis, perhaps the Climate Change Futures report (October 2005) has something to offer here. (Evan Mills, Lawrence Berkeley National Laboratory)	Rewritten.
1-1210	A	62	8			Section 1.3.7 The last paragraph on top of page 64 is difficult to understand unless more explanation is provided. (Raymond Desjardins, N/A)	OK; Non-substantive
1-1211	A	62	8	68	14	The section on human health contains too much general information on climate sensitivity, and lacks discussion on the detection and attribution question. Much of this material duplicates what is in chapter 8 and should be deleted to focus on the objectives of chapter 1. Many important references are not included, such as those on highland malaria in Africa. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Addressed.
1-1212	A	62	10	62	11	Since Table 1.13 includes both climate change and ENSO, which is a climate variability event, it is suggested to replace climate change by climate variations, so to	Table deleted.

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						read "Human health and climate variations" Regarding the Table 1.13 contents, human health and climate data miss a number of regions where observer cases are registered. This situation suggest to add between the brackets in line 14 (see chapter 8 and regional chapters). This addition may suggest the cancellation of the rather reference-skewed Table 1.13 (Osvaldo Canziani, IPCC)	
1-1213	A	62	10			Insert the following after the pereiod on line 10: "The magnitude of this impact, which is currently small compared tot the total burden of disease (WHO 2002), will depend on adaptive capacity and the extent to which that capacity is employed." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Done
1-1214	A	62	11		12	"These observed changes are related to temperature and precipitation extremes and their resultant adverse impacts on food- and water-borne diseases" Lyme disease p65 linr 43-47, TBE page 66 line 4-6 and HABs Box 1.4 might be change due to trends in climate not only extremes. Therefore introduction should include both trends and extremes (Markus Erhard, Forschungszentrum Karlsruhe)	Addressed.
1-1215	A	62	16	62	16	Not greenhouse-induced but greenhouse gas -induced. (Kaija Hakala, MTT Agrifood Research Finland)	NS; Modified
1-1216	A	62	19	62	19	The year is missing at the reference Kovats, Campbell-Lendrum et al. (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	2001 added
1-1217	A	63	0	63	30	table 1.13 clogs up my printer indefinitely so there could be problems for others in printing this out (Peter Stott, Met Office)	Deleted.
1-1218	A	63	1			Table 1.13. The table is difficult to read. I recommend the authors improve it. (Gregory Beaugrand, univ-lille)	Deleted.
1-1219	A	63	1			Table 1.13 is difficult to read (Raymond Desjardins, N/A)	Deleted.
1-1220	A	63	1			Table 1,13: Title: "Disease studies related to seasonnality and climatic changes" It is not clear if "quantitative assessment" means "significant"modifications during the period of the "climate change"(no dates in the last column) and relations with ENSO does not mean impact of climate change. In the last column what does mean for Vibrio cholera the mention "no climate influence" for the comparison between 1893-1940? (Annick Douguedroit, Université de Provence)	Deleted.
1-1221	A	63	1			Add Craig et al. (2004a and 2004b) to this table. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Deleted.

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1-1222	A	63	1	63		Table 1.13. 2nd row. The Campylobacter study found no effect of climate change, and concluded that future climate change would not effect the seasonality of this disease because the signal was too weak. . (Sari Kovats, London School of Hygiene and Tropical Medicine)	Deleted.
1-1223	A	63	1	63		Table 1.13 should be completely rewritten or deleted. Currently, it includes an arbitrary list of papers, many of which are about association with climate variability not observed climate change. [Only the Rodo paper in fact addressed climate change] The first reference - Benson 2000 is not in the reference list and does not appear to be about disease or health outcome. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Deleted.
1-1224	A	63	2			Table 1.13. I found the presentation of this table a bit confusing. Could the author use the same presentation as in the other tables of the chapter? (Isabelle Chuine, CNRS)	Deleted.
1-1225	A	63	2			Table 1.13. "Water borne disease" instead of "WBD" would be clearer (Isabelle Chuine, CNRS)	Deleted.
1-1226	A	63	3			Table words difficult to read (Geoffrey Levermore, Manchester University)	Deleted.
1-1227	A	64	0	64		1.3.7.1 Analysis of evidence re: ENSO & human health: This section is misleading and must be modified as suggested above. In Himalayan region and over the Indian subcontinent in general, Monsson season with damp and relatively cooler weather is associated with more health problems than hot dry summer climate. In last few years,as many people in India and southeast Asia died of cold spells in winter as during hot summer weather, as people are more acclimatized to long hot summer season than occasional but severe cold spells in short winter season. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Text rewritten.
1-1228	A	64	5	64	5	The viability/capacity of the public health infrastructure (much more than water supply) have been shown to play an important role in defining the impacts of climate change on human health (reference recent publications on the subject from the WHO and others). (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Agreed.
1-1229	A	64	11			Insert the following new para on line 11: "In a two-part study that examined the variation in malaria case numbers due to climatic and non-climatic factors using 30 years data from Kwa-Zulu Natal (KZN), Craig et al. (2004a, 2004b) found that these numbers were significantly associated with mean maximum daily temperatures from January to October of the preceding season and total rainfall during the current summer months of November–March but found no evidence of association between case totals and climate. In KZN, where malaria control operations are intense, climate	Added

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						<p>appears to drive the interannual variation of malaria incidence, but not its overall level. Thus, while climate is a major limiting factor in the spatial and temporal distribution of malaria, many non-climatic factors may alter or override the effect of climate (Craig et al. 2004a, 2004b). These non-climatic factors include, primarily, drug resistance and HIV prevalence and, secondarily, cross-border people movements, agricultural activities, emergence of insecticide resistance and the use of DDT for indoor residual spraying (Craig 2004b, Barnes et al. 2005). {References: [1] Craig MH, Kleinschmidt I, Nawn JB, Le Sueur D & Sharp BL (2004a) Exploring thirty years of malaria case data in KwaZulu-Natal, South Africa: Part I. The impact of climatic factors. Tropical Medicine and International Health, 9, 1247–1257. [2] Craig MH, Kleinschmidt I, Le Sueur D & Sharp BL (2004) Exploring thirty years of malaria case data in KwaZulu-Natal, South Africa: Part II. The impact of non-climatic factors. Tropical Medicine and International Health 9, 1258–1266. [3] Karen I. Barnes, David N. Durrheim, et al. 2005. Effect of Artemether-Lumefantrine Policy and Improved Vector Control on Malaria Burden in KwaZulu–Natal, South Africa. PLoS Medicine DOI 10.1371/journal.pmed.0020330. [4] Patrick E. Duffy and, Theonest K. Mutabingwa. 2005. Rolling Back a Malaria Epidemic in South Africa. PloS Medicine. DOI: 10.1371/journal.pmed.0020368.}</p> <p>(Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	
1-1230	A	64	12			<p>Section 1.3.7.1 needs rewriting. Several statements are unclear. (Raymond Desjardins, N/A)</p>	Rewritten.
1-1231	A	64	12	64	47	<p>In view of the frequent mention of an ENSO/human health (and specifically cholera cases) connection in this section and in its title, some explanation should be given of why there appears to be so little correlation between ENSO and cholera cases in Figure 1.10, p. 65. (Claire Parkinson, NASA Goddard Space Flight Center)</p>	Distinguished between climate variability and climate change impact
1-1232	A	64	14	64	36	<p>Need to be careful about ENSO-linked changes in the context of climate change. The GFDL model shows no change in ENSO from global warming, and a recently published paper (Oldenborgh et al, Ocean Science 1, 81-95, 2005) finds that this result is robust in the IPCC multi-model ensemble, especially when only those models that are the most realistic are considered. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)</p>	Substantive. Text rewritten.
1-1233	A	64	14	64	47	<p>Empirical studies that find an association between an infectious disease and ENSO are not de facto evidence of the early effects of climate change. [For further details on this point - see Kovats et al. 2001]. In fact, the el nino signal will obscure and confound any effect due to the more subtle trend due to global warming. There are</p>	Substantive. Text rewritten.

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						important studies of the effect of climate variability on cholera in Bangladesh - and these studies are reviewed in chapter 8. The text here relies too heavily on a single study (Rodo et al), and requires a more balanced and critical discussion. (Sari Kovats, London School of Hygiene and Tropical Medicine)	
1-1234	A	64	19	64	20	I do not understand the purpose of this sentence here. (Isabelle Chuine, CNRS)	Removed.
1-1235	A	64	29	64	33	Comment is repeated here (David Rind, NASA/GISS)	Unclear.
1-1236	A	64	37	64	37	This paragraph is very confusing. Are the authors implying that climate change has changed the ENSO cycle in south Asia since 1980s? Does this mean that therefore health effects related to the "new"? ENSO patterns are therefore attributed to global climate change? I think this kind of third-level attribution is very weak, and it is not supported by the literature (either the health literature or the climate literature). (Sari Kovats, London School of Hygiene and Tropical Medicine)	Substantive Text rewritten.
1-1237	A	65	26			Fig. 1.10 It appears that the correlation with ENSO is not that clear. Other factors to explain the cholera cases?? (Raymond Desjardins, N/A)	Substantive; removed
1-1238	A	65	26	65		Figure 1.10. This figure should be deleted as it is not relevant. It is just a standard WHO graphic that does not address the climate change question. It would be better to have a map showing the location of the health-cc studies. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Substantive, Removed
1-1239	A	65	26			Figure 1.10. Cholera is first and foremost caused by faulty hygiene. (Richard S.J. Tol, Uni. Hamburg)	Removed
1-1240	A	65	44	65	47	More discussion of observed changes in tick distribution is required here - several key references are missing. The increase in Lyme disease in the US has been attributed to changes in human-tick contact, more houses in scrub/bush land, and a resurgence of deer (reservoir host), and there is no evidence that climate change played a role. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section rewritten by Sari Kovats
1-1241	A	65	50			Section 1,3,7,2: The only mention of a "significant" result in Section 1,3,7 (Annick Douguedroit, Université de Provence)	Section rewritten
1-1242	A	66	0	66		1.3.7.3 Effects of trends in heat & cold stress: Throughout Europe and in higher latitude countries of Northern Hemisphere, cold-related deaths are far more common than heat-related deaths. (see Donaldson et al, 2001, 'Health effects of climate change in UK' p. 70-80, Report to UK Department of Health). In USA, Canada and Europe, fewer heat-related deaths are occurring in recent years due to improved health care & technology (air conditioners etc).	Agreed. Reference now to "Heat and cold stresses"

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						(Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1243	A	66	1	66	2	The Cazelles paper is about the effect of El Nino and not observed climate change. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Sentence cut
1-1244	A	66	9	66	10	Relatively speaking, there has been several papers that address the impact of climate change on highland malaria. This is an important issues and should receive more attention - and a less equivocal conclusion. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Substantive. Section rewritten by Sari Kovats.
1-1245	A	66	9	66	16	Poleward shifts of malaria have been documented, particularly in the former Soviet Union. This is entirely due to the collapse of the health care system. The shift of malaria to the African highlands is fiercely contested; I believe that the data are not there to say anything about this. (Richard S.J. Tol, Uni. Hamburg)	Malaria statements removed.
1-1246	A	66	18			Section 1.3.7.3 rewrite and reverse the sentence: increased mortality was associated with episodes of extremely or extremely cold temperatures. Same thing in the following paragraph. The last paragraph in this section suggests strongly that other factors than climate are operating and acting on death rate. (Raymond Desjardins, N/A)	Text rewritten.
1-1247	A	66	18	66	43	Discuss results reported in the WHO report on Climate Change and Human Health (2004) (Giampiero Maracchi, Institute of Biometeorology)	See health chapter.
1-1248	A	66	18	66	43	Discuss results in M Morabito, P A Modesti, L Cecchi, A Crisci, S Orlandini, G Maracchi, G. F. Gensini, 2005: Relationships between weather and myocardial infarction: A biometeorological approach. International Journal of Cardiology (Giampiero Maracchi, Institute of Biometeorology)	Not observed changes.
1-1249	A	66	18			Are there any global or regional stats on cold mortalities that can be cited in comparison to heat-related events? (Evan Mills, Lawrence Berkeley National Laboratory)	Added.
1-1250	A	66	20	66	43	Need to tackle the question of "harvesting" directly, otherwise the skeptics will pile on. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	See health chapter.
1-1251	A	66	20	66	43	This section should be shortened as it about climate sensitivity and not observed effects of climate change, and duplicates material in chapter 8. However, the studies on observed changes in heat waves, hot days and heat stress indices (e.g. gaffen and ross), as well as the attribution of the 2003 heat wave event in Europe should be discussed somewhere. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section shortened.
1-1252	A	66	26	66	27	"There is evidence of recent increases..... in variability of high temperatures". What	Clarified.

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						exactly is meant here? An increase in the number of high temperature extremes? A broader high tail of the distribution of temperature? This should be clarified. (Nathan Gillett, University of East Anglia)	
1-1253	A	66	26		36	Deaths in winter due to cold in the vulnerable, in fuel poverty, outnumber summer deaths. (Geoffrey Levermore, Manchester University)	Section rewritten
1-1254	A	66	26	66	29	Schar 2004 does not present convincing evidence that the 2003 heatwave was due to an increase in variability rather than an increase in mean temperatures (Peter Stott, Met Office)	Addressed (page 52, line 8)
1-1255	A	66	27			The Alexander et al (JGR 2005 accepted) deals with extreme temperatures and precipitation over the world. Over 70% of the global land area sampled showed a significant decrease in the annual occurrence of cold nights and a significant increase in the annual occurrence of warm nights. Some regions experienced a more than doubling of these indices. This implies a positive shift in the distribution of daily minimum temperature throughout the globe. (Matilde Rusticucci, Universidad de Buenos Aires)	This is a WGI topic. See WGI.
1-1256	A	66	30	66	30	Another study showed that the 2003 heat wave was the hottest since 1370 (Chuine I, Yiou P, Viovy N, Seguin B, Daux V, Le Roy Ladurie E. 2004 Nature 432:289-290. (Isabelle Chuine, CNRS)	Relevant to WGI.
1-1257	A	66	30	66	30	"since 1500" but earlier in this chapter there is a reference to this but in terms of it being the hottest summer since at least 1500. I think the reference to 1500 must be completely consistent between these places. (Jeremy Kerr, University of Ottawa)	Cited only in one place.
1-1258	A	66	30			Why cite only the mortalities in France when we have a full European count? Also, I have heard much larger numbers for France alone. Is the source you selected the most authoritative? (Evan Mills, Lawrence Berkeley National Laboratory)	Authoritative source for French citation.
1-1259	A	66	32			this reference does not appear in the reference list and its spelling is suspect. (Ian Burton, University of Toronto)	References corrected.
1-1260	A	66	37	66	43	Access to air conditioning is not universal, even in Europe and the US, potentially adding to disparities in impacts. (Kimberly Hall, Michigan State University)	Revised.
1-1261	A	66	39			air conditioning (and consequent increased CO2 emissions, see WGIII Chap 6) (Geoffrey Levermore, Manchester University)	Will add in TOD.
1-1262	A	66	42			what is the significance of "southern regions"? Is it because they are warmer? What is the role of adaptation in heat and cold related stress/deaths? Some studies seem to suggest that in Canada winter deaths are decreasing and summer deaths increasing.	Added.

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						(Ian Burton, University of Toronto)	
1-1263	A	66	42	66	43	Winter cold decreases in mortality are not sufficiently deal with in this short section. Such reductions are likley to exceed any increased mortality duting the summer months for many mid latitude areas and have significance for many areas of health care provision. Such winter reductions deserve some mention in this section to counterbalance the 'headline heat wave' material. (John Sweeney, National University of Ireland, Maynooth)	See Chap 8 Health
1-1264	A	66	44			Add a para on line 44 dealing with the health effects of extreme cold. This should note that extreme cold is a factor in mortality and mortality in the northern climates. The increase in life expectancies in indigenous populations in the Arctic, for instance, could partly be due to reductions in these risk factors due to warming. [See the references provided in comment 39.] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	See Chap. 8 Health
1-1265	A	66	45	67	8	Although ground water contamination with heavy metals (i.e. Arsenicum) is indirectly related to climate change, but related to WEHAB, reference on diseases resulting from groundwater mining is necessary (Arsenic 's fatal legacy, New Scientist, August 2003; "Insidious Contamination, The Atlas of Water. Earthscan, 2004, pages 56 and 57, Sc. American January 2005) (Osvaldo Canziani, IPCC)	See Chap. 8 Health
1-1266	A	66	47	67	8	Again, this section describes studies of foodborne disease and short term climate variability and not climate change. - which may confuse a non-expert reader. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Text revised.
1-1267	A	67	5			All of the really high profile cases of E coli outbreaks in Canada recently have been due to gross mismnagement of land use and have nothing, or almost nothing, to do with climate change. I believe this reference should be omitted or clarified. (Jeremy Kerr, University of Ottawa)	Caveat included that "this cannot be attributed to climate change."
1-1268	A	67	10			Box 1.4. Harmful Algal Blooms. The authors should also state that eutrophication is seen by many authors to have had an effect on the proliferation of HABs. (Gregory Beaugrand, univ-lille)	Address in TOD. Text rewritten.
1-1269	A	67	10	67	25	I don't think this is a consensus view. Again, changes in nutrient supply, particularly in the Si:N ratio have also been implicated in harmful algal blooms. See for example, Humborg et al., Ambio:Journal of the Human Environment: Vol. 29, No. 1, pp. 45-50. Insofar as the studies suggesting otherwise are correlative, they are not attributive. (Anand Gnanadesikan, NOAA/Geophysical Fluid Dynamics Laboratory)	Added comment.
1-1270	A	67	10			Comment on Box 1.4. There should be some information (numbers, for instance) attached to this box so the reader can gauge how serious a threat algals blooms pose, in light of all the other serious threats that are rampant.	Address in TOD.

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						(Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-1271	A	67	10	67	26	Surely, algae blooms are related to eutrophication as well. (Richard S.J. Tol, Uni. Hamburg)	Will add in TOD.
1-1272	A	67	11	67	26	box 1.4. This is an interesting and useful box ..but HABs do not pose a "serious" threat to human health. Not all HABs produce harmful toxins, and in many areas routine monitoring prevents toxic shellfish from entering the food chain. Further, toxins occur without the occurrence of HABs. Were any empirical studies on this distribution of temperate shell fish poisoning found? (Sari Kovats, London School of Hygiene and Tropical Medicine)	Removed "serious."
1-1273	A	67	29	67	44	A place to remark the increasing surface ozone contamination by VOC's under warmer atmosphere conditions, shall be found. (Osvaldo Canziani, IPCC)	Not an observed change.
1-1274	A	67	29			Section 1.3.7.5 Consider renaming this "Respirator Disease" so that you can include other factors such as smoke from wildfires as well as molds and other climate-related aeroallergens. I believe that heat also contributes to respiratory disease. (Evan Mills, Lawrence Berkeley National Laboratory)	Will consider for TOD.
1-1275	A	67	29			If the following section (1.3.8) does not include health/life impacts of disasters, then you may want to add something to this section. (Evan Mills, Lawrence Berkeley National Laboratory)	Section on Diseases of wildlife added(1.3.7.6)
1-1276	A	67	31	67	32	I would add "consistently with the advancement of the flowering (see section 1.3.5)" (Isabelle Chuine, CNRS)	Will address in TOD.
1-1277	A	67	35			Statement on pollen conflicts with statements on p 51, line 28-29. (Kimberly Hall, Michigan State University)	Will address in TOD.
1-1278	A	67	42			Did only Gyan reported this increases or all the authors? In this latter case, remove "Gyan(" ...keep the reference... ")" (Bernard Clot, MeteoSwiss)	Text revised. References added.
1-1279	A	67	43	67	44	"have been attributed to increase in Sahara dust, which has in turn, been attributed to climate change". Which studies attribute an increase in Saharan dust to climate change? Is the link statistically significant? I am doubtful whether changes in Saharan dust reaching the Caribbean really can be attributed to anthropogenic climate change. (Nathan Gillett, University of East Anglia)	Substantial; statement modified.
1-1280	A	67	44	67	44	A reference relating Saharan dust change to climate change should be included here (David Rind, NASA/GISS)	Reference added.
1-1281	A	67	46	68	4	There are adaptation measures to reduce risk due to heat waves in France (legislation) see e.g. unfccc.int/files/meetings/workshops/other_meetings/application/vnd.ms-powerpoint/planton.ppt This example show that states and other institutional organizations can react on impacts but this depends on their adaptive capacity. This	Text rewritten.

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						would support the last statement of increase vulnerability in developing countries (Markus Erhard, Forschungszentrum Karlsruhe)	
1-1282	A	67	48	68	4	Replace this para with the following: "For each adverse climate change-related health outcome, GENERALLY several adaptation OPTIONS exist. These include instituting adaptive health policies, strengthening of the public health infrastructure, improving health-oriented management of the environment such as air, water, food and vector issues THROUGH PRACTICES SUCH AS EARLY WARNING SYSTEMS, SURVEILLANCE AND TRACKING, AND FOLLOW-UP. THERE SHOULD BE EMPHASIS ON BOTH PREVENTION AND CURE. IT IS IMPERATIVE TO CONSIDER COSTS IN IMPLEMENTING SUCH ADAPTIVE MEASURES, PARTICULARLY IN DEVELOPING COUNTRIES SINCE THEIR HEALTH BUDGETS ARE TYPICALLY VERY THIN. SOME MEASURES MAY LOSE EFFICACY DUE TO THE DEVELOPMENT OF RESISTANCE OR MAY HAVE SOME ADVERSE SIDE EFFECTS. HOWEVER, ESCHEWING THEM WITHOUT CONSIDERING THE IMPACTS AND EFFICACY OF SUBSTITUTE MEASURES MAY CAUSE MORE HARM THAN GOOD -- A FORM OF MALADAPTATION (Goklany 2001, 2002a)." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Not related to observed changes.
1-1283	A	67	48	68	4	It is not clear what type of evidence should be presented in this section. For example, the fact that most European cities have a heat health warning system in place post 2003 is clearly an adaptation to climate change. If someone bothered to look, there would probably be health related responses, such as buying hay fever medication earlier in the season. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Text rewritten.
1-1284	A	68	0	72		1.3.8 Disasters & Hazards: Once again, this section is written in general terms with no substantive evidence of climate change impact. The European river floods must be examined in the context of river management and development of infra-structure around European rivers. The Mississippi river flood (1993) was exacerbated due to improper managemnet and riverside development. Extra-tropical cyclones are on the decline and a study by Bijl et al (1999,Climate Research, 11, 161-172) concludes a small weakening of storms in southern North Sea over the past 100 years. Tropical cyclone activity in the North Atlantic may have increased due to regional climate change, however, the Bay of Bengal with high SSTs (~29C and higher) has not developed intense cyclones in last 15 years. Increased economic losses due to extreme weather are primarily due to societal change and NOT due to global warming (Changnon, 2003, Natural Hazarads, Vol. 29, p. 273-290). US east coast damage due to storms (Zhang et al, 2000) may be as much due to coastal	Text rewritten.

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						management as due to regional sea-level rise. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1285	A	68	0	68		1.3.7.8 summary: This must be changed and reference to ENSO-related health hazards must be deleted. In last few years, human health world-wide has improved due to improved technology and living conditions, especially in Third World countries. The biggest world-wide health concern today is the possible outbreak of bird flu and related epidemics, these epidemics being primarily due to societal change, globalization etc. Recent global warming and climate change do not pose a human health hazard at present or in future. This aspect of human health must be brought out here. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Text rewritten.
1-1286	A	68	0	72	0	Sections 1.3.8 This is a very useful compilation. Can it go one step further and identify what else is needed to get definitive statistical evidence on attribution to climate change. That could feed into recommendations on future research. (Merylyn McKenzie Hedger, Environment Agency)	Section rewritten.
1-1287	A	68	2	68	3	According to Sutherst (2004), "Efforts to eradicate malaria with insecticides failed in many regions due to the withdrawal of DDT, the development of resistance to the pesticides, or the reintroduction of the mosquitoes from other areas." I am sure there were areas where resistance to DDT had developed (especially it was used for broad agricultural applications, but in other places it was withdrawn for other reasons. And, for instance, when it was reintroduced in KZN, malaria cases dropped (see Barnes et al. 2005; Craig et al. 2004b; references provided above.) (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Text rewritten.
1-1288	A	68	8	68	14	This summary is rather weak, and again, I feel that it doesn't do justice to the published literature. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Section rewritten
1-1289	A	68	17	72	21	It goes without saying that the recent environmental disasters call for reference in this section. Again, cross reference to regional chapters is necessary. (Osvaldo Canziani, IPCC)	Will address in TOD.
1-1290	A	68	17			I would strongly recommend not limiting the scope of this section to "Rapid-onset meteorological catastrophes", or to add a new section 1.3.8 describing small-scale meteorological events. There are vast numbers of "every-day" weather-related events that also cause physical/economic losses for humans. Examples include roadway hazards, soil subsidence, lightning, localized storms, localized floods, ice storms, mudslides, permafrost melt, etc., etc. Depending on the "threshold" used when defining "disaster", the cumulative effect of these smaller events can be as or more costly in a given year than those from disasters. Of the total global weather-related	Will reference smaller events. However it is not clear the record of such events is comprehensive back in time, and therefore it is very difficult to determine whether it is the small events or the tendency to seek compensation through insurance that has increased.

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						losses from Munich Re, a full 60% are from "small" events, and this is itself an underestimate since not all events are included in their database (about 14,000 between 1980 and 2004). It can be argued that small-scale events are easier to insure, yet they are also more pervasive and pose material costs. (Evan Mills, Lawrence Berkeley National Laboratory)	
1-1291	A	68	17	72	21	The sub-chapter heading is misleading. The text deals mostly with hazard events. There is very little reference to disasters as the impact of hazard events on society (B Wisner et al, At Risk, 2004 summarises the extensive literature on this). See also following comments on parts of this sub-chapter. (John Twigg, Benfield Hazard Research Centre)	Agreed – will avoid using ‘disasters’
1-1292	A	68	17			Section 1.3.8 has none of the subtlety and complexity of the treatment of disasters in chapter 20 (section 20.5). The tiny paragraph on human adaptation to hazards tacked on to the end of chapter 1 (section 1.4.7.3) is hardly sufficient to balance the impression given in section 1.3.8 that extreme climatic events cause disasters, and that human beings and their institutions are either not involved or irrelevant – “as straw dogs to the gods” in the words of Lao Tse. This is a very mistaken impression to give the reader. Therefore, at a very minimum I would suggest cross referencing the treatment of disasters in chapter 20. The tiny paragraph on human adaptation to hazards tacked on to the end of chapter 1 (section 1.4.7.3) is hardly sufficient to balance the impression given in section 1.3.8 that extreme climatic events cause disasters, and that human beings and their institutions are either not involved or irrelevant – “as straw dogs to the gods” in the words of Lao Tse. This is a very mistaken impression to give the reader. Therefore, at a very minimum I would suggest cross referencing the treatment of disasters in chapter 20. (Ben Wisner, London School of Economics & Benfield Hazard Research Centre)	Agreed – will avoid using ‘disasters’.
1-1293	A	68	19			It would be appropriate to note here that global data from EM-DAT that aggregate deaths and death rates due to climate-related extreme events have been dropping since the early decade of the last century. See comment 13. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	This dataset has been employed extensively within forthcoming RMS publication on ‘Global Normalized Catastrophe costs’ paper – to be referenced in this section.
1-1294	A	68	19	7	12	It was not clear to me why there is a review of the methods of detecting the observed changes. Is it to define the studies that will be included into further analysis, or to make sure that the reader has an overview of the type of data available. If it is the latter may be this section could be synthesised. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Cross reference with WG 1.
1-1295	A	68	19	68	20	It may be worth mentioning that the definition of a "disaster" varies - and that the	‘disaster’ removed.

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						definition used always includes the human impacts (e.g. as recorded in the disaster databases held by WMO, emdat, munich re, etc). It is not clear what definition is used in this section. (Sari Kovats, London School of Hygiene and Tropical Medicine)	
1-1296	A	68	19	68	26	The notion of 'catastrophe' is problematic and the term is not explained. Social and natural sciences (and indeed insurers) may have different definitions. Social science (particularly sociological) writings on disasters differentiate between disasters and catastrophes. There should be more clarity about terms here. (John Twigg, Benfield Hazard Research Centre)	'catastrophe' removed.
1-1297	A	68	22	68	22	"...probabilities of 5-10%": per year? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Text rewritten.
1-1298	A	68	23			might note that building standard and construction quality trend to be significantly lower in developing countries. (Ian Burton, University of Toronto)	Text rewritten.
1-1299	A	68	23			The comment on buildings only applies in (parts of) the industrialized world (Evan Mills, Lawrence Berkeley National Laboratory)	Text rewritten.
1-1300	A	68	24			Section 1,3,8: "Given that a strong rise in global temperatures (add: associated) with a climate change, only began in the 70's.." (Annick Douguedroit, Université de Provence)	Edited.
1-1301	A	68	24	68	25	Replace "...there is a fundamental problem in demonstrating..." with "... it is difficult to demonstrate ..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	See forthcoming RMS publication referenced above.
1-1302	A	68	24	68	26	Note that the historical record of disasters' socio-economic impact is also very unreliable before the 1970s. For more on this, and the matter of disaster impact data generally (which is wholly overlooked in the sub-chapter), the authors should consult the Centre for Research on the Epidemiology of Disasters at the University of Louvain (http://www.cred.be), which hosts the main global database. The recent outputs of the ProVention Consortium's 'global hotspots' project should also be read (http://www.proventionconsortium.org/projects/identification.htm). (John Twigg, Benfield Hazard Research Centre)	See reference to forthcoming RMS publication which reviews this.
1-1303	A	68	24			please confirm that a strong rise in global temperature only began in the 1970s or in the 1980s. (Bangzhong Wang, China Meteorological Administration)	Confirmed.
1-1304	A	68	26	68	26	Please add the year 2001 to this reference. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Fixed.
1-1305	A	68	26	68	26	The year is missing at the reference Frei and Schar (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Fixed.

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1-1306	A	68	29			The term "peril" is used here; "hazard" in section heading. Clarify definitions/jargon for uninitiated readers. (Evan Mills, Lawrence Berkeley National Laboratory)	Clarify definitions.
1-1307	A	68	38	68	38	Please cross check the contents of this Section 1.3.8.1 on floods with the contents of WG2 Chapter 3 on water resources. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Will check in TOD.
1-1308	A	68	38			Section 1.3.8.1 what means « coterminus US »? (Raymond Desjardins, N/A)	Text rewritten.
1-1309	A	68	38	69	32	I get the impression that there are no real data here, but natural fluctuation. This chapter could be reduced to one third, with clear reference to natural change. (Kaija Hakala, MTT Agrifood Research Finland)	Text rewritten.
1-1310	A	68	38	69	32	Is this discussion internally consistent with statements elsewhere in the chapter that global runoff has increased? (Evan Mills, Lawrence Berkeley National Laboratory)	This section documents extremes. The hydrology section documents changes in runoff means.
1-1311	A	68	38	71	18	It is surprising that drought does not feature in this discussion of hazard types. (John Twigg, Benfield Hazard Research Centre)	Section 1.3
1-1312	A	68	40	68	40	Please add the year 2004 to this reference. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Fixed.
1-1313	A	68	40	68	50	It's important that time frames be given here (not just later in the paragraph). For instance, on lines 42-43, the statement that "certain classes of flood were found to be less frequent" needs to be extended to include the two time periods being compared. (Claire Parkinson, NASA Goddard Space Flight Center)	Clarified.
1-1314	A	68	40	68	40	The year is missing at the reference Kundzewicz (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Fixed.
1-1315	A	68	42			I would replace the sentence on lines 42 and 43 with the following quote from Kundzewicz's abstract, which would provide the reader with a road map regarding the detailed discussion below: "The analysis of 195 long time series of annual maximum flows... does not support the hypothesis of general growth of flood flows. Even if 27 cases of strong, statistically significant increase have been identified... there are 31 decreases as well, and most (137) time series do not show any significant changes. Some regional patterns have been observed. However, a caution is needed, that in case of strong natural variability, a weak trend, even if it exists, cannot be detected by statistical testing." I would, however, replace "cannot" in the last sentence with "may not". (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Cross ref with Chapter 3 in TOD and explain that picking the decade of the maximum is sampling further into the tail of extremes than looking for an overall trend across all return periods.
1-1316	A	68	42	68	43	Less frequent than what (or when)? (David Rind, NASA/GISS)	Edited.

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1-1317	A	68	48	68	48	Typo in "conterminous". (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Edited.
1-1318	A	69	0			The text on p. 69 should be simplified (Raymond Desjardins, N/A)	Edited and cross-ref with Chapter 3
1-1319	A	69	0			The lack of commas on this page made is hard to understand - I know I should not comment on grammar but it was so hard to get in places here that I can't easily comment on content! (Jeremy Kerr, University of Ottawa)	Edited.
1-1320	A	69	1	69	10	The value for the 1960s should be given in this paragraph as well. (David Rind, NASA/GISS)	Edited.
1-1321	A	69	7	69	7	The year is missing at the reference Mudelsee, Borngen et al.), (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Reference removed.
1-1322	A	69	10			Long term time series of river flows exist for some of the italian rivers such as Po, Arno, Tiber. No detailed analysis of time series has been published as far as I know, but internal reports of the Basin Authorities show decreasing trends in the flow detected in natural areas far from towns and preserved by hand made manufacts such as dams,with possible links with less precipitation. (Giampiero Maracchi, Institute of Biometeorology)	Not sure how this could be used. Please provide actual references.
1-1323	A	69	12	69	12	No reference is listed, but I assume that this is Nature 415, 514-517 (2002). (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Addressed.
1-1324	A	69	12			The relevance of the date "1953" is unclear from the text --is this the midpoint of the study period? (Kimberly Hall, Michigan State University)	Edited and addressed.
1-1325	A	69	12	69	24	As Milly et al. did not have long, homogenous time series on these rivers, they cannot have estimated the 100-year flood with any confidence. (Richard S.J. Tol, Uni. Hamburg)	Checked and clarify. Confidence level included.
1-1326	A	69	12	69	12	The year is missing at the reference Milly et al (Munk) (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Fixed.
1-1327	A	69	34	71	18	these two section seems to locate in the relevant parts of IPCC WGI report. It is necessary to keep the same or similar conclusion between two working groups' reports. (Bangzhong Wang, China Meteorological Administration)	Cross ref to WG1 in TOD.
1-1328	A	69	36	69	38	This sentence shoud be rewritten for clarity: what is being said about storms in which western European countries? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Sentance rewritten.
1-1329	A	69	36	69	37	English needs correcting here (David Rind, NASA/GISS)	Sentance rewritten.

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1-1330	A	69	40	69	40	Isn't there any more comprehensive (beyond 1980) and more recent literature (after 1998) on extratropical cyclones in Europe? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Section rewritten. Please provide individual references.
1-1331	A	69	40			Although this may go without saying, I presume some mention of this year's incredible Gulf of Mexico storm season will come up here? (Jeremy Kerr, University of Ottawa)	Included in tropical cyclones section.
1-1332	A	69	42	69	42	I consider it is not necessary include 'at nadir' in this phrase because no reference there is here to satellital observation. (Sergio Alonso, Universitat de les Illes Balears (University of the Balearic Islands))	Clarify this is storm pressure nadir – ie lowest pressure of an ETC storm
1-1333	A	69	44	69	45	"... major damaging and loss causing storms" this is too anecdotic: how damaging, how large were the economic losses? References? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Clarified.
1-1334	A	69	44	69	45	"Damaging" and "loss causing" are most often the same thing. If the text of chapter 1 should be half of the present length, then this kind of litterature style should be omitted. (Kaija Hakala, MTT Agrifood Research Finland)	Clarified.
1-1335	A	69	45	69	45	"wave heights increased" by how much, and is this significant? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Section rewritten.
1-1336	A	69	46	69	48	Reference for this "strong correlation"? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	OK
1-1337	A	69	46	69	46	The year is missing at the reference Woolf, Challenor et al.). (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Edited.
1-1338	A	69	49	70	2	So there has been a decline, but I am still unclear as to what the role of natural variability is in extratropic cyclone activity/intensity, as opposed to (human induced) climate change. Can you please explain what the conclusion would be on the basis of the text of this Section 1.3.8.2? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Most likely natural variability
1-1339	A	69	49	69	49	Again, how much damage? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	clarify
1-1340	A	69	50	70	1	Is this decline statistically significant ? (Peter Stott, Met Office)	Check and clarify
1-1341	A	70	4	70	4	Section 1.3.8.3: please bring these contents in line with relevant chapters in WG1, in particular since there is currently much debate in the literature on the links between climate change and hurricanes. I also note that some crucial references on this topic are missing, e.g. Trenberth, K.E. (2005). Uncertainty in hurricanes and global warming. Science 308, 1753-1754. http://dx.doi.org/10.1126/science.1112551 ; Webster, P.J., Holland, G.J., Chang, H.R. (2005). Changes in tropical cyclone	Link with WG 1 and add new relevant refs. Will establish link in TOD.

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						number, duration, and intensity in a warming environment. Science 309, 1844-1846. http://dx.doi.org/10.1126/science.1116448 (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	
1-1342	A	70	4			Section 1.3.8.3 there is actually not much difference between the period 1950-1955, with 60 % of the years with high activity, and the period 1956-1994, with 70% of the years with high activity. (Raymond Desjardins, N/A)	Checked and clarified.
1-1343	A	70	4	71	18	Webster et al., Science, 2005 should be cited and discussed somewhere in this section. (Nathan Gillett, University of East Anglia)	Cited. Mistake was made though in END NOTE. Will correct in TOD.
1-1344	A	70	4			Section 1.3.8.3: For information on changes to cyclone activity in the Southern Hemisphere see Hennessy KJ (2004) Climate change and Australian storms. Proceedings of the International Conference on storms, Brisbane, 5-9 July, 2004 and Kuleshov YA (2003) Tropical cyclones in the Southern Hemisphere: influence of the ENSO phenomenon. In Seventh International Conference on Southern Hemisphere Meteorology and Oceanography, 24-28 March 2003, Wellington NZ, 202-203 (Lesley Hughes, Macquarie University)	Grety Literature. Please provide hard copies.
1-1345	A	70	4	71	18	This, generally well written section requires updating to incorporate the 2005 hurricane season. (John Sweeney, National University of Ireland, Maynooth)	Done
1-1346	A	70	6	70	16	Include citations to recent Nature (Emanuel) and Science papers (Peter Stott, Met Office)	Done.
1-1347	A	70	7			Has volatility itself been changing? (Evan Mills, Lawrence Berkeley National Laboratory)	At landfall it appears so – will do in TOD.
1-1348	A	70	7	70	7	The year is missing at the reference Pielke, Landsea et al.), (Sabine Wurzler, North-Rhine Westphalia State Environment Agency)	Fixed.
1-1349	A	70	12	70	12	This reference (HURDAT 2005) cannot be found in the reference list. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Fixed.
1-1350	A	70	14	70	16	Can this statement on the link between sea surface temperature and hurricane activity be substantiated with a reference? For example: Pielke Jr., R.A., Landseas, C.N. (1999). La Niña, El Niño and Atlantic hurricane damages in the United States. Bulletin of the American Meteorological Society 80(10), 2027-2033. <a href="http://dx.doi.org/10.1175/1520-0477(1999)080<2027:LNAENO>2.0.CO;2">http://dx.doi.org/10.1175/1520-0477(1999)080<2027:LNAENO>2.0.CO;2 . Also, I do not see how Figure 1.11 supports this statement. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Emanuel reference cited.
1-1351	A	70	14	70	14	"more than 4", but the figure shows a level of just over 3 (Figure 1.11c). What is the correct number?	Figure cut.

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						(Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	
1-1352	A	70	16	70	16	The multi-decadal cycle in SST in the North Atlantic should have a reference given for it. (David Rind, NASA/GISS)	Done
1-1353	A	70	18			Shouldn't Webster et al (Science 309:1844) be cited/discussed as well? (Evan Mills, Lawrence Berkeley National Laboratory)	Reference mentioned. Mistake was made in END NOTE for paranthetical citation.
1-1354	A	70	18	70	28	Fig 1.11a Why do the numbers not add up to 100% ? (Peter Stott, Met Office)	Because of earlier decades not shown – will clarify
1-1355	A	70	41	70	41	I am uncertain what is being plotted in Figure 1.11a. If it's the percent of European rivers having a record of the annual maximum daily flow, then it would be much clearer to state it that way, both in the caption and in the figure itself. (Claire Parkinson, NASA Goddard Space Flight Center)	Figure cut.
1-1356	A	70	48			For clarity, insert word "rising" between "tropical" and "sea-surface" (Evan Mills, Lawrence Berkeley National Laboratory)	Section rewritten.
1-1357	A	71	2	71	2	Replace "measured" by "observed". (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Edited.
1-1358	A	71	5	71	5	Delete "(prior to 1970)". (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Done.
1-1359	A	71	5			delete (prior to 1970) (Lesley Hughes, Macquarie University)	Done.
1-1360	A	71	5	71	5	don't eed the paranethetic prior to 1970, as it's already included in the sentence. (David Rind, NASA/GISS)	Edited.
1-1361	A	71	9	71	18	Discuss trends, if any, in associated phenomena (storm speed, precipitation, storm surge) (Evan Mills, Lawrence Berkeley National Laboratory)	No refs on this mention links with other parameters.
1-1362	A	71	12	71	18	Please give references for these statements. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Done.
1-1363	A	71	15	71	16	Is this decrease from 25% to 15-20% significant? This pattern discussion should definitely be altered to include the 1005 season. (David Rind, NASA/GISS)	Section rewritten.
1-1364	A	71	17			This will probably need to be updated after conclusion of the 2005 season. (Evan Mills, Lawrence Berkeley National Laboratory)	Section rewritten.
1-1365	A	71	18	71	18	Could we add here the number of hurricanes in the US territory, and Mexican gulf in 2005? (22 by 24.10.2005) (Kaija Hakala, MTT Agrifood Research Finland)	Section rewritten.
1-1366	A	71	18			At this point general consideration on hurrican/typhoon 2005 season can be added	Section rewritten.

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						considering both Atlantic and Pacific Ocean (Giampiero Maracchi, Institute of Biometeorology)	
1-1367	A	71	20	71	20	Please make a cross reference to the relevant sections in WG2 Chapter. Additionally, many very relevant references to recent peer reviewed articles are missing, some of which are mentioned in the following comments. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Cross ref Chapter 7
1-1368	A	71	20	71	20	IPCC TAR Chapter 8 did not state that there is an apparent exponential increase. Please rephrase, or delete the reference to IPCC TAR WG2 Chapter 8. Also, these data should be updated. What are the latest insights from e.g. Munich Re in global catastrophic losses since the IPCC TAR? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Clarified and edited – also mention latest M Re data –check exactlt what was mentioned in TAR
1-1369	A	71	20			Section 1.3.8.4 In this section, there is likely a greater relation between human behavior and loss size than between climate and loss size. What do you want to demonstrate with the paragraph on top of p. 72? (Raymond Desjardins, N/A)	Normalized results included.
1-1370	A	71	20	72	21	Attribution of economic losses to climate change over time is very difficult as descibed in the text. Trends in number of (catastrophic) events as available from different data bases (MuRe, University of Louvain, Belgium) may be more feasible to assess trends in climate change than evaluation of economic losses alone. One or two paragraphs describing trends in numbers of events may help for a better understanding of trends (Markus Erhard, Forschungszentrum Karlsruhe)	Normalized results used.
1-1371	A	71	20	72	21	Insurance losses seem out of place here. Could be omitted. (Kaija Hakala, MTT Agrifood Research Finland)	Disagree. Reference as being helpful for estimating economic losses.
1-1372	A	71	20	72	21	If economic impacts are addressed, which are affected by non-climate factors, then so should trends in mortality from disasters- there is some literature on this. Although the major determinant is population growth and population movement. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Disagree. Mortality is even more difficult to normalize because of significant improvements in providing protection and warnings
1-1373	A	71	20	72	21	some monetary values of insurance payouts would be useful to show the scale (Geoffrey Levermore, Manchester University)	Please give some examples.
1-1374	A	71	20	72	21	Refers only to economic and insurance losses, not the wider socio-economic impacts. This also has the effect of marginalising developing countries, where most of those affected by disasters live. (John Twigg, Benfield Hazard Research Centre)	Took out mention of disasters and acknowledged that the economic costs biases the sample.
1-1375	A	71	22			following. It might be good to cite contrary interpretations even if only to refute them. There is widespread belief that increasing disaster losses can e attributed to climate change.	Ref to RMS Normalized loss paper that covers this included.

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						(Ian Burton, University of Toronto)	
1-1376	A	71	22			As noted in the following paragraph, "All" is probably not the correct word. (Evan Mills, Lawrence Berkeley National Laboratory)	Edited.
1-1377	A	71	23	71	23	"Numeraire". Recommend avoid using non-english terms. (Jeremy Kerr, University of Ottawa)	Deleted.
1-1378	A	71	25	71	26	Please support this statement on consistency and homogeneity with a reference. Also, Munich Re has tried to overcome the issue of reporting by only including so-called "great natural catastrophes" in their numbers, this should be mentioned, see IPCC TAR WG2 Chapter 8. Moreover, I would argue that consistency and homogeneity is just one issue on this topic related to the increasing losses. A much more pressing issue is whether the increase losses can be attributed to climate change. This topic is not included here, but should be, as there is a lively debate going on. See also Chapter 14, Section 14.3.6 on human settlements. See also these papers, and the references therein: Mills, E. (2005). Insurance in a climate of change. Science 309, 1040-1044. http://dx.doi.org/10.1126/science.1112121 ; Pielke Jr., R.A., Agrawala, S., Bouwer, L.M., Burton, I., Changnon, S., Glantz, M.H., Hooke, W.H., Klein, R.J.T., Mileti, D., Sarewitz, D., Tompkins, E.L., Stehr, N., Von Storch, H.(2005). Clarifying the attribution of recent disaster losses: a response to Epstein and McCarthy. Bulletin of the American Meteorological Society 86(10), 1481-1483. http://dx.doi.org/10.1175/BAMS-86-10-1481 (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Included refs and short summary of the debate along with RMS publication on Normalized losses.
1-1379	A	71	25			"issues around consistency and homogeneity". Surely the main issue here is increases in exposure? This should be stated more clearly here. (Nathan Gillett, University of East Anglia)	Clarified
1-1380	A	71	26			Agreed, although Changnon does state that insurance data are the best data of this kind. D. Changnon, BAMS 1231 (2003). (Evan Mills, Lawrence Berkeley National Laboratory)	Clarified
1-1381	A	71	28	71	29	This sentence does not make sense. What is probably meant, is that losses are more prominent when they are covered by insurance. Penetration is higher for windstorm losses than for flood losses. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Clarified
1-1382	A	71	28	71	30	Not clear what these sentences mean - need to differentiate storm loss from flood loss in the reader's mind. (David Rind, NASA/GISS)	Clarified
1-1383	A	71	34	71	35	Although I would agree with this observation, it needs to be substantiated, either by a reference or an example.	Clarified with ref on GDP and insurance penetration

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						(Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	
1-1384	A	71	34		35	Yes, in absolute terms, although it may be important to note that economic impacts in terms of erosion or slowing of GDP tend to be much greater in developing countries. (Evan Mills, Lawrence Berkeley National Laboratory)	Clarified
1-1385	A	71	37	71	37	So what happened in 1990? For what reason can we assume that data since the is complete? This year seems to be arbitrary, as Munich Re's loss data for instance, is quite well established for large catastrophes since the 1980s. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Used ref to RMS study which has greater detail on completeness through time
1-1386	A	71	37		46	Countervailing factors are also at work and should be mentioned, e.g. improved building codes, disaster preparedness, crop protection, reduced insurance limits and increased premiums, etc., etc. (Evan Mills, Lawrence Berkeley National Laboratory)	Clarified
1-1387	A	71	40	71	46	This links to the attribution issue (see my comment 26). Please add references, such as IPCC TAR WG2 Chapter 8; Raghavan, S., Rajesh, S. (2003). Trends in tropical cyclone impact: a study in Andhra Pradesh, India. Bulletin of the American Meteorological Society 84(5), 635–644. http://dx.doi.org/10.1175/BAMS-84-5-635 ; Pielke Jr., R.A., Agrawala, S., Bouwer, L.M., Burton, I., Changnon, S., Glantz, M.H., Hooke, W.H., Klein, R.J.T., Mileti, D., Sarewitz, D., Tompkins, E.L., Stehr, N., Von Storch, H.(2005). Clarifying the attribution of recent disaster losses: a response to Epstein and McCarthy. Bulletin of the American Meteorological Society 86(10), 1481-1483. http://dx.doi.org/10.1175/BAMS-86-10-1481 ; Bouwer, L.M., Vellinga, P. (2002). Changing climate and increasing costs: implications for liability and insurance. In: Beniston, M. (ed.) Climatic Change: Implications for the Hydrological Cycle and for Water Management. Kluwer, Dordrecht, 429-444. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Check for TOD.
1-1388	A	71	44			"in Florida" (Lesley Hughes, Macquarie University)	Edited.
1-1389	A	71	48			The last paragraph, on page 71, is more impact, and it is not related with the formation of hurricanes (Raymond Desjardins, N/A)	Shorten and refenced.
1-1390	A	72	0	73		1.3.9 Socio-economic indicators: There are well documented examples and studies (not all published) showing beneficial impact on energy consumption during winter months in high latitude regions. The energy saving in house heating in winter would more than offset increased energy cost in summer (air conditioners etc) because mean summer temperatures have declined in many mid- and high-latitude countries in recent years as a result of climate change. Global tourism will possibly benefit due	Section rewritten.

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						to warmer winters of high-latitude regions of North America and Europe (see Scott et al, 2004, Climate Research, 27, p. 105-117). (Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1391	A	72	5	72	6	How can a trend be constructed from only three events? It may perhaps be that these losses are unprecedented. And what does it mean that there is no accompanying increase in the frequency of large floods in central Europe (please elaborate), see Mudelsee, M., Börngen, M., Tetzlaff, G., Grünewald, U. (2003). No upward trends in the occurrence of extreme floods in central Europe. Nature 425, 166-169. http://dx.doi.org/10.1038/nature01928 (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Clarified distinction between overall trend and occurrence of most extreme events.
1-1392	A	72	9	72	15	Needs to be updated to include Katrina. The very relevant point here is that it is indicative of how natural climatic effects can have severe impacts even in industrialized countries like the U.S. (so much for U.S. invulnerability in the face of climate change). (David Rind, NASA/GISS)	Done.
1-1393	A	72	13		14	This Downton and Pielke article applies ONLY to the US and only to certain hazards. It is often overstated and unscientifically extrapolated to other parts of the world. If there is literature for other hazards and parts of the world it should be cited and caveated as appropriate. (Evan Mills, Lawrence Berkeley National Laboratory)	Ref new RMS normalized loss study.
1-1394	A	72	14	72	16	It is not obvious that the effect described by Zhang, Douglas and Leatherman has so far been as significant as the increase in societal vulnerability noted in the previous sentence. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Clarified with normalized loss study.
1-1395	A	72	16			There is any reference on flood losses in Europe/Mediterranean? Any info on 2002, 2004 floods losses? (Giampiero Maracchi, Institute of Biometeorology)	No known reference to study relating severity of extremes to previous occurrence statistics.
1-1396	A	72	18	72	21	What does normalized mean here, for what is the Japan data normalized? Is there a reference for this paragraph? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Explained.
1-1397	A	72	22			There should be a new subsection paralleling Section 1.3.8.4 that would address mortality due to extreme climate-related events. Information in comment 13 could help in that regard. This section should note that according to the EM-DAT database -- which is incomplete, and the further back one goes, the more incomplete it is likely to be -- aggregate deaths and death rates worldwide due to "weather-related extreme events" (droughts, extreme temperatures, floods, landslides, waves and surges, wild fires and wind storms of different types (e.g., hurricanes, cyclones, tornados,	There are too many changes in protection and forecasting to use mortality statistics in this way.

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						typhoons, etc.) have trended downward since the 1920s. Specifically, comparing the 1920s to the 2000-2004 period, the annual number of deaths has declined from 485,200 to 19,400, a 96 percent decline, while the death rates per million has declined from 241.8 to 3.1, a decline of 98.7 percent. The average number of deaths per year from floods dropped from 436,000 during thw 1930s to 5,000 from 2000-2004, while death rates over this period dropped from 204 per million to around 1 per million. For droughts, average deaths per year dropped from 472,000 in the 1920s to about 200 in 2000-2004; death rates declined from 235 per million to less than 0.04 per million. For wind storms, death rates peaked in the 1970s (at 36 per million) and were down to 0.4 per million from 2000-2004. [Source: updated from Goklany 2005(c.)] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
1-1398	A	72	24	73	15	The whole chapter 1.3.9 seems really trivial. The title is good, but there is no substance. (Kaija Hakala, MTT Agrifood Research Finland)	More substance and references have been added.
1-1399	A	72	24			This section appears, at present, to be compiled of 'odds and sods' which don't comfortably fit in any other section ! I realise that evidence for impacts on socio-economic processes is scanty but surely energy use and tourism are not the only themes for consideration here ? What about the impact on climate change on; markets for natural resources (e.g. timber, fisheries), migration, balance of international relations, population trends, public attitudes towards climate change response strategies, gender specific impacts etc. (Paul Jeffrey, Cranfield University)	Issues added
1-1400	A	72	26	73	3	1.3.9.1 Energy consumption is mostly restricted on buildings. The aspect of energy supply and institutional constrains (administrative level) are almost completely missing. Major problems for energy supply may rise from extreme events (e.g. summer 2003 http://assembly.coe.int/Documents/WorkingDocs/doc04/EDOC10350.htm) by increasing consumption for cooling and reducing production because cooling water for power plants is limited. Adaptation to extreme events needs long time periods (e.g. building of new power supply lines) (Markus Erhard, Forschungszentrum Karlsruhe)	Noted in text.
1-1401	A	72	28			up to 50% in some developed countries (see WGIII Chap 6) (Geoffrey Levermore, Manchester University)	Noted in text.
1-1402	A	72	33	72	43	Outreach is restricted to UK and Hong Kong. I just cannot believe that there are no other studies available (work by S.Changnon in USA, numerous studies in the Russian Arctic, and so on).	Other regions included

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						(Pavel Groisman, UCAR Project Scientist at NOAA National Climatic Data Center)	
1-1403	A	72	34	72	43	Add the study of observed climate change and the urban heat island in london by Wilby 2003. (Sari Kovats, London School of Hygiene and Tropical Medicine)	Other references cited
1-1404	A	72	39			"the 36 year period". But the dates given on line 37 were 1976-1995, which is 19 years. (Nathan Gillett, University of East Anglia)	Changed
1-1405	A	72	43			These last years, many countries experienced the extreme phenomena (cold waves in winter season and heat waves in summer season), which induced exceptional peaks of electric power consumption. The national production proved to be insufficient to meet the demand side causing many interruptions of electricity and serious socio-economical disturbances. (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Included in chapter now.
1-1406	A	72	45	73	3	This discussion should note that adaptation strategies and implementation are also strongly motivated by the cost of energy. (David Rind, NASA/GISS)	Noted in text with references.
1-1407	A	72	48			the worry is that energy consumption will increase as air conditioning is adopted for warmer summers (see Chap 6) (Geoffrey Levermore, Manchester University)	Noted in text and cross referenced.
1-1408	A	73	0	74		Review of meta-analysis: some of the discussion on phenology can be shortened for reasons given earlier. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Addressed.
1-1409	A	73	0	83		1.4 Larger-scale aggregation and attribution: This section can be condensed by deleting some of the material re:phenology and forest fire attribution. Since attribution is an important aspect of climate change which is being dealt by WGI in a separate chapter, some of material on attribution presented here could be deleted with suitable reference to WGI. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Addressed.
1-1410	A	73	3	73	3	For balance, add the following at the end of this paragraph: "Warming should improve the ease of thermal comfort in cold climates and seasons but worsen thermal comfort in hot climates and seasons" (or something else along those lines). (Claire Parkinson, NASA Goddard Space Flight Center)	Thermal comfort included.
1-1411	A	73	5	73	15	There should be much more literature on tourism and climate change. See e.g. http://www.cru.uea.ac.uk/tourism/ for publications and links. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	More references added.
1-1412	A	73	5			Section 1.3.9.2 Does not add much. I suggest deleting it.	Expanded section.

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						(Raymond Desjardins, N/A)	
1-1413	A	73	7	73	15	there are adaptation measures especially in winter tourism due to climate change (artificial snow, new resorts at higher elevation, closing of resorts at lower elevation ..) Some of this aspects are summarized in a EEA report on adaptation which will be published this year (www.eea.eu.int Vulnerability and Adaptation to Climate Change in Europe - A scoping report) please see also comment above at line 22 of the Excel sheet for page 20-21 (Markus Erhard, Forschungszentrum Karlsruhe)	Adaptation section has been rewritten by new Contributing Author.
1-1414	A	73	7			"Climate is a major factor..." (Lesley Hughes, Macquarie University)	Addressed.
1-1415	A	73	7	73	15	Interesting to note that the Tourism industry is taking climate change seriously though - The first International Conference on Climate Change and Tourism," was held on the island of Djerba, Tunisia (April 9-11, 2003) !! (Paul Jeffrey, Cranfield University)	Yes, it is interesting.
1-1416	A	73	15			Should note that from a global perspective, changes in tourism are probably a zero sum game. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Please provide references.
1-1417	A	73	16			Considerations on ecotourism should be added as well as on sustainable tourism for elimination of poverty (STEP) and citation to appropriate WTO (World Tourism Org) reports and documents (Giampiero Maracchi, Institute of Biometeorology)	These topics are not germane to observed changes.
1-1418	A	73	18	81	12	The logic of Section 1.4 is flawed. The section on 'Relation to large-scale climate variability patterns' belongs with the reviews of meta-analyses because the studies described are also meta-analyses; the section on 'Synthesis of sectors and systems' belongs after the discussion of the Gillet et al. and Root et al. GCM-based studies, because that section, in effect, assesses the evidence brought forward by the full chapter. Thus -- Section 1.4.1 -- Review of meta-analyses, with subsections 1.4.1.1 Meta-analyses related to warming; 1.4.1.2. Meta-analyses related to major climate variability systems; Section 1.4.2 Joint attribution, with subsections 1.4.2.1 Assessing the relation of observed regional climate changes to anthropogenic causes; 1.4.2.2 GCM-based studies; 1.4.2.3 Synthesis of systems and sectors. (David Rind, NASA/GISS)	Section outline revised according to suggestions.
1-1419	A	73	18	83	31	Would have expected to see more related to some of the recent research since the TAR related to the role of adaptation and adaptive capacity, and their contributions to modulating impacts rather than a focus on impacts; as well as the continuum between current vulnerabilities, adaptive capacity, and long-term adaptation (see FOD Chapter 14 for specifics)	These topics are addressed in section 1.4.3.

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						(Roger Brian Street, Meteorological Service of Canada, Environment Canada)	
1-1420	A	73	18	83	31	Would have expected much more on vulnerabilities and resilience within natural and managed systems (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Seperate section (1.4.3) on adaption and vulnerability, rewritten.
1-1421	A	73	18	83	31	Unclear as to the relationship between this section and section 1.2. There appears to be some duplication that adds to confusion of the reader. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked deleting redundancies with section 1.2.
1-1422	A	73	21	73	34	See previous comments "on joint attribution". I suggest that the term be replaced with "sequential detection", and that the description of this process should include a discussion of the difficulties that may arise in trying to do a full end-to-end attribution analysis. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Comment considered but not taken. Joint attribution describes process adequately. Caveats added related to confidence in section 1.2.
1-1423	A	73	37	74	27	The content may be shorten and moved in the section 1.3.5.2. (Xiaoqiu Chen, College of Environmental Sciences)	Repeats eliminated in section 1.3.5.
1-1424	A	73	37	74	27	1.4.1 Review of meta-analyses: considering that this chapter needs shortening I think that this section is unnecessary - most of the information in it has either been mentioned before or could be incorporated more concisely in section 1.3.5 (Lesley Hughes, Macquarie University)	Repeats eliminated in section 1.3.5.
1-1425	A	73	37	76	11	This section on phenology overlaps with a previous section touchng on the same topic. Rationalisation should be attempted. (John Sweeney, National University of Ireland, Maynooth)	Repeats eliminated in section 1.3.5
1-1426	A	73	37	74	27	Section 1.4.1. could be linked more explicitly to Section 1.3.5.2 (Pages 46-51), and any repetition between the sections should be checked. (Robert Wilson, Universidad Rey Juan Carlos)	Repeats eliminated in section 1.3.5
1-1427	A	73	39	73	39	See comment to Chapter 1, Page 16, Line 11 -> Suggestion for rewording the sentence: "Several studies have examined the 'fingerprint' (Walther et al. 2001) of observed warming in recent decades on plants and animal species ...". (Gian-Reto Walther, Institute of Geobotany)	Section rewritten.
1-1428	A	73	39	73	39	Use of the word "fingerprint". This is a term that has a specific technical meeting in formal climate change detection and attribution work, for example, as reviewed in the TAR (WG1, Ch 12). In formal studies, a "fingerprint" is the expected pattern of change simulated by climate models in response to external forcing. A detail is that this pattern is sometimes adjusted to improve signal-to-noise ratios. The detection analysis then assesses whether that signal pattern is present in observations. It is not clear from the context here whether the term "fingerprint" also refers to an expected pattern of change in the plants and animals studied. If not, then I think it would be best to avoid using this word here.	Fingerprint used in same way in biology for expected pattern of change.

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						(Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	
1-1429	A	73	48	73	48	Another example of a ref that needs sorting out (Peter Stott, Met Office)	Addressed.
1-1430	A	73	50			Parmesan and Yohe (2003) meta-analysis also estimated northward range shifts of 6.1 km/decade (for northern range boundaries in northern hemisphere). (Camille Parmesan, University of Texas at Austin)	Numbers included.
1-1431	A	74	0	76		1.4.2 Synthesis of sectors and systems" Once again, too much emphasis on number of studies cited should be avoided. Reference by Karoly & Wu (p.75) is not found in the list of references. Another paper by Jones & Moberg (2003, J of Climate, 16,p.206-223) shows spatial distribution of recent (1975-2000) warming where only 19% of 5x5 grid locations indicate statistically significant warming, these locations being predominantly over large urban and populated centres of the world. The impact of urbanization on recent warming must be discussed here (see Khandekar et al, 2005, Pure & Applied Geophysics, 162, p. 1557-1586). Table 1.14 is not very convincing. The phrase "anthropogenic cause" (section 1.4.3) must spell out if it is meant to include human activity on ground (urbanization, land-use change etc) or ONLY human-induced CO2 related impact. It is important to separate the two impacts. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Addressed.
1-1432	A	74	3	74	3	If correct, "was found for 279 species" should be enhanced to: "was found for 279 of the 1700 species". (Claire Parkinson, NASA Goddard Space Flight Center)	Will change in TOD (page 58, line 31)
1-1433	A	74	6	74	23	This paragraph is a bit too long compared to the space allocated to the metaanalyses of Root et al and Parmesan et al. (Isabelle Chuine, CNRS)	Turned into a box.
1-1434	A	74	6	74	23	These statements require references (Isabelle Chuine, CNRS)	Reference now included.
1-1435	A	74	6	74	27	Is the EU COST725 an actual statistical meta-analysis? The text indicates that original time series data were re-analysed. This seems to be a large-scale, primary analysis of data from multiple sources, not a statistical meta-analysis. Likewise, the bird arrival dates seems to be a summary of time series. No statistics that are hallmarks of statistical meta-analysis, e.g. effect size, are provided. (Kimberly Hall, Michigan State University)	Turned into a box.
1-1436	A	74	17	74	27	It would be useful to have a statement indicating what concerns and/or advantages might be associated with the reported advances in the leafing, flowering, and fruiting phases and in the bird arrival dates. (Claire Parkinson, NASA Goddard Space Flight Center)	See section 1.3.5.5. Concern is trophic mismatch. Will address further in TOD.
1-1437	A	74	30			Section 1.4.2. The first para could be incorporated into Section 1.1.1 in which	Section rewritten.

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						findings of the TAR are summarised. There does not seem to be a real need to repeat it here. (Lesley Hughes, Macquarie University)	
1-1438	A	74	30	76	11	Section 1.4.2. This is a good, clear and convincing section. (Robert Wilson, Universidad Rey Juan Carlos)	Thank you.
1-1439	A	74	32	74	39	Is this paragraph necessary? Since the purpose of the IPCC chapter is not necessarily to reference every relevant study, particularly those published before the TAR, and further the scope of the chapter may have changed since the TAR, these numbers may not be that useful. I think it would better just to say that more evidence has accumulated for climate impacts since the the TAR and leave it at that. (Nathan Gillett, University of East Anglia)	Section deleted.
1-1440	A	74	32			It would be useful to broaden the discussion in the first para to note how many studies were unable to identify changes, and also whether there might be a selection bias in that areas/topics were selected for study because the expectation was that there would be identifiable changes. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Number of studies removed.
1-1441	A	74	32	74	39	This could just reflect more people looking at the problem (Peter Stott, Met Office)	Yes. Section deleted.
1-1442	A	74	32	74	39	See my previous comment about counting papers. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section deleted.
1-1443	A	74	44	74	46	This description of the data used in the study doesn't make much sense to me. A distinction should be drawn between the temperatures contoured on the map, which must be from either the Hadley Centre or NOAA (there are no joint datasets from both), and other data used for the trends in systems and sectors, which presumably comes from a wide variety of sources. (Nathan Gillett, University of East Anglia)	Maps redrawn and made more clear.
1-1444	A	75	23			Fig. 1,12: In the title is mentioned .."Observed changes documented..": are they significant? the areas with significant trends in temperature being noticed on the same figure. (Annick Douguedroit, Université de Provence)	Statistical tests conducted. See supplementary material.
1-1445	A	75	23			Fig 1.12 I did not understand the subtitle 'the observed changes corresponding to two groups of studies ending after 1993 and 2000'. Are there two distinct groups of studies? Why not just say that all studies are evaluated over periods ending after 1993? (Nathan Gillett, University of East Anglia)	Maps redrawn.
1-1446	A	75	23			The caption for Figure 1.12 describes "'white areas". I don't see any white areas in this figure. Do the authors mean lighter areas?	Maps redrawn.

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						(Paul J. Hanson, Oak Ridge National Laboratory)	
1-1447	A	75	25	75	26	"White regions do not have sufficient coverage to estimate a trend". There are no white regions on the plot. (Nathan Gillett, University of East Anglia)	Maps redrawn.
1-1448	A	75	38	75	40	How is the significance of the temperature change indicated? (David Rind, NASA/GISS)	Maps redrawn.
1-1449	A	75	38	75	40	This sentence makes no sense (Peter Stott, Met Office)	Rewritten.
1-1450	A	75	39			"no" should be inserted after the "but" at the end of this line. (Kimberly Hall, Michigan State University)	Section rewritten.
1-1451	A	75	43	75	43	"452" would be better than "nearly 500" (Isabelle Chuine, CNRS)	Text changed.
1-1452	A	75	45	75	48	"For regions where there are both significant warming and observed changes, there is a greater probability of finding coincident significant temperature change and observed responses in the expected direction". This is a relatively weak conclusion. How much greater probability? Is the difference in probability significant? (Nathan Gillett, University of East Anglia)	Statistics tests conducted; see supplementary material.
1-1453	A	75	45	75	48	Given than the sentence starts off by indicating we're looking at regions where there is both significant warming and observed changes, we cannot find in such regions significant temperature change and no response (as the sentence suggests is possible). (David Rind, NASA/GISS)	Good point. Will address in TOD (page 63, line 125)
1-1454	A	75	48	75	50	this is not what is shown in table 1.14.: is it a problem with the table? Should not the number "10" in "0C deg temperature change" column be in the "obs with no change" column? (Isabelle Chuine, CNRS)	Table revised and updated
1-1455	A	76	1	76	7	Table 1.14 - what does OC deg temp change mean (how close to zero ?) Suggest removing this row. Numbers are integers not reals. Adding up the numbers in each column it looks like there are eg 30 observations of change in expected direction in cells with no available temperature data but how do you know the expected direction if you don't have temperature data ? For 1932 cells with available temperature data looks like we're missing a lot more 5 by 5 degree cells than is apparent in fig 1.12. Is this work published ? (Peter Stott, Met Office)	Table revised and updated.
1-1456	A	76	2			Table 1.14 I suggest replacing 'Observation with no change' with 'no change' for consistency with the cells to the left and right. Secondly, what distinguishes a 0C temperature change from an insignificant positive or negative change? Presumably this depends entirely on the precision at which the trend is quoted. I suggest working	Table revised and updated.

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						to a large enough precision to enable all trends to be distinguished positive or negative, and deleting this row. If not, the reader must at least be told to what precision the trend is 0C. (Nathan Gillett, University of East Anglia)	
1-1457	A	76	2	76	6	Table 1.14 is based on a huge amount of studies on temperature rise, and very few on temperature decrease. I'm afraid that 4 observations of change in decreased temperatures is not enough to draw conclusions. Moreover, the whole contents of this table has been said in the text, and the table is not necessary. (Kaija Hakala, MTT Agrifood Research Finland)	Table revised and studies updated.
1-1458	A	76	2	76	7	Table 1.14 is far more cumbersome than it should be. Suggested improvements: (1) Delete all decimal places (all of which are 0's). (2) In the row headings (leftmost column), delete the four cases of "(total =)**". These totals are all given in the final column, where they belong. (3) In the column headings, delete "(417)", "(26)", and "(8)", and instead replace 387, 24, and 8 by 417, 26, and 8 in the final row, adding also in the first column, last row, the heading "Total number of observations". (3) In the second to last row, add to the first column the heading "Observations in cells with no temperature data", delete the words in the rest of the columns and add to columns 2-4 the numbers 30, 2, and 0, respectively. With these changes, the table will contain all the same information but in a far more understandable presentation. (Claire Parkinson, NASA Goddard Space Flight Center)	Table revised and updated.
1-1459	A	76	2			Table 1.14. Please add an estimate of the number of species. It strikes me that your sample is only a tiny fraction of the population. If observations contradict expectations, is this not an indication that the theory is bad. (Richard S.J. Tol, Uni. Hamburg)	Relevant population is number of gridcells.
1-1460	A	76	2			Table 1.14. Row "OC Deg temperature change". In this row, do the 10 systems with changes in the expected direction effectively refer to systems with observations of no change? If so, the cells for Change in Expected Direction and No Change could be merged, and/or a note could be put in the table heading or footnote clarifying this point. (Robert Wilson, Universidad Rey Juan Carlos)	Table revised and updated.
1-1461	A	76	9	76	11	In view of the prominent retreats found in tropical glaciers, it's important here to specify exactly which "observed changes" (line 9) the text is referring to when it proceeds to say "Evidence in tropical regions is sparse." (Claire Parkinson, NASA Goddard Space Flight Center)	Good point. Will address in TOD.
1-1462	A	76	14			Section 1.4.3 On top of page 77, suggest deleting « major » in the sentence ...the six major continents... Also there is a need to develop further the last paragraph. (Raymond Desjardins, N/A)	Will address in TOD.

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1-1463	A	76	14	77	16	Need to ensure that this section is not duplicating that work reported in WGI. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Impacts of warming, which is the focus of this section, is not covered in Working Group I.
1-1464	A	76	17	76	18	Karoly 2003 and Karoly 2005 are not in the reference list. (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	References added.
1-1465	A	77	0	78		1.4.4 Joint attribution: The example of area of forests burned in Canada is poor as pointed out earlier. Forest fire climatology depends on a number of parameters, mean temperature being of least importance. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Add caveat in TOD.
1-1466	A	77	1	77	4	"most of the observed warming ... is likely" - Is the "likely" IPCC calibrated language? If so, is this Stott's assessment, or this an assessment made by this chapter? If the latter, this assessment should be carefully coordinated with WG1, Ch 9. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Good Point. Will address in TOD.
1-1467	A	77	10	77	11	This implies that the models used incorporate all the features that would explain internal climatic variability in the first place. Is that indeed the case? How well are all the features affecting "internal variability" included in the models, what's not included, what difference would that make, if any? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Will address in TOD.
1-1468	A	77	19			Comment on Section 1.4.4. See above comment. Also, with respect to plants (and paint-feeders), CO2 is an important variable, which doesn't seem to have been factored in, among other things. Similarly, what about changes in land use etc.? So, while interesting (and intriguing), this approach is not definitive. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	See section 1.2 for non-climate driving forces. Add caveat in TOD.
1-1469	A	77	19	78	50	Section 1.4.4. Joint attribution: There is over 1.5 pages devoted to describing just 2 studies. While they are both excellent studies this section could be cut down or the information incorporated into other sections (Lesley Hughes, Macquarie University)	Section shortened.
1-1470	A	77	19			Joint attribution: Please remove this section. Ecosystems respond to climate change, regardless of its cause. It has been established that a large part of observed climate change is human-induced; it readily follows that a large part of climate-change-induced ecosystem change is human induced. (Richard S.J. Tol, Uni. Hamburg)	Yes, but it is important to determine what areas of human-induced climate change have documented changes.
1-1471	A	77	21			I feel a bit uncomfortable with this section, but this is because I feel uncomfortable with the study of Root et al. 2005 on this issue. From my point of view one important thing is missing in the demonstration which is described here: the correlation of the Julian dates of spring phenological events with observed temperature. Similarly, I do	Section rewritten. Will address in TOD.

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						not quite agree when the authors say that the detection of anthropogenically-forced climatic signals in plant and animals records show that HadCM3 has predictive ability across local and regional scale. I do not dismiss HadCM3 model at all, but for me HadCM3 predictive ability cannot be better assessed than with observed climate. As the first paragraph says, joint attribution is a two-step linkage: (1) climate-related change in systems and sectors and (2) anthropogenic-related change in climate. Demonstrating joint attribution with Fig 1.13 is from my point of view misleading. (Isabelle Chuine, CNRS)	
1-1472	A	77	21	77	25	There is a confusion here. Earlier in the chapter, joint attribution is defined as WG1 TAR attribution plus WGII attribution but now it is being defined as WGI detection plus WGII attribution. Suggest stick with definition given in 1.2.3.3. But note difference between AR4 WGI and TAR WGI definitions of detection and attribution - suggest modify to make consistent with AR4 WGI. (Peter Stott, Met Office)	Section 1.2.3.3 to avoid redundancy. Definition of joint attribution clarified.
1-1473	A	77	21	77	21	See comments above on "joint attribution". (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Addressed above.
1-1474	A	77	24			Gillett et al. (2004) was not purely a 'joint detection' study, in the sense described here. Although we did start by demonstrating a significant correlation between area burnt and temperature, and that changes in Canadian fire season temperatures were attributable to anthropogenic forcing, the study went further than this. We also attempted to directly attribute changes in area burnt to anthropogenic influence, using interannual variability in area burnt to estimate the magnitude of decadal natural variability, and the relationship between interannual variations in temperature and area burnt to estimate the anthropogenic signal in area burnt. Note also that 'Gillett' is misspelt 'Gillet'. (Nathan Gillett, University of East Anglia)	Will address in TOD.
1-1475	A	77	27	34		See comments for page 57 lines 37-35; the range of natural variability is not captured within the last 100 years. See Carcaillet, C., Bergeron, Y., Richard, P.J.H., Fréchette, B., Gauthier, S., and Prairies, Y.T. 2001 J. Ecol. 89: 930-946 ; Carcaillet and Richard 2000 The Holocene 11: 467-476. Bergeron Y, Gauthier S, Flannigan M, Kafka V (2004b) Ecology 85, 1916-1932. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Will address in TOD.
1-1476	A	77	27	77	34	I don't think it is correct to describe the Gillett et al result as a "two-stage" result. Rather, it can be thought of as an end-to-end detection result. The fire area burned detection process involved essentially the following steps: First, a statistical model was developed to relate observed high-frequency interannual temperature variation	Will address in TOD.

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						(time scale less than five years) to high-frequency interannual variations in area burnt. Thus this "impacts" model was built using information not subsequently used in the detection analysis. The detection analysis studied variability on timescales of 5-years and longer. Second, this statistical impacts model was driven by climate model output (at time scales of 5 years and longer), to produce an estimate of the end-to-end response in area burnt to anthropogenic forcing. The same model was also driven by a climate model control simulation to estimate the internal variability in area burned on 5-year and longer time scales. Finally, using this information, a detection analysis was performed on observed area burnt. (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	
1-1477	A	77	29	77	31	The reference should be in the "References" section (Isabelle Chuine, CNRS)	Fixed.
1-1478	A	77	29	77	31	Flannigan et al. 2005 is a more up to date reference. They find a strong positive relationship between temperature and area burned in Canada. Flannigan et al. 2005 - Climatic Change 72:1-16 (Mike Flannigan, Canadian Forest Service)	Include in TOD.
1-1479	A	77	29	77	31	Second and third lines don't constitute a sentence. (David Rind, NASA/GISS)	Addressed.
1-1480	A	77	31			Should be "humans" or "human-induced warming." (Hayley Fowler, Newcastle University)	Changed to "human activity."
1-1481	A	78	1	78	50	I'm not familiar with the Root paper, and the description given here doesn't clearly explain how the detection analysis was performed in that study. However, it sounds like a phenological change was correlated with SIMULATED temperature change under different forcing conditions, and that significant correlations were found when anthropogenic forcing was included. If I understand this correctly then it is neither end-to-end detection (because a plant model that would simulate the phenological change in response to temperature change is not embedded in HadCM3), nor "two-stage" detection (because the text doesn't make it sound like observed phenological changes were attributed to observed temperature changes, and subsequently, that an anthropogenic effect was detected in those temperature changes. Rather, the text makes it sound like simulated temperatures were directly correlated with phenological changes. If so, what guarantee is there that the authors got the right answer for the right reasons? One could as easily correlate the Dow Jones index with phenological change and probably get a positive correlation... but be aware that this is a comment made with my tongue planted firmly in my cheek. I'm probably misunderstanding the text :) (Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	Section rewritten.

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1-1482	A	78	13	78	36	The evidence from Fig 1.13 is of two trends, one for phenology and one for temperature in models that include anthropogenic forcings. Whereas two coincident trends could be fortuitous the claim of anthropogenically forced climatic signals would be much strengthened if phenological traits are well correlated with local temperature changes including regions where temperatures are decreasing and phenological trends are opposite to most other regions. Some further discussion of spatial patterns of correlation would be helpful. (Peter Stott, Met Office)	Section rewritten.
1-1483	A	78	37	78	47	Figure 1.13: what is the coefficient of determination r^2 for the data in panel A? (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Will address in TOD.
1-1484	A	78	37			Fig. 1.13 Use Calendar date rather than Julian date (Raymond Desjardins, N/A)	Figure changed. Change caption in TOD.
1-1485	A	78	48	78	50	I find this sentence out of purpose here (Isabelle Chuine, CNRS)	Section rewritten.
1-1486	A	78	48	78	50	I don't think that the validation of the predictions of HadCM3 is a principal finding of Root et al. My interpretation is simply that the model has significant temperature trends on local and regional scales, and it is these which are found to be correlated with observed phenological changes. If Root et al. had carried out their study with an energy balance model they would also have found significant correlations with phenological changes and therefore presumably a strong validation of the predictive skill of the energy balance model across local and regional scales. (Nathan Gillett, University of East Anglia)	Will address in TOD?
1-1487	A	79	0	81		1.4.5 Reaction to large-scale climate variability patterns: The purpose of this discussion is not clear. If anything, it confuses the reader about climate change impact vs. large-scale circulation pattern impact. Once again, the authors of this chapter have sloppily mixed climate change issue with large-scale circulation change issue. Impact of NAO, ENSO, PDO etc. on climate and phenology etc. is not directly linked to climate change and this must be spelled out. The large-scale atmospheric circulation patterns have been identified and studied for over 100 years and variability in these large-scale circulations is primarily due to natural variability of climate and is in NO WAY linked to recent global warming. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	The reviewer does not understand this figure, which seeks to tease apart the NAO from the climate change signal.
1-1488	A	79	3	81	12	The relationship between spring phenology and NAO (air pressure!) is indirect, which reflects actually the influence of spring temperature to spring phenology. Therefore, the relationship between large scale temperature patterns and spring phenology is more significant. Therefore, the results by Chmielewski & Reotzer (2002, Climate Research, 19: 257-264) should be cited in this section.	This paper is cited in section 1.3.5

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						(Xiaoqiu Chen, College of Environmental Sciences)	
1-1489	A	79	3			Section 1.4.5 Statements are not supported by references in the first paragraph. In the second paragraph, what do you mean by ... widespread influence of manifold ecological processes? (Raymond Desjardins, N/A)	Section rewritten.
1-1490	A	79	3			Section 1,4,5: Relations to the NAO pattern. See below comments on the relations with "climate change" (Annick Douguedroit, Université de Provence)	Unclear.
1-1491	A	79	3	81	12	section 1.4.5 Relation to large-scale climate variability patterns: It should be explained in one two sentences what the indices esp. NAO stand for. The chapter describes very clear the impacts of NAO. Other indices are mentioned p 80 line 38-41 but due to the global perspective of IPCC impacts of these variations should also be explained. In this sense the chapter is very good but imbalanced in the context of the global perspective. Parts of NAO impacts might be transferred to regional chapters (e.g.Chap 12 Europe) if Chapter 1 must be shortened but impacts of ENSO, PDO and others should also be described here (Markus Erhard, Forschungszentrum Karlsruhe)	Yes, this is a good point. NAO further described in section 1.2.
1-1492	A	79	3			1.4.5 Relation to large-scale climate variability patterns: this section is focussed on ecological impacts only whereas I would have expected that all the impacts discussed in section 1.3 would be discussed and their relationships with large-scale circulation explored. (Hayley Fowler, Newcastle University)	Will address in TOD.
1-1493	A	79	3	79	30	Nowhere in this section on the relation between phenological measures and the NAO does it say why these measures might correlate with the NAO. My guess is that all the impacts discussed relate to the NAO's impact on temperatures. This section should therefore be linked better with the previous one - phenological measures respond to temperature, and temperature is influenced by anthropogenic climate change and also by modes of natural variability such as the NAO. The current wording might leave an unformed reader wondering how phenological measures respond to atmospheric pressure. (Nathan Gillett, University of East Anglia)	Variability systems described more fully in section 1.2.
1-1494	A	79	3	81	12	Section 1.4.5. Relation to large-scale variability patterns: This section is about 2 pages long yet only the NAO is discussed. Some balance is needed regarding other patterns such as ENSO, especially its role in the tropics. (Lesley Hughes, Macquarie University)	ENSO studies have been included as well.
1-1495	A	79	3	79	30	It would be helpful to put this discussion into context with some discussion of the NAO and climate change since recent multi-decadal trends in the NAO could be	Variability system described more fully in section 1.2.

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						internal variability or forced. (Peter Stott, Met Office)	
1-1496	A	79	9	79	10	"Plants also respond to climatic conditions over multiple scales (Walther 2004): ..." <- add reference (full reference is provided in comment to Page 14 Line 50). (Gian-Reto Walther, Institute of Geobotany)	Cited in section 1.3.5
1-1497	A	80	26	80	27	There are programs in Europe to change forest structure and species composition. Some of these programs don't include climate change. In any case these initiatives seem not to be documented in the literature (Markus Erhard, Forschungszentrum Karlsruhe)	Unclear.
1-1498	A	80	38	81	12	At least one reference is missing here: Mysterud et al. Nature 2001, 410: 1096-1099 (Isabelle Chuine, CNRS)	Add in TOD.
1-1499	A	80	38	80	40	Would be more helpful to identify the impacts on/vulnerabilities of the affected systems rather than merely stating that there was a response/impact. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Will address in TOD.
1-1500	A	80	44	80	44	"northern indigenous peoples" - where? Presumably not in the whole of the Arctic. (Nathan Gillett, University of East Anglia)	Will address in TOD.
1-1501	A	80	47			More studies on relationship between salmon abundance and large scale climate variability are available and should be added at this point. (Giampiero Maracchi, Institute of Biometeorology)	Will address in TOD.
1-1502	A	81	0	83		1.4.7 Learning from current and recent observed response and adaptation: Many of the adaptive measures may be due to exacerbation of a situation due to inter-annual variability rather than due to climate change & global warming. Agricultural practices like sowing etc. depend exclusively on year-to-year variability some of which can be predicted with sufficient skill using regional seasonal weather forecasting. Section (1.4.7.3) Human p. 82-83: Recent changes in building code especially in Canada and northern US States are driven primarily from energy conservation point of view like improved insulation to reduce heat loss in winter, smart buildings installed with sensors to cut heating cost etc. These changes do not include global warming impact as yet. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	Adaptation section rewritten.
1-1503	A	81	0	81		1.4.6 Uncertainties and confidence levels: Here an example of regional climate change for eastern Canada can be included and discussed (see Zhang X et al, 2000, Atmosphere-Ocean, 38, p. 395-429). The eastern Canadian provinces and adjoining region of Northwest Atlantic have significantly cooled in last 50 years with some locations showing a cooling of over 2C. This cooling is attributed to NAO phase. It is important to point this out here to emphasize the uncertainty re: regional climate change.	Section cut.

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						(Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1504	A	81	0	81		Here and more generally in the discussion of uncertainty it is important to make the point that increased uncertainty is costly in itself. For example, increased uncertainty about rainfall levels may lead to unnecessary investments in dams to secure water supplies, if a decline in rainfall is anticipated but does not occur. Alternatively, it may lead to unproductive investments if there is an unanticipated decline in rainfall. (John Quiggin, University of Queensland)	Section cut.
1-1505	A	81	10	81	11	"but do not attribute climate patterns to population trends". Presumably this is a typo. (Nathan Gillett, University of East Anglia)	Will address in TOD (page 60 line 38)
1-1506	A	81	12			More studies are under development on birds (swallow) migration (date and paths) and climate. (Giampiero Maracchi, Institute of Biometeorology)	Please send references.
1-1507	A	81	15			Section 1.4.6 This section should come very early in the chapter to advise the reader about the uncertainties in the analyses. An issue here is how to address the uncertainties. This is not discussed. (Raymond Desjardins, N/A)	Section cut, but topics is addressed in section 1.1 and 1.2.
1-1508	A	81	15	81	35	1.4.6 Uncertainties: might this section be better at the beginning in the discussion of methods? (Lesley Hughes, Macquarie University)	Section cut, but topics is addressed in section 1.1 and 1.2.
1-1509	A	81	15	81	35	Need to better relate the text to uncertainties and confidence levels. How do the concepts/ideas included in these paragraphs impact on uncertainties and get interpreted into confidence levels (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section cut, but topics is addressed in section 1.1 and 1.2.
1-1510	A	81	24	81	24	Does tectonic activity deserve to be listed as one of the major drivers of environmental change on the large scale? If this is included, then why not include e.g. changes in the earth's orbital parameters? - these caused ice ages. (Nathan Gillett, University of East Anglia)	Tectonic activity removed.
1-1511	A	81	29	81	30	Well, this seems a pessimistic assessment. If the impacts model were integrated into the climate model, and an end-to-end detection and attribution study were undertaken, it may well turn out to be the case that the separate responses to the different external forcings might be possible (given adequate data, etc). Of course, one would anticipate that this wouldn't be easy. For example, the temperature responses to different external forcings over the 20th century appear to have been more or less additive, and that has generally aided the D&A community in separating the responses to the different forcings. That additivity would probably break down in the case of the response in an impact variable - presumably making a detection analysis more difficult.	Will address in TOD.

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						(Francis Zwiers, Canadian Centre for Climate Modelling and Analysis)	
1-1512	A	81	38			It is not clear whether this section should be referenced or not. Some sub-section are, some others are not. (Isabelle Chuine, CNRS)	Section reworked and summarized with chapter sections references.
1-1513	A	81	38	83	7	Would have expected more of a "what have we learned from past experiences (successes and failures)", including what needs to be done to learn more, approach rather than simply identifying various adaptive responses. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked. Will address in TOD.
1-1514	A	81	45			It is misleading just to say that adaptive strategies are already underway because adaptation (not called by that name) has been going on for a very long time. (Ian Burton, University of Toronto)	Section reworked; addressed.
1-1515	A	81	45	81	50	The example of New Orleans should be discussed here - it's a great example of the problems involved in particular locals. (David Rind, NASA/GISS)	Section reworked.
1-1516	A	82	4	82	5	It is not worth citing these studies if their findings are not described. (Nathan Gillett, University of East Anglia)	Section reworked.
1-1517	A	82	5	82	7	The statement "...although costs of adaptation are high." needs sme further clarification. The costs are high compared to what? No action? (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1518	A	82	9	82	15	This paragraph is not referenced (Isabelle Chuine, CNRS)	Section reworked.
1-1519	A	82	9			Section 1.4.72 the last paragraph is very poor. You could mention the relation between type of crops and degree-days. (Raymond Desjardins, N/A)	Section reworked.
1-1520	A	82	9	82	29	In section 1.4.7.2 (Learning from biological responses and adaptation) something should be said about the role and possible approaches for conservation to minimise biodiversity loss because of climate change - studies showing changes to species distributions and the difficulties imposed by habitat fragmentation emphasise the importance of maintaining protected area networks, whilst studies such as McLaughlin et al (see point 16 above) emphasise the importance for species conservation of maintaining heterogeneous habitat conditions to buffer species and communities against climatic variability and extreme events in particular. (Robert Wilson, Universidad Rey Juan Carlos)	See chapter 4.
1-1521	A	82	11	82	12	I suggest " Evidence of adaptation in water ecosystems is found in" (Isabelle Chuine, CNRS)	Section reworked.
1-1522	A	82	13			The tiny paragraph on human adaptation to hazards tacked on to the end of chapter 1 (section 1.4.7.3) is hardly sufficient to balance the impression given in section 1.3.8	Will reference chpater 20 in TOD. Will address in TOD.

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						that extreme climatic events cause disasters, and that human beings and their institutions are either not involved or irrelevant – “as straw dogs to the gods” in the words of Lao Tse. This is a very mistaken impression to give the reader. Therefore, at a very minimum I would suggest cross referencing the treatment of disasters in chapter 20. (Ben Wisner, London School of Economics & Benfield Hazard Research Centre)	
1-1523	A	82	17	82	21	The content has been repeated several times and should be deleted. (Xiaoqiu Chen, College of Environmental Sciences)	Section reworked.
1-1524	A	82	17	82	18	This paragraph is not referenced (Isabelle Chuine, CNRS)	Section reworked.
1-1525	A	82	17	82	21	There is evidence, at least in earlier assessments, of actions by humans that could improve the probability of adaptaiton (e.g., migration corridors). (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1526	A	82	19	82	21	As noticed earlier, the second part of the sentence has nothing to do with the first part as I understand it (Isabelle Chuine, CNRS)	Section reworked.
1-1527	A	82	22	62	37	There is also a need for these cultures/communities to have access to appropriate levels of resources (knowledge, institutional and financial) with which adaptive responses can be identified, assessed, implemented and evaluated (ACIA) (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1528	A	82	23	82	29	This paragraph is not referenced (Isabelle Chuine, CNRS)	Section reworked.
1-1529	A	82	23	82	29	Believe there is evidence of success (and failure) with earlier adaptors that was referenced in earlier assessments. Unknown whether anything since the TAR has been done on this subject, however, there is a need to properly reference the state on which this assessment is being built. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1530	A	82	31	84	6	section 1.4.7.3 There are national and sub-national programs for adaptation at least in Europe (e.g. Finland, Czech Republic) summarized in EEA 2005 Vulnerability and Adaptation to Climate Change in Europe - A scoping report) The context of national and sub-national adaptation is missing (Markus Erhard, Forschungszentrum Karlsruhe)	Section reworked.
1-1531	A	82	33		49	A key factor is choice of location. Invasion of exposed and high risk areas (low lying coasts, riverine flood plains, high drought risk areas and steep unstable slopes) is pervasive. Exposure to the risks of climate change and variability could be substantially reduced (or the increase could be slowed down) by more judicious choice of locations for human populations and infrastructure. The reasons for	Section reworked.

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						increased exposure can include both wealth (Caribbean and US beach properties) and poverty (favellas on steep slopes). (Ian Burton, University of Toronto)	
1-1532	A	82	34	82	37	This reads a bit like a statement of faith. If these sentences are to be included, then you need to give some examples of mechanisms fostered by native cultures to adapt to adapt to past environmental change. While I agree it is certainly a good idea to involve native stakeholders in decision-making, is 'resiliency to future changes' really dependent on incorporating their 'understanding of the processes controlling long-term dynamics' into policy? What types of processes controlling long-term dynamics? How does the incorporation of this understanding into policy improve resiliency? (Nathan Gillett, University of East Anglia)	Section reworked.
1-1533	A	82	39	82	49	There appears to be some repetition here of material covered in section 1.3.8.4. Also this paragraph seems to deal more with impacts that with adaptation. For example 'one approach to test if adaptation to climate change is occurring is to analyze damages related to climate-related and non-climate-related events'. Surely this tells us about impacts of climate change, but not adaptation? What changes in damages related to climate events would lead one to conclude that adaptation was occurring? Presumably to do this properly one would need to know something about trends in the damaging events themselves, along with changes in predicted damages. If the changes in actual damages were less than those predicted then would one conclude that the reduction in damages was due to adaptation? I found this unclear. (Nathan Gillett, University of East Anglia)	Section reworked.
1-1534	A	82	39	82	50	Such data are available from both Munich Re and Swiss Re (Evan Mills, Lawrence Berkeley National Laboratory)	Section reworked.
1-1535	A	82	39	82	39	Adaptation likely plays a role in mitigating (or enhancing) the impacts of disasters and hazards. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1536	A	82	47	82	49	Is this not repeting statements already provided on page 16 (line 40 - 46). This emphasizes the need to reconsider the content of these two sections (1.2 and 1.4). As currently written they appear to cover much of the same material and in some cases there appears to be more on observed changes rather than the material as suggested in the outline. (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1537	A	83	0	83		1.4.8 Realtive sensitivity etc. : Countries in tropical latitudes (+/- 23.5 deg.) are not impacted significantly by global warming/climate change metric at this point in time. For ex. countries in south Asia (India, Malaysia, Bangladesh, Vietnam etc) and in	Section reworked.

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						tropical Africa(Zambia, Angola, Congo, Chad, Niger, Nigeria etc.) are influenced primarily by Monsoonal climate and interannual variability of ITCZ (Intertropical Convergence Zone). These countries are more vulnerable to interannual Monsoon variability and ITCZ migration. Global warming related climate change has minimal impact on the climate of these countries at this point in time. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	
1-1538	A	83	1	83	6	A key factor is choice of location. Invasion of exposed and high risk areas (low lying coasts, riverine flood plains, high drought risk areas and steep unstable slopes) is pervasive. Exposure to the risks of climate change and variability could be substantially reduced (or the increase could be slowed down) by more judicious choice of locations for human populations and infrastructure. The reasons for increased exposure can include both wealth (Caribbean and US beach properties) and poverty (favelas on steep slopes). (Ian Burton, University of Toronto)	Section reworked.
1-1539	A	83	3	83	6	This sentence is awkward (Isabelle Chuine, CNRS)	Section reworked.
1-1540	A	83	6			See also WGIII Chap 6 (Geoffrey Levermore, Manchester University)	Section reworked.
1-1541	A	83	9			I found this section weak compared to the preceding ones. It does not exactly provide a summary of the sensitivity and adaptive capacity of the systems which have been described in the previous sections. I suggest a major revision of this section. (Isabelle Chuine, CNRS)	Section reworked.
1-1542	A	83	9			Section 1.4.8 The paragraph about agriculture is not relevant to the topic. Furthermore, these concluding remarks are not very useful to a reader who cannot browse through the whole chapter. This would be the place to answer the 6 questions raised in the introduction. (Raymond Desjardins, N/A)	Section reworked.
1-1543	A	83	11	83	31	I did not find the conclusions matched the chapter as well as I thought they would. Perhaps as the content of this chapter evolved, the conclusions have been warped a little bit from their original form. However, they need to be revisited and rewritten according to the salient points from the chapter. I thought they were quite weak (though perhaps this is for good reason, at this stage of the chapter's development). (Jeremy Kerr, University of Ottawa)	Section reworked.
1-1544	A	83	18	83	22	There is a general conclusion that species with highly localised or isolated populations such as those restricted to mountainous regions will be more vulnerable to change, since they are unlikely to be able to shift their distributions, and these are the systems in which adaptation within refugia may be necessary to allow persistence.	Section reworked.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Robert Wilson, Universidad Rey Juan Carlos)	
1-1545	A	83	27			I presume that the authors will add a few sentences, following those on agriculture, for forests and for wetlands? (Kevin Percy, Canadian Forest Service)	Section reworked.
1-1546	A	83	30	83	30	I would go further and suggest that access to public health and access to data and knowledge also reduces adaptive capacity (TAR) (Roger Brian Street, Meteorological Service of Canada, Environment Canada)	Section reworked.
1-1547	A	84	0	109		The references need work. Check for missing citations, dates, page numbers, and remove all references that are not published or in press. (Paul J. Hanson, Oak Ridge National Laboratory)	References fixed.
1-1548	A	84	0	110		References: A large number of references can be deleted, especially those which are dated 1998 and earlier. In most areas only important references need be included while referring to some key references which can provide information on other references. It may be useful to give websites for information on data, unpublished reports etc. AMS (American Met. Society) Bulletin June issues of past several years provide an excellent overview of the State of the Climate for past years. These issues should be cited. (Madhav Khandekar, Retired research scientist and consulting meteorologist)	References fixed.
1-1549	A	84	0			Add the reference to WMO report on Climate Change and tourism (2005) and WHO report on Climate change and human health (2004) for discussion on effects of snow cover change on tourism Activities (see pag 20) and of heat waves on human health, respectively. (Giampiero Maracchi, Institute of Biometeorology)	Added.
1-1550	A	84	0			Add references from book "Increasing climate variability and change" Ed Salinger, Sivakumar, Motha. Springer 2005 (Giampiero Maracchi, Institute of Biometeorology)	Will address in TOD.
1-1551	A	84	1	84	1	Please include all the authors in the reference list, rather than list "et al". (Laurens Bouwer, Institute for Environmental Studies, Vrije Universiteit)	Check with TSU.
1-1552	A	86	2	86	3	Important to distinguish between economic and technical feasibility. Technical feasibility is usually greater than economic feasibility (we can build more than we are prepared to build or think we can afford), but economic circumstances and value judgments may change. It was technically possible to protect New Orleans and failure to do so was an economic (and political) judgment. (Ian Burton, University of Toronto)	Section reworked.
1-1553	A	87	17		18	Change the title by this one "Changes of the 0°C isotherm and the Equilibrium Line Altitude in central Chile during the last quarter of the XXth century" (Jorge Carrasco, Dirección Meteorológica de Chile)	Changed.

IPCC WGII AR4 FOD Expert Review Comments

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1-1554	A	89	4			should be: Dyurgerov M., Meier, M., 2005. Glaciers and the changing Earth System: a 2004 snapshot. INSTAAR, University of Colorado Occasional paper #58, 117 pp. (Mark Dyurgerov, University of Colorado)	Fixed.
1-1555	A	91	1			Reference should state: Journal of Climate, in press. (Hayley Fowler, Newcastle University)	Fixed.
1-1556	A	92	18	92	18	This reference's year is 2003, not 2004. (Mark Schwartz, University of Wisconsin-Milwaukee)	Fixed.
1-1557	A	98	48			Should be Meier, M.F., Dyurgerov, M.B., McCabe G. (Mark Dyurgerov, University of Colorado)	Fixed.
1-1558	A	103	15	103	18	Repetition of reference Root, Price et al. (Robert Wilson, Universidad Rey Juan Carlos)	References reformatted.
1-1559	A	103	45	103	49	Repetition of reference Schär, Vidale et al. (Robert Wilson, Universidad Rey Juan Carlos)	References reformatted.
1-1560	A	104	13	104	14	This paper has now been accepted (pending minor revision) in Global Change Biology. (Mark Schwartz, University of Wisconsin-Milwaukee)	Fixed.
1-1561	A	108	11	108	14	References: twice the same, the first being incomplete. (Annick Douguedroit, Université de Provence)	Fixed.
1-1562	A	108	11	108	14	Repetition of reference Walther, Post et al. (Robert Wilson, Universidad Rey Juan Carlos)	Fixed.
1-1563	A	109	18	109	24	There is a further recent Yom-Tov & Yom-Tov reference related to those included in the literature, "Global warming, Bergmann's rule and body size in the masked shrew Sorex cinereus Kerr in Alaska", Journal of Animal Ecology (2005) 74: 803-808. (Robert Wilson, Universidad Rey Juan Carlos)	Included.