



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

Specific Comments

GOVERNMENT REVIEW COMMENTS

Chapter 19

August 2006

Discussion of Government 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 AUGUST

Substantive comments

- The chapter writing team should discuss all substantive Govt review comments, by email and/or at Cape Town.
- 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 should be kept in this document, ideally electronically.
- 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 **8th December 2006**.

IPCC WGII AR4 SOD *GOVERNMENT* Review Comments

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
G-19-1	A	0				Throughout the chapter it would be helpful to consistently look at impacts that occur up to or above a global mean temperature change of 2 deg compared to pre-industrial values (1.4 deg above 1990), including in table 19.2. On one hand, at this temperature change already severe impacts for example for ecosystems are expected (see chapter 4 executive summary and chapter 4.4.11), on the other hand this is an important threshold to look at since it is discussed in the political arena. Furthermore, chapter SPM (page 7) uses pre-industrial temperatures as reference point for global temperature changes - for consistency it would be helpful to use this reference point also in chapter 19. (Government of Germany)	Unfortunately, we cannot accommodate everyone with respect to this choice (see comment E-19-91, e.g.). As explained in the text, we make this choice to reflect the most common metric found in the literature, but are clear to be explicit each time what baseline is being used.
G-19-2	A	0				This chapter strays too far from the science into normative policy judgments, adds little value scientifically, and should be deleted unless it is significantly rewritten. (Government of USA)	We take care to carefully draw distinctions between scientific and normative judgments in this chapter, particularly with respect to Article 2. We also follow the charge to our chapter in the Plenary-Approved Outline to address KVs and Art 2.
G-19-3	A	0				This chapter is one of the most important in the WG2 report, and it is well structured and clearly presented. The authors should, however, attempt to further highlight that a number of their findings on what represents a "key" vulnerability are subjective. (Government of Australia)	We agree, and have attempted to highlight this as much as possible, as well as indicating how we apply our criteria to the assessment of each key vulnerability.
G-19-4	A	0				There is no mention of "informal" economic systems, though they form the basis of many livelihoods in developing countries. (Government of Norway)	Text revised.
G-19-5	A	0				There is a need to ensure that all references in the text are actually included in the list of references. (Government of Canada)	Yes, this has been edited.
G-19-6	A	0				The whole chapter needs careful editing for language. Parts of the current draft seem to have been written under severe time pressure, and this is obvious from the little attention paid to grammar and style. In addition, the references need to be checked carefully. Many references are not cited in the text, some references are sorted by their first name (e.g. "H.-M. Füssel") etc. (European Union)	Yes, these editorial issues have been improved.
G-19-7	A	0				The definition of "key vulnerabilities" is too broad to provide scientific clarity of which vulnerabilities might be key and as a result of which attributes. (1) The authors should work from the definition of "vulnerability" that is in the TAR WGII report. (2) The authors should use consistently the criteria laid out on page 2 as the	Yes, we agree. The definition of "key vulnerabilities" has been clarified and made consistent through the chapter. It is also explicitly linked to the WGII glossary

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						<p>method for evaluating all the vulnerabilities throughout the chapter. What makes a vulnerability rise to the level of being “key” should be made clear -- for example, whether a vulnerability would be “key” if it met only one or a couple of the criteria on page 2, or whether “key” requires meeting all of the criteria. If the former, then it would be difficult to defend the exclusion of many vulnerabilities; if the latter, then the scope of Table 19.1, for example, would be much reduced. The authors should make the basis for their judgments clear and then apply it consistently. The chapter would be of much greater value if it adhered strictly to the criteria the authors set for themselves and specified those in the Table 19.1 The first column should be sector/activity (not KV). The second column should be what the vulnerability is (e.g. shutdown of THC). Then identify what the criteria are that were met that allowed the authors to put this into the table as a KEY vulnerability. <i>The chapter would have more value-added if the authors more strictly adhere to their own construct: the assessment of “key” using the criteria that they identify on page 2. Otherwise, the partial summary becomes a confusing redundancy with other chapters.</i> (Government of USA)</p>	<p>definition of “vulnerability”. We also explicitly link the relevant criteria for “key” to each entry in the summary Table 19.1.</p>
G-19-8	A	0				<p>The chapter often refers to CO2 and CO2-equivalent concentrations, without specifying which gases are included in the CO2 equivalent calculation (only Kyoto based, all GHGs, also aerosols). Chapter would benefit from a box at the beginning of Section 19.4.2 that clarifies the issue and gives a coarse indication how the different stabilization levels are related to each other. (European Union)</p>	<p>We have added text to 19.4.2 that acknowledges this distinction between CO2 and CO2-equivalent. Unfortunately, space limitations do not allow us to include a discussion of how these different levels are related to each other. We refer readers to WGI.</p>
G-19-9	A	0				<p>The chapter is in reasonably good shape, in particular given the challenges of writing a synthesis chapter at the same schedule than the sectoral and regional chapters to be synthesized. However, a grave concern is the inflationary and completely indiscriminatory use of the vague terms "may" (78 instances), "could" (42 instances) and "might" (13 instances) to describe potential future impacts of climate change in large parts of the text (in particular Section 19.3). In these cases, the reader is completely at loss whether the authors have low or very high confidence to a particular statement or projection. For an example, see p.3, l. 34-37. The authors should make every possible effort to use the confidence statements as agreed by the IPCC consistently to express their subjective confidence in a particular statement. I assume that from the 133 uses of these terms, only those are justified that refer to normative evaluations of facts by stakeholders. (European Union)</p>	<p>Yes, we agree (and we thank the reviewer for acknowledging the parallel schedules difficulty). We have focused considerable effort on removing the vague terms mentioned here, and replacing them with precise language. Our efforts for balanced and consistent uncertainties treatments have been considerable in the Final Government Draft.</p>

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G-19-10	A	0				The chapter is a bit extensive, needs some condensing, (Government of Sweden)	Yes, we have focused on shortening chapter.
G-19-11	A	0				The authors sometimes use value judgments as to which impacts indicate “dangerous interference.” Judgments of what may constitute “dangerous interference” are inappropriate for a chapter in an IPCC assessment, as the authors themselves argue on page 2 of this chapter. The authors should refrain from using the term “dangerous interference” but, rather, stick to explicit description of what the key vulnerabilities might be in a form that is useful for policy-makers to make DAI judgments. (Government of USA)	Yes, we agree that care is needed to carefully draw distinctions between scientific and normative judgments in this chapter, particularly relating to Article 2. We clearly state that the key vulnerabilities in this chapter are intended to provide information useful to policy-makers in making DAI judgments, not to provide those judgments.
G-19-12	A	0				New reference: Nilsson, G., Rosqvist, H., Andersson-Sköld, Y., Starzec, P. & Norrman, J. 2005. Föreningsspridning, Underlag för handlingsplan för att förutse och förebygga naturolyckor i Sverige vid förändrat klimat, Deluppdrag 3. Statens Geotekniska Institut, Varia 560:3, 40 pp. (Government of Sweden)	Not clear where this is suggested to be included.
G-19-13	A	0				New reference: EEA 2004: Mapping the impacts of recent natural disasters and technological accidents in Europe. Environmental issue report No 35, European Environmental Agency, Copenhagen, Denmark. (Government of Sweden)	Not clear where this is suggested to be included.
G-19-14	A	0				Key vulnerabilities need to have more social emphasis. Particularly in the context of slums which are going to be a key issue in the future given that increased extremity of climate change events will increase displaced peoples. (Government of Finland)	Many included key vulnerabilities focus on social systems, including regional systems—see extensively revised text and table.
G-19-15	A	0				It is unclear whether the understanding of key vulnerabilities in Chapter 19 is the same as that used in the other chapters in their assessments of key vulnerabilities. We strongly recommend that the definition and construct for evaluating key vulnerabilities be made consistent across chapters and with this chapter. This chapter then can become a more defensible and useful synthesis of the assessments in each of the other chapters. (Government of USA)	The definition of “key vulnerabilities” has been clarified and made consistent through the chapter. It is also explicitly linked to the WGII glossary definition of “vulnerability”.
G-19-16	A	0				It is important to be prepared in the case of event. In relation to climate change it is important for regions to identify their weaknesses and to have actionplans on how to react to climate change. This can be achieved by the planning process in each region by performing research games on different climate-related scenarios. The Swedish National Institute of Public health is about to publish a report on this (ISBN 91-7257-449-6). (Government of Sweden)	No change suggested.

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G-19-17	A	0				General - no statement of what TAR said and thus, where we were and what's new (Government of UK)	We link to TAR in 19.3.7.
G-19-18	A	0				Flash flooding?? Needs a definition, or a reference to where to find a definition (Government of Sweden)	Agreed.
G-19-19	A	0				Executive Summary: Provide source references in brackets, provide statements in bold face with stated levels of confidence., and include a section on research priorities. Ensure that there is consistency among these, the Technical Summary, and with the underlying chapter (as well as the SPM) (Government of USA)	Agreed.
G-19-20	A	0				Develop conceptual physical mechanisms between general circulation and extreme events. (Government of Spain)	This is not part of the charge to our chapter.
G-19-21	A	0				Chapter 19 uses "current" (1990-2000) temperatures as the baseline for their impact estimates (cf. Box 19.2 on p.6) whereas the SPM uses "preindustrial" (1750) temperatures (cf. footnote 7 on p. 7). WG II may wish to agree on a common baseline for GMT changes, and have them implemented across all chapters and including the summary chapters. (European Union)	Unfortunately, we cannot please everyone with respect to this choice (see comment E-19-91, e.g.). As explained in the text, we make this choice to reflect the most common metric found in the literature, and are explicit in many places what baseline we are using.
G-19-22	A	0				As to the meaning of the term “key vulnerability,” section 19.1.2.1 of the chapter does not attempt to define or explain the term. Instead, it merely concludes (p. 6) that “[i]n accordance with the pertinent literature” (which is not referred to anywhere), the term is “used” in the chapter <u>broadly in the context of potentially severe impacts of climate change that merit particular attention by policymakers because they endanger the lives and well-being of people or other valued attributes of climate sensitive systems</u> . The term ‘key vulnerability’ may refer to the vulnerable system itself (e.g., low-lying islands or coastal cities), the impact to this system (e.g., flooding of coastal cities and agricultural lands or forced mitigation), or the mechanism causing these impacts (e.g., disintegration of West Antarctic Ice Sheet). That may be an overly broad application of the term. According to the chapter, the context of this discussion is FCCC Article 2. In fact, Box 19.1 of chapter 19 (p. 6) includes two sentences in quotation marks that purport to be Article 2. However, the second sentence begins with the words “This stabilization level” and the remainder of the quoted sentence is bulleted, which is not an accurate replication of Article 2. It is our understanding that IPCC procedures do not give WGII the latitude to rewrite the FCCC to fit its interpretation of Article 2. [Appendix 1, section A1.1 of the SPM defines the term “climate change” for purposes of the draft to “include climate changes due to	The definition of “key vulnerabilities” has been clarified and made consistent through the chapter. It is also explicitly linked to the WGII glossary definition of “vulnerability”. We have carefully examined all statements relating to Article 2, and we take care to carefully draw distinctions between scientific and normative judgments in this chapter, particularly relating to Article 2. We clearly state that the key vulnerabilities in this chapter are intended to provide information useful to policy-makers in making their own DAI judgments, not to provide those judgments.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						<p>natural causes” and observes that it “so differs” from the FCCC definition of this term. However, the WGII adoption of this different definition does not amount to a rewrite of the FCCC definition.] Please quote Article 2 precisely.</p> <p>Chapter 19 (p. 7) asserts that Article 2 “leaves the <u>definition</u> of ‘dangerous’ <u>flexible, thereby allowing different interpretations and reinterpretations of what is dangerous</u>” (emphasis added). It also asserts (p. 8) that Article 2 “<u>defines international policy efforts</u> in terms of avoidance of a level of greenhouse gas concentrations beyond which the effects of climate change would be considered ‘dangerous’” (emphasis added). [There does not appear to be any literature reference in the chapter to support this assertion.]</p> <p>These assertions in the draft tend to leave the impression that much consideration has been given to the meaning and scope of Article 2, which does not appear to be the case. Indeed, even the chapter notes that “the literature” regarding the Article “remains relatively sparse.” Article 2 sets forth the “ultimate objective” of the FCCC to be achieved “in accordance with the relevant provisions of the Convention” and within a “<u>time-frame sufficient to allow</u> ecosystems to adopt naturally to climate change, to <u>ensure</u> that food production is not threatened and to <u>enable</u> economic development to proceed in a sustainable manner” (emphasis added). We question whether Article 2 can be said to be a definition of “international policy efforts” in any way. Similarly, whether the Article “leaves the definition of ‘dangerous’ flexible” so as to allow “different interpretations and reinterpretations of what is dangerous” has yet to be addressed by the FCCC Parties. In short, neither assertion is within the purview of WGII.</p> <p>The chapter also refers to what is called “[o]perationalising Article 2” and the “[o]perationalisation of Article 2” and seeks to explain what they mean (pp. 7-8): <u>Operationalising Article 2 requires a scientific analysis of what impacts are expected for different level of greenhouse gas concentrations or climate change. Second, it requires a normative evaluation of which impacts are significant enough to constitute, individually or in combination, DAI.</u></p> <p>Operationalisation of Article 2 is necessarily a <u>dynamic process</u> because the establishment of a specific level of greenhouse gas concentrations as “dangerous” may be modified based on changes in scientific knowledge, social values, and political priorities. <u>One target that has received considerable attention in the literature is to limit global mean temperature increase to 2°C over pre-industrial levels</u> (about 1.3°C above 2006 levels).</p> <p>However, in a 2003 speech IPCC Chairman Dr. Rajendra K. Pachauri cautioned the IPCC in developing AR4 not to stray “into policy prescriptive territory,” noting</p>	

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						<p>that: <u>at no stage must any part of the AR4 cross the storm front that would inappropriately take us into policy prescriptive territory. This would be a difficult but critically important requirement, and one that is at the core of the scientific credibility and effectiveness of the IPCC....Purely as an example, I would like to refer to the need for treading carefully on the issue of Article 2 of the Framework Convention on Climate Change, which refers to the level of stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system....It is for others to determine what constitutes dangerous levels of interference with the world's climate system and what actions should be taken....Such value judgments do not reflect scientific assessment, and can at best be facilitated by an objective assessment of risks, impacts and key vulnerabilities of the systems thus affected and their relationship with specific mitigation options.</u> The chairman's words of caution are pertinent to the above comments. Moreover, we question whether the IPCC should drift into discussing or mentioning such matters as the "[o]perationalisation of Article 2" and the singling out of a "target" that has been suggested informally by one group of FCCC Parties. (Government of USA)</p>	
G-19-23	A	0				<p>An appended file entitled <19.1&19.2_Reformat.doc> has been included with the U.S. submission. (Government of USA)</p>	Not provided, although suggested categories were included below.
G-19-24	A	0				<p>All policy judgments should be removed from the chapter. (Government of USA)</p>	We agree and those identified have been removed.
G-19-25	A	0				<p>A lot of abbreviations make it hard to capture the essence of the text (Government of Sweden)</p>	Abbreviations are defined.
G-19-26	A	1		40		<p>The authors may want to consider the Goklany references offered in the Chapter 18 comments. (Government of USA)</p>	Some Goklany refs cited.,
G-19-27	A	2	3	3	7	<p>There are apparent contradictions with respect to terminology from an IPCC perspective in the executive summary. The authors should consider clarity of terminology - this should be useful for policy-makers, not overly ambiguous (Government of Canada)</p>	The definition of "key vulnerabilities" has been clarified and made consistent through the chapter. It is also explicitly linked to the WGII glossary definition of "vulnerability".
G-19-28	A	2	3		3	<p>Add to the beginning of the Executive Summary: "The mandate of this chapter is to synthesize the key vulnerabilities to climate change – hence the chapter makes no effort to provide balanced treatment of both positive and negative potential impacts."</p>	The definition of "key vulnerabilities" has been clarified and made consistent through the chapter. It is also explicitly linked to the WGII glossary definition of "vulnerability".

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						(Government of USA)	
G-19-29	A	2	6	2	10	This reminder that the definition of DAIs can not be based on scientific facts alone, but must include value judgements, should be included in the SPM. (Government of Finland)	We agree, and so state that judgments are involved.
G-19-30	A	2	19	2	19	Change "assessing and defining" to "identifying" (European Union)	Changed.
G-19-31	A	2	20	2	26	Replacing the "neutral" criteria with directed criteria may make intuitively clear under which conditions a vulnerability is condered "key" and would help understanding. Concretely, authors could consider to use "immediacy" instead of "timing"; "persistence and irreversibility" instead of "persistence and reversibility"; "lack of feasible adaptation" instead of "potential for adaptation"; "inequitable distribution" instead of "distribution". (European Union)	We prefer to keep the criteria themselves neutral.
G-19-32	A	2	21		26	We suggest changing “timing” to rates of change” and eliminating “importance of the vulnerable system” as a criteria because it is inherently a value judgment and different people will value systems differently. (Government of USA)	Timing in our usage means more than rates of change (see 19.2). Importance is inherently more qualitative, and we acknowledge that assessment of importance involves subjective judgment. We carefully clarify how we use this term in the description of this criterion.
G-19-33	A	2	28	2	28	Add "biophysical systems" to the list. (European Union)	This list now reflects what is covered in Table 19.1.
G-19-34	A	2	31	2	33	Order the list according to some sensible criterion; e.g., social systems first, other living systems second; geophysical systems last. (European Union)	This list now reflects what is covered in Table 19.1.
G-19-35	A	2	33			Append a new sentence at the end of this para which would read as follows: “However, it should be noted that a key geophysical vulnerability may not translate into a key socio-economic vulnerability of equal significance.” As an example consider the melting of various ice sheets that, if it occurs, will take centuries to millennia (p. 19 of this chapter). The socioeconomic impacts of such melting can be substantially mitigated due to the long time frames involved. (Government of USA)	This is not appropriate here, and the example given is speculation. Moreover we assign confidence levels to these events to deal with uncertainties.
G-19-36	A	2	35	2	49	The relationship between, and attribution of, natural and anthropogenic climate change is not clear, but it is very important for the authors to be clear about how attribution of climate change is linked to vulnerability. (Government of Australia)	In the abstract, vulnerability to climate change exists regardless of the cause of the climate change. Relationship to attribution has been specified here.
G-19-37	A	2	37	2	38	Please clarify whether the word "increases" refers to an increase in frequency or an increase in the strength of tropical cyclones.	Phrase removed.

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						(Government of Australia)	
G-19-38	A	2	37			Insert “many” prior to “glaciers”. (Government of USA)	We disagree.
G-19-39	A	2	37			“increases in human mortality” vaguely described like this, does not provide enough context for including this statement as a key vulnerability. We do not find the research justification for this in the underlying chapter. It should either be provided in the chapter or deleted from the Executive Summary. Either delete or explain. (Government of USA)	Chapter text revised for consistency with Chapter 8.
G-19-40	A	2	38			We are unaware of empirical data with sufficiently long coverage that indicates any global increase in intense tropical cyclones. By long term, we mean data that covers more than 3 to 4 decades. Any thing less than that is indistinguishable from short term fluctuations not necessarily connected to climate change (anthropogenic or otherwise). (Government of USA)	Phrase removed here. Chapter text revised for consistency with WGI.
G-19-41	A	2	38			Increases in extreme events (what kind of increases? Too vague.) may not qualify as a key vulnerability since extreme events like hurricanes and cyclones sometimes vary on multi-decadal scales cycles How these variations may be affected by climate change have not been documented. . Loss of glaciers is the only example of the three that seems to meet the definition the authors use for a current key vulnerability. (Government of USA)	Text clarified to mean increases in frequency and/or intensity of extreme events.
G-19-42	A	2	39	2	46	It should be clarified in the executive summary how the value 2 deg above 1990 compares to the 2 deg goal of the EU, which is above preindustrial (Government of Germany)	Specific mention of individual policy goals is beyond the scope of this chapter. Relationship between temperature baselines is explained in Box 19.2—reference added.
G-19-43	A	2	39	2	41	Change “will exacerbate current key vulnerabilities” to “may exacerbate some key vulnerabilities while relieving others, at least temporarily”. Consider, for example, for temperature increases less than 2o C, global carbon sink capacity (and habitat lost to cropland) may be augmented (e.g., Levy et al 2004). [REF: Levy, P.E., et al. (2004). “Modelling the impact of future changes in climate, CO2 concentration and land use on natural ecosystems and the terrestrial carbon sink,” Global Environmental Change 14 (1): 21-30.] Similarly, it’s not clear that moderate temperature changes may not reduce net global hunger [Parry et al.. 2004, Fig.14 Panel A]. (Government of USA)	This is changed to key impacts and linked directly to the first bullet. Confidence statements reflect level of uncertainty.
G-19-	A	2	39		46	To avoid confusion, it would be more appropriate to present these as “If...then”	We change “will” to “would”

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44						statements. The confidence levels on these lines are overstated. (Government of USA)	
G-19-45	A	2	39		49	The temperature breakouts in the underlying chapters and the models on which they are based do not support the specificity of the temperature categories presented and should not be included here in this way. (Government of USA)	We disagree—these are broad statements.
G-19-46	A	2	39		41	The literature, including the 2001 IPCC Assessment and Hitz and Smith 2004, cites some positive impacts at this level of temperature change but this is not mentioned. (Government of USA)	As we now clearly state in the text, Vulnerability to climate change is the degree to which systems are susceptible to, and unable to cope with, adverse impacts from climate change. As we also now clearly state, given this focus on vulnerability, the analytic emphasis of this chapter is on people and systems that may be <i>adversely</i> affected by climate change, particularly where impacts could have serious and/or irreversible consequences. Positive impacts are addressed where relevant to this assessment of key vulnerabilities. We have added a statement about possible benefits to global agricultural productivity here.
G-19-47	A	2	39			Consistency issue - SPM uses pre-industrial temp as baseline, not >1990 (Government of UK)	See G-19-21
G-19-48	A	2	40	2	40	Move the assessment "(high confidence)" from after "others" to in between "vulnerabilities" and "and". (Government of Australia)	Moved.
G-19-49	A	2	44			It should be noted here that already a modest rise temperature increase from today trigger widespread, if not a almos total deglaciation in Greenland. [see chapter 19, page 26, lines 1 - 1] (Government of Finland)	Chapter has been revised for consistency with WGI.
G-19-50	A	2	45		46	For greater accuracy, rewrite this bullet to read as follows: "The higher the global mean temperature (GMT) increase over 4o C above ~1990 levels, the greater the likelihood of exceeding the current adaptive capacity of many systems". We note that if higher GMTs are associated with higher levels of economic growth and technological prowess, adaptive capacity might keep pace with climate change impacts, at least for some systems (Goklany 2006a, 2005c). (Government of USA)	Overall socio-economic development is considered in the baseline. We acknowledge that baseline levels of development affect adaptive capacity, but that the literature is sharply divided on by how much that potential might be realized. Moreover, whether a climate change impact would be either greater

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							or smaller than welfare gains or losses associated with particular development scenarios is beyond the scope of this chapter-- and is dealt with in Chapter 20 and in Working Group III. Likewise, comparison of the costs of mitigation or adaptation relative to the projected income from the growth rate in the GDP are also beyond the scope of this chapter.
G-19-51	A	2	47	2	48	Why does this paragraph focus on climate variability and not the full range of climate change impacts more generally? Suggest replacing the start of this paragraph to read " Regions that are already under stress are more likely to be adversely affected..." (Government of Australia)	Revised in keeping with comment.
G-19-52	A	2	47	2	47	Define what scale the term "region" refers to. (Government of Australia)	Not appropriate here.
G-19-53	A	2	51			Eliminate "planned". There is no reason why adaptations have to be "planned". They could be spontaneous. (Government of USA)	Removed.
G-19-54	A	3	1		7	Ch. 17 should be referenced here. However, though it is the appropriate place, that chapter doesn't currently provide a very good summary of current adaptive capacity across regions and sectors. Also, either Ch. 17 or 19 should provide more specific details on adaptation limitations across regions. (Government of USA)	This is a critique of Chapter 17. Please refer to section 19.4.1 for cross-references.
G-19-55	A	3	4	3	4	Add "or non-existent" after "very limited". (European Union)	We disagree, overly wordy.
G-19-56	A	3	5	3	7	Change to "On the other hand, most developing countries have significant capacity to implement..." . Often it is not lack of capacity but lack of awareness and thus political will that prevents adaptation in planning and decision making. (European Union)	Sentence revised.
G-19-57	A	3	9	3	13	Integrate with previous paragraph as there is considerable repetition. (European Union)	Condensed.
G-19-58	A	3	17	3	17	Remove the quotation marks around "guardrail analysis", also in Table 19.3 (European Union)	Done.
G-19-59	A	3	20		21	To the list of uncertainty factors, add the following two: "adaptive capacity and the likelihood of bringing such capacity to bear." (Government of USA)	Added.

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G-19-60	A	3	24		28	This point is very poorly worded. Amend it to say, "Reductions in global greenhouse emissions reduces the likelihood of adverse impacts. Postponement of emissions reductions increase the likelihood of adverse impacts." The remainder of the paragraph does not belong here, but in WGIII (if appropriate). (Government of USA)	Revised.
G-19-61	A	3	25		28	Delete this sentence. The first sentence of the bullet makes the key point and the rest of the bullet is a diversion of questionable merit with lots of qualifiers that would be better addressed in Chapter 18 or in WG 3 (Government of USA)	Deleted.
G-19-62	A	3	27	3	28	Delete the phrase "(e.g., less than 500 ppm CO2 equivalent)". It is inappropriate to refer to a specific stabilization level. (Government of Japan)	Deleted.
G-19-63	A	3	28			SPM uses CO2-only, not CO2-equiv. (Government of UK)	This has been removed.
G-19-64	A	3	29	3	30	The meaning of this text is unclear. What exactly does "historical climate change" mean and what does it refer to in this context? Further, we wonder if the writers are in fact asserting in the current text that the "deglaciation of major ice sheets" will occur even if GHG concentrations are stabilized at the current level. There is a danger that more can be read into this text which will lead to gross misinterpretations and we ask that this text be re-written with scientific clarity. (Government of Japan)	This text has been revised for clarity.
G-19-65	A	3	29			Insert a new bullet to read as follows: "Increases in adaptive capacity would also reduce the socioeconomic risks from key vulnerabilities." (Government of USA)	This is not appropriate here, and is discussed elsewhere in the ES.
G-19-66	A	3	30		33	Amend the existing point to read, "Some researchers' modeled results suggest a significant probability that some large-scale events (e.g. deglaciation of major ice sheets) may no longer be avoided due to historical greenhouse gas emissions and the inertia of the climate system." (Government of USA)	This text has been revised for clarity.
G-19-67	A	3	34	3	37	The statement "There is high confidence that ... levels above 450 ppm could cause an increase in GMT in excess of 2°C above current levels..." provides hardly any information, given the nonsensical combination of a specific confidence estimate with the vague term "could". This is just one of many examples where findings of the literature are essentially watered down by indiscriminate use of very vague language. (European Union)	Removed.
G-19-	A	3	34	3	37	Text referring to temperature rise and CO2 concentration must be consistent with	Removed.

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68						the assessment of climate sensitivity by WG1. We ask that the writers review so as to ensure consistency with WG1 and WG2. In this paragraph, we see no consistency. Further, any reference to climate sensitivity should be directly quoted from WG1. (Government of Japan)	
G-19-69	A	3	39			Use “key vulnerabilities” instead of “DAI issues”. (Government of USA)	Yes, we agree
G-19-70	A	3	44			Eliminate “adversely”. Alternatively, add a sentence acknowledging that many changes that have been observed to date are not necessarily adverse (as yet). For instance, the northern latitudes apparently have turned greener. (Government of USA)	Relevant text removed.
G-19-71	A	3	50			severe floods in many regions) -> severe floods, drought and extreme cold in many regions) (Republic of Korea)	Relevant text removed.
G-19-72	A	4	2		3	Consider adding to the end of the point, “even though socio-economic development has added to adaptive capacities.” (Government of USA)	Relevant text removed.
G-19-73	A	4	6		7	Amend to read: “Eliminate “that have historically contributed little to anthropogenic climate change” and “However,” At the end of the paragraph add, “Other countries or groups may benefit from climate change, at least under certain conditions.” (Government of USA)	Relevant text removed. Addition not appropriate here.
G-19-74	A	4	13		25	The main point made in this paragraph is that there is lower confidence in assessments of aggregate effects than in the TAR – the paragraph points out what some of these may be but then highlights “in particular” greater uncertainties in estimates that show aggregated benefits at low levels of climate change. This placement gives those findings special standing, yet the supporting text in the body of the chapter (pages 29-30) does not include any citations of literature addressing this point. Recommend deleting last sentence of paragraph after “in the TAR.” Also, change the first part of the sentence to read, “In summary, there remains low confidence in assessments of aggregate effects, as in the TAR.” (Government of USA)	See 19.3.2.3 and 19.3.7 where text has been revised.
G-19-75	A	4	27	4	31	There are two problems with this text. Firstly, the use of the term threshold. It seems odd and rather misleading to use the term threshold in this context, specifically when discussing the phenomena of melting ice over a time span of tens of thousands years. The second problem with this text is that we do not agree with the comparison between TAR findings and AR4 WG1 chapter 10.6.4.2 and	Clarified that thresholds are associated with initiating changes that do not occur instantaneously. We disagree that comparison cannot be made between TAR and AR4. Please refer to 19.3.5 for detailed discussion

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						Question 10.2. Threshold discussions in TAR were concerned with phenomena observable over a period of five to seven centuries where as in AR4 the discussion related to temperature changes is concerned with a tens of thousands of year span. The timespans are different and thus direct comparison of TAR with AR4 is inappropriate in this context. We suggest this be fundamentally rewritten. (Government of Japan)	which is consistent with WGI.
G-19-76	A	4	27	4	31	The first part refers to WAIS only, whereas the second part refers to WAIS and the Greenland ice sheet. Consistency is needed here. (European Union)	Relevant text removed.
G-19-77	A	4	32	4	33	Despite the low confidence in the conclusions about net biogenic feedbacks on the carbon cycle, the possible risk is very large, if the terrestrial carbon sink becomes a source this century. As such the authors should more clearly highlight and expand upon this point. The authors should also highlight that "large scale singularities" include climate surprises and tipping points. (Government of Australia)	Relevant text removed.
G-19-78	A	5	38	5	38	What does "such as stabilisation and mitigation/adaptation options" mean? Is GHG stabilization not a mitigation option? Are there others than adaptation or mitigation that are presented or ignored? (See respective comment on Section 19.4 regarding research and compensation.) (European Union)	We now clarify this text to state that, "the chapter provides an assessment of literature bearing on the contributions that various mitigation and adaptation response strategies, such as stabilisation of greenhouse gas concentrations in the atmosphere, could make in avoiding or reducing the probability of occurrence of key vulnerabilities."
G-19-79	A	5	42	4	50	The text confuses a few times what is in Section 19.2 and 19.3. (the current Section 19.2 hardly deserves to be a separate section and should be renumbered to Subsection 19.1.3 - see comment below.) (European Union)	This has been corrected.
G-19-80	A	5	47			says 19.2 can't provide exhaustive list of KVs but 19.2 doesn't give list, it discusses criteria - suggest should be referencing 19.3 (Government of UK)	This has been corrected.
G-19-81	A	5	48		50	We question whether an IPCC assessment of the literature should include a table identifying key vulnerabilities (reference here should be Tables 19.1 and 19.2, not Section 19.2) based on the "authors' collective judgments" of which, among "a vast array of possible candidates" in the literature meet their criteria (also subjective) of what should be deemed key vulnerabilities. This is not a brainstorming exercise. A better source for material in any such table would be a listing of the key vulnerabilities contained in the other chapters, providing they used the same criteria	As stated in the text, this chapter "synthesizes information from Working Group I and Chapters 3-16 of this Report and identifies key vulnerabilities based on seven criteria (see 19.2)." As such it is clearly based on the information contained in other IPCC chapters. But space does not permit a

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						for determining the key vulnerabilities as the authors in Chapter 19. (Government of USA)	comprehensive list, so author's judgements on what to include in a representative list are unavoidable.
G-19-82	A	6	0	7		Useful definition of KV and Dangerous CC (Government of UK)	Thank you.
G-19-83	A	6	18	6	33	The majority of the WG2 report uses thresholds for global mean temperature change with respect to pre-industrial levels. As Box 19.2 describes, Chapter 19 uses 1990-2000 levels as the base metric. While this may be due to the assessed literature, the authors should attempt to also include the possible change from pre-industrial levels (possibly in brackets) whenever a temperature change is given. This will ensure greater consistency across the WG2 report. (Government of Australia)	This is a useful suggestion, but one we must decline, because it would imply a false level of rigor regarding the reported levels. For example, the statement of a threshold such as 2C above 1990-2000 levels would be equivalent to 2.6C above pre-industrial levels. We just clarify often what baseline is used.
G-19-84	A	6	24	6	25	To ensure consistency across the AR4 the authors should include a reference to WG1's findings for the increase in temperature from pre-industrial-levels. (Government of Australia)	This has been added.
G-19-85	A	6	38	6	45	The term "key vulnerability" is defined more than once (also loosely defined in executive summary); might be best to put the whole definition at the beginning or say it is defined below. (Government of UK)	Definition revised to be specific, tied to AR4 Glossary, and consistent with ES.
G-19-86	A	6	47	7	3	It does not make sense or add substantive value to identify a vulnerable system as a key vulnerability. A low-lying island is not a key vulnerability – it is threatened by a key vulnerability, that is , likely sea level rise that will inundate the island in severe ways. Sea level rise, in an of itself is not a key vulnerability if it doesn't threaten societies or ecosystems or can be adapted to. Therefore, the authors would do well to extend the accepted TAR definition of vulnerability in all three of its aspects in defining key vulnerabilities. This definitional issue causes problems later in the tables. (Government of USA)	Definition revised to clarify connections among the different uses of KV.
G-19-87	A	6				Box 19.1 and relating text: Interpreting Article 2 of the UN FCCC is not a scientific endeavor. Either delete Box 19.1 or, preferably, amend it to quote exactly the language of Article 2. (Government of USA)	Revised to quote exactly.
G-19-88	A	7	13	7	17	A few examples of non-climatic developments may be mentioned in parenthesis after the words "non-climatic developments" in line 13 in order to make the text more clear. (Government of Pakistan)	Done
G-19-	A	7	26	7	28	Delete the last sentence which is out of place in an IPCC report which should deal	Deleted

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89						with scientific knowledge only. Ethical, moral, and religious arguments are indeed subjective (some people do not even believe in any religion) and cannot inform subjective value judgement, in the same sense as scientific knowledge (line 22).. (Government of France)	
G-19-90	A	7	26		28	Shorten this sentence to read: "Value judgments are necessarily subjective". The additional phrase "they may be informed by ethical, moral, or religious arguments" is less informative than it sounds because these arguments – and more importantly - the force that should be given to these argument is itself subjective. In fact, it is a good argument for avoiding such judgment, because otherwise one will get into discussions of theology. We urge that the IPCC stick to science instead. (Government of USA)	Discussion rewritten
G-19-91	A	7	32	8	3	A discussion of operationalizing Article 2 is inappropriate here, as is venturing to posit what would be required or highlighting one approach. All are strictly policy judgments best handled in the UNFCCC or by implementing countries. Article 2, as the objective of the UNFCCC is already operationalized through the many activities of the Convention, including capacity building, technology transfer and other activities. There is little or no reason for this chapter to mention DAI. (Government of USA)	Discussion rewritten as in comment E-19-105
G-19-92	A	7	47	8	3	The current wording for this text comes across as being policy prescriptive, verging on the political. We ask that the current wording be revised and that scientific assessments be inserted into the text so as to maintain scientific neutrality in the text. We ask that the writers insert the so-called "recent literature" on page 8, lines 2-3, and the varying findings these contain. (Government of Japan)	See above response.
G-19-93	A	8	2	8	4	Provide some references for this statement (e.g., Mastrandrea & Schneider, 2004; Wigley, 2004) (European Union)	Discussion deleted.
G-19-94	A	8	2			Add a new sentence on this line that would read as follows: "However, the scientific basis for was weak when adopted and increasing uncertainty about climate change impacts (see lines 13-25, page 4 of this chapter) haven't necessarily strengthened its underpinnings." (Government of USA)	Discussion deleted.
G-19-95	A	8	30		45	Revise this section in line with the recommendation to eliminate all discussion of "dangerous anthropogenic interference as unhelpful and unnecessary." (Government of USA)	DAI is an appropriate subject for this chapter, given our PAO mandate to discuss Article 2. We do refrain from making judgments about what constitutes DAI.
G-19-	A	8	38	8	39	Ecosystems, infrastructure and tourism are not "climate impacts".	Discussion rewritten to clarify.

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96						(European Union)	
G-19-97	A	8	48			Section 19.2 is a logical continuation of 19.1.1. and 19.1.2, It does not deserve to be a separate section and should instead be renumbered to Subsection 19.1.3. (European Union)	Structure is now clarified, we choose to keep 19.2 as its own section.
G-19-98	A	9	10		11	“different decision makers are likely to perceive different vulnerabilities as ‘key’” So how is it the authors expect that they might produce such a determination in a way that is scientifically credible? (Government of USA)	Sentence deleted. We do not “determine” what is key; we only assess what criteria might be involved and how they might be applied.
G-19-99	A	9	19	9	19	Add "primarily" after "interference". (European Union)	Rewritten
G-19-100	A	9	42	9	42	Add "centuries" after "triggered". (European Union)	Section rewritten accordingly.
G-19-101	A	10	20	10	32	This discussion of likelihood and confidence is quite specific and differs from the IPCC conventional definitions recalled in SPM, page 22, lines 9 to 23 (Government of France)	Section clarified by language connection to SPM.
G-19-102	A	11	8		16	In what way is this paragraph scientifically relevant? On what scientific evidence is assumption based about what values decision makers may use to determine key vulnerabilities? Why is only one value presented? (Government of USA)	Discussion revised and troublesome point eliminated.
G-19-103	A	11	36	11	42	The list of key vulnerabilities is said to be illustrative, not comprehensive. There needs to be some discussion of the criteria used to determine which KVs were included in this illustrative list. There must have been some reasoning behind the selection and the omission of others. Were the KVs included those which were expected to impact more people, impact the most disadvantaged people, those expected to have the greatest economic impact, etc..? (Government of USA)	See revised text in section 19.2 for fuller discussion of the criteria to consider in assessing what is “key”.
G-19-104	A	12	12			Add the following sentence to the end of this para: “However, by ignoring the time dimension, it is not possible to account for secular changes in technology, and time dependent changes in economic growth or changes in human and social capital – all determinants of adaptive capacity, a key criterion for establishing key vulnerability. Accordingly, results from most cases should be treated with caution Goklany (2006a).” (Government of USA)	We do not predict baseline changes and compare them to impacts of marginal climate changes except when a specific baseline scenario changes estimates of adaptive capacity.
G-19-105	A	13	1			Table 19.1 contains several unclear statements, e.g. "several °C warming this century", "1-2°C or more", " (European Union)	text revised
G-19-	A	13		15		We provide specific comments on cells in the existing Tables 19.1 and 19.2,	Revised text more consistent with this

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106						notwithstanding that we strongly urge that the tables be revised to be much more specific and to follow the criteria for “key” laid out in the Executive Summary of the Chapter 19. Of course, all entries in the table(s) (SEE TABLE BELOW) should come from and visibly tie to the Key Vulnerabilities sections in each of the sectoral chapters, and be consistent in the TS and the SPM. Please note, we suggest eliminating “importance of the vulnerable system” as a criterion because it is inherently a value judgment and different people will value systems differently. (Government of USA)	comment, but we do not remove “importance” criteria since it is in the literature—but we do very explicitly label it as a normative judgment.

Eliminate “importance of the vulnerable system” because it is a value judgment of whoever is making the table. Different people will value these differently. Be much more clear about what the vulnerable people or systems are. Mock-up of Improved Table 19.1 and 19.2 (L= low confidence; M= medium confidence, H = high confidence)

Vulnerable Sector or Activity	Criteria for “Key” Vulnerability					
	Magnitude	Rates of Change	Persistence and reversibility	Likelihood and confidence	Potential for Adaptation	Distribution
Bounded ecosystems such as coastal, mountain and already stressed	State magnitudes of vulnerability for different magnitudes of change, especially thresholds, relative to temperature, precipitation or the other critical parameters that create the vulnerability	State any critical rates of change that affect vulnerability	Provide information on the likelihood that the vulnerable sector will be affected by an irreversible impact and whether it is likely to persist.	Overall confidence and likelihood, but state confidence also with any specific figures or points.	State capacity for adaptation. Is adaptive capacity sufficient to delay or prevent adverse impacts and at what cost.	Provide information on the distribution of impacts – both physically and socially within countries (not in a simple developed/developing dichotomy).

(Government of USA)

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G-19-107	A	13		15		We have a great deal of difficulty reconciling the criteria for “key vulnerabilities” and the Reasons for Concern constructs. We have great difficulty tracking between the two. The chapter would be far easier to understand and more effective if the reasons for concern construct were not overlaid on the key vulnerabilities. We struggle, as well, with the different categorizations of vulnerabilities. And might prefer “physical systems” , “socio-economic systems” , and environmental, rather than according to the reasons for concern in Table 19.1. These constructs need to be better reconciled or the Reasons for Concern construct deleted. (Government of USA)	Text revised to deal with many of these issues.
G-19-108	A	13		15		Table 19.1: Using the” reasons for concern” categories in the burning embers diagram as a way to organize the authors’ examples of key vulnerabilities does not work as one of the categories (extreme events) does not meet the criteria for persistence and irreversibility and another of the categories (aggregate effects) can be determined with lower confidence than in the TAR. Also, according to the table, everything is a key vulnerability (terrestrial ecosystems, regional systems) For these reasons and the comment above, we suggest deleting Table 19.1 and incorporating some information from column 2 into Table 19.2. Column 3 is already covered in Table 19.2. (Government of USA)	Tables now amalgamated into one organized by social, biological and physical systems and extreme events.
G-19-109	A	13				the box on right hand side on glaciers and small ice sheets.. I find that the formulation is too general to reflect the findings of the report, that predict significant mountain glaciers to disappear already well before several degrees of warming [seeChapter 10, page 46 for the Himalaya; chapter 9, page 31 for the mount Kilimanjaro; for Andes chapter 13]. (Government of Finland)	Have to be general at our leel of aggregation, but do cross refernce back to regional chapters very often.
G-19-110	A	13				The box on coral ecosystems.. It states that 1 degrees warming will be too much for coral ecosystems, but as I understood it, it should here reflect the change from	Consistent with Ch 4.

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						today's temperatures. And if so, then I believe it should be closer to 0,4 degrees. [see for example SPM-3] (Government of Finland)	
G-19-111	A	13				Table 19.1 Row 6 (ocean ecosystems) Column 3 (remarks...). Language needs to be more specific: what does "coral reefs threatened..." actually mean? If this is meant to claim that coral reef as ecosystems and/or geomorphological structures might cease to exist, then there is far from consensus that this is plausible or likely at 1deg C warming. Suggest, as more accurate and less contentious term: "coral reefs degraded...." (Government of Australia)	Revised
G-19-112	A	13				Table 19.1 Risks from extreme events: Infrastructure: Very good comment on "criteria for key" and "remarks on critical level, timings and confidence". Although, it is also important to remember that the pipe system design vary from country to country (combined sewer system or separated system) which will imply different effects during extreme events, e.g. flooded basements, flooded drainage systems, etc. (Government of Sweden)	Minor point
G-19-113	A	13				Infrastructure: Add at the end of the 3rd column: "...and/or repair during normal maintenance cycle, and/or gradual abandonment based on the rate of relative SLR and increases in risks." (Government of USA)	Assuming everyone has perfect foresight and acts appropriately. We cite literature, not speculate on what might or might not be a response to SLR.
G-19-114	A	13				Indigenous, poor or isolated communities: The 3rd column should note that adaptive capacity should improve over time if, per the SRES scenarios, populations become wealthier and technologically more sophisticated and if there is progress toward sustainable development as exemplified, for instance, by the Millennium Development Goals (because such progress will also add to human and social capital) (Goklany 2006a, 2005a)." (Government of USA)	Makes an assumption about distribution of wealth. Does anyone seriously presume there will be no poor people in the future?
G-19-115	A	13				In Table 19.1, Colum 3, Row box 2, line 2, the word "at" is repeated; one "at" may be deleted. (Government of Pakistan)	OK
G-19-116	A	13				Coastal Communities: In the third column replace "partially reduced" with "reduced if not eliminated". First, it leaves the original meaning intact. Second, in theory, at least, this particular vulnerability can be eliminated if people move (or are moved) inland. (Government of USA)	Revised
G-19-	A	14	1	14	47	Table 19.1 row - "Cross-border issues". The statement that "SLR will displace	Wording consistent with literature.

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117						many people" is not presented in such stark terms in either Chapter 7 or 16, suggest rephrasing to "on-going SLR could displace many people". (Government of Australia)	
G-19-118	A	14		15		Table G-19-2:(Greenland Ice Sheet, West Antarctic Ice Sheet) replace "Triggering of partial deglaciation possible 1-2C... millennium above 2.5-5C" with "Triggering of partial deglaciation/disintegration. Potential for ten or more metres SLR over several centuries to millennium." It is not appropriate to refer to specific temperatures as 'criteria of "key" vulnerability'. (Government of Japan)	Rewritten to be consistent with relevant WGI chapters.
G-19-119	A	14				Water supply: Replace the current entry in column 3 with the following: Results may overestimate negative impacts if they do not fully account for increases in adaptive capacity due to increased economic and technological progress. This is particularly important for the poorest countries because they gain the most from a marginal increase in economic development (Goklany 2005c, 2006a)." (Government of USA)	Adaptive capacity and various views of its potential and obstacles are a main theme in our assessment of the literature.
G-19-120	A	14				The box on economic production / welfare, it is not clear whether the temperature rises here reflect to preindustrial levels or "current" levels. (Government of Finland)	Current
G-19-121	A	14				Table 19.1, row 7, column 2 The "health - criteria for key" should include water and soil pollution. (Government of Sweden)	Too narrow
G-19-122	A	14				Table 19.1 : line cross-border issues. In the third column, what is the meaning of the indication low confidence? The sentence is clear enough without it. Double caveats are introducing confusion. (Government of France)	Revised
G-19-123	A	14				Table 19.1 : in the third column of line "Economic production and welfare" the statement "GDP decreases are typically projected above 3°" is in contradiction with the third column of the following line "Crops and food supply" which states that we have low confidence in" wider negative impacts at large warmings" (Government of France)	Revised
G-19-124	A	14				MOC/THC In the third column, is the statement "Social consequences mostly uncertain" adequately reflecting, page 26, lines 27 to 31 results ? (Government of France)	Deleted
G-19-125	A	14				Health: Add the following to the end of column 3: "However, these results may overestimate negative impacts if they do not fully account for increases in adaptive capacity due to increased economic and technological progress."	Baseline; addressed in text- see G-19-50.

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						(Government of USA)	
G-19-126	A	14				Economic production/welfare: Add at the end of the 3rd column, the following sentence: "However, these results may overestimate negative impacts if they do not fully account for increases in adaptive capacity due to increased economic and technological progress (Goklany 2005c, 2006a)." (Government of USA)	Ditto
G-19-127	A	14				Crops and food supplies: Add the following to the end of column 3: "However, these results may overestimate negative impacts if they do not fully account for increases in adaptive capacity due to increased economic and technological progress." (Government of USA)	Ditto
G-19-128	A	15	10	15	20	Table 19.1 row - "Biospheric positive feedbacks". The authors should attempt to include the possible increase in atmospheric concentrations of CO2 by 2100 if the biosphere becomes a net source. Friedlingstein (as quoted at page 25) notes that most models project an increase in CO2 of between 50-100ppm. This is an important finding and should be highlighted. If possible a confidence reading for this finding should also be included. (Government of Australia)	Done.
G-19-129	A	15				Biospheric positive feedbacks: This entry is misleading. It should be replaced by one titled "Biospheric feedbacks" because these feedbacks may be negative particularly if global temperature increases are low and CO2 concentrations are higher than today's. We note in passing that the biosphere seems to be absorbing more now than it did a few decades ago, particularly in the northern latitudes. The key vulnerability ought to be couched in terms of when this increase might turn negative and the degree of confidence that might be attached to that date. (Government of USA)	Import WG I
G-19-130	A	15				Anarctic Ice Sheet. First lines are missing in columns 2 and 3. (Government of France)	Typo
G-19-131	A	16	1			Table 19.2: All entries should contain confidence estimates (e.g., "Potential regional extinction of coral reefs" is too vague). The "Arctic" row contains no entries. The code "***" is described below the table but never used. (European Union)	Yes--done
G-19-132	A	16		20		Table 19.2: The first column in Table 19.2 is not a listing of key vulnerabilities – the key vulnerabilities are described in the other columns. The first column is a listing of sectors/regions where vulnerabilities occur – better heading: Area of concern. The temperature breakouts in the underlying chapters and the models on which they are based do not support the specificity of the temperature categories	Agree

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						presented and should not be included here in this way. These temperature categories become even more difficult if the authors draw, as they should, on the key vulnerabilities included in the other chapters, as the key vulnerabilities identified there do not use these temperature categories .(Inserted from SPM comments and discussion) (Government of USA)	
G-19-133	A	16				Water Supply: These results may overestimate negative impacts if they do not fully account for increases in adaptive capacity due to increased economic and technological progress. (Government of USA)	Baseline
G-19-134	A	16				Table 19.2: If possible, please include references from the KVs to the WG I and WG II chapters where these vulnerabilities are discussed in greater detail. This was done nicely in Table 19.1. (Government of USA)	Done
G-19-135	A	16				Consider adding a table summarizing vulnerability by region. Some of that is in Tables 19.1 and 19.2, but a table summarizing regional vulnerability would be very useful. (Government of USA)	Don't have space
G-19-136	A	17				Table 19.2, row 4, column 3. "Water and soil pollution" should be inserted. (Government of Sweden)	Too narrow
G-19-137	A	17				Indigenous...communities: In the last column insert "currently" prior to "difficult", and add the following new sentence: "adaptive capacity will rise in the future if sustainable development goals are met or if economic and technological development follows paths consistent with any of the SRES scenarios (Goklany 2005c, 2006a)." (Government of USA)	There is no guarentee this will happen. Average income and income disparity can rise at the same time—revised text consistent with literature.
G-19-138	A	17				High-Mountain Communities: At the end of the first sentence in the last column, add the following: "unless alleviated by storage projects and/or changes in current water resource management" (Government of USA)	Ditto
G-19-139	A	18	1			Table 19.2, entry under "Geophysical Systems/MOC", column "Remarks". It seems wrong to comment solely on findings based on simplified models as the state-of-the-art GCMs do not support them. (AR4/WGI, Ch10 states currently that "Although the MOC weakens in most models run for the three SRES scenarios, none shows a collapse of the MOC by the year 2100. No coupled model simulation of the Atlantic MOC shows a mean increase of the MOC in response to global warming by 2100. It is very unlikely that the MOC will undergo a large abrupt	Yes

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						transition during the course of the 21st century." Please amend with this, leading to a remark on that the possibility MOC shutdown by 2100 is based on simplified models, whereas the more complex ones do not show the same. (Government of Sweden)	
G-19-140	A	18				There should be a row devoted to cropland and/or habitat conversion. This is because such conversion of habitat to cropland is currently the most important threat to terrestrial biodiversity, and it is important to look at changes wrought by CC within this context. This needs to take into account the shifts in likely locations of agricultural production due to climate change. (Government of USA)	Baseline issue—see G-19-50.
G-19-141	A	18				Biodiversity: This entry is based on an overly simplistic view of the threats to biodiversity. In particular, CC will not only affect species directly, it will also indirectly affect biodiversity through changes in: (a) the amount of habitat available or freed up for nature, e.g., by the reduction in cropland that might occur at lower levels of temperature change even as CO2 concentrations increase or (b) biomass production (see, e.g., Levy et al. 2004). In fact, for the next several decades, these indirect avenues may be more critical to biodiversity than the direct CC effects on species. Accordingly, we recommend a substantial rewrite that would address these countervailing factors and how they may be modulated by climate change. Accordingly, we recommend a substantial rewrite of these entries that would address these countervailing factors (see, e.g., Goklany 2005a, 2005c). For the same reasons we cannot agree with the characterization of the level of confidence (Government of USA)	Baseline—see see G-19-50.
G-19-142	A	19		20		All entries under Extreme Events should note that impacts can be alleviated if adaptation measures are undertaken in a timely and intelligent fashion (Government of USA)	Baseline—see see G-19-50.
G-19-143	A	19				Table 19.2, row 2, column 2. Rephrase to: "Higher flows in many northern rivers will increase flooding, pollution transport and bank erosion." (Government of Sweden)	Small point
G-19-144	A	19				It should be noted here that already a modest rise temperature increase from today trigger widespread, if not a almos total deglaciation in Greenland. [see chapter 19, page 26, lines 1 - 1] In the current form I find the table misleading. (Government of Finland)	Rewritten to be consistent with relevant WGI chapters.
G-19-145	A	20				Tabel 19.2, row 3, column 5. Add a phrase at the end of the paragraph about the increase in pollution transport and it's consequences on human health and on ecology (see EEA 2004). (Government of Sweden)	Small

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G-19-146	A	21	3	21	5	Change "by which" to "where". Delete the last sentence of this paragraph, which is obvious. (European Union)	Ok
G-19-147	A	21	14		15	Eliminate "is low confidence that"; instead, add "low confidence" in parentheses at the end of that sentence. (Government of USA)	Ok
G-19-148	A	21	15		24	It is worth noting that agricultural production is a function of more than yield, so reduced yields don't automatically imply reduced production even without new technology. Farmers can substitute inputs (land, fertilizer, water, capital) that can offset yield declines. We see exactly this in numerous studies—for example the Millennium Ecosystem Assessment (2005). (Government of USA)	Good point; studies have been comprehensive
G-19-149	A	21	37			The text should note that losses from Hurricane Katrina are probably more due to lapses in disaster management than climate change per se. (Government of USA)	Yes
G-19-150	A	21	38	23	26	Editorial change: There are several symbols of degrees wrong (instead of "°" there are "0" superscripted). Change to "°" (Government of Spain)	OK
G-19-151	A	21	44	21	46	The statement is so cautious,so vague that the degree of confidence could be rated as very high (Government of France)	Will revise
G-19-152	A	21	46		46	This sentence doesn't make sense; please edit for clarity. (Government of USA)	OK
G-19-153	A	22	3	22	7	unclear decription of current knowlege: "Total economic impacts may be in the range of a few percent of global product" is just another example of an essentially information less sentence. It may be - but it may not be, and what are a few percent? A few lines later we learn that "most studies indicate that gross world product [presumably the same as global product] could decrease". Could it also increase? clarify what can be said and/or cite more precisely existing range of study results (European Union)	Clarified
G-19-154	A	22	11	22	14	The phrase "species lost" in line 12 may be replaced by "species extinction" or "loss of species". (Government of Pakistan)	OK
G-19-155	A	22	27	22	27	The phrase "provision food" may be relpaced by "provision of food". (Government of Pakistan)	Ok
G-19-	A	22	30	22	33	The sentence may be changed to read something like: "Formal institutions such as	Will consider

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156						states and regulated markets tend to underpin provision of basic goods and social services in the developed world AND URBAN AREAS OF THE DEVELOPING WORLD; informal social institutions, such as families and community groups, tend to dominate and may be the only service providers in MOST OF THE RURAL AREAS of the developing world or areas subject to conflict." (Government of Pakistan)	
G-19-157	A	23	4			Reference is pre-TAR and not up-dated, and yet prefaced with "it is estimated" - so not up to date (Government of UK)	Citations as up to date as possible.
G-19-158	A	23	19	23	19	The phrase "IPCC 4AR" may be changed to "IPCC AR4". (Government of Pakistan)	Ok
G-19-159	A	23	33	23	33	Some illustrative example may be mentioned in parenthesis after the phrase "traditional use of natural resources". (Government of Pakistan)	ok
G-19-160	A	23	42	23	43	8 to 16 million USD (a factor 2 uncertainty) is inconsistent with 17-18% of GDP (a 6% uncertainty). (European Union)	Revised
G-19-161	A	23	48	23	49	again vague language: "Fires could increase in arid and semi-arid regions". We need confidence statements here - and elsewhere. (European Union)	Revised
G-19-162	A	24	2	24	46	This subsection is based on an overly simplistic view of the threats to biodiversity. In particular, CC will not only affect species directly, it will also indirectly affect biodiversity through changes in: (a) the amount of habitat available or freed up for nature, e.g., by the reduction in cropland that might occur at lower levels of temperature change even as CO2 concentrations increase or (b) biomass production (see, e.g., Levy et al. 2004). In fact, for the next several decades, these indirect avenues may be more critical to biodiversity than the direct CC effects on species. Accordingly, we recommend a substantial rewrite that would address these countervailing factors and how they may be modulated by climate change (see, e.g., Goklany 2005a, 2006a). (Government of USA)	Section is consistent with ecosystems chapter.
G-19-163	A	24	21	24	23	The phrase "disruption or extinction" in line 23 may be replaced by "extinction or disruption" so that it is in accordance with the phrase "species and ecosystems" appearing in line 22. (Government of Pakistan)	Ok
G-19-164	A	24	28	24	41	For the specific examples given showing the increasing risks to ecosystems, of global warming, specific confidence readings should be included.	Ok

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						(Government of Australia)	
G-19-165	A	24	30	24	30	This is another example where there is a critical need to distinguish between 'bleaching' and 'bleaching-induced mortality'. Suggest this be reworded for accuracy and meaningfulness to: "...could result in significant deterioration in condition of four-fifths of coral reefs due to bleaching...." (Government of Australia)	Ok
G-19-166	A	24	33	24	33	This is another example where there is a critical need to distinguish between 'bleaching' and 'bleaching-induced mortality'. Suggest this be reworded for accuracy and meaningfulness to: "...is estimated to result in serious degradation to 97% of coral reefs due to bleaching...." (Government of Australia)	Ok
G-19-167	A	24	33	24	34	The statement about "one-sixth of global ecosystems losing area" is unclear. What is a "global ecosystem"? - I thought all ecosystems are regional. Does this statement mean that five sixth of "global ecosystems" win area, so that the overall impact is positive? The study cited here (as well as others on the same subject) are very clear, and the authors should made all efforts to convey the main results in their summary - or not cite them at all. (The same problem applies to lines 38-39.) (European Union)	Clarified
G-19-168	A	24	34			Clarify which areas in "one-sixth of global ecosystems losing area". (Government of USA)	OK
G-19-169	A	24	38			Clarify which areas in "one-fifth of global ecosystems losing area". (Government of USA)	Ok
G-19-170	A	25	1			The references to WG I report, Chapter 7 should be updated as they do not agree with the latest AR4/WGI Ch 7 draft that has only four levels of subchapter headings and not five as in, e.g. 7.2.2.1.4. (Government of Sweden)	Chapter numbers updated
G-19-171	A	25	25		27	These remarks about methane should be included in the SPM. (Government of Finland)	This will be considered by SPM writing team.
G-19-172	A	26	9		12	change "wider" to "wide". (Government of USA)	Section rewritten, comment no longer relevant.
G-19-173	A	26	14	26	17	WAI is covered in WG1 Chapter 10.6.4.2 and Question 10.2. We ask that the writers crosscheck the work here with WG1 and ensure consistency with the assessments of WG2. We suggest clarification of the time line regarding information given previous to this sentence, as well as the information given regarding this sentence. (Government of Japan)	Section has been rewritten to assure consistency with WGI. The point on timing is covered in the previous paragraph and does not bear repeating.
G-19-	A	26	26	26	26	Does not WG I exclude the possibility of any absolute cooling ? WG I, chapter 10,	The section discusses "potential" impacts.

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174						lines 40-42 say "It is important to note that in models where the MOC weakens, warming still occurs downstream over Europe due to the overall dominant role of the radiative forcing associated with increasing greenhouse gases." (Government of France)	Note that an abrupt MOC change occurs in none of the analyzed models, yet WG1 still does not exclude an "large abrupt transition during the course of the 21 st century" from the realm of possibility (specifically, the FAR, WG1, Chapter 10, Executive Summary assesses this as very unlikely). In models where an MOC collapse does occur in the 21 st century (e.g., Vellinga and Wood, 2006), there is a net cooling in North Atlantic. We have also added the citation of Vellinga and Wood (2006).
G-19-175	A	26	37	26	37	While it is laudable that the authors attempt to assign a confidence level to one of their statements, "modest confidence" is not part of the IPCC-approved terminology ("medium confidence" is). (European Union)	Thanks for pointing this out. We have revised the language to be consistent with the IPCC-approved terminology.
G-19-176	A	27	27		28	If "trends" refers only to "recent decades", how can it be considered a "significant" trend? There is little scientific merit in such broad statements. Consider inserting the word "recent" before "significant" (Government of USA)	Significance emerges from analysis—some long trends not significant, some short trends are significant—we follow the literature case by case.
G-19-177	A	27	40	27	41	The text should be supplemented with a phrase dealing with the risk of increased pollution transport as a consequence of more flooding events and a greater immobilization of both sediments, microorganisms and pollutants (see Nilsson et al. 2005). (Government of Sweden)	Synergisms are mentioned.
G-19-178	A	27	51	27	51	The WG No. needs to be specified here. (Government of Pakistan)	Ok
G-19-179	A	28	15	30	33	The inclusion of this construct (burning embers) in the chapter on key vulnerabilities adds a matrix layer that doesn't fit well with the criteria the authors have used to identify key vulnerabilities, (as stated in comments above) or are duplicated by the criteria. The criteria "importance of the vulnerable system" covers unique and threatened systems, extreme events are not necessarily persistent and irreversible, distribution is a criteria, and risks from large scale discontinuities are covered through the criteria for magnitude and irreversibility. Reconcile the constructs of "key vulnerabilities" with the criteria the authors propose (with our amendments) .(See comment above on Tables 19.1 and 19.2) (Government of USA)	Dropped figure

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G-19-180	A	28	36	28	37	This paragraph ends in the middle of the sentence. The rest has probably been moved to p. 29, l. 22-23. (European Union)	Pagination error
G-19-181	A	28	36	28	37	The sentence is incomplete. (Government of Pakistan)	Ok
G-19-182	A	28	38	28	38	Line 38 is missing (Government of France)	Ok
G-19-183	A	28	42			Replace “indicates” with “suggests” and “has” with “may have”. These issues have not been fully resolved. (Government of USA)	Can consider; need to be consistent w/ WGI
G-19-184	A	28	43	28	43	The word "an" appearing after "heat waves" may be replaced by "and". (Government of Pakistan)	Ok
G-19-185	A	28	43	28	43	Replace an by and (Government of France)	Ok
G-19-186	A	28	47			Change the “medium confidence” to “low confidence.” (Government of USA)	See Ch 19 of TAR
G-19-187	A	28	50			Change the “high confidence” to “low confidence”. We note that there are no references provided here. (Government of USA)	Disagree.
G-19-188	A	29	1	29	23	Figure 19.1 is helpful could be more useful if paired with a new figure updated for the new findings of the AR4. (Government of Australia)	. Can defend qualitative discussion, but overall AR 4 findings yet to be determined..
G-19-189	A	29	22	29	23	The sentence needs to be reconstructed. (Government of Pakistan)	Not clear why?
G-19-190	A	29	45			Change “a preliminary” to “an inadequate”. (Government of USA)	Can't; it's judgmental word.
G-19-191	A	30	4		6	Add “or overstate” after “understate, and in line 5, change “there is now lower” to “remains low” (Government of USA)	Disagree, as above
G-19-192	A	30	5	30	6	Change "there is greater uncertainty" to "there is even lower confidence". (European Union)	Revised to clarify
G-19-193	A	30	12	30	12	Insert "and pollution" into the end of the phrase "increased risk of exposure to disease". (Government of Sweden)	Synergisms mentioned..
G-19-194	A	30	13	30	15	The reference for the summary of the 2002 WHO Burden of Disease assessment is: M. Ezzati, A. D. Lopez, A. Rodgers, S. Vander Hoorn, C. J. L. Murray, and Comparative Risk Assessment Collaborating Group, 2002: Selected major risk	We think we have the right reference

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						factors and global and regional burden of disease, Lancet, 360:1347-1360. According to this study, anthropogenic climate change is estimated to have caused the loss of over 150.000 human lives per year in the 1990s. (European Union)	
G-19-195	A	30	13		15	The McMichael et al (2004) study is scientifically suspect. In Chapter 20 of "Comparative Quantification of Health Risks", McMichael et al. themselves note on page 1547 that "Empirical observation of the health consequences of long-term climate change, followed by formulation, testing and then modification of hypotheses would therefore require long timeseries (probably several decades) of careful monitoring. While this process may accord with the canons of empirical science, it would not provide the timely information needed to inform current policy decisions on GHG emission abatement, so as to offset possible health consequences in the future. Nor would it allow early implementation of policies for adaptation to climate changes, which are inevitable ...". So it seems these results are based on a scientific short cut. It would also be useful place the burden of disease ascribed to CC in context of the total global burden of disease. For 2000, it works out to about 0.4%. (Government of USA)	We agree study has problems; which is why we do not cite specific numbers. If we use %, then we have to list the specific numbers from the study.
G-19-196	A	30	25	30	28	WAI is covered in WG1 Chapter 10.6.4.2 and Question 10.2. We ask that the writers crosscheck the work here with WG1 and ensure consistency with the assessments of WG2. Furthermore, deglaciation of WAI and Greenland Ice Sheet do not consist of the same time line, therefore it is necessary to clarify the different time lines and discuss them individually. (Government of Japan)	ok
G-19-197	A	30	29	30	29	What is "2 to 4-5°C global warming"? Is it the same as "2-5°C"? (European Union)	OK
G-19-198	A	30	29	30	29	Please check if the global warming range given here as "2 to 4-5 oC" is correct. Or is it "2 to 4.5 oC"? (Government of Pakistan)	Ok
G-19-199	A	30	36			Section 19.4 discusses adaptation (in 19.4.1) and mitigation (in 19.4.2) explicitly and research (in 19.4.4) implicitly as response strategies to address key vulnerabilities of climate change. The chapter does not mention how to potentially deal with residual impacts on human systems that have not been avoided by adaptation or mitigation. The issue of compensation for unavoided damage from climate change should also be discussed. Selected literature on this topic is: Peter Hayes and Kirk Smith, 1993: "The Global Greenhouse Regime - Who Pays?", United Nations University Press, Tokyo; Richard S.J. Tol, Roda Verheyend, 2004:	This issue of compensation via side payments is beyond the scope of this chapter. Such material is suitable for WGIII.

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						State responsibility and compensation for climate change damages—a legal and economic assessment. Energy Policy 32: 1109-1130; J.E. Aldy et al.: Beyond Kyoto - Advancing the International Effort Against Climate Change. Pew Center on Global Climate Change; Müller, Benito. 2002. "Equity in Climate Change: the Great Divide," Oxford Institute for Energy Studies. (European Union)	
G-19-200	A	30	36			Sec 19.4 – This section does not really provide full reviews of the literature on adaptation and mitigation. The authors might want to consider directing readers to Ch. 17 and WGIII Ch.3 for adaptation and cost-effectiveness and cost-benefit mitigation analysis respectively. The authors in this chapter could provide brief summary discussions drawn directly from those chapters instead of the partial literature reviews that are there now. (Government of USA)	We indicate relevant sections of WGII and WGIII that discuss related topics. This section is not intended to provide "full" reviews of the literature on adaptation and mitigation, only to discuss the literature relating these strategies specifically to key vulnerabilities.
G-19-201	A	30	47	30	49	The phrase "for the selection" in line 48 may be deleted. (Government of Pakistan)	Removed.
G-19-202	A	30	48	30	49	Delete "in the selection" and "this". (European Union)	Removed.
G-19-203	A	30	48			Change "relative lack of" to "lack of knowledge about". Because the study of adaptation to CC is in its infancy, we cannot say whether adaptations are truly lacking or only perceived to be lacking. Equally importantly, many view available adaptation options in terms of today's conditions. We need to examine what adaptations might become available in the future as societies get wealthier and technologically more sophisticated, but few studies take increases in adaptive capacity into consideration. A similar change should be made on p. 41, line 8. (Government of USA)	. The proposed change implies nothing at all is known about adaptive potential, which is not consistent with the literature. As is stated here, relative lack of feasible adaptations is an important criterion in our assessment of key vulnerabilities. We now explicitly identify key vulnerabilities for which low adaptive capacity was a key factor in their selection in Table 19.1.
G-19-204	A	30	49	30	51	The word "this" appearing after the phrase "Section 19.4.2" may be deleted. (Government of Pakistan)	Removed.
G-19-205	A	30				Section 19.4: Again, this assessment erroneously considers that there are only two major forms of action to address climate change, and ignores at least two major additional forms: investment in better information and in improved capacity. These are very important options in a risk management framework and under some conditions, merit a major portion of the response portfolio. There is a lot of literature on the value of improving information and learning, as well as on investment in capacity for decision-making, mitigation or adaptation (which is separate from investment in those activities directly). (Government of USA)	Yes, we agree to mention and will cross ref to WGIII.

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G-19-206	A	31	24			Replace Goklany (2006a) for (2003) in the list of references. (Government of USA)	Yes
G-19-207	A	31	36	31	38	The reference to Sen (1981) seems a bit out-dated given the quarter-century since. Alas, the same state of affairs probably persists even today. The reference might nevertheless be reconsidered. (Government of Sweden)	Reconsidered and kept Looking for better reference if there is time.
G-19-208	A	31	38			Add "On one other hand..." after "agriculture" (Government of USA)	ok
G-19-209	A	31	46		47	These two sentences may only be valid for economic losses. They do not apply to deaths due to extreme events. Accordingly, on line 47, insert "economic" prior to "losses", (Government of USA)	We agree
G-19-210	A	32	3	32	4	"have caused more damage" than Katrina and the 2003 heatwaves? - or rather "have also caused substantial damage" (European Union)	Yes, we agree.
G-19-211	A	32	3		4	It should be noted that European authorities, despite greater acceptance of climate change as a significant risk, failed to bring their considerable adaptive capacity to bear during the 2003 heat wave, perhaps because they underestimated the usefulness of adaptation as an effective response strategy or viewed adaptation and mitigation as mutually exclusive approaches. (Government of USA)	See expert comments. The text makes this point--and also about Katrina impacts.
G-19-212	A	32	17	32	18	Barriers to adaptation are not only market and institutional but first of all psychological. (European Union)	Yes, incorporated.
G-19-213	A	32	20		24	It should be noted that market and social systems might be able to adapt to changes in geophysical systems, if the se changes occur over a long enough period or are predictable. (Government of USA)	Clarified.
G-19-214	A	32	24		30	Although social and market systems are clearly more adaptable than biological systems, this section downplays the possibilities of adaptation in biological systems. Specifically, CC is one of many threats to biological systems. Other threats include habitat conversion, and loss of corridors. Therefore, one method of reducing the vulnerability of biological systems is to reduce these other pressures (see Goklany 1995, 2000, 2005a, 2006a). (Government of USA)	This point is made many times in this chapter and elsewhere.
G-19-215	A	32	26	32	26	The word "than" appearing after the word "impacts" may be replaced by "that". (Government of Pakistan)	ok

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G-19-216	A	32	33			Add a new sentence at the end of this para that would read as follows: “On the other hand, adaptive capacity should increase in the future which would increase the ability to cope to climate change and other problems, e.g., water stress, droughts, floods, pests, plant diseases, human health, etc. (Goklany 2006a, 2005c). However, we do not know how much adaptive capacity may increase relative to the demand of multiple stressors. (Government of USA)	Adequately covered.
G-19-217	A	32	37	32	40	The sentece is not clear and needs to be reconstructed. (Government of Pakistan)	Yes
G-19-218	A	32	46			Section 19.4.2 –Change the title of the section to “Mitigation of Risks” and remove all references to DAI. DAI is an unnecessary concept here that distracts from the point of the Chapter. This section is currently framed with a broad scope that suggests that it assesses the climate change mitigation literature. The text reveals that that is not the section’s intent. Instead it is really focused on the vulnerability reduction and analyzing thresholds and pathways, not mitigation—cost-effective or economically efficient. Therefore, I suggest that the section be reframed to better characterize the scope and emphasis. For example, scenarios analysis (as defined here) evaluates vulnerability under climatic conditions and trajectories and helps define vulnerability boundaries, and guardrail analysis identifies potential trajectories for boundaries. Cost-effectiveness and benefit-cost analysis are really about the next set of logical questions—what will it cost to achieve boundaries and follow trajectories and what are the “optimal” strategies? These methods are worth mentioning in this chapter, but don’t really belong here. The authors might consider simply referencing WGIII for an assessment of the literature. As is, the literature reviews on these topics in this chapter are not complete. (Government of USA)	Paragraph added at the beginning of 19.4.2. to clarify the purpose of this section and to provide cross-references to WG III Ch. 3.
G-19-219	A	32	48	33	38	Subsection 19.4.2.1 is important for the discussion but is currently not integrated into the rest of the text. I suggest putting it into a box, and to reference this box on p.34, l. 16-21 and at other places, where appropriate. (European Union)	Accepted.
G-19-220	A	32		32		Here, or in another suitable place within Section 19.4, there needs to be a discussion of the various forms of possible response strategies, which include reduction of the stressor (mitigation of GHG gases), investing in better knowledge (improving predictions and understanding of options), investing in capacity-building (including ability and tools to make good decisions under stress and given uncertainties), as well as direct adaptation to the risk. The dichotomy between Mitigation (of GHG) and Adaptation is unhelpful and such narrow thinking may	We now mention these other response strategies here, although we choose to retain the focus on mitigation and adaptation strategies to avoid key vulnerabilities, which is part of our charge in the PAO.

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						unintentionally lead to less risk reduction than is possible. In other words, there should be at least 4 major sections in 19.4, not 2. Moreover, there is far too much discussion of GHG mitigation in this chapter, given that it is discussed in, for example, Chapter 18. (Government of USA)	
G-19-221	A	32				Section 19.4.2: Furthermore, since “DAI thresholds” cannot be determined scientifically, mention of them here is inappropriate and fully unnecessary. In many cases, DAI has been postulated by researchers and their research is presented here as if “DAI” has been clearly defined or identified. There is no use of it here that adds any information of substance, and nothing of fact lost if all are deleted. (Government of USA)	This is in the literature, and we reference their definitions. This is also part of our charge in the PAO.
G-19-222	A	32				Section 19.4.2.1 and Section 19.4.2.2: These sections are methodological and are not about key vulnerabilities. As such, if they belong in the WGII report at all, they belong in Chapter 2 on methodologies. However, it is unclear to what degree it belongs in Chapter 2, because inclusion depends on the degree to which it underpins major research and conclusions presented in this Chapter or others. (Government of USA)	These sections have been revised and cross-references to WG III Ch. 3 have been added.
G-19-223	A	33	18			The following sentence could be added at the end of the paragraph: Multiple risk model approaches addressing model uncertainty may be coherently treated in an integrated way using approaches like the Alternative Hypothesis Approach (Zio and Apostolakis, 1996) Zio E., Apostolakis G., 1996. Two methods for the structured assessment of model uncertainty by experts in performance assessments of radioactive waste repositories, Reliability Engineering and System Safety, 54(2-3), 225-241. (Government of Finland)	Overly narrow point, and old reference.
G-19-224	A	33	40	33	40	Change "response" to "mitigation" in the section title (European Union)	Changed
G-19-225	A	33	42	33	43	The sentence is not clear and needs to be reconstructed. (Government of Pakistan)	Fixed
G-19-226	A	33	42	33	44	The beginning of the first sentence is missing. (European Union)	Fixed
G-19-227	A	34	2	34	2	The end bracket appearing after the word "pathways" may be deleted. (Government of Pakistan)	Fixed
G-19-228	A	34	6	34	21	Reverse the order of the two bullet points. (European Union)	Accepted
G-19-229	A	34	30	34	32	Readers would benefit from a short explanation of why the two dimensions (optimizing strategy and pre-defined targets) were selected for inclusion in Table	The reviewer neglects the fact that the answer to whether an approach is targeted or

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						19.3 and the following discussion. There seems to be an effort to define 10 different methodological approaches to assessing response strategies, but eight of these are abruptly dropped without an explanation of why the selected two were chosen for further discussion. Why are these 2 preferred over the others described in 19.4.2.2? (Government of USA)	optimizing has two answers, not one, of course. But in response to this comment, we have removed the dynamic vs. static dimension, as this applies most specifically to the scenario analysis/stabilization analysis category, and we clarify that deterministic, set-based, and probabilistic approaches can all be applied to any of the methods, and thus their inclusion in the table would not be useful. The table includes the remaining two dimensions.
G-19-230	A	35	9	35	14	This sentence is currently verbose and is confusing. The authors should revise and consider clarifying the discussion of stabilisation pathways. (Government of Australia)	This sentence has been revised for clarity and care has been taken to clarify the discussion of stabilization pathways.
G-19-231	A	35	26	35	29	Many literatures show higher temperature ranges for the threshold to avoid MOC collapse (e.g., Stocker et al., 1997) and Fig. SPM-3 considering these many literatures also indicate a higher range for the threshold. WG1 Chapter 10.3.4 it concludes that "Taken together, it is likely that the MOC will reduce". We ask that the writers refer to WG1 and if deemed necessary quote relevant assessments related to the MOC. It is imperative that WG2 maintain consistency with the scientific work of WG1. Also this sentence assume that 450ppm stabilization will lead to 3 degree increase in 100 years. Assessment of climate sensitivity needs to be consistent with that of WG1. We see no consistency here. (Government of Japan)	First, this section reports results from literature that specifically examines mitigation response strategies with respect to key vulnerabilities and UNFCCC Article 2, and that is what is done here when referring to a specific threshold for MOC. Please refer to section 19.3 for a complete discussion of results related to MOC shutdown. Second, the reviewer has misinterpreted the statement about a linkage between 450ppm and 3 degrees, this is not what the sentence assumes. The statement has been clarified. Third, the temperature ranges associated with various stabilization levels in the paper in question are based on IPCC TAR model results, and therefore are consistent with WGI at the time this paper was written.
G-19-232	A	35	27	35	29	This sentence wrongly suggests that the same thresholds were used for avoiding MOC collapse and averting WAIS deglaciation. (European Union)	This statement has been clarified.
G-19-233	A	36	2	36	25	We recommend a fundamental re-write of the current text. Climate sensitivity has been assessed in WG1 and we ask that the work of WG1 be referred to and be used for this section. WG1 contains the most updated assessments of research related to	As stated in the response to G-19-231, this is a discussion of literature that specifically examines mitigation response strategies with

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						climate sensitivity and should be referred to and be used in this text. There should be no independent assessment of climate sensitivity by WG2. (Government of Japan)	respect to key vulnerabilities and UNFCCC Article 2, part of our chapter's charge in the PAO. This is not an independent assessment of climate sensitivity, and should not be interpreted as such. See also the "key caveat" added to 19.4.
G-19-234	A	36	25	36	25	Delete last sentence of the paragraph since it repeats a statement made just before. (European Union)	The statements have been combined.
G-19-235	A	37	25	37	30	Exactly the same approach had been used in 1995 by the German Advisory Council on Global Change (see http://wbgu.de/wbgu_sn1995.pdf). For that reason, it is of little value to cite this study from 2004. Authors may wish to consider deleting the whole paragraph. (European Union)	We have deleted this paragraph.
G-19-236	A	37	39	37	39	Add after "the Alps" "and the Pyrenees"(There are more than 30 skiing resorts in Spain, France and Andorra in the Pyrenees) (Government of Spain)	This appears to be a comment on another chapter. Text does not appear in Chapter 19.
G-19-237	A	37	45	37	45	Insert "WBGU, 1995" before "Toth, 2003". The tolerable windows approach was proposed by WBGU in this publication. Citation: "WBGU (German Advisory Council on Global Change): 1995, Scenario for the Derivation of Global CO2 Reduction Targets and Implementation Strategies, WBGU, Bremerhaven, Germany", available at http://www.wbgu.de/wbgu_sn1995_engl.html . The tolerable windows approach has been elaborated further in subsequent publications by WBGU (1997, 2003) available at http://www.wbgu.de/wbgu_sn1997_engl.html and http://www.wbgu.de/wbgu_sn2003_engl.html (Government of Germany)	Unfortunately, we do not have space for a history of the tolerable window approach in a space-constrained synthetic chapter.
G-19-238	A	37				There are figures and text in WG1 which deal with climate sensitivity and we recommend that those be used here. Figures and texts that are used in WG2 should be taken from approved sources in WG1, such as Box 10.2 (Figure 10.5.4), Chapter 10; Section 9.6 (Figure 9.6.1), Chapter 9. There should be no independent assessment of climate sensitivity by WG2. (Government of Japan)	See the response to G-19-233. Risk management literature uses published climate sensitivity estimates not assessed by WG 1. We do not contradict WG 1, but do go to the appropriate literature for risk managements which of necessity includes pdfs of climate sensitivity—see also "key caveat" in 19.4 on how this is framed in our text.
G-19-239	A	38	1	38	45	Figure 19.3 seems to convey a similar message as Figure 19.2 on the previous page but it is less accessible. Given the limited added value of having both figures, Authors may wish to consider deleting Figure 19.3. (European Union)	The messages are in fact quite different, as one examines only equilibrium temperature change, while the other presents transient temperature implications. Given specific

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							support for Figure 19.3 (see G-19-240) and very different messages, we respectfully decline to delete it.
G-19-240	A	38	1	38	38	Figure 19.3 is useful and clearly presented, however, we suggest removing references to DAI-EU, as it is not relevant that the EU has endorsed a specific level of climate change as this is a political, as well as scientific, judgement. (Government of Australia)	Yes, we agree, and have revised Figure 19.3 to remove specific reference to DAI-EU.
G-19-241	A	39	3			Append after “(HadCM2)”, the following: “accuracy of impact models, and assumptions regarding adaptive capacity and adaptation.” (Government of USA)	Text added
G-19-242	A	39	22	39	25	The text mentions CO2 concentration however it fails to touch on temperature increase, a critical impact factor. One without the other is insufficient and we recommend that the writers include in this text work from WG1 which reviews climate sensitivity and from there assess the relationship between CO2 concentration levels and temperature increase. There should be no independent assessment of climate sensitivity by WG2. (Government of Japan)	Text added on climate sensitivity and reference to Figure 19.2.
G-19-243	A	39	47			After “time discounting” add “adaptation.” (Government of USA)	Changed
G-19-244	A	40	34	40	38	The study by Yohe et al. (2004) has been shown to use a flawed methodology (Füssel, H.-M., 2006: Methodological and empirical flaws in the design and application of simple climate-economy models. Climatic Change, accepted). Their is generally no consensus whether "moderate" abatement as these authors argue or rather "drastic" GHG reductions are necessary already in the short and mid-term; the sentence should be deleted. There is however consensus that scientific uncertainty can not be used by itself to justify to do nothing today. (European Union)	Sentence deleted
G-19-245	A	40	34			Replace “there is general consensus” with: “these studies suggest”. (Government of USA)	Sentence deleted
G-19-246	A	40	40			Add a new para that reads as follows: “Cost-effectiveness analysis has also been used to explore and compare the relative merits of various adaptation and mitigation approaches through the next several decades. Goklany (2005a), based on global impacts analyses of malaria, hunger, water stress and coastal flooding through the 2080s,concludes that in the in the short-to-medium term the emphasis should be on reducing current vulnerabilities to climate sensitive problems that might be exacerbated by climate change. However, because in the long term	Verbatim repetition of E-19-394.

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						mitigation is unavoidable, he recommends implementation of “no-regret” measures (e.g., reduction of subsidies for overuse of energy and land) and an active program to make future mitigation more cost-effective.” (Government of USA)	
G-19-247	A	41	23		25	Amend the existing point to read, “Some researchers’ modeled results suggest a significant probability that some large-scale events (e.g. deglaciation of major ice sheets) may no longer be avoided due to historical greenhouse gas emissions and the inertia of the climate system.” (Government of USA)	Partly amended.
G-19-248	A	41	23			Add “Some” prior to “Risk analyses”. (Government of USA)	The item is edited.
G-19-249	A	41	27	41	32	This paragraph deals with the assessment of climate sensitivity. We ask that the writers refer to the work in WG1 so as to ensure consistency with their work. Further, we suggest that the writers directly refer to the work done by WG1. A direct quote of the WG1 work is recommended. There should be no independent assessment of climate sensitivity by WG2. (Government of Japan)	See G-19-238 response on climate sensitivity treatment.
G-19-250	A	41	41			Add 3 new items that reflect the effects of the other 3 major types of response options: investment in better information, investment in capacity, and adaptation. The Adaptation point (number 6) could read as follows: “An adaptation program that would reduce vulnerabilities to climate change may reduce some cumulative risks and damages relatively rapidly and cost-effectively. In the longer term, however, mitigation may be unavoidable.” These should be also added to the list of key conclusions on page 2. (Government of USA)	Discussed above. Partly taken into account in item 6.
G-19-251	A	41	44	41	44	Introduce the word "are" between the words "there" and "many". (Government of Pakistan)	
G-19-252	A	41	48	42	14	This list has no comprehensible order. It should be ordered according to some consistent principle, and similar points (e.g. lines 8-9 and l. 10-11) should be merged. (European Union)	Text revised
G-19-253	A	41	49	41	49	Change "various" to "potential". (European Union)	Text revised
G-19-254	A	41	49		50	Amend to read: research on the possible exposures, sensitivities, adaptive capacities, adaptation measures and costs of potentially vulnerable systems and populations under varying degrees, patterns and rates of climate change and socio-economic change.	Text in this section has been revised.

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						(Government of USA)	
G-19-255	A	41				Section 19.4.4: There should be a section, consistency in form with the other chapters, covering Key Conclusions and their Uncertainties, confidence levels, research gaps. Include an explanation of a time frame for the conduct of such proposed research. (Government of USA)	Text has been expanded to include knowledge and information gaps, confidence levels, and conclusions, but page limits do not allow us to make this a separate section.
G-19-256	A	41				Section 19.4.4: All points in this section that are not substantively (and specifically) grounded in discussion in Chapter 19 should be removed, such as research on geosciences. (Government of USA)	Text substantially revised.
G-19-257	A	42	6	42	7	What is the "cdf's" ? No description in this chapter. (Government of Japan)	Text removed
G-19-258	A	42	6		7	Better quantification of uncertainties for various potentially vulnerable systems and populations, and further development of decision tools to support alternative social choices, including better characterization of likely decisions and information needed to make them. (Government of USA)	Text substantially revised.
G-19-259	A	43	1	67	17	Many references are incomplete. (Government of Pakistan)	repaired
G-19-260	A	48	47	48	48	This paper has been published in Climatic Change 75(3):301-329, 2006 (European Union)	noted
G-19-261	A	49	39	49	41	This reference should read: Füssel, H.-M., 2006:"Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research." Global Environmental Change (accepted). (European Union)	noted

This part contains LATE GOVT comments for chapter 19

CHAPTER 19

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19-1	LATE	0				There are large gaps with the approved outlines. Without discussion on key impacts, only respectively assessed risk and adaptation, that will be different from the truth, and it is difficult to accept some general conclusions. (Government of China)	We agree with comment and now specifically define key vulnerabilities and their relationship to key impacts and risks. We believe content from approved outline is fully and explicitly included in the chapter, although the headings are not the same.
19-2	LATE	2	6	2	7	This sentence is very important, please keep it in future "definition of DAI cannot be based on scientific arguments along, but must incorporate value judgements..." (Government of China)	Yes, we agree, but there are more than just value judgments, but scientific judgments as well—both reflected in revised language..
19-3	LATE	2	14	2	14	Add "identifying key impacts, and their risk of occurrence, approaches to determining levels of climate change for key impacts" Because these are important contents of approved outlines, but have not been assessed in the draft. (Government of China)	See answer above—these topics are included in 19.2, 19.3, and 19.4.
19-4	LATE	2	39	2	46	The three conclusions need to rewrite, because the visual angle is not accepted, even these were far from some contents in Table 19.2, neglecting the function of adaptation, say exceeding the adaptive capacity need more carefulness. (Government of China)	Revised to deal with this and other similar comments.
19-5	LATE	3	34	3	37	Doubt this conclusion “stabilization above 450ppm could cause 2 warming”, it should need more evidences. (Government of China)	Text removed.
19-6	LATE	5	22	5	23	IPCC Plenary also ask this chapter to be focused on key impacts, it needs more work on this. (Government of China)	We now clarify key vulnerabilities and key impacts, per response to 19.1 LATE.
19-7	LATE	6				Box 19.2, a new concept for current climate (1990-2000), but it looks too short. Other important point for key impacts is “in most land areas, regional warming is larger than global warming (WGI)”, need more assessment for it in this chapter (Government of China)	This comment is identical to E-19-92. The same response is copied: We do not attempt to define “current climate” using a ten year period (the reviewer is correct, a longer period is needed). Instead we wish to differentiate between pre-industrial temperatures and temperatures at the end of the 20 th century, and have modified the text to clarify this point. Regarding the assessment of regional temperature levels, we defer to WGI, and simply report temperature levels associated with key vulnerabilities where possible.
19-8	LATE	9	22		28	Magnitude: For Latin America the most reliable indicator of the magnitude of climate impacts must be *the number of people affected*	This criteria is part of “magnitude” as stated.

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						(Government of Argentina)	
19-9	LATE	14				There is a lack of cross reference to Chapter 13. Reference to be considered: see Figure 13.2 Chapter 13, particularly Amazonia vulnerability and glaciers's reduction. (Government of Argentina)	Have added more references to Ch 13 and mention tropical glaciers.
19-10	LATE	23	18		51	This paragraph is affected by the lack of cross-references with the Regional Chapter 13. (Government of Argentina)	Cross references added.
19-11	LATE	24	4		46	Once again, there is a lack of cross reference to Chapter 13. (Government of Argentina)	This section is cross referenced to Chapter 4, not individual regions. Please refer to Chapter 4 for such cross-references to regional chapters.
19-12	LATE	33	7		16	This is a theoretical paragraph. Concrete reference to lack of basic hydro meteorological data in developing countries must be included. This is a central point for Latin American countries. (Government of Argentina)	The proposed content is not appropriate in this paragraph.
19-13	LATE	41	48	42	14	Specific reference to efforts of developing countries to improve the hydro meteorological facilities is lacking. (Government of Argentina)	The proposed content is not appropriate in this paragraph.