

**IPCC WORKING GROUP I CONTRIBUTION TO THE FOURTH ASSESSMENT REPORT
FINAL GOVERNMENT DISTRIBUTION COMMENTS
on Summary for Policymakers
December 7, 2006**

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
SPM	0		0		Consider creating a box/intro that states what is “New since the TAR” as a précis to the SPM. U.S. Government
SPM	1	5	1	6	<p>Delete last sentence of the first paragraph (“It builds ... research.”) and insert the first two paragraphs of the Technical Summary (TS-3, lines 3-17) as a more substantive introduction. Major points need to be on the first page, so highlight that “likely” (TAR) has evolved to “very likely” (AR4) regarding attribution to human activities. Include the headline (SPM-8, lines 23-24): “It is <i>very likely</i> that anthropogenic greenhouse gas increases caused most of the observed increase in globally averaged temperatures since the mid-20th century” to the end of the first inserted TS paragraph. This increased confidence is the bottom line.</p> <p>Suggested inserted text follows:</p> <p>“In the last 6 years since the IPCC’s Third Assessment Report (TAR), significant progress has been made in understanding past and recent climate change and in projecting future changes. These advances have arisen from large amounts of new data, more sophisticated analyses of data, improvements in the understanding and simulation of physical processes in climate models, and more extensive exploration of uncertainty ranges in model results. The increased confidence in climate science provided by these developments is evident in this Working Group I contribution to the IPCC’s Fourth Assessment Report. This report finds that, “It is <i>very likely</i> that anthropogenic greenhouse gas increases caused most of the observed increase in globally averaged temperatures since the mid-20th century.”</p> <p>While this report provides new and important policy-relevant information on the scientific understanding of climate change, the complexity of the climate system and the multiple interactions that determine its behaviour impose limitations on our ability to understand fully the future course of</p>

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					Earth’s global climate. There is still an incomplete physical understanding of many components of the climate system and their role in climate change. Key uncertainties include aspects of the roles played by clouds, the cryosphere, the oceans, land-use, and couplings between climate and biogeochemical cycles. The areas of science covered in this report continue to undergo rapid progress and it should be recognized that the present assessment reflects scientific understanding based on the peer-reviewed literature available in mid-2006.” U.S. Government
SPM	1	4	1	5	Delete “and attribution” because the sentence already mentions “dominant causes of climate change” which is essentially the same thing, and “attribution” is jargon. U.S. Government
SPM	1	15		15	Replace “affect” with “alter”. U.S. Government
SPM	1	21		21	After “methane” replace rest of sentence with “are at their highest levels in the last 650,000 years and far exceed pre-industrial values.” U.S. Government
SPM	1	26		29	Include a statement on the record high emission rate and rate of increase in CO ₂ abundance. Pull from TS-6, lines 46-48. U.S. Government
SPM	1	33		33	After “1993” add “and were nearly zero from 1999-2005”. Delete the rest of the sentence. U.S. Government
SPM	1	34		34	Replace “Most” with “The majority of”. U.S. Government
SPM	2	9		9	Banner on Figure SPM-1 says “Time (years before present).” Change to “years before XXXX” -- i.e., whatever the date is. U.S. Government
SPM	3	2		2	The term “very high confidence” is used, but is not in the lexicon of uncertainty in Footnote 5. Make the SPM consistent throughout regarding uncertainty qualifiers. U.S. Government

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
SPM	3	2		5	This is a very strong statement that the TAR could not make. Presumably, the total radiative forcing is based on observed differences in greenhouse gas abundances between 1750 and 2005. Problem is that the authors have assumed that ALL increases in abundances are anthropogenic. The total forcing change since 1750, though dominated by human activities, cannot be totally attributed to human activities. If you are going to sum the asymmetric totals, put the period after “warming” and move this summation statement to a sub-bullet prior to the solar output one (SPM-4, lines 4-5). At present, it’s an incomplete total, a sum of asymmetrically weighted quantities in varying certainties. Be very explicit with the numbers given: “.. radiative forcing <i>IN YEAR 2005(?)</i> of +1.6 ...” Combine sentence on SPM-3, line 4-5, with the solar sub-bullet. U.S. Government
SPM	3	3		3	Add the endpoint of 2005 – i.e., 1750-2005. U.S. Government
SPM	3	7		7	Level of precision is different from what is in Figure SPM-2 on the same page (tenths vs. hundredths). U.S. Government
SPM	3	13		13	Delete “Anthropogenic” U.S. Government
SPM	3	17		17	Delete “net” since the term is not defined with radiative forcing which already includes both plus and minus terms. U.S. Government
SPM	3	18		18	Add to end of sentence “and can also force climate change.” U.S. Government
SPM	3	20		20	Delete “Anthropogenic” U.S. Government
SPM	3	26		27	In Figure SPM-2, how do authors justify a “Low” confidence level for Cloud Albedo Effect, rather than “Very Low” considering the large error bar for the indirect effect? U.S. Government
SPM	3	26		27	In Figure SPM-2, remove “Anthropogenic” and “Natural” as y-axis labels. We do not have the data

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					to attribute. Remove the word “total” on label “Total Aerosol” because you don’t have the cloud lifetime effect. U.S. Government
SPM	4	4		4	Change “have caused” to “cause”. U.S. Government
SPM	4	4		5	Add “Several lines of evidence that had been used to provide the higher estimate (comparison with other stars, variations of cosmogenic isotopes) have been shown to be less relevant than previously believed.” U.S. Government
SPM	4	17		17	Use the likelihood terminology of Footnote 5 (not “unequivocal”). U.S. Government
SPM	4	23		25	Is Figure SPM-3 consistent in terms of the confidence intervals shown? The top panel from Chapter 3 assesses the 5-95% confidence interval for decadal values, whereas the bottom panel the 5-95% confidence interval refers to individual values. It is not clear what the shaded area represents in the middle panel, but if it is the bars from Chapter 5, then is it not comparable to top or bottom panels. U.S. Government
SPM	5	1		1	Add to the beginning of the bullet, “Since 1994(?), ..” and adjust sentence accordingly. Name the 12 years (not everyone will read the AR4 in calendar year 2007). U.S. Government
SPM	5	1		7	Units for trends are “per decade” and in other places in this very same section in terms of “per year”. Consider normalizing it in the SPM; when given as a rate of change, give the same units (time interval). Suggest deleting the parenthetical “(0.13 [0.10 to 0.16]°C per decade)” in line 5 because the units raise confusion with those stated above. Add “per century” after °C on lines 3 and 4. U.S. Government
SPM	5	6		7	Consider replacing the last sentence of the bullet with “Urban heat islands distort the local temperature trends but have negligible influence on the global or hemispheric mean temperatures.” U.S. Government
SPM	5	10		10	Should it say “...surface temperature record and <u>are</u> consistent...”

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					U.S. Government
SPM	5	13		15	Add to end of bullet “Water vapor is a strong greenhouse gas and can amplify radiative forcing.” Authors should introduce the subject of this positive feedback somewhere in the SPM, if not here. U.S. Government
SPM	5	14		14	How does “broadly consistent” map onto the IPCC terminology of confidence and likelihood? Delete the qualifier “broadly” and replace with “physically”. U.S. Government
SPM	5	18		18	Can you replace “most” with a value or range? Page 5-8, line 15, gives a value for the fractional oceanic heat absorption of “more than 90%” with no confidence interval. U.S. Government
SPM	5	19		21	The trend in sea level in Figure SPM-3 looks linear over the last few decades, yet the thermal expansion in the text is stated to be four times larger in the last decade. Is the increased rate indicated on lines 19-21 consistent with the linear trend represented in Figure SPM-3? There is also a smaller increase in the glacial component. Should this be explained? U.S. Government
SPM	5	19		49	Suggest coalescing the various sea-level rise observations and interpretations into one spot (see also lines 25, 27-32, and 47 on this page). Then all the sea-level rise contributions would be together, adding up (or not, as the case may be) to the global average rise. It would also allow all the temperature changes to be together. U.S. Government
SPM	5	24		24	Add “small” before <u>both</u> “glaciers” and “ice caps”. U.S. Government
SPM	5	27		30	Shouldn’t the global sea-level rise sum from thermal expansion <u>and</u> melting of glaciers and ice caps? If yes, the presented numbers for rate of increase don’t add up. The value of 3.1 listed for the last decade is greater than the contributing factors of 1.6 (line 20) from thermal expansion and 0.77 (line 25) from glacial melting. The discrepancy still exists when one adds the Ice Sheet estimate of 0.41 (line 47), although it is less. Similarly the value of 1.8 (line 27) listed for 1961-2003 is (much) greater than the contributions listed from thermal expansion (0.42, line 19) plus glacial melting (0.5,

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					line 24). Given this discrepancy, wouldn't that produce some uncertainty in the global average sea-level rise values quoted on lines 27 and 28? These values should have confidence levels associated with them. Authors might consider consulting TS-26, lines 1-9, to help reconcile. That said, how can the value for the 20th century, which is obviously strongly affected by what happened over the last 40 years, be of "high confidence" (nomenclature that needs, at minimum, to be defined at first use or converted to the footnote 5 uncertainty statements)? U.S. Government
SPM	5	35	6	31	The lack of mention of the changing Walker Circulation—published well within the AR4 period—is a serious omission (Vecchi <i>et al.</i> , Nature summer 2005). This major <u>new</u> climate change certainly has large policy implications. U.S. Government
SPM	5	41		41	Clarify what spatial distribution is being referenced in the final clause. What different spatial distribution occurred in that time period? U.S. Government
SPM	5	47		49	Why isn't the recent loss of the Larsen ice shelves mentioned here? U.S. Government
SPM	6	5		10	Why don't the precipitation trends have a confidence level associated with them, especially given the last lines of this bullet? U.S. Government
SPM	6	8		10	It would be helpful to specify why "robust long-term trends have not been observed for other regions". Is it due to the nature of the trends (low signal/noise), the quality of the observations, or the number or quality of the analyses of the observations? U.S. Government
SPM	6	14		15	Change "... (SST), atmospheric circulation patterns, and decreased snowpack and snow cover have..." to "... (SST) and atmospheric circulation patterns, and decreased snowpack and snow cover, have..." Also, does "linked" mean "contributing"? U.S. Government
SPM	6	15		15	It is not obvious that "snowpack" refers to the thickness of the snow cover. Suggest rewording as

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					“...decreased thickness and extent of the snowpack”. U.S. Government
SPM	6	18		19	Suggest changing “Basin-scale” to “Ocean-wide”. Also, ‘ocean salinity changes’ needs elaboration. Do you mean freshening of ocean salinity? And what are the implications for ocean circulation? Granted, this is the Observations section; however, these major issues need to be addressed in an appropriate portion of the SPM. U.S. Government
SPM	6	21		22	The statement “The frequency of heavy precipitation events has increased, ...” may be taken to mean ‘everywhere,’ which almost certainly is not true. Consider re-crafting this sentence with appropriate modifiers to provide a clearer statement consistent with findings. Add the geographical qualifier (e.g., TS-21, line 7) “...in many land regions”. Also, shouldn’t there be a likelihood qualifier here and throughout much of this page? Refer at minimum to Table SPM-1 in all relevant instances. In this particular case, add “(see Table SPM-1)” after “increased”, so readers see the confidence level. U.S. Government
SPM	6	25		25	Change “rarer” to “less frequent” because “rarer” could describe spatial or temporal frequency. Do you mean “less widespread” as well? U.S. Government
SPM	6	28		30	Replace second sentence of bullet with “Several studies based on the interpretation of long-term satellite records provide evidence that increasing tropical sea surface temperatures are associated with more intense, but not necessarily more frequent, typhoons since about 1970.” The SPM needs to reflect the vigorous and ongoing debate regarding this issue. Recent analyses using a homogenous satellite data record spanning 1983 to 2005 find no significant increase in hurricane frequency and intensity outside the Atlantic basin, and questions remain as to the adequacy of observational data sets for detecting hurricane trends prior to the satellite era. U.S. Government
SPM	6	36		37	If there is no geographic language attached, is the reader to assume that these are global averages? This needs to be made clear, both here and elsewhere in the SPM text. And, in many cases, authors apparently co-mingle land vs. ocean, and such distinctions also warrant delineation.

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					U.S. Government
SPM	6	39		41	There are statistically significant trends in Antarctic sea ice, just not on a zonal-average or Southern Ocean-average scale. Over the last 2 decades, sea-ice concentrations and duration have been decreasing strongly in the western Antarctic Peninsula and southern Bellingshuasen sea-ice regions (numerous references) while increasing in the western Ross Sea (again numerous references). So, as a whole, there is little significant change, but regionally these are strong trends: in the first region, there has been a decrease of 85 annual sea-ice days between 1979 and 2004, and in the second region an increase of 60 days. The statement as given in this paragraph is misleading and should be altered to indicate that there are regionally significant trends, but not hemispherically. U.S. Government
SPM	7	1		13	In Chapters 3 and 9, from whence most if not all of the information for Table SPM-1 is pulled, these are just “Extreme Weather Event” phenomena. At minimum, delete “and climate events” from line 4 of the title. However, a more comprehensive treatment is preferable. This table provides the authors with a valuable opportunity to communicate the “Climate Event” findings of the underlying report, even if only addressing items that warranted elevation to the SPM itself. It is the belief of the U.S. Government that Table SPM-1 should be significantly modified to more fully serve the purpose for which it is expressly intended—that is, to indicate “recent trends which have a discernible human influence and are likely to continue in the 21 st century”. Tables traditionally recapture key points in the accompanying text, and are often used as standalone presentation vehicles. Table SPM-1 should fulfill this role with respect to trends. As it now stands, only a few of the trends deemed worthy of discussion in the document are included, and one could argue they are not even the most important ones. It is recognized that the table was originally focused on extremes; but, given that it is so explicitly concerned with trends and anthropogenic influence, it gives the impression that the trends mentioned are the only ones worth highlighting as having an attributable human influence (5 out of 7 with marginal certainty). This deficiency could be corrected by either adding phenomena with more pronounced human influence or by removing the attribution column. At a minimum, Table TS-4 (TS-30, lines 1-13) should be substituted for Table SPM-1 as foundation of the editing process, because this version of the table explains the origins of

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<p>the attributions.</p> <p>The following is a list of parameters <u>that are mentioned in the SPM itself</u>, with trends currently occurring and likely having a discernible human influence (or at least <i>more likely than not</i>) and whose trends are likely to continue in the 21st century:</p> <ol style="list-style-type: none"> 1. Carbon dioxide 2. Nitrous oxide 3. Positive radiative forcing 4. Global average surface air temperature 5. Low- to mid-tropospheric temperature 6. Atmospheric water vapor 7. Global ocean temperatures 8. Global average sea level 9. Northern Hemisphere snow cover and mountain glaciers 10. Arctic sea ice 11. Greenland and Antarctic ice sheets (here one could make the point that their trend in the 21st century is uncertain, even though the trend currently is for shrinkage) 12. Increased precipitation (N. America, S. America, northern Europe, northern and central Asia; the model projections could be used to suggest whether these are likely to continue and, if so, it would increase the likelihood that the current trend is due to human influence). 13. Decreased precipitation (Sahel, the Mediterranean, southern Africa and parts of southern Asia; again use models to estimate continued likelihood and current anthropogenic influence). 14. More intense and longer droughts 15. Specific basin-scale salinity changes (in particular, if the North Atlantic is getting fresher) 16. Frequency of heavy precipitation events 17. Extreme temperatures – cold nights and frosts, hot days, hot nights, and heat waves 18. Tropical cyclones (appropriately caveated) 19. Atmospheric circulation.

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<p>Omitted are items (such as methane) that do not have current trends. Adding true “climate events” provides authors with more signals to give higher degrees of certainty (including <i>very likely</i>, <i>extremely likely</i>, and <i>virtually certain</i>).</p> <p>Given the current space devoted to Table SPM-1, this list, in part or in its entirety, would fit on one page. It would provide a convenient summary of both past changes, likely predictions, and the probability of anthropogenic influence.</p> <p>U.S. Government</p>
SPM	7	1		13	<p>Define “extreme high sea level” because Table 3.7 in Chapter 3 does not contain this phenomenon.</p> <p>U.S. Government</p>
SPM	7	1		13	<p>In third column (on discernible human influences) associated with Tropical Cyclone phenomenon, substitute “inconclusive” for “more likely than not”. Refer to U.S. Government comment on SPM-6, lines 28-31, for argument regarding lack of consensus.</p> <p>U.S. Government</p>
SPM	7	1		13	<p>Clarify to what areas of the globe Table SPM-1 refers (e.g., only drought has a geographic qualifier), since these changes are not observed everywhere. If it <u>is</u> the global average throughout, this should be stated in the table title.</p> <p>U.S. Government</p>
SPM	7	1		13	<p>Since often used as a standalone item, footnote the table to refer to the certainty definitions found on TS-4, and the methodology in Chapter 9 to come to those qualifiers. Add SPM footnote 5 back in as a footnote to the table too.</p> <p>U.S. Government</p>
SPM	7	1		13	<p>There is a thread on heat waves that starts in FAQ 3.3 in Chapter 3 that states that “More warm extremes imply an increased frequency of heat waves.” Since there is little direct evidence that true heat waves have increased and must be “implied,” this statement does not rise to the level of <i>likely</i> in Table SPM-1 and the similar table in Chapter 3; in both instances the uncertainty should be <i>more likely than not</i>. This statement then leads into the statement on projected increases in heat waves in the SPM that “It is very likely that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent. {10.3}” There may be high confidence that there will be</p>

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					increases in heat waves over the 21st century, but not that they “continue” since it has not been directly established that they have increased over the last half of the 20th century. U.S. Government
SPM	7	1		13	Delete “continuation of” in the fourth column header. U.S. Government
SPM	7	27		27	Suggest changing to “...suggests that past warming has <u>also</u> driven large-scale...” U.S. Government
SPM	7	27		28	This sentence is really two points that are totally independent as articulated in the two paragraphs that follow, and has to be read very carefully to properly interpret the message. The danger for policymakers is that one can easily assume that “unusual nature of the recent warming” and “past warming” are the same warming, whereas the paragraphs that follow indicate that one is past recent warming during the second half of the 20 th century and the other past warming was 125,000 years ago. At the very least, break the statement into two sentences, as edited and as follows: “Paleoclimate information supports the unusual nature of the recent warming. Paleoclimate evidence suggests that more distant past warming (glacier-free periods of the last 500,000 years) has driven large-scale ice sheet retreat and sea level rise.” U.S. Government
SPM	7	30		31	Suggest replacing the first sentence of the bullet with “Some studies since the TAR have indicated greater cooling during the so-called Little Ice Age, particularly during the 12 to 14th, 17th, and 19th centuries.” U.S. Government
SPM	8	5		5	Does “polar” refer to both north and south? How do orbital changes get factored in? U.S. Government
SPM	8	8		8	Change “implying” to “suggesting”. U.S. Government
SPM	8	32		34	Suggest changing to “ <i>extremely likely</i> that the past climate change of the last 50 years was not caused by natural variability alone.”

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SPM	9	2		6	In Figure SPM-4, add a panel for Antarctica, especially since it's the only outlier. Although the Arctic is not a continent, consider adding it to show the high-profile rapid warming trends and change the illustration banner accordingly. U.S. Government
SPM	9	12		12	In Figure SPM-4 caption, delete “unadjusted” or define what is meant by that term. U.S. Government
SPM	9	17		18	Define “smaller scales” in the first sentence, or better yet just say what scales you are talking about. U.S. Government
SPM	9	22		24	Elaborate on “Human influences”. Clarify that the influences are indeed related to greenhouse gas forcing. U.S. Government
SPM	10	1		3	Syntactically challenged sentence. Restructure as follows: “For the most extreme hot nights, cold nights, and cold days, temperatures are <i>likely</i> to have....” Otherwise it might be misread to mean the number of cold nights and days have increased with global warming! U.S. Government
SPM	10	6		7	Authors need to be clearer that they are talking about climate sensitivity. Change sentence to “There is now increased confidence in the estimation of climate sensitivity to radiative forcing.” And explain why there is increased confidence. U.S. Government
SPM	10	13		13	Add “of past climate” after “observations” (line 13) U.S. Government
SPM	10	13		16	How can it be known for sure that water vapor feedbacks are the dominant ones when there is still uncertainty in cloud feedbacks, especially since there are links between the two? U.S. Government
SPM	10	18		18	How do you justify <i>very likely</i> considering the admitted difficulties in quantifying solar and volcanic forcings?

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					U.S. Government
SPM	10	18		22	Consider moving this bullet to become the second bullet of the Paleoclimate section (before bullet on SPM-8, lines 4-9). U.S. Government
SPM	10	28		28	“to constraints from observations” is syntactically incorrect. Fix it. U.S. Government
SPM	10	37			The U.S. Government objected to the newly invented use of the term “committed warming” in the Expert and Government Review SPM draft for two reasons: (1) Hansen pioneered the use of this and defined it 2 decades ago as “unrealized warming;” and (2) it mistakenly projects that this limited warming is all that we are committed to. Use the original published definitions or, at a minimum, delete the word “committed.” U.S. Government
SPM	10	40		43	Suggest rewording of this bullet for clarity: “Confidence in warming projections for the next few decades are strengthened by the agreement between the observed warming during 1990-2005 of 0.2°C per decade and the warming projection of 0.15-0.3°C per decade, as made in the IPCC First Assessment Report in 1990.” U.S. Government
SPM	10	46		46	Another use of the newly coined “committed” expression. U.S. Government
SPM	10	48	11	1	Delete clause “, none of which considered climate initiatives.” This eliminates need to specify which climate initiatives; interested parties can consult the Special Report on Emissions Scenarios. U.S. Government
SPM	11	1		4	Suggest that the last sentence beginning with “Best-estimate projections...” be made its own bullet. U.S. Government
SPM	11	23		26	The projected ranges of sea level rise will mislead the primary audience of the SPM, because the projections are based entirely on models that fail to account for possible increases in ice discharges from the Greenland and Antarctic ice sheets. The contributions from these polar ice sheets have the potential to exceed the processes that the models include.

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					<p>Many people are aware of the recent reports about increased ice sheet contributions to sea level. It is misleading to provide estimates only for the processes that have been modeled (such as thermal expansion and increased high-latitude precipitation) while ignoring the potentially larger contributions that models cannot yet estimate (associated with ice sheet dynamics). It is also misleading for those projections to be based on the assumption that, even in the worst of cases, Antarctica will remain too cold to contribute to sea level, because the data indicate that it already making a contribution. The proposed IPCC AR4 projections state, in effect, that the risk of a significant rise in sea level during the next century is <u>less</u> than previously believed, even though the most important recent observations show that the ice sheets—taken as a whole—are contributing <u>more</u> than previously expected.</p> <p>As written, the model output does not bound the full range of uncertainty.</p> <p>U.S. Government</p>
SPM	11	28		34	<p>Insert “the thermal expansion component” between “Projections of” and “sea-level rise”, and replace “are smaller than given in the TAR” with “have a narrower range than given in the TAR” -- to result in “Projections of the thermal expansion component of sea-level rise have a narrower range than given in the TAR, ...” The lowest projection given this time (19 cm) is more than double the (9 cm) low estimate from the TAR.</p> <p>U.S. Government</p>
SPM	11	29		29	<p>Add “small” before “ice cap” and delete the callout for footnote 7.</p> <p>U.S. Government</p>
SPM	11	30		34	<p>Delete everything after “...upper bound.” and replace with “However, recent events including the apparent increase in the rate of sea-level rise over the last decade, and the disintegration of several Larsen ice shelves, has increased the uncertainty about the response of the Greenland and Antarctic ice sheets to global warming and contributions to sea-level rise.”</p> <p>U.S. Government</p>
SPM	11	36		40	<p>State the significance / policy relevance of ocean acidity? Move the footnote 12 callout after “units”.</p> <p>U.S. Government</p>
SPM	11	47		47	<p>Suggest making it simpler: “In all SRES(?) scenarios, the projected warming in the 21st century</p>

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					shows geographical patterns similar....” U.S. Government
SPM	11	48		48	Add “most” before “high northern latitudes”. U.S. Government
SPM	12	8		8	“globally averaged <i>surface</i> temperatures....” Add the word “surface” to the caption even though in figure banner. U.S. Government
SPM	12	16		33	These are very important and should be included in a revised/expanded Table SPM-1. Refer to detailed U.S. Government comment regarding page SPM-7, lines 1-13. U.S. Government
SPM	12	19		19	Add “Extent and thickness of...” to beginning of sentence. U.S. Government
SPM	12	26		27	What are the confidence levels of the statements about tropical cycle frequency and intensity? U.S. Government
SPM	12	28		29	What does “apparent increase” imply? Delete sentence unless strong evidence exists regarding the “apparent increase”. Alternatively, replace that sentence with “The ability of these AOGCMs to simulate typhoons and hurricanes has not been adequately demonstrated.” U.S. Government
SPM	12	31		31	What is the confidence level of the statement about poleward moving storm-track changes? U.S. Government
SPM	13	2		2	Note that the expected increase in precipitation at high latitudes does not imply that soil moisture increases, of importance to the future of methane emissions from soils (the average soil moisture response actually decreases in models). It would be very useful to indicate that here. U.S. Government
SPM	13	26		28	Restructure sentence to read as follows: “Anthropogenic warming and sea-level rise would continue for centuries even if greenhouse gas concentrations were to be stabilized, due to the time scales associated with climate processes and climate feedbacks.”

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					U.S. Government
SPM	13	31		31	Replace “required” with “included”. U.S. Government
SPM	13	38		38	Delete “committed”. It is not needed. U.S. Government
SPM	14	3		4	What is the confidence level associated with the complete elimination of the Greenland ice sheet? U.S. Government
SPM	14	8		8	Explain “dynamical process”. Vector displacement of ice sheets? U.S. Government
SPM	14	13		15	Model projections of mass gain over Antarctica remains a concern. The statement is unclear with respect to time scale, but apparently refers to projections to 2100. There is current evidence for mass loss, and while this may not continue, it does give rise for concern over how much confidence should be ascribed to current model projections. The previous bullet (SPM-14, lines 8-11) states that current models are inadequate for representing potentially significant processes in ice sheet dynamics. Given this stated uncertainty, the authors should consider whether inclusion of the second-to-last bullet is still warranted as a major finding. At minimum, reverse the order of bullets and move lines 13-15 before 8-11, and note that currently Antarctica appears to be losing mass and contributing to sea-level rise. And add Chapter 4 to the curly brackets. U.S. Government
SPM	14	19		19	What is missing in these future visions is the fact that much of the CO ₂ stays forever, and that stabilization requires nearly zero emissions. This is already known, but perhaps a brief sentence summarizing it would help. U.S. Government