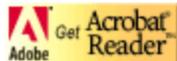


# Past Climate Variability and Change in the Arctic and at High Latitudes

Public Review Comments on Draft Prospectus for Synthesis and Assessment Product 1.2

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## Comments were received from:



Name: Michael MacCracken  
Organization: Climate Institute

Name: S. Fred Singer  
Organization: University of Virginia/SEPP

Name: Ashley D. Williamson  
On Behalf of Jerry Elwood  
Organization: Department of Energy

**Also available:**  
[CCSP Synthesis and Assessment Products](#). Four-page background document (dated September 2007). In addition, it is available as a [PDF file](#) and can be ordered in hardcopy from the [GCRIO Online Catalog](#)

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## General Comments:

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**Michael MacCracken**

First General Comment: I was rather surprised at the summary of the science included in the prospectus, in that I would have thought a number of the statements (especially those sentences including the word "will") would end up being in the results of the study rather than in the opening statement of the situation (see specific comments for some examples).

**Response:** *Responses given under specific comments. We have revised the language to be more consistent as per this suggestion.*

Second General Comment: In preparing the CCSP synthesis and assessment report itself, It would be helpful to very carefully explain the use of words regarding likelihood and

level of confidence. This is being done in the IPCC reports and was done in the US National Assessment report using lexicons that were carefully explained and other words (like "may" and "could" were intentionally avoided as not communicating useful information about likelihood or confidence in the statements. I would urge that a similar sort of approach be used here.

**Response:** *We concur and will adopt the approach of the IPCC in this matter. This is now noted in section 1.7.*

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**Fred Singer**

I wish to comment on the choice of Lead Authors of SAP1.2. I have some concern about lead author Dr J, Brigham-Grette, the lead signer of a recent article in Eos. The signers do not distinguish between a warming of the climate and one that is anthropogenic. Further, to support their arguments, they misquote the findings of SAP-1.1. (see attached). I would feel more comfortable if Gerald North and/or Kurt Cuffey were added as lead authors.

**Response:** *A cadre of contributing authors and reviewers will be involved in the production of this report. Of the two suggestions offered, Prof. Cuffey has the appropriate expertise in paleoclimate to be engaged in this SAP. He is currently on sabbatical and has declined to participate at the lead author level. Dr. North's expertise lies outside the realm of paleoclimate analysis but his climatology expertise would be most welcome and will be sought as a reviewer.*

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**Ashley D. Williamson**

It would be useful to know what time scales

1.2 will span. The draft prospectus says beyond the historical period, but it's not clear how far back in time they will go.

**Response:** *Similar to the line of reasoning arrived at during the scoping session on drawing hard limits on the geographical definition of 'high latitudes', the participants agreed that at the outset they would focus on a timescale for which meaningfully-resolved records exist, for which the role of orbital forcing would come into play, and for which good analogs for present conditions exist. There was general consensus that the timescale needs to be flexible enough to yield meaningful insights and not be artificially constrained by setting a limit which might exclude consideration of important analogs that lie outside such a limit. Having said this, it is likely that the record to be considered will extend back at least as far as the last full interglacial (125Kyr) but will entrain much older portions of the record where doing so yields additional insights.*

There is a lack of reference to global coupled climate models. If the questions raised in 1.2 dealt with determining the range of variability based on the paleo record to provide a context of current changes in Arctic, based on past observational and proxy data, it's fine to bypass dealing with climate projection results. But Question 1, Question 3, Question 4 need GCMs to answer. Question 1, Question 3, Question 4 are all to do with future... simply analyzing the past record won't do. There is no mention of how these will be addressed using climate change projections.

**Response:** *Introductory material has been added to elucidate the intended relationship between the record of the past and its implications for the future. The questions have been rephrased to indicate this. Each of*

*the following questions (below) that raises the issue of the role of climate models should be addressed by the added material. The utility of the paleoclimate record, as intended by the authors, is to shed light on the range of possibilities as supported by clear demonstration of prior existence. Insofar as the past record can shed light on possible other states it has application to potential futures. It is not the intention of the authors to enter into the realm of global coupled climate modeling extensively, but rather to answer the questions.. 'has this happened before' and 'under what circumstances'.*

**The paragraphs under Question 1**, do not deal with answering Question 1 per se. They deal with the impact of decreased sea ice cover. Either the question should be substituted to be the one that will be answered by the text, or the text should be altered to answer Question 1 'What will be the fate of the Arctic sea ice in the 21st century?' This question can only be answered using climate change projections.

**Response:** *Question 1 was rephrased in response to the earlier CCSP review and the header text has been altered to indicate that the material presented under each question is meant to provide both background information that gives the reader a sense of why the question has been deemed important (i.e. the 'so what?') and also states the relevance of the paleoclimate record in helping to answer the question. Similarly, questions 3 and 4 have also been rephrased.*

**Similarly the paragraphs under Question 3**, do not deal with answering Question 3 per se. They deal with the impact warming would have, and historical records. Either the question should be substituted to be the one that will be answered by the text, or the text

should be altered to answer Question 3 'How much warmer/colder, wetter/drier is it going to get in the next 100 years?' This question can only be answered using climate change projections.

**Response:** See response to prior question.

**Question 4** 'What will be the rates of change?' We'd need to refer to climate model results. But page 4, line 44 is how the report will answer this question, viz the report will summarize paleoclimatic data ... filling those gaps'. I believe this will not provide the answer to Question 4. Either change question, or change text to answer question.

**Response:** See response to prior question.

How is 1.2 related to 3.4? 1.2 will look at Abrupt Climate Change in the Arctic; 3.4 deals solely with Abrupt Climate Change. So will both deal with Abrupt Climate Change. It is not clear where climate processes will be dealt, under 1.2 or 3.4? Given these assessment products in the same stage of evolution, there needs to be some cross-talk so redundancy is reduced.

**Response:** This is now specifically addressed on pg.6 line 28. The paleoclimate record is the only extant record of abrupt climate change. The timing, scope, and extent of the past abrupt events will be examined in SAP 1.2, with discussions of causes and impacts where the record supports them (e.g. the paleoclimate evidence for the outburst flooding from Lake Agassiz and the subsequent cooling and freshening of North Atlantic surface water 8.2Kybp). The discussion of the climate processes for these event will be dealt with in depth in SAP 3.4. The overlap of the two products is recognized and a plan for cross-

communication between the two writing teams is in place.

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## Specific Comments:

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**Ashley D. Williamson**

**Page 1 Line 43:** can you put numbers on 30 year trend in Arctic?

**Response:** *We feel that we did address this question in our response. To reiterate... any numbers that state specific average temperature changes in the prospectus have the potential to be misleading in the face of the large spatial variability of average temperatures in the Arctic over the past 30 years. The authors do not wish to create a level of specificity where it is likely to be misinterpreted in the prospectus. A general statement about air temperatures over Arctic land masses in the 20th century has been added*

**Page 2 Line 44:** Some of these are already occurring. Why is the draft prospectus talking in future tense.

**Response:** *Text has been adjusted..*

**Page 3 Lines 9-15:** How will the CCSP product address this, if at all? What is the relevance of this para to 1.2? Page 3, line 32 also refers to iceberg distribution and 'thus shipping'.

**Response:** *Section deleted.*

**Page 8:** Final prospectus is scheduled for Dec 2006. It will take at least a couple of months before FACA committee is approved. Page 9 timetable is not realistic.

**Response:** FACA approval has been received. The timeline has been adjusted to reflect this.

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**Michael MacCracken**

**Page 1, line 43:** An uncertainty range should be associated with the amount of overall warming.

**Response:** Uncertainty range has been inserted.

**Page 1, line 45:** The phrase “although the variability is also greater in the Arctic” seems a bit strange. First, it should explicitly say greater than what, but more importantly, it is not made clear why this is important and what the time scale of the variability being talked about is? Is it the century long variability, or over the 30 years or what? And is the comparison to the variability over a small region like the Arctic to the planet as a whole, to other latitude bands, or to other regions of similar size around the world—it is just not clear what is meant. And, a key issue for the Arctic is having representative data across the whole region over the times of the comparison—there is little observational data over much of the Arctic for period prior to 1950, so some of the variability likely being referred to (i.e., that during the early 20th century) is compromised by the changing coverage of data. Finally, on this point, in that human-induced climate change for the Northern Hemisphere, as reconstructed by the models, extends back through the 20th century and has a similar pattern to the observed trends in the North Atlantic (and sulfate aerosols likely played a role in the temporal pattern, it is not really clear what was variability and what was change. I would hope that this assessment report would address a number of these questions, so

seeing them apparently settled in the prospectus seems a bit troubling.

**Response:** *The phrase has been deleted. The authors appreciate the suggestion to ensure that the variability/change issue is adequately addressed in the report.*

**Page 2, lines 3-4:** The shallow inversion in the Arctic also plays a role in making it a more sensitive region—less mass of air to be affected.

**Response:** *Noted*

**Page 2, lines 9-11:** Just to note that the Arctic Climate Impact Assessment also found it useful, at least for the early 20th century and in regions where formal observations were lacking, to draw forth information about climate and climate proxies from the recollections of elders. Proxy information such as the appearance or absence of certain species (like birds, insects, etc.) can give a useful sense about whether conditions during the early-mid 20th century were comparable to those today. So, I would urge consideration be given to traditional knowledge as a useful augmentation of traditional proxy indicators, seeking, of course, to also find collaborating evidence of other types.

**Response:** *Indigenous knowledge will be very valuable in filling the gaps between the paleo-record and the instrumental record and in elucidating impacts to human and animal populations. The authors will seek a contributing author to cover this aspect of the record.*

**Page 2, lines 25-27:** The words used here need to be clarified, in particular, what does

“in the recent geologic past” mean? My understanding is that, from studies of the presence of trees and boreal habitat, that the Arctic has not been warmer than at present since the Holocene Optimum some 6000 years ago when Milankovitch forcing was quite different—is 6000 years ago the “recent geologic past,” or does this term mean earlier or later. In that this phrasing could be misconstrued to mean that the present warming is not all that unusual, this phrasing needs to be made much more specific.

**Response:** *In the context of the prospectus text the ‘recent geologic past’ is taken to mean the past 125K years. However this phrase is likely to suggest some unintended constraints on the use of paleo-data. It has therefore been deleted.*

**Page 2, line 42 to Page 3, line 2:** This paragraph is one where careful application of the lexicon would seem to be needed. First, the paragraph indicates that “reduction in sea ice *will* accelerate” and then that this “*will* influence weather systems” (so, in both cases suggesting complete certainty, but all in qualitative terms, so this does seem reasonable) and then it is said, “changes in ice cover and freshwater flux out of the Arctic Ocean *may* also affect ...” [emphasis added]. I would suggest that if one says “will” in the first two cases, then “will” should apply in the same sense for the third phrase—these are qualitative and not quantitative sentences and doing otherwise implies some sort of judgment is being made about quantitative aspects and importance. If that is the case, then all the phrases should be couched in a lexicon like that of the IPCC (i.e., virtually certain, very likely, etc.). This problem continues in the next paragraph, where it is said that “reduction of sea ice will also accelerate coastal erosion” and “food web will

change” but only that wildlife “are likely to be adversely affected.” Then the assertion is made that “a loss of sea ice will allow for greater commercial exploitation” without seeming to consider a number of qualifications that are likely applicable, such as whether this can be done with permafrost melting, the potential of hazards and pollution and clean-up liabilities and capacity, issues of sovereignty, problems and liabilities associated with shipping in dangerous waters for ice-free seasons of varying length and intensity, etc.—and so on.

**Response:** *Text has been rewritten to be more self-consistent. The examples given in these sections are meant to provide background for why the question being asked in the SAP has relevance to human and animal populations. The statement that a ‘reduction of sea ice will allow for greater commercial exploitation...’ has been amended to read ‘The loss of sea ice will also provide the opportunity for greater commercial exploitation....’. However, both statements simply make the point that, all other things being equal, an open sea route will provide additional access for activities which are currently limited by the presence of sea ice.*

**Page 2, line 10:** Just to note that in the Arctic Climate Impact Assessment, the term “northern sea route” was used as this is apparently preferable to “northeast passage.”

**Response:** *Text changed to this wording.*

**Page 2, lines 23-25:** More uses of the word “will”—the first is fine, but it should not be implied that this report will provide a full context for evaluating current and future impacts—this will take much more than paleoclimatic information.

**Response:** *This has been a difficult line to walk. The authors do not intend that this report will provide a full context for evaluating current and future impacts. As Michael observes, that is well beyond the scope of the paleoclimate record alone. But they do intend that the relevance of the paleo-record to the present and future is made clear in a supportable way.*

**Page 2, lines 33 and 39:** Why is the word “could” now being used—in the framing earlier of qualitative statements, “will” is as valid—“could” is really an innocuous and ill-defined word and should be replaced by a word in whatever lexicon is to be drawn upon. Similar issues arise throughout later paragraphs, and not being careful in the prospectus would seem to bode ill for the report itself.

**Response:** *In the two particular instances in which ‘could’ was used, - the first referring to the breakdown of clathrates in the Arctic shelf and the second referring to undersea landslides generated by destabilization of the continental shelf – the proposed mechanisms are plausible, but have yet to be demonstrated to have happened through a clear chain of evidence in the paleo-record. We therefore feel that the use of ‘could’ rather than ‘will’ is more appropriate in these instances.*

**Page 2, line 46:** Switch “is it” to “it is”

**Response:** Corrected

**Page 3, lines 37-38:** The phrase “are superimposed” seems a poor choice of words, for it seems to somehow imply that we’ll continue to have conditions like the present, with the baseline just a bit higher. Actually, the change in the baseline is going to

overwhelm natural variability. Indeed, there will be some variations remaining, but not like the present ones.

**Response:** Text amended to reflect this.

**Page 3, lines 40-42:** It is not at all clear that future variability will be like past variability, and the “changes of even larger magnitude” that have occurred in the past were, as I understand it, when the surrounding continental areas were generally ice-covered and massive melting and formation of glacial lakes led to outflows that dramatically affected ocean circulations. Such circumstances don’t exist now, and to imply that one could get such large variations now seems quite misleading, unless there is a real though that accelerated melting of Greenland could lead to this, and if that is to be the cause, then the text should indicate this and what it would be meaning for changes in sea level. As the text is now, it seems to me to underplay the important changes human activities are inducing.

**Response:** Text has been added (pg. 5, 22-25) that explicitly recognizes that past warm periods are not necessarily completely analogous to the current warm period. Nevertheless, the fact remains that we do not yet fully understand where the triggers for abrupt climate change lie and that our best clues to this lie in the record of past changes.

**Page 8, lines 15-22:** That this prospectus on line 22 indicates that the lead authors will participate in the final responses to comments from the NSTC level review is encouraging for it seems to go beyond the published guidelines (see the Web site of the guidelines). Thus, this paragraph, indicating conformance between this prospectus and

the guidelines seems not to be fully the case, and it is about time the guidelines were revised, as not having the lead authors involved in the finalization of the document would make it into a political document and greatly diminish its credibility.

***Response:*** *It is the understanding of the authors that they will be engaged in all phases of the review process and that once the final language is agreed upon between the NSTC reviewers and the authors, no re-writing can occur.*