

USGS/CCSP SAP 1.2 “Past Climate Variability and Change in the Arctic and at High Latitudes” Workshop

July 12-13, 2007

Hampden Inn West
Ponderosa Room
137 Union Boulevard
Lakewood, Colorado

Meeting Goal: Produce a detailed outline of the synthesis and assessment product, identify contributing authors, and establish writing assignments and timelines.

Thursday, July 12, 2007

9:00 AM to 10:40 AM – Closed to the Public

- Administrative matters
- Opening Statement
- Logistics of meeting
- Nancy Baumgartner (USGS) on Special Government Employee (SGE) status and FACA requirements

11:26 AM to 12:00 PM – Open to the Public

Participant list:

Committee Members:

- Joan J. Fitzpatrick, USGS
- Richard Alley, Pennsylvania State University
- Julie Brigham-Grette, University of Massachusetts, Amherst
- Leonid Polyak, Ohio State University

Speakers:

- Jack McGeehin, USGS

Public:

- Scott Lundstrom, USGS

Joan Fitzpatrick opened this first lead-author’s meeting for SAP 1.2 and began by outlining the status of the SAP 1.2 Prospectus. She has received committee responses to reviewer’s comments and will assemble them in a cover letter to accompany the final revised prospectus to CCSP.

Joan Fitzpatrick reminded all lead authors to keep the committee in the loop by copying them when exchanging e-mail on timelines and production of their

respective sections of the document. Subcommittee e-mail exchanges do not need to be copied to the entire committee.

There are two names to be added to the committee:

James White, University of Colorado

John Andrews, INSTAAR

The 0° draft of SAP 1.2 is due the end of October. The 0° draft includes input from contributing authors and constitutes the body of technical input.

CCSP has a required format, but the 0° draft will not yet have all required elements (for instance the technical and executive summaries).

This meeting will focus on building the technical portion of the report based on the four questions outlined in the prospectus.

The FACA will need to reconvene in late October (either by telecom or in person) to review the 0° draft. Meeting date was set for Monday, October 29, as a telecom.

Committee will have one month from the end of October to craft the 0° draft into a 1° draft suitable for technical expert review. FACA members will need to identify technical reviewers.

Peer review is estimated to begin by December 10 and run through January 9.

The FACA committee will have January and February to respond to technical review comments and Joan will compile the introductory material (technical summary?) during this time. CCSP will create the executive summary for SAP 1.2.

FACA committee will need to meet after the technical review. Julie Brigham-Grette suggests a face-to-face meeting to address technical review and public comments.

Joan Fitzpatrick will research what FACA requirements are for such a meeting.

National Academy of Sciences Building in Washington D.C. suggested for a meeting site. Committee member's schedules suggest Friday, January 25, as a start date for the meeting, which can continue through the weekend.

The next draft (2°) for public review is due the end of February. The review period is 45 days. Once public comments have been received and addressed and the draft revised, the resulting version will be submitted to CCSP.

CCSP will have additional reviews after the document is submitted to them in June 2008, but that process is managed by CCSP. The deadline for the SAP 1.2

FACA committee is June 2008. CCSP's review is largely procedural and should not entail rethinking the science.

Richard Alley proposed sharing guidelines from the IPCC review process for standardizing responses to review comments, especially to comments already addressed in the review process. Joan Fitzpatrick will do her best to minimize the impact of large volumes of comments on committee members.

Once the document is final, a series of Congressional briefings will be arranged by the Congressional Affairs Office at USGS. Joan Fitzpatrick is responsible for delivering the briefings, but would appreciate FACA members' support.

The USGS Office of Communications will help craft a communications plan that includes appropriate Congressional offices. Timing of the Congressional briefings would be July 2008, or after their summer recess in September.

Break from 11:59 AM to 1:00 PM

Jack McGeehin, USGS and DFO for SAP 3.4, was introduced in preparation for his presentation tomorrow on the SAP 3.4 outline and areas of potential overlap with SAP 1.2.

The group returned to discussion of responsibilities with respect to comments on the prospectus. Joan Fitzpatrick will write a cover letter with point-by-point responses to comments received that will accompany the revised prospectus when it is returned to CCSP. Some comments suggested topics that are beyond the scope of SAP 1.2; it is the committee's prerogative to decline to include such topics in the final report.

Joan Fitzpatrick would like the committee to come to consensus and approve the content of the cover letter to CCSP.

Leonid Polyak inquired whether substantial changes can be made to the 0° draft. It was agreed that the 0° draft is just for the committee and could incorporate changes within the boundaries of the prospectus. Changes to later drafts once they had been through peer review would be primarily limited to responses to reviewer comments.

Next the committee addressed the structure and content of the report outline.

The first topic of discussion was the Greenland Ice Sheet: Lead Author – Richard Alley. Question posed in the prospectus is: What does the paleoclimate record tell us about the past extent and status of the Greenland ice sheet and its implication for sea level changes?

Richard Alley believes this question requires consideration of models, consideration of physics, and consideration of forcings and responses. To inform the future requires more than just a history of the paleoclimate, but also understanding of the ice sheet.

I. Introduction

II. Background on the Ice Sheet – Shawn Marshall, Kurt Cuffey, Garry Clarke, Richard Alley

Richard suggested an introduction followed by a short overview of ice, ice flow, glaciers, ice sheets, and a description of Greenland. He suggests Shawn Marshall as a contributing author, though he believes Shawn has been contacted by other SAP groups. Richard also suggests Kurt Cuffey or Garry Clarke and himself (RA).

Jack McGeehin interjected that Shawn Marshall is a lead author for SAP 3.4. He's not official yet, but is in the six-month process of being certified through DOI. The group is unsure whether it is a problem to have one author contribute to two SAP documents.

- A. The ice sheet – size, extent, sea-level equivalent
- B. Behavior of the ice sheet – snowfall, melting, ice flow, iceberg calving
- C. Ice-sheet response to forcing – volume changes in response to climatic and other forcing
- D. Recent history – changes in snowfall, melting, and ice flow

On the matter of introductory material, Joan Fitzpatrick believes she will be compiling front matter for the SAP 1.2 report and that lead authors should provide introductory material for each of their chapters.

Jack McGeehin suggests using the layout in SAP 1.1, which has been through the entire CCSP process. Joan Fitzpatrick suggests it's important to have some consistency. Discussion about who the audience is for the report and how different audiences might read the report.

III. Paleoclimatic indicators' bearing on ice-sheet history

Richard Alley proposed the next issue for the outline to be a synopsis of how scientists know how a particular ice sheet has behaved. "The indicators; The HOW"...

- A. The marine record – John Andrews
 - a. Ice rafted debris
 - b. Ice contact deposits
 - c. Meltwater evidence
 - d. Sea floor erosion
- B. The terrestrial record – George Denton. Julie Brigham-Grette suggests Svend Funder (National Museum of Copenhagen) would have a broader impact because of his focus on older indicators. Maybe have both?

- a. Moraines
 - b. Physical stratigraphy
 - c. Lake core stratigraphy (switching from saltwater to freshwater)
 - d. Raised beaches
 - e. Fossils
- C. Ice cores – Dorthe Dahl-Jensen and DNA at the bottom of the DI-3 core. Using cores to infer the size of Greenland. She has strongly held views on the stability of Greenland. Niels Reeh also has strongly held views on the other side of the argument.
- a. Paleoclimatic indicators
 - b. Presence or absence of ice from a particular age
 - c. Dating basal materials
 - d. Ice cap size/ total gas measurements
- E. Sea level indicator (Far Field) the Eemian 5e – a synopsis of the Overpeck and Otto-Bleisner papers. Stage 11 should also be addressed. Dan Muhs might address 5e and 11. Paul Hardy is also mentioned as is Betty Otto-Bleisner as a modeler (NCAR in Boulder)
- a. Shorelines
 - b. Beach deposits
 - c. Coral reef deposits
 - d. Modeling
- D. Geodetic Data – Jerry Mitrovica (Toronto)
- a. Earth rotation
 - b. Far field sea level
 - c. Near field sea level
 - e. GPS

IV. Ice-sheet and climate history (the “Paleoclimatic indicators” – contributing authors will supply information bearing on each time interval for which a particular indicator provides information)

- A. Initiation of the Greenland ice sheet
 - a. Age and climate
- B. Pre-Eemian history including MIS 11 (re-initiation)

Jack McGeehin suggests using text boxes to explain information relevant to the public and policymaker when the material doesn’t fit neatly in the main text.

 - a. Evidence that ice sheet has disappeared and reformed in the past
 - b. Climate conditions associated with growth and decay
- C. Eemian
 - a. Extent and thickness of the ice sheet during the Eemian
 - b. Climate of the Eemian
 - c. Modeling and far field sea level indications – Otto-Bliesner
- D. Growth and maximum of most recent ice age
 - a. Heinrich and D-O events
 - b. Climate and response
- E. End of most recent ice age

- a. Timing of deglaciation and temperature change
Joan Fitzpatrick and Richard Alley discussed where to put convective overturn, MOC; Richard suggests it will go under rates of change
- b. Meltwater spikes
- F. Holocene including Little Ice Age (LIA)
 - a. Mid-Holocene retreat
 - b. Late-Holocene advance (into LIA)
 - c. Post LIA retreat
 - d. Current deglaciation

Individual contributing authors will also write to the “what”; lead authors will write the synopsis.

V. Attribution

VI. Synopsis

Discussion of how best to contact potential contributing authors:

Approach officially

Have those with established relationships invite participation

Decision on process:

Joan Fitzpatrick will send an invitation to all identified contributing authors; lead authors who know the potential contributors will then send e-mails to them encouraging their participation. Once a contributing author has committed to participate, they will get an official letter from Joan (on USGS letterhead?).

Scott Lundstrom was queried, as a member of the public, whether he had any comments or additions at this point in the discussion. He did not.

Leonid Polyak asked about proportion of various subchapters...that is, should most of the text be about the “what” and the rest be subordinate or should volume of material be about equal between the “why”, “how”, and “what”?

Joan Fitzpatrick believes the primary focus should be on the “what”, though she does not want to dictate percentages devoted to each topic. Descriptions of proxies will have to be brief and can include references for more in-depth discussion. General agreement that approximately 60 percent of the text be devoted to the “what”.

Scott Lundstrom asked how the fairly comprehensive description of the past will be used to talk about future possibilities. He stated the public will be most interested in what will happen in the future.

Discussion among the committee on the purpose of these reports. General agreement that they are for policymakers, to provide them with background information for decision making. The primary focus is the record of the past and

includes possible implications for the future (based on the record of the past). To demonstrate what can be learned from the past, about the sensitivity of the Arctic to change. An indication of the dynamic range of change and the reasons behind it. SAP 3.4 will provide some statements of probability of abrupt change.

Break from 2:49 PM to 3:16 PM

Continuing with discussion of the outline for SAP 1.2.

Rates of Change: Lead Author – James White

Preliminary outline was prepared by Richard Alley as Jim White is out of the country. Richard Alley comments that he sees the question as what have been the past periods of change and what do they tell us about current and future rates of change. His initial understanding was that abrupt climate change, as well as gradual change, were within the purview of this topic. He is less sure now as a result of the earlier discussion on SAP 3.4. There are recent papers published by the Europeans projecting rates of warming using IPCC models at 2x and 4x CO₂ and comparing those rates to rates of climate change observed in most Antarctic and Greenland cores. Based on their work, the human pervasion is even more worrisome. He feels there is interest in putting the human pervasion in a broader framework and addressing that through paleoclimate records from the Arctic

I. Introduction – James White (with help from Richard Alley if desired)

II. Variability versus change; definitions and clarification of usage – White

- A. Weather versus climate
- B. Style of change (Bradley, i.e. timescales of change)
- C. How to talk about rates of change
- D. Spatial characteristics of change

III. Issues concerning reconstruction of rates of change from paleoclimatic indicators – absolute and relative dating, synchrony/asynchrony/diachrony, stratigraphic markers – what are the actual capabilities?

- A. Marine – Anne Jennings
- B. Terrestrial – Konrad Hughen
- C. Ice-core – Jeff Severinghaus
- D. Sea Level – Bill Thompson, WHOI

Richard Alley feels it's important for a policymaker or member of the public to be able to sort out a climate variable, rapid versus gradual changes, frequency of events, cycles, forcing factors – classes of changes. Create a primer on what makes climate change and what it might look like.

IV. Classes of changes, with attribution – Lead Authors

- A. Ice-age cycling
- B. Dansgaard-Oeschger/Heinrich-Bond

C. Higher-frequency events especially in Holocene (solar forcing, volcanic eruptions, ENSO, NAO, AO, other; MWP/LIA)

V. Observed rates of change – Anne Jennings, Konrad Hughen, Severinghaus; Ray Bradley for the Holocene

VI. Interpretation/Inferences – White

Group discussion on rates of change. Concern over possible overlap with SAP 3.4 and whether SAP 1.2 Rates of Change Chapter was intended to cover abrupt climate change and should it still if abrupt climate change is the focus of SAP 3.4?

Does a discussion of rates of change include discussion of how fast trees can migrate when their ecosystem changes? After deglaciation in Alaska, there are data on how fast and in what order the trees came back. Julie Brigham-Grette has information in her temperature theme on the Holocene thermal maximum and migration of the tree line in Russia. Constructing temperature change from trees; the issue is the pollen record cannot resolve the fastest changes because there's an ecosystem lag. Richard Alley thinks providing information on the rate of climate change is very different from talking about the rate of ecosystem change. He makes two points: first, the ecosystem lag puts a fuzzy filter on climate reconstruction and second is "what does climate [change?] mean for living things?" For Richard, the important message to convey is the expected warming is very fast compared to almost everything that has happened in the past and the temperature says we are likely to go "out of the bend" of natural variability for a long time, and the rate says we are likely to go "out of the bend" of natural variability much faster than past changes.

Rates of change varied from location to location. For example, the Younger Dryas was prominent around the North Atlantic and in Greenland, but had much less impact in Alaska. This scenario is very different from now where changes seem more widespread.

Julie Brigham-Grette suggested tabling the rest of this discussion until the group has worked its way through Temperature and Precipitation History (Brigham-Grette's section), because she thinks the group is stuck.

Jack McGeehin thinks his group (SAP 3.4) and this one will end up using many of the same records and coming to similar conclusions. Jack's group discussion let them to conclude that there isn't going to be much abrupt change by the definitions they have established. They may turn their attention to describing what is happening now and what the implications are.

Richard Alley pointed out that Jack's committee has more people who are critics of abrupt climate change than people who believe in abrupt climate change.

Julie Brigham-Grette pointed out that larger mammals have survived earlier periods of warming (the Eemian) when there was a lot less sea ice, but what is different now is the rate. Even without knowing exactly how fast the sea ice decreased, we do have some idea about the rate. What may have taken 10 or 15 polar-bear lifetimes for the sea ice to retract in those earlier warm periods may only take one or two polar-bear lifetimes in the near future.

Jack McGeehin thinks his group may be focusing on future events, and the changes are slower than what is defined as an abrupt event. The trick is the definition of “abrupt”. Jack’s group is thinking of policymakers who are looking out less than 100 years, what seems like a slow rate of change for them is abrupt in geologic terms. Jack’s group uses the definition of abrupt as a change that takes place over a few decades and then persists for a few decades.

Joan Fitzpatrick is not as concerned with overlap with SAP 3.4 because they are looking at global records; SAP 1.2 is focusing on the record in the Arctic; 3.4 is not looking at longer timescale rates of change, 1.2 is trying to build an understanding that rates of change in climate respond to different forcings and mechanisms that operate on different timescales.

Group discussion on how best to clarify that “high latitudes” in the SAP 1.2 title means high northern latitudes and not the Antarctic. Joan Fitzpatrick said she would change the prospectus wording to clarify.

Temperature and Precipitation: Lead author – Julie Brigham-Grette

This section starts with a short tutorial on the role of the Arctic as a sink for heat generated in the tropics and transferred by the oceans and atmosphere. A simple graphic from Lisecki and Raymo, of an isotopic record, reflects what most consider to be the temperature trend of the Cenozoic. Julie proposes to go back no further than 3.5 to 4 million years when continents have been relatively stable so discussion of potential changes in temperature and precipitation will be relevant to the future.

I. Forcings and feedbacks influencing Arctic temperature and precipitation – Maureen Raymo

- A. What external and internal natural factors influence Arctic temperature and precipitation?
 - a. Milankovitch forcings of insolation
 - b. Volcanic forcings – Ammann, Robock
 - c. Greenhouse gas forcing (cite IPCC, Miller)
 - d. Freshwater balance of the Arctic Ocean and THC – Weaver
 - e. What external and internal natural factors influence Arctic temperature and precipitation
- B. What are the most significant feedbacks operating at high latitudes?

- a. How does albedo work? – Serreze
 - i. Ocean/sea ice feedbacks
 - ii. Vegetation feedbacks
- b. How does thermohaline circulation (THC) work? – Weaver

Leonid Polyak stated that the two most important feedbacks are albedo and THCs.

Scott Lundstrom (member of the public) asked whether, under albedo, seasonal snow cover for the Arctic should be added. Julie Brigham-Grette responded that there aren't any paleo records that provide information on seasonal snow cover. She agreed that seasonal snow cover should be mentioned. Scott Lundstrom suggested seasonal snow cover might be discernable from vegetation records and if not there, somewhere in other records.

II. Proxies of Arctic temperature and precipitation

- A. Reconstruction of temperature
 - a. Vegetation/pollen records – Mary Edwards, Linda Brubaker, Pat Anderson
 - b. Isotopic records
 - i. Marine – Raymo, Herbert, Polyak, Spielhagen
 - ii. Lacustrine – Lesleigh Anderson
 - iii. Ice cores – Jeff Severinghaus, Jim White
 - c. Biogeochemistry (alkenones) – Tim Herbert
 - d. Fossil content (???)
 - i. Marine SSTs – John Barron, Bauch, Keigwin
 - ii. Lake temperatures – John Smol, Alex Wolfe, Maryanne Douglas
- B. Reconstruction of Precipitation – Mary Edwards, Brubaker, Anderson, Bruce Finney
 - a. Vegetation/pollen records
 - b. Geomorphology
 - c. Isotopes – Finney
 - d. Lake level records – Finney, Edwards, Miller
 - e. Fossils – beetles, etc. – Scott Elias
 - f. Ice cores – Alley

III. Geologic record of Late Cenozoic warm intervals (if the Arctic has been warm before, why and how warm was it? Learning from earlier warm periods) – Svend Funder, JBG, Pat Anderson, Gif Miller

What can we learn from the earlier warm periods? What were the possible tipping points? What do we learn from vegetation shifts, ocean temperatures, precipitation, presence or absence of the Greenland Ice Sheet? The size of the ice sheet is covered in Richard Alley's chapter. Why do interglacials vary? What controls the forcing?

- A. Pliocene – Cenozoic greenhouse – Funder
- B. 41 ka and 100 ka world – duration of earlier warm periods?

- C. Stage 11 – is it special?
- D. Stage 5e (Eemian) – Pat Anderson, Polyak, Bauch
- E. Stage 3 warm intervals versus Holocene – Pat Anderson, Polyak
- F. Characterizing warmer intervals and possible tipping points based on:
 - a. Vegetation shifts
 - b. Ocean temperatures/sea ice
 - c. Precipitation proxies
 - d. Permafrost proxies
 - e. Presence/absence and size of the Greenland Ice Sheet
- G. What can we learn from sections a-f about the future and a warmer world?
Julie Brigham-Grette says we learn that the world has been warmer before for different reasons than it is now.
- H. Wrap up of [previous section] -- JBG

For post-glacial history of Arctic temperature and precipitation there are radiocarbon dates which give more evidence. Discussion between Julie and Jack McGeehin on whether radiocarbon dating is included in SAP 1.2; Jack said it is. They agreed that what is considered abrupt depends on the age. Jack is not sure how his group will handle this issue. Radiocarbon plateaus make everything look abrupt.

Group discussed how best to explain geochronology and its accuracy and range to users of this document. Whether to put explanation in a box (sidebar), include it as an appendix, place it in the section on geologic records, or in the introductory material to the document. Describe what paleoclimatology is, how sediments are used for dating, by counting annual layers or using radioactive decay, and the scientific basis for understanding past events. No decision on where to put the explanation, either in the introductory material or in an appendix.

IV. Post-glacial history of Arctic temperature and precipitation – Jim White

- A. Ice core records of rapid change (in Richard Alley's section)
- B. Marine records of change – emerging from the LGM – Andrews, Bauch, Polyak, Kiefer, Keigwin
- C. Land records (lakes and ice cores) emerging from the LGM – Miller
- D. Younger Dryas temperature story – question of dynamics/tipping points (can possibly combine this point and the previous one)
- E. Holocene Thermal Maximum – Darrell Kauffman, Glen MacDonald
 - a. Regional records of T&P
 - b. Forcings and feedbacks
 - c. Sea ice link (reference to Leonid Polyak's section)
 - d. Permafrost link
- F. Is the Holocene climate stable? – Alley, Mary Edwards et al
 - a. What is stable?
 - b. Known natural cycles – noise on future trends
- G. Late Holocene changes – what are we emerging from? – Ray Bradley
 - a. Neoglaciation across the Arctic
 - b. Medieval Warm Period – did it happen in the Arctic? Why?

- c. Little Ice Age
 - i. Spatial and temporal evidence across the Arctic
 - ii. Causes and forcings
- H. Lessons from post-glacial climate and why now is different – Bradley and JBG

V. Future analogs from natural experiments on past climate history of the Arctic – JBL et al

- A. What is certain?
- B. What is probable?
- C. What is possible?
- D. Links to rates of change

The group discussed whether it is within their purview to look at the past record and use that information to look at how much warmer/colder, wetter/drier it may become in the future. Is the past record a good analog for what's happening now and what might happen in the future? This was a hot-button topic for the SAP 3.4 panel. This group feels the whole point of this question is to learn from the past. And though past drivers may not be the same as future drivers, the end results may be similar, so what are the range and scope of possible future climate behaviors based on what has happened in the past? After some investigation of other SAPs, it appears there are no other committees that will discuss future climate scenarios in the Arctic. Leonid Polyak mused that it was odd that CCSP chose to look at paleo-records of the Arctic without considering present and future scenarios. It was agreed the group would stay away from modeling issues.

Meeting was adjourned at 5:02 PM and will resume tomorrow, July 13, 2007

Friday, July 13, 2007

8:30 AM – Open to the Public

Participant list:

Committee Members:

- Joan J. Fitzpatrick, USGS
- Richard Alley, Pennsylvania State University
- Julie Brigham-Grette, University of Massachusetts, Amherst
- Leonid Polyak, Ohio State University

Speakers:

- Jack McGeehin, USGS

Public:

- Scott Lundstrom, USGS

The first topic of discussion will be SAP 3.4 – Abrupt Climate Change, led by Jack McGeehin. SAP 3.4 is on the same schedule as SAP 1.2; it is due the end of June 2008.

Their prospectus was written by agency participants; Dave Anderson, NOAA; John Barron and Jack McGeehin, USGS; and Dave Verardo, NSF, not by the FACA members, as the SAP 1.2 prospectus was. Jack McGeehin called prospective committee members, whose names were suggested by agency participants, to serve on the FACA. Once Jack had a positive response, the person was nominated to serve on the FACA. The process to have FACA members approved took much longer than expected so the first SAP 3.4 workshop had to be cancelled. Once the approval process was complete, SAP 3.4 held their first workshop in Reston, VA in March 2007.

At the workshop, the prospectus was divided into four topics and four subcommittees were formed to address them and to create an outline:

- I. Rapid changes in glaciers and ice sheets and their impacts on sea level – Konrad Steffen
- II. Abrupt changes in atmospheric methane – Ed Brook
- III. Potential of abrupt change in the Atlantic Meridional Overturning Circulation – Tom Delworth
- IV. Hydrologic variability and change – Ed Brook

After the workshop, committee members were given a few weeks to flesh out the outline and find contributing authors. Once this step was finished, authors had three to three and a half months to write the first draft, the 0^o, though the SAP 1.2 committee is going to turn their draft around quickly before they meet again. Jack McGeehin has editors who will look at the draft for cohesiveness and the two coordinating editors will make sure the draft has focus. Their first draft is due the end of July 2007. They want to have the manuscript out for peer review by the end of August 2007, though it will probably be September. Jack is working with USGS to develop a peer review process (lead agencies are responsible for peer review and USGS is lead on three SAPs). Perhaps NSF and USGS will propose names for preliminary reviewers who will look for conflict of interest and balance before the document is sent outside for peer review.

There are two models for peer review:

A letter review – a group of peer reviewers is chosen, the report is sent to them with a list of questions to consider and request for comments, and a due date is established.

A National Academy review – several SAPs have paid the NAS to do a peer panel review. Arranging this kind of review takes a long time and is expensive.

SAP 3.4 will use a letter review. Language used in the SAP 1.2 prospectus is “panel”, but Joan Fitzpatrick was using the term as it is used internally in the USGS, not to mean an NAS review panel. Joan will check the OMB language to make sure “panel” does not automatically mean NAS panel.

SAP 3.4 is allowing two months for their peer review; SAP 1.2 is allowing six weeks. Once the peer review comments have been addressed, the document goes to CCSP who will handle the 45-day public review by putting the document up on their website. Jack McGeehin believes the two review processes can be nearly overlapping; peer review comments can be posted on the website before they’ve actually been incorporated in the document and while the public review is in process. Compressing the review schedule like this could save four to six weeks.

Once peer and public review comments have been addressed, the document will go through USGS FSP as a highly influential document. The time required for USGS FSP may be long, there is no process developed yet, and this step must be completed prior to the June 30 deadline to CCSP.

Once the document is submitted to CCSP, it will be reviewed by participating CCSP agencies. This level of review is supposed to be just for policy, but early SAPs have been held up by wording disagreements. Concurrently with the agency’s reviews is the OSTP-NSTC review. There was some misunderstanding between Joan Fitzpatrick and Jack McGeehin about the exact sequence of these review steps. It seems they agreed that the sequence is as described in the beginning of this paragraph.

The committee expressed concern that the document must come back to the FACA after it has been through the participating agency’s reviews so any changes can be evaluated. The understanding is the agency and OSTP reviews are not supposed to affect scientific content, but the FACA members feel it is a matter of their integrity to see the results of the last reviews. It was stressed to the FACA members that their jobs are not done on June 30, because the CCSP review process starts on that date.

Joan Fitzpatrick and Jack McGeehin explained use of the password-protected website where subcommittee members can post and discuss their work as it is in progress.

During consideration of the timeline for producing SAP 1.2, it was suggested that responses to peer and public comment could be handled via e-mail and not with a face-to-face meeting due to time constraints. Perhaps have a face-to-face meeting once all comments are received and processed to make sure the FACA members agree with the ultimate changes and editing.

Richard Alley suggested using the IPCC method of responding to comments which was a table showing chapter, line number, public comment, and response. Jack McGeehin agreed that the CCSP process would be similar because the documents are posted with line numbers and the comments are distributed to the authors referenced to section and line number. Richard described the system for responding to comments that were not specific suggestions for change; IPCC developed a set of appropriate responses for authors to use when addressing comments, he will distribute them to the committee.

Next the committee took up the issue of potential overlap with SAP 3.4. Jack McGeehin feels CCSP designed the process so there would be overlap between chapters. Issues such as the Younger Dryas, ice cores, geochronology techniques and others will be in both documents; there is no way to avoid that overlap and still do justice to the respective topics. Most complaints of overlap will come from people intimately involved in CCSP because they are likely to be the only ones who read all the documents cover-to-cover. Each report will need to stand on its own, thus there needs to be overlap as well as coordination. The only potential problem in Jack McGeehin's mind is rates of change, but there may be a niche for it in SAP 1.2. Julie Brigham-Grette feels that SAP 3.4 has defined rates of change narrowly and SAP 1.2 will take the broader view. Leonid Polyak also pointed out that SAP 1.2 will be addressing the Arctic specifically.

Jack McGeehin's concern is that discussions that contrast slower rates of change with abrupt change may get heated, especially with those that don't agree with the concept of abrupt change. Richard Alley clarified that these discussions would be about future scenarios and not about the paleo-record. This discussion was a segue to considering how far into the future SAP 3.4 and SAP 1.2 would look. Jack McGeehin reported that his workshop had decided it would be appropriate for them to look 100 years in the future for instances of abrupt change, for instance the MOC, is it more likely to shut down 100 years from now or five to ten years from now?

Richard Alley asked Jack McGeehin whether his committee would be looking at the distribution as well as the mean in their projections (not the physical distribution, but the statistical likelihood of events). Jack's committee has had numerous discussions about how to deal with uncertainty and they adopted the IPCC approach of likely, very likely, unlikely and their respective percentages.

Joan Fitzpatrick feels the scope of SAP 1.2's discussion of rates of change is sufficiently more broad than what SAP 3.4 will address. SAP 1.2 will focus on rates of change at all scales to set an appropriate context for abrupt changes. This treatment will help policymakers understand the full scope of rates of change. Jack McGeehin suggested some words of explanation in the introduction explaining how SAP 1.2's discussion of rates of change differs from SAP 3.4's discussion of abrupt change. In fact, to facilitate understanding between the two SAP groups, Jack and Joan discussed having Joan's lead authors write short

introductory/explanatory paragraphs for their sections to share with Jack's lead authors, since his lead authors will not have had the benefit of today's discussions. A few words of explanation may go a long way toward preventing concern with overlap. Jack will also write up a summary of today's meeting to share with his lead authors.

Joan Fitzpatrick and Jack McGeehin discussed the mechanics of Jack's lead authors providing feedback to Joan's lead authors on their outlines and what the FACA implications might be. Jack counseled Joan to establish subcommittees consisting of each of her lead authors before the end of this FACA meeting. Lead authors are members of the FACA; contributing authors are not members of the FACA so they are not bound by the same rules. They will investigate whether it is allowed under FACA guidelines for subcommittees of one FACA to talk directly to subcommittees of another FACA. Joan inquired whether feedback would go both ways between SAP 1.2 and 3.4. Jack reminded everyone that SAP 3.4 was beyond the prospectus stage and would have a 0° draft very soon and SAP 1.2 would get an informational copy.

Julie Brigham-Grette asked Jack McGeehin whether his committee would address ocean acidification because it is not mentioned in their prospectus. Jack suggested that would be a good issue to talk about one-on-one. There was general agreement that all subcommittees of both SAPs would be in communication. Jack reminded the lead authors to keep a record of their conversations at the subcommittee level for FACA purposes. This comment sparked a round of discussion about what the SAP 1.2 committee members understood from Nancy Baumgartener's presentation yesterday on FACA requirements for archiving. Jack McGeehin said he would find out more specifically what the record-keeping requirements are for subcommittees. Joan Fitzpatrick agreed that they need to get clarification on the record-keeping requirements. Jack suggested record-keeping would be a good topic for Joan to bring up at her upcoming FACA training.

Julie Brigham-Grette asked who would be responsible for arranging to use a figure already in print. Jack McGeehin replied that USGS would handle it in the editing process. Also discussed was how to indicate to CCSP which material should be in side-bars for final publication. Jack said the author is responsible for indicating which text is to be in a side-bar or in a text box and the USGS editor would do the formatting.

Some more discussion on whether to use an ad hoc USGS editor or use the EPN. Jack McGeehin indicated it would be very expensive to use the EPN.

Break in the proceedings

When the session resumed, the next topic was sea ice.

Sea Ice: Lead author – Leonid Polyak

John Andrews provided some structure which Leonid expanded. Leonid felt it would make more sense for this chapter to follow Julie Bingham-Grette's chapter. Richard Alley suggested the order of chapters to be: Temperature and Precipitation; Rates of Change; Greenland Ice Sheet; and Sea Ice. Leonid agreed this will reduce the need for repetition.

I. Introduction

II. Background on the Arctic sea ice cover – Serreze and Otto Bliesner

- A. Controls on sea ice extent, drift, and duration – Serreze
- B. Influence of changes in ice cover on the climate system – Otto-Bliesner
- C. Present day extent, historical change, and future projections – Serreze

III. Types of paleo archives and proxies for sea-ice record

- A. Ice cores (sea salts) – Eric Wolff, BAS
 - i. **Strength:** *continuous, long records, good resolution, age control*
 - ii. **Weakness:** *limited geography, evidence from remote areas*
- B. Marine sedimentary records (biological, geochemical, and sedimentological proxies) – **Andrews, Darby**
 - a. Continental margins
 - b. Deep sea
 - i. **Strength:** *local evidence, complete geographic coverage, continuous records*
 - ii. **Weakness:** *short stratigraphies (on the shelves), low resolution (in deep sea), limited amounts of material, problems with proxy preservation, age control*
- C. Coastal records – **Brigham-Grette, Dyke, Forman**
 - i. **Strength:** *large exposures, local evidence, all relevant to interglacial sea ice extent*
 - ii. **Weakness:** *limited geography, discontinuous records, problems with proxy preservation, age control*

IV. Geographic regions

- A. Central Arctic Ocean (Darby, Polyak)
- B. Margins
 - a. Iceland & East Greenland margin - MIZ – **Andrews, Jennings, Funder**
 - b. Baffin Bay - MIZ – **Andrews, Jennings, de Vernal**
 - c. Canadian Arctic & Beaufort margin – **Dyke, Andrews, Brigham-Grette**
 - d. Chukchi Sea - MIZ – **Brigham-Grette, de Vernal, Polyak**
 - e. Siberian seas – Bauch, **Polyak**
 - f. Barents Sea - MIZ – Koc, **Polyak**

Regions with MIZ - sensitive to minor changes in sea-ice extent
Regions without MIZ - capture big ice-reduction events

IV. History of Arctic sea ice extent and circulation patterns, with an emphasis on low-ice periods

- A. Pre-Quaternary history – **Brigham-Grette, Darby**
- B. Quaternary interglacials – **Darby, Polyak**
- C. Holocene – **Andrews, Darby**
- D. Historical records – **Andrews, Darby**, Kevin Wood
Indigenous knowledge in here – talk to Wendy Warnick at ARCUS

V. Synopsis – Polyak

IX. Synthesis – Lead Authors

X. Glossary

XI. References Cited

Joan Fitzpatrick requested that the lead authors send her their lists of potential contributing authors and their e-mail addresses. Leonid Polyak asked about how many pages each chapter could be. After some group discussion, the general consensus was 20 to 25 pages with the primary focus on the paleoclimate record. Leonid also asked about the number of figures in the text. Joan replied that the authors should use as many figures as they need; but it is generally expected there will be more text than figures. Jack McGeehin cautioned the lead authors to get high quality graphics from their contributing authors the first time around.

Leonid Polyak will be at sea starting August 8 and will not return until late September. Joan Fitzpatrick suggested he arrange for a deputy. Leonid answered that John Andrews is his deputy. There was discussion about deadlines for contributing authors to submit their contributions to lead authors. There was general consensus that as soon as possible was best, but by mid-October to give lead authors time to put their chapters together.

Short break in the proceedings

There was extended discussion of potential authors for Julie Brigham-Grette's chapter. The suggested names are included in the outline of her section above.

Break from 11:56 AM to 1:20 PM

Jack McGeehin did not return to the meeting after the break.

Joan Fitzpatrick started the discussion of the outline. CCSP will write the Executive Summary if the group would like; it will address potential policy impacts of the report; why policymakers should read the report; and why or how this particular topic was included as one of the 21 CCSP topics.

Julie Brigham-Grette asked if the group would have a chance to edit the Executive Summary if it is written by CCSP. Joan Fitzpatrick assured her the group would see the summary. Joan listed topics she felt should be included in the Preface, including the geographic and temporal scope of the chapter; a list of the four questions from the Prospectus and why they are important; an explanation of how they dealt with uncertainty; concepts and terminology as background for this particular SAP; and information on the authors.

The context and background section will set the stage for what follows in the rest of the SAP so make sure the reader will understand the language, concepts, and the larger issues common to all four of the questions.

Looking at the workshop agenda, Joan Fitzpatrick reviewed issues and decisions made during the past two days:

- The group will handle uncertainty the same way IPCC handled it.
- On the issue of overlap with SAP 3.4, SAP 1.2 will send their outline with short paragraphs of explanation to Jack McGeehin to distribute.
- On contacting contributing authors, Joan will draft a general e-mail message to send the list of people identified during this workshop. She will include an overview of the four questions and indicate that one of the lead authors will contact them soon with additional information.
- Authors need to reference, reference, reference because they will be condensing large bodies of information down to a few pages. Authors also need to understand the substance of their contributions is limited to published literature.
- Joan would like the FACA committee members to recommend appropriate peer reviewers.
- As comments are received, Joan will distribute them to the appropriate lead author for response.
- Review comments and committee responses will be compiled in a table.

Joan reviewed CCSP guidelines on the peer, or technical, review:

- Expert reviewers will be selected by lead agencies;
- Reviewers may be citizens of any country, and be drawn from within or outside the federal government;
- Reviewers will be known for the qualifications and other forms of recognition of their expertise; and

- Expert reviewers will focus on the scientific and technical content of the draft document.

Richard Alley suggested it might be wise to include a scientist-turned-policy person in the expert technical review to alleviate some of the last minute deluge of comments from that sector.

Joan reviewed the uncertainty she and Jack McGeehin discussed previously about the order of the policy review. Joan thinks it takes place after this group submits their document to CCSP on June 30.

Leonid Polyak asked whether the group should exchange their draft chapters prior to the October teleconference. Joan said yes.

Joan Fitzpatrick officially named subcommittees for SAP 1.2, they are:

1. The Subcommittee for Temperature and Precipitation, led by Julie Brigham-Grette
2. The Subcommittee for Rates of Change, led by James White, Richard Alley will be co-lead for this subcommittee until Jim White returns
3. The Subcommittee for Sea Ice Records, led by Leonid Polyak
4. The Subcommittee for Greenland Ice Sheet History, led by Richard Alley

The group decided to defer the decision whether to have the document go straight into public review after expert review, but before expert review comments have been addressed. They will wait and see what the response is from expert reviewers. If the group decides to handle the reviews this way, there will be a window of time between March 1 and April 15 where the group can provide input to Joan who will be working with an editor on layout. Joan also intends to forward review comments to the lead authors as they are received, so they don't get them all at the end of the review period.

A review of possible timelines resulted in the group agreeing to try and address expert reviews as they are received, and not wait until the end of the expert review period to start addressing comments. If they are successful, they may be able to initiate the public review a little earlier than originally planned.

The group agreed that their 0° drafts should be complete by October 30. Earlier, in response to Leonid's question, it was agreed that group members would exchange draft chapters prior to the October teleconference. Here Joan agrees with Julie that group members will not have seen each other's 0° drafts prior to the teleconference. But the discussion goes on to suggest the 0° drafts will be compiled into a single document and distributed before the group decides whether to have a FACA-level teleconference at that point.

Joan reminded lead authors they can communicate with one other subcommittee at a time without invoking FACA rules. FACA restrictions apply when they meet

as a group to deliberate or act as a FACA that will provide advice to the federal government.

A discussion regarding e-mail addresses and contact information followed.

Leonid Polyak suggested they discuss a wording change in the prospectus stemming from comments that he and Julie Brigham-Grette made on the same section. The group also discussed another comment made by a reviewer and decided how to handle it in the prospectus.

Joan Fitzpatrick told the group she would be sending them the final prospectus and the cover letter with review responses.

Short Break

Joan requested the lead authors to let her know as soon as they have confirmed contributing authors.

Richard Alley will send the group the IPCC table format and agreed-on responses for responding to review comments.

Joan Fitzpatrick will establish a Quick Place site to post expert review comments. The group asked Joan to let them know when new comments have been posted in Quick Place.

There was more discussion on what introductory material should stay with the individual sections of SAP 1.2 and what should go into the overall introduction. Joan suggested that if the information is generally applicable to the entire topic that it be sent to her for the overall introduction. Richard Alley suggested a statement for the overall introduction explaining paleoclimatology; how sediment is used to interpret climate; calibration; space; time; how dating works; layer counting; radiometric decay; and introduction to the Arctic and its role in the Earth system. The group continued to discuss the merits of including various information in the overall introduction.

The proceedings adjourned at 3:11 PM on July13, 2007.