Briefing to U.S. House of Representatives Select Committee on Energy Independence and Global Warming

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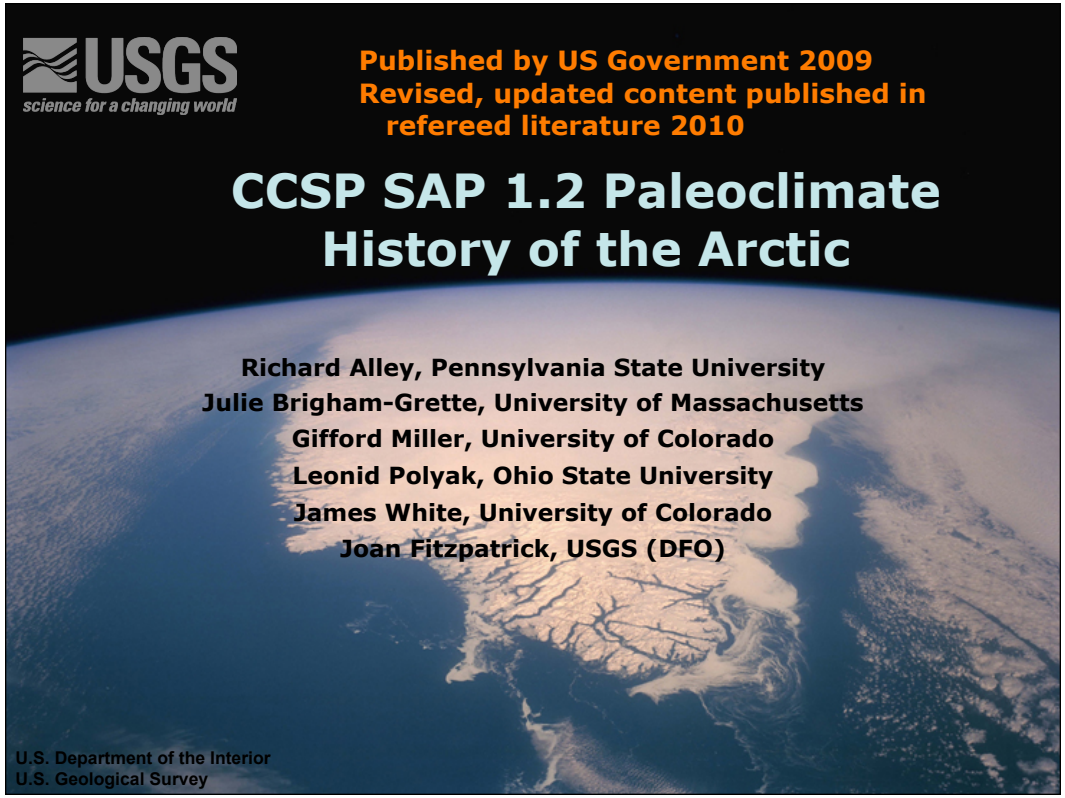
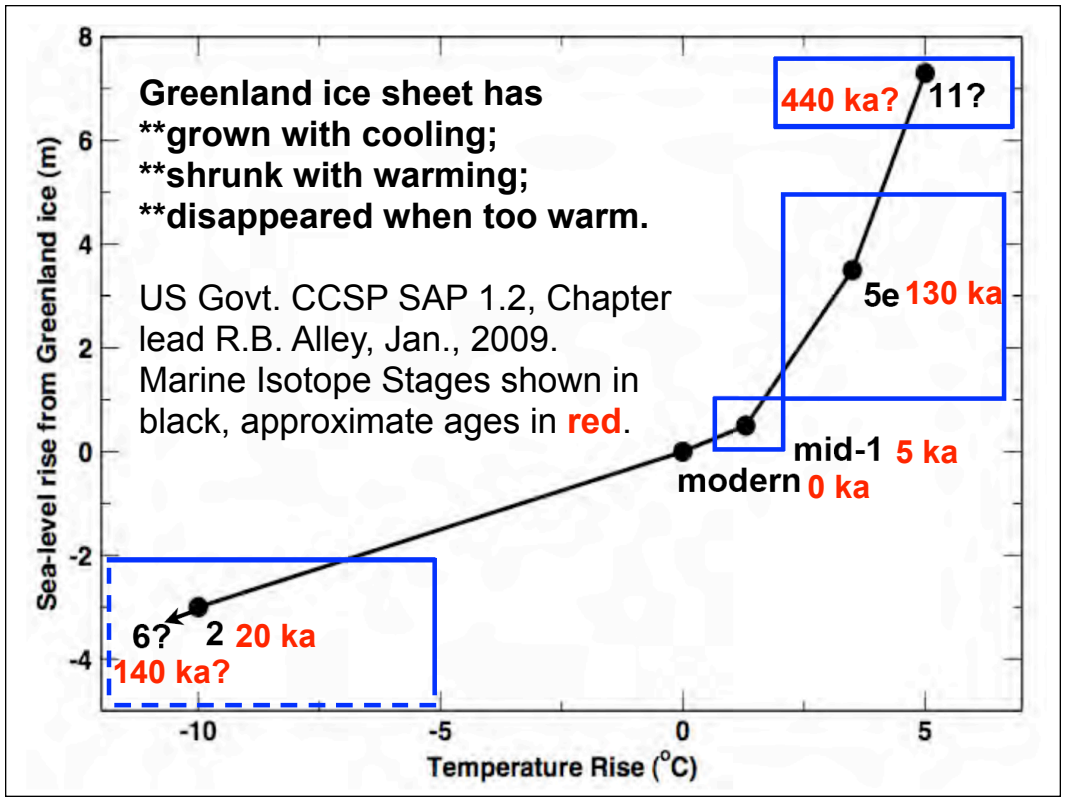

USGS
science for a changing world
Published by US Government 2009
Revised, updated content published in refereed literature 2010
CCSP SAP 1.2 Paleoclimate History of the Arctic
Richard Alley, Pennsylvania State University
Julie Brigham-Grette, University of Massachusetts
Gifford Miller, University of Colorado
Leonid Polyak, Ohio State University
James White, University of Colorado
Joan Fitzpatrick, USGS (DFO)
U.S. Department of the Interior
U.S. Geological Survey

Some Key Results

- Please note: Because of time constraints, I did not have time to consult with the other authors of the report, but I believe I have accurately represented their insights. I am speaking as a citizen, and not formally representing CCSP, Penn State, or other bodies.
- Warming has been amplified in Arctic
- Recent sea-ice loss occurs at a time when the long, slow processes of the Arctic have pushed towards sea-ice gain; sea-ice loss tends to contribute to warming
- Considering both rate and size, the fastest natural climate changes have been comparable to recent events, but projected Arctic warming becomes anomalous in comparison to natural changes.
- A few degrees of warming has been sufficient to almost completely remove Greenland's ice sheet, although at an unknown rate, and not sure just how many degrees.


Greenland ice sheet has
**grown with cooling;
**shrunk with warming;
**disappeared when too warm.
US Govt. CCSP SAP 1.2, Chapter lead R.B. Alley, Jan., 2009.
Marine Isotope Stages shown in black, approximate ages in red.
440 ka?
11?
5e 130 ka
mid-1 5 ka
modern 0 ka
6?
2 20 ka
140 ka?
Sea-level rise from Greenland ice (m)
Temperature Rise (°C)
8
6
4
2
0
-2
-4
-10
-5
0
5

Synopsis

- Warming melts ice and raises sea level
- Snowfall generally increases with warming, but not by enough to stabilize the ice sheets
- Probably centuries or more are required to completely lose an ice sheet
- Easier to lose an ice sheet than to get one back, so there are “tipping points” for ice sheets—concern about Antarctic ice at least as big as for Greenland
- Might reach such a “tipping point” within decades
- Much good work ongoing, but still not possible to provide confident projections—we’re just not sure yet


Warming brings changes that shrink ice and raise sea level; rapid scientific progress, but large uncertainties and much to do.