

U.S. Department of Energy



Office of Science

Status of CCSP Synthesis and Assessment Product 3.1

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Nov 14-16 CCSP Workshop
Climate Science in Support of Decision Making
Session 2: Climate Variability and Change



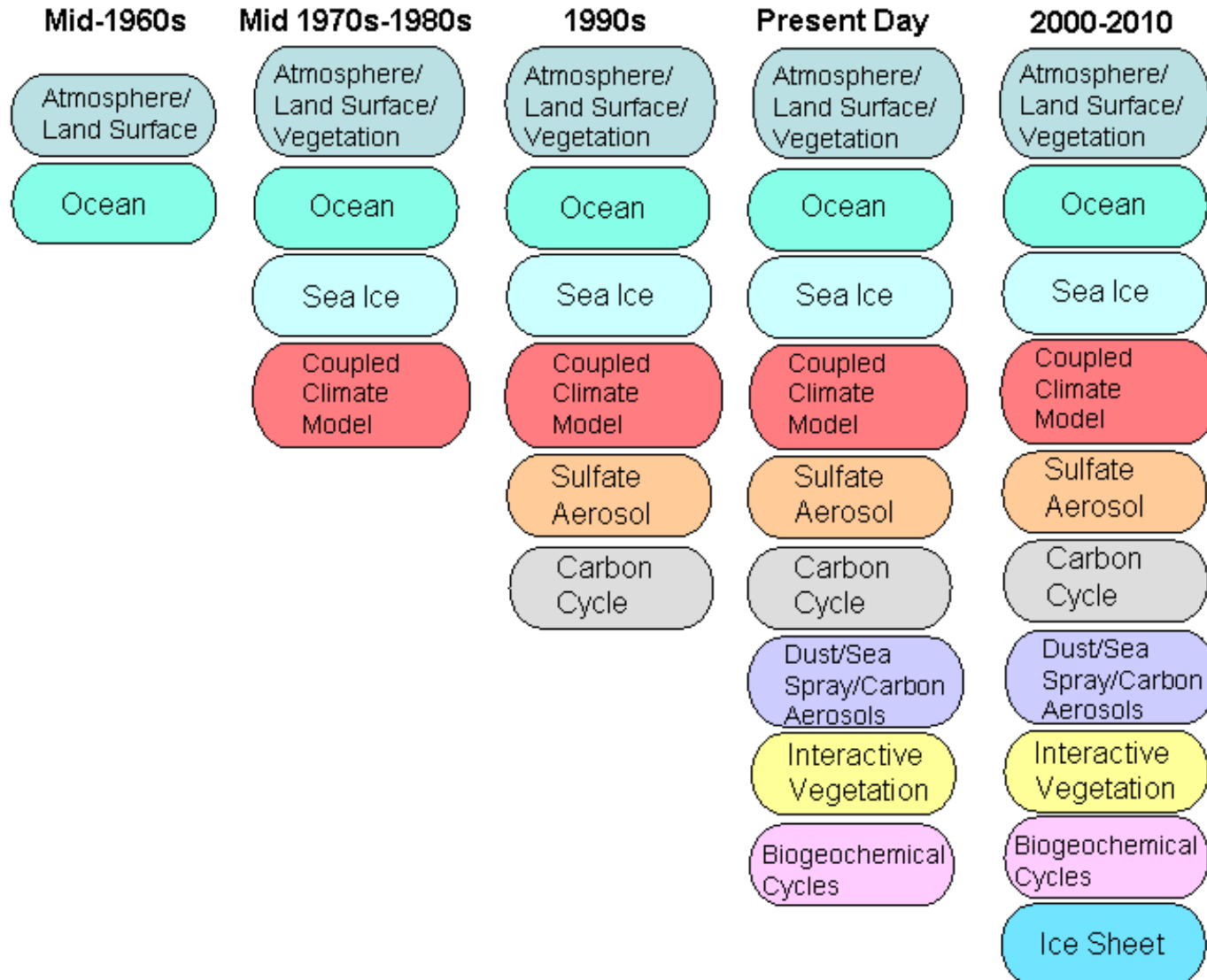
CCSP S&A Product 3.1

Title: *Climate models and their uses and limitations, including climate sensitivity, feedbacks, and uncertainty analysis*

Participating Agencies: *DOE, NASA, NOAA, NSF*



Timeline of Climate Model Development





Contents of S&A 3.1 *Draft Prospectus*

- 1. Overview: Description of topic, audience, intended use, questions to be addressed**
 - 2. Contact info for responsible individuals at lead and supporting agencies**
 - 3. Lead authors***
 - 4. Proposed Plans for Drafting, Reviewing, Producing and Disseminating the Product**
 - 5. Proposed Approach for Evaluation and Communication of Uncertainty and Confidence Levels of Climate Model Output. E.g. of volcanic forcing.**
 - 6. Relation to Other National and International Assessment Processes**
 - 7. Timeline**
- * Qualifications in Appendix A**



Contents of S&A 3.1 *Draft Prospectus (contd.)*

- 1. Overview:** Description of topic, audience, intended use, questions to be addressed.

Focus is on natural and human-caused factors influencing climate variability and change, ~1870 to 2000; characterize sources of uncertainties in comprehensive coupled climate models. Discussion on future projections of climate will be limited.

Audience is primarily climate model researchers, modelers from impacts community including those who use climate model output as input to studies/analyses in their disciplines.



Contents of S&A 3.1 *Draft Prospectus (contd.)*

Specific questions to be addressed:

Q1: What are the major components and processes of the climate system that are included in present state-of-the-science climate models, and how do climate models represent these aspects of the climate system?

Q2: How are changes in the Earth's energy balance incorporated into climate models? How sensitive is the Earth's (modeled) climate to changes in the factors that affect the energy balance?



Contents of S&A 3.1 Draft Prospectus (*contd.*)

Q3: How uncertain are climate model results? In what ways has uncertainty in model-based simulation and prediction both increased and decreased over time with increased knowledge about the climate system? (an example of aerosol-climate to follow)

Q4: How well do climate models simulate global climate variability over the historical period?

Q5: How well do climate models simulate regional climate variability and change?

Q6: What are the tradeoffs to be made in further climate model development (e.g., between increasing spatial/temporal resolution and representing additional physical/biological processes)?



Contents of S&A 3.1 Draft Prospectus (*contd.*)

2. Agency Contact Info:

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3. Lead author Info:

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Dr. Curtis Covey/PCMDI LLNL

Dr. Bill Gutowski/Iowa State

Dr. Isaac Held/NOAA GFDL

Dr. Jeffrey Kiehl/NCAR

Dr. Ken Kunkel/Ill Water Survey, UIUC

Dr. David Rind/NASA GISS



Contents of S&A 3.1 Draft Prospectus (*contd.*)

4. Review Plan

- **Currently the draft prospectus is awaiting concurrence from the CCSP Principals**
Public review of draft prospectus complete
- **Conforming to the Data Quality Act of Jan 2005, the Peer Review Plan is up at**
<http://www.science.doe.gov/informationtechnologymgmt/html/hisa.htm>
- **FACA Charter pending approval at DOE**
- **FACA committee pending approval at DOE**



Current Contents of 3.1 Draft Prospectus (contd.)

5. ^{Office of Science} Proposed Approach for Evaluation and Communication of Uncertainty and Confidence Levels of Climate Model Output

The central theme of this CCSP Product is uncertainty and confidence levels of climate model output with respect to climate change caused by natural forcing and human activities during the period 1870-2000

Sources of Key Uncertainties in Climate Change Assessments

- Future emissions
- Climate sensitivity*
- Heat flux into the ocean
- Radiative forcing due to aerosols and clouds E.g. to follow.
- Carbon Cycle/climate feedbacks
- Changes in ocean circulation

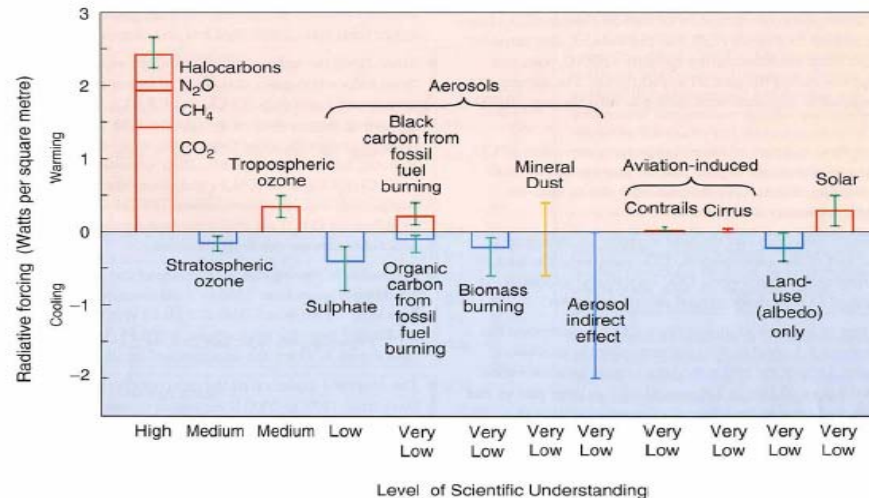
* The climate sensitivity determines how much the climate will change for a given change in atmospheric composition. It is usually expressed as the eventual global-mean warming for a doubling of the CO₂ concentration, and lies in the range of 1.5-4.5o C with 90% confidence



Proposed Approach for S&A 3.1:

E.g. inclusion of understanding on aerosol-climate interactions in climate modeling runs to simulate effect of past volcanoes**

TOA radiative forcing since preindustrial time



** First IPCC: Climate change considered to be driven by anthropogenic GHG. Inadequate understanding of aerosol climate interactions. Subsequent IPCC reports documented studies on aerosol-climate interactions. Recent studies have confounded the previously orderly world of IPCC of the 1990s



Mt Pinatubo eruption in the Philippines, June 15, 1991. Gases and solids injected 20 km into the stratosphere.

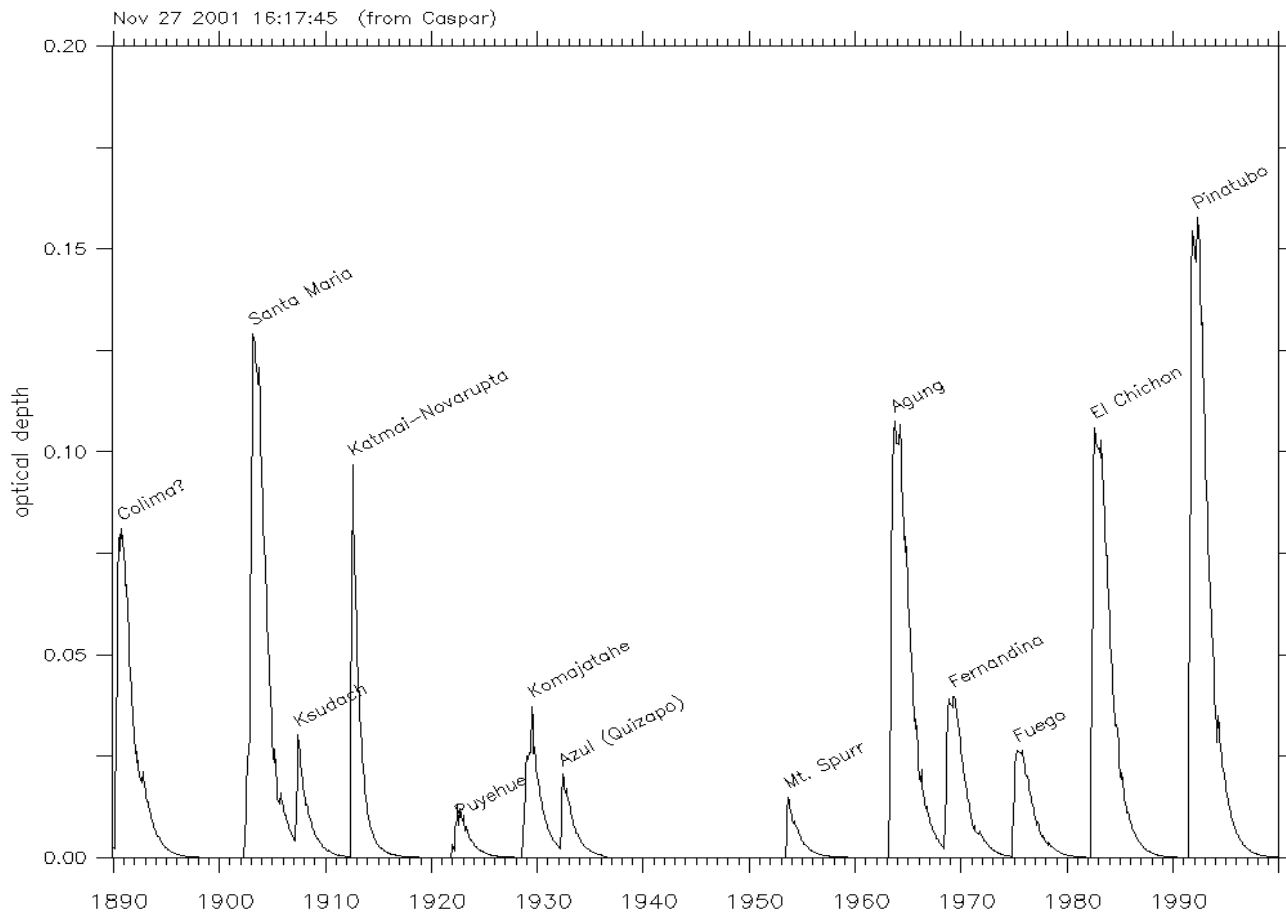
Courtesy W. Washington/NCAR



Proposed Approach for S&A 3.1: E.g. Including aerosol-climate interactions due to volcanoes

Volcanic forcing 1890–2000

(as visible optical depth)



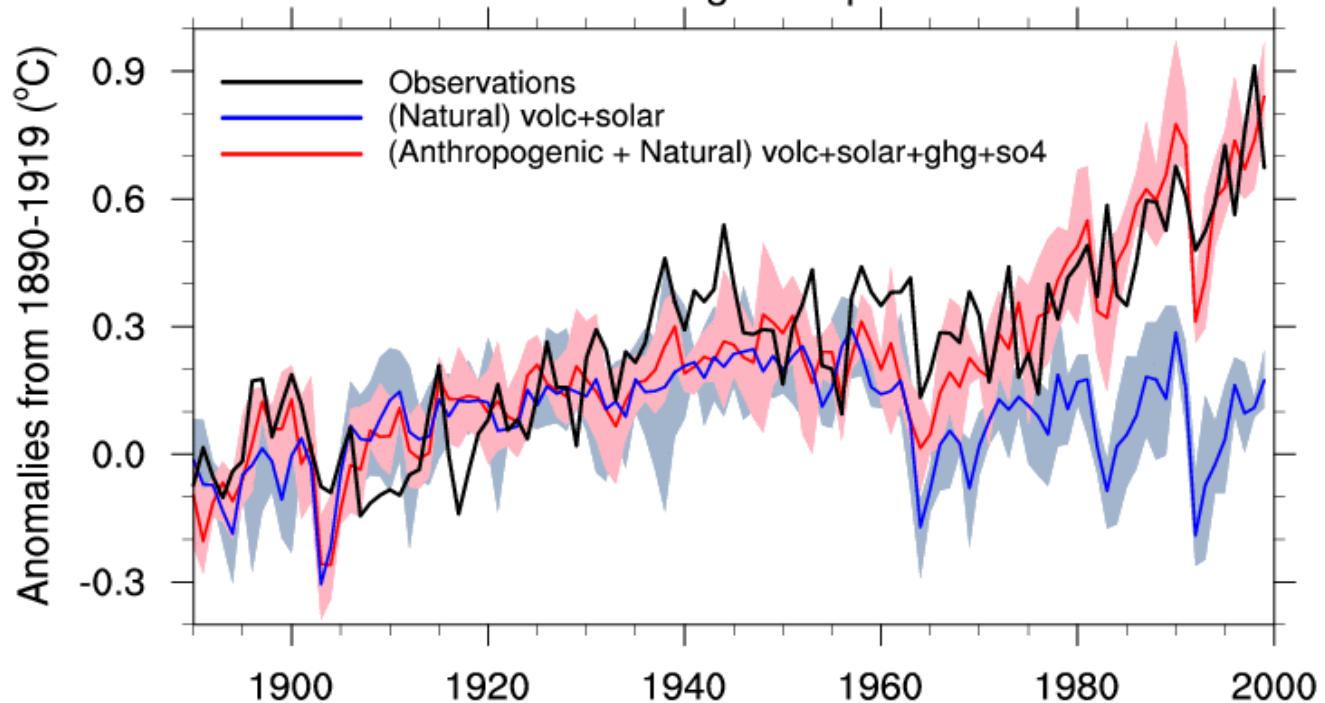
Courtesy W. Washington/NCAR



Proposed Approach for S&A 3.1: Evaluation of Climate model simulations for historical period 1870-2000

PCM Ensembles

Global Average Temperature



Agreement with observations in simulations that include both natural and greenhouse gas forcing



Current Contents of 3.1 *Draft Prospectus* (contd.)

6. Relationship to Other National/International Assessments

Crucial input to S&A 3.1 likely to be

- (i) AR4 Chap 8 (Climate Models and Their Evaluation), Chap 9 (Understanding and Attributing Change);**
- (ii) relevant NRC reports on climate models *e.g.* 2005 NRC Radiative Forcing of Climate;**
- (iii) Results of U.S. CLIVAR Climate Model Evaluation Project(CMEP)**
- (iv) Review process**



Timeline for S&A 3.1



2005

- **Feb** Approved prospectus posted on CCSP web site, and lead and contributing authors selected by lead agency
- **Nov** CCSP Principals approve draft prospectus
- **Nov – Dec** Draft product written by lead authors, with input from potential contributing authors



Timeline for S&A 3.1 (*contd.*)

2006

- **Jan-Apr** Draft product written by lead authors, with input from contributors (contd.)
- **Apr** Peer reviewers selected by lead and supporting agencies
- **May-July** Draft product peer-reviewed
- **July-Aug** Lead authors revise draft product based on public comment
- **Sep-Oct** Draft product made available for public comment (45 days)
- **Nov** Draft product revised based on public comments
FACA Advisory Committee Meeting
- **Dec** CCSP Principals review product



Timeline for S&A 3.1 (*contd.*)

2007

- **Jan-Feb** NSTC clearance
- **Mar** Lead agency produces final product according to format provided by CCSPO
- **Apr** Online version of report released, lead agency coordinates with CCSPO
- **Jul** Hardcopy version of report released, lead agency coordinates with CCSPO