

**U.S. CCSP Workshop: Climate Science in
Support of Decision Making
November 14-16, 2005**

Prospectus for CCSP Synthesis and Assessment Product 1.3:

“Reanalyses of historical climate data for key atmospheric features. Implications for attribution of causes of observed change.”

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CCSP Product 1.3**

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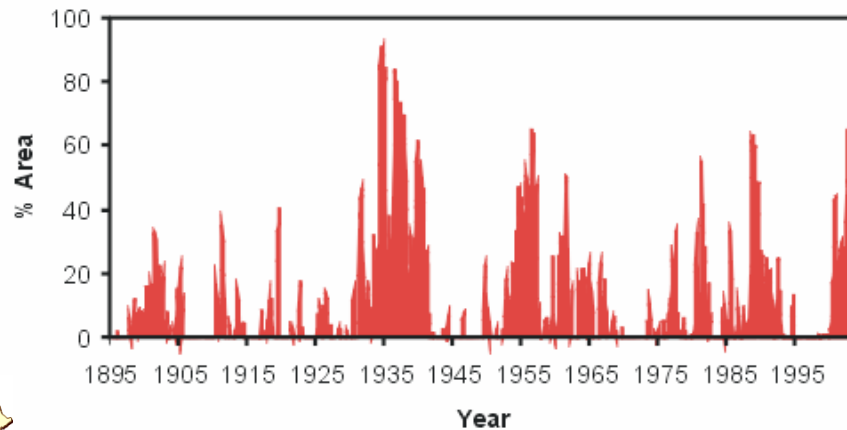
CCSP Product Statement and Purpose

Proposed synthesis topic: “Reanalysis of historical climate data for key atmospheric features. Implications for attribution of causes of observed change.”

- *Significance: “Understanding the magnitude of past climate variations is key to increasing confidence in the understanding of how and why climate has changed and how it may change in the future.” (CCSP Strategic Plan, chapter 2).*
- *Primary end use: “To inform policy decisions.”*
- *Time frame for product: 2-4 years.*
- *Proposed lead agency: NOAA.*
- *Supporting agencies: NASA, DOE, (NSF).*

E.g., What causes major drought in the United States? What can we expect in the future?

Percent Area of the Missouri Basin Experiencing Severe to Extreme Drought January 1895–March 2004



Based on data provided by the National Climatic Data Center, NOAA

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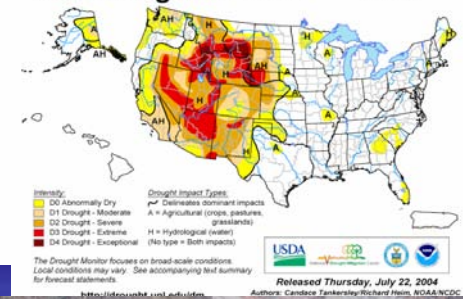
The Dust Bowl



1930s Dust Bowl



U.S. Drought Monitor July 20, 2004



Lake Meade 2003



Background on Prospectus Development

- Draft Implementation Plan. Developed by an *ad hoc* Science Work Group (SWG): Co-chairs: Siegfried Schubert (NASA), Glenn White (NOAA). This group included approximately 20 members from NOAA, NASA, DOE, NCAR, and the University community.
- Workshop on “Ongoing Analysis of the Climate System” (8/03).
- CLIVAR Ocean Reanalysis Workshop (11/04)
- CCSP Office provided guidance to SWG and IWG.
- *Present status*: Sent to CCSP Office for review (10/3/05).

Prospectus: Overview

Proposed Product

A state-of-science synthesis report that:

- (a) Summarizes the **present status** of current reanalysis efforts.
- (b) Discusses key research findings on the **strengths and limitations of the current reanalysis products** for:
 - (1) Describing past climate variations and trends.
 - (2) Attributing causes of climate variations and trends.

The temporal focus is that period covered by the first-generation reanalyses; effectively, 1948-present.

Descriptions of Past Climate Variations and Trends

Some Key Questions:

- What role does reanalysis play within a comprehensive climate observing system?
- What are applications for which reanalyses are now of sufficient quality to be usefully employed, and where do present limitations warrant particular caution by users?
- What steps would be most useful in reducing major uncertainties in describing the past behavior of the climate system through the use of reanalysis methods?
- How can results from reanalyses be used to assess or improve climate models, including those used for climate change predictions or projections?

Attribution of the Causes of Climate Variations and Trends

- What is our **present understanding of the causes for regional climate variations** over the reanalysis record, including the role of the oceans or other natural or non-greenhouse gas anthropogenic effects, including land-use changes?
- What is our present understanding of the causes for other observed **high-impact climate events**, such as prolonged, severe droughts or variations in the frequency or magnitude of major climate variations, for example, of ENSO or other climate modes?
- What is the **nature and cause of apparent rapid climate shifts** in the atmospheric circulation during the 20th century (e.g. the mid-1970s)?
- **What (if any) signatures of volcanic eruptions or other external forcing mechanisms appear in the reanalyses?** What might this indicate about uncertainties in our present understanding and modeling the responses to these forcings?

Re-analysis (optimal combination of model and historical observations)

$$\frac{\partial x}{\partial t} = \text{dynamics} + \text{physics} + \Delta x$$

The diagram illustrates the equation $\frac{\partial x}{\partial t} = \text{dynamics} + \text{physics} + \Delta x$. Three white arrows point from the text below to the terms in the equation: one from 'Observed change (A)' to $\frac{\partial x}{\partial t}$, one from 'Model predicted change (B)' to 'dynamics', and one from 'Correction needed to keep model on track (C)' to Δx .

Observed change (A)

Model predicted change (B)

Correction needed to keep model on track (C)

Fundamentally want (C) to be "small". If not:

- reflects deficiencies in model or observations
- limits ability to do "attribution"

Studying the relationship between (B) and (C) can be used to:

- improve the model
- identify and correct problems with the observations

Primary Target Groups for Information

1) *Policy makers*

Two questions of major concern:

- What is the scientific confidence - or **uncertainty** - in describing past climate variations and changes?
- For those climate variations or changes in which there is confidence, what can we say about their **causes**?

2) *Program managers*

Provide information for program development.

- help **guide priorities** for future observing, modeling, and analysis systems that will be required to better describe and attribute causes for climate variations and trends.

3) **Scientific and various applications communities**

guidance on strengths and limitations for science and applications.

challenges for the future -**reducing uncertainties**

Responsibilities

Responsible Agencies

NOAA is designated as lead agency. NASA and DOE are supporting agencies.

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Proposed Lead Authors*

1. Martin Hoerling (NOAA, Climate Diagnostics Center).
2. Siegfried Schubert (NASA, Global Modeling and Assimilation Office)

*If approved, these initial nominees have agreed to serve.

Responsibilities-continued

Proposed Contributing Authors (not finalized)

Nominations to date:

Dr. Phil Arkin (University of Maryland)

Dr. James Carton (University of Maryland)

Dr. Paul Dirmeyer (Center for Ocean-Land-Atmosphere Studies)

Dr. Eugenia Kalnay (University of Maryland)

Dr. David Karoly (University of Oklahoma)

Dr. Masao Kanamitsu (Scripps Institute of Oceanography)

Dr. Arun Kumar (NOAA, Climate Prediction Center)

Dr. Roger Pulwarty (University of Colorado)

There is a strong desire to add additional contributors, particularly in areas of complementary expertise (e.g., from the applications/user perspective).

We are planning to go through a FACA process, so meetings will be open.

Stakeholder Interactions

Planned stakeholder interactions: near-term

1. May, 2005 AGU - New Orleans. Two sessions organized:
 - a) Strengths and Limitations of Reanalyses for Understanding Climate Variability and Trends.
 - b) Attribution of Climate Variability over the Past 100 Years.

2. September, 2005: International Workshop on “The Development of Improved Observational Data Sets for Reanalysis: Lessons learned and Future Directions” . Funded by NASA, NOAA, and NSF.

2. Spring, 2006. Workshop on CCSP Product (NOAA has approved funding for external participants, will be in Boulder).

3. Winter 2005-2006. Special sessions to be proposed: AGU, AMS.

Proposed Schedule

Prospectus	
Drafting	June 2005
CCSP Review	October 2005
Public Comment	November 2005
Revised Draft	December 2005
Stakeholder Interactions	
AGU Session	May 2005
Reanalysis Workshop	June 2006
Drafting	
Initial Draft	September 2006
Final Draft	June 2007
Review	
Expert Review	October 2006
Public Comment	February 2007
CCSP Review	June 2007
NSTC Clearance	September 2007
Communications	
Communications Plan	June 2007
Hardcopy Production	November 2007
Web Production	November 2007
Dissemination	February 2008