

# Reanalysis / Ongoing Analysis and Climate Observations

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# Concepts, Definitions, Assumptions, Status

- Upper Air Observing System:
  - Climate Observing System for the atmosphere (troposphere for sure, stratosphere probably)
  - Winds, temperatures, moisture
  - What about clouds, precipitation?
  - Aerosols, constituents?
- Reanalysis/Ongoing Analysis:
  - Climate Analysis for the atmosphere
  - Winds, temperatures, moisture certainly
  - Others are legitimate targets, but not close yet

We need more comprehensive climate observations and we must make more efficient use of those that are and will be available.

## THE NEED FOR A SYSTEMS APPROACH TO CLIMATE OBSERVATIONS

BY KEVIN E. TRENBERTH, THOMAS R. KARL, AND THOMAS W. SPENCE

Because climate is changing, we need to determine how and why. How do we best track and provide useful information of sufficient quality on climate?

*Bulletin of the American Meteorological Society:*

November 2002, **83**, 1593-1602



# **Observing system** means a comprehensive approach, including

- **Climate observations** from both space-based and in situ platforms taken in ways that address climate needs and adhere to the ten principles outlined by the NRC (1999).
- A global telecommunications network and satellite data telemetry capacity to enable data and products to be disseminated.
- **A climate observations analysis capability that produces global and regional analyses of products for the atmosphere, oceans, land surface and hydrology, and the cryosphere, based on four dimensional data assimilation capabilities that process the multivariate data in a physically consistent framework to enable production of the analyses: for the atmosphere and oceans, land surface and so on.**
- Global climate models that encompass all parts of the climate system and which are utilized in data assimilation and in making ensemble predictions.

# GEOSS--- Creating a “System of Systems”

## Global Observing Systems

GCOS  
GOOS  
GTOS  
WHYCOS  
World Weather Watch  
IGBP  
IOOS  
CEOS  
IGOS

## National/Multinational Observing Systems

Satellites  
Surface Observations  
Radar  
Aircraft  
Ocean Observations  
Paleo-data

## Private Sector Observing Systems

Satellites  
Mesonets  
Lightning  
Commercial Aircraft

## Integration / Synthesis / Analysis

Climate  
Variability and  
Change

Ocean  
Resources

Disasters

Energy

Health

Agriculture

Ecosystem

Water Resources

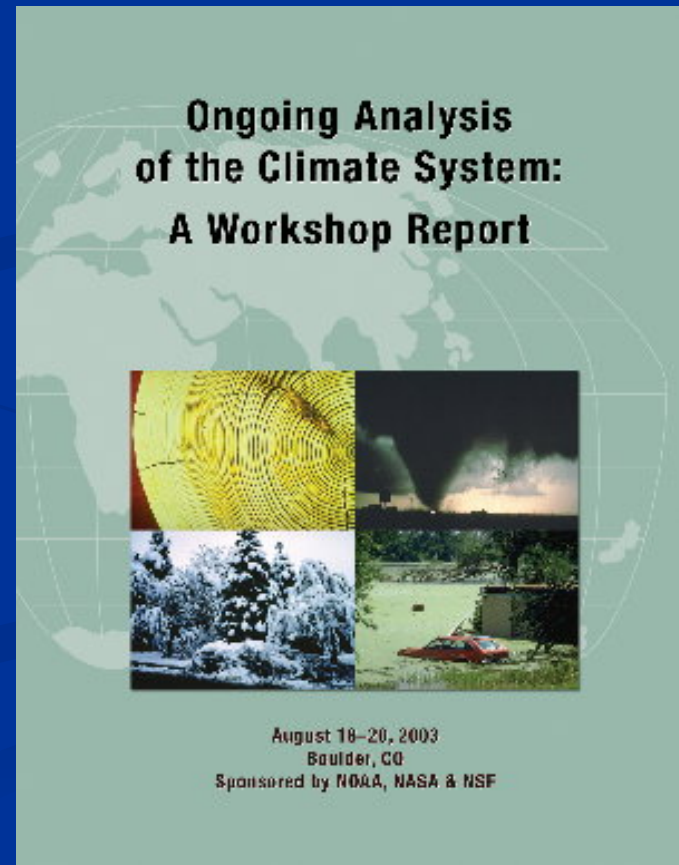
**Societal Benefits**

# Reprocessing and Reanalysis are essential

**Given the continuing improvement in climate observations and the need for long time series, reprocessing is an essential element of every climate observing system.**

## **Workshop on Ongoing Analysis of the Climate System 18-20 August 2003, Boulder, Colorado**

- Workshop report distributed
- See workshop web site  
([http://www.joss.ucar.edu/joss\\_psg/meetings/climatesystem/](http://www.joss.ucar.edu/joss_psg/meetings/climatesystem/)) for pdf version of report and background information from the workshop.





**The Workshop concluded that the U.S. must establish a National Program for Ongoing Analysis of the Climate System to provide a retrospective and ongoing physically consistent synthesis of earth observations in order to:**

- **Guide the design and operation of observing systems**
- **Produce and sustain the growing climate record**
- **Reconcile disparate climate observations and characterize analysis uncertainty**
- **Establish initial conditions for climate prediction**
- **Validate prediction and projection models on all time scales**
- **Provide long time series of global and regional climatic analyses for all types of prediction and projection verification**

# Elements of a Comprehensive Ongoing Analysis

- **Enhancing and managing the observational database**
  - Archeology, new sensors, continuity and feedback
- **Ongoing analysis:**
  - Continually update most recent reanalyses (CDAS)
  - Use OSEs and OSSEs to document impact of continuing observing system changes
  - Provide feedback to observing system developers/operators
- **Periodic reanalyses**
  - Post 1979 reanalysis with goal of continuous climate record
  - Post 1950 reanalysis with same goal
  - Post 1850 surface NH oriented
  - Continental-scale regional reanalysis at very high spatial resolution
- **Stewardship and dissemination**
  - Ensure that the products are useable
- **Applied research**
  - Develop improved methods and products
  - Intended to solve problems identified within program



# Critical Gaps (per Mike Wallace)

- **Availability/accessibility of original observations**
  - Collect/rationalize reanalysis databases
  - Ensure availability of original observations
  - Take advantage of feedback files
- **Identify added value of specific observations :**
  - Use OSEs and OSSEs to document impact of observing system elements
  - Provide feedback to observing system developers/operators
  - Determine what makes an analysis “better” (e.g., in NWP, a better analysis is one that produces a better weather forecast – in climate analysis, what is the metric?)
- **Unique contributions from individual observations**
  - Integrated analyses of various sorts as context

# **“Requirements”**

- **Upper Air Observing System must be accompanied by an appropriate Climate Analysis System (or systems)**
- **Utilize the analysis system to inform decisions on observing system design**
- **Strive for stable, well calibrated observations with known error characteristics**