Climate System Observations and Analysis

Randall Dole

Overview

Background

- Theme 1 highlighted the extensive ESRL expertise in fundamental observations and measurements for *process understanding*, e.g., air-sea fluxes, precipitation.

- Here, the focus is on climate observations and analysis capabilities needed *to identify, monitor and attribute causes of climate variations and change.*

Sustained Earth system observations are critical to understanding climate and central to NOAA's Mission.

General Drivers

NOAA Mission Goal: Understand climate variability and change to enhance society's ability to plan and respond.

OAR Five-Year Research Plan Goal: Develop an integrated global observation and data management system for routine delivery of information, including attribution of the state of the climate.

Climate Goal:

- **Climate Observations and Monitoring Program** – *integrate atmospheric, oceanic and arctic observations* and maintain consistent, long-term access to historical climate data.
- **Climate Research and Modeling Program** – *assimilate observational data* and run models to attribute causal forces to climate effects and to make predictions and projections.

From Weather to Climate: Water as an Integrator

- Air-sea-land **turbulent eddy fluxes** of water vapor provide the "source"
- **Atmospheric circulations transport** this water vapor regionally and globally
- Often complex **cloud and mesoscale processes create precipitation**
- **Soil moisture** modulates the impacts of precipitation from water supply to flooding, drought impacts and feedbacks, on weather and climate time scales
- PSD scientists use state-of-the-art measurement systems to address outstanding scientific and practical questions related to each of these key physical processes
- PSD engineers develop and deploy new sensors and sensor combinations to fill key gaps needed to better monitor or understand key water cycle processes
- PSD leaders develop and implement plans that both shape and take advantage of this research

Arctic Observatories

- The Arctic is experiencing some of the most rapid changes on Earth. Climate model projections indicate such changes are likely to continue.
- Impacts of the changes are profound and have a large national and international policy implications.
- Observations in the Arctic and less complete and processes more poorly understood than in most other regions on Earth.
- In NOAA's Next Generation Strategic Plan (draft), "Expanding Arctic climate observations and research …" is identified as a top priority.
- ESRL, and PSD in particular, have extensive experience and expertise in Arctic system science, including its international dimensions.

Historical Reanalysis

- Climate reanalysis is a very high interagency (USGCRP) priority.
- Through the methods of data assimilation a limited number of centers (NOAA, NASA, ECMWF, JMA) around the world have used models together with observations to develop atmospheric "reanalyses" that extend back to ~ 1950s.
- Research questions: Could we go further back in time? If so, how?
- Scientists here with expertise in data assimilation undertook to answer these questions.