Climate - Theme Overview

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ARL Laboratory Review

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# Scope and Goals of ARL's Climate Program

- Climate Observing Networks

Goal: To develop *in situ* observational networks to meet climate needs

- Climate Variability and Change Analysis

Goal: To advance understanding of upper-air climate changes

- Regional Climate Modeling

Goal: To develop a NOAA modeling capability for regional climate projections, including comprehensive uncertainty analysis

Observations

Analysis

Modeling
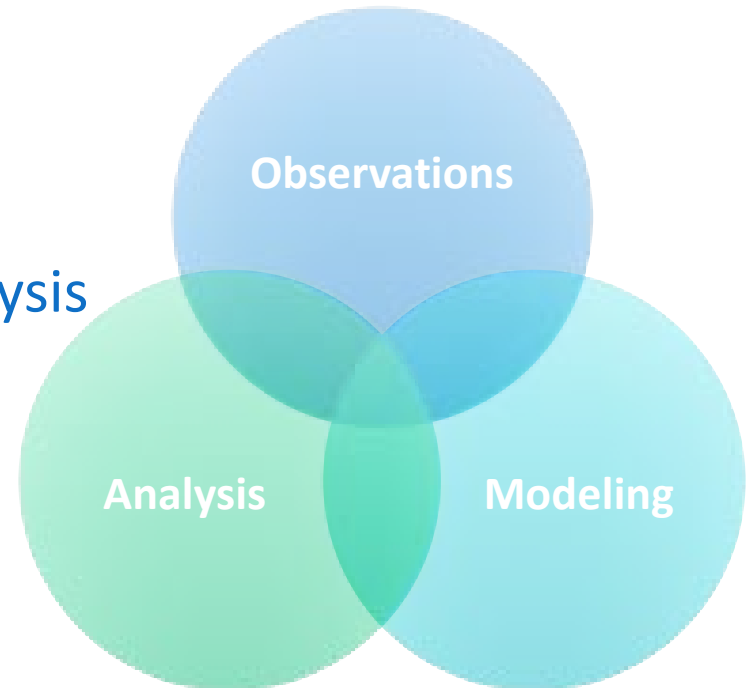
Driver: NOAA Next Generation Strategic Plan

Long-Term Goal: Climate Adaptation and Mitigation

An informed society anticipating and responding to climate and its impacts

- Objective: Improved scientific understanding of the changing climate system and its impacts

- Objective: Assessments of current and future states of the climate system that identify potential impacts and inform science, service, and stewardship decisions

Selected Other Drivers:

- Provide monitoring, assessment, and analysis of the climate system through high quality observations … as well as modeling capabilities (Global Change Research Act, National Weather Service Organic Act, Coastal Zone Management Act, US Ocean Action Plan).

- NOAA's Climate Goal will focus on improving the utility of its observations by integrating climate observations … and analyzing data derived from these observing systems …(Research in NOAA: Toward Understanding and Predicting Earth's Environment A Five -Year Plan: FY 2008– 2012)

  - Collecting and delivering regular, systematic, and **reliable climate data and information**—with **rigorous scientific standards** and easy data access by customers—that document and describe the current and evolving state of the climate system …

  - Producing **reference data sets** that provide improved climate information

  - Conducting observational, diagnostic, and modeling **research to improve understanding of physical mechanisms and processes** … that will lead to improved climate models and climate predictions

Brief History of ARL Climate Efforts:
Climate Observing Networks

Oak Ridge

- 1950s and 1960s – Development of expertise in high-quality surface and tower observations for basic research and turbulence and dispersion applications.

- 1970s and 1980s - Application to contemporary air quality issues, e.g., acid deposition.

- 1990s to present – Application to emerging climate issues, including energy, carbon and water budgets, and reference observations.

Silver Spring

- 1960s -1980s – Analysis of global radiosonde and ozone profile observations, US cloudiness and sunshine records.

- 1990s – ARL's baseline observing network and sounding programs form basis of new climate lab. Recognition of inadequacies of sonde data for humidity and temperature trends.

- 2000s to present – Advocacy of reference upper-air observations and associated research

Brief History of ARL Climate Efforts:
# Climate Variability and Change Analysis

- Pioneering analyses of upper-air (temperature & humidity) and surface climate (1970s)

- Recognition of data homogeneity and metadata issues (1990s)

- Dataset intercomparisons (2000s)

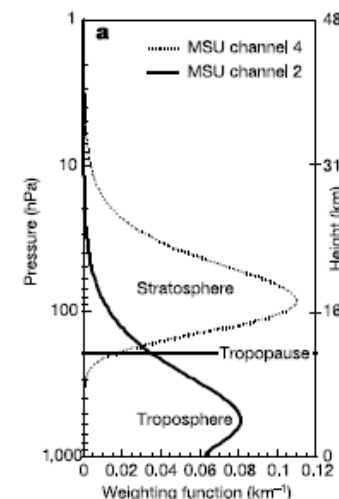- Analyses of vertical profile of temperature trends (2000s)
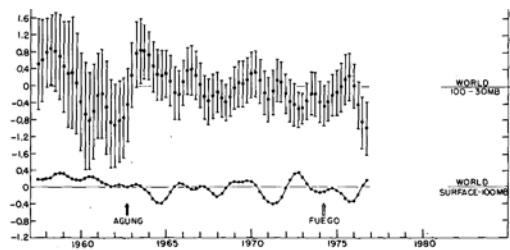
Global Temperature Time Series
1958-1977
Angell and Korshover
(Mon. Wea. Rev. 1978)
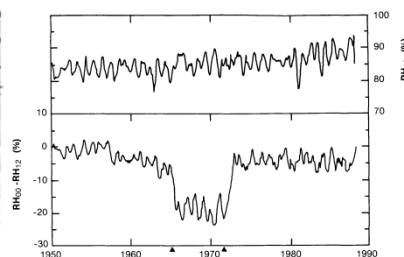
Hilo 850 hPa RH Record
1950-1988
Elliott and Gaffen
(Bull. AMS 1991)
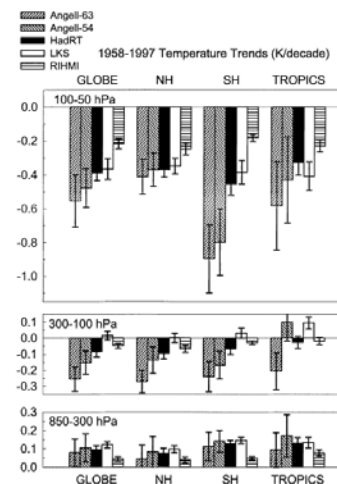
Upper Air Temperature Trends
Dataset Intercomparison
Seidel et al .
(J. Climate 2004)

Layers Sensed by Satellites
Effect of Stratosphere
Fu et al.
(Science 2004)

Brief History of ARL Climate Efforts:

Regional Climate Modeling

- 2001: ARL began regional climate model development

- Collaborative partnerships
  - University of Illinois at Urbana-Champaign
  - Weather Research and Forecasting modeling community
  - University of Maryland, College Park (2011)

- Goal: Provide reliable climate information at regional-local scales, using state-of-art science and technology
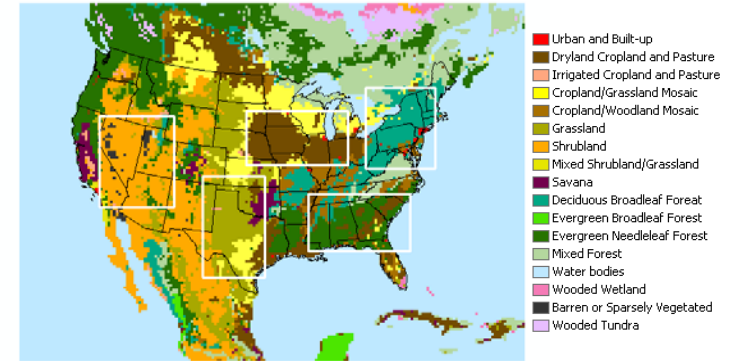
Guiding Philosophies

❖Identify emerging issues where ARL can contribute significantly

❖Engage in evolving scientific debate

❖Pay attention to data quality and associated uncertainties

❖Collaborate with pre-eminent colleagues at relevant US and international institutions, particularly within NOAA

❖Communicate results through peer-reviewed publications and scientific conferences, and with the general public

❖Contribute to and support scientific assessment activities

❖Maintain strong long-term capabilities

Overview of ARL's Current Climate Program
Climate Observing Networks

- Surface Energy Budget Network (Tilden Meyers)

- Surface Climate Reference Networks (Bruce Baker)

- POSTERS:
  - Utilizing land surface models for gap-filling energy and CO_2 exchange rates (Tilden Meyers)

  - Automated Solid Precipitation Measurement (John Kochendorfer)

  - In situ and satellite measurements of land surface skin temperature (Praveena Krishnan)

  - Testing and Evaluation of the Best Aircraft Turbulence (BAT) Probe for Airborne Research (Ed Dumas)

  - GCOS Reference Upper Air Network (Dian Seidel)

Overview of ARL's Current Climate Program
Climate Variability and Change Analysis

- Understanding Upper-Air Climate Change
  - Part I: Changes in the vertical temperature profile (Melissa Free)
  - Part II. Stratospheric temperature trends and links to other climate changes (Dian Seidel)

- POSTERS:

- Climatology of the global planetary boundary layer (Yehui Zhang)

- Changes in cloudiness in the US from surface observations (Melissa Free)

- ARL contributions to national and international scientific assessments

- PODCAST: What the upper atmosphere reveals about climate http://www.oar.noaa.gov/podcast/arl/arl-1.php

Overview of ARL's Current Climate Program
Regional Climate Modeling

- POSTER: Regional Climate Modeling (Julian Wang)
- Poster describes:
  - Need for climate information at regional-local scales
  - Model development philosophy
  - Major model improvements
  - Recent research results

Thank You!