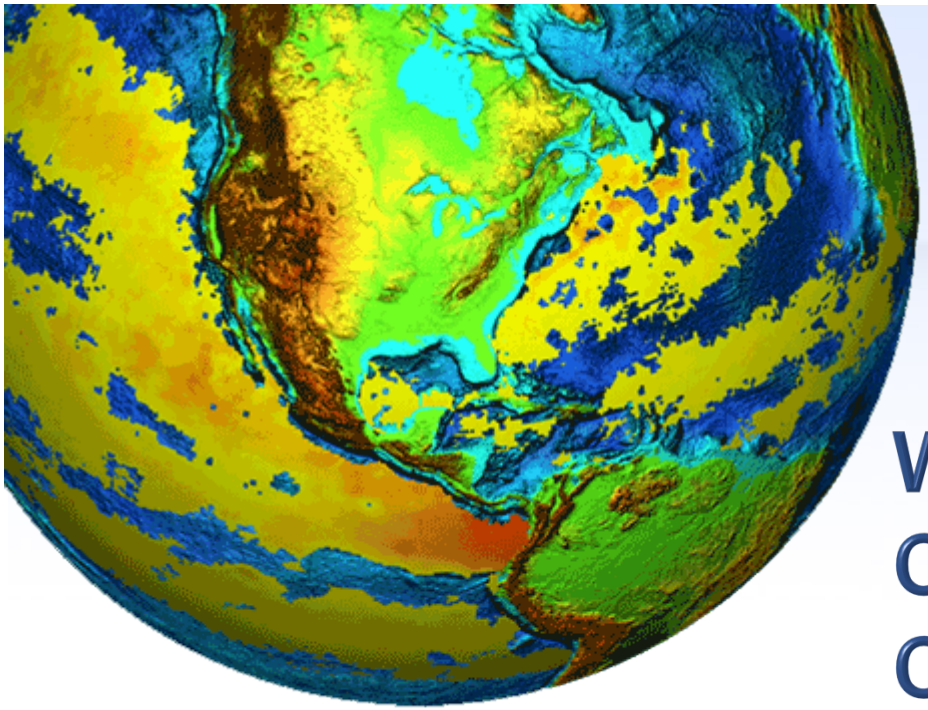


Water Resource Challenges in a Changing Environment:

Climate Services in NOAA

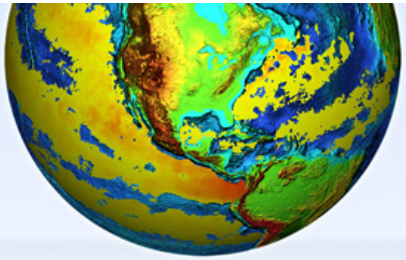
Association of Metropolitan Water Agencies
2011 Water Policy Conference

Thomas R. Karl

Director, National Climatic Data Center

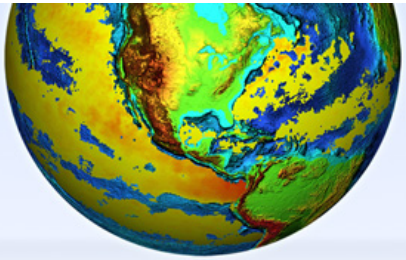
Chair, Subcommittee on Global Change Research

April 12, 2011

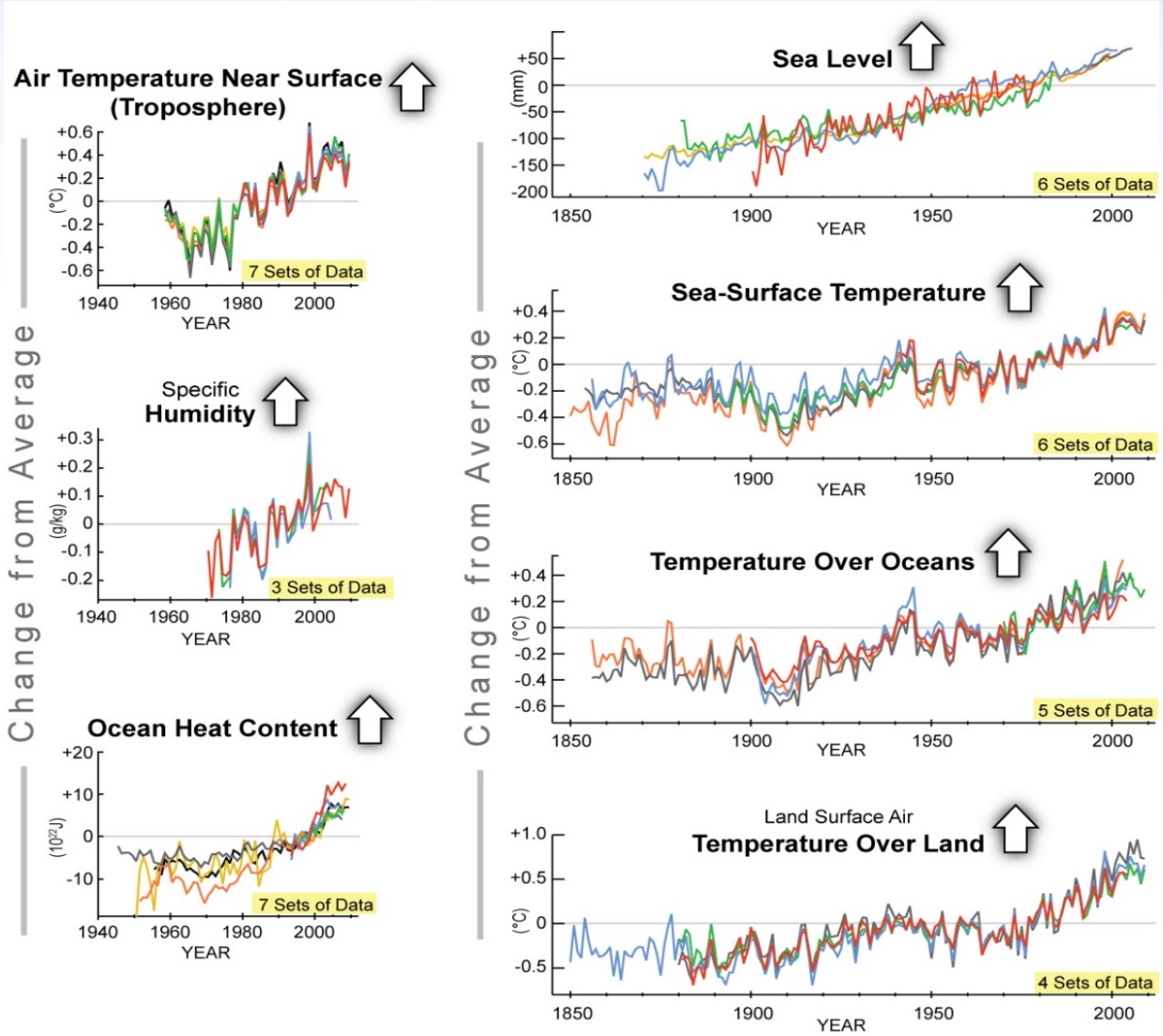


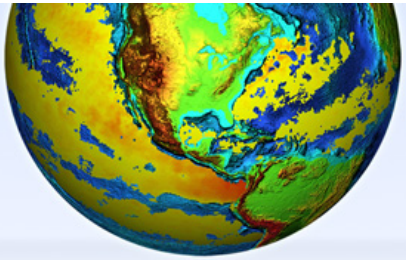
Overview

- The Challenge
- Relevant Climate Services in NOAA
  - Drought Portal
  - Drought Early Warning System
  - Snowmelt
  - Soil Moisture
- Extreme Precipitation
- Sea Level
- National Assessment
- Questions

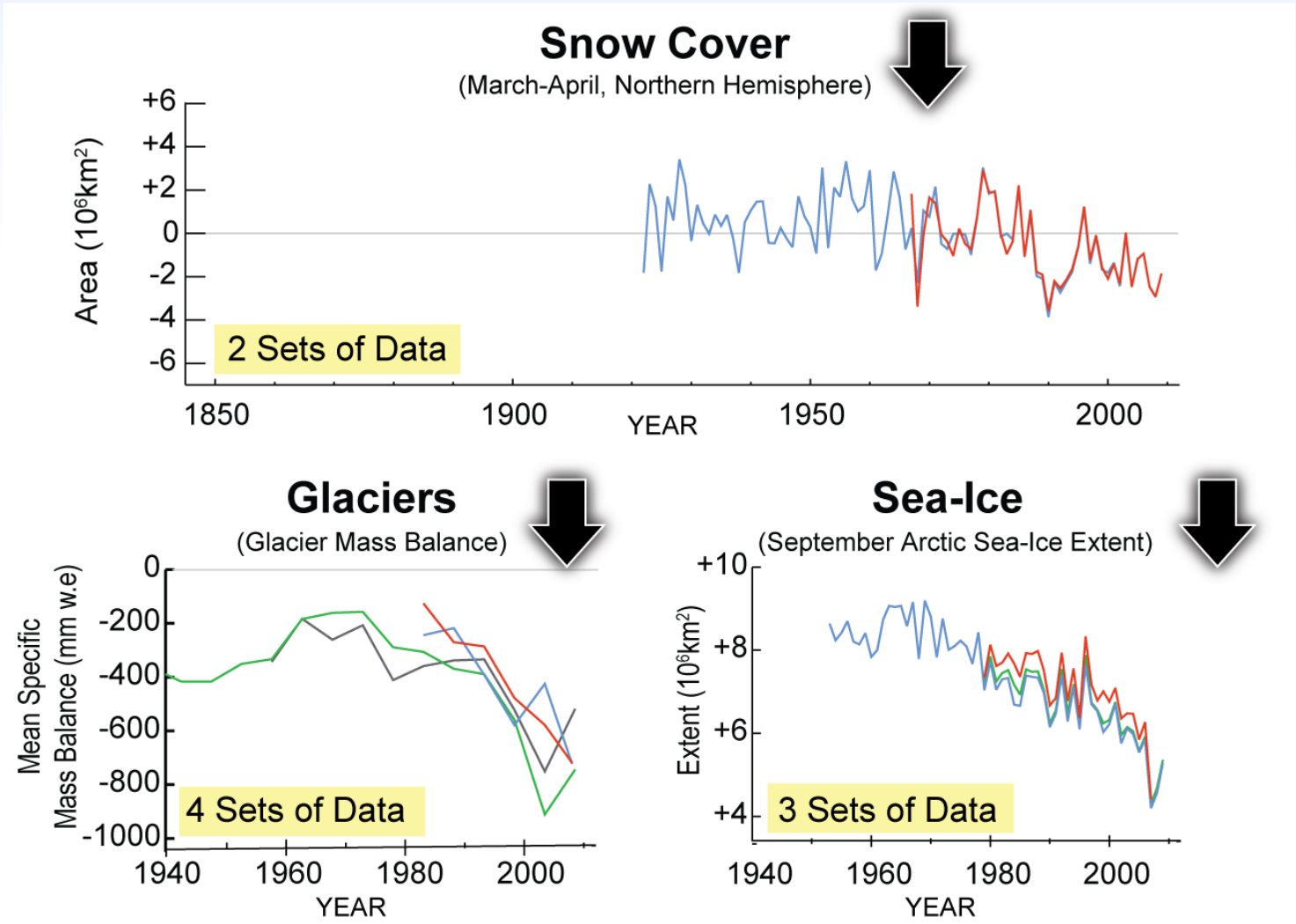


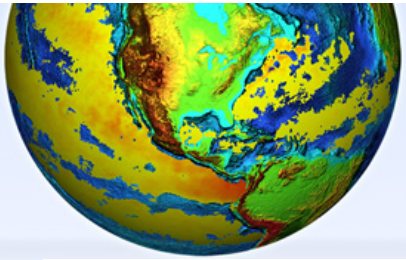
These Indicators Increase in a Warming World





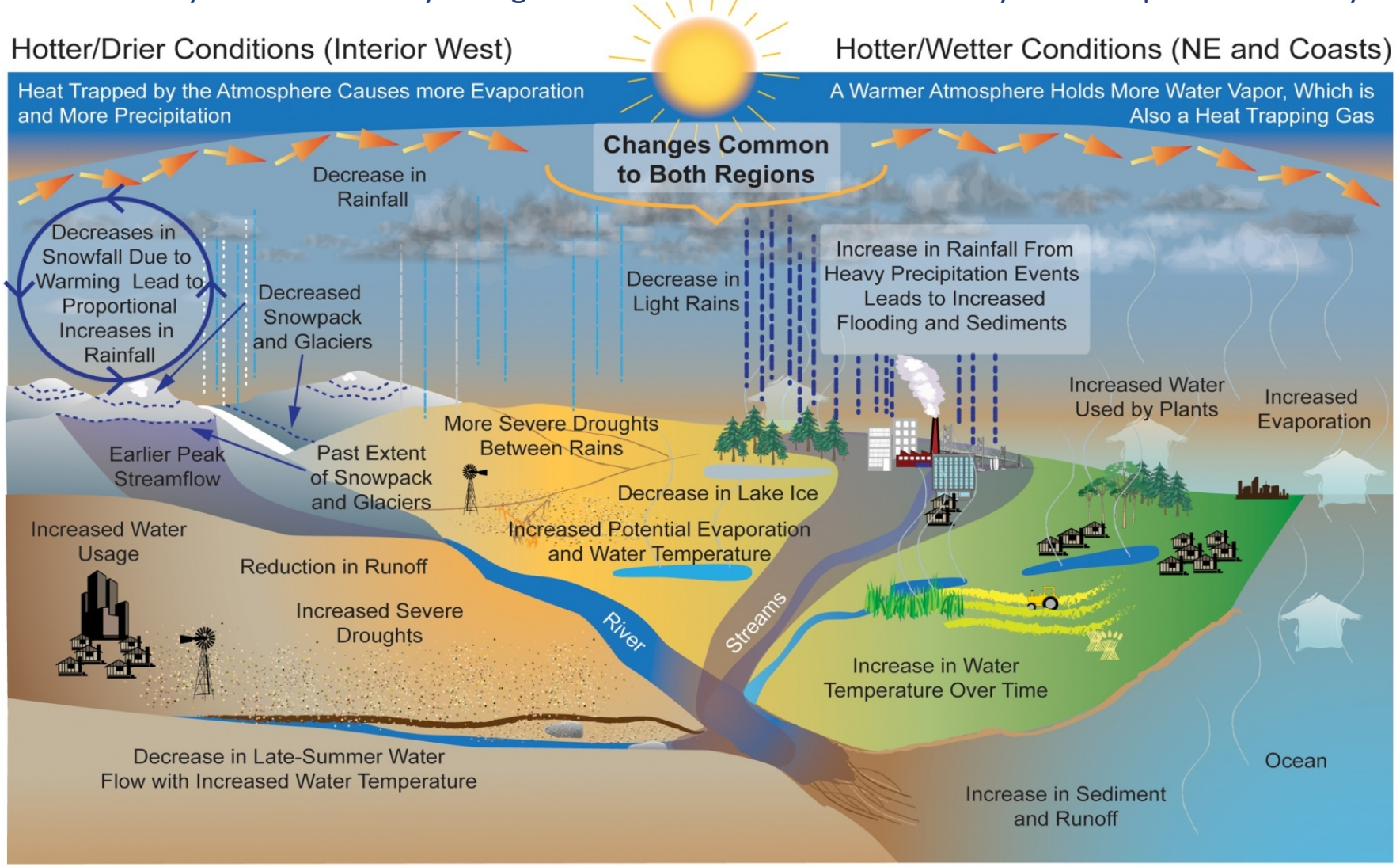
These Indicators Decrease in a Warming World



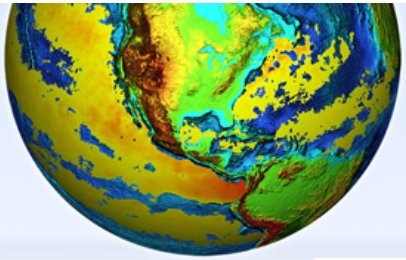


Projected Changes in the Water Cycle

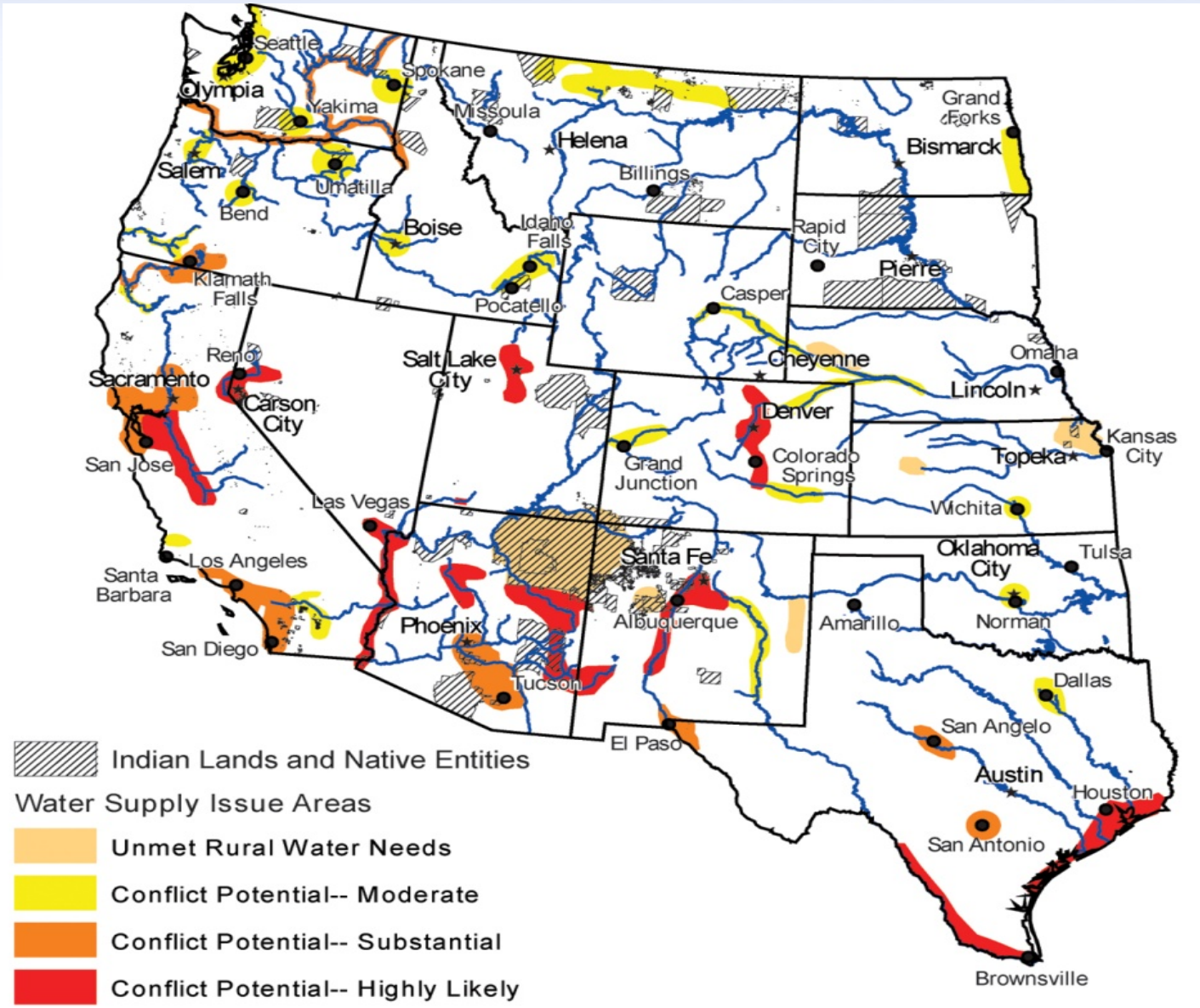
The water cycle exhibits many changes as the Earth warms. Wet and dry areas respond differently.

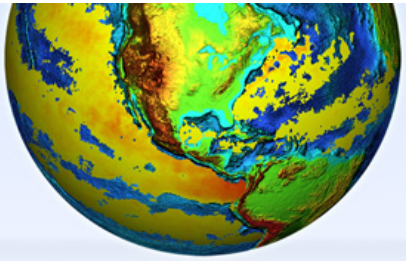


NOAA/NCDC



Potential Water Supply Conflicts by 2025

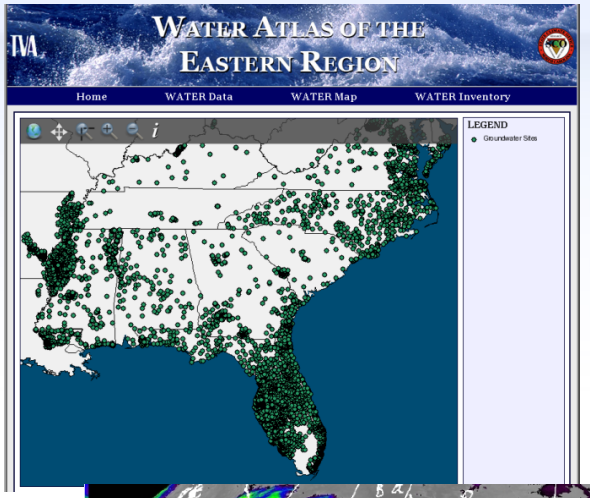


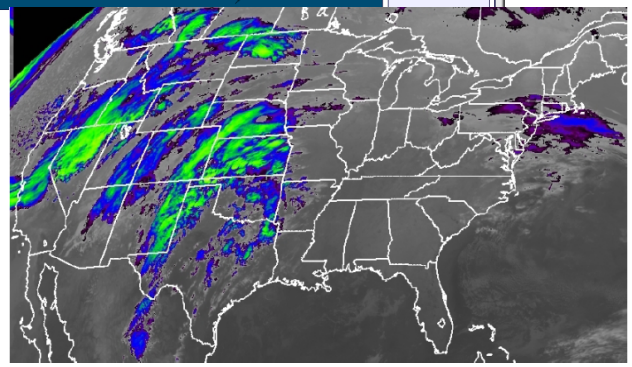


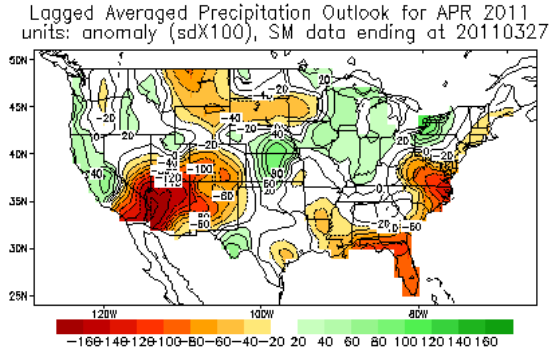
Drought Data and Information

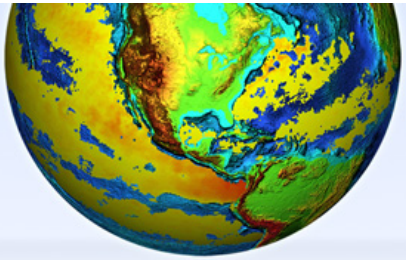
Finding a drought signal in a flood of information

- There are many indicators
  - Temperature
  - Atmospheric Water Vapor
  - Soil Moisture
  - Snowpack, Snow melt time…
- There are many sources
  - NOAA, USDA, DOI…
  - State & local agencies…
  - TVA, private firms, universities…
- Water managers need a single source for authoritative and timely data and information



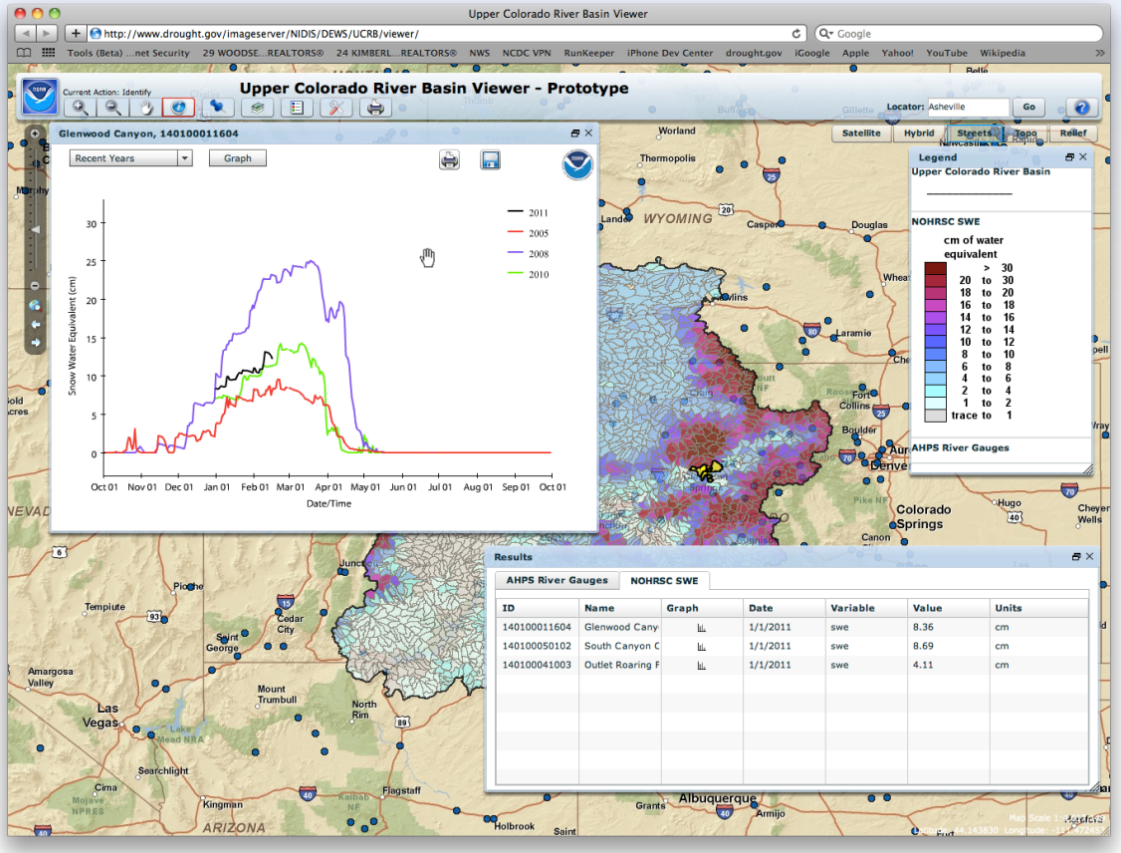




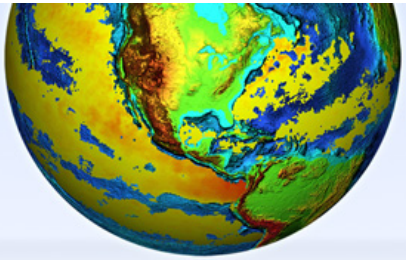


U.S. Drought Portal

- Drought.gov: a one-stop shop for drought information
- Integrates data and services from multiple government agencies & partners
  - NOAA, USDA, TVA…
- Presents information at appropriate scales for decision making



Example of Upper Colorado River Basin Drought Community providing tailored information for the Basin



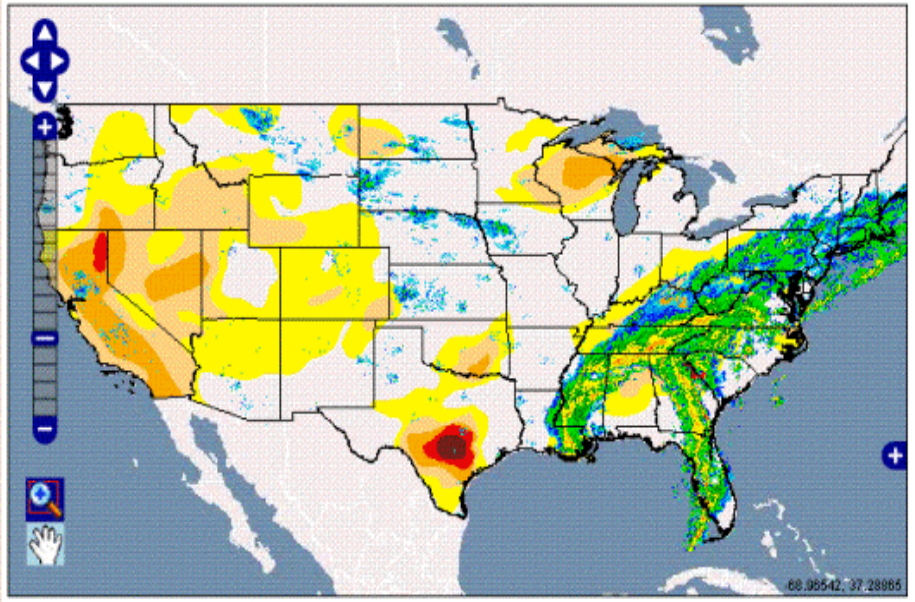
Regional Drought Early Warning Systems

National Integrated Drought Information System (NIDIS) is establishing regional drought early warning systems.

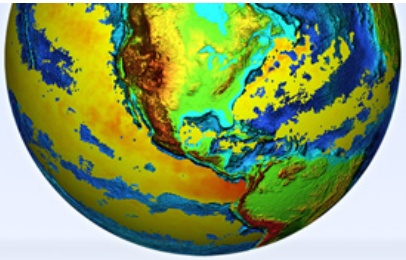
- Understanding user data and observi needs
- New regional drought indicators
- Basin scale data and warnings
- Education component for state decis makers
- Improved Forecasting:

When a region…

  - Goes into a drought
  - Recovers from a drought

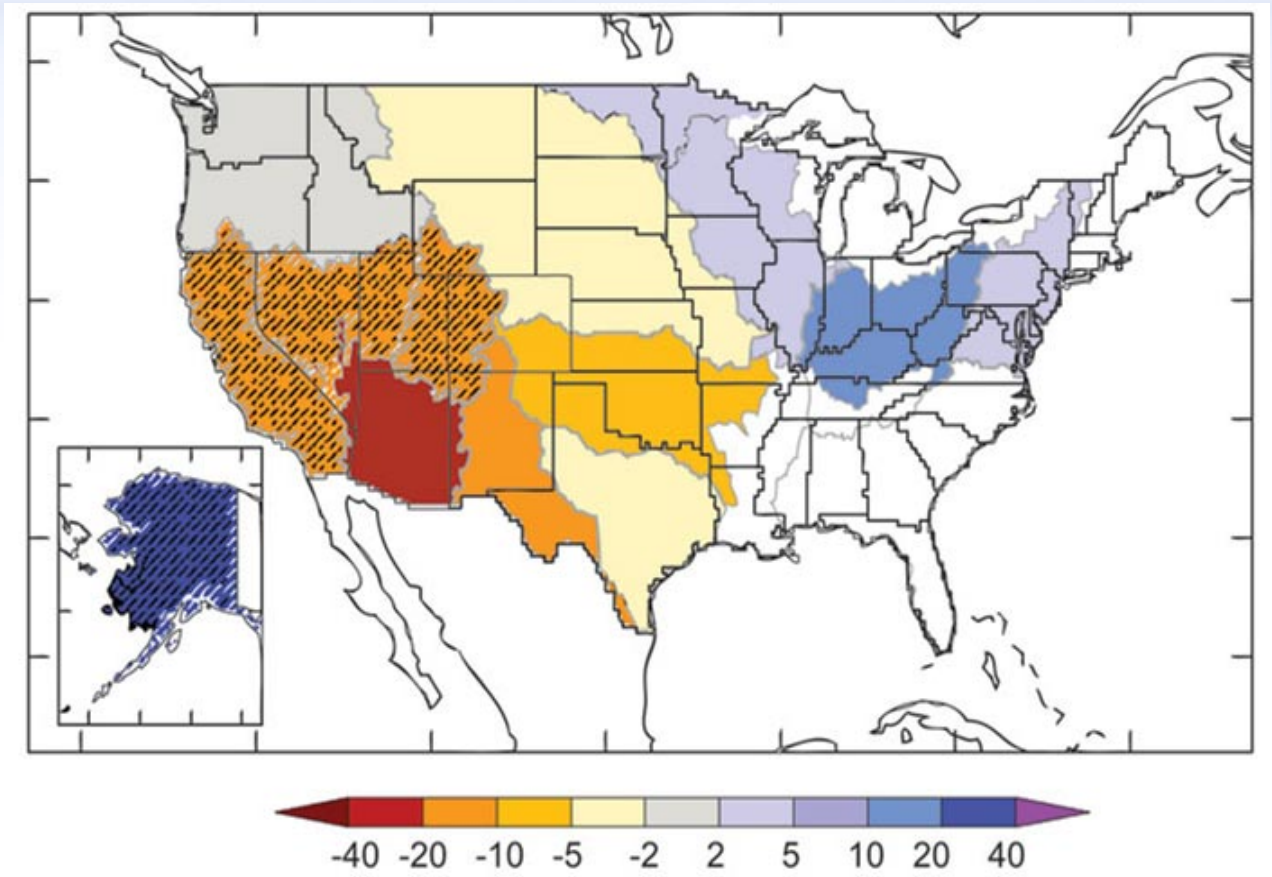


Interactive maps integrate data from different sources: US Drought Monitor from the National Drought Mitigation Center and 45-minute NEXRAD precipitation from Iowa State University.

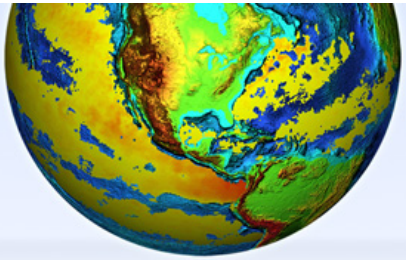


Projected Changes in Annual Runoff

- Long-term regional projections are of limited value for day-to-day water resource decisions

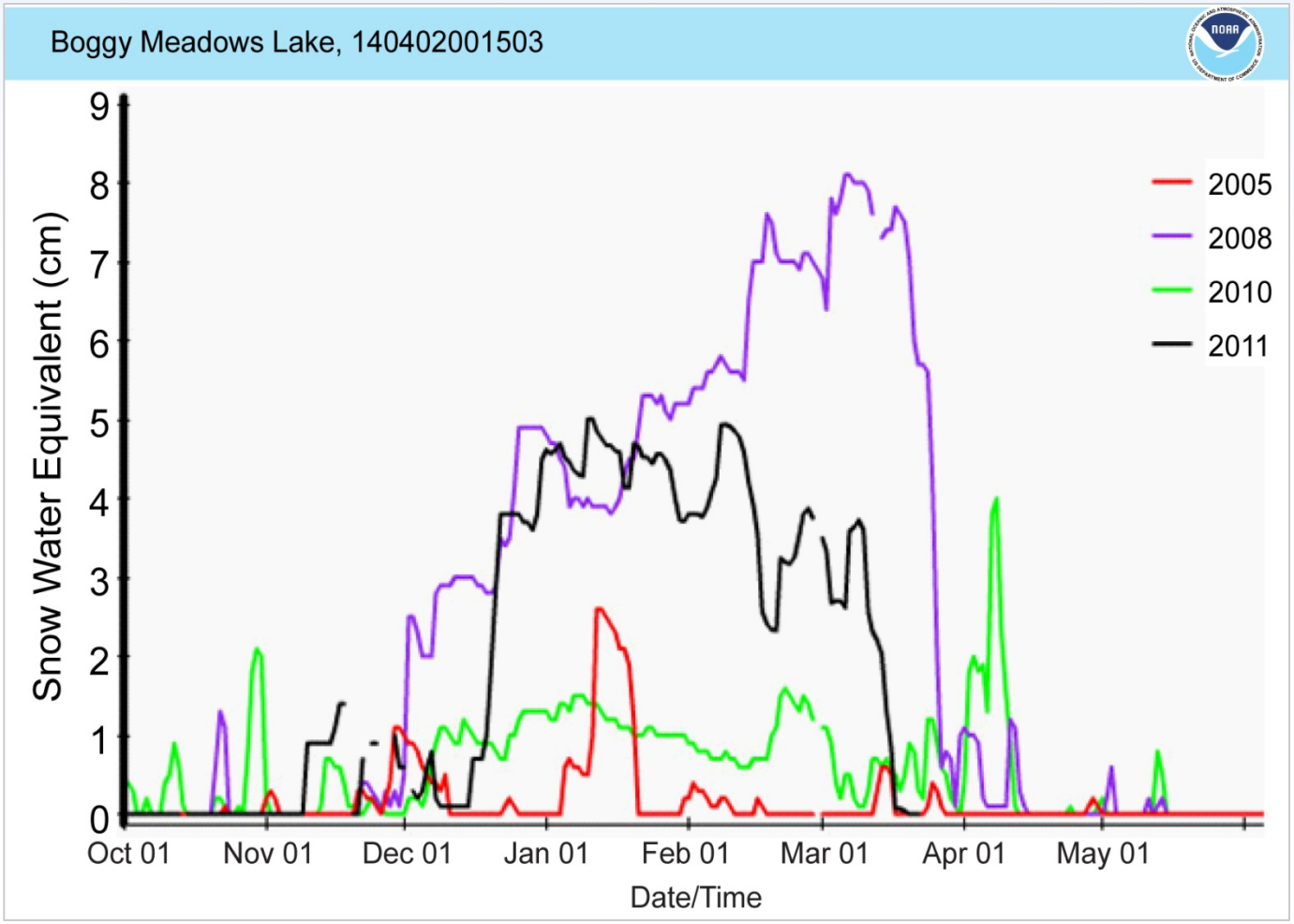


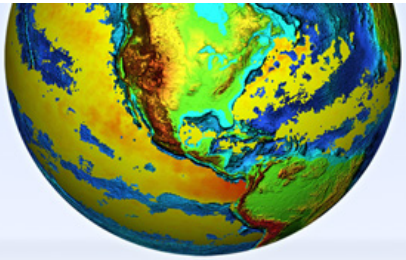
Projected percentage changes in median runoff for 2041-2060 relative to 1901-1970. Hatched areas indicate greater agreement among model projections; white areas indicate model divergence.



Provide Local Snowpack Monitoring

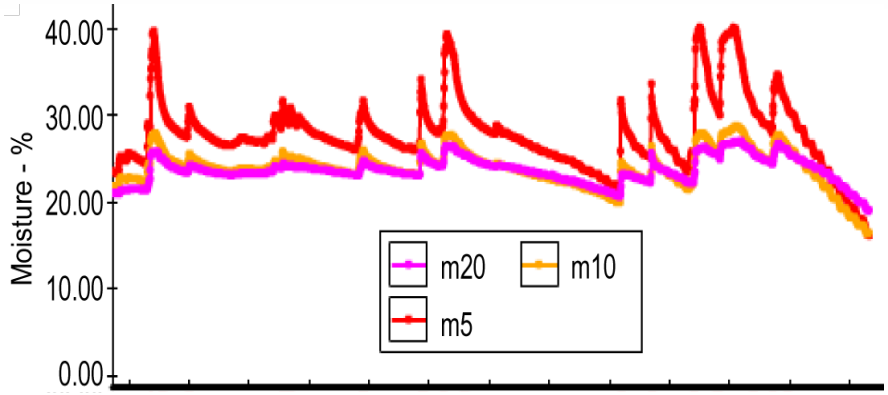
- Experimental product for Colorado
- Compares snowpack water equivalents
  - Max (purple)
  - Min (red)
  - Previous (green)
  - Current (black)
- Note early snowmelt in 2011 (black)

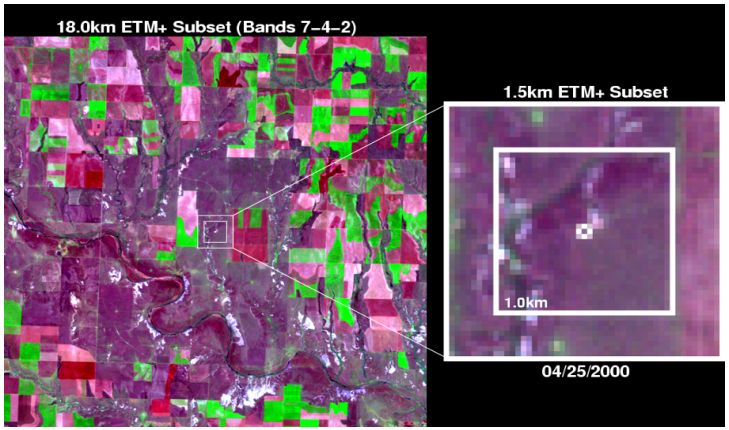


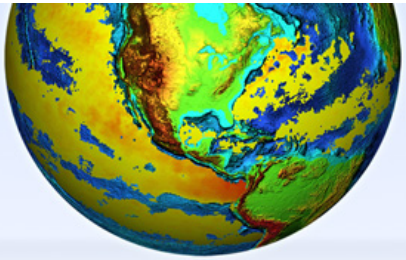


Soil Moisture

- High-quality precipitation, temps, and soil moisture for
  - drought monitoring
  - climate monitoring & prediction
  - weather and water forecasting
- 114 stations across continental U.S., more in AK and HI
- Ground-based measurements validate satellite remote sensing of soil moisture and surface temperature
- Soil moisture measurements are complementary to other regional networks, e.g., USDA and state agencies



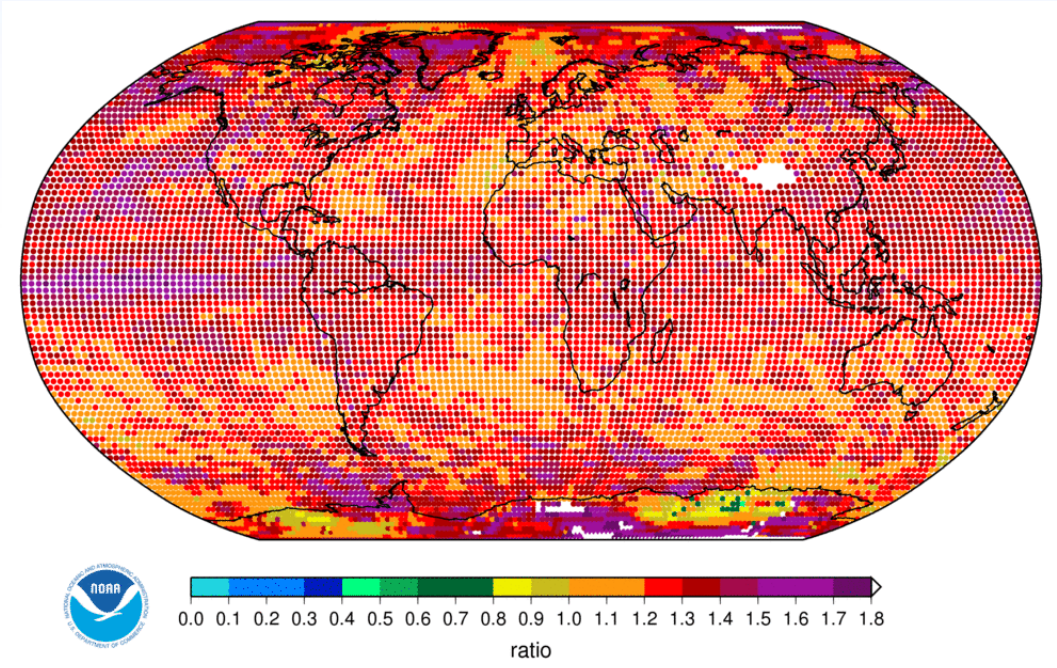




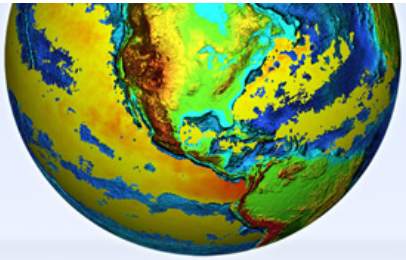
We anticipate changes in very heavy precipitation. Why?

- Precipitable atmospheric water vapor between two periods: 2071-2100 and 2001-2010
- Climate model simulations for a high emissions scenario
- Values increase almost everywhere. Over the U.S., the increases are in the range of 10 to 50%

Ratio of Maximum Daily Precipitable Water
2071-2100 / 2001-2010

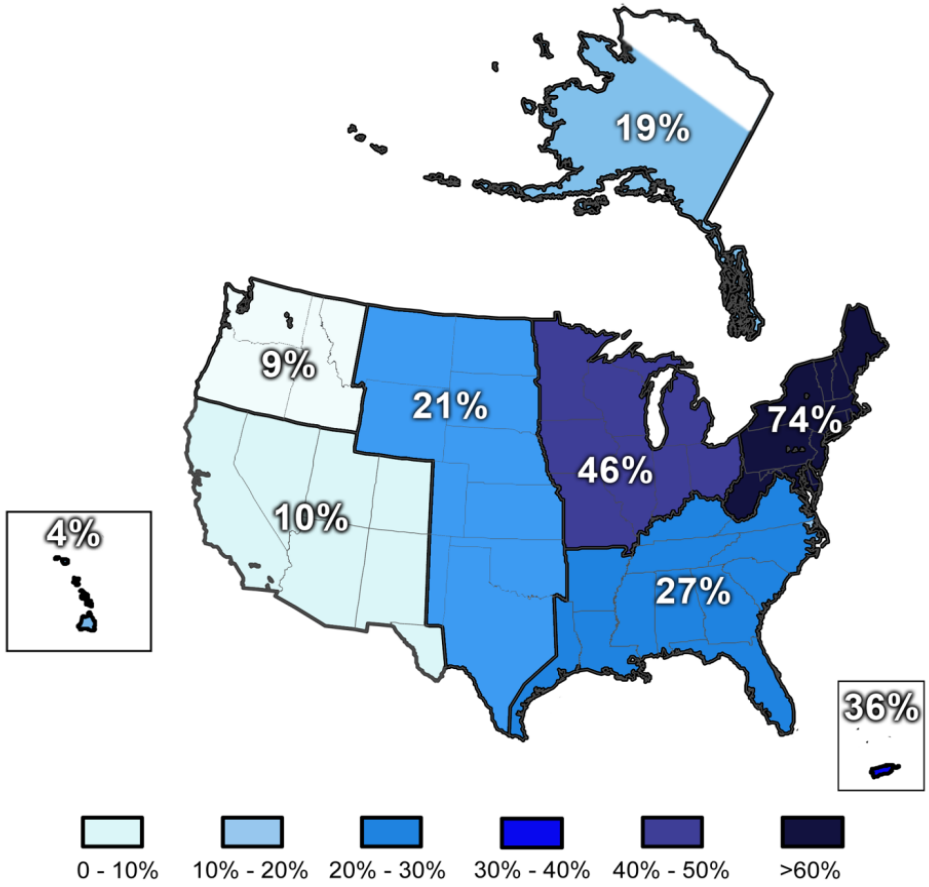


More water evaporates from a hotter pot.

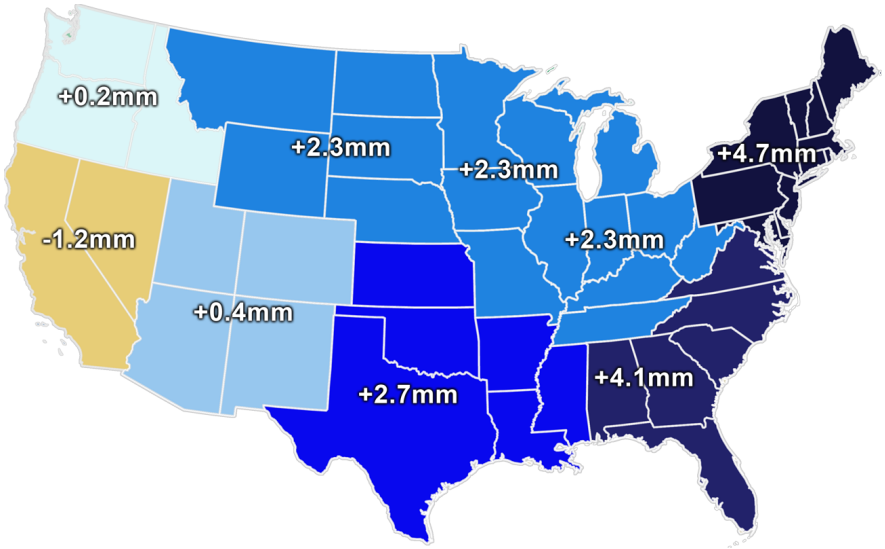


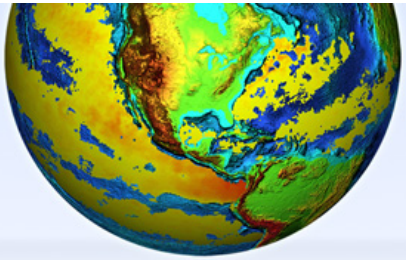
Extreme Precipitation: Comparison with Water Vapor

Observed Trends in 1-day Very Heavy Precipitation (1958 to 2010)



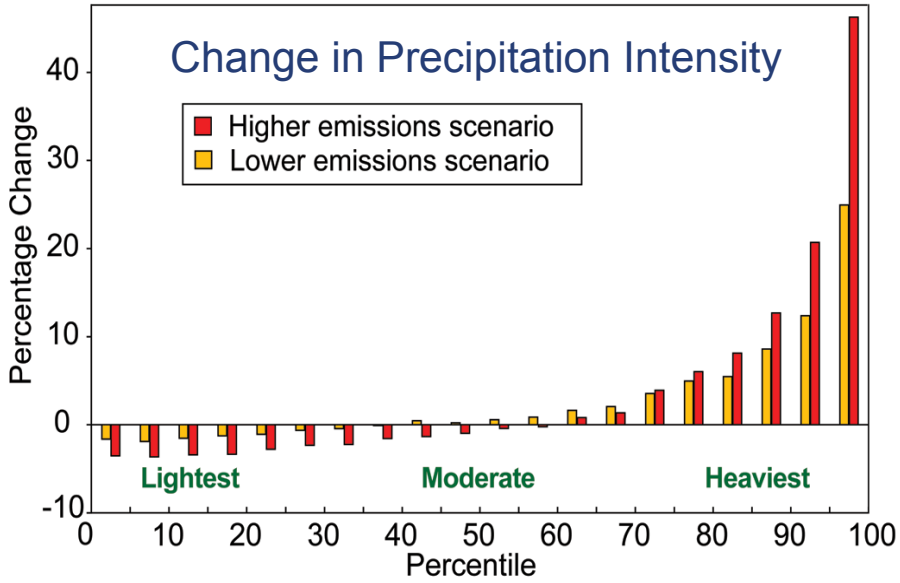
Observed Differences in Annual Maximum Atmospheric Water Vapor (1982-2009 minus 1961-1981)



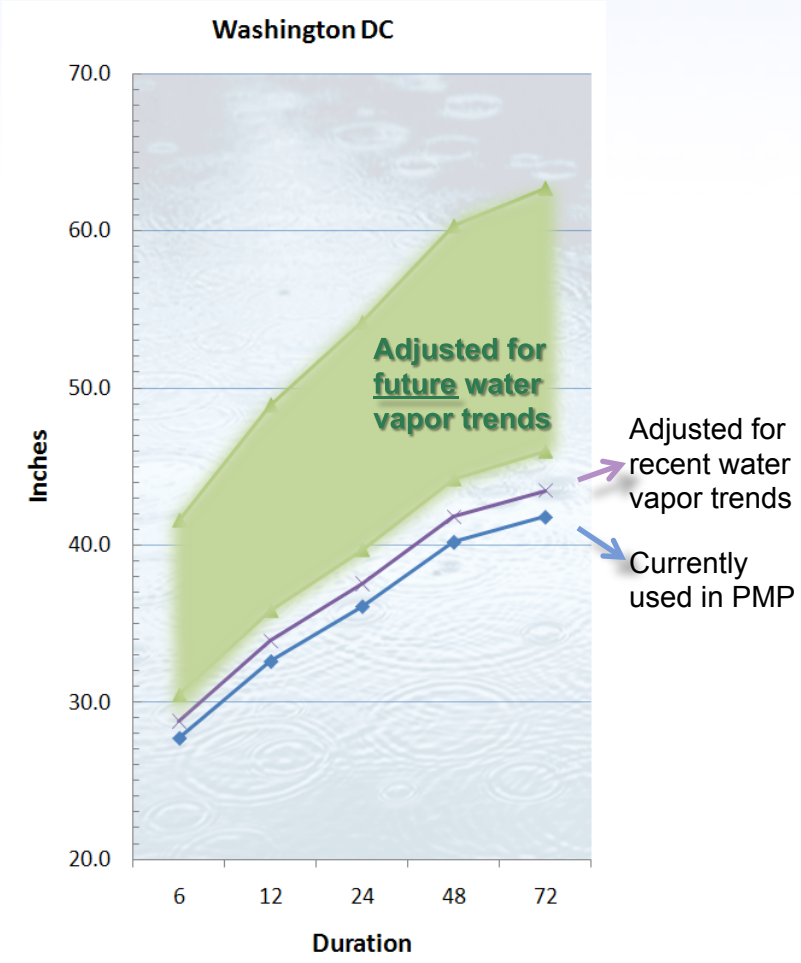


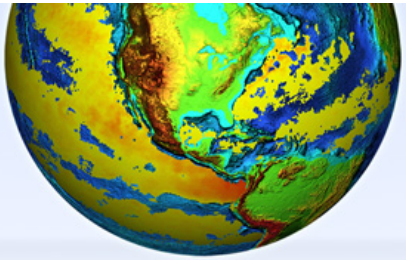
Extreme Precipitation: Projected Future Trends

Theoretical Maximum Precipitation likely to increase with increases in atmospheric water vapor due to warming oceans and increased evaporation.

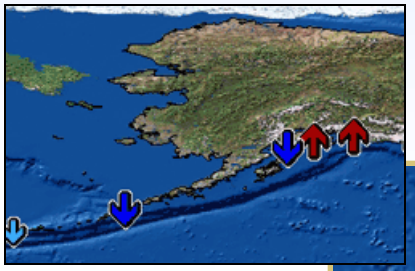


Theoretical Maximum Precipitation

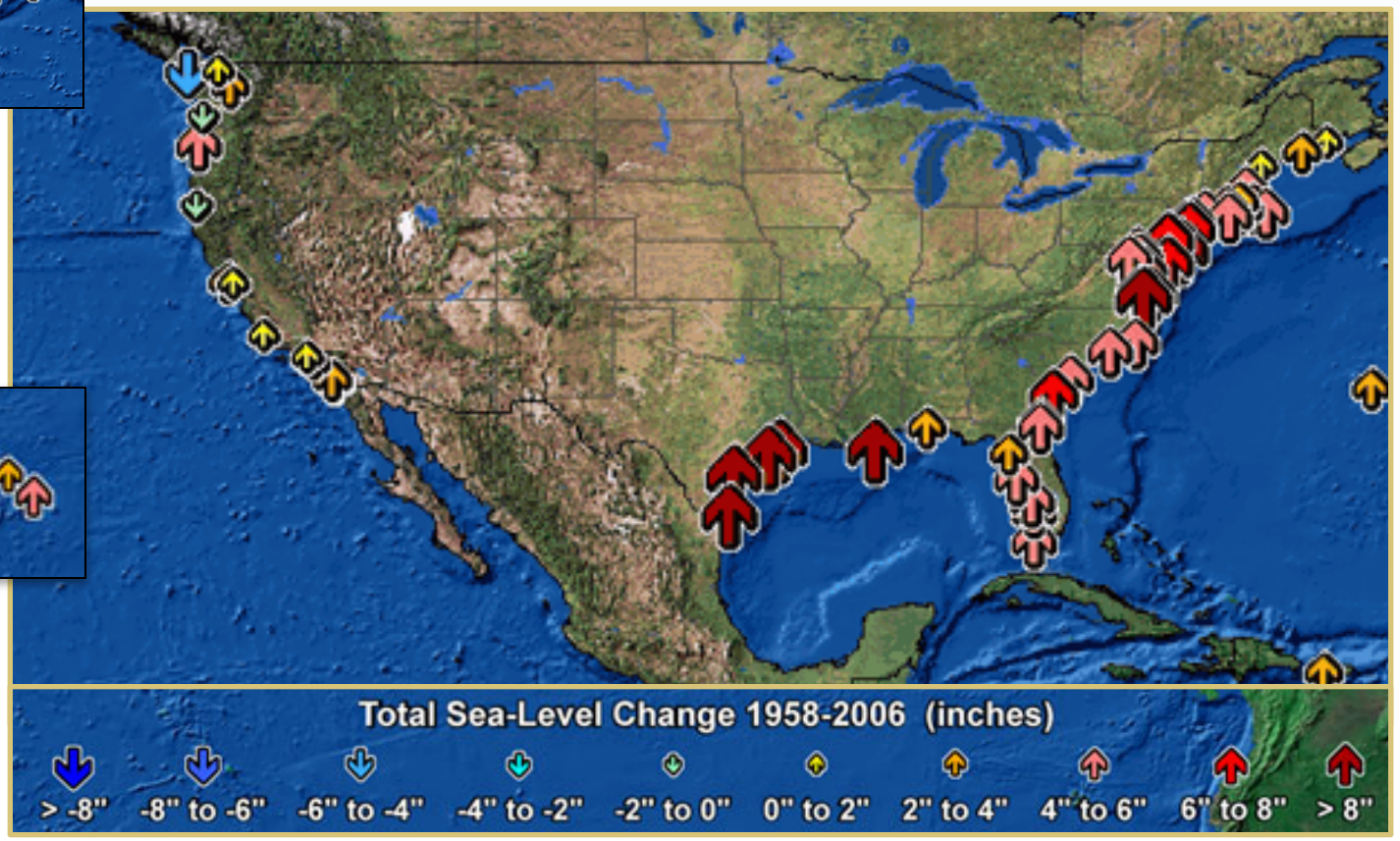


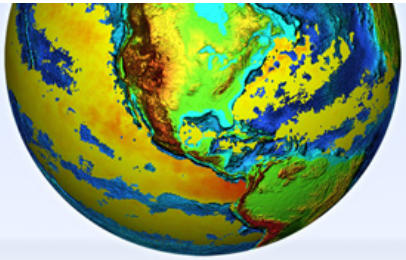


Observed Sea Level Changes



Coastal areas are at increasing risk from sea-level rise and storm surge

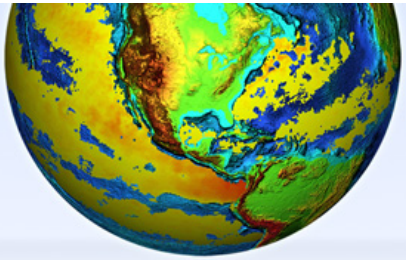




Sea Level Rise and Coastal Flooding Impacts Viewer

- Overlays coastal flooding onto local maps
- 14 new counties from Alabama eastward through Levy County, FL by end of March
- Finish all of TX coast
- Begin work on West Coast CA, OR, WA
- Share methods with states to build capacity for mapping SLR
- Begin working with Housing and Urban Development (HUD) to map vulnerability

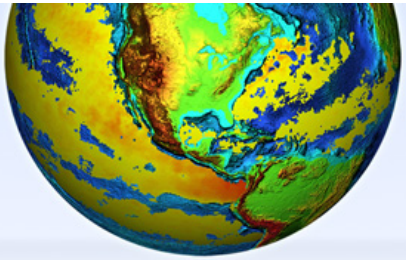
http://www.csc.noaa.gov/digitalcoast/tools/slrviewer



Previous Assessments

Over the past 20+ years:

- The USGCRP-led first National Assessment (2000)
- 21 USGCRP Synthesis and Assessment Products (2006-2009)
- USGCRP Global Climate Change Impacts Report/2nd National Assessment (2009)
- IPCC assessments (1995, 2001, 2007, next due in 2013)
- Ozone assessments (1994, 1998, 2002, 2006, 2010)
- State of the Climate Reports

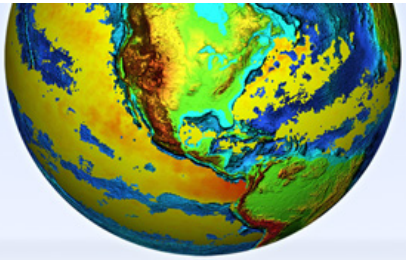


The Third National Climate Assessment

- New Approach - some outcomes from early community input:
  - Sustainable process/multiple products
  - Risk-based framework
  - Central coordination, multiple partners
  - Regional and sectoral networks

United States Global Change Research Program
National Climate Assessment

- Ways to Engage:
  - Attend Federal Advisory Committee Meetings (public, announced in Federal Register)
  - Let us know about existing meetings that we can attend and discuss the NCA
  - Sign-up for newsletter to keep abreast of workshops and strategy at: http://www.globalchange.gov/what-we-do/assessment



For More Information…

www.noaa.gov/climate

- Vision and Strategic Framework, Document, Q&As, climate handouts, links to background resources.

www.climate.gov

- NOAA's Climate Portal

www.globalchange.gov

- US Global Change Research Program