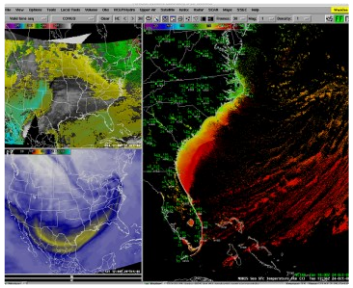
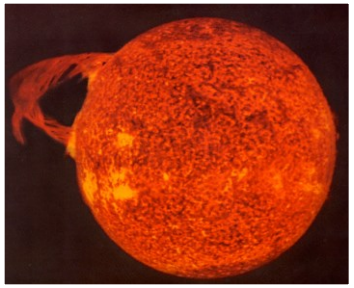
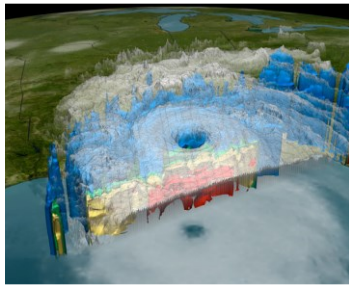
The National Weather Service: Western Region Perspective








Grant Cooper, PhD
Director, Western Region
NOAA National Weather Service

Improving Sub-Seasonal and Seasonal Precipitation Forecasting for Drought Preparedness Workshop, San Diego, CA

May 27-29, 2015

NWS Regions


Alaska Region HQ
Anchorage, Alaska
Western Region HQ
Salt Lake City, Utah
Central Region HQ
Kansas City, Missouri
Eastern Region HQ
Bohemia, New York
National Headquarters
Silver Spring, Maryland
Pacific Region HQ
Honolulu, Hawaii
Southern Region HQ
Fort Worth, Texas

National Weather Service

Our Mission

Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy

NOAA'S NATIONAL WEATHER SERVICE STRATEGIC PLAN:
Building a Weather-Ready Nation

www.weather.gov/com/stratplan

Let's Predict the Weather!

Start by solving these basic equations for the entire globe from the surface to the top of the atmosphere…out to how many days, weeks, months?

$$\frac{\partial u}{\partial t} = -u\frac{\partial u}{\partial x} - v\frac{\partial u}{\partial y} - w\frac{\partial u}{\partial z} + \frac{uv\tan\phi}{a} - \frac{uw}{a} - \frac{1}{\rho}\frac{\partial p}{\partial x} - 2\Omega(w\cos\phi - v\sin\phi) + F_x$$

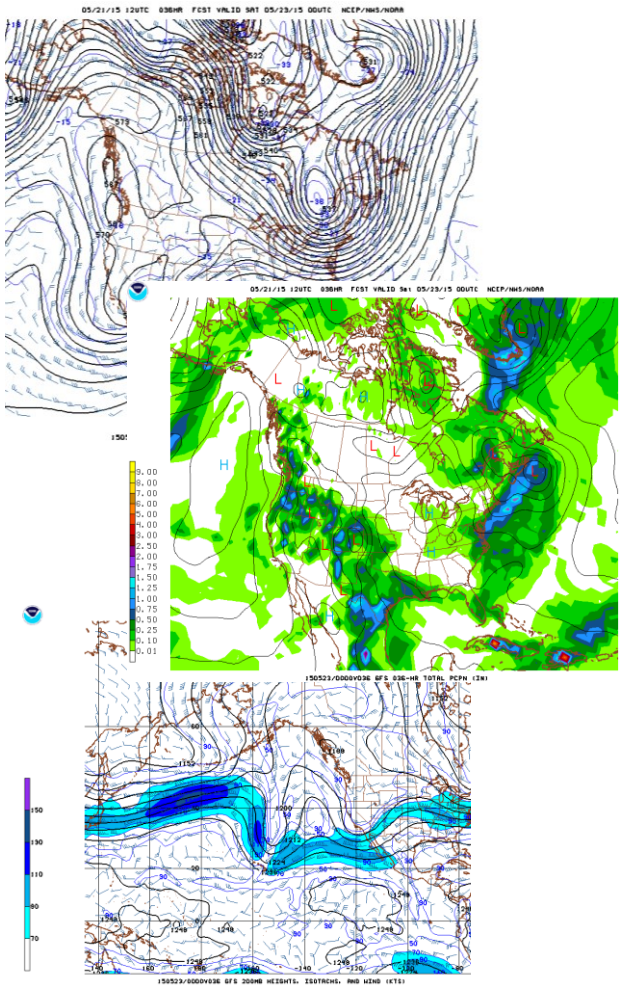
$$\frac{\partial v}{\partial t} = -u\frac{\partial v}{\partial x} - v\frac{\partial v}{\partial y} - w\frac{\partial v}{\partial z} - \frac{u^2\tan\phi}{a} - \frac{uw}{a} - \frac{1}{\rho}\frac{\partial p}{\partial y} - 2\Omega u\sin\phi + F_y$$

$$\frac{\partial w}{\partial t} = -u\frac{\partial w}{\partial x} - v\frac{\partial w}{\partial y} - w\frac{\partial w}{\partial z} - \frac{u^2+v^2}{a} - \frac{1}{\rho}\frac{\partial p}{\partial z} - 2\Omega u\cos\phi - g + F_z$$

$$\frac{\partial T}{\partial t} = -u\frac{\partial T}{\partial x} - v\frac{\partial T}{\partial y} - w\frac{\partial T}{\partial z} - w\gamma_d + \frac{Q}{c_p}$$

$$\frac{\partial \rho}{\partial t} = -u\frac{\partial \rho}{\partial x} - v\frac{\partial \rho}{\partial y} - w\frac{\partial \rho}{\partial z} - \rho\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}\right)$$

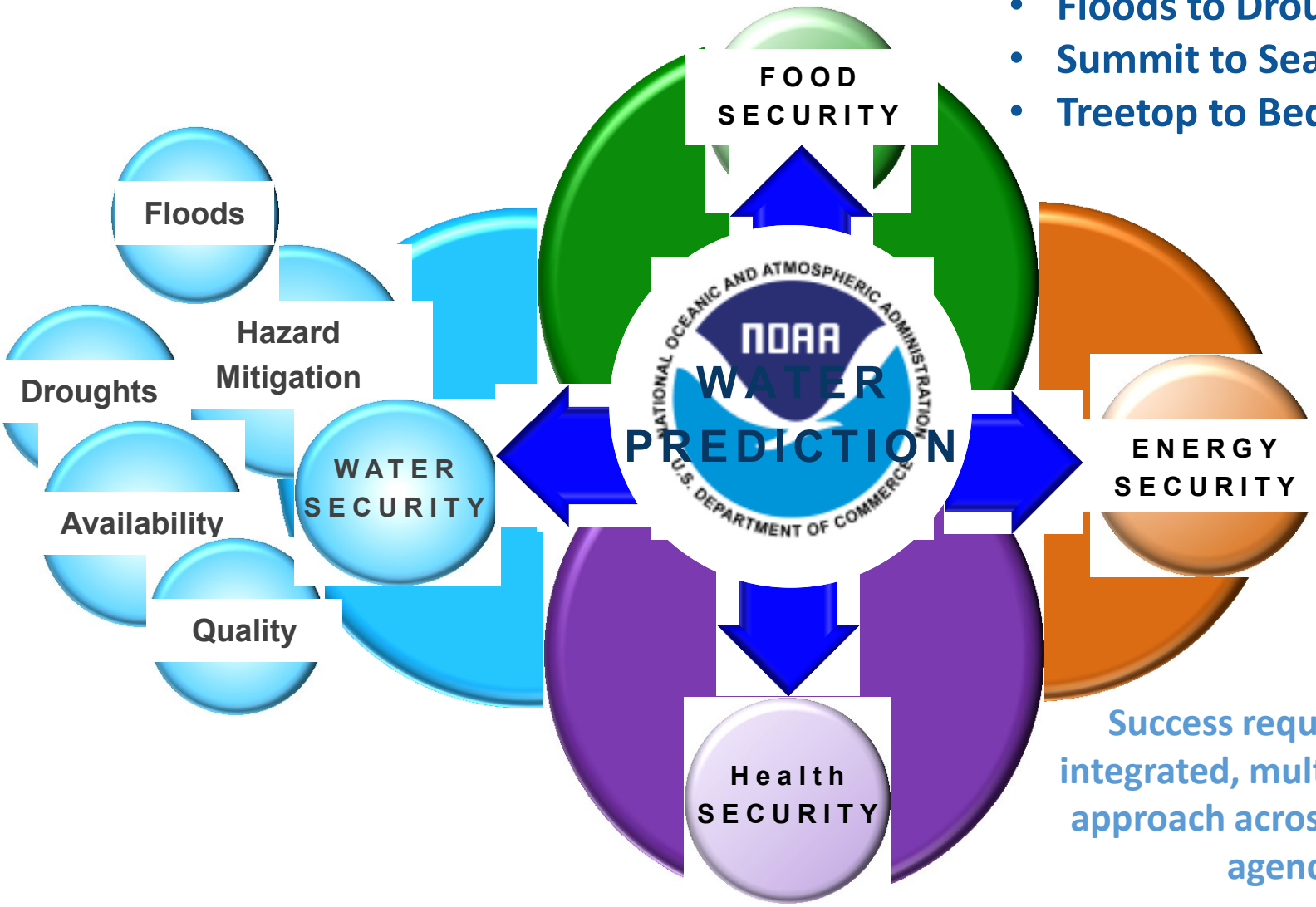
$$p = \rho RT$$



We do pretty well out to ~ 8 days

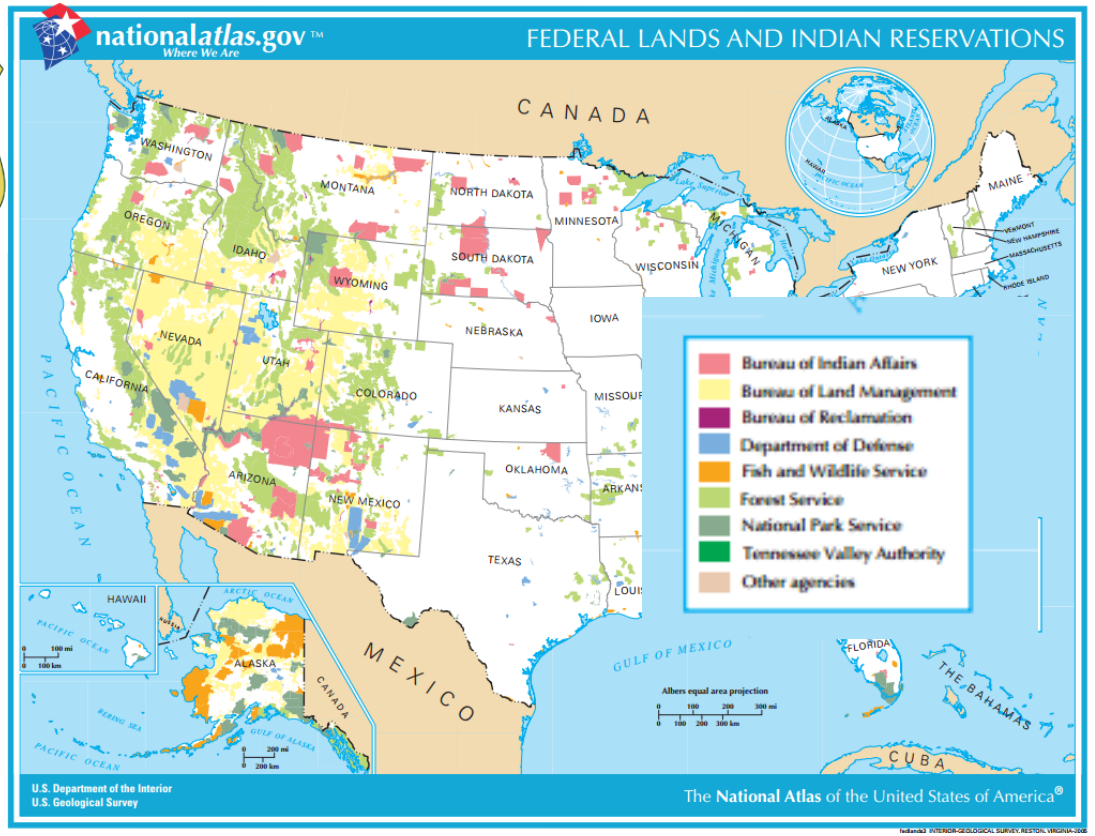
The Growing Importance of "Total Water Prediction"

- Floods to Droughts
- Summit to Sea
- Treetop to Bedrock



Success requires a fully integrated, multi-disciplinary approach across supporting agencies

NWS Partnerships in the West



U.S. FISH & WILDLIFE SERVICE

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

U.S. DEPARTMENT OF THE INTERIOR 1824 BUREAU OF INDIAN AFFAIRS

western states water council

UNITED STATES COAST GUARD 1790

NATIONAL PARK SERVICE

USGS science for a changing world

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

Caltrans CALIFORNIA DEPARTMENT OF TRANSPORTATION

UDOT udot.utah.gov

FEDERAL EMERGENCY MANAGEMENT AGENCY

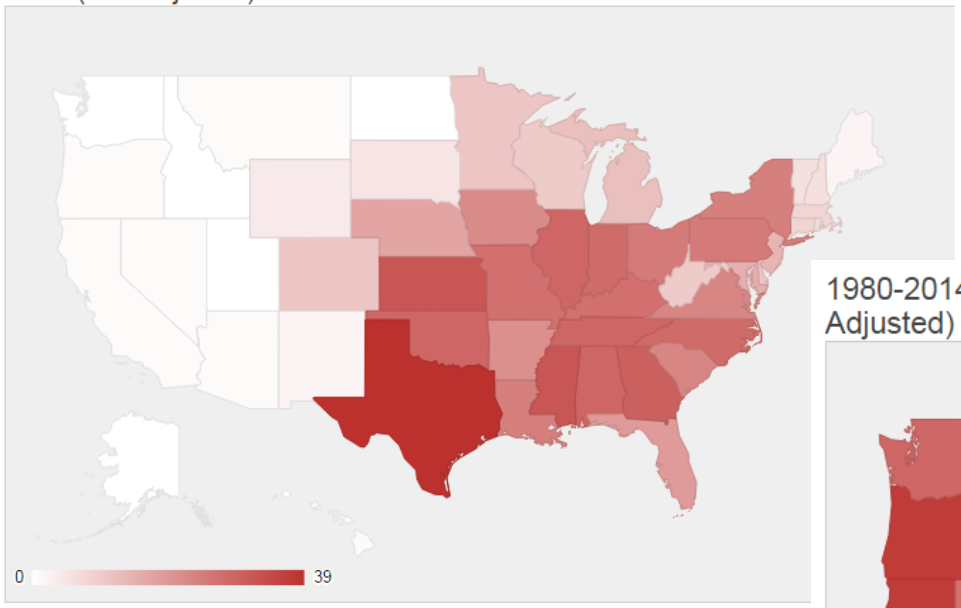
US Army Corps of Engineers®

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

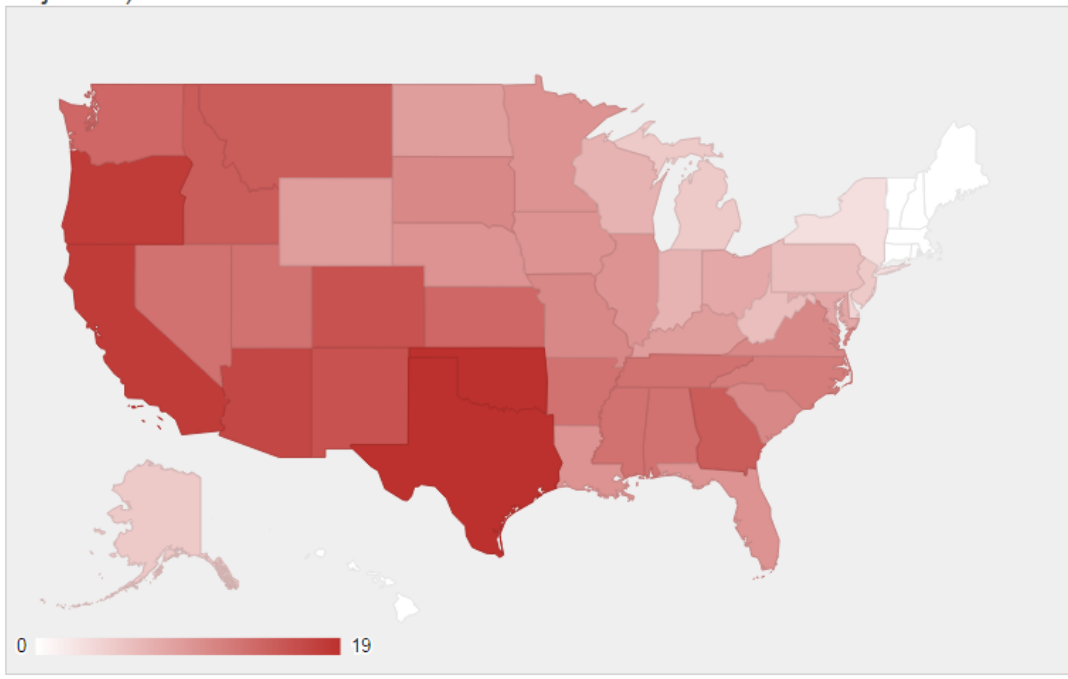
U.S. DEPARTMENT OF HOMELAND SECURITY

Weather Disasters by State

1980-2014 Billion-Dollar Severe Storm and Tropical Cyclone Disasters By State (CPI-Adjusted)



1980-2014 Billion-Dollar Drought and Wildfire Disasters By State (CPI-Adjusted)



Source: NCEI

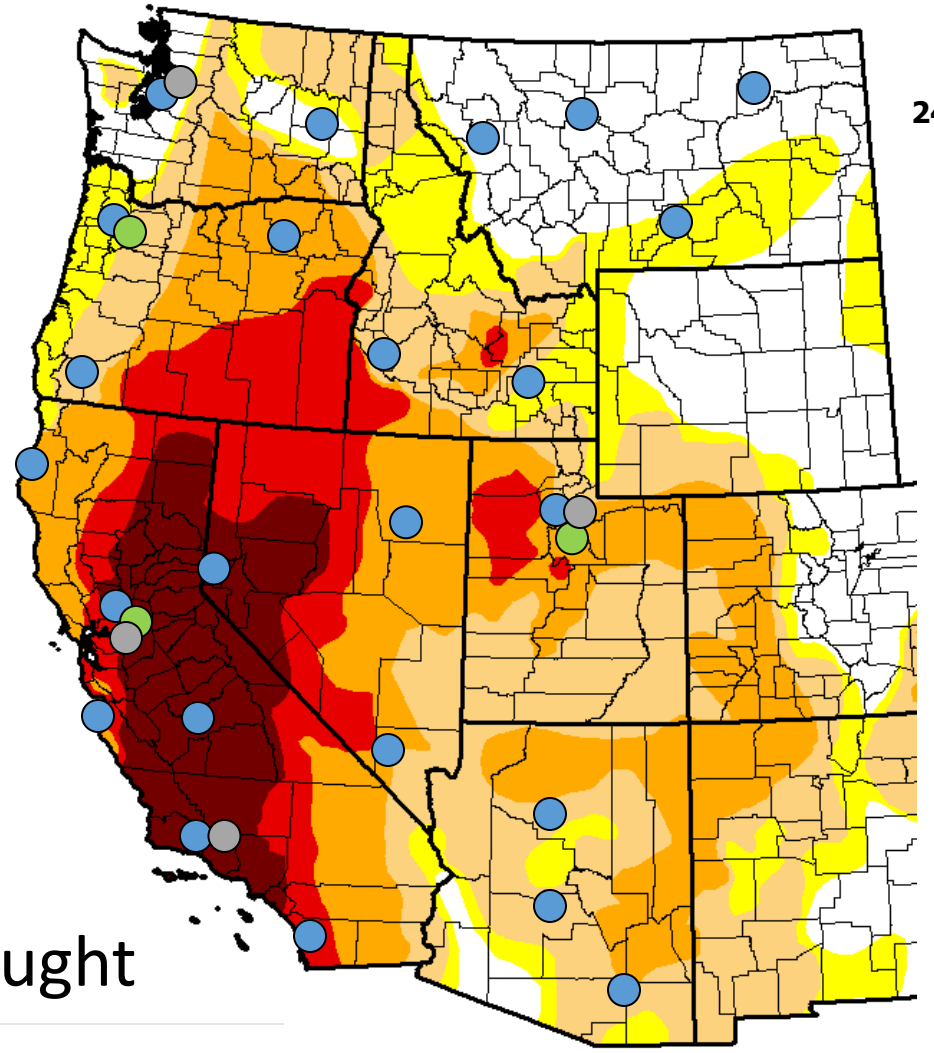
Unique Western Challenges

It's all about water in the West

- Too Much
  - Flash flooding
  - River flooding
  - Mudslides/debris flows
  - Winter storms

- Too Little
  - Water supply management
  - Drought
  - Wild fires
  - Dust storms
  - Heat

The West – It's Where We Live



SO DOES NWS!

24 Weather Forecast Offices

3 River Forecast Centers

4 Aviation Forecast Units

Western Drought

Intensity:

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

U.S. Drought Monitor (5 May 15)
www.droughtmonitor.unl.edu

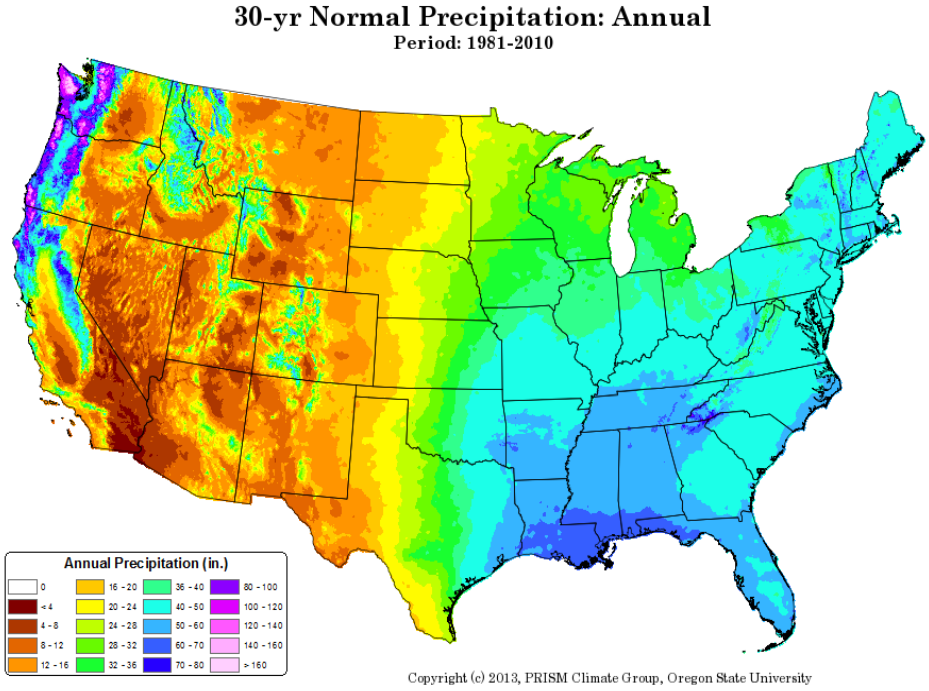
Western Water Resources

Context:

- Vast majority of water supply originates as snow in high elevation mountains
- Extensive water conveyance systems move water to farms and cities creates reliance on distant rather than local supplies

Challenges:

- Supply and demand curves crossing for major river systems in the semi-arid Southwest
- Multiple uses often in conflict particularly in Northwest
- Climate variability is large



Hydrology in the West

WFO-RFC Collaboration:

- River Floods
- Flash Floods
- Recreational

RFCs:

- Water Supply Forecasts
- Environmental (Peak) Flows

Challenges:

- Data scarcity
- Extremes (weather, climate, topography, etc...)
- Wide variety of hydrology

Partners

US Army Corps of Engineers

Department of Water Resources, State of California

NRCS Natural Resources Conservation Service

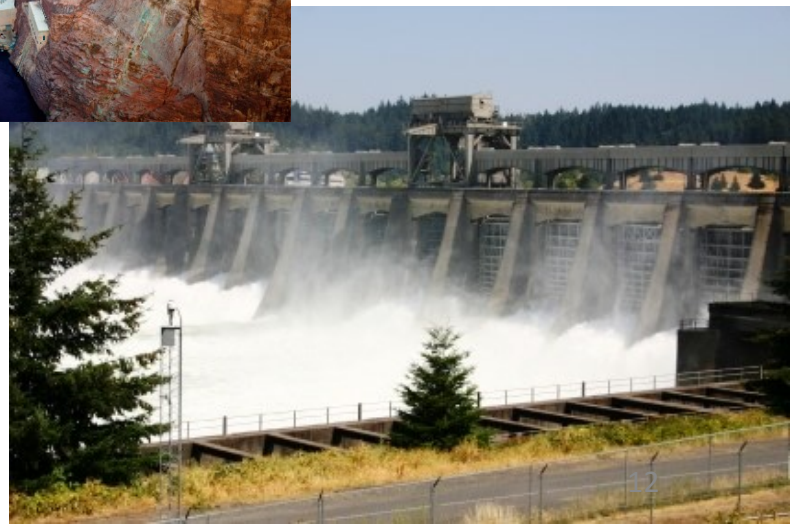
U.S. Department of the Interior, Bureau of Reclamation

USGS science for a changing world

RFCs and Water Supply Forecasts

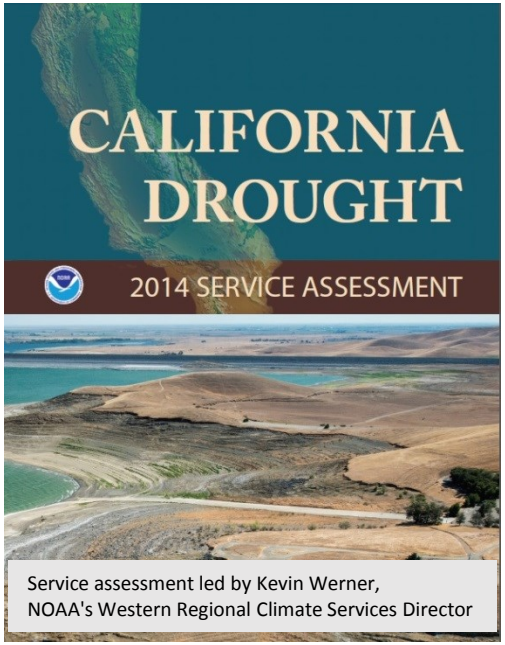
- Probabilistic volume forecast
- 3 Western Region RFCs
- Sophisticated Stakeholders
- Support billion dollar decisions every year
- Data dependent

USDA NRCS Natural Resources Conservation Service



CA Drought Assessment Top Findings

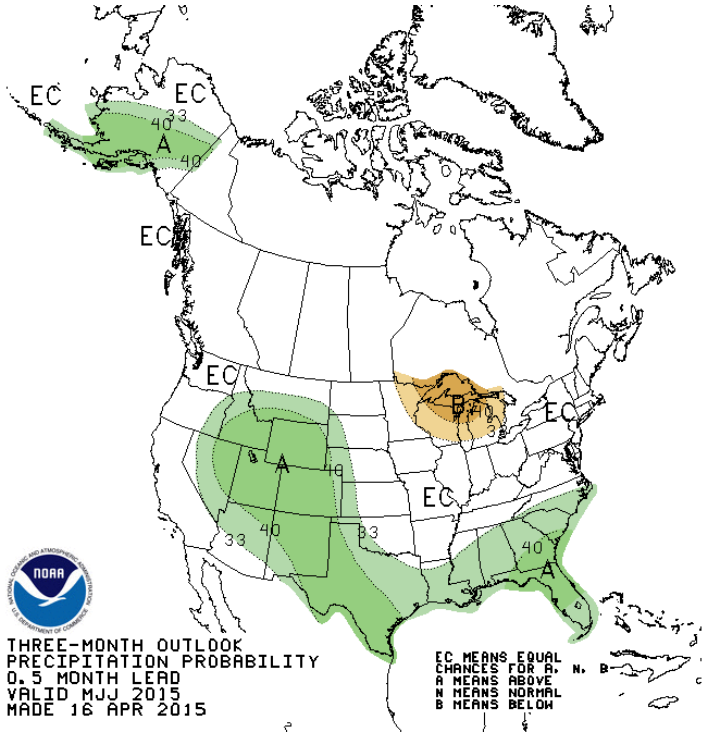
- Improve seasonal prediction
- Build "full natural flow" water resources modeling
- Enhance NOAA internal coordination of drought services
- Design environmental monitoring projects on sub-regional or watershed-specific scales



Service assessment led by Kevin Werner, NOAA's Western Regional Climate Services Director

Common Need: Seasonal Predictions

- Water resource managers and wildfire managers alike routinely plan on seasonal timescales often committing financial and physical resources months into the future.
- Requirements for seasonal forecasts have been regularly documented including:
  - Improvements to forecast skill
  - Watershed focused forecasts
  - Cool season precipitation



NWS Western Region Role

- Provide forecast decision support
  - Water resources are key stakeholders
- Document and prioritize requirements for new or improved services
- Facilitate advancements to priority stakeholder needs

Questions?

March 27, 2010

March 29, 2015

Images from MODIS on NASA's Aqua Satellite
www.earthobservatory.nasa.gov