

Water Year 2019 – Wet or Dry??



Improving Sub-seasonal to Seasonal Precipitation Forecasting
Jeanine Jones, Department of Water Resources

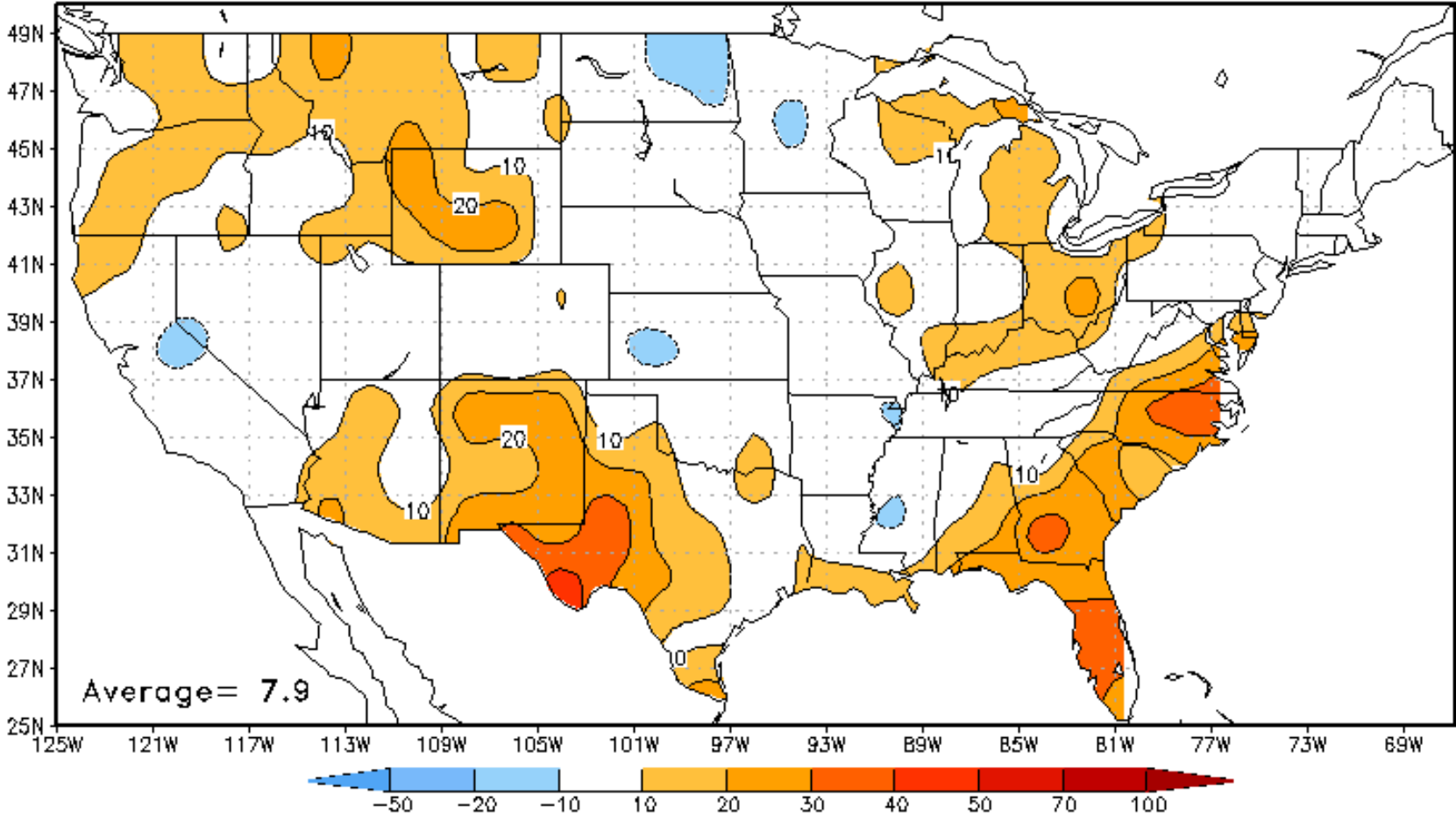
Winter Outlook Workshop 10th Anniversary!

- Began during 2007-09 drought as an outreach activity
- Focus on sub-seasonal in last few years
- Need to refocus on original purpose – seasonal precipitation

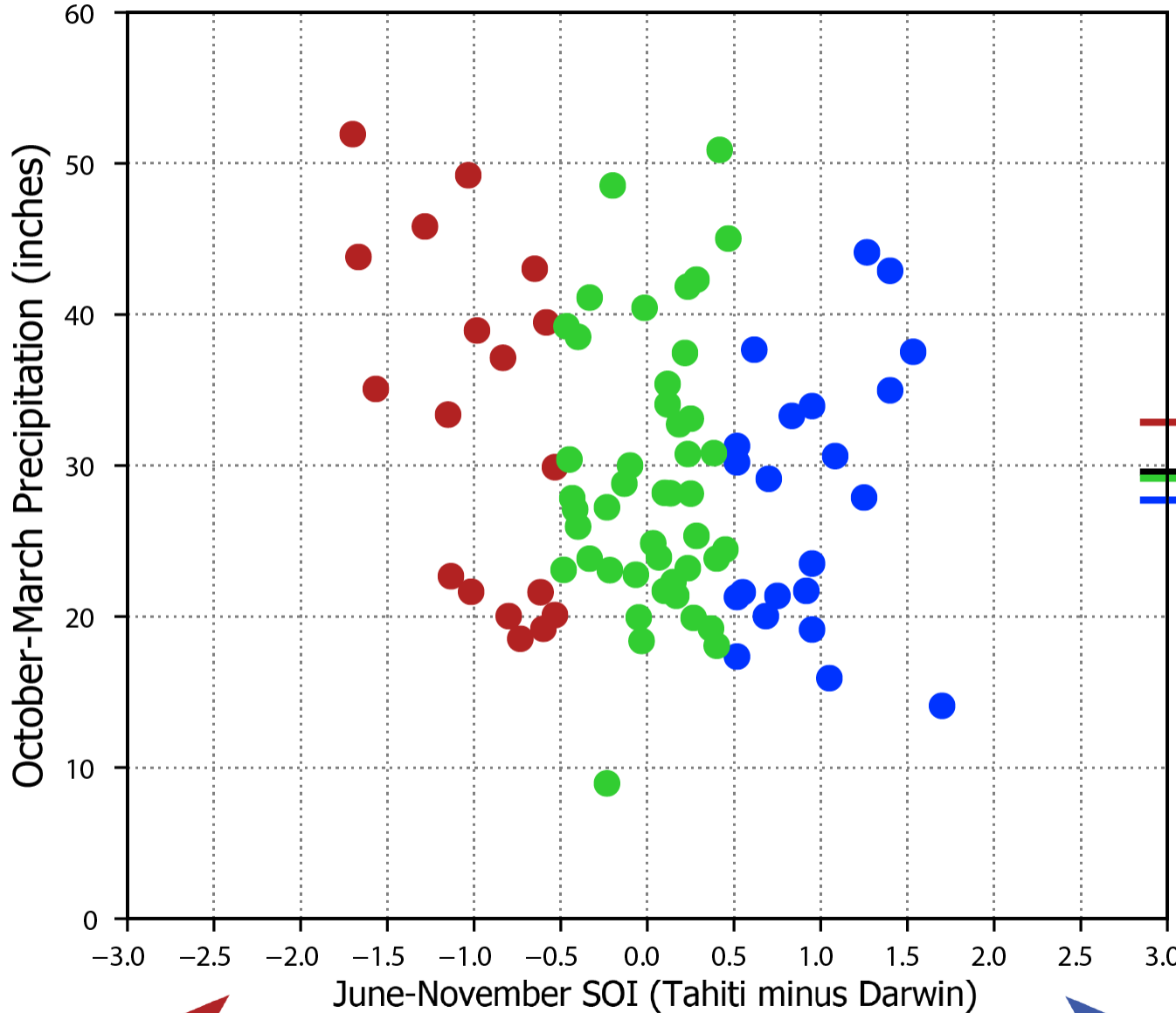


NOAA NWS Climate Prediction Center Skill Scores

Seasonal (Lead 0.5 Months) Precipitation Heidke Skill Score
DJF Manual Forecasts From 1995 to 2018



CA Division 2 October-March Precipitation (versus Southern Oscillation Index for prior year June-November)

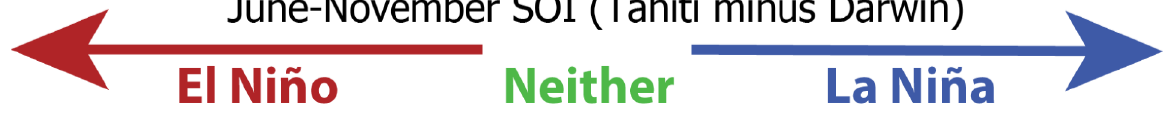


**Years 1933/1934 -
2017/2018**
 $r^2 = 0.04$
Correlation = -0.20

- Mean = 32.86 in**
- Mean all = 29.57 in**
- Mean = 29.16 in**
- Mean = 27.71 in**



Western Regional
Climate Center



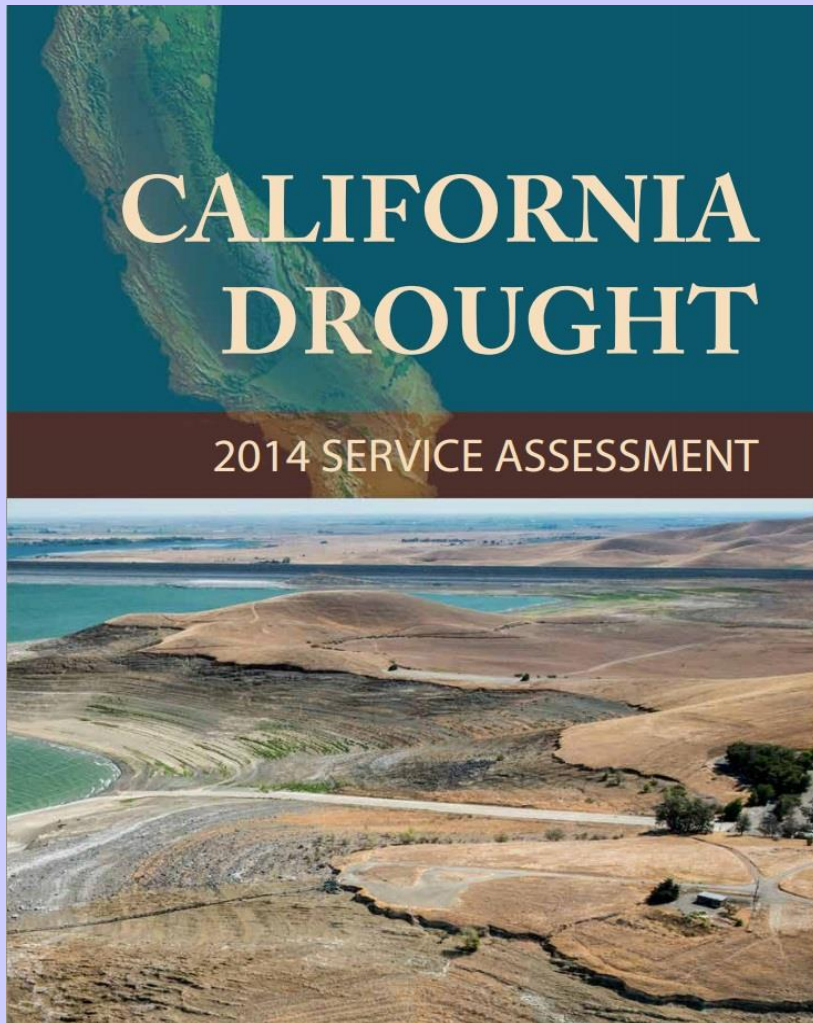
Excerpts from: *The 1976-1977 California Drought, A Review.* DWR, May 1978

There has been one serious problem in these forecasting techniques, and that is the lack of a proven system of long-range weather forecasting. The precipitation levels are never known until relatively late in each season, after the fact.

The procedure used by the NWS in these predictions is beyond the scope of this report, but is based upon predictions of airflow patterns in the atmosphere. The 30-day outlooks have been issued since 1947 but experience shows that success has been modest, with temperature forecasts enjoying more success than precipitation forecasts. Figure 28 is a com-

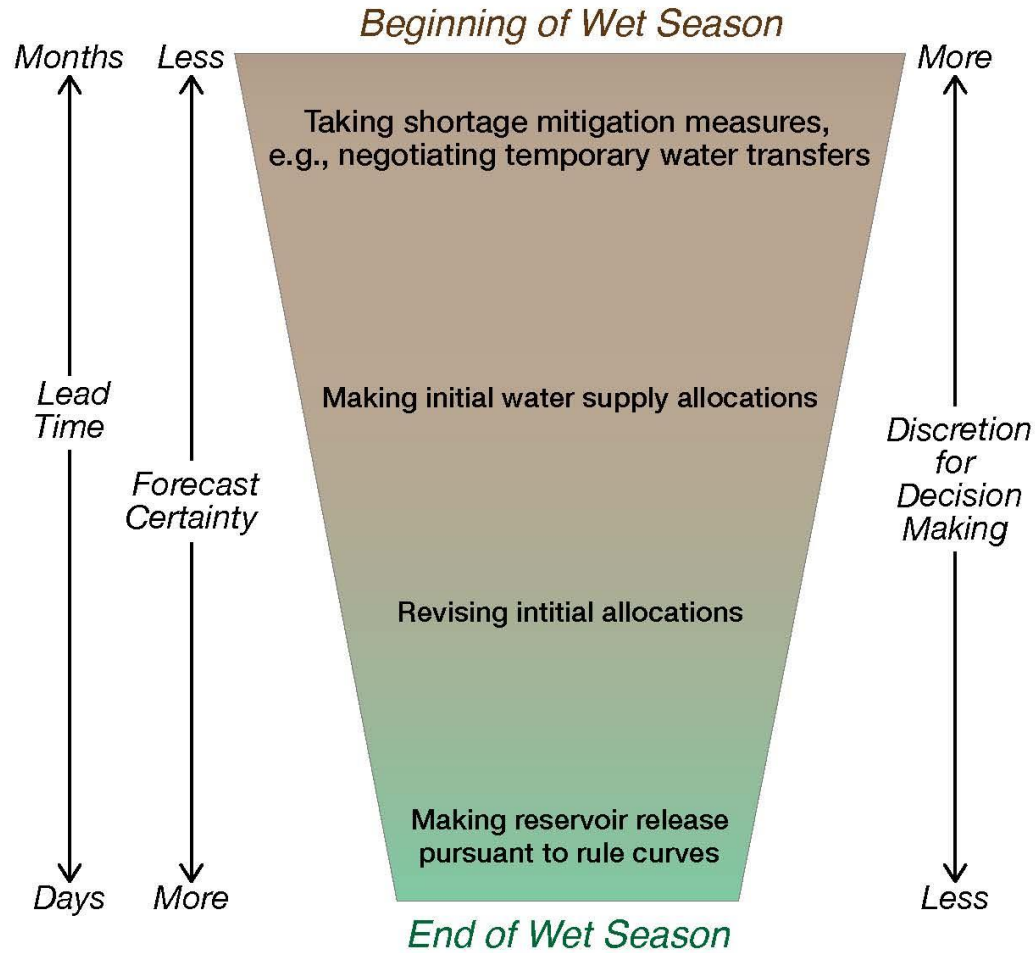
Although it would be desirable to develop additional skill in forecasting the weather a month hence, what is needed for operation and management of a complex water supply project is a long-term projection, at least a year in advance, with a high degree of reliability.

NOAA's California Drought Service Assessment



- **Goals:**
 - Understand drought impacted decisions
 - Assess NOAA's effectiveness in supporting those decisions
- **Methodology:**
 - 3 focus sectors (water resources, agriculture, fisheries)
 - 100+ interviews
 - 40+ reviewers
 - 400+ comments
- **Major Recommendations:**
 - Improve seasonal prediction for water resources
 - Develop full natural flow modeling and forecasting
 - Improve NOAA internal coordination

Seasonal Water Management Funnel



So Are We Back to Extended Dry Conditions?

- 2007-09 drought
- 2010 normal year
- 2011 wet year
- 2012-16 drought
- 2017 very wet
- 2018 dry



DWR Priorities

It's Nov 15th, what will the winter be like?

It's Jan 15th, what will the rest of the winter be like?

Lead Time Very Important for Water Management

- Public health & safety decisions
- Balancing risk/cost trade-offs
- Increasing water management efficiency
- Operating within legal & regulatory frameworks
- Reducing impacts of extreme events
- Responding to increased competition for resources

Will This Winter be Wet or Dry?

Example Seasonal Decisions

- Should we begin negotiating contracts for one-time sale of surplus wet-weather water? Can we set up a temporary groundwater banking program to take advantage of wet conditions?
- Do we need to seek additional drought response funding or raise water rates? Do we need to budget for enhanced water conservation activities?
- Should we make plans and adopt regulations for adopting a drought water bank?
- Should we intensify flood preparedness activities in vulnerable areas?

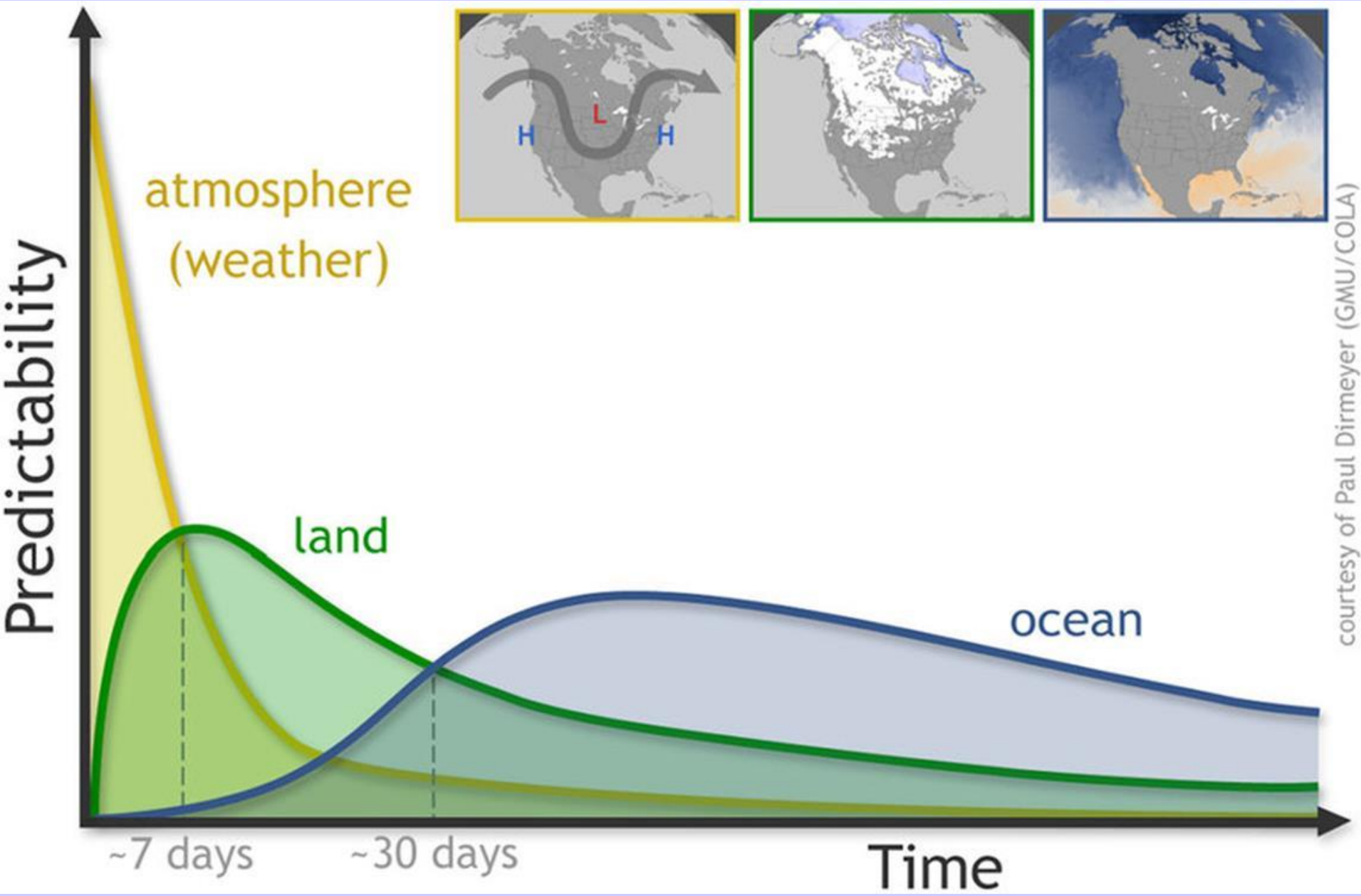
Will the Rest of This Winter be Wet or Dry?

Example Sub-Seasonal Decisions

- How much water will we be able to provide to our water users? When can we make the announcement?
- Will we hit hydrologic shortage triggers that require extraordinary conservation measures, or the need to negotiate contracts or adopt regulations?
- Is an elevated flood risk likely this spring? Should we pre-position resources?
- If the rest of this winter looks dry, can we use reservoir flood control space to store water for allocation to users (e.g., forecast-informed reservoir operations)?
- Will we have to curtail diversions on intensively used rivers? How early in the season?

DWR Drought Examples

- Mid-fiscal year budget revisions – legislation enacted in March, proposals due to DOF in December (ballpark of \$1B of drought emergency funds in each of WYs 2014 & 2015)
- 2007-09 dry year purchasing program (option based) – purchase requests due to DWR in November for March commitments
- Planning for emergency temporary Delta salinity barriers, 2014-15



courtesy of Paul Dirmeyer (GMU/COLA)

A PROCLAMATION OF A STATE OF EMERGENCY

WHEREAS the State of California is experiencing record dry conditions, with 2014 projected to become the driest year on record; and

WHEREAS the state's water supplies have dipped to alarming levels, indicated by: snowpack in California's mountains is approximately 20 percent of the normal average for this date; California's largest water reservoirs have very low water levels for this time of year; California's major river systems, including the Sacramento and San Joaquin rivers, have significantly reduced surface water flows; and groundwater levels throughout the state have dropped significantly; and

WHEREAS dry conditions and lack of precipitation present urgent problems: drinking water supplies are at risk in many California communities; fewer crops can be cultivated and farmers' long-term investments are put at risk; low-income communities heavily dependent on agricultural employment will suffer heightened unemployment and economic hardship; animals and plants that rely on California's rivers, including many species in danger of extinction, will be threatened; and the risk of wildfires across the state is greatly increased; and

WHEREAS extremely dry conditions have persisted since 2012 and may continue beyond this year and more regularly into the future, based on scientific projections regarding the impact of climate change on California's snowpack; and

WHEREAS the magnitude of the severe drought conditions presents threats beyond the control of the services, personnel, equipment and facilities of any single local government and require the combined forces of a mutual aid region or regions to combat; and

WHEREAS under the provisions of section 8558(b) of the California Government Code, I find that conditions of extreme peril to the safety of persons and property exist in California due to water shortage and drought conditions with which local authority is unable to cope.

NOW, THEREFORE, I, EDMUND G. BROWN JR., Governor of the State of California, in accordance with the authority vested in me by the state Constitution and statutes, including the California Emergency Services Act, and in particular, section 8625 of the California Government Code **HEREBY PROCLAIM A STATE OF EMERGENCY** to exist in the State of California due to current drought conditions.

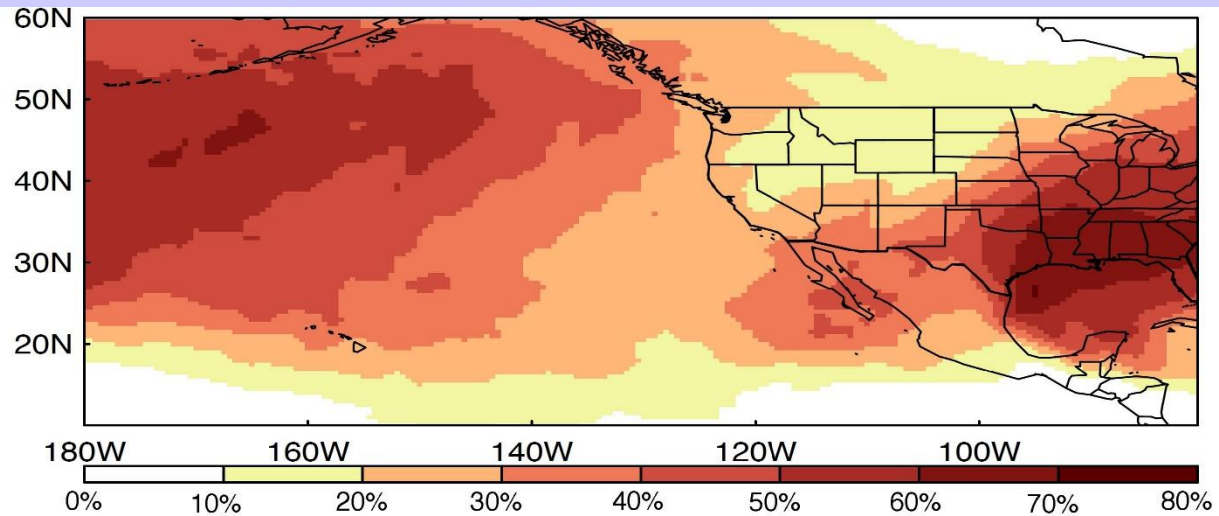
IT IS HEREBY ORDERED THAT:

17.The Department of Water Resources will refine its seasonal climate forecasting and drought prediction by advancing new methodologies piloted in 2013.

Initial Preliminary Experimental Research AR S2S Probability Forecasts

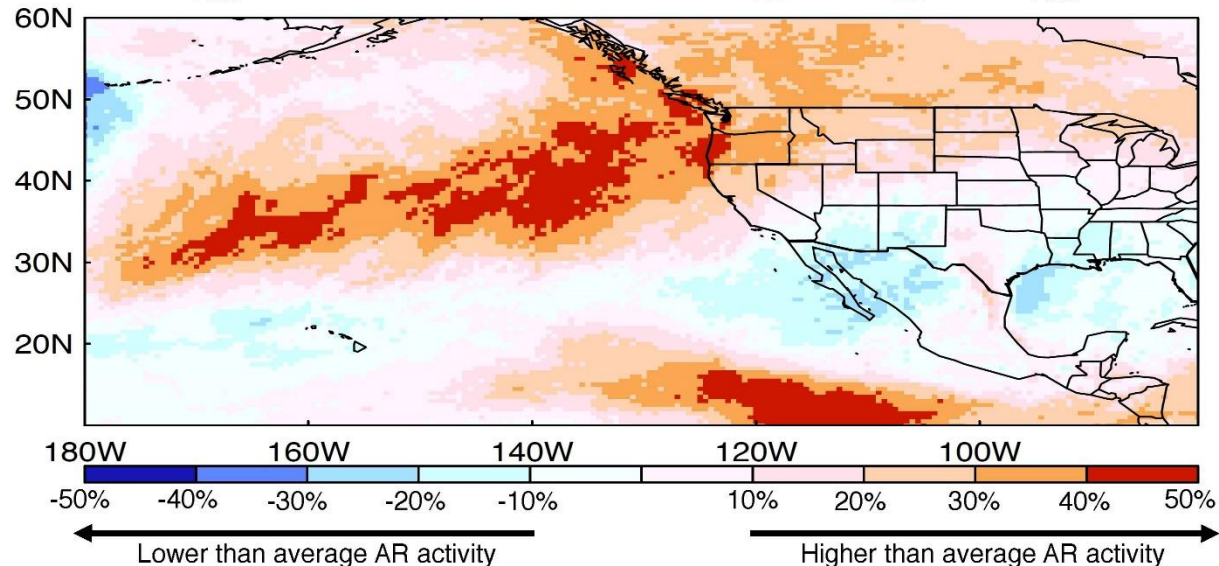
AR Occurrence Climatology

- Chance of an AR occurring sometime during a week-long period in mid-January
- Climatology based on all week-3 ECMWF forecasts from 1996-2015 for mid-January



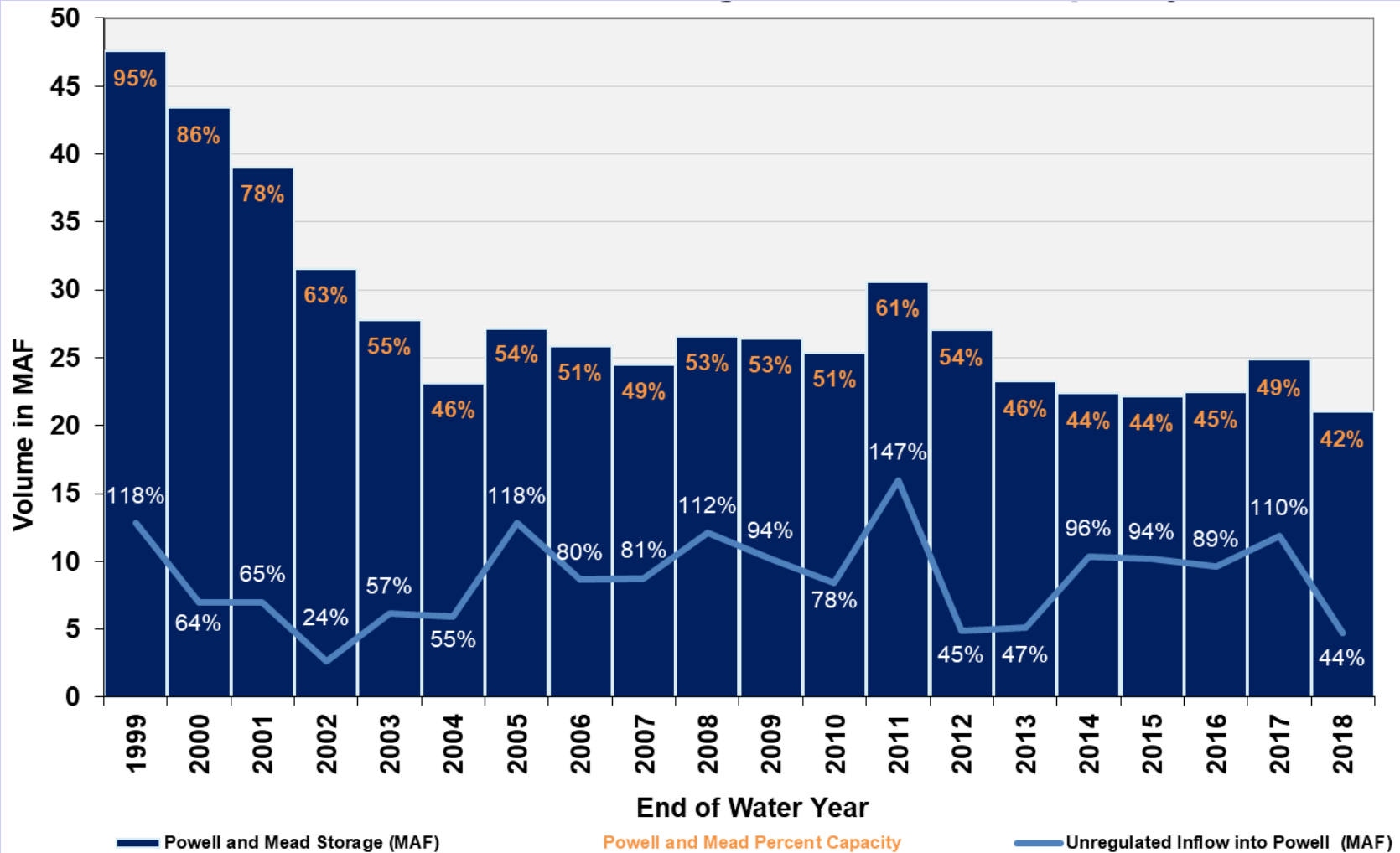
AR Occurrence Forecast Relative to Climatology

- Week 3 ECMWF forecast valid for Jan 16-22, 2018
- Values shown are forecast minus climatology (top)
- ECMWF ensemble forecast includes 51 members



Courtesy of D. Waliser et al.

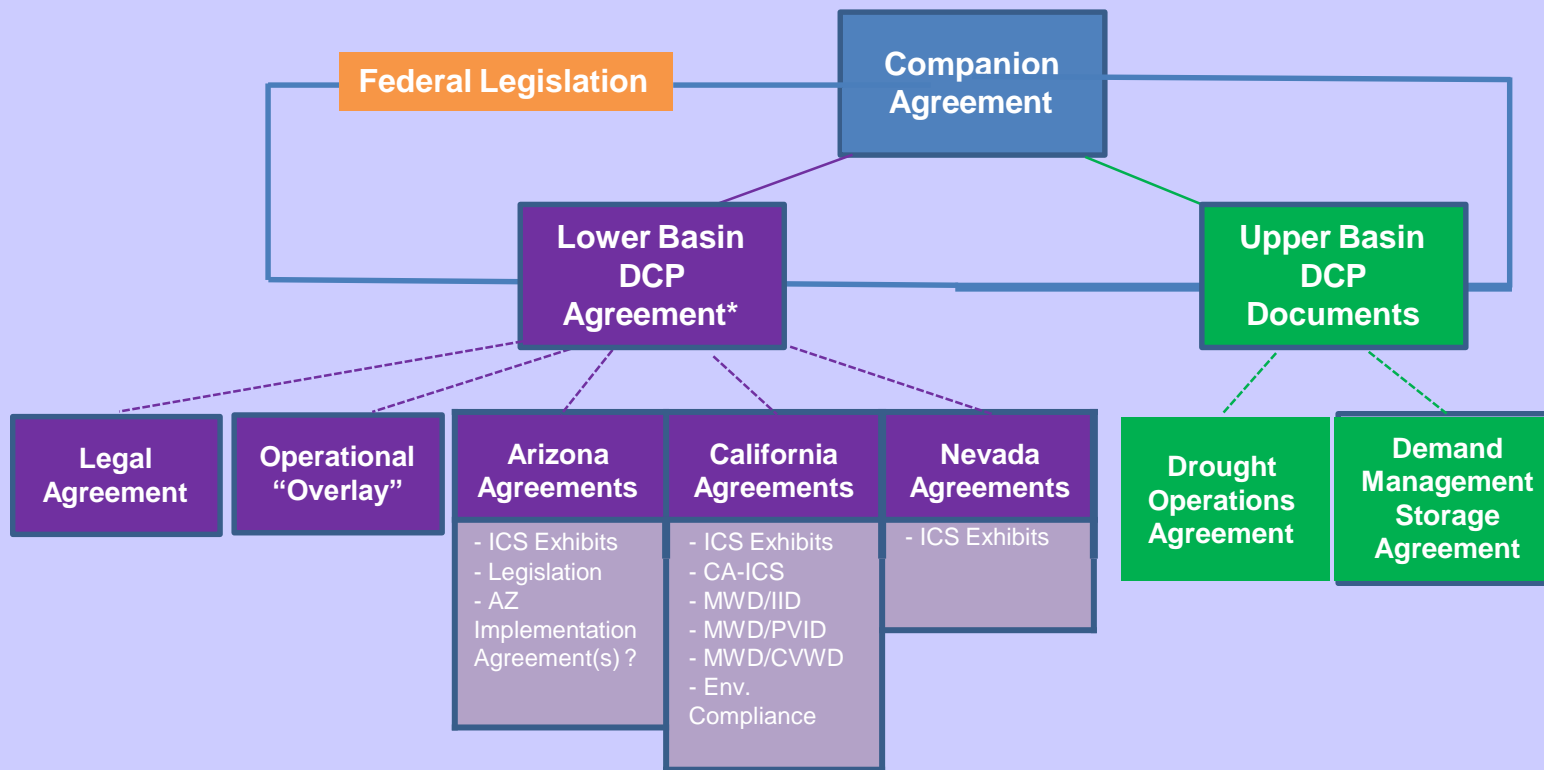
Lakes Powell & Mead Storage and Percent Capacity & Unregulated Inflow into Lake Powell



¹Values for Water Year 2018 are projected. Unregulated inflow is based on the latest CBRFC forecast dated September 17, 2018. Storage and percent capacity are based on the September 2018 24-Month Study.

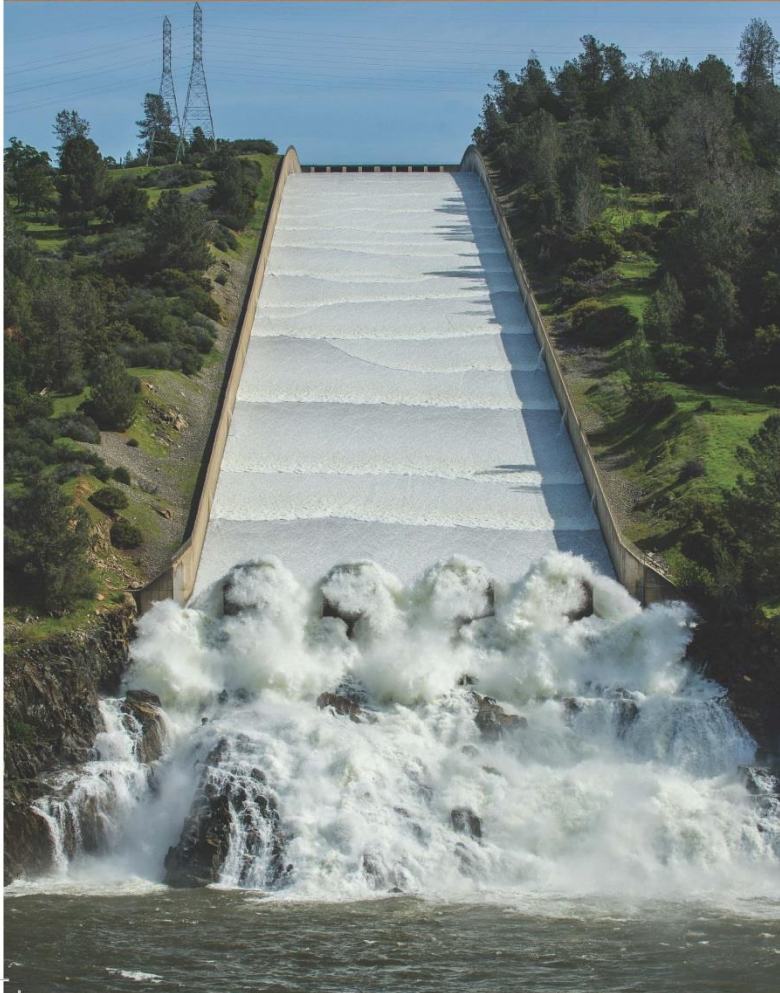
²Percentages on the light blue line represent percent of average unregulated inflow into Lake Powell for a given water year. The percent of average is based on the period of record from 1981-2010.

Colorado River Basin Drought Contingency Plan Documents and Agreements



*Activates Section IV of Minute 323 (Binational Water Scarcity Plan)

Improving
Sub-Seasonal to Seasonal
Precipitation Forecasting for
Water Management



WESTERN
STATES
WATER
COUNCIL