



# **CDWR Virtual Winter Outlook Workshop 2021**

**Jeanine Jones, California Department of Water Resources**

# Where We Are Now in California

- State emergency proclamations for drought issued in April, May, July, & Oct
- All 58 counties now covered by state proclamations
- All counties covered by USDA drought disaster designations



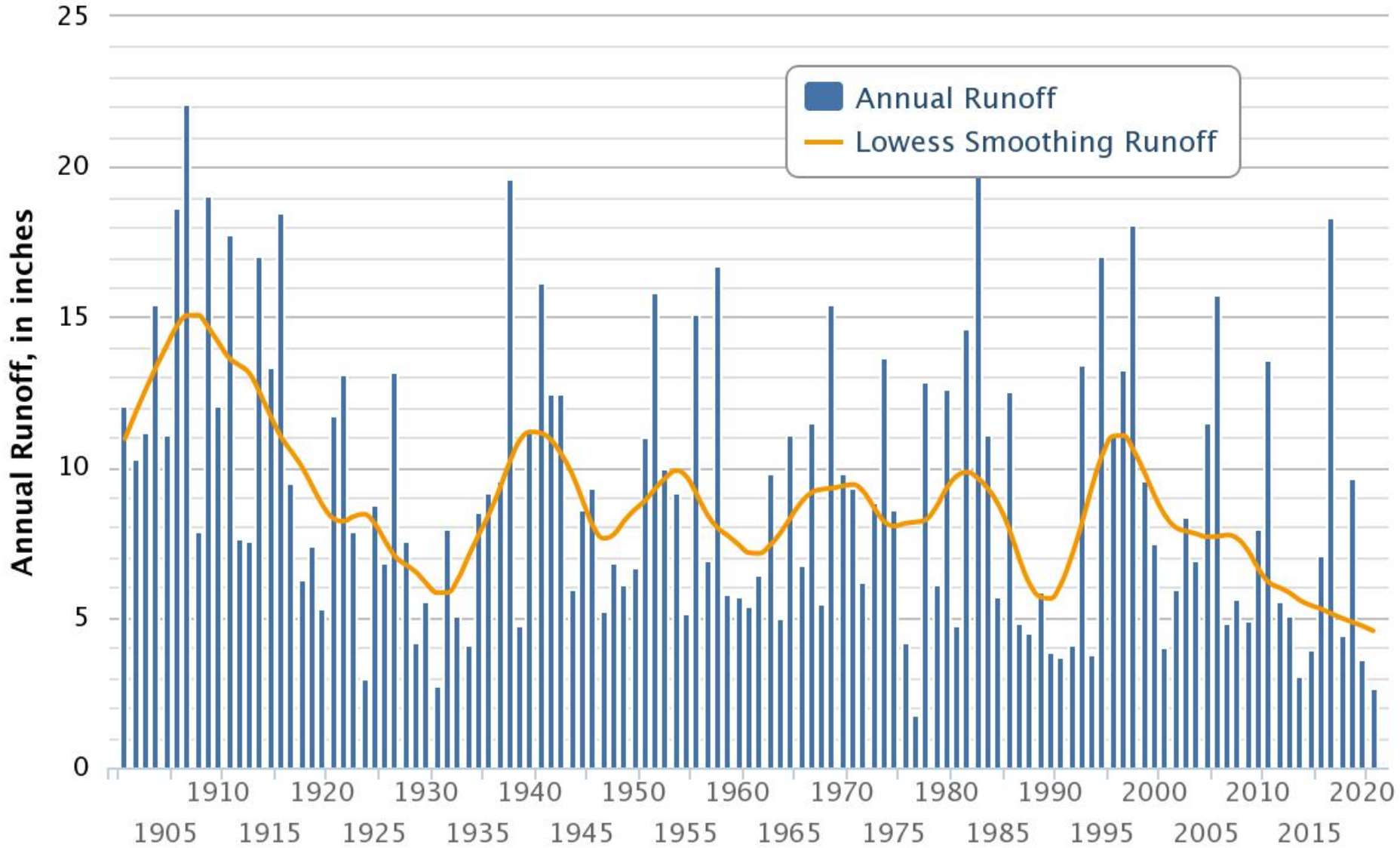
# Persistent & Extreme Drought

- WY 2021 2<sup>nd</sup> driest for statewide precipitation, after 1924
- WYs 2020 + 2021 are California's driest 2-year period for statewide precipitation, beating WYs 1976 + 1977



# USGS Statewide Runoff

## Annual California Runoff



# Bridging the Valley of Death

From multiple decades to days

Climate

Where the decisions happen

Weather



## Climate

Long-term  
planning

## Water Operations

Annual water allocations  
Water supply forecasts  
Water rights administration  
Water budgets  
Water transfers  
Water pricing  
Delivery schedules  
Water agency budgets  
Reservoir operations  
Recharge operations

## Weather

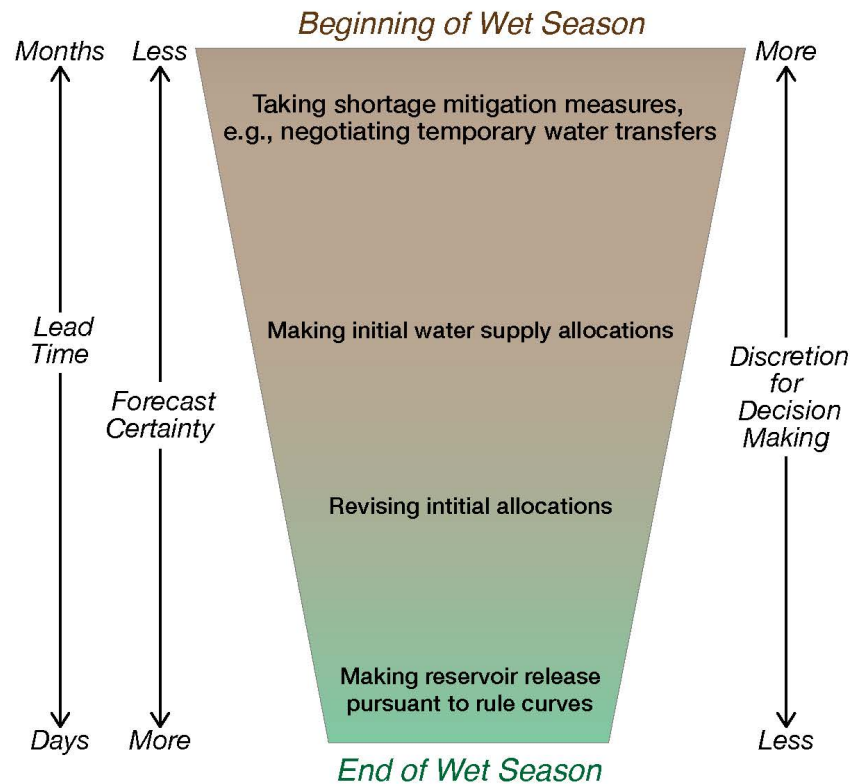
Reservoir operations  
Recharge operations  
Flood forecasts

# Key Need – Skillful S2S Precipitation Forecasts to Support Water Management

- *Although it would be desirable to develop additional skill in forecasting the weather a month hence, what is needed for operation & management of a complex water supply project is a long-term projection, at least a year in advance, with a high degree of reliability. (CDWR, 1978, review of 1976-77 Drought)*
- *The Panel recommends that DWR identify & seek funding for research in the areas of long-range weather forecasting...Improved long-range weather forecasting would be invaluable in operating federal, State, and local water projects...(Governor's Advisory Drought Planning Panel, 2000)*
- *Top findings include: Improve seasonal prediction. Numerous stakeholders commented on the need for a seasonal prediction capability focused on cool season mountain precipitation, both in California and in the Colorado River Basin. (NOAA, California Drought 2014 Service Assessment)*
- *Skillful sub-seasonal to seasonal (S2S) precipitation forecasting would be extremely useful in informing drought preparedness and response. CDWR, 2020, California's Most Significant Droughts)*

# Lead Time for Drought Preparedness & Response (& Water Management Generally)

## Seasonal Water Management Funnel





# Decision Support Opportunities

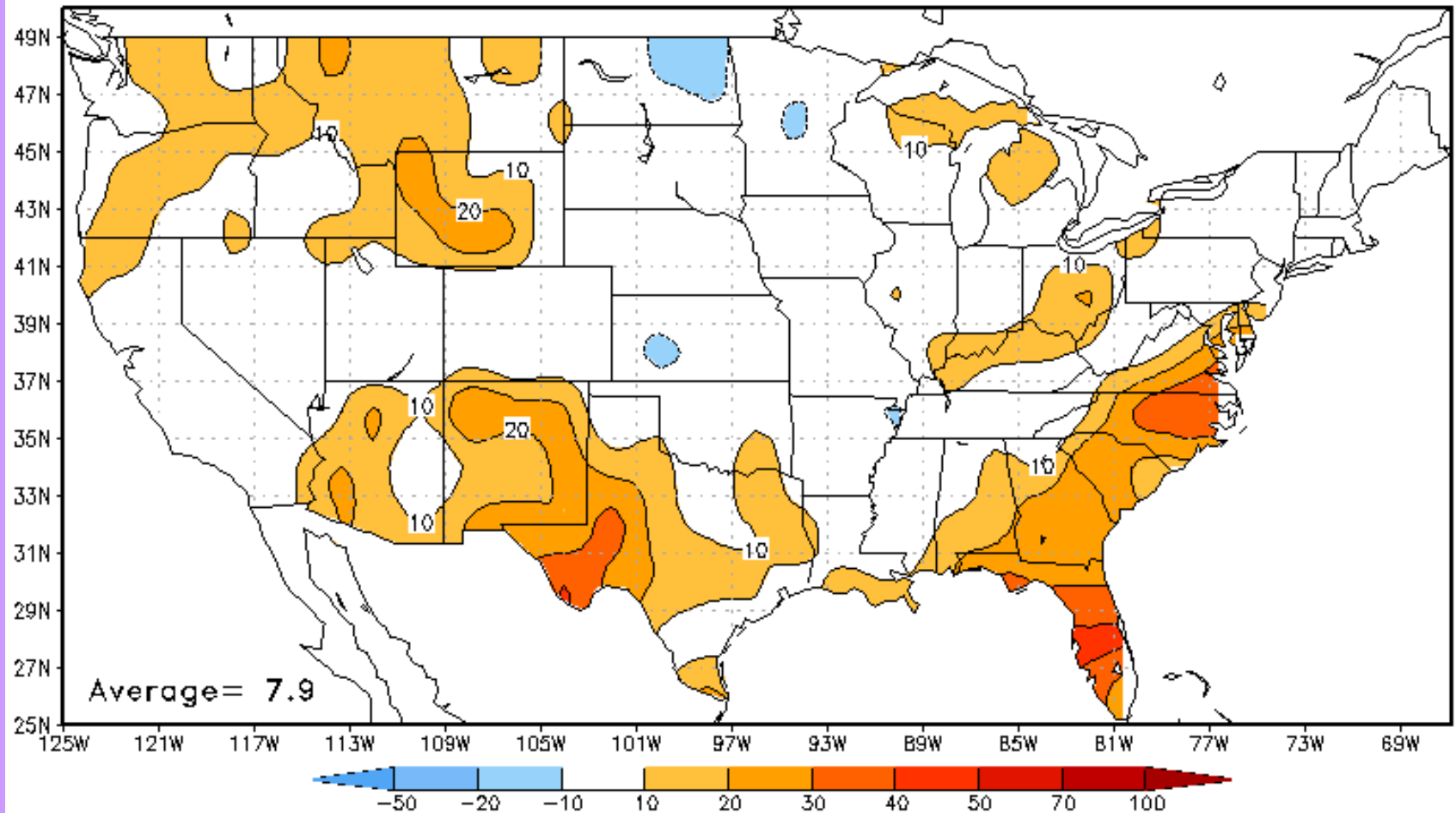
- Improve seasonal precipitation forecasts to support costly resource allocation and policy decisions
- Improve understanding of dynamics in the climate system during the (hopefully) wet season
- Improve sub-seasonal precipitation forecasting to encourage greater use of FIRO and FloodMAR

# Sub-seasonal to Seasonal (S2S) Precipitation Forecasting

- S2S forecasts extend from 2 weeks to 1-2 years
- Long recognized as major need for improving drought response
- Skill of operational NOAA National Weather Service outlooks is minimal
- DWR is funding experimental forecasts to catalyze NOAA research, & urging needed federal investment in NOAA model improvements

# Historical Skill of NOAA Seasonal Precipitation Outlooks

Seasonal (Lead 0.5 Months) Precipitation Heidke Skill Score  
DJF Manual Forecasts From 1995 to 2019





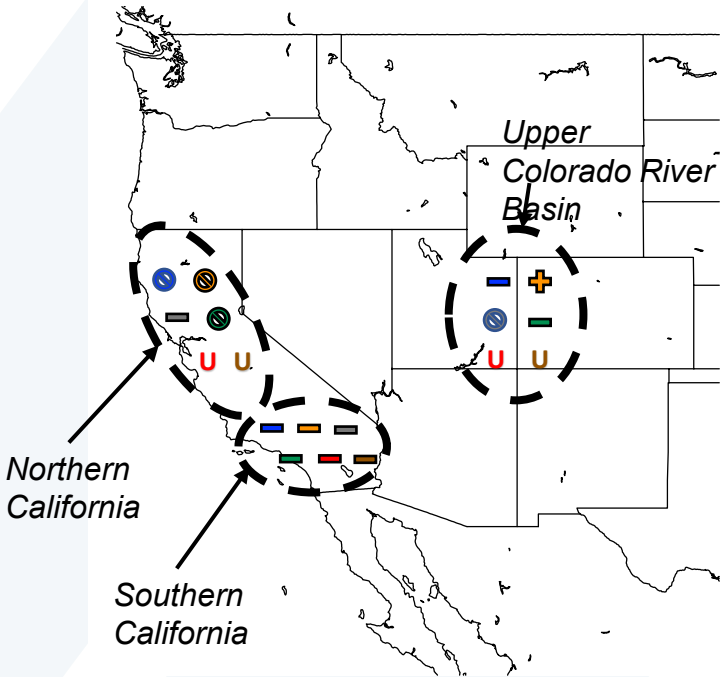
## REPORT TO CONGRESS

### SUBSEASONAL AND SEASONAL FORECASTING INNOVATION: PLANS FOR THE TWENTY-FIRST CENTURY

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*Developed pursuant to:  
Section 201 of the Weather Research and Forecasting Innovation Act of 2017,  
(Public Law 115-25)*

# Experimental Seasonal Precipitation Forecast for Winter 2021-22\*



Methods	Organization(s)	Nor Cal	So Cal	Upper Colo
Machine Learning based Forecast for Nov-Jan (Gibson et al.)	Jet Propulsion Laboratory California Institute of Technology Center for Western Weather and Water Extremes SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO			
Univ. of Arizona Hybrid Seasonal Forecast for Nov-Jan (Zeng et al.)				
Evolution-centric Statistical Forecast for Dec-Feb (Sengupta et al.)	Jet Propulsion Laboratory California Institute of Technology			
NOAA ESRL Seasonal Forecast (Switanek et al.)				
NMME Seasonal Forecast for Dec-Feb	The North American Multi-Model Ensemble			
NOAA CPC Seasonal Outlook for Nov-Jan*				



	Above Normal
	Below Normal
	Normal
	Uncertain/Equal Chances

Slide Credit: A. Sengupta, M. DeFlorio, D. Waliser

\* NOAA CPC Seasonal Outlook is the only Operational product

# Winter Outlook Workshop Agenda

- 1:00 **Opening Remarks**  
**Improving Seasonal Precipitation Forecasting**  
*Jeanine Jones, California Department Water Resources*
- 1:20 **Research Forecasts from NOAA's North American Multi-Model Ensemble**  
*Mike Anderson, California Department Water Resources*
- 1:40 **Experimental NOAA ESRL Forecast for DWR**  
*Matt Switanek, NOAA Earth Systems Research Laboratory*
- 2:10 **Experimental NASA JPL Contract Forecasts for DWR**  
*Duane Waliser, NASA Jet Propulsion Laboratory*
- **Machine Learning Forecast**
    - *Mike DeFlorio, University of California, San Diego, Scripps Institution of Oceanography*
  - **Forecast with Precipitation, Temperature, and Snowpack**
    - *Xubin Zeng, University of Arizona*
  - **Evolution-Centric Statistical Forecast**
    - *Agniv Sengutpa, NASA Jet Propulsion Laboratory*
- 3:40 **Ongoing Research with Climate Diagnostics**  
*Gudrun Magnusdottir, University of California, Irvine*
- 4:10 **Runoff Efficiency with USGS Basin Characterization Model**  
*Lorraine Flint, Earth Knowledge, Inc.*
- 4:40 **Q&A Discussion**
- 5:00 **Adjourn**

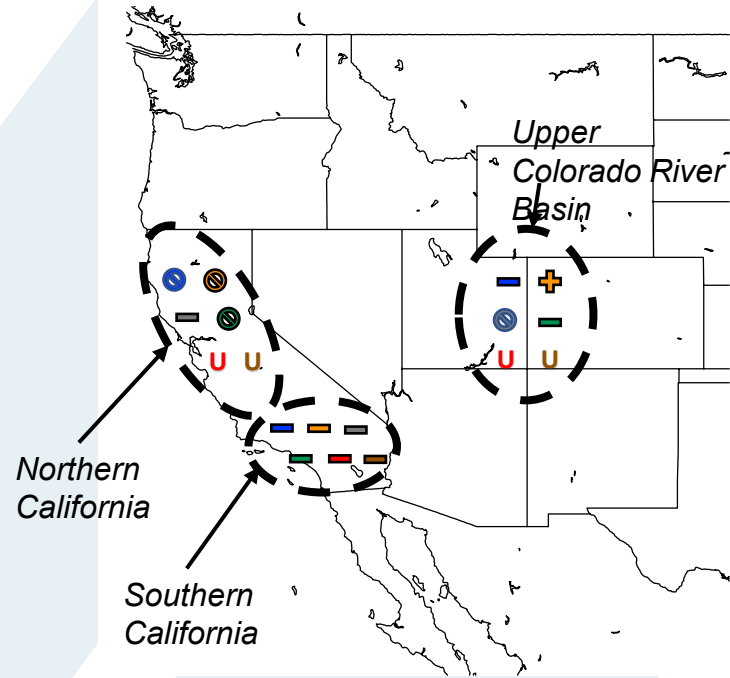
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Improving  
Sub-Seasonal to Seasonal  
Precipitation Forecasting for  
Water Management



WESTERN  
STATES  
WATER  
COUNCIL

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Evolution-centric Statistical Forecast for Dec-Feb (Sengupta et al.)	Jet Propulsion Laboratory California Institute of Technology	⊖	⊖	⊖
NOAA ESRL Seasonal Forecast (Switanek et al.)		⊖	⊖	⊖
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