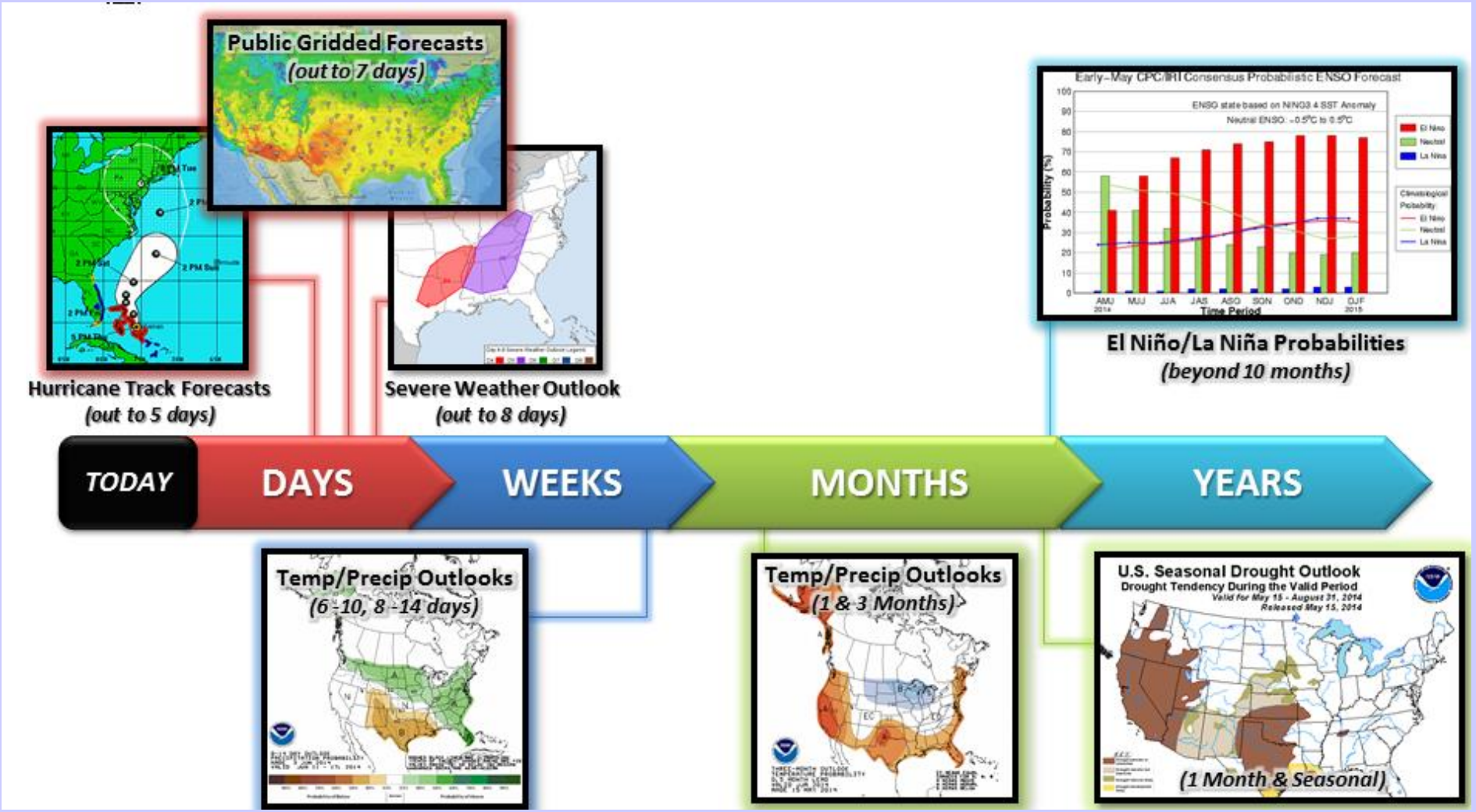
S2S Precipitation Forecasting

Jeanine Jones, California Department of Water Resources

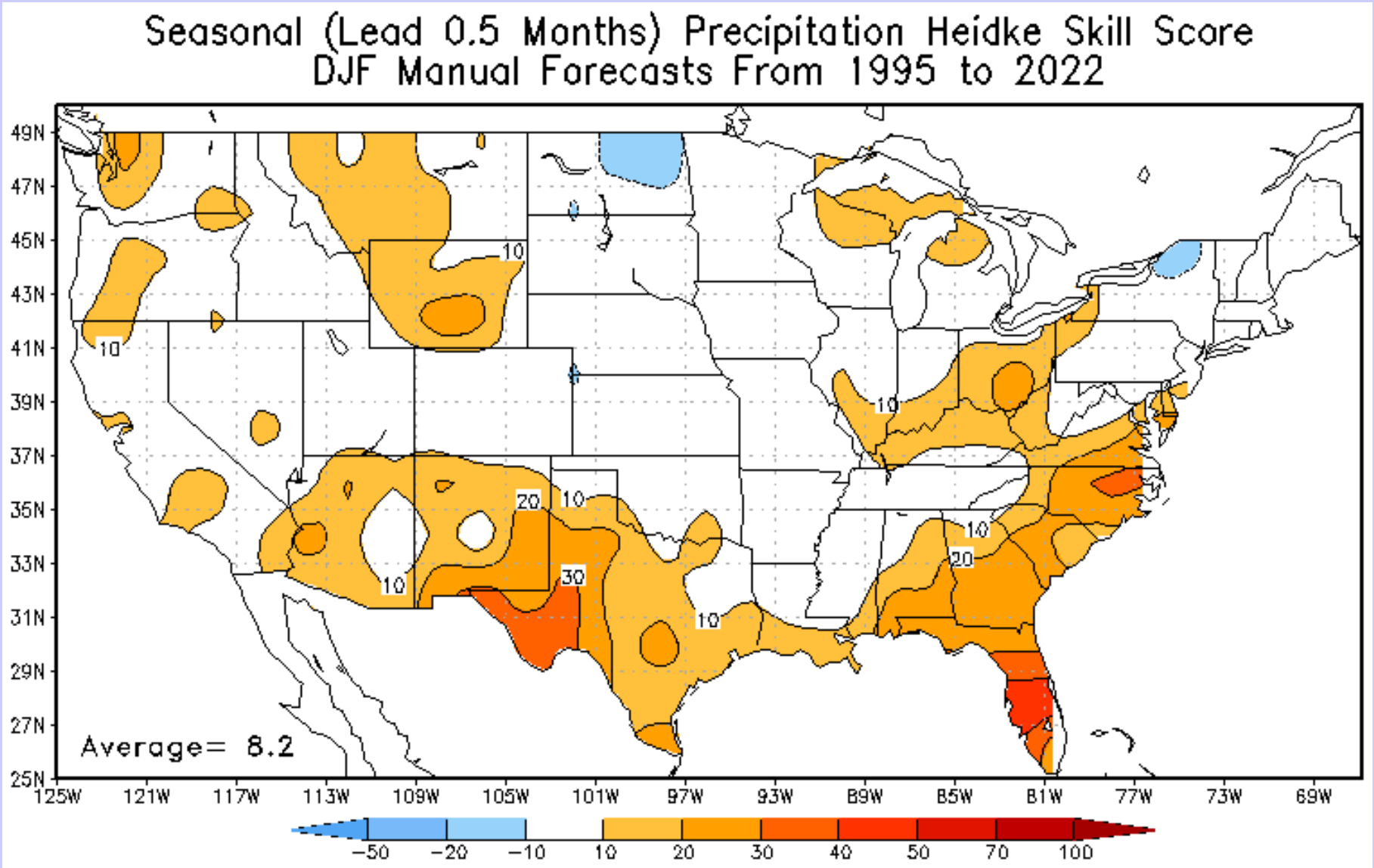
Life Beyond a Weather Forecast: Sub-Seasonal to Seasonal (S2S) Precipitation Forecasting

- Operational weather models – typically 2 weeks out (higher skill in first week)
- Sub-seasonal – 2 weeks to about 60 days
- Seasonal – up to 12-24 months

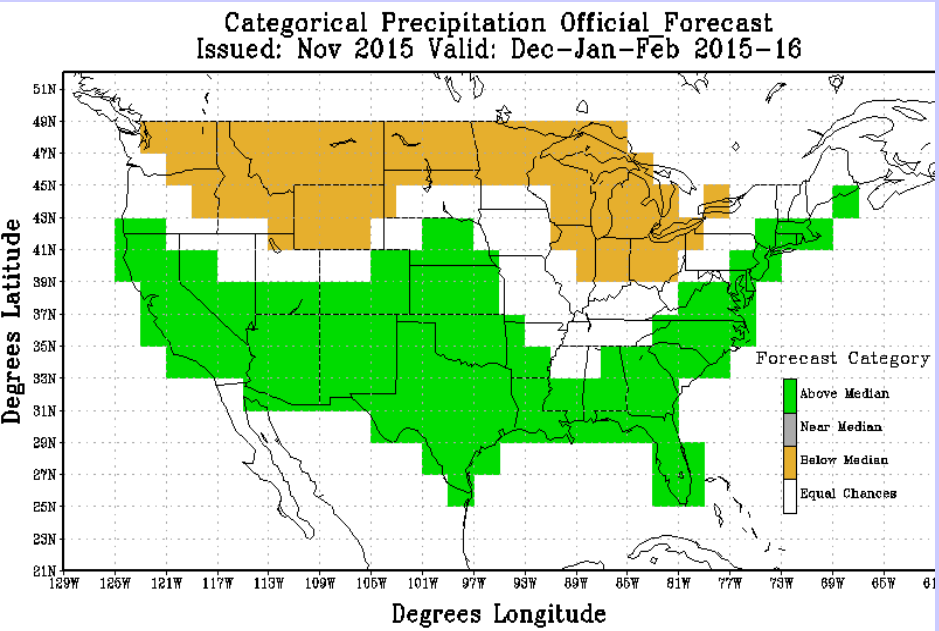
NOAA National Weather Service Products

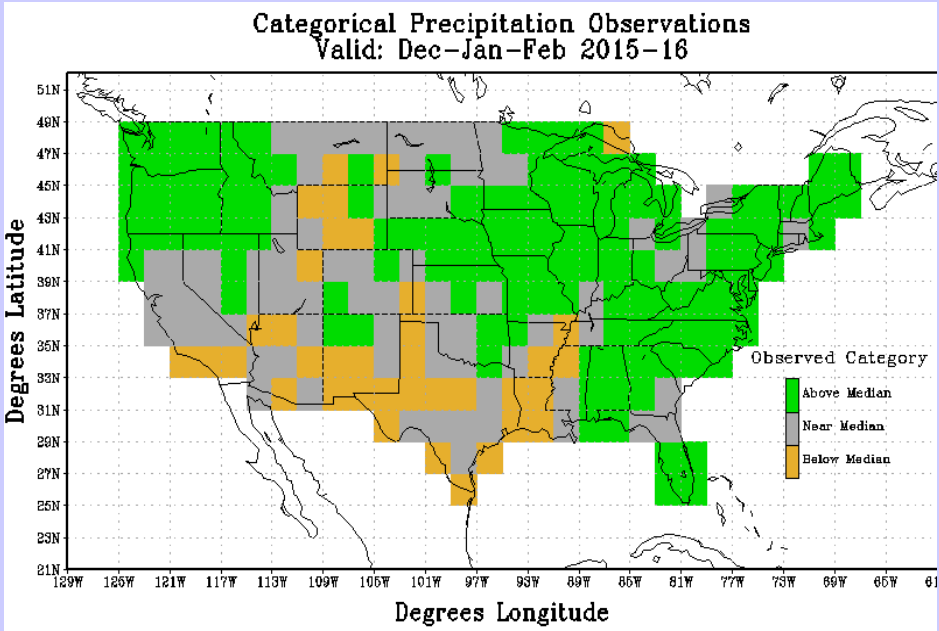


Historical Skill of NOAA Seasonal Outlooks – Not Usable for Water Management



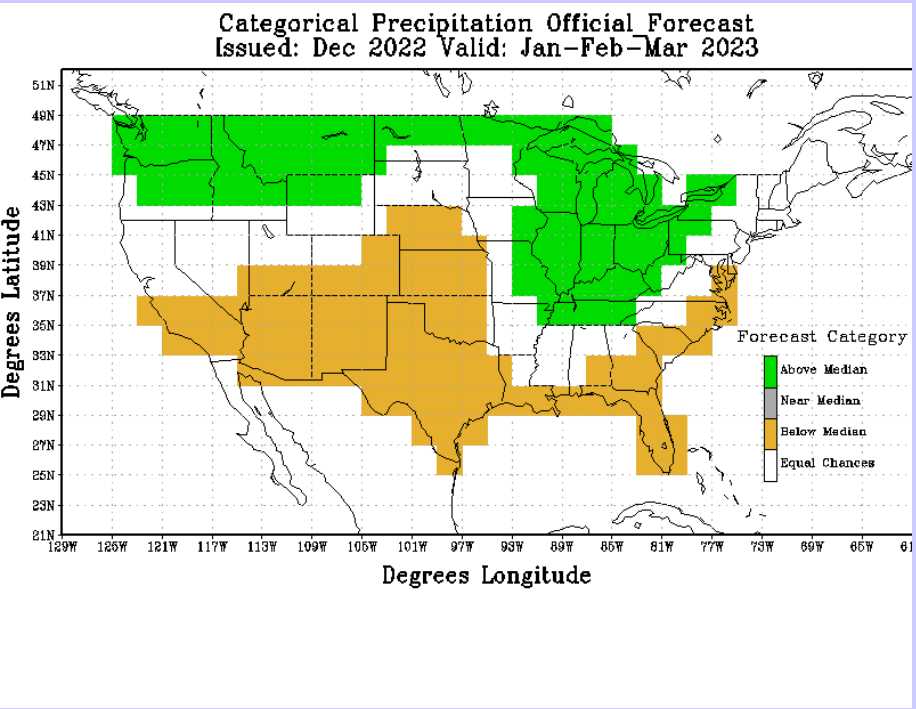
Water Year 2016 (Year 5 of California's Prior Drought)

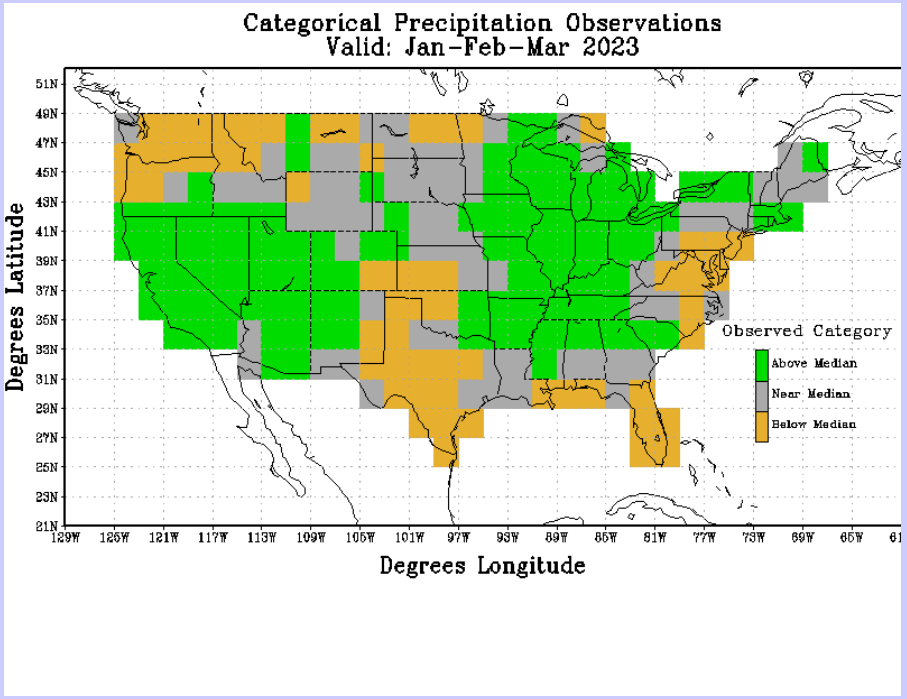




Remember the Godzilla El Niño?

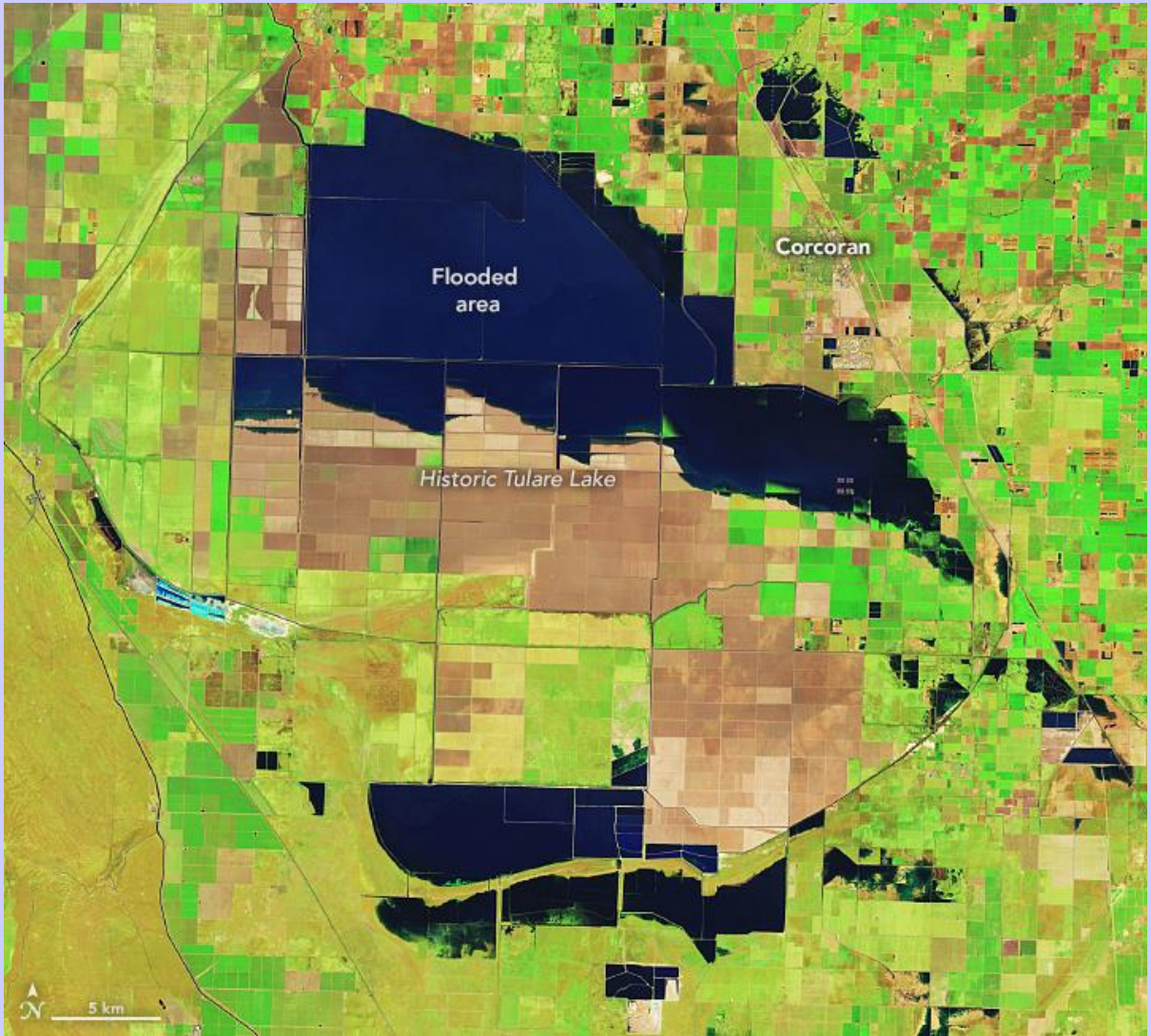
Water Year 2023 – Weather Whiplash, From Extreme Drought to Flood





California’s Famine to Flood

Tulare Lakebed Flooding, 600TAF +/-



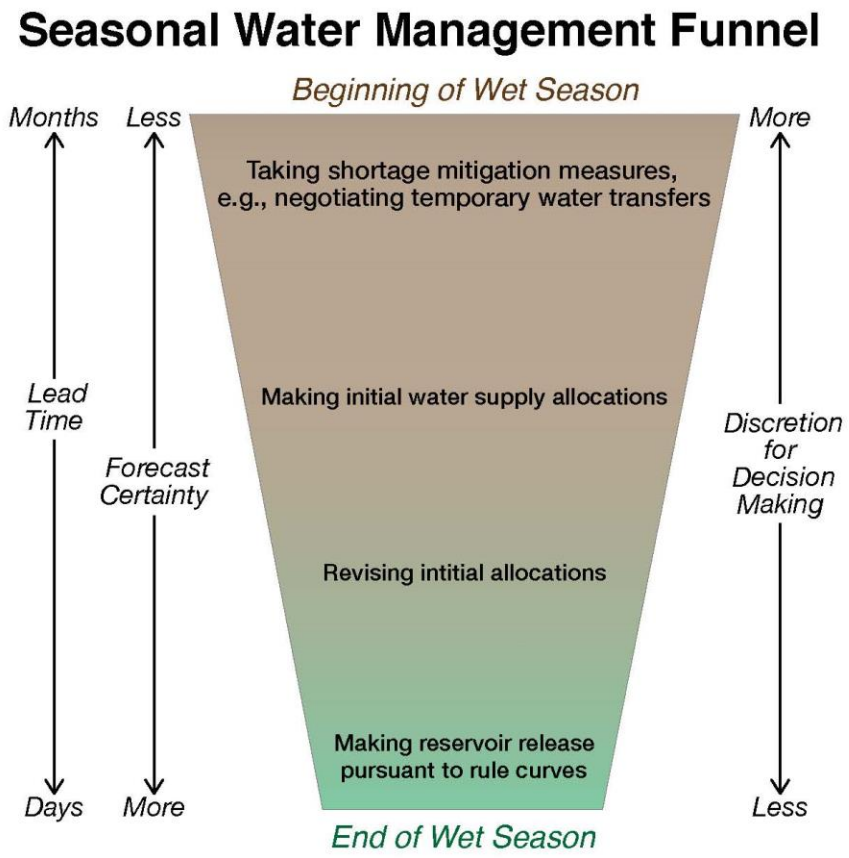
S2S Forecasting Challenges

- Difficult science problem
- Historically minimal federal research funding in comparison to weather and climate time scales
- Community of academic researchers is small (because no research funding)
- Not a NOAA priority (it's a western water problem)

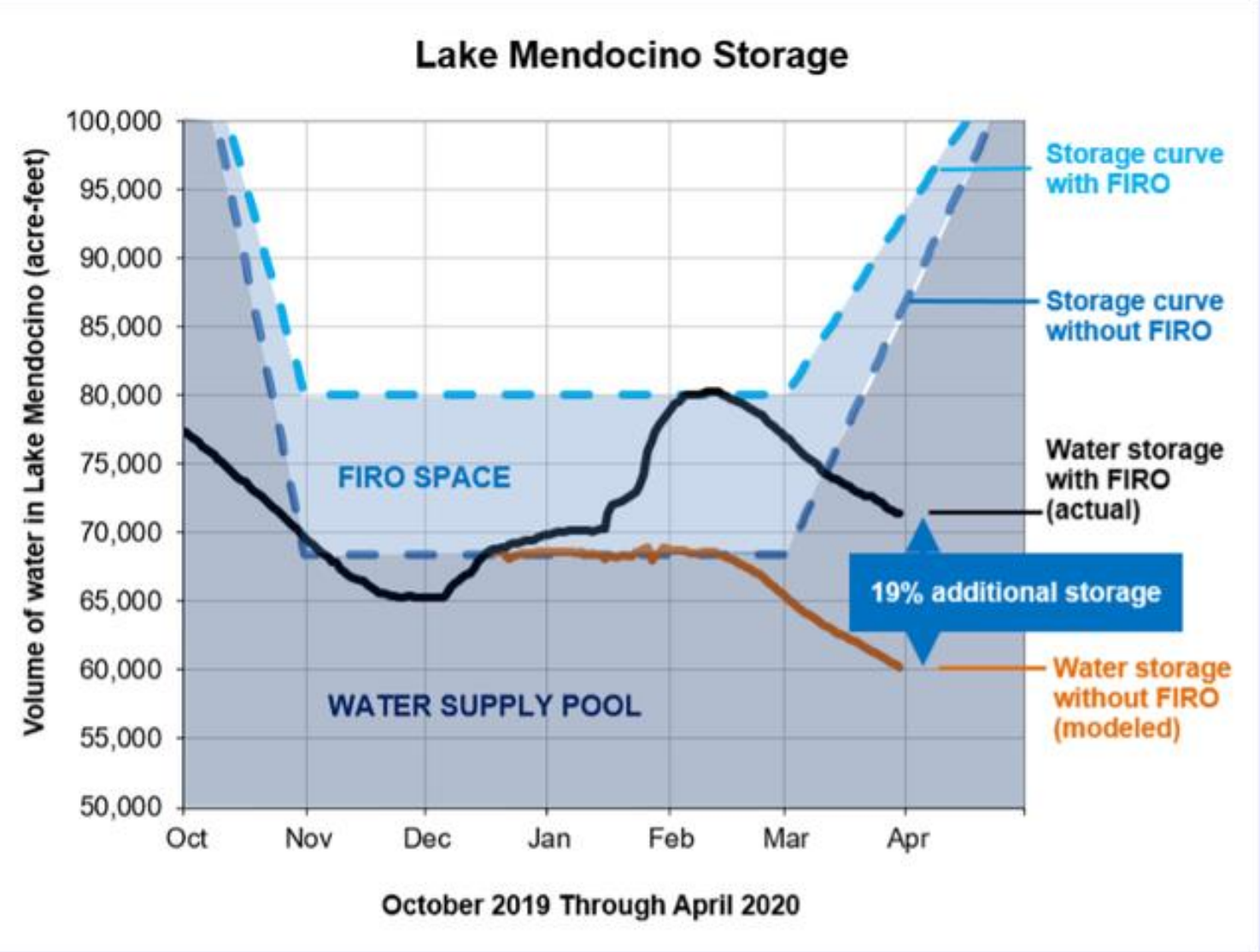
Why S2S? Lead Times Very Important for Water Management

- Manage impact risk and financial exposure risk
- Budgeting & resource allocation (e.g. water conservation projects)
- Project financing (local water agencies)
- Contract negotiation and execution
- Environmental permitting & regulatory approvals
- Construction activities
- Supporting individual water users' decision-making (e.g. agricultural producers make planting decisions in winter to begin field preparation in spring)

Lead Time & Forecast Certainty



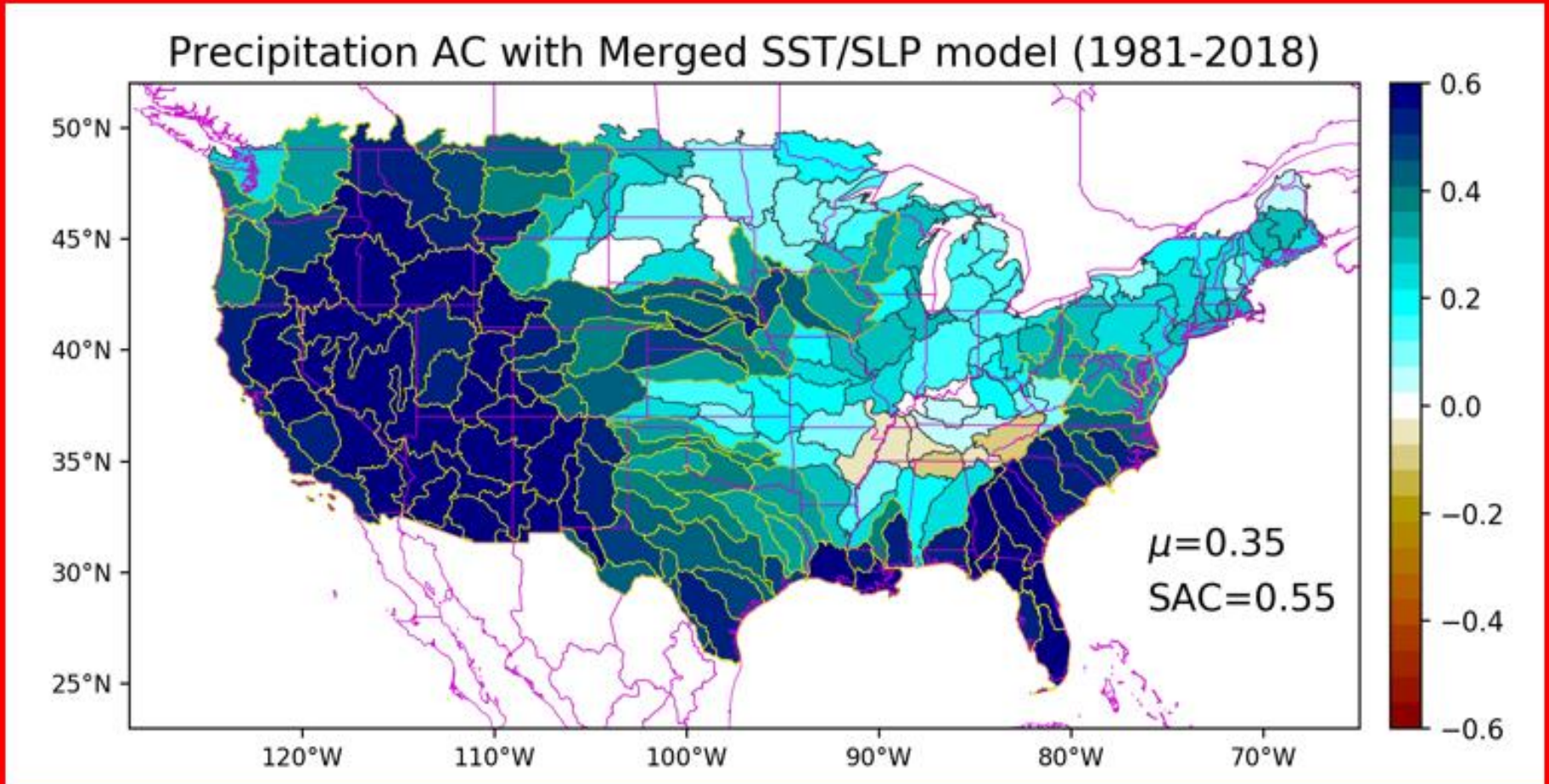
S2S Supports More Efficient Water Management – FIRO & FloodMAR



Pathway to Improving S2S Forecasting

- Science recommendations in two National Research Council reports
- CDWR research funding
- PL 115-215 (Weather Research & Forecasting Innovation Act of 2017) enacted in 2018 and subsequently reauthorized; reauthorization now pending again
- NOAA report to Congress in 2020 recommending S2S pilot projects
- Formation of S2S Coalition, efforts on FY23 & FY24 appropriations for pilot project (NOAA Office of Atmospheric Research)

Skill of Example Seasonal Experimental Forecast Funded by CDWR (NOAA ESRL contract)



NOAA ESRL (Switanek et al, doi:10.1175/WAF-D-19-0241.1)

NOAA 2020 Report to Congress

Regional Pilot Projects to Accelerate S2S Predictive Skill Improvement

- **Winter S2S Precipitation Forecasts for Water Management in the Western U.S.**
- The dominant fraction of the annual mean precipitation along the west coast of the United States and in the mountain regions west of the Mississippi River occurs from October through April. In many regions, this precipitation falls as snow, and the mountains act as a natural reservoir. Key science challenges to improving these forecasts include: inadequate model resolution (horizontal and vertical) to resolve the mountainous terrain, which influences the intensity of precipitation and the relative fraction of precipitation that falls as rain versus snow; improved fidelity in modeling of the atmospheric boundary layer in mountainous regions; and an inability to predict periods of blocked versus unblocked flow over the eastern North Pacific Ocean and western U.S.


ROAD
BLOCKED
ROAD
BLOCKED

See Tab H in Briefing Materials

- S2S fact sheet
- Congressional Dear Colleague letters
- Stakeholder support letter, FY24 appropriations

Annual CDWR/WSWC S2S Workshop

- Aug 15 -17 in San Diego

Improving Sub-Seasonal to Seasonal Precipitation Forecasting for Water Management

WESTERN STATES WATER COUNCIL