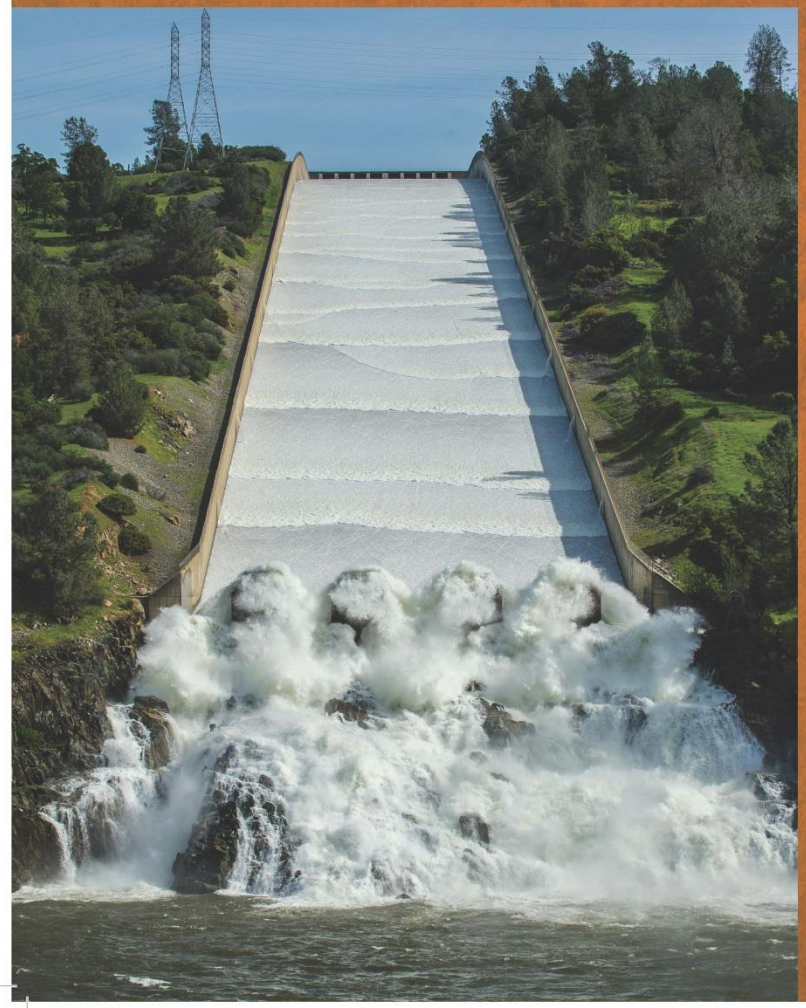
Improving Sub-Seasonal to Seasonal Precipitation Forecasting for Water Management



WESTERN
STATES
WATER
COUNCIL

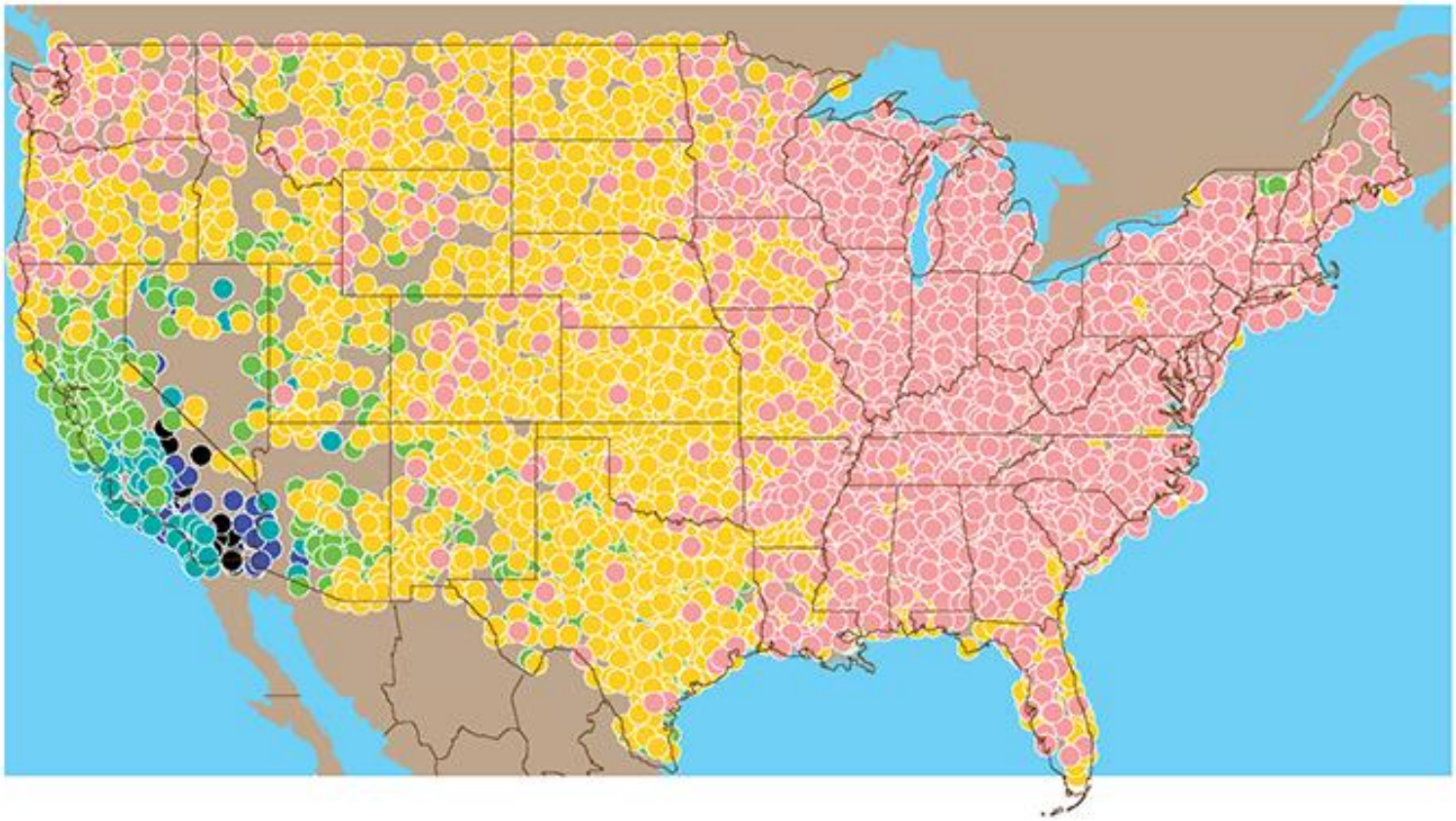
Why This Effort?
WSWC Perspective

- Importance of skillful sub-seasonal to seasonal precipitation forecasting for Western water management
- Lack of resources being directed to improving S2S precipitation forecasting
- Lack of resources being directed to Western precipitation prediction needs
- Time is ripe for action

WSWC/NOAA/CDWR Workshops on S2S Precipitation Forecasting

- San Diego, May 2015
- Salt Lake City at NWS Western Region HQ, October 2015
- Las Vegas at Colorado River Water Users Association, December 2015
- College Park, April 2016
- San Diego, 2016

California Precipitation is Uniquely Variable



Variation of Total Precipitation, Water Years 1951-2008

$$\frac{\text{Std Dev of Annual Precipitation}}{\text{Mean Annual Precipitation}}$$

10% 20% 30% 40% 50% 60% 70%

Dettinger et al, 2011

CALIFORNIA DROUGHT

2014 SERVICE ASSESSMENT

NEXT GENERATION EARTH SYSTEM PREDICTION

STRATEGIES FOR SUBSEASONAL TO SEASONAL FORECASTS

Committee on Developing a U.S. Research Agenda to Advance Subseasonal to Seasonal Forecasting

Board on Atmospheric Sciences and Climate
Ocean Studies Board

Division on Earth and Life Studies

This prepublication version of Next Generation Earth System Prediction: Strategies for Subseasonal to Seasonal Forecasts *has been provided to the public to facilitate timely access to the report. Although the substance of the report is final, editorial changes may be made throughout the text and citations will be checked prior to publication. The final report will be available through the National Academies Press in spring 2016.*

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Importance of Improved Forecasting for Water Management

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 the Rest of This Winter be Wet or Dry? Example Sub-Seasonal Decisions

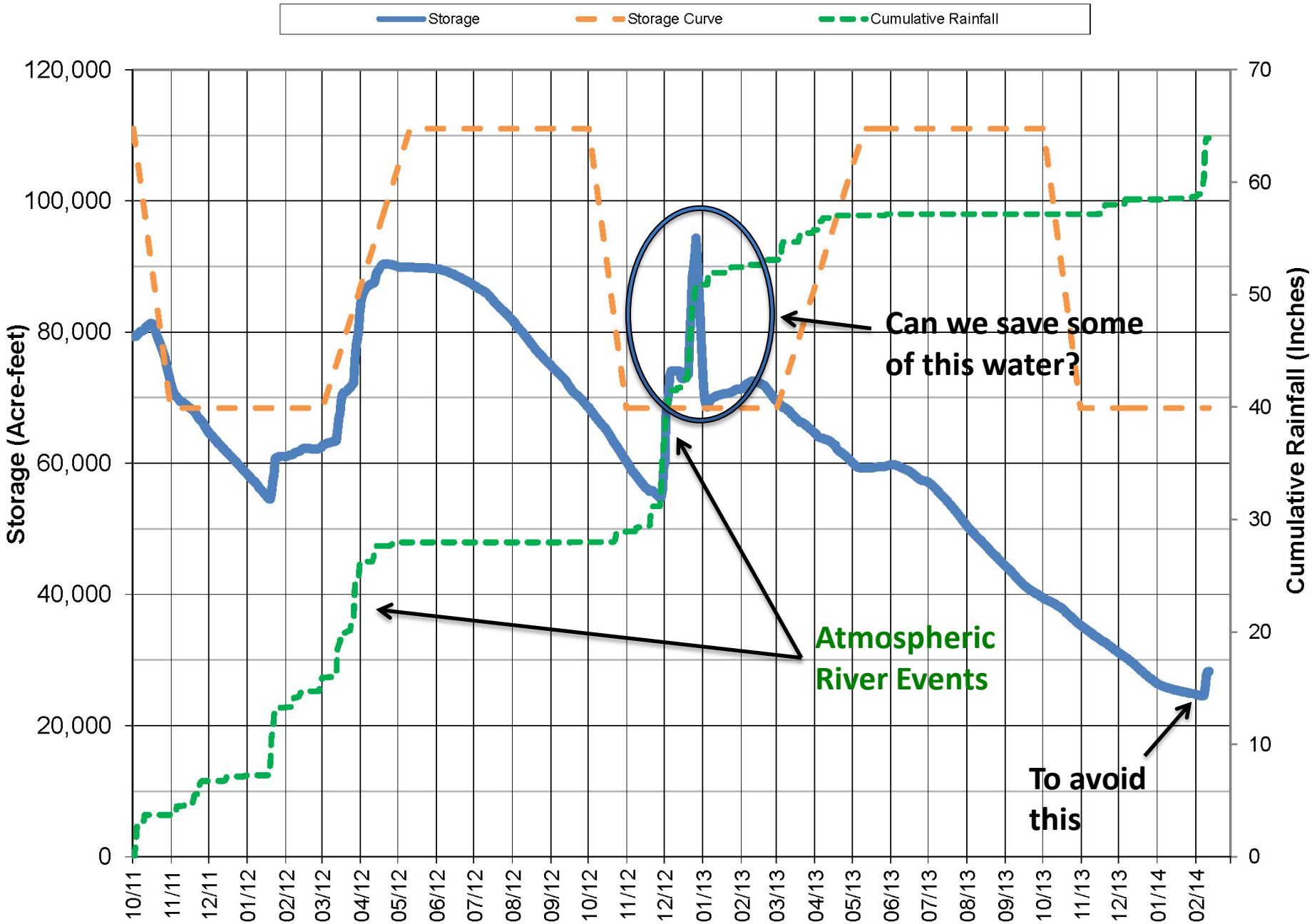
- How much water will we be able to provide to our water users? When can we make the announcement?
- Will we hit hydrologic shortage triggers that require extraordinary conservation measures, or the need to negotiate contracts or adopt regulations?
- Is an elevated flood risk likely this spring? Should 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?

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?

Lake Mendocino Water Years 2012 - 2014

J. Jasperse, SCWA



Lake Mendocino FIRO Demonstration Project – A Collaborative Effort

Broad coalition of federal, state, & regional agencies comprised of scientists & water managers

<u>Steering Committee:</u>

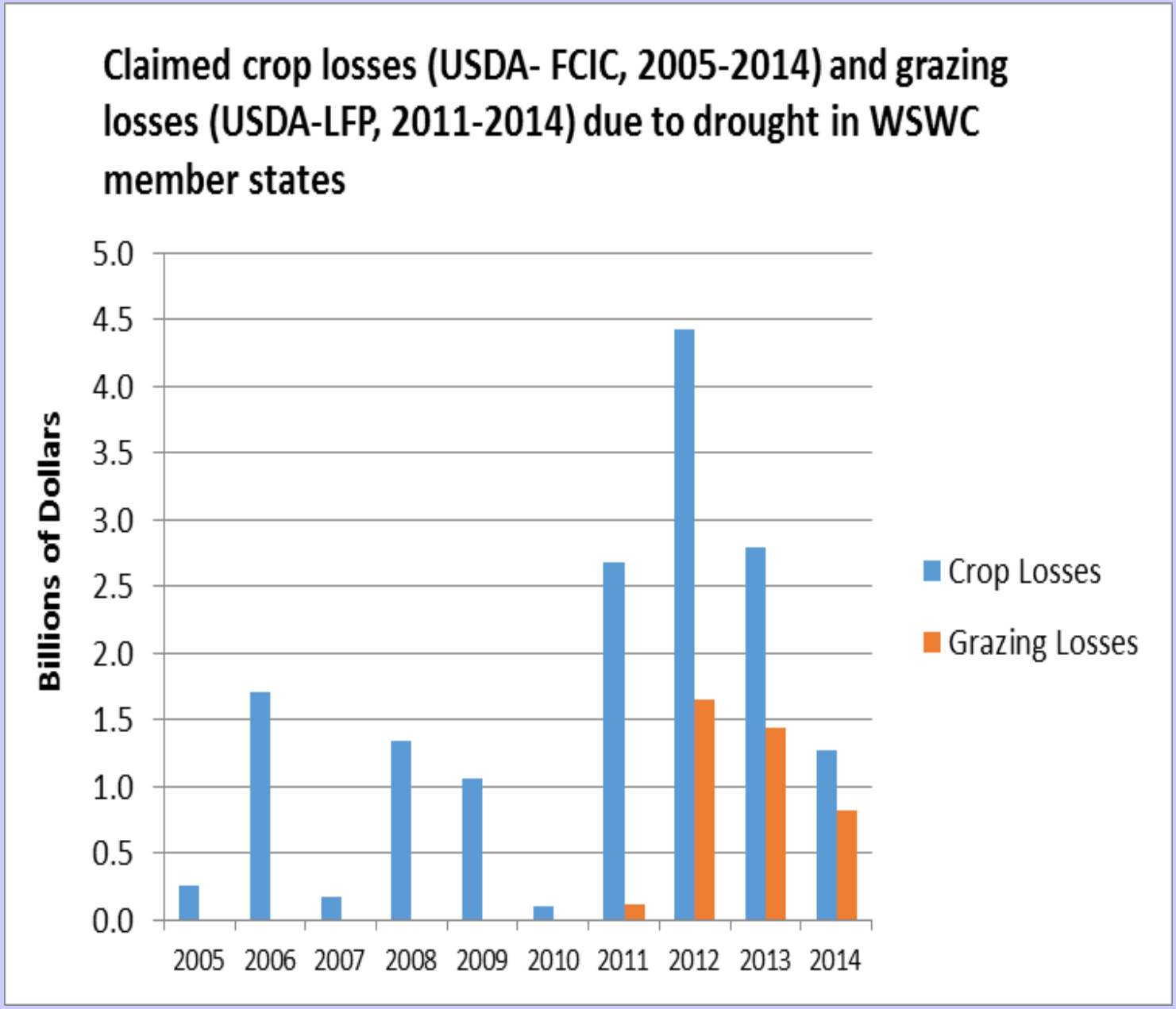
Federal: NOAA (OAR, NWS, NMFS), USGS, Army Corps of Engineers, & Bureau of Reclamation

State: California Department of Water Resources & Scripps Center for Western Weather & Water Extremes

Regional: Sonoma County Water Agency

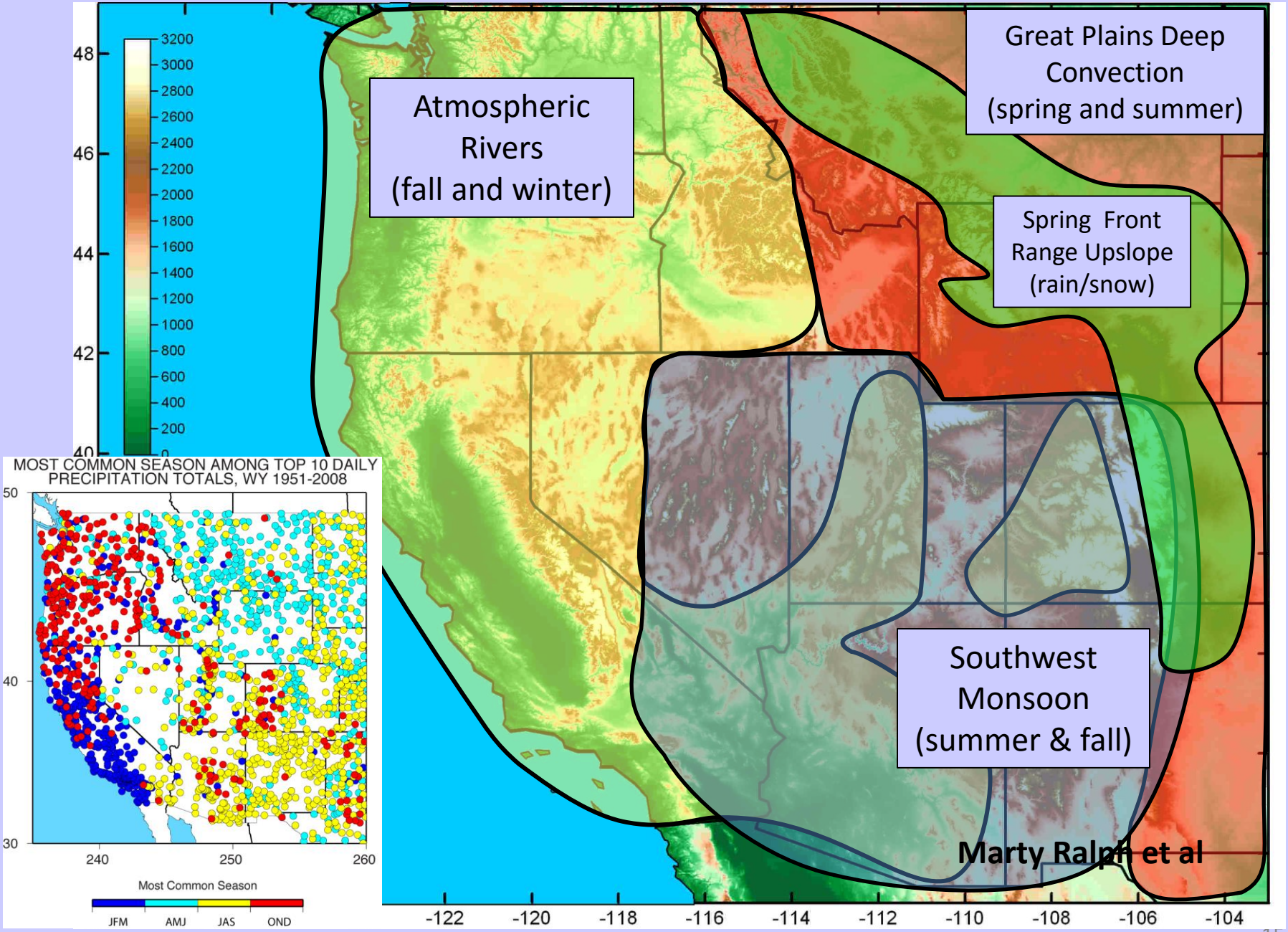
Partnerships: NOAA Habitat Blueprint

Integrated Water Resource Sciences & Services


Claimed crop losses (USDA- FCIC, 2005-2014) and grazing losses (USDA-LFP, 2011-2014) due to drought in WSWC member states
Billions of Dollars
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Crop Losses
Grazing Losses

New understandings of role of extreme precipitation (e.g., atmospheric river storms) in West, implications for improving predictability at <u>regional</u> scale

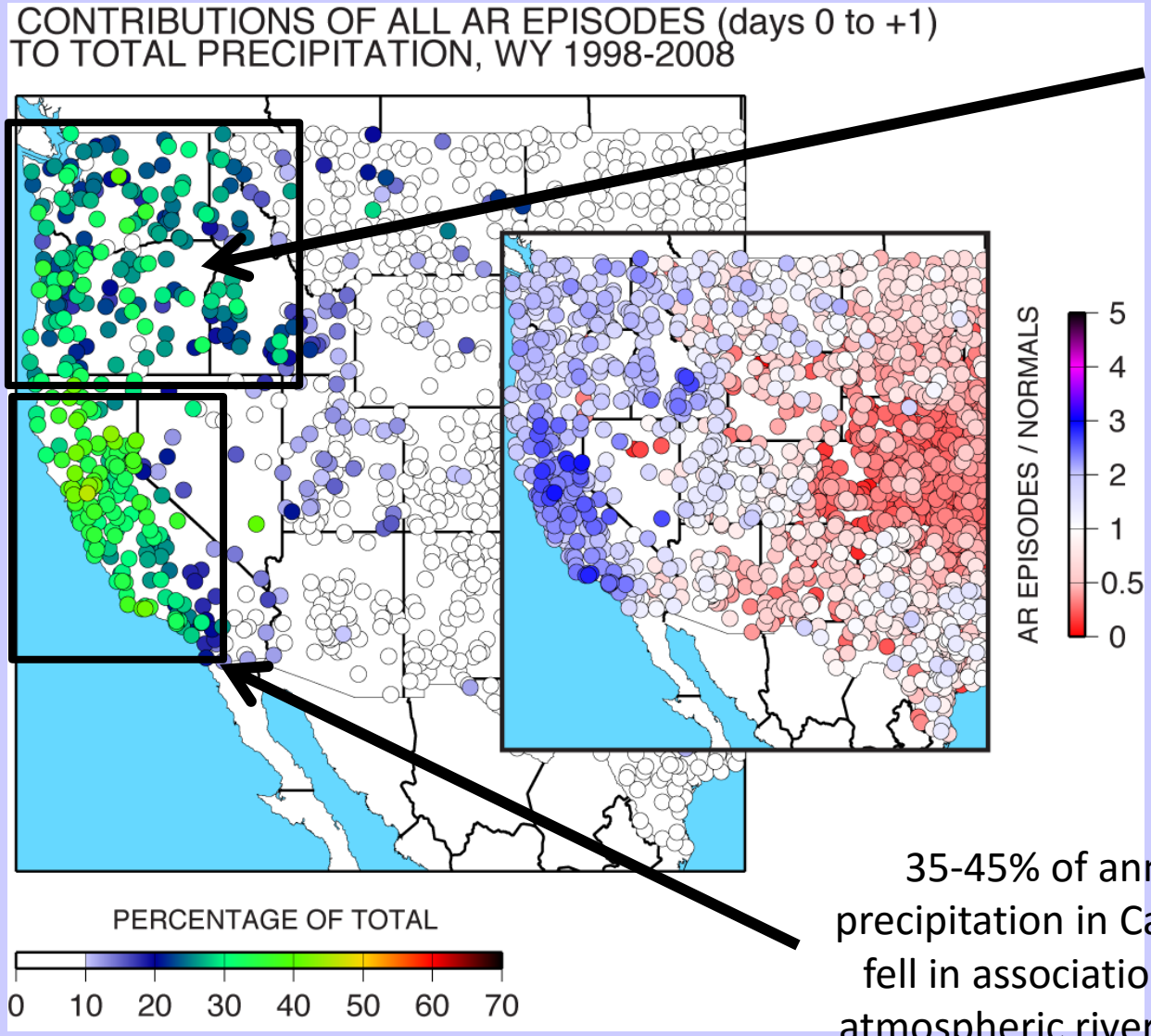
Schematic illustration of regional variations in the primary weather phenomena that lead to extreme precipitation, flooding and contribute to water supply in the Western U.S.



Atmospheric Rivers, Floods and the Water Resources of California

by Mike Dettinger, Marty Ralph, , Tapash Das, Paul Neiman, Dan Cayan

Water, 2011

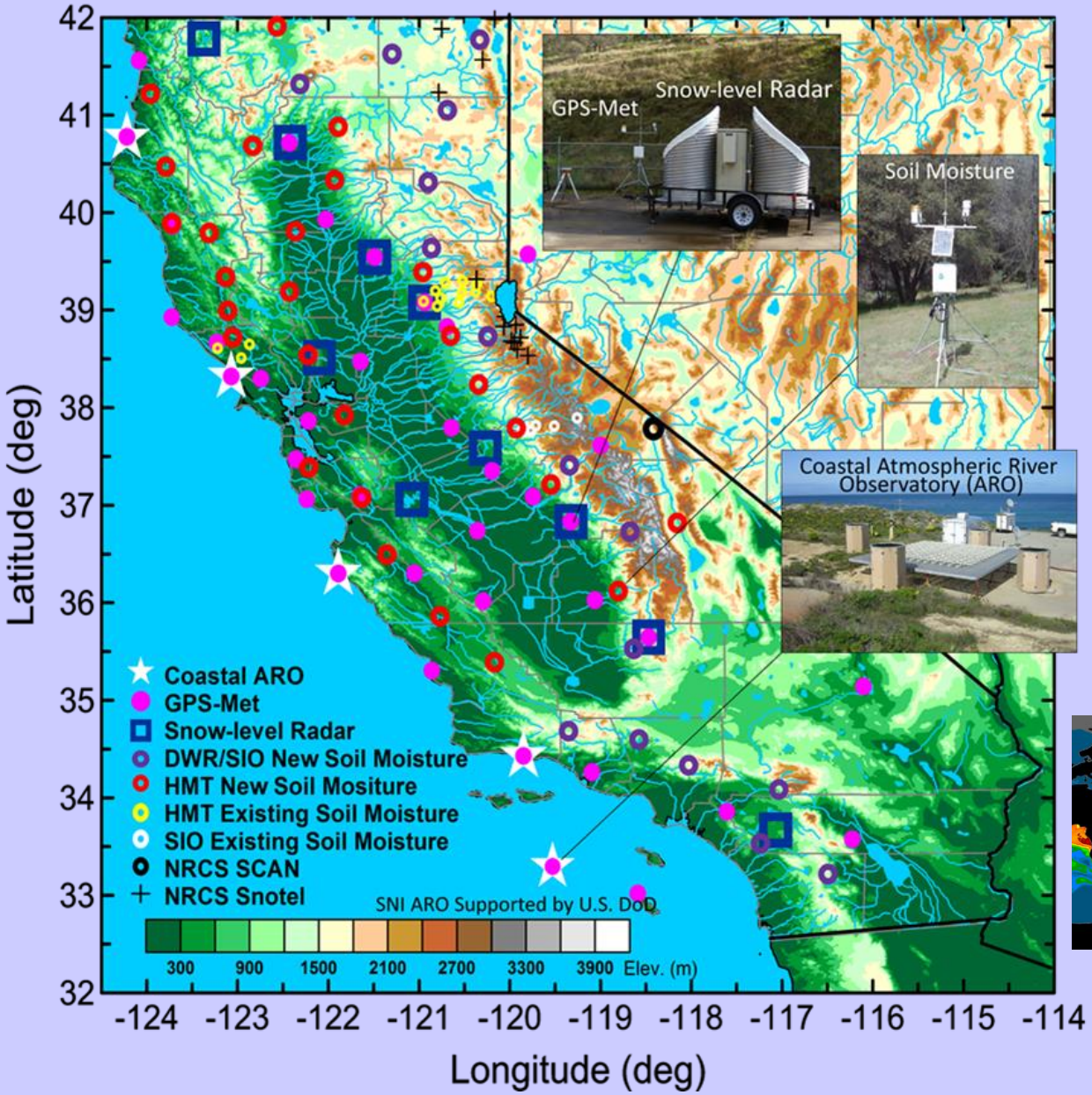


25-35% of annual precipitation in the Pacific Northwest fell in association with atmospheric river events

35-45% of annual precipitation in California fell in association with atmospheric river events

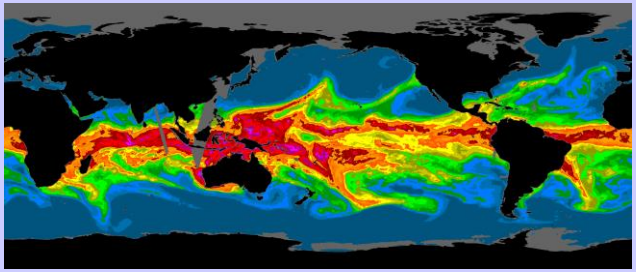
Courtesy of M. Ralph

California Observing System for Extreme Precipitation



►Jointly funded by NOAA HMT & DWR (from Prop. 1E bond funds), investment of about $25M

► Focus on observing & understanding atmospheric river storms



State of California Investments in Observing & Researching AR Storms

- NOAA HMT (state share) -- $15M
- Advanced precip monitoring & forecasting grant to Bay Area local agencies -- $19M
- Calwater I & II field observing campaigns -- $5M
- Research with UCSD/Scripps -- $3.5M

Summary

- High need for improved S2S precip forecasting for water management
- Scientifically challenging, but large potential payoff for water, agriculture, transportation, etc. sectors
- Recent NAS report, improved regional-scale observations of extreme precip show pathway forward