



# Going Dry or Just Not Wet?

Western States Water Council  
Workshop April 2013

# Talk Overview

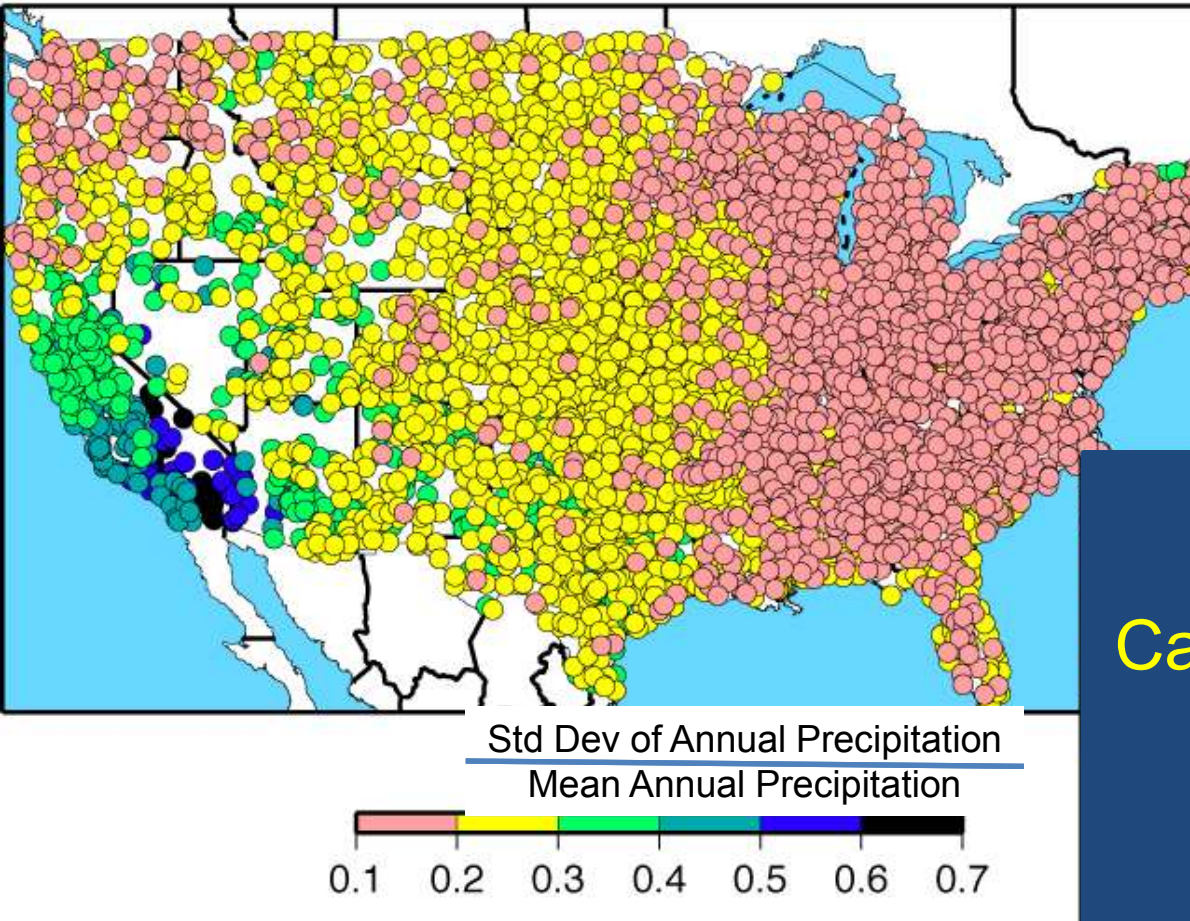
An aerial photograph of a mountain range, likely the Sierra Nevada, showing a central valley with a river and surrounding peaks. The image is dark and moody, with some clouds visible in the sky.

- History
- Statistics
- Some Physics
- Thoughts for Prediction



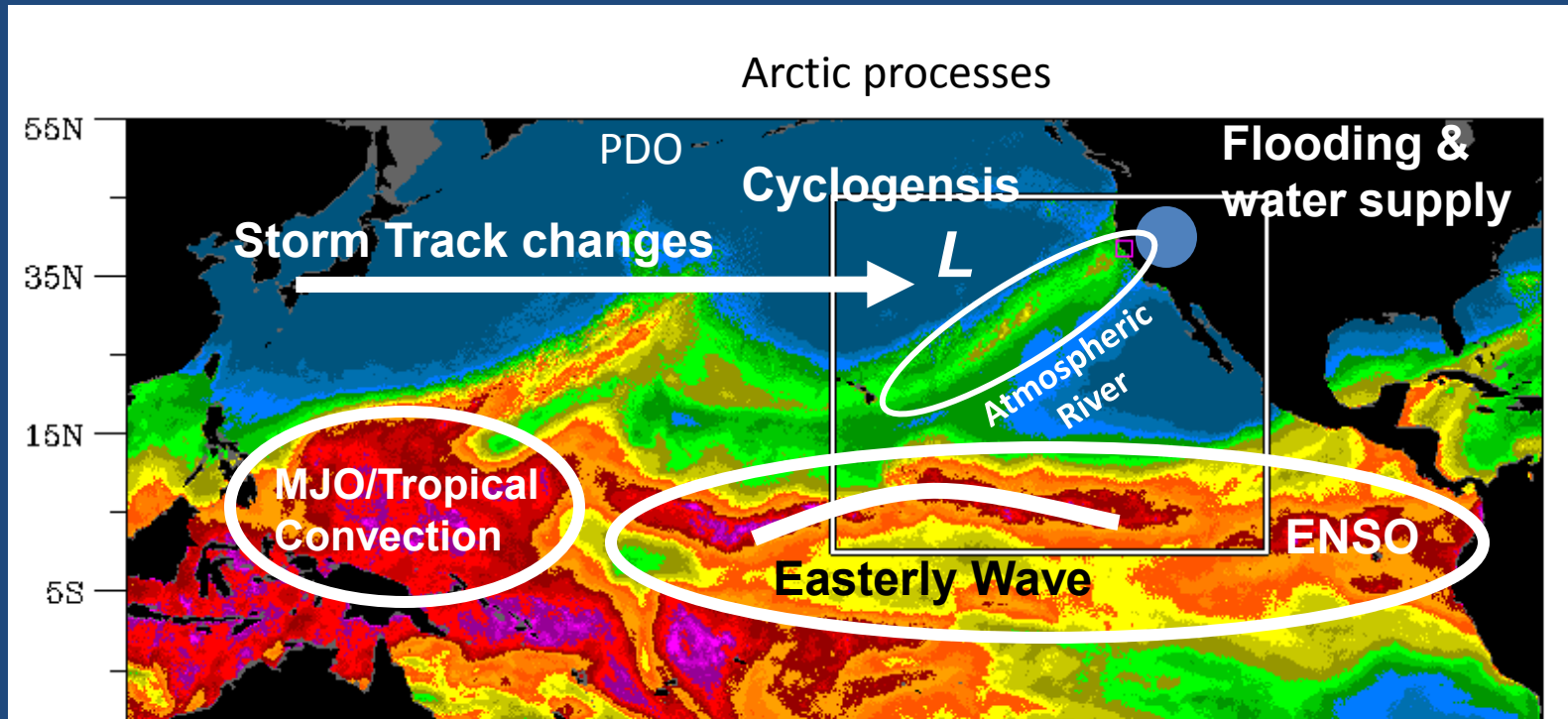
# Year to Year Precipitation Variability

a) COEFFICIENTS OF VARIATION OF TOTAL PRECIPITATION, WY 1951-2008



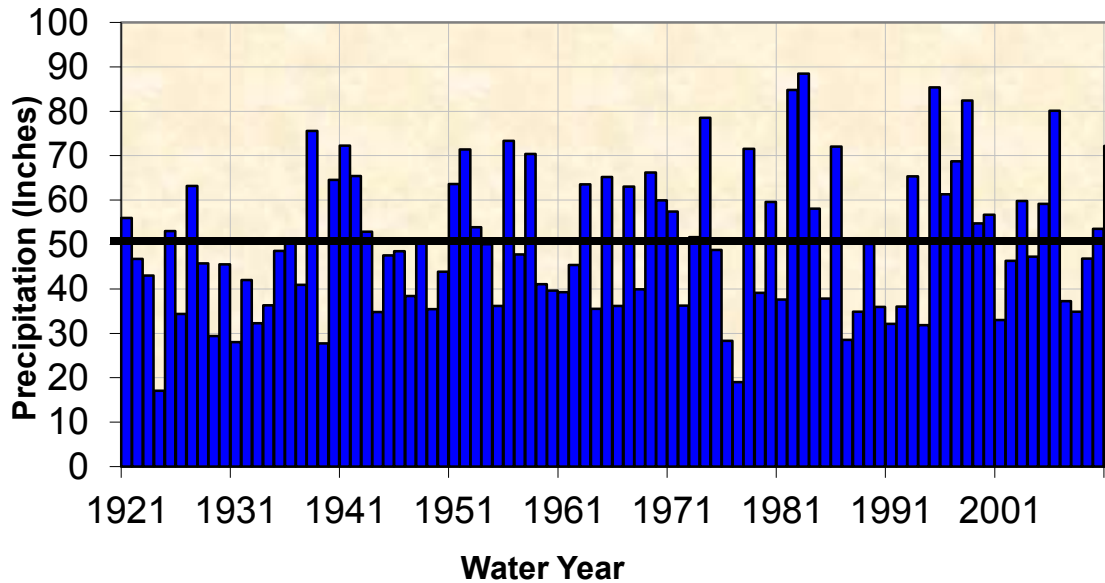
California precipitation is uniquely variable

# Key Phenomena Affecting California Water Supply/Flooding:



**The most extreme CA storm would result from a rare alignment of key processes**

# Northern Sierra 8 Station Index



Average of:

Mt. Shasta City

Shasta Dam

Mineral

Brush Creek RS

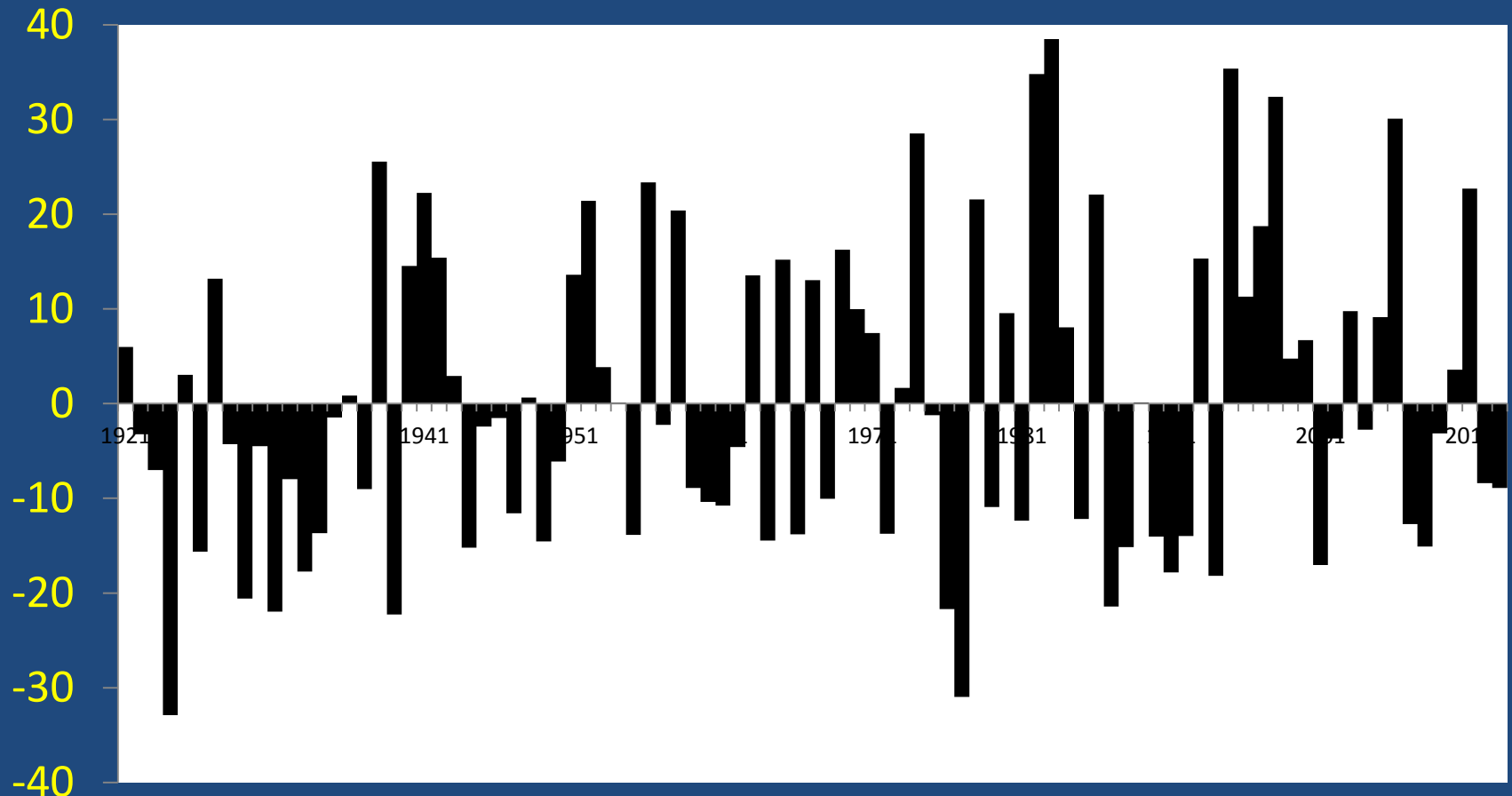
Quincy

Sierraville RS

Pacific House

Blue Canyon

# 8-Station Index Departures

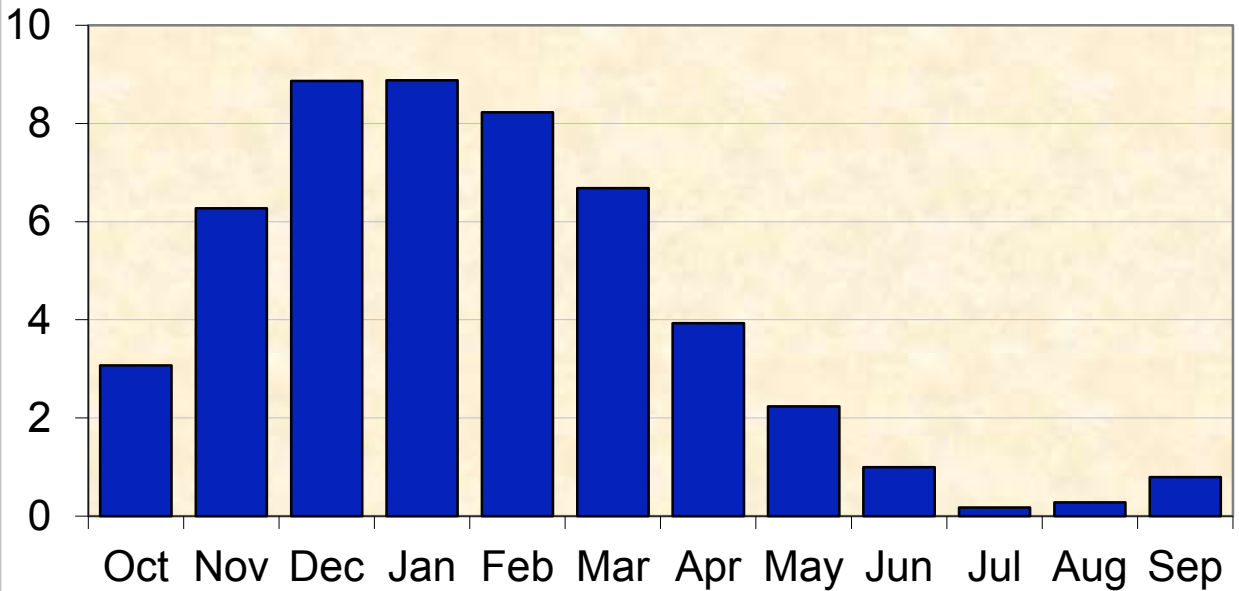


23 Wet to Dry Transitions

50 Drier than Average Years

93 Years in Period of Record

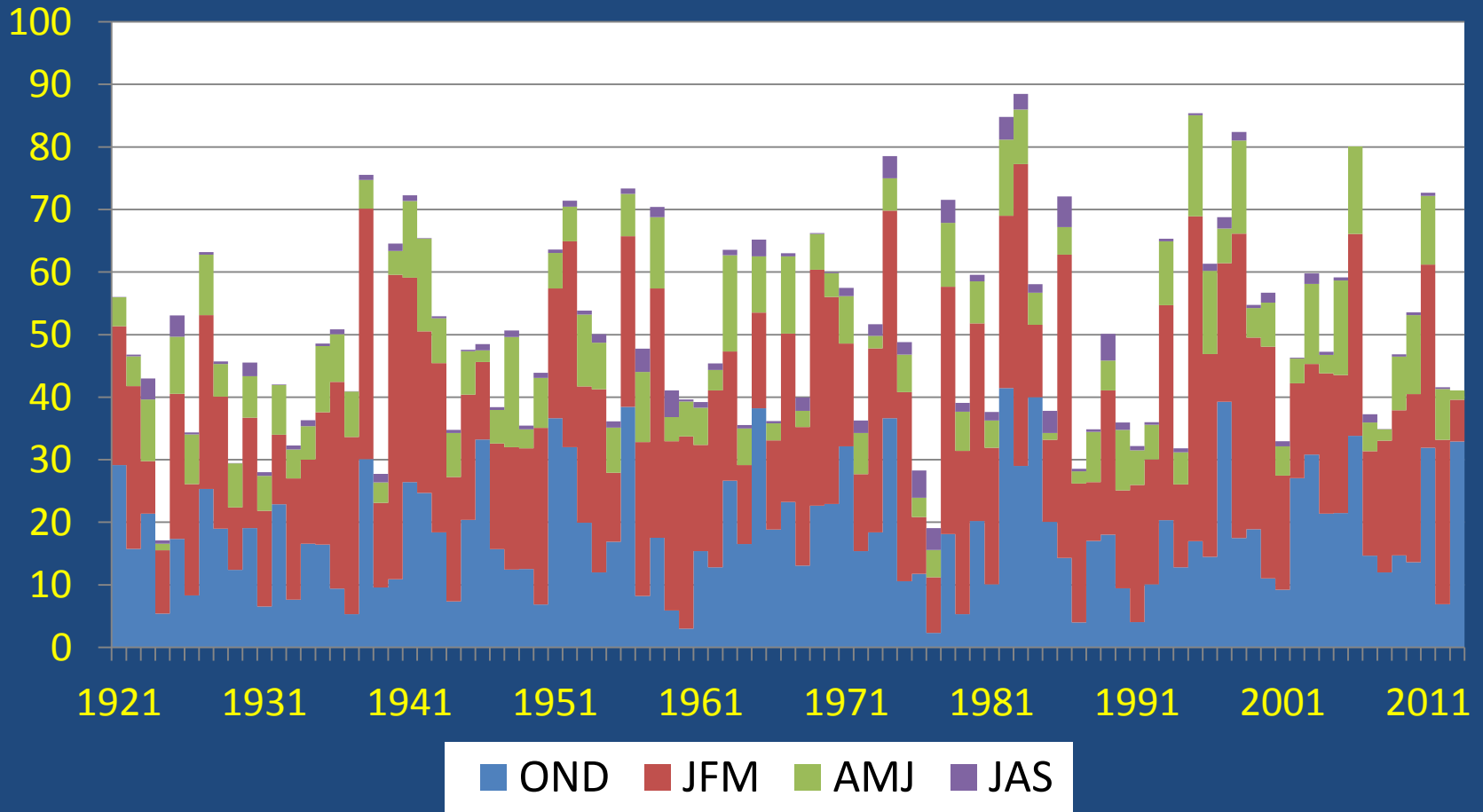
# Northern Sierra 8 Station Index



Annual Average: 50 inches  
Maximum Year (1983): 88.5 inches  
Minimum Year (1924): 17.1 inches  
Period of Record 1921- Present

Average of:  
Mt. Shasta City  
Shasta Dam  
Mineral  
Brush Creek RS  
Quincy  
Sierraville RS  
Pacific House  
Blue Canyon

# 8-Station Index by Season



21 Wet Fall to Dry Winter Years

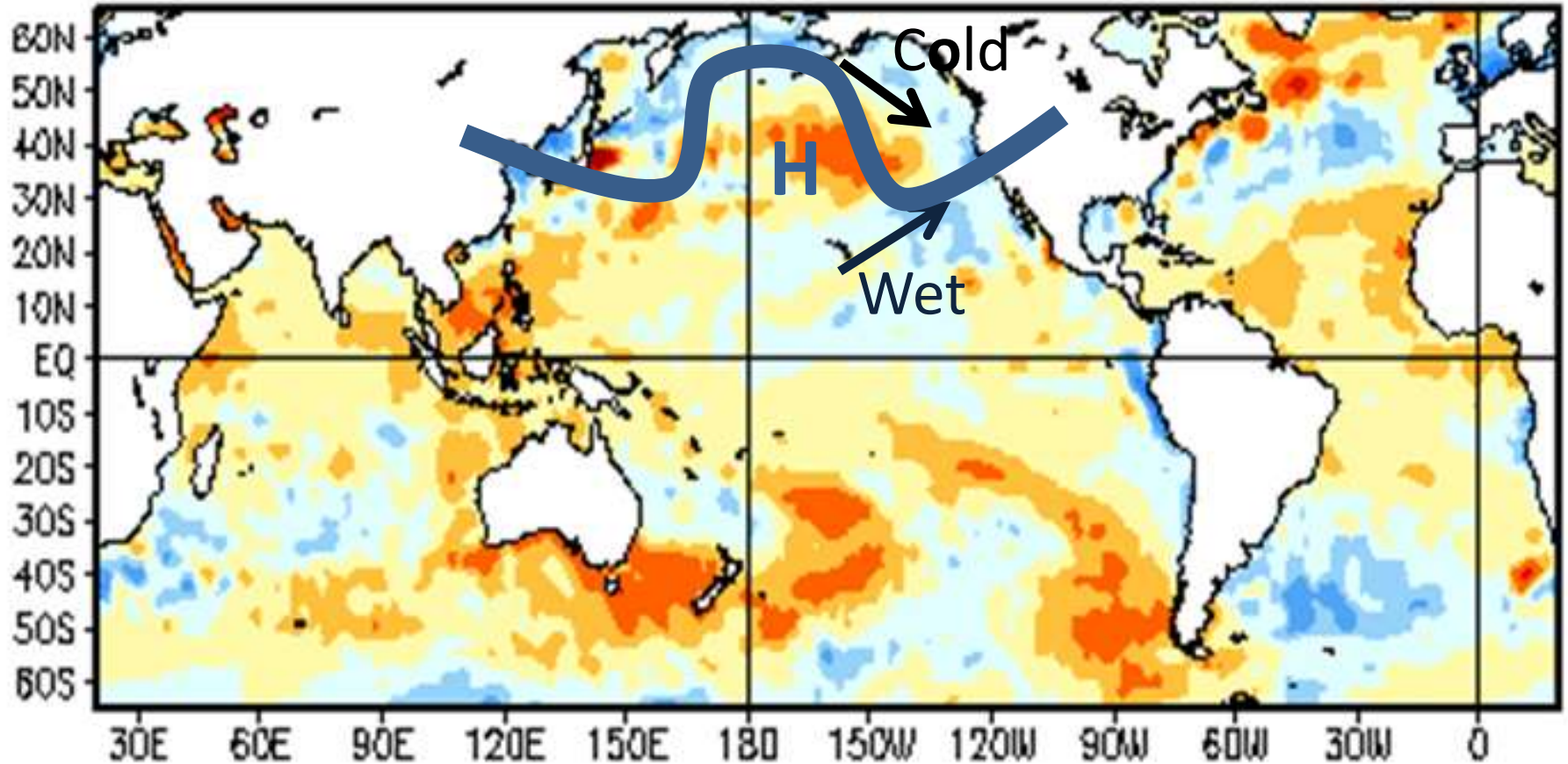
11 of 21 drier than average  
2 of 21 less than 40 inches



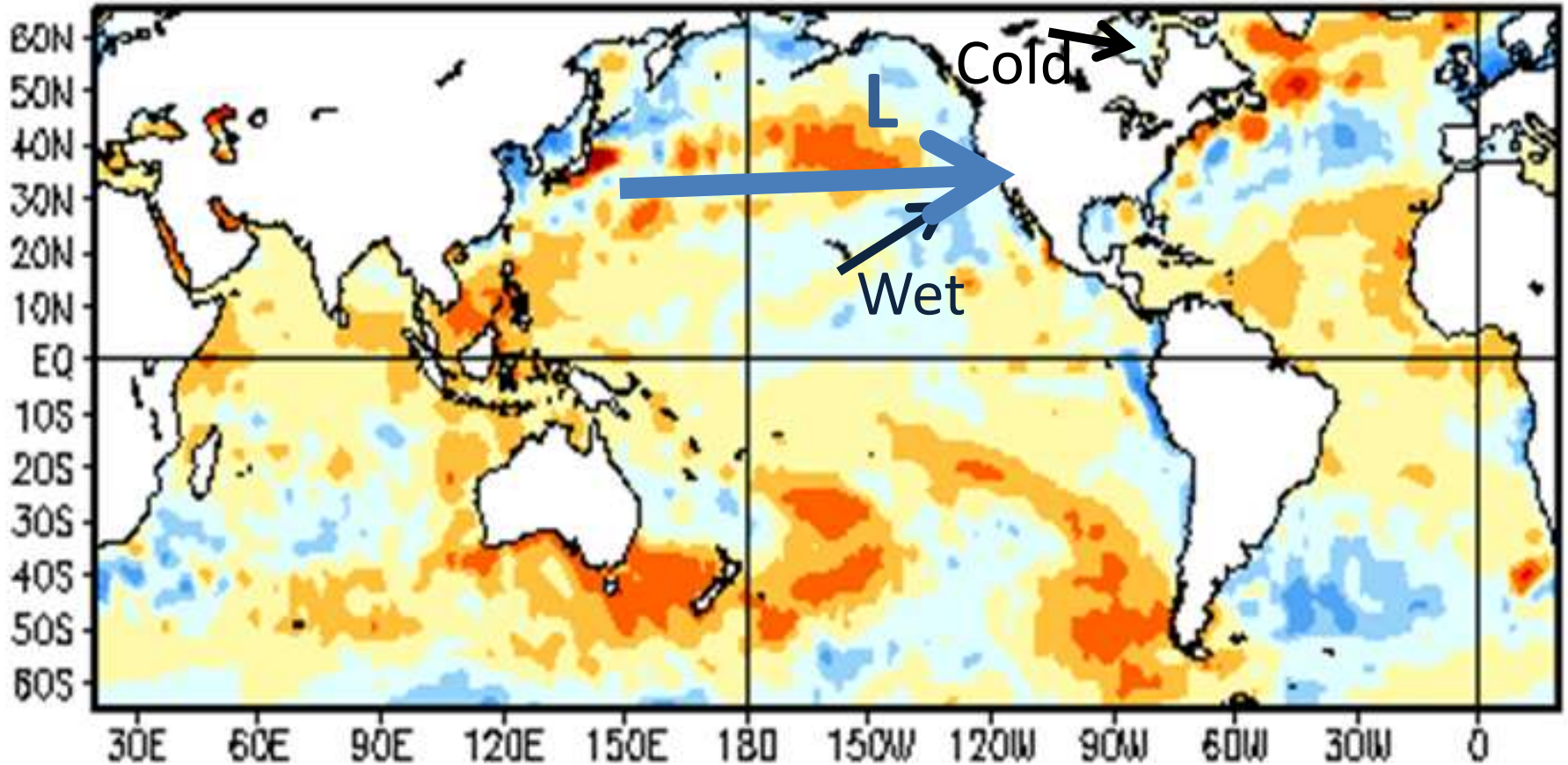
# Missing Out

- Need right combination of cold dynamics and moisture inflow for best water supply results
- Weak events or quick moving events limit benefit
- Storm track location can limit benefit
- Season and timing matters for impacts

# Storm Tracks



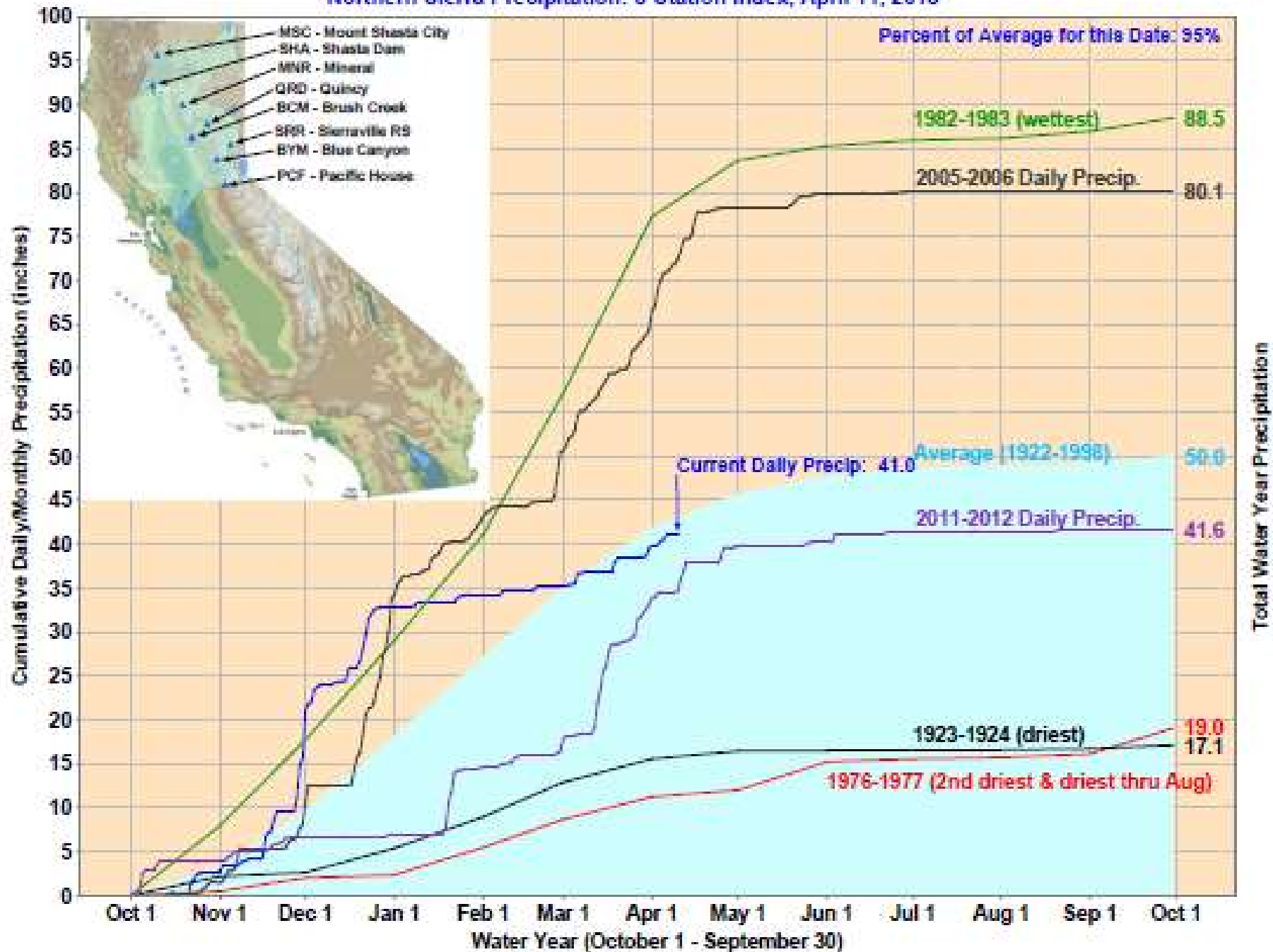
# Storm Tracks



# Just One Storm

- 14.75 inches from 11/28/12 to 12/06/12 (1/3 of water year to date total)
- 10 inches of SWE accumulates from 12/19/12 to 12/27/12 (half of year's total SWE for northern region of CA)

# Northern Sierra Precipitation: 8-Station Index, April 11, 2013



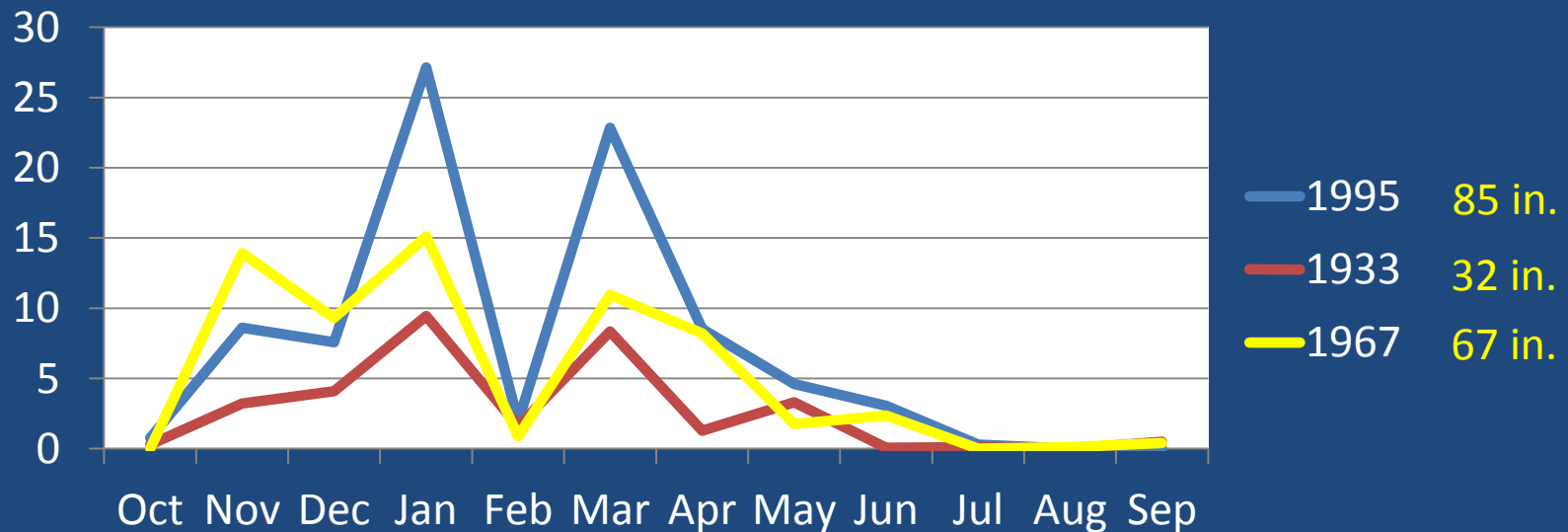


# Surfing the Waves

- Climate signals (PDO, ENSO, AO, etc) are identified wave patterns occurring at different frequencies and strengths.
- Different correlations of wet and dry patterns have been made to different specified states
- Combinations of states now being studied

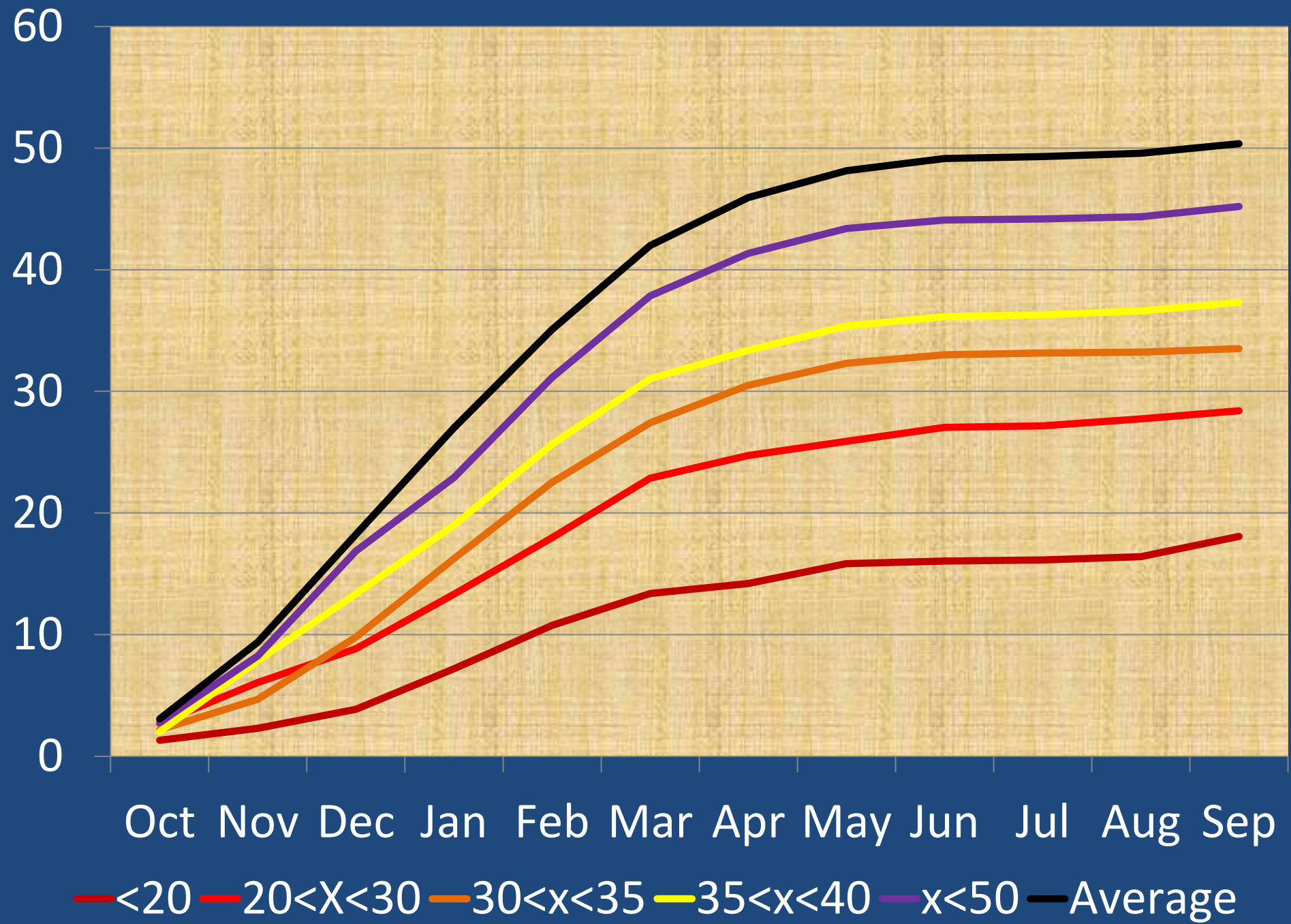
# Analog

- Vehicles to gain understanding of processes and patterns
- Correlations to total precipitation may miss the pattern match

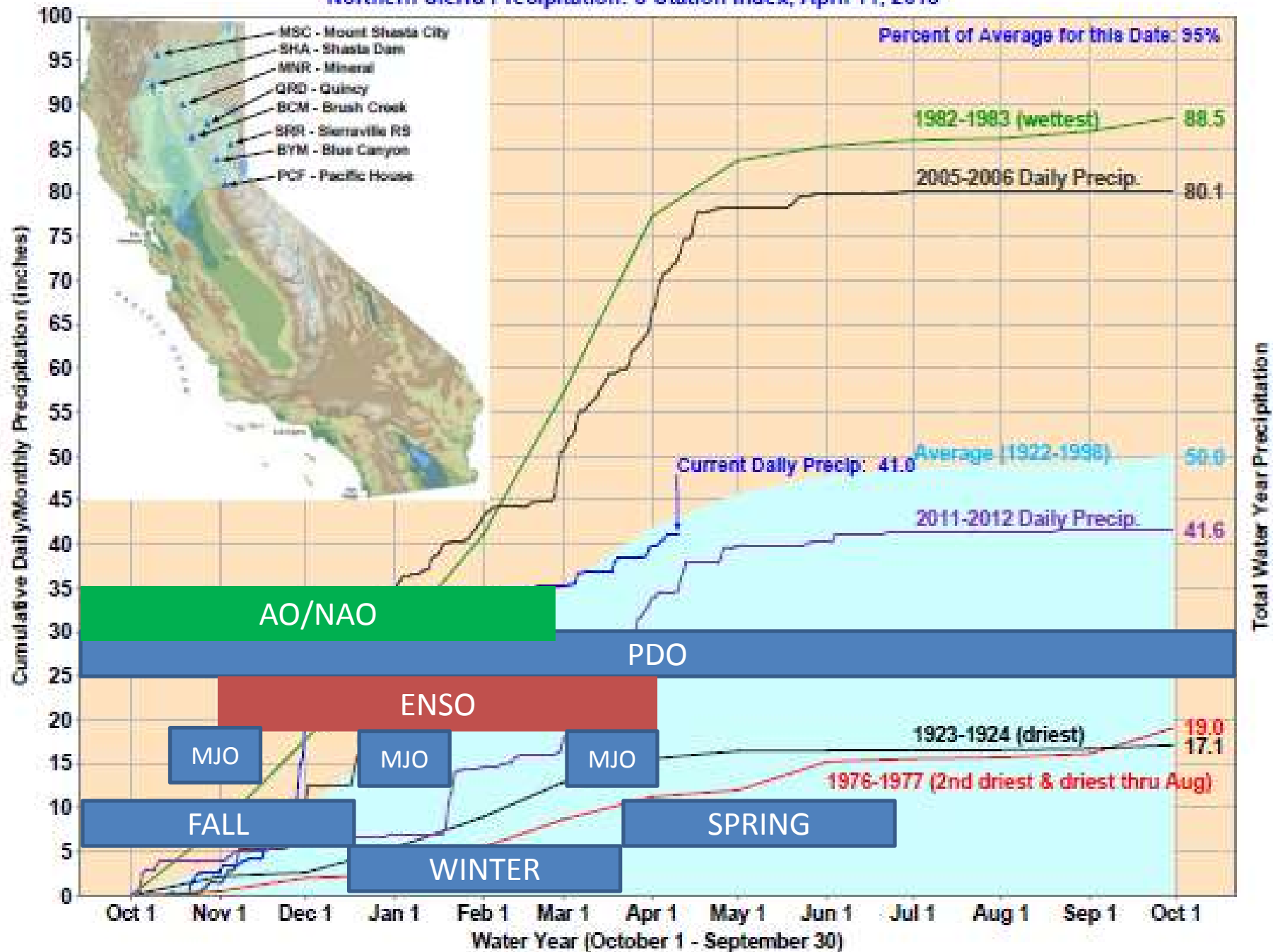


# Drought Recipes

- Multi-signal reinforcement of mid-Pacific high off-shore or over California throughout winter months
- Zonal flow without southward displacement of storm track or excessive displacement
- Notable lack of AREs hitting California (lack of alignment of multiple processes)



# Northern Sierra Precipitation: 8-Station Index, April 11, 2013





# Ideas for Seasonal Prediction

- Identify Atmospheric River Event (ARE) potential (number, flux and duration)
- Study precipitation patterns at synoptic scale then relate back to larger space and time scales
- Pay attention to seasonal transitions

# Ideas in Seasonal Prediction

- Identify circulation patterns and associated storm tracks and position of large-scale features (ie La Nina High)
- Identify stability of circulation pattern in space (what can modulate it and when)
- Identify timing issues associated with faster evolving climate signals and their fluctuations

An aerial photograph of a vast, rugged mountain range, likely the Sierra Nevada in California. The terrain is characterized by steep, rocky slopes and deep, narrow valleys. The lighting is soft, suggesting either early morning or late afternoon, with long shadows cast across the mountain ridges. The overall color palette is dominated by earthy browns, greys, and muted blues. The word "Questions?" is centered in the middle of the image in a bright yellow, sans-serif font.

Questions?

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