The Latest Water-Relevant Climate Change Projections for California

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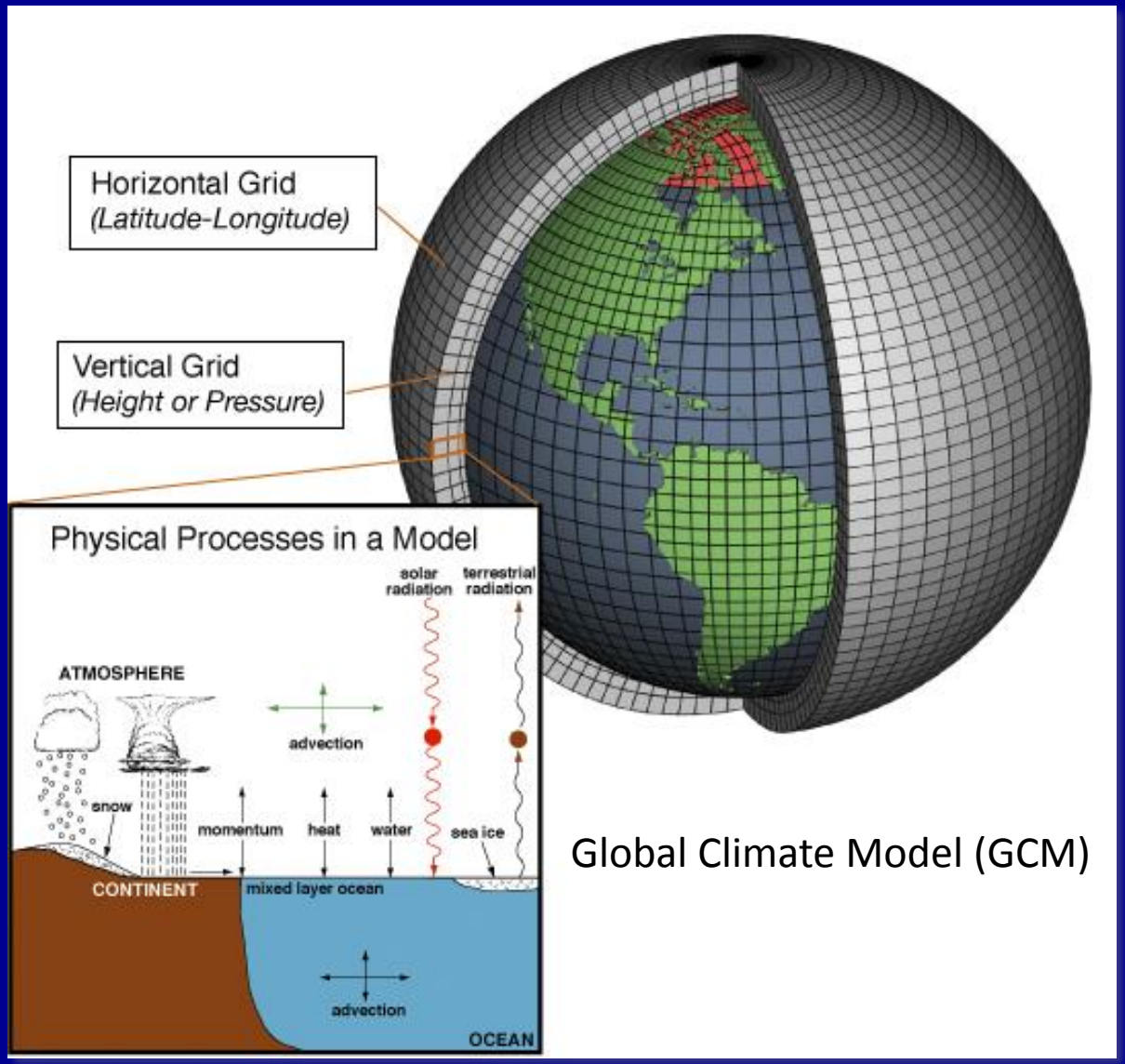
Climate Change Projections: Sources

Today:

- Some "sneak peaks" of the latest climate-change projections for the next IPCC Climate-Change Assessment Report (AR5)
- Some somewhat older projections of likely water-resource impacts
- Special attention to Delta and Colorado River supplies

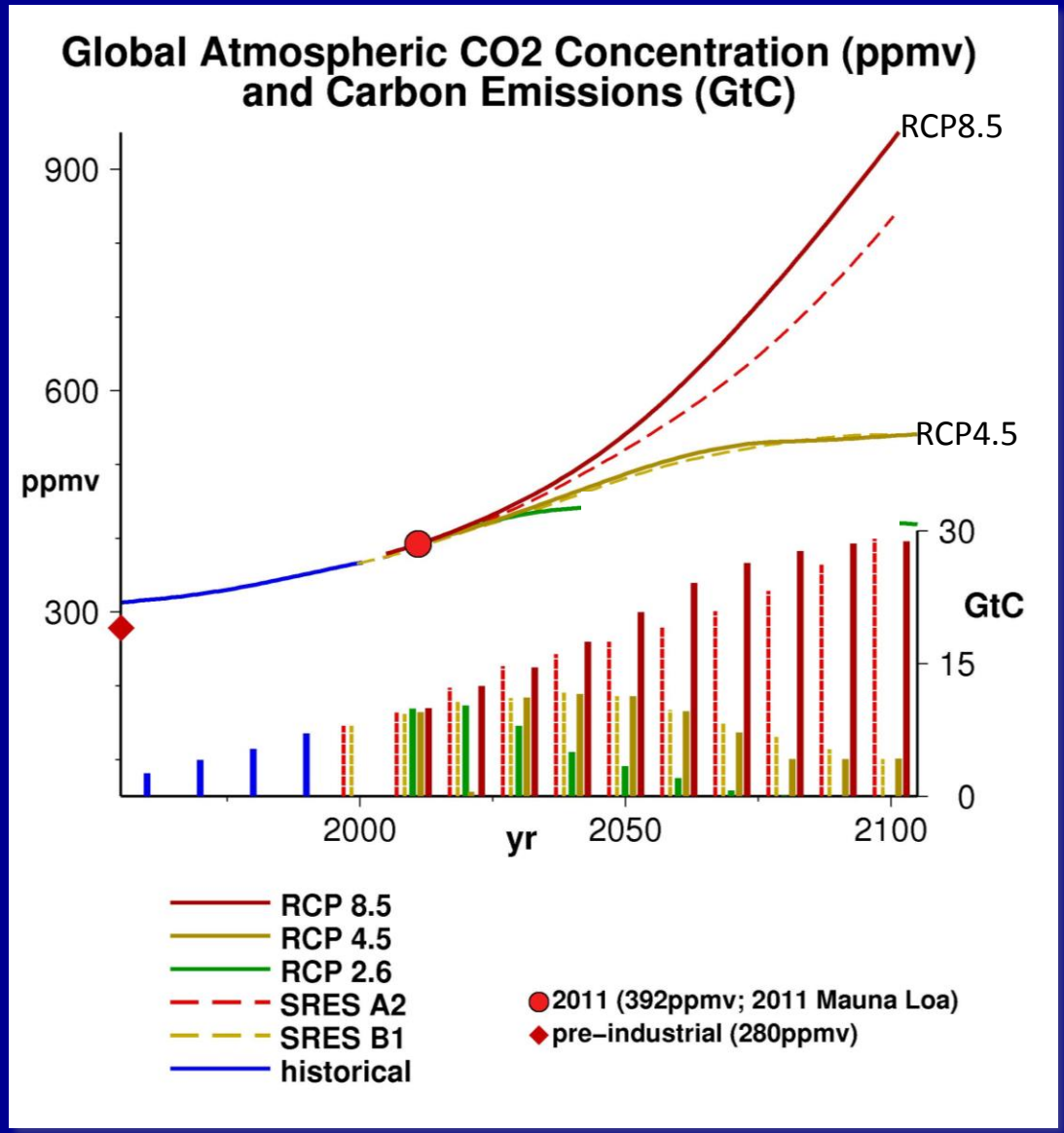


Global Climate Model (GCM)

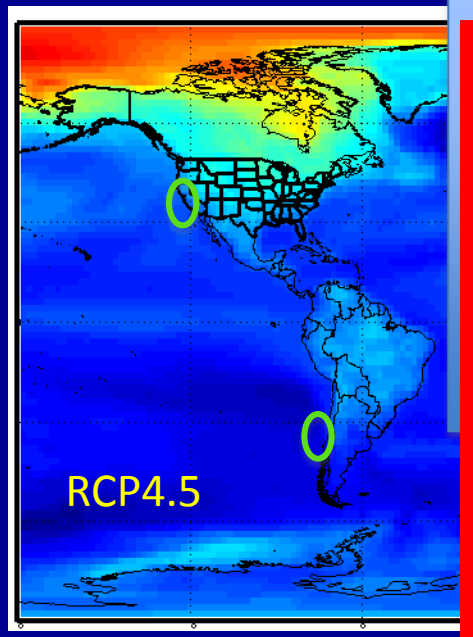
Climate Change Projections: Forcings

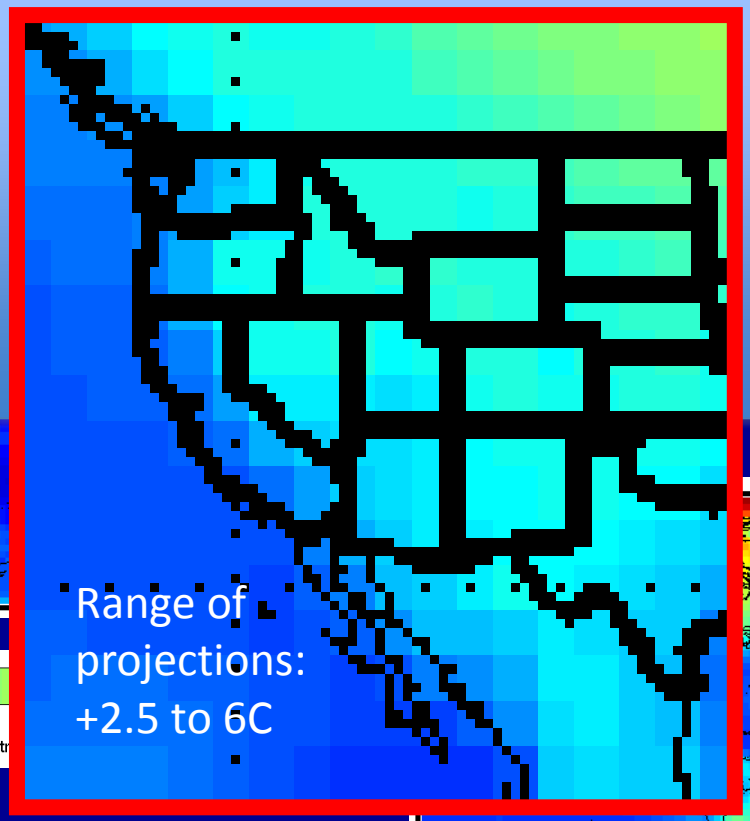
IPCC Fifth Assessment
(still underway, but climate projections becoming available)

Representative Concentration Pathways (RCPs) of greenhouse-gas emissions and concentrations

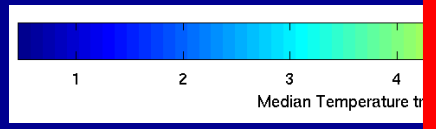


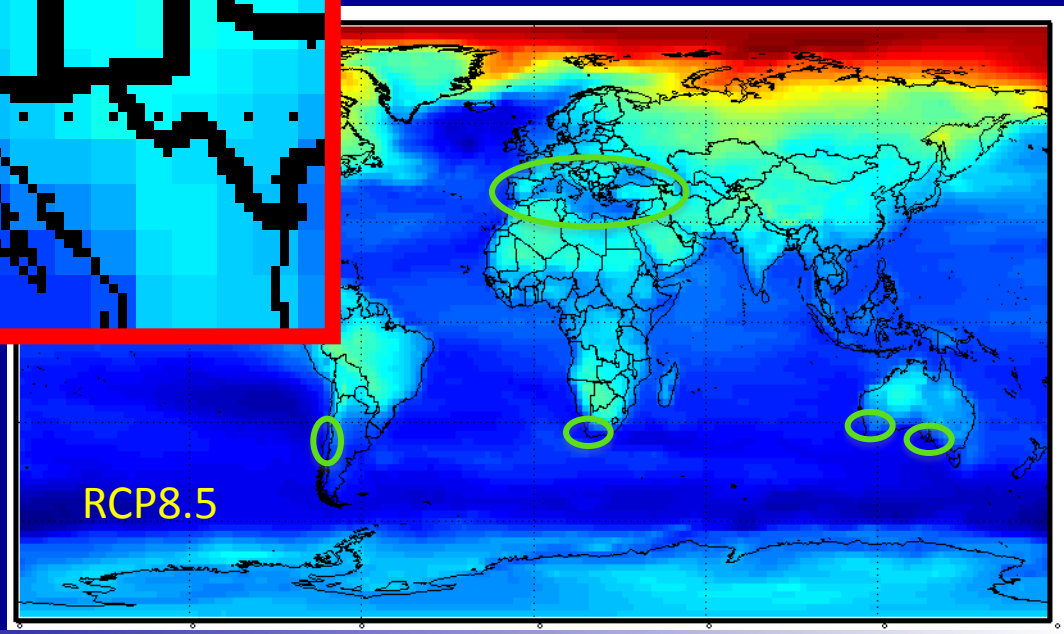
Projected Temperature Changes





Warming over California is moderated (somewhat) by its position in midlatitudes & on the coast.





Median temperature trends from 14 GCMs under two emissions scenarios

Courtesy of Suraj Polade, SIO

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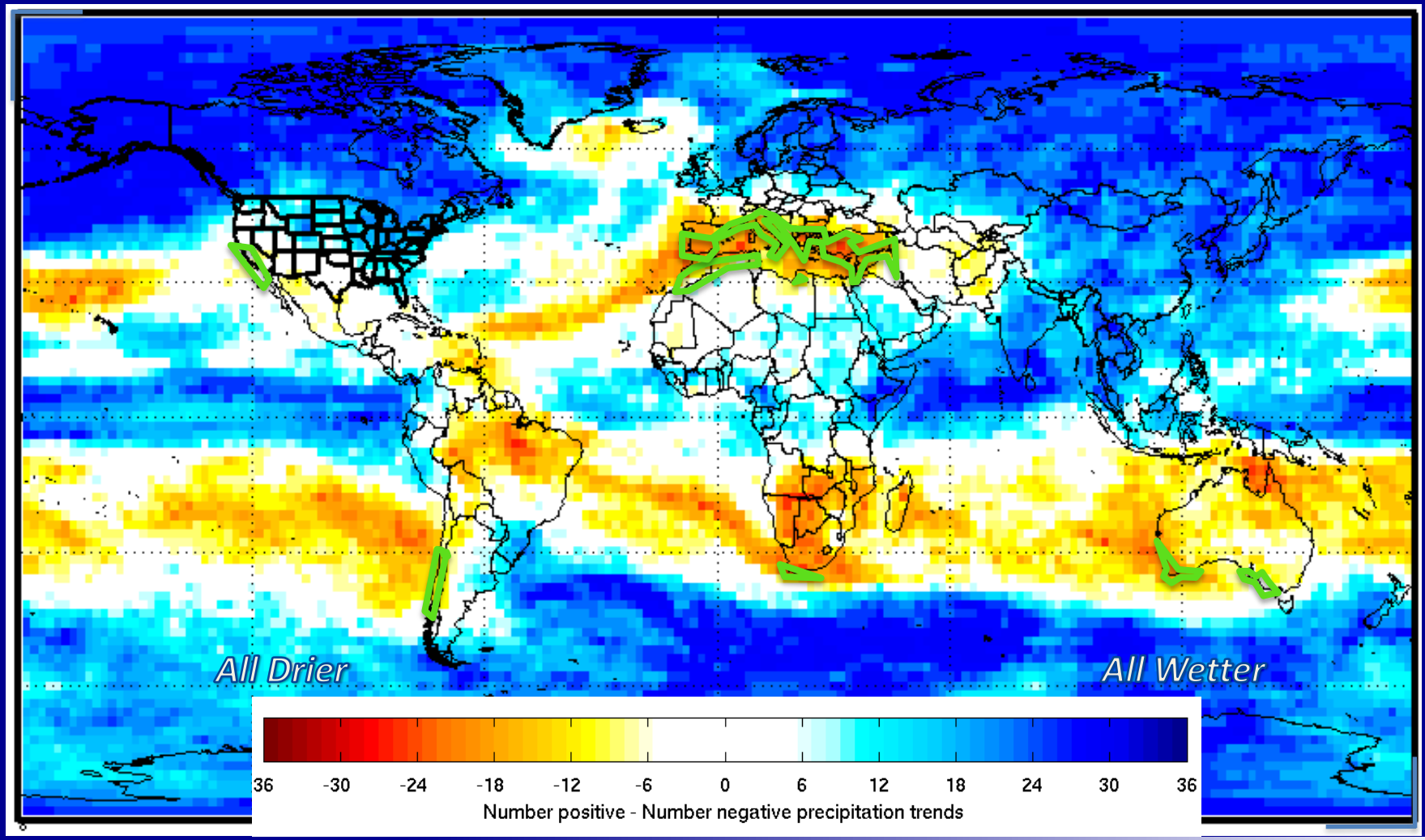
Projected Precipitation Changes

Among 36 projections with RCP2.6-8.8 emissions, how many models yield increasing (decreasing) precipitation?

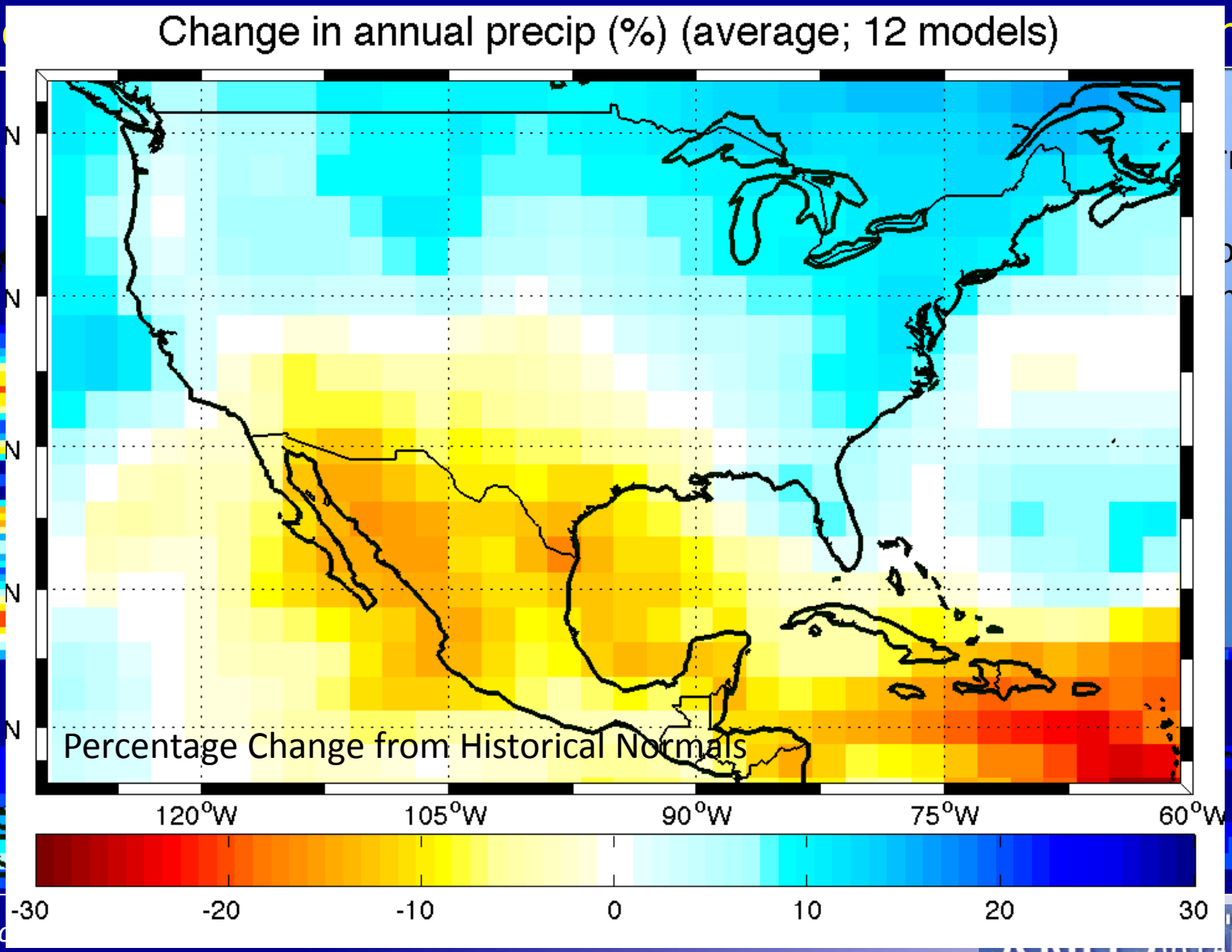


Courtesy of Suraj Polade, SIO

Projected Precipitation Changes

Among 12 projections with RCP8.5 emissions,

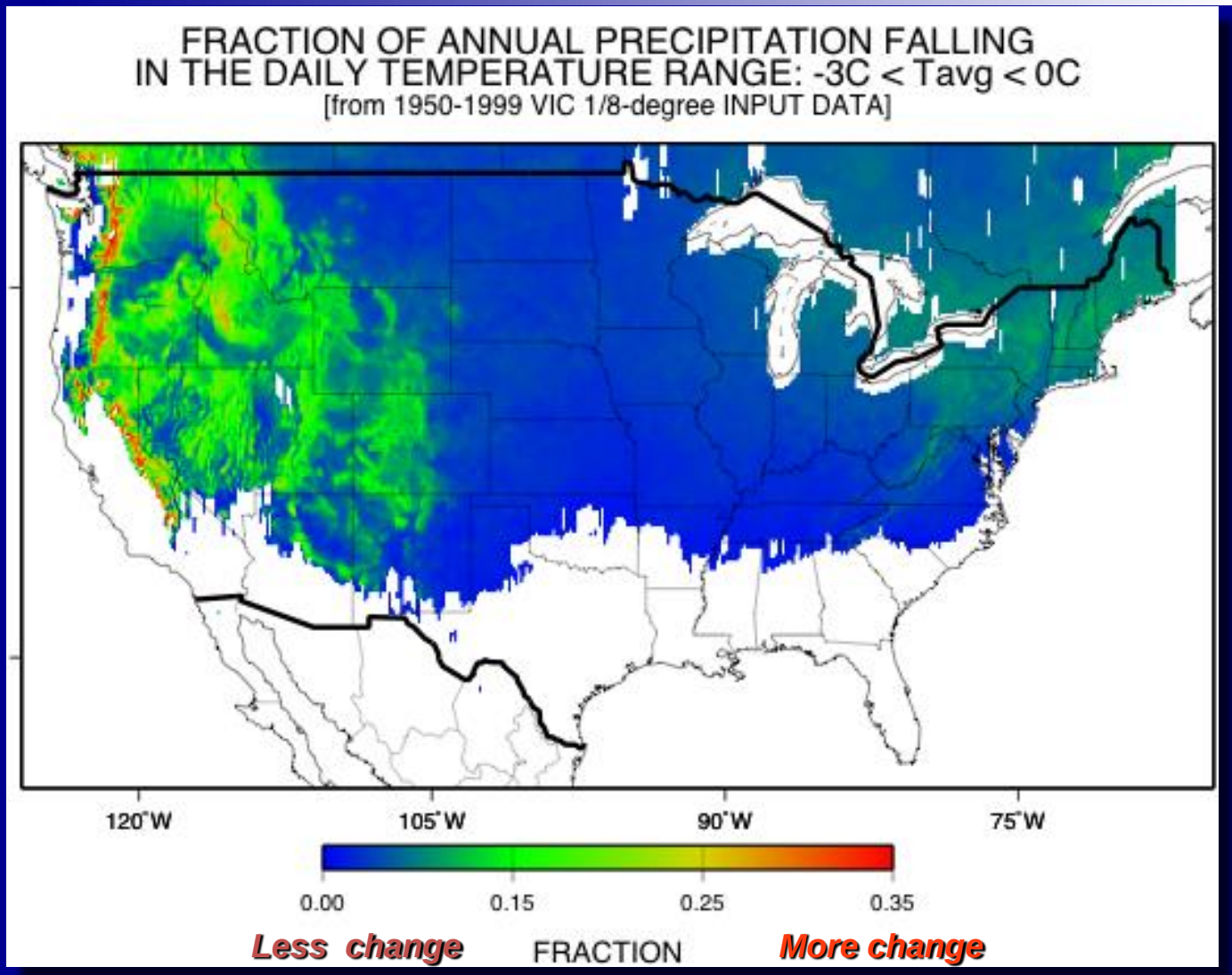
h… …n?



Courtesy o…

Projected Snowfall Changes

What fraction of precipitation historically fell on days with average temperatures just below freezing?



"Rain vs Snow"

Dettinger & Culbertson, SFEWS, 2008

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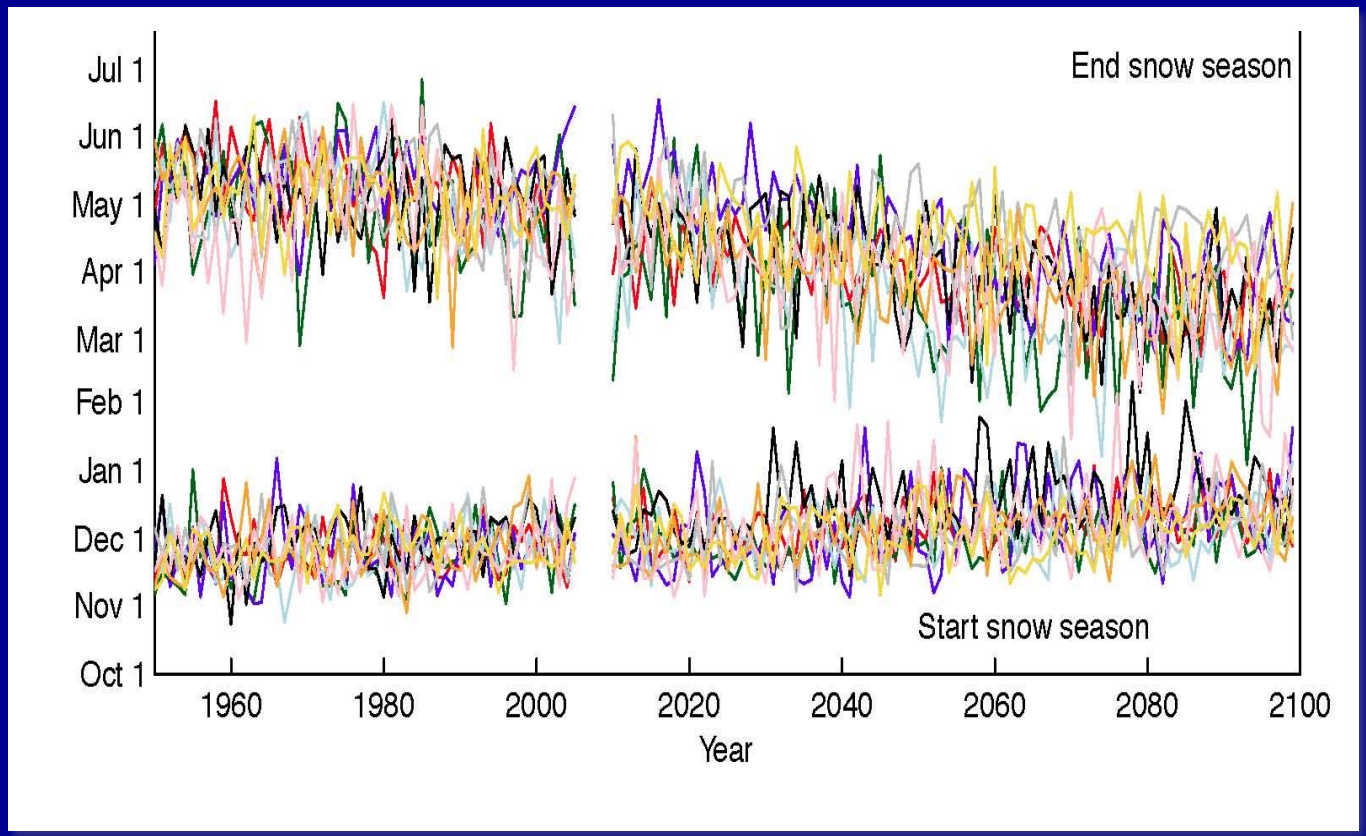
Projected Snow-Season Changes: California

Projected Changes in Snow Season Northern Sierra Nevada, California

(9 CMIP5 RCP4.5 GCMs BCCA downscaled, VIC snow simulated)

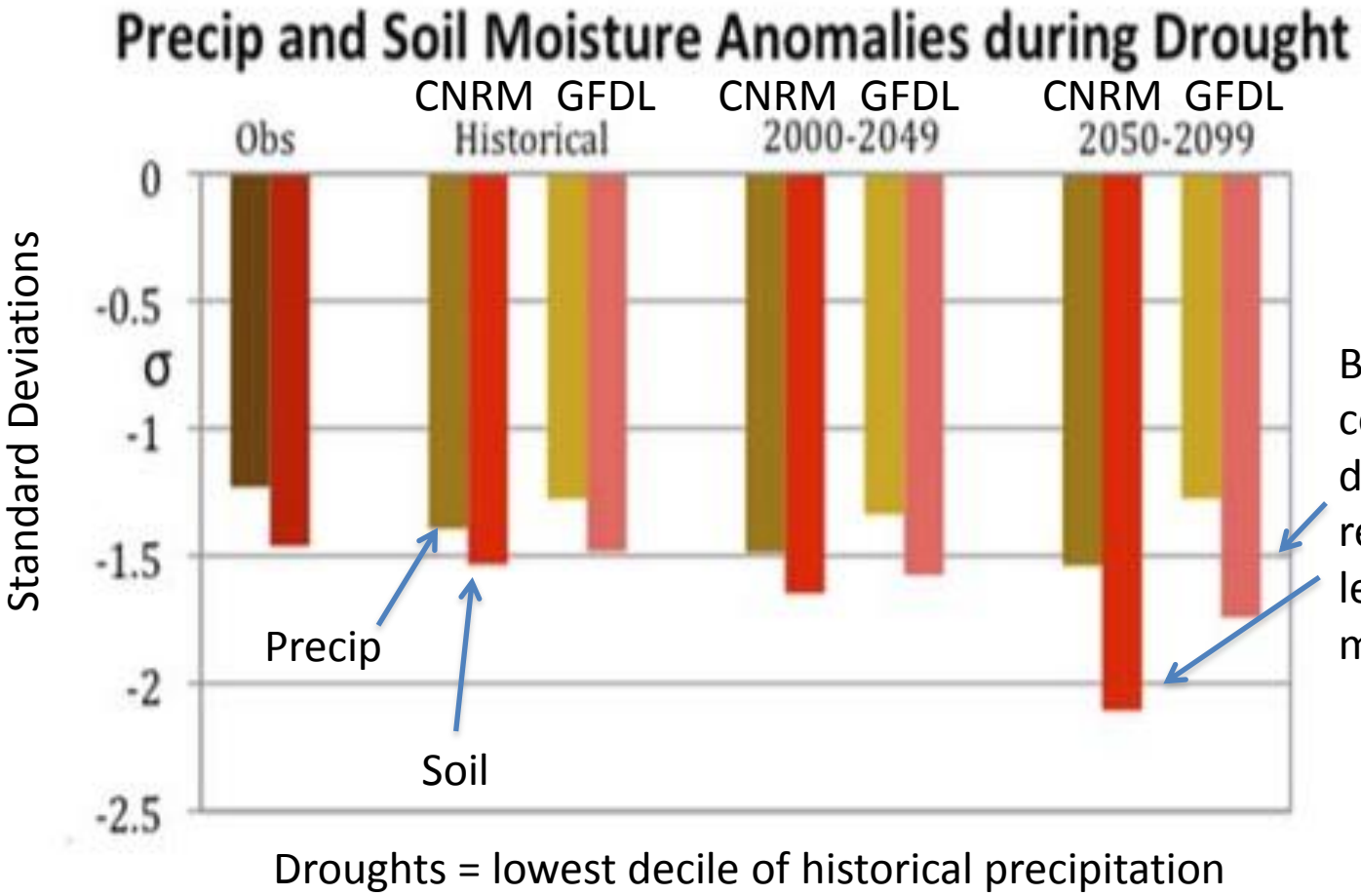


Length of snow season declines from ~6 months to ~3 months

Courtesy of David Pierce, SIO

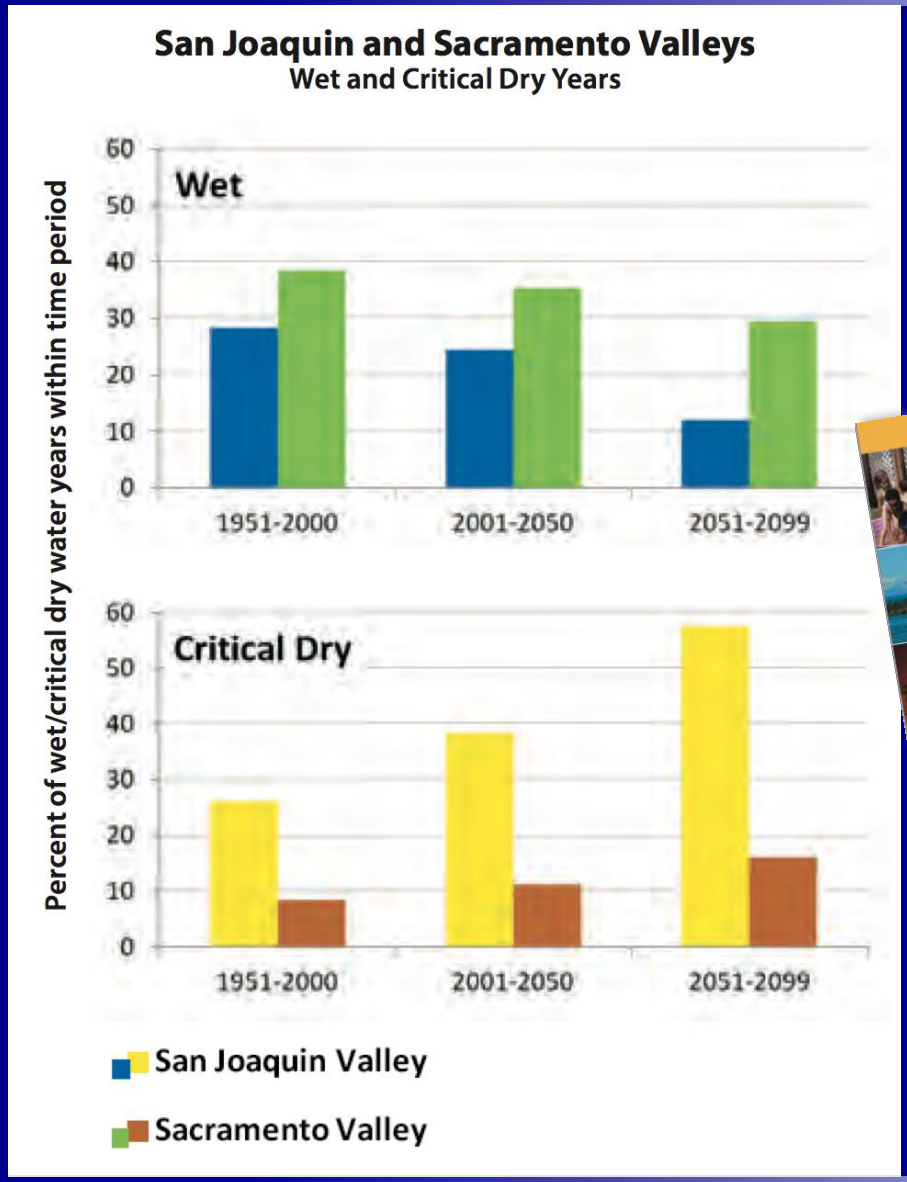
Projected Drought Changes: Southwest US

AR4-era A2 hydrologic simulations over Southwestern US



Cayan et al., PNAS, 2010

Projected Supply Changes: California

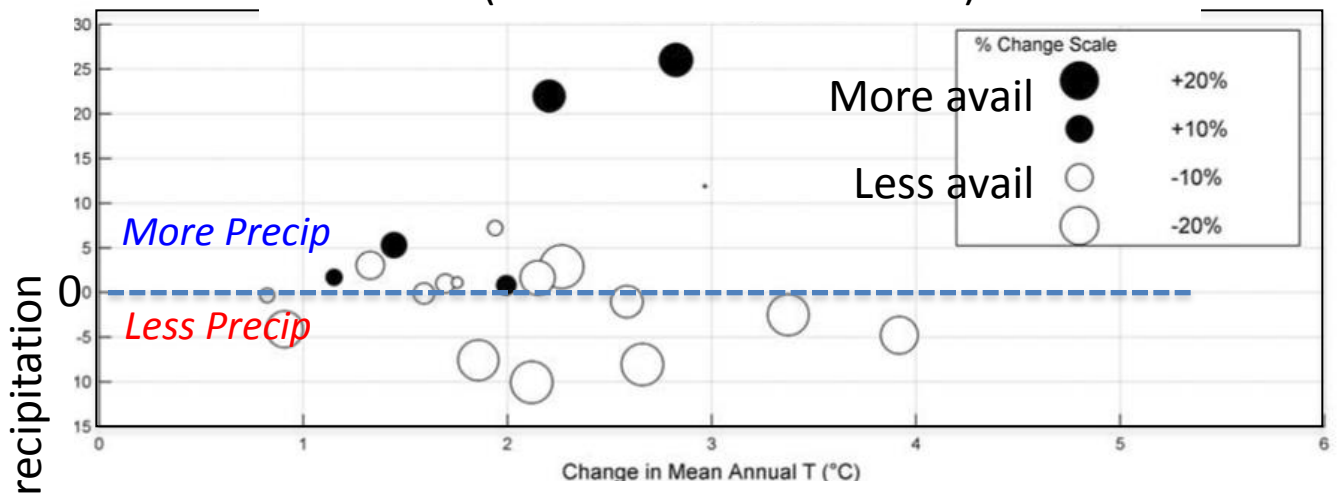


Cayan et al., Our Changing Climate, 2012

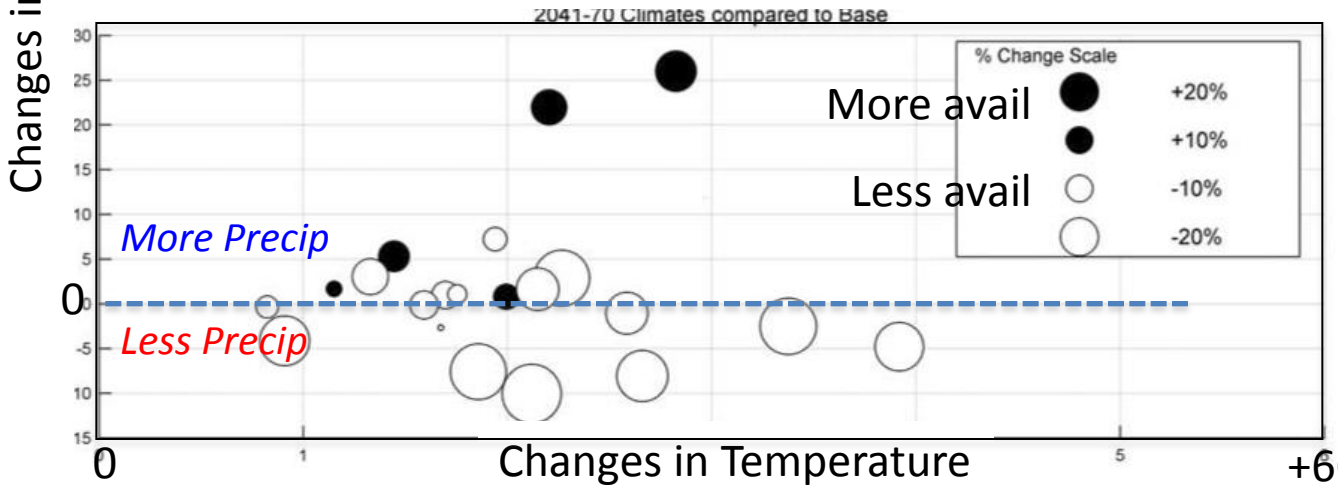
Projected Supply Changes: California

Even under scenarios with increasing precipitation, upon routing through the State's (CALSIM II) water-mgmt model, warming results in reduced water availability.

Changes in Exports to Southern California
(2041-70 versus 1950-99)



Changes in (Shasta) Reservoir Carryover



Brekke et al., WRR, 2009

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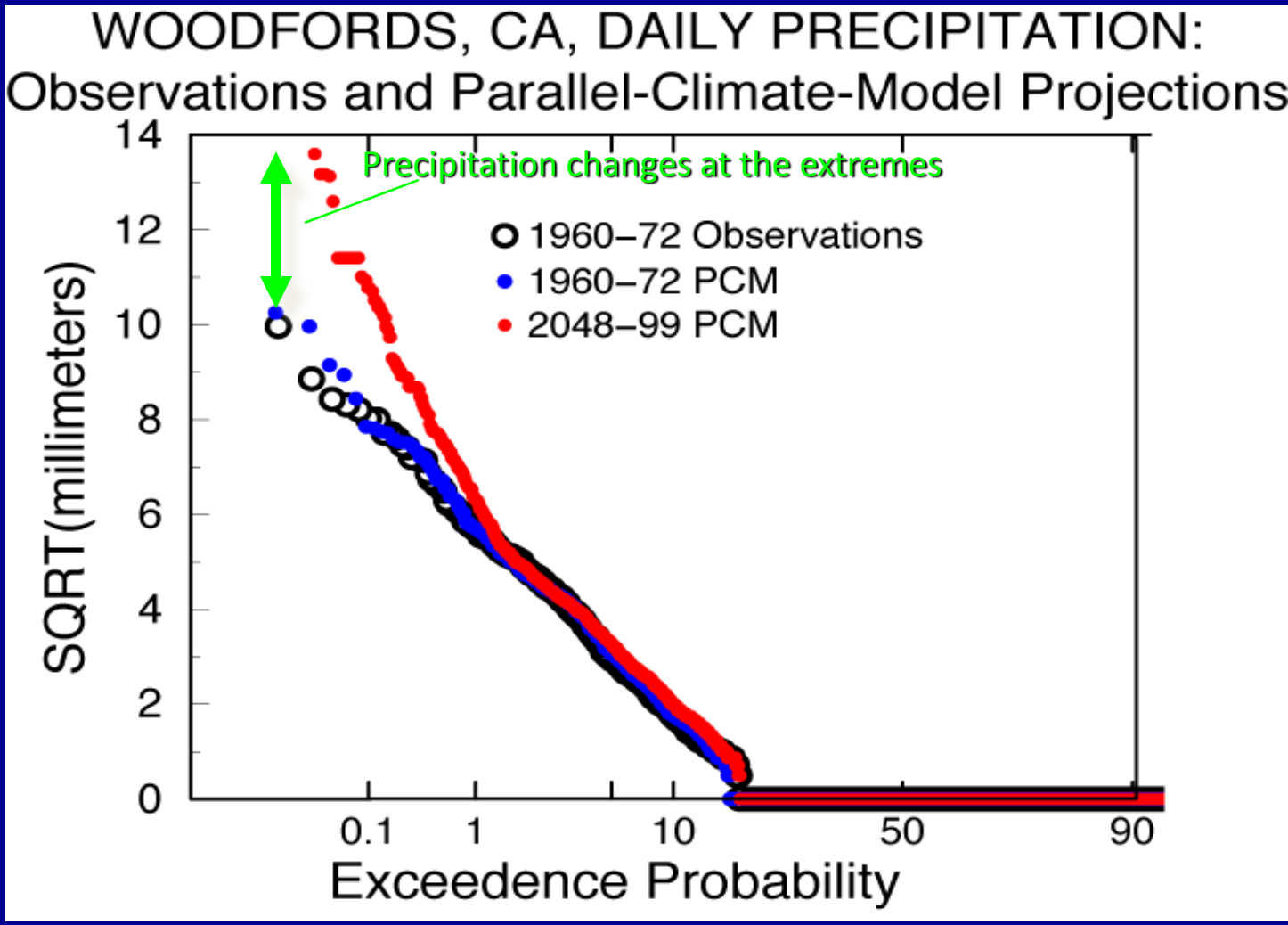
Projections of Extreme Precipitation

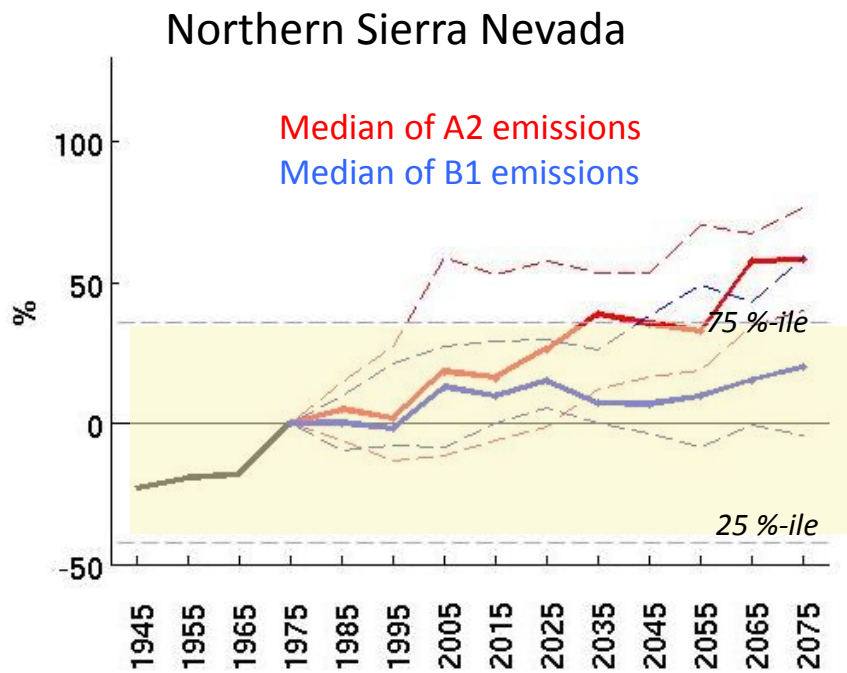
Results from the US Parallel-Climate Model, which yields small change in AVERAGE precipitation



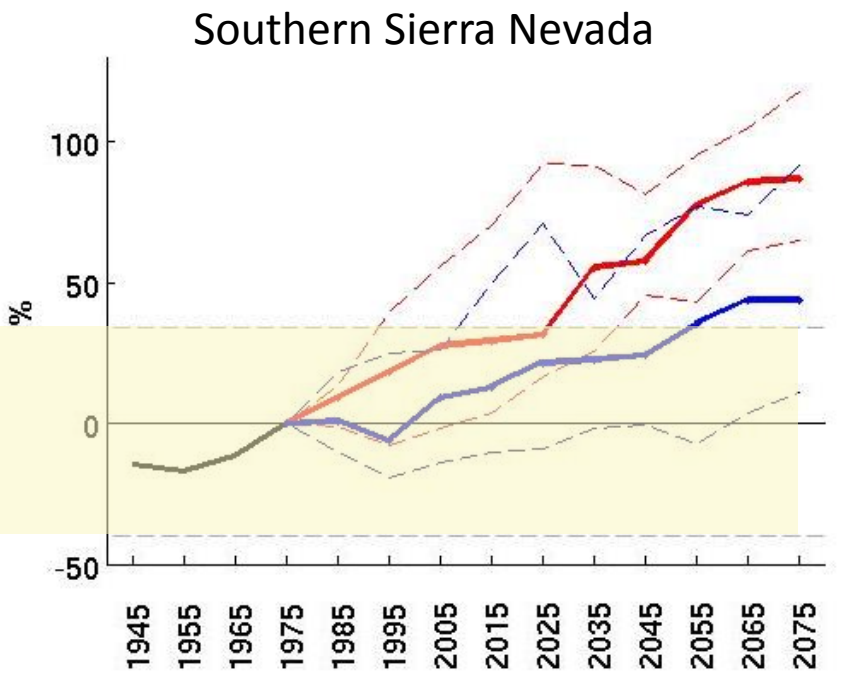
Dettinger et al., Clim Chg, 2004

Projected 50-yr Flood Conditions: California

Distributions of 50-yr flood changes, from ensemble of 16 GCMs



Center of sliding 50-yr window



Center of sliding 50-yr window

From recent extensions (in review) to the analyses in:
Das, T. et al.., 2011, Potential increase in floods in California's Sierra Nevada under future climate projections: Climatic Change, 24 p.

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Conclusions

- Southern California & much of Colorado basin are focus of predominantly declining precipitation projections; Northern California more uncertain.

- Projected warming trends moderated somewhat by coastal & midlatitude locations

- Precipitation extremes expected to increase; flood risks may increase, drought risks WILL increase