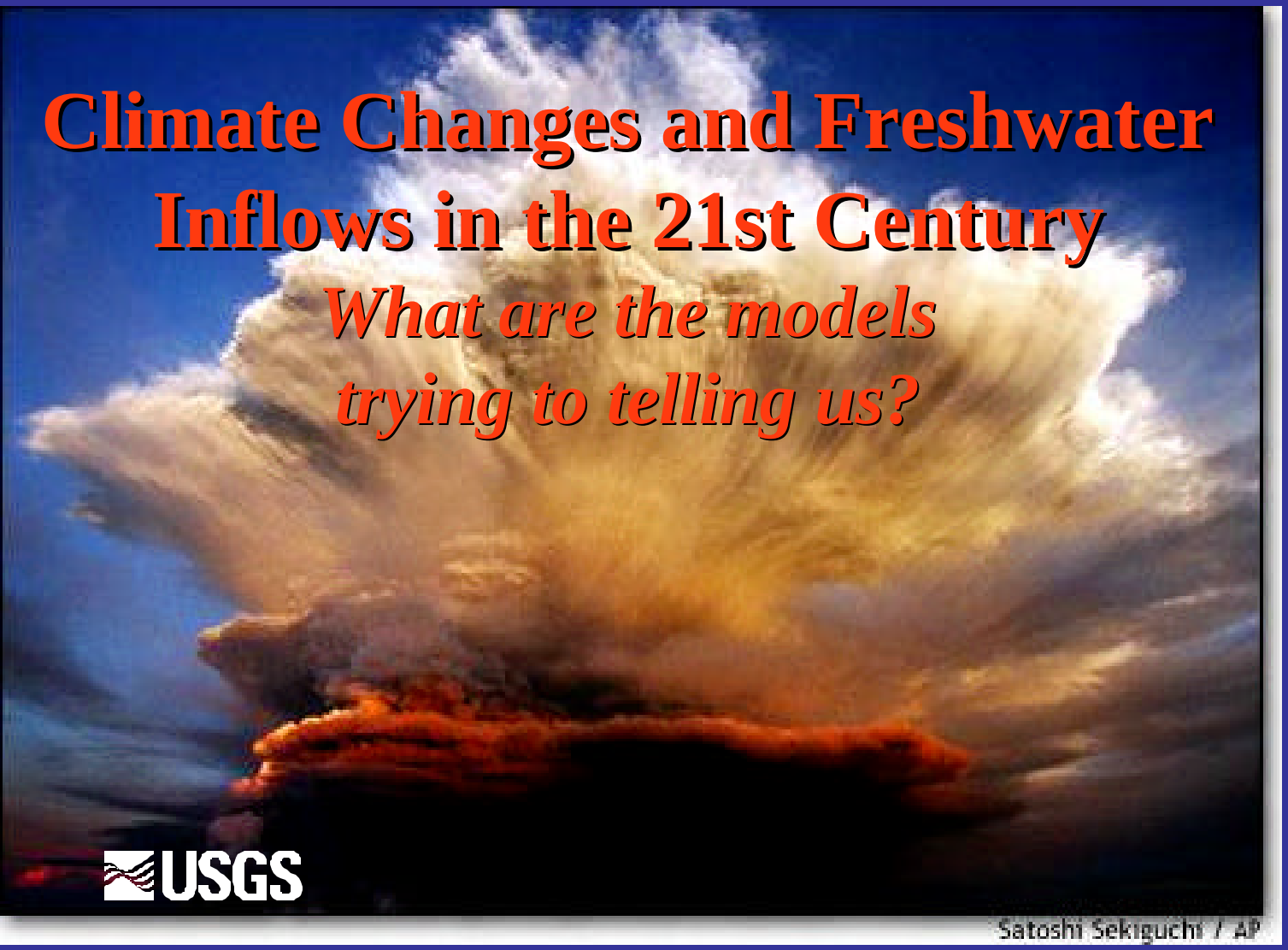


Climate Changes and Freshwater Inflows in the 21st Century

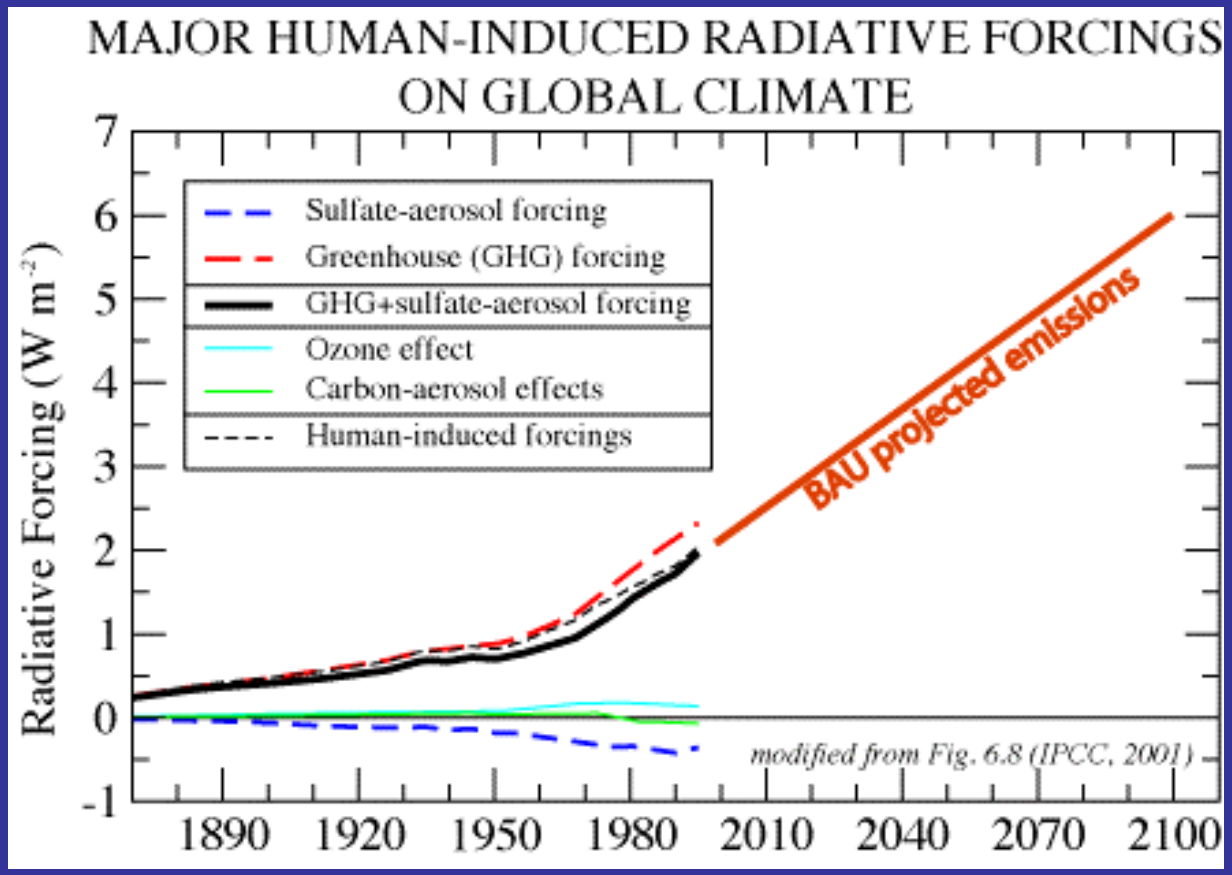
What are the models trying to telling us?

Mike Dettinger, Noah Knowles, & Dan Cayan
US Geological Survey

Sponsored by **the** USGS SF Bay Ecosystem Program & the DOE-funded Accelerated Climate Prediction Initiative

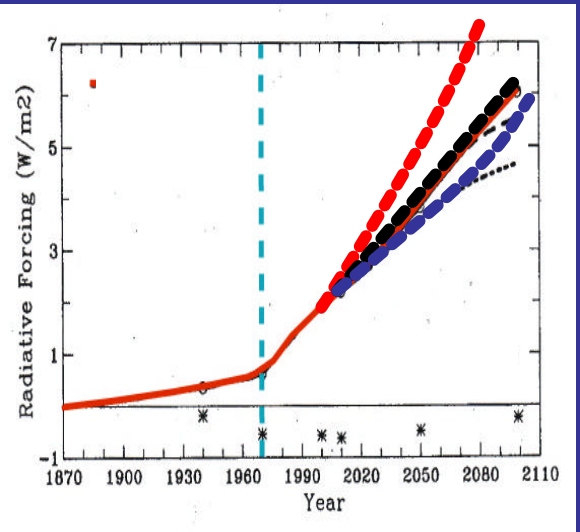
In the near future, global-warming trends are likely to be superimposed upon 'normal' climate variations that our resource systems accommodate...

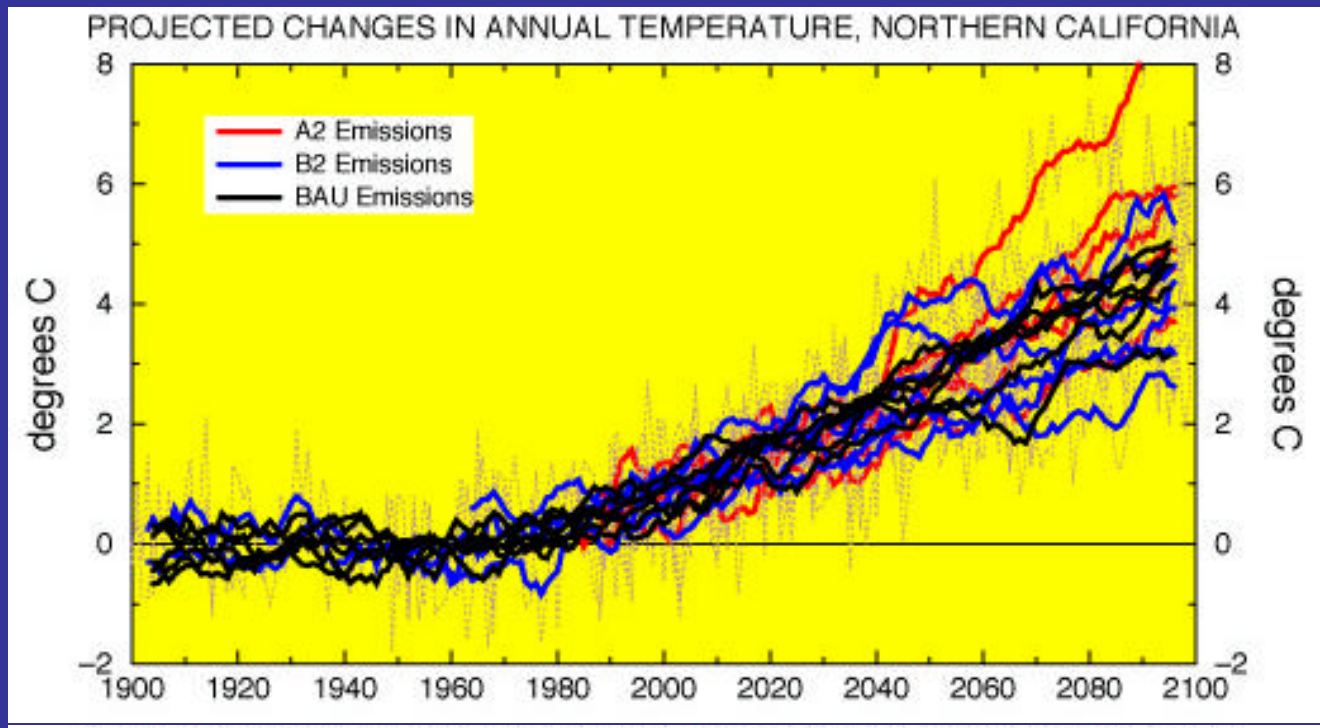
Extra Heat Trapped by CO2 & other Emissions

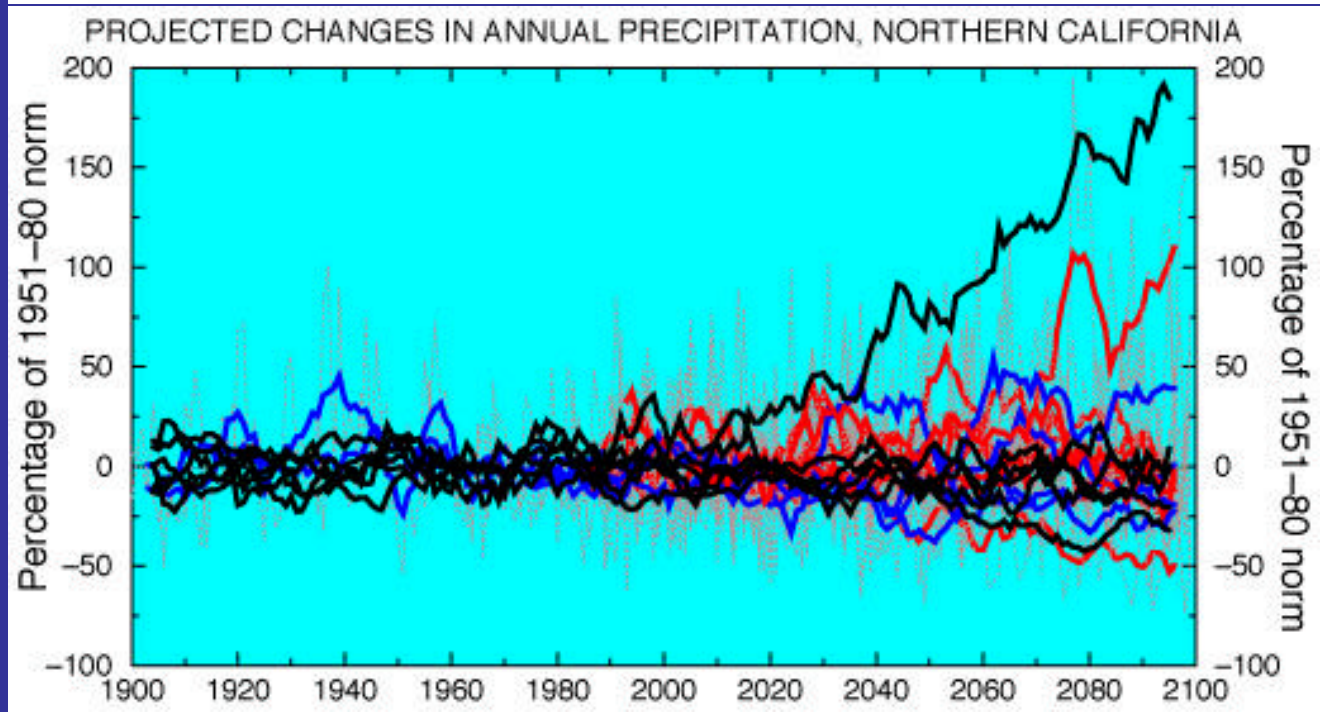


…in response to accelerations of the greenhouse effect that began 30+ years ago!

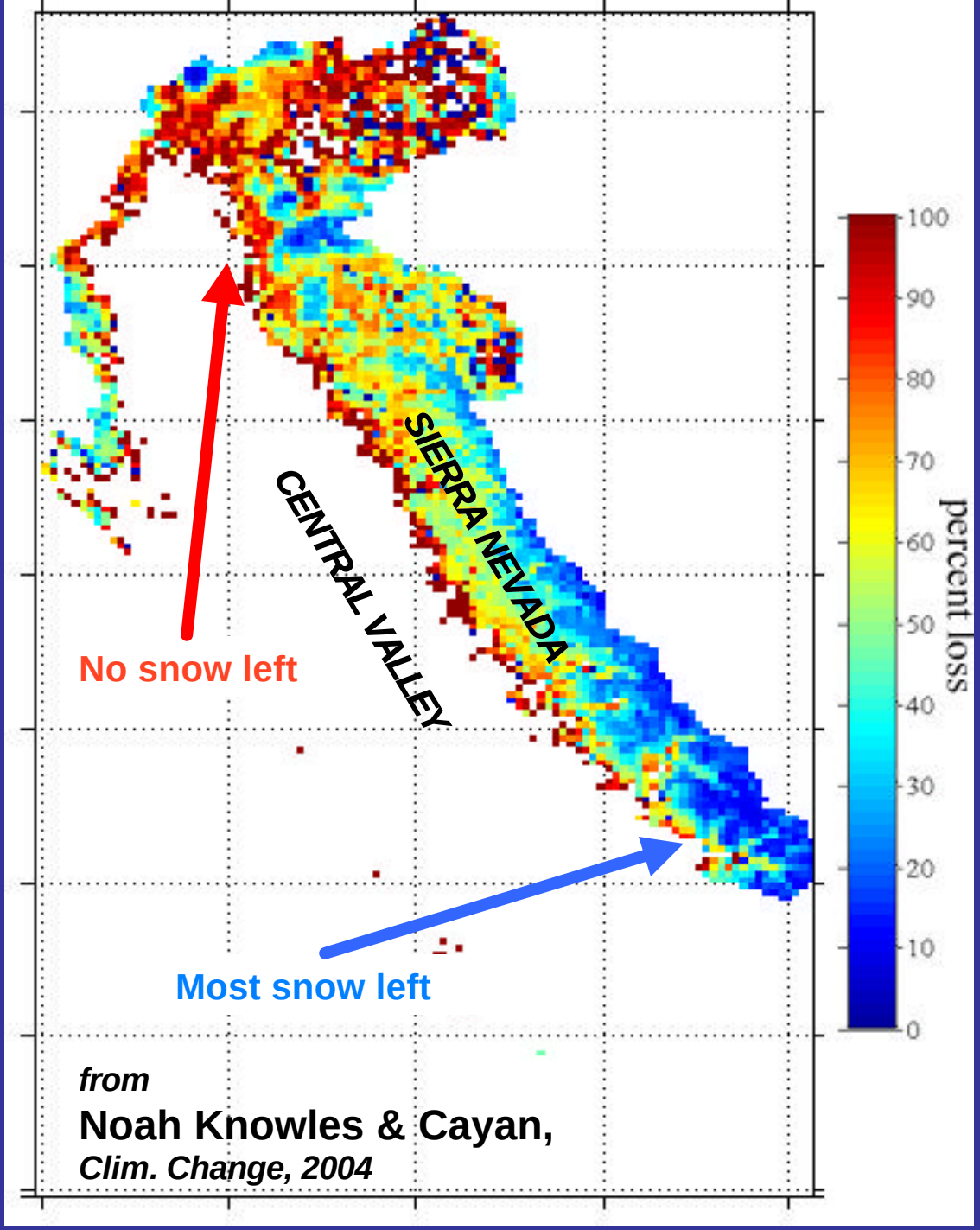
Under such forcings, climate models yield a narrow range of warming scenarios and (amidst a broader overall range) a tendency for little precipitation change in California.







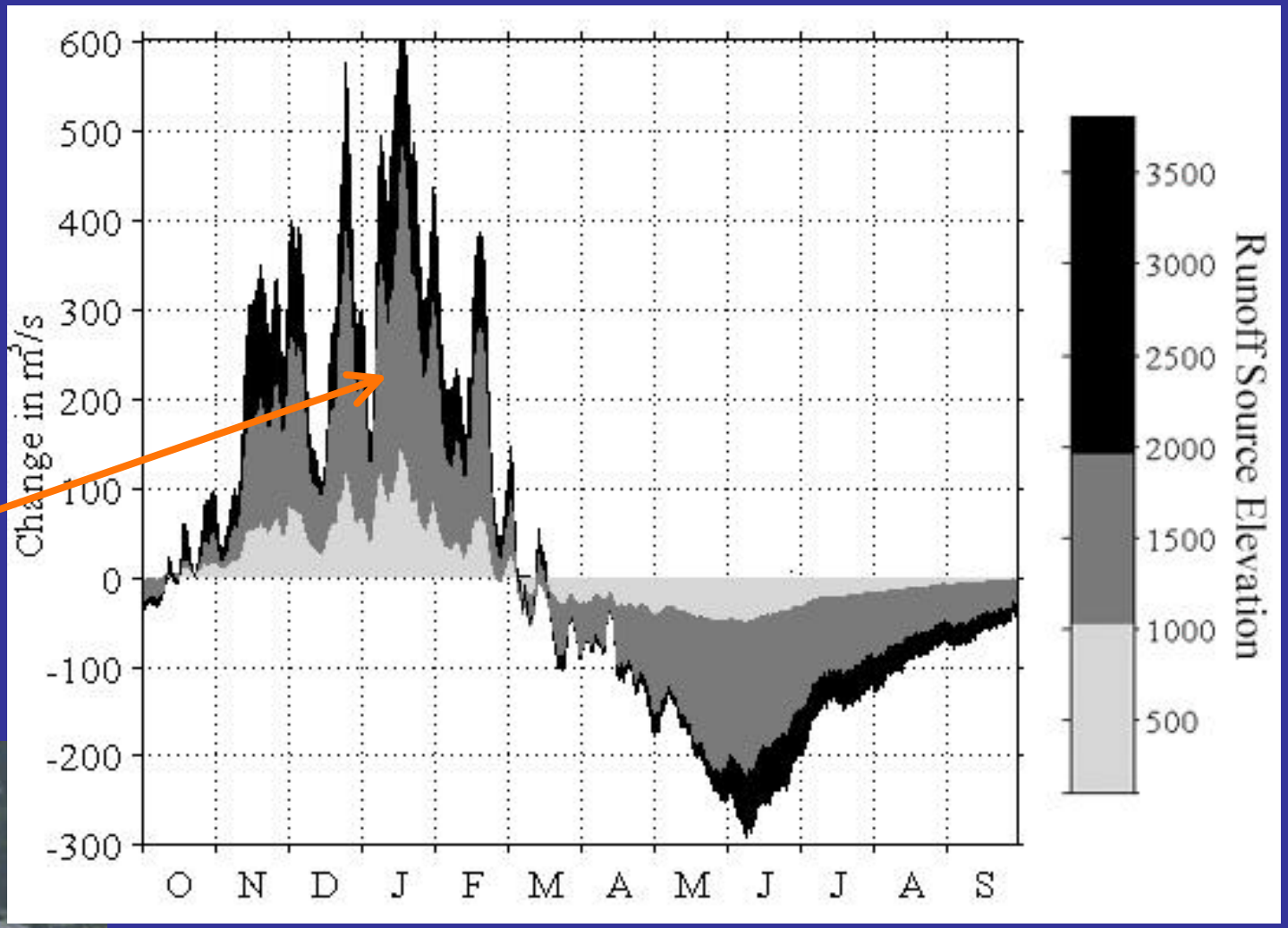
By the middle of the 21st Century, *even in the coolest of the scenarios*, earlier snowmelts & major reductions in snowpacks of the Sierra Nevada are projected...



USGS

Changes in Freshwater Inflow to SF Bay, 2060 – 2000

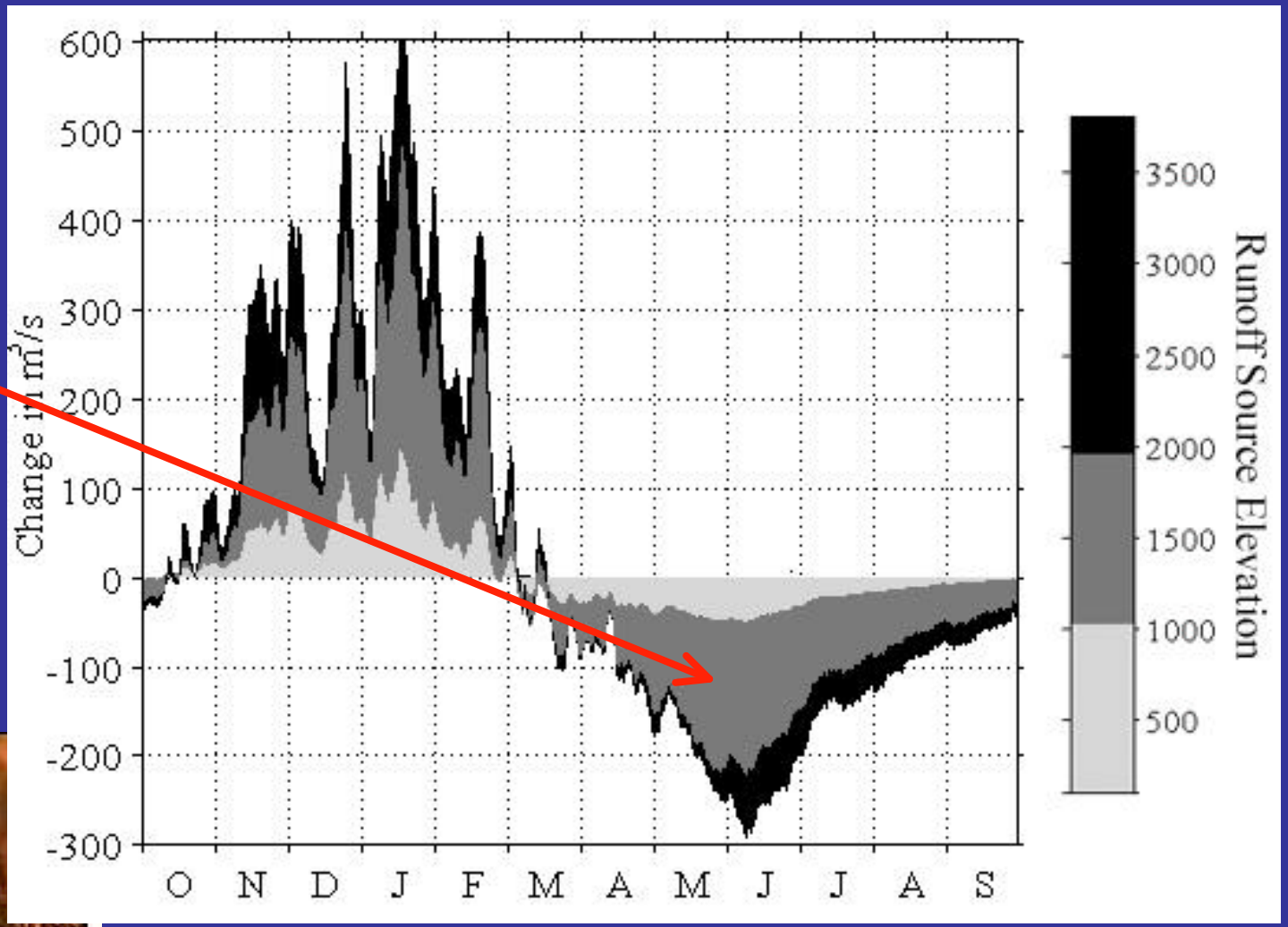
Even with no change in precipitation, the coolest of these temperature projections will bring more severe winter floods…



Knowles and Cayan, 2004;
http://www.cgd.ucar.edu/cas/ACACIA/workshops/precip/dettinger.pdf

Changes in Freshwater Inflow to SF Bay, 2060 – 2000

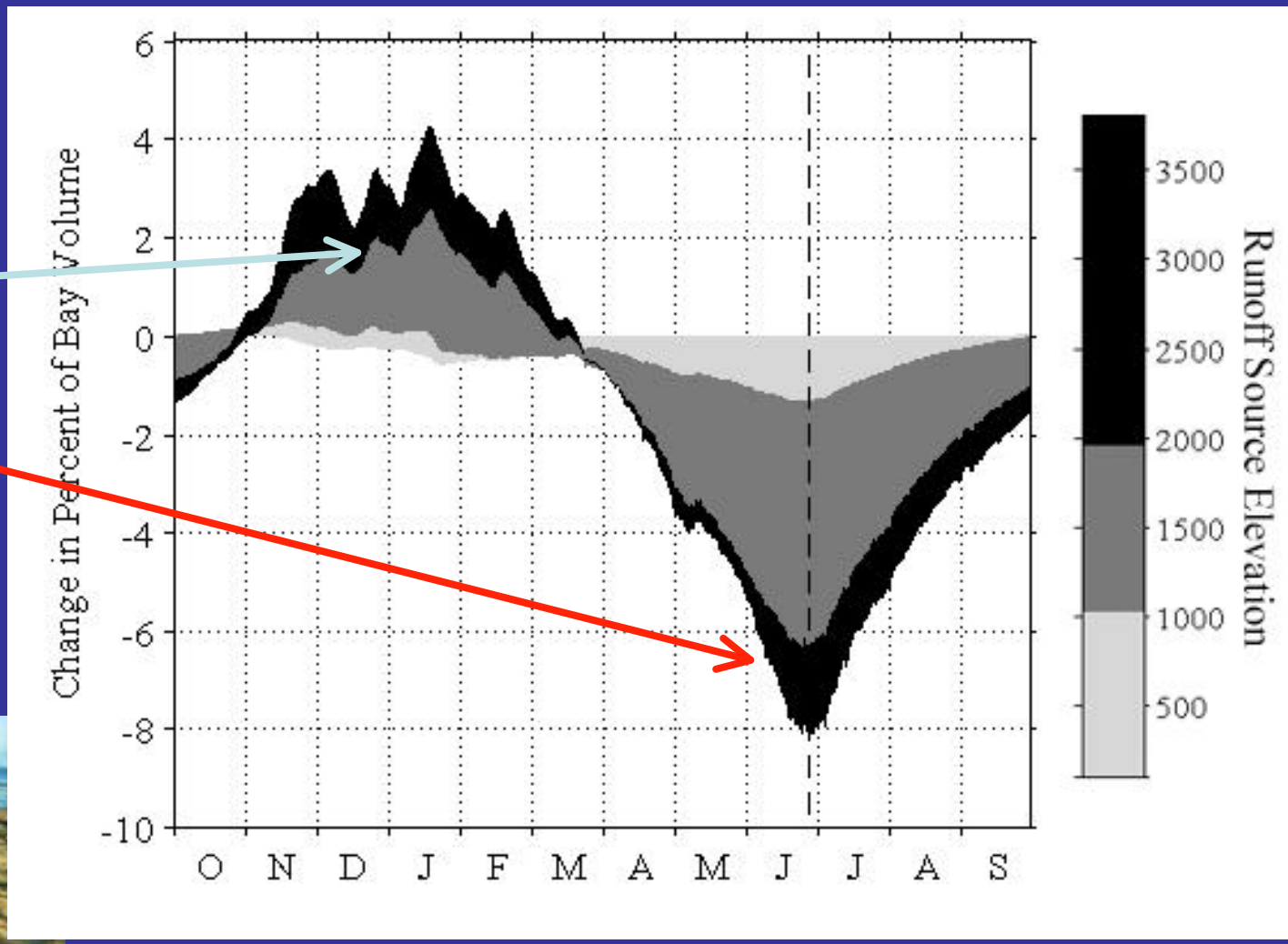
… and much drier springs and summers.



Knowles and Cayan, 2004
Dettinger and others, 2004

Changes in Freshwater Content of SF Bay, 2060 – 2000

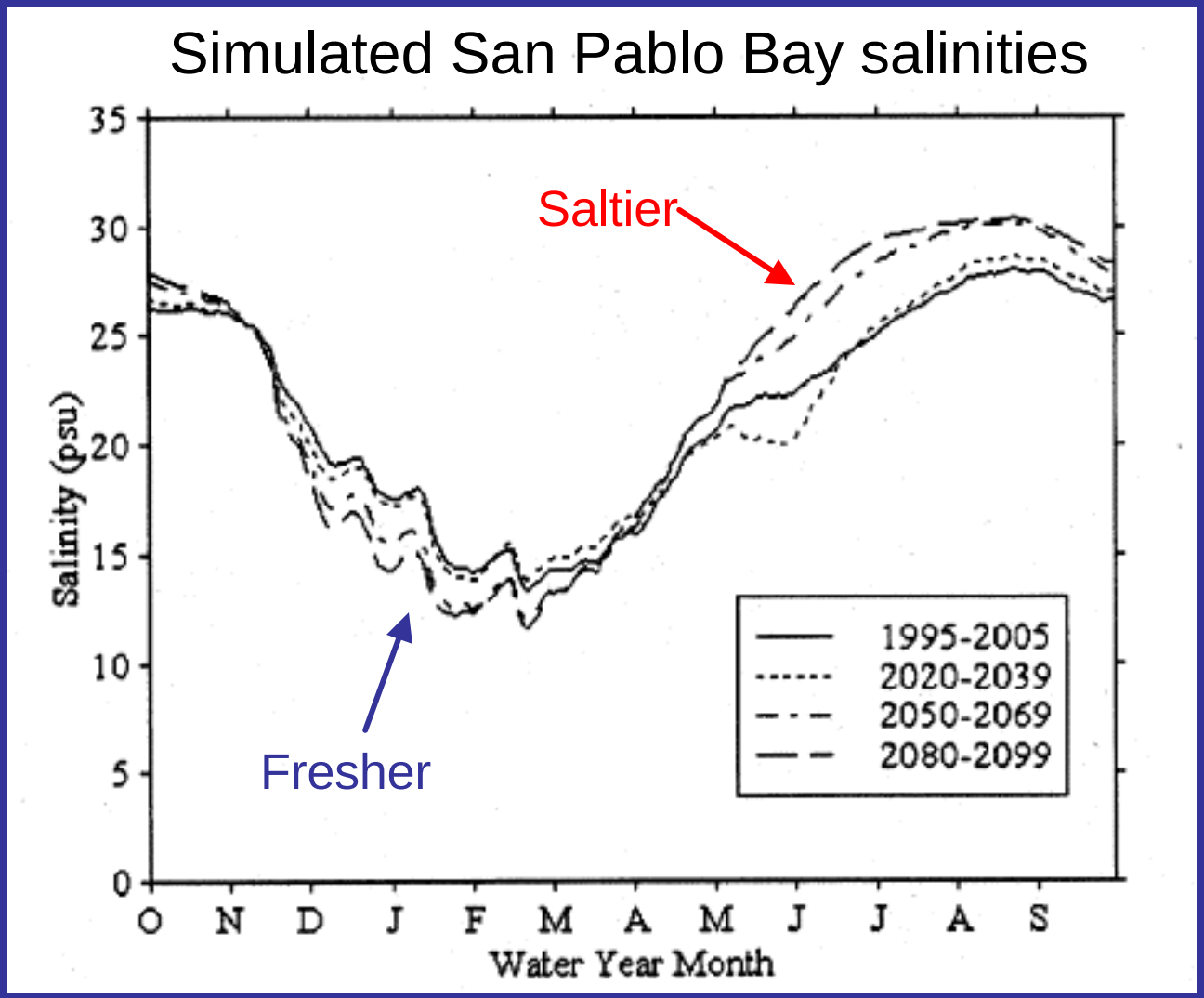
For the Bay, this means wetter winters and drier springs and summers.



Knowles and Cayan, GRL, 2002
Knowles and Cayan, 2004

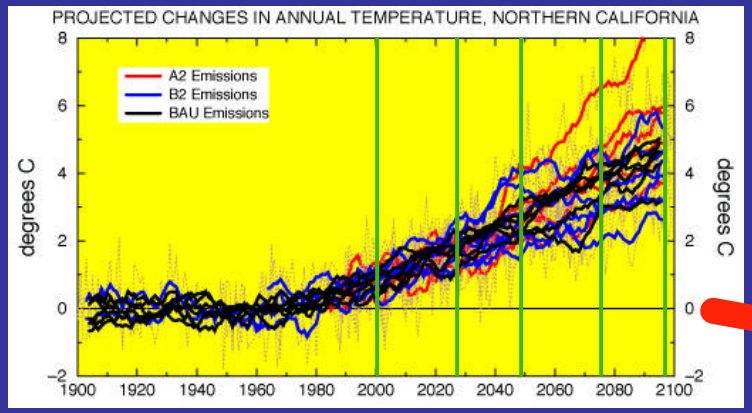
In the Bay, fresher winters and very salty summers result.

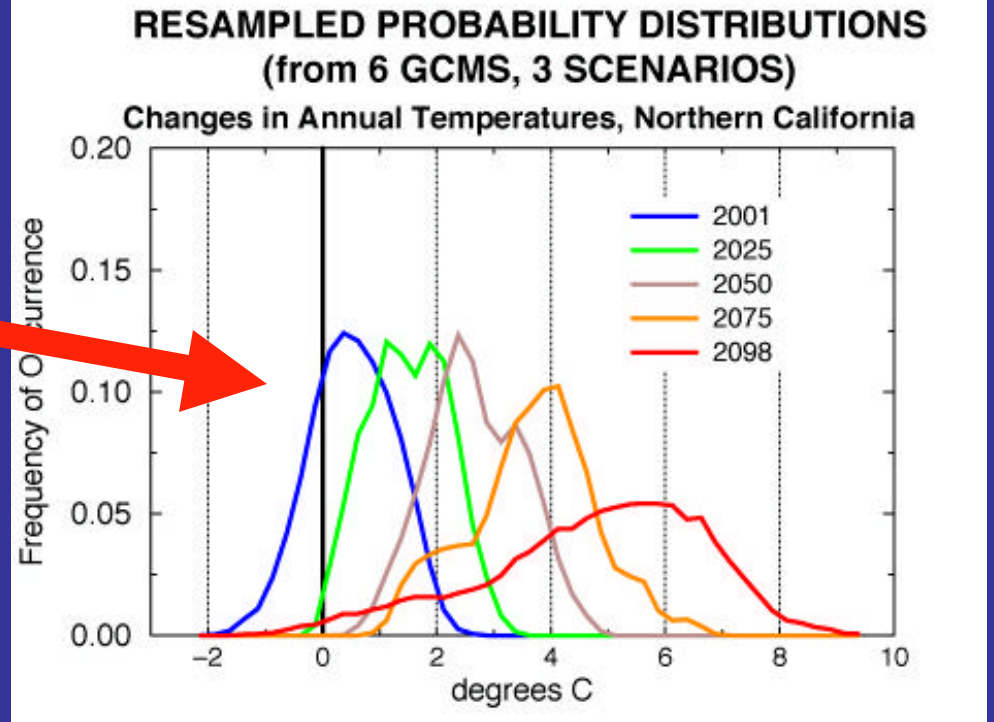
This will be aggravated by 0.3 m to 0.9 m sea-level rise.

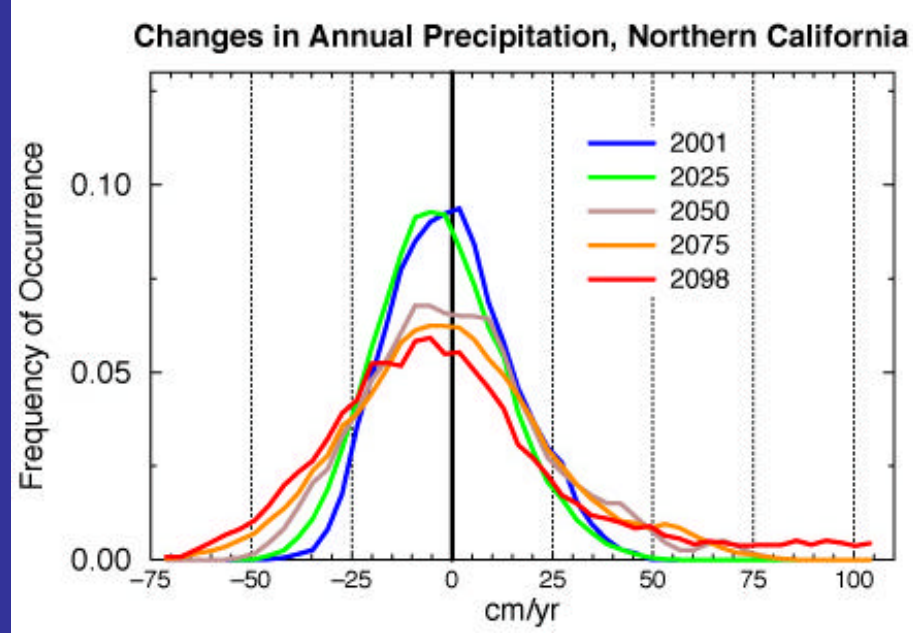


USGS

Knowles, and Cayan, 2002







Dettinger, in review, Climatic Change

Time slices through the full ensemble of projections emphasizes:

- ❖Important temperature (& snowmelt) changes within about 20 years
- ❖Strong tendency toward little precipitation change, with a hint of slightly drier
- ❖General spreading of possibilities due to model and emissions uncertainties

WHAT ARE THE MODELS TRYING TO SAY?

- Northern California temperature projections are broadly in consensus (+3 to +6 or more ºC warmer), enough for earlier flows, more floods & drier summers

- Northern California precipitation projections are a bit more scattered, but MOST show small (drier?) changes

- Fresher winters & saltier summers in the Bay result

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REFERENCES

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