Greening Borders USD Nov 18, 2009

Climate Change – a looming challenge for the California region

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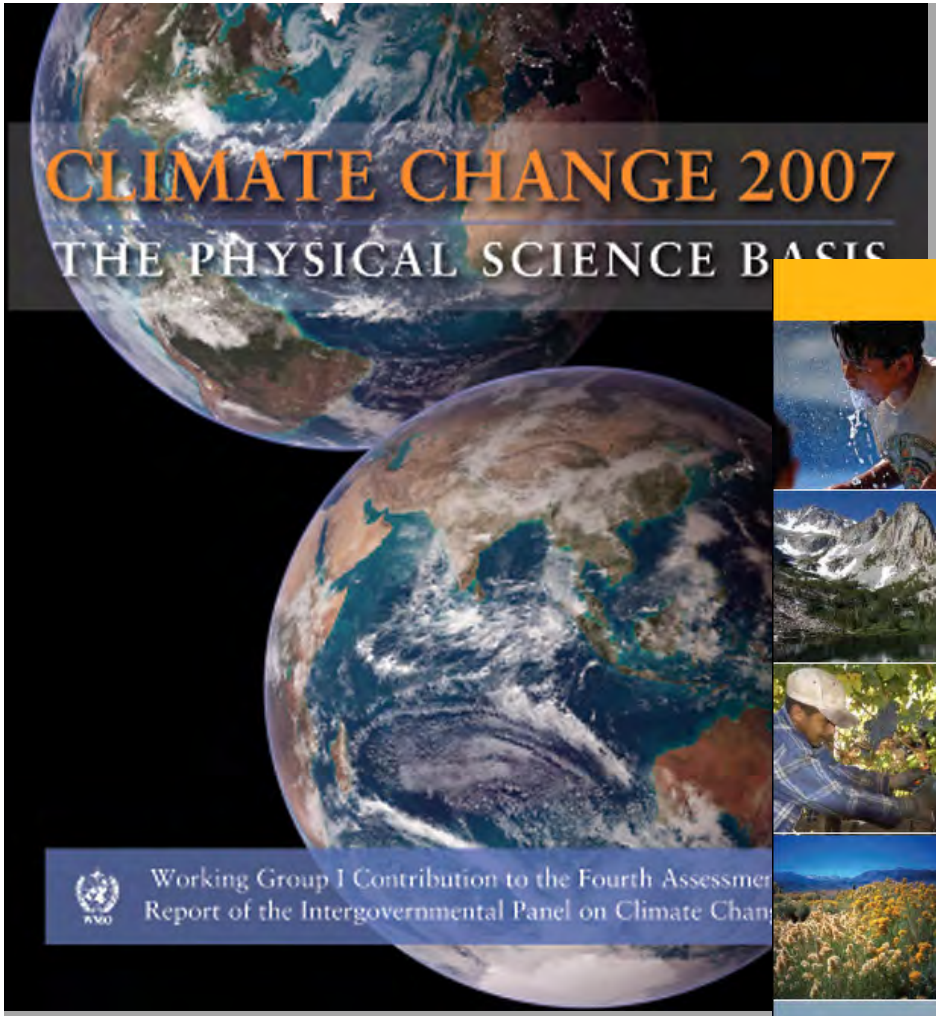
sponsors:
California Energy Commission PIER program
California Ocean Protection Council
NOAA OGP RISA element

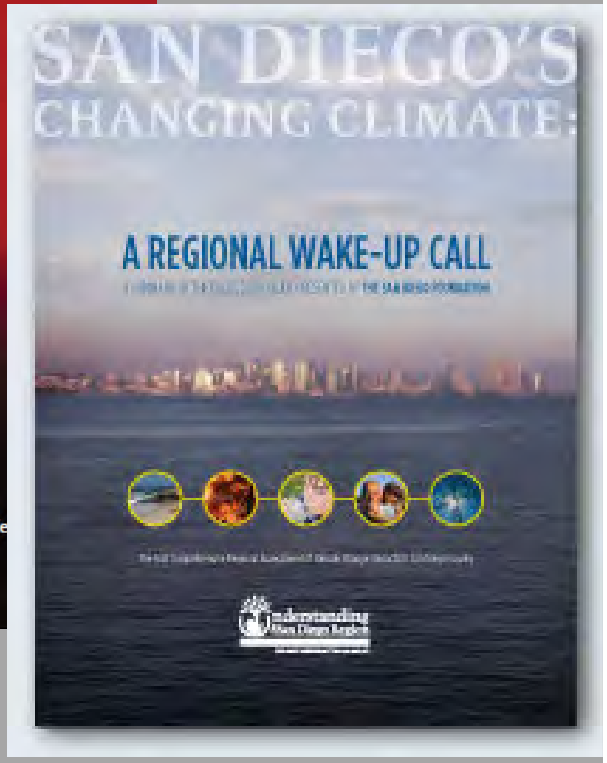
http://meteora.ucsd.edu/cap

a nested, ongoing evaluation of
global regional climate change



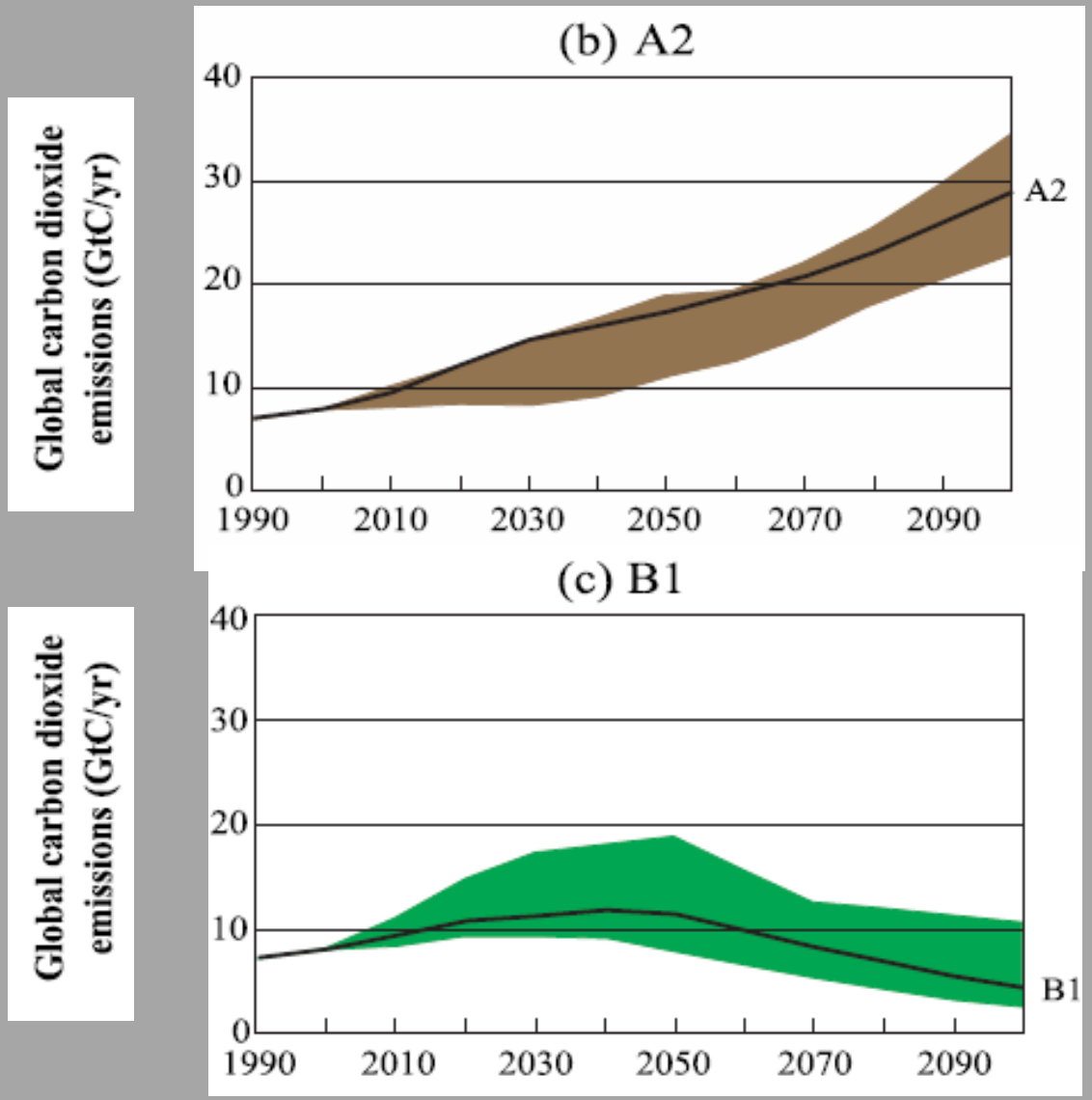
IPCC 4th Assessment, 2007

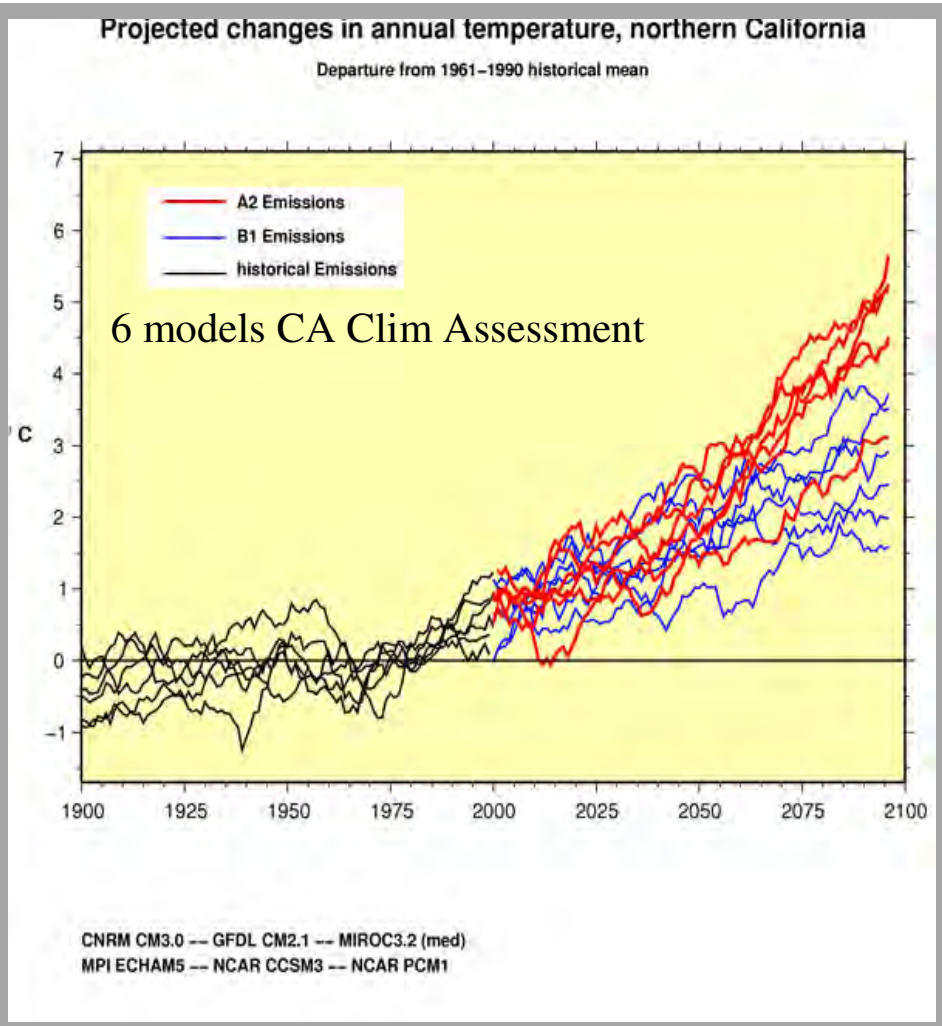
California Climate
Scenarios Assessment
2005-06 and 2008-09



San Diego Focus 2050
2008

SRES A2 and B1 Scenarios: Global carbon dioxide emissions





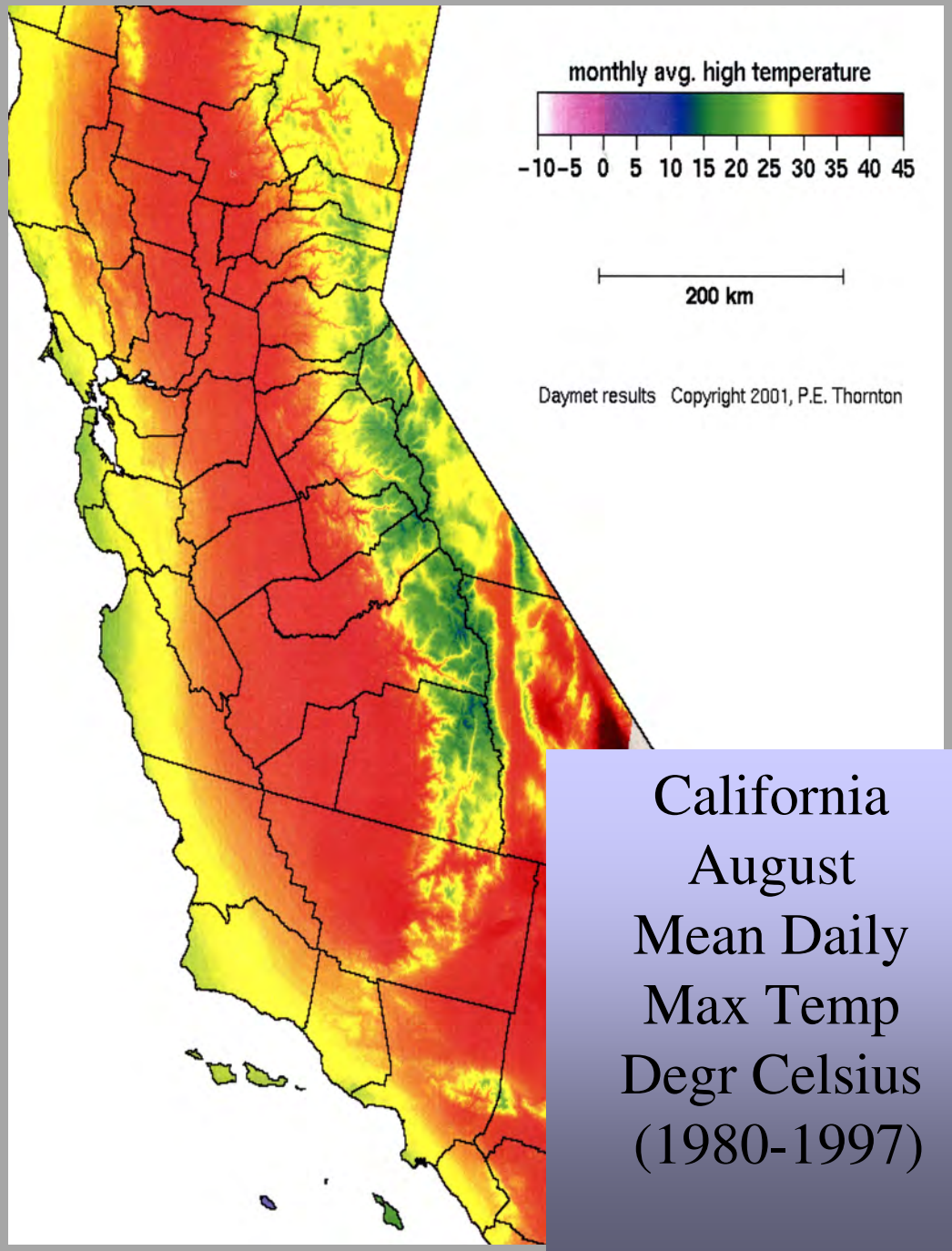
All simulations warm over the 21st Century, at very substantial rates

A2 simulations (red) warm more than B1 simulations (blue)

6 models selected for California Assessment are representative of larger population of IPCC AR4 models

John D. Landis and Michael Reilly
How We Will Grow: Baseline Projections of the Growth of California's Urban Footprint through the Year 2100

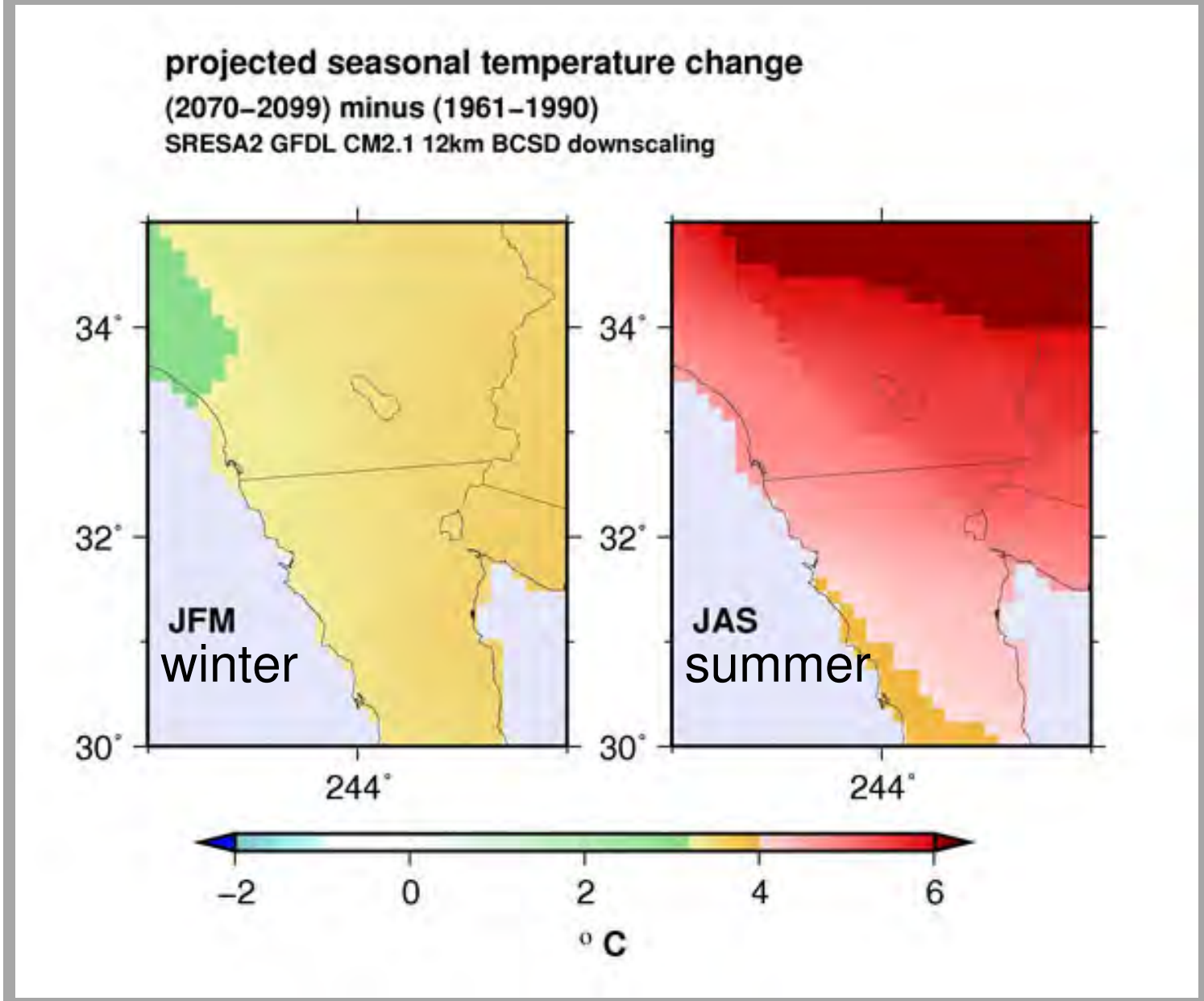
Department of City and Regional Planning
Working Paper 2003-04
Institute of Urban and Regional Development
University of California, Berkeley



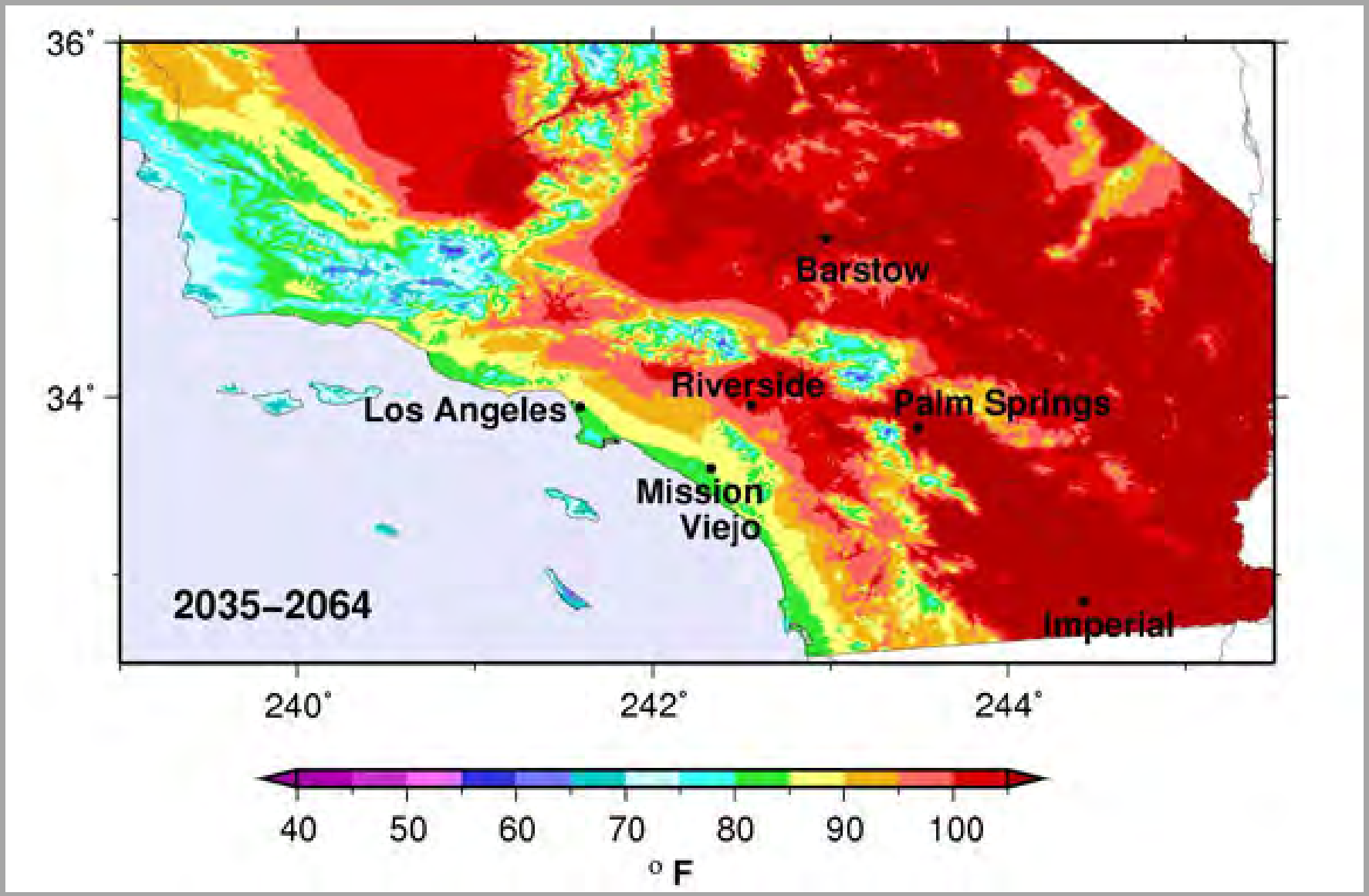
California
August
Mean Daily
Max Temp
Degr Celsius
(1980-1997)

Our environment In California— very strong gradients

Development is occurring in hotter interior valleys



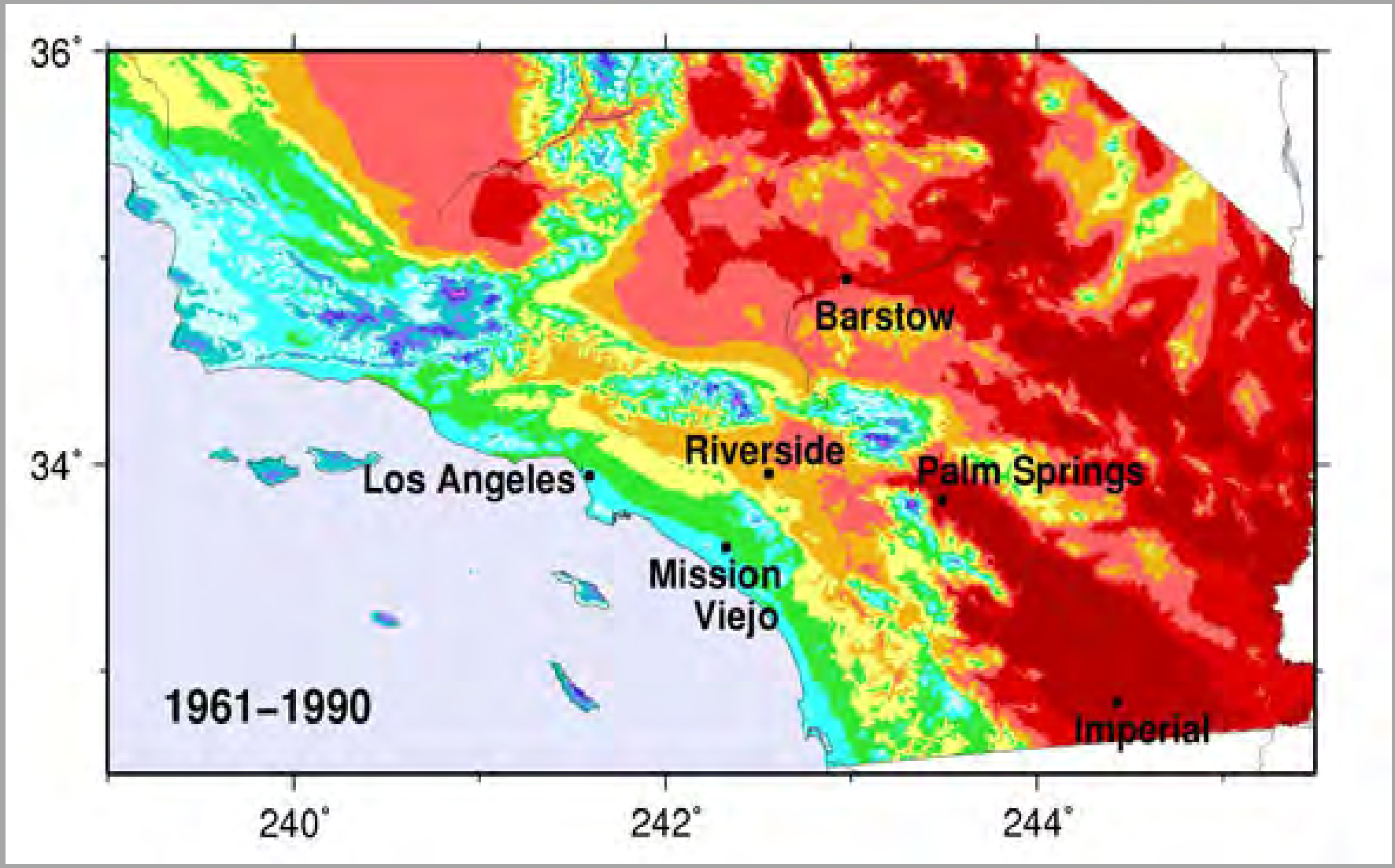
warming expected in climate models is accentuated in summer



One climate model scenario of July average daily Tmax mid 21st Century

GFDL A2 1km downscaled to 1km

Hugo Hidalgo Tapash Das Mike Dettinger



estimated present-day historical July average daily Tmax

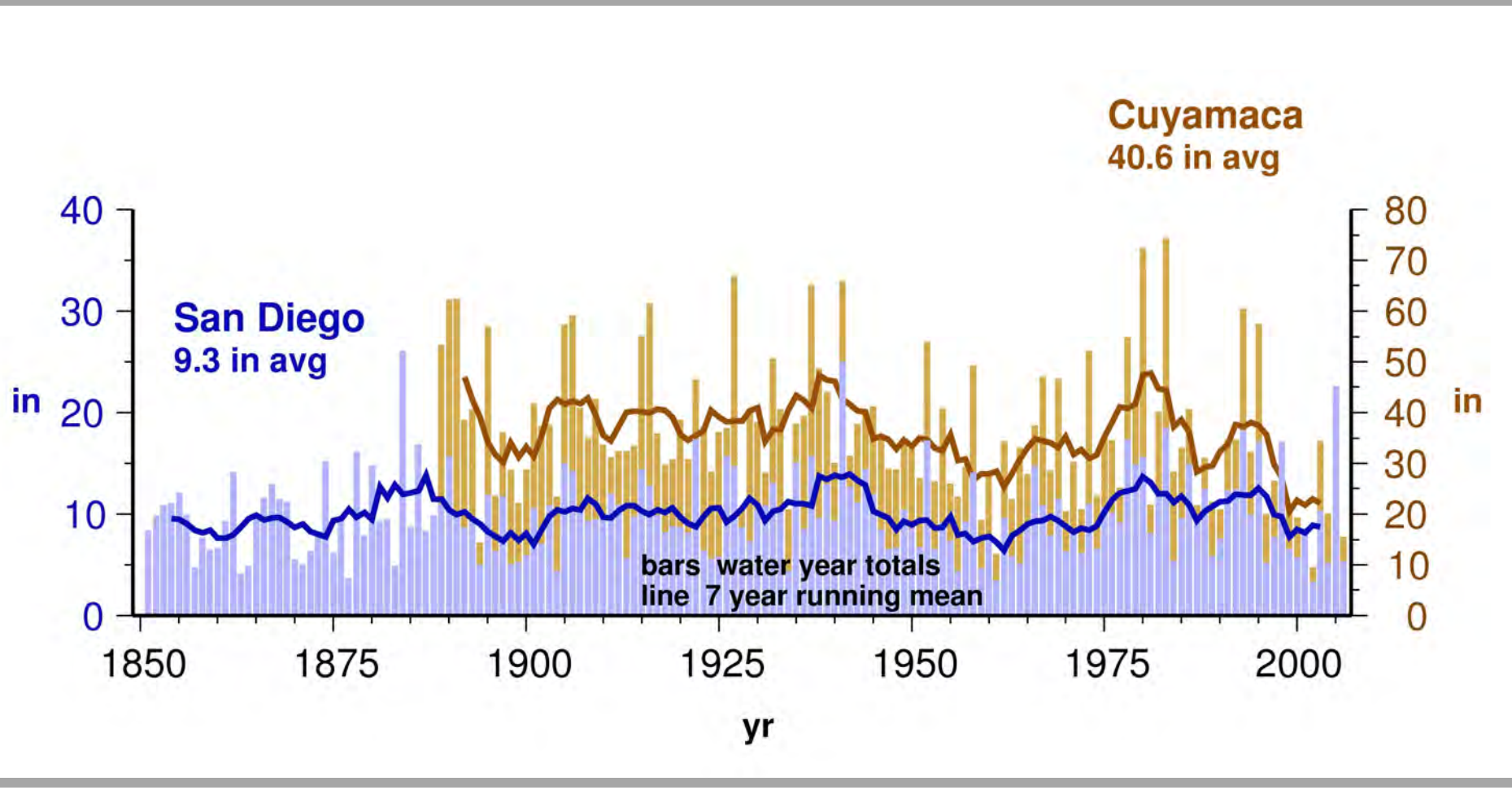
1km downscaled to 1km

Hugo Hidalgo, Tapash Das, Mike Dettinger

Yearly Precipitation San Diego region

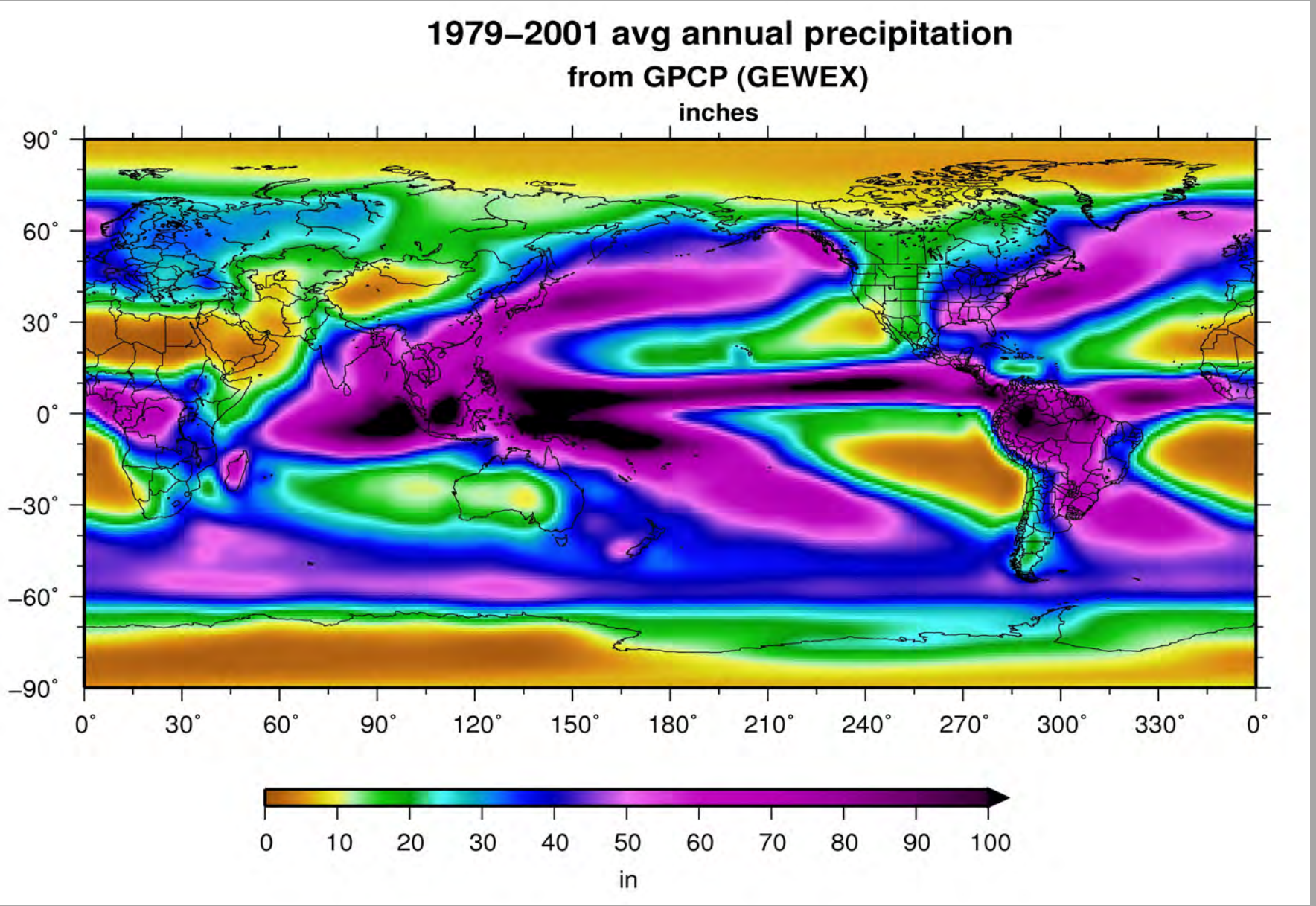
ranges from ~33% to 280% of average

(water year=oct-sep)



Global Precipitation—

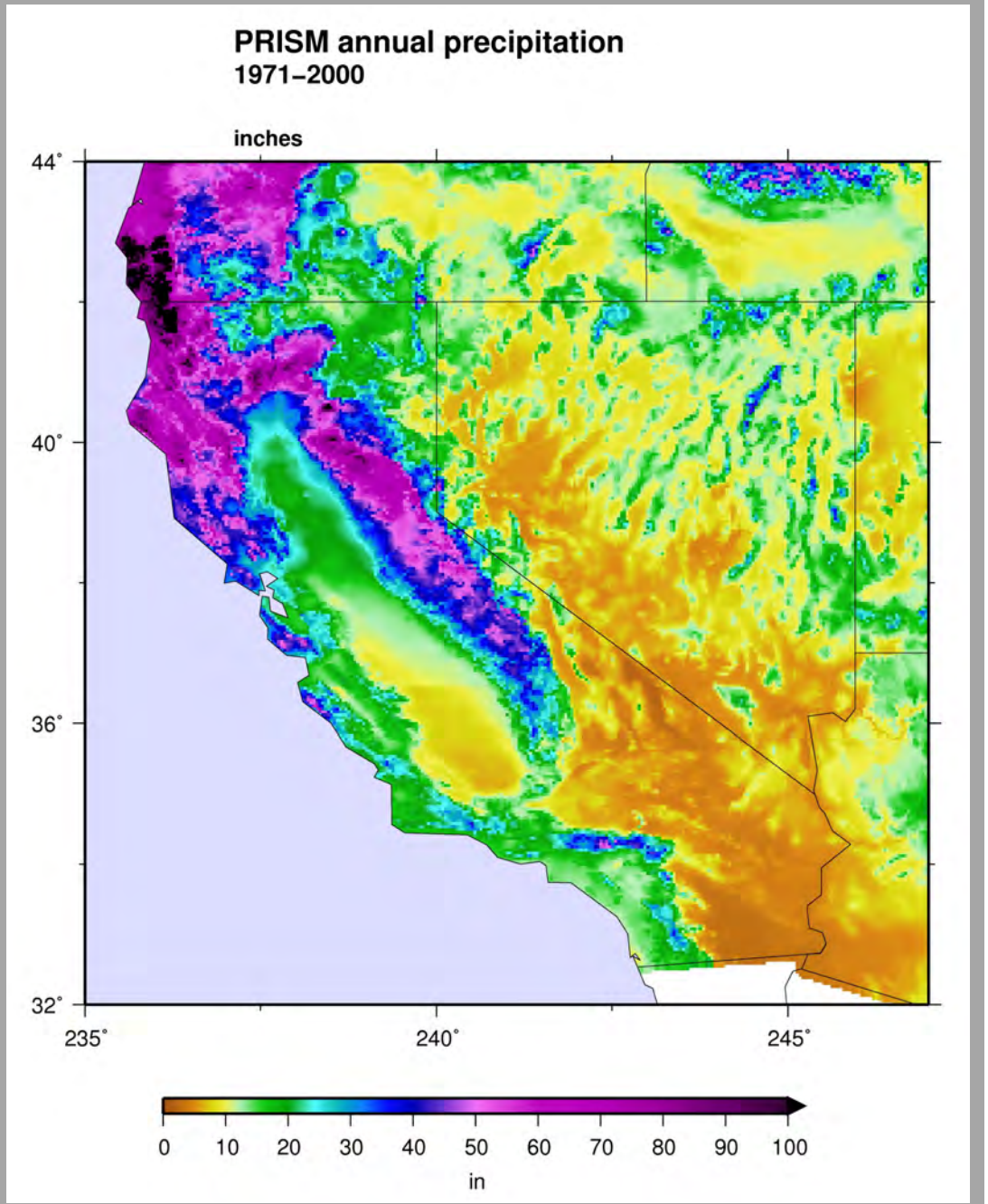
SoCal is under the effect of one of the subtropical dry zones



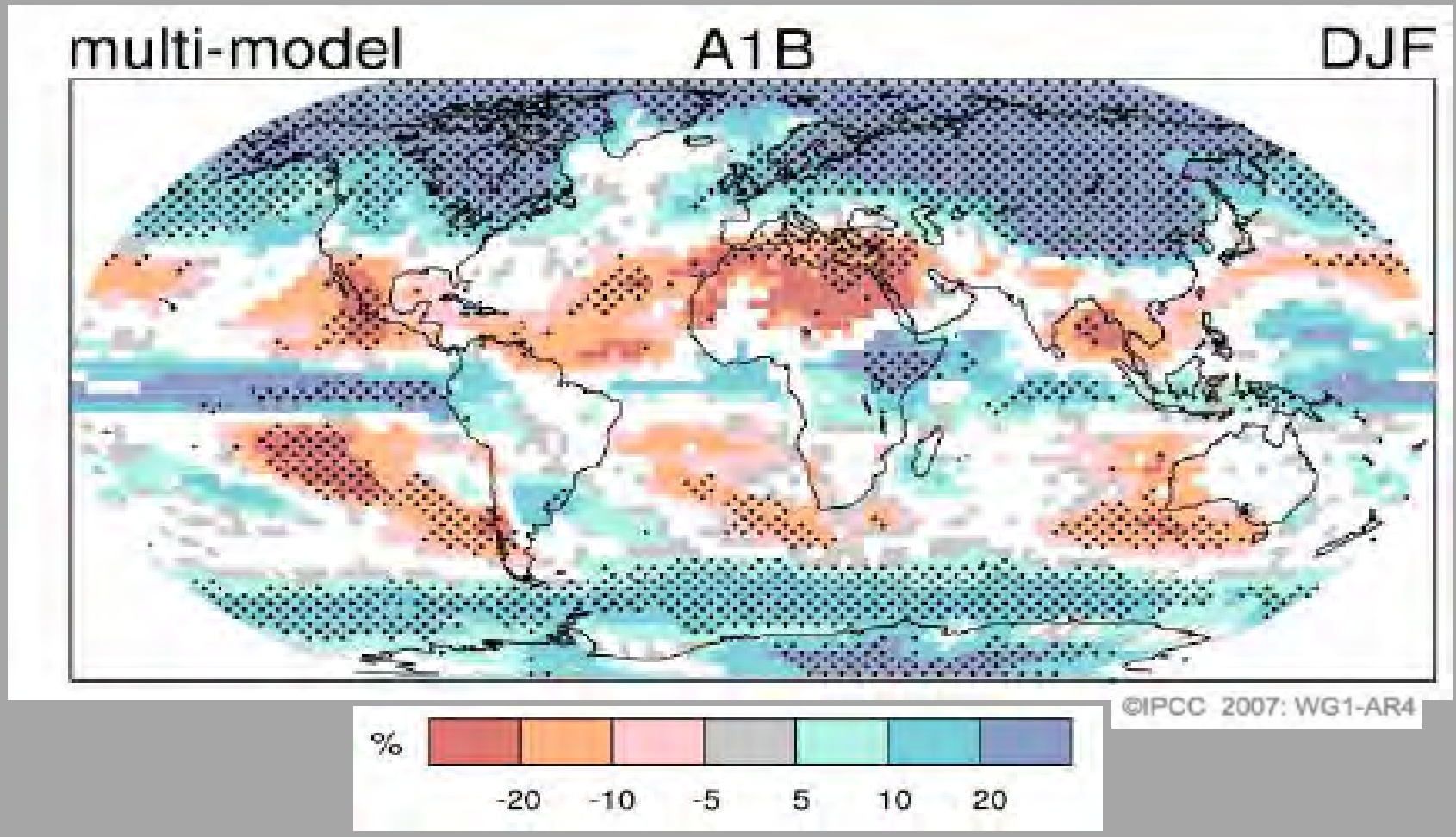
precipitation is heavily influenced by terrrain

Range of precip in Calif 1”-100”/yr

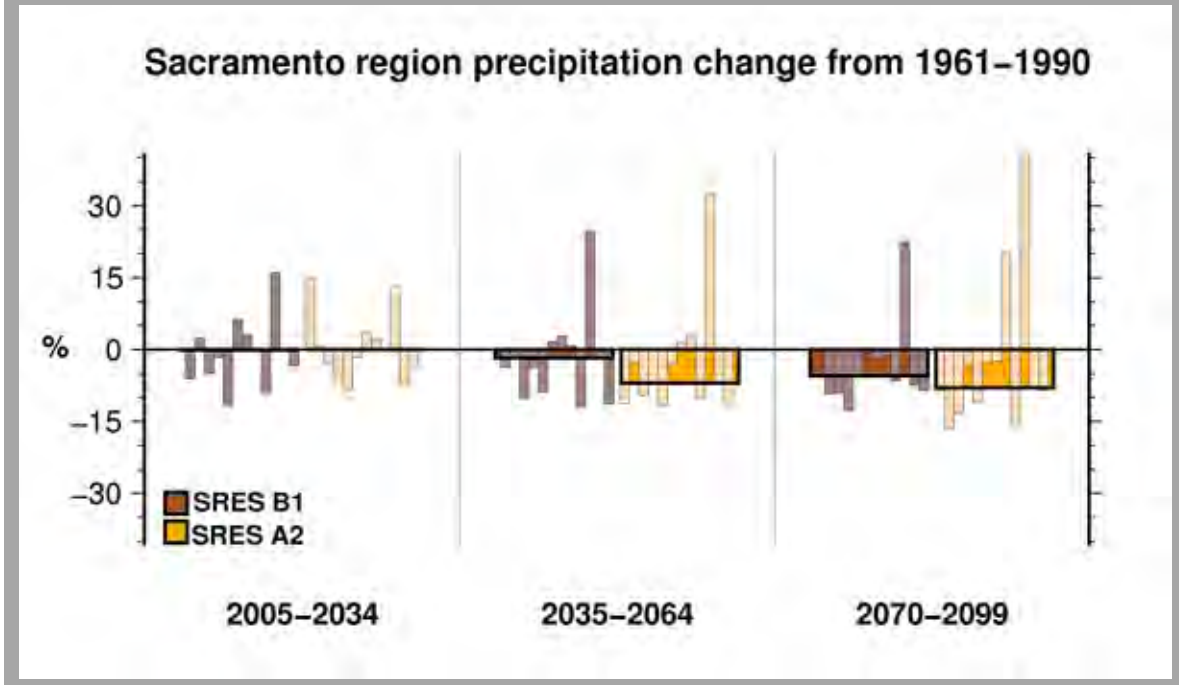
Volume of precipitation delivered to San Diego County is only enough to supply 5-10% of water consumed

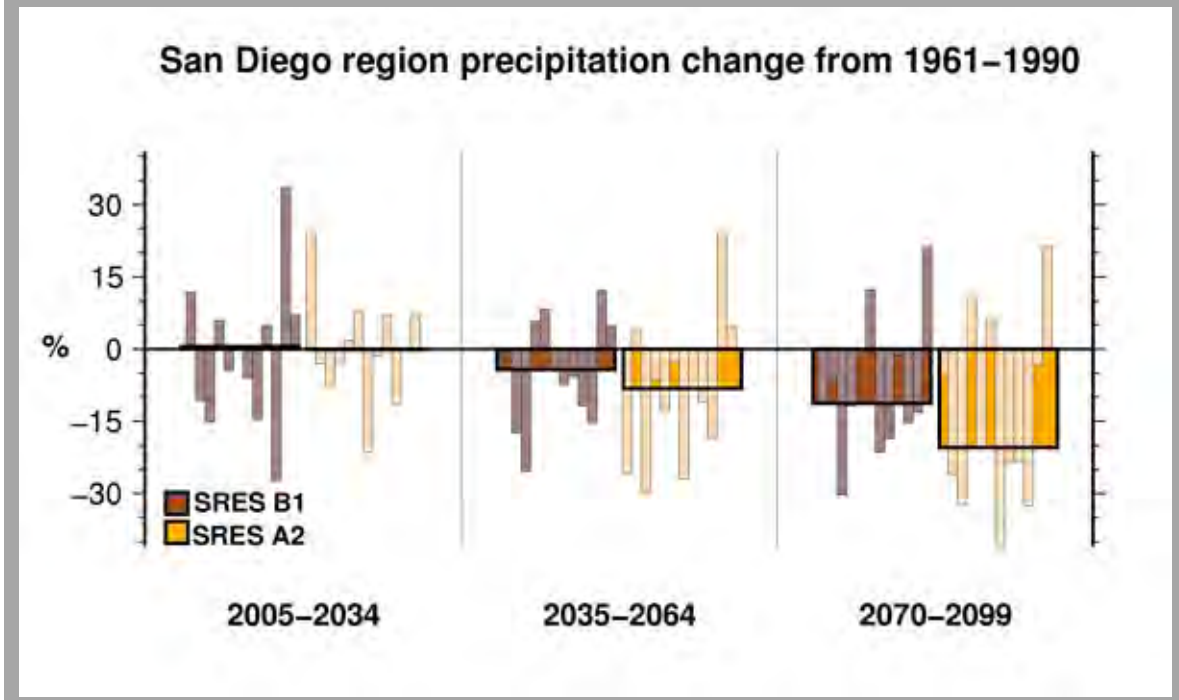


Projected patterns of precipitation changes 2090-2099 versus 1980-1999

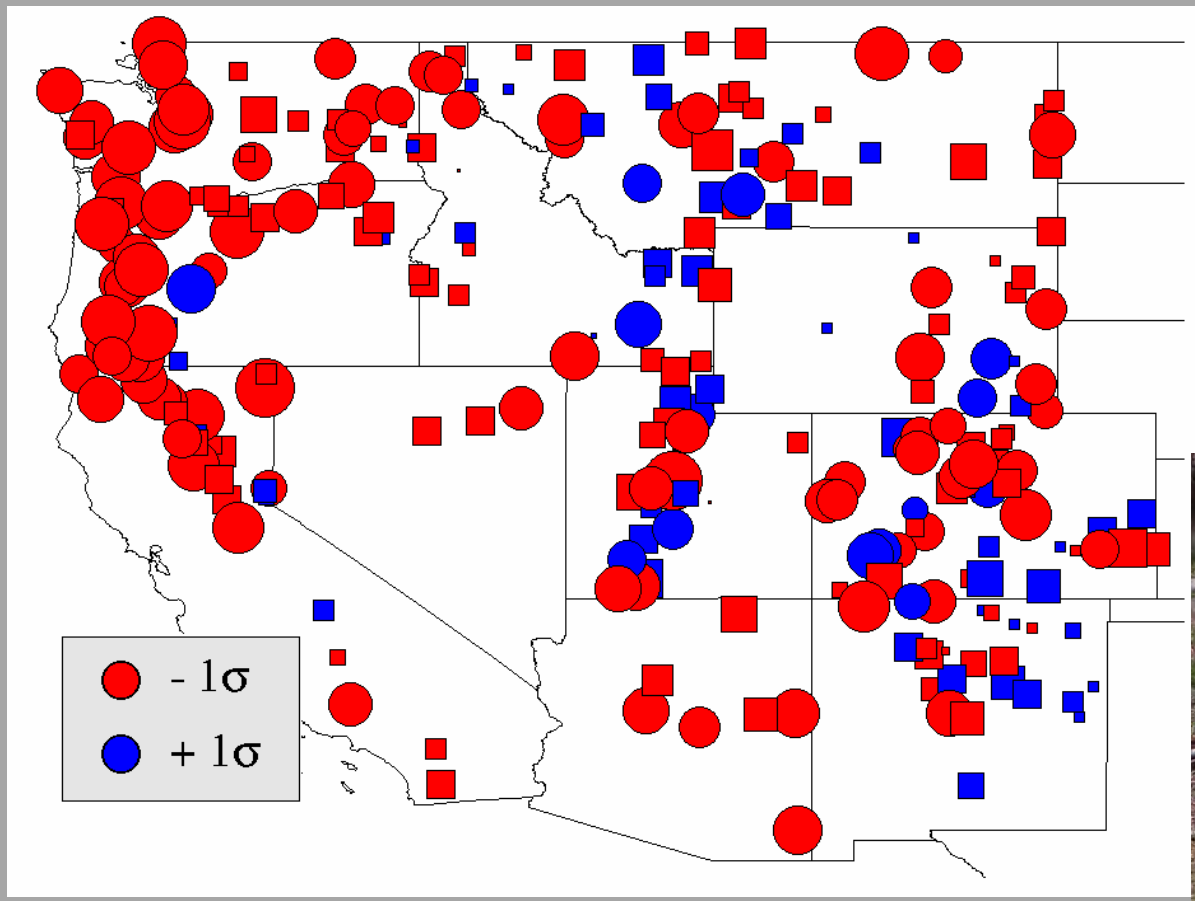


Globally, dry regions become drier?





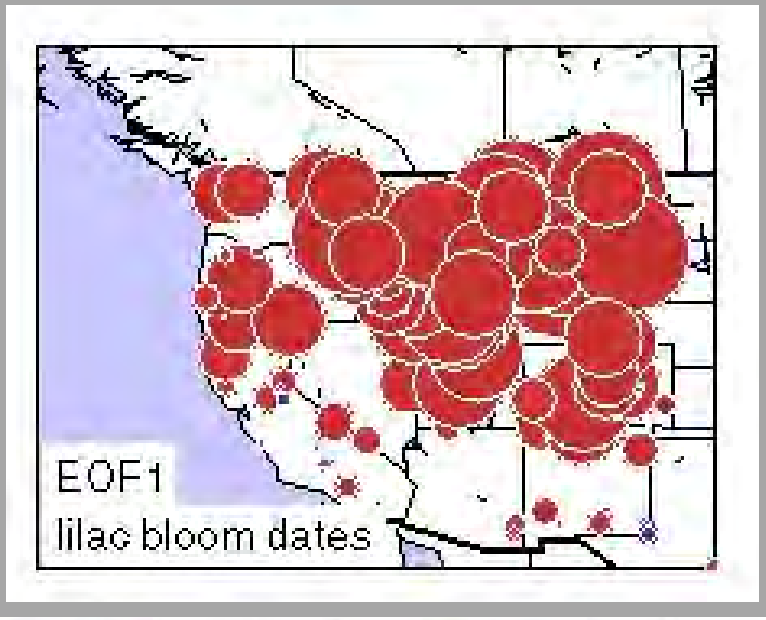
12 AR4 GCMs, 2 emissions s scenarios--- an uneven consensus toward lower California precipitation



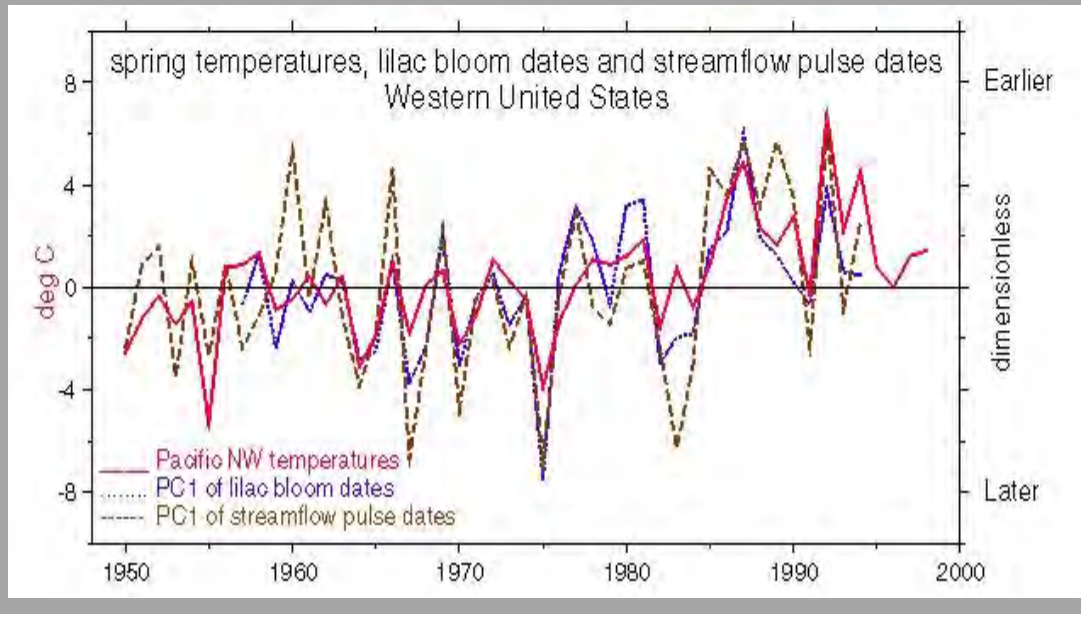
More Rain
Less Snow
WY 1949-2004

Noah Knowles et al. 2006
in press J. Climate

Winter (Nov-Mar) SFE/P trends at western US weather stations: symbol area is proportional to study-period changes, measured in standard deviations as indicated; circles indicate high trend significance ($p<0.05$), squares indicate lower trend significance ($p>0.05$).

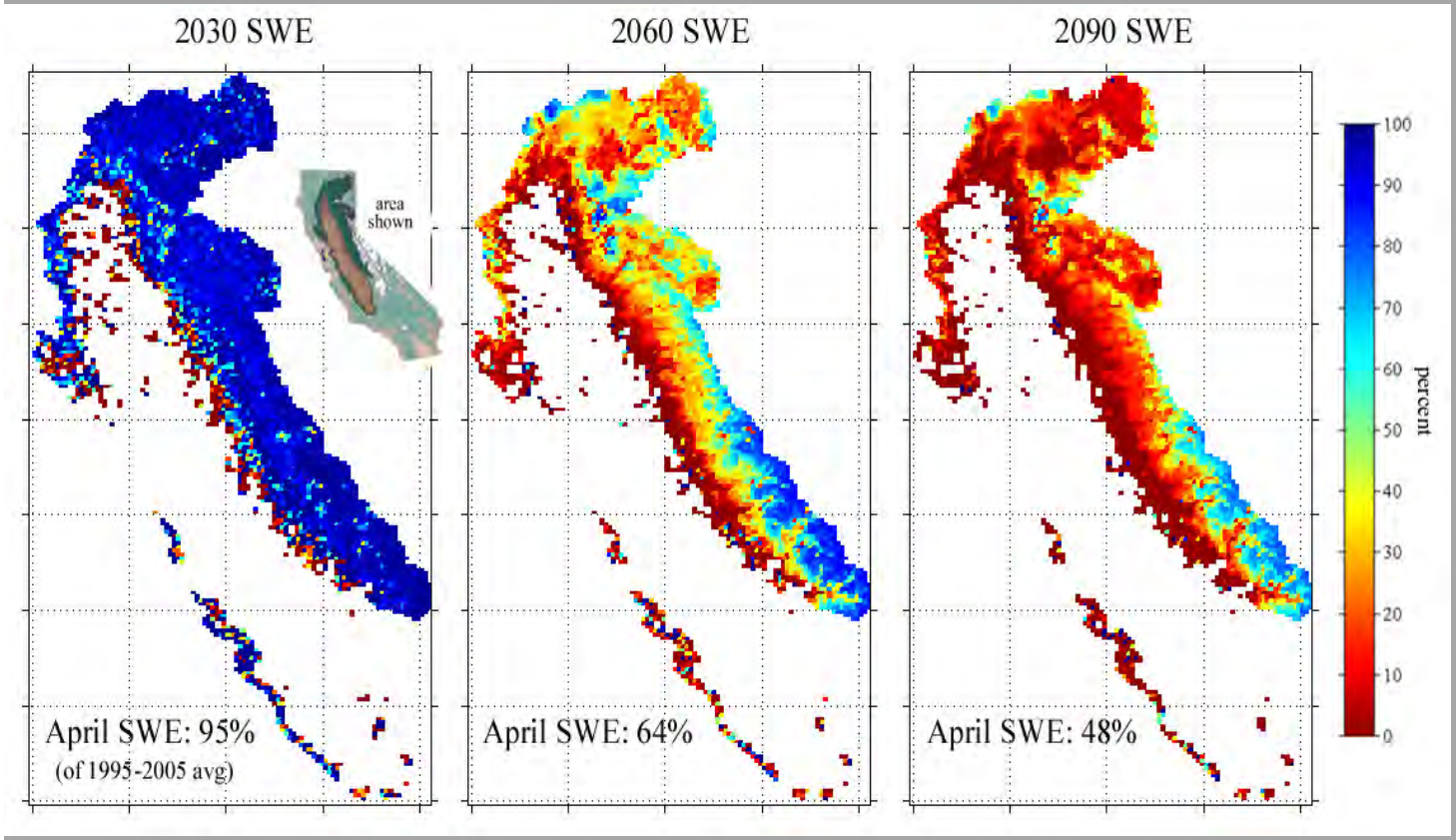


Plant bloom timing advanced by 1 wk at cooperative observer sites in the western United States 1957-1994



Cayan et al., 2001; Bull Am Met Soc

We face significant losses of spring snowpack



- Less snow, more rain
- Particularly at lower elevations
- Earlier run-off
- More floods
- Less stored water

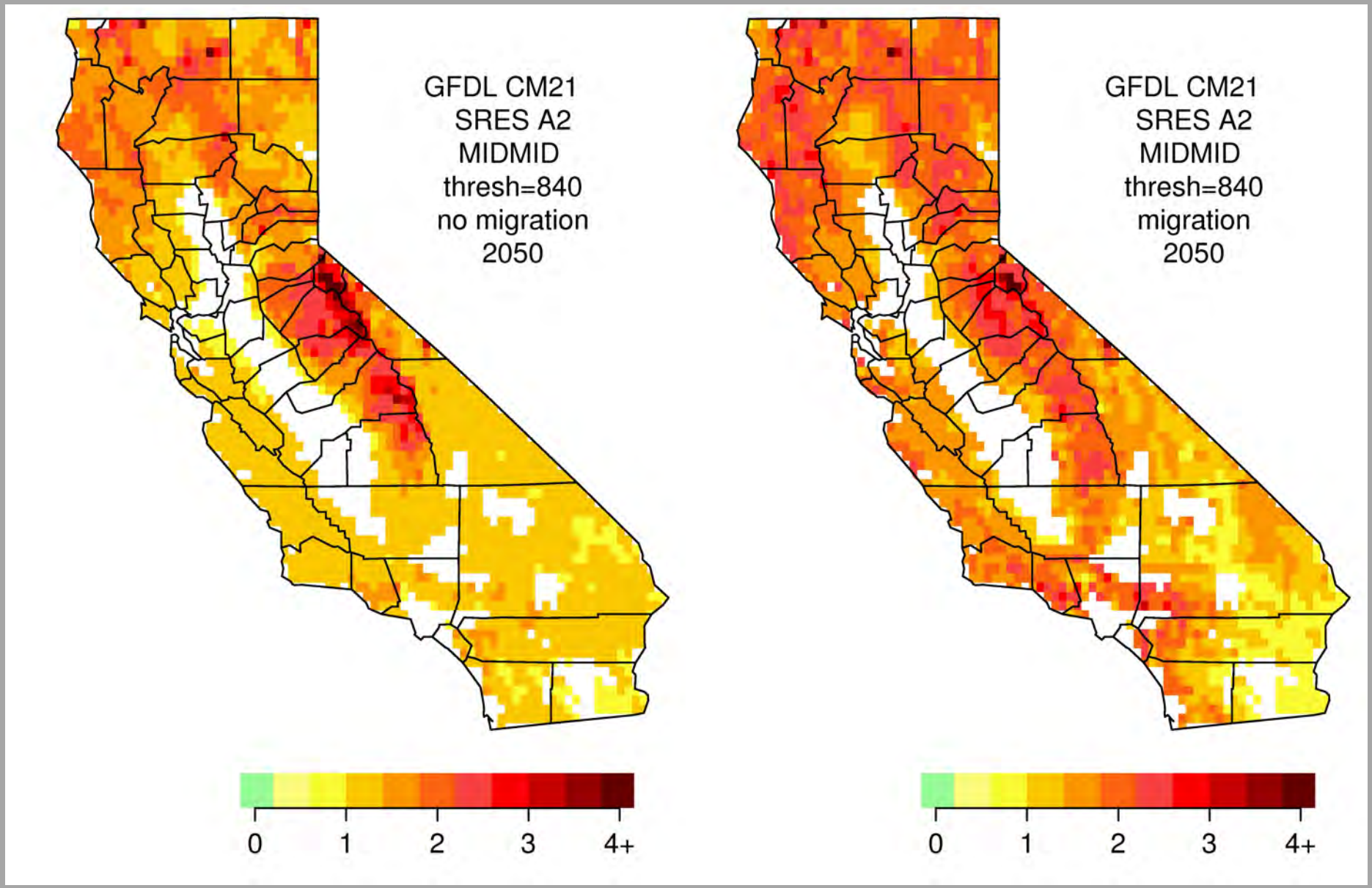
By the end of the century California could lose half of its late spring snow pack due to climate warming. This simulation by Noah Knowles is guided by temperature changes from PCM's Business-as-usual climate simulation. (a middle of the road emissions scenario)

Knowles and Cayan 2001

since 1985 the number of large wildfires in western U.S. increased by 4X

Anthony Westerling et al. Science August 2006

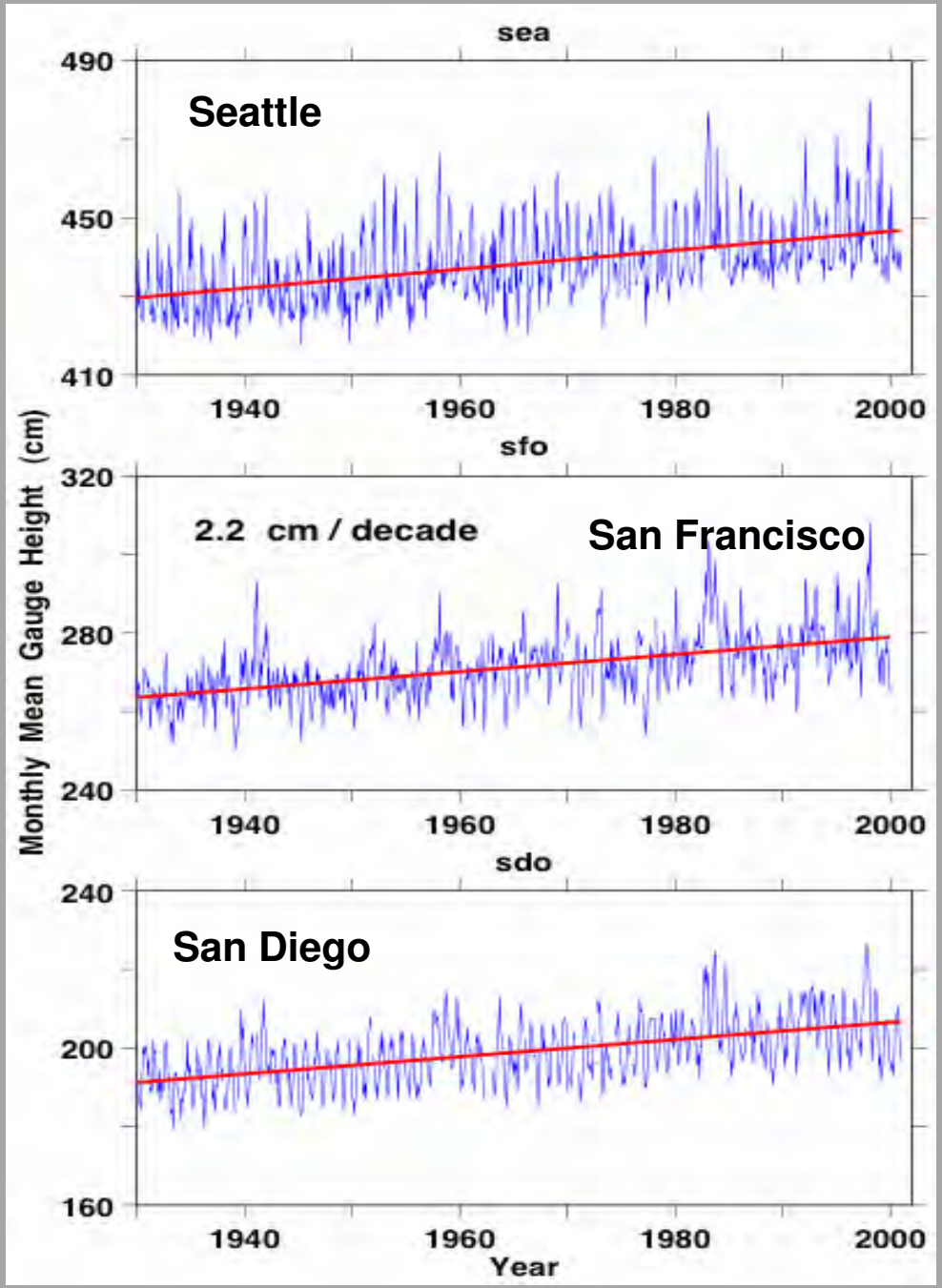
Changes in Fire Frequency for Two 2050 Scenarios

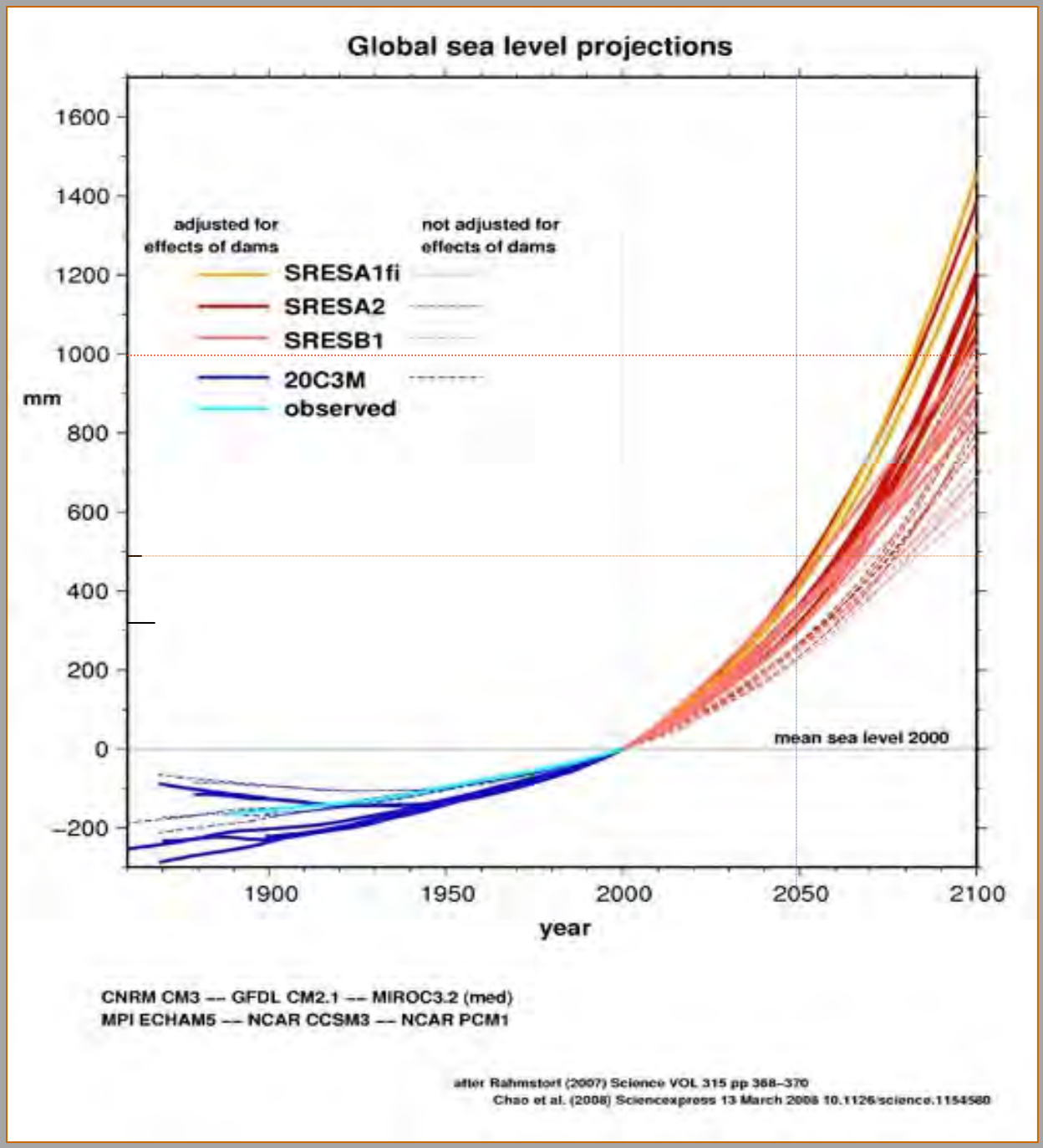


Sea Level has been rising globally and along the West Coast

Increase is about 7 inches over the last 100 years

High sea level events Along the California Coast Have occurred during Large El Ninos




Global sea level projections
1600
1400
1200
1000
800
600
400
200
0
−200
mm
adjusted for
effects of dams
not adjusted for
effects of dams
SRESA1fi
SRESA2
SRESB1
20C3M
observed
mean sea level 2000
1900
1950
2000
2050
2100
year
CNRM CM3 — GFDL CM2.1 — MIROC3.2 (med)
MPI ECHAM5 — NCAR CCSM3 — NCAR PCM1
after Rahmstorf (2007) Science VOL 315 pp 368–370
Chao et al. (2008) Sciencexpress 13 March 2008 10.1126/science.1154580

OBSERVATIONS AND MODELS INDICATE:

The West has already seen signs of climate warming, including warmer winter storms, more rain, less snow, and earlier spring plant development and snowmelt. Part of these changes appears to be attributable to anthropogenic warming. More warming is very likely in future decades.

Projected Warming is greatest in continental interior regions during summer.

Recent IPCC model projections for western precipitation are scattered, but *several* show moderate drying as tends to be characteristic of Mediterranean regions globally—California and Baja Mexico lie in this zone. A reduction in precipitation is amplified into even greater reduction in soil moisture and runoff in the more arid basins of the West.

Higher cumulative GHG emissions will result in greater warming and more extreme consequences.

Regardless of the GHG emissions scenario, we should be concerned about, and prepare for many impacts e.g. increased wildfires, floods, challenged water supplies will likely occur with hydroclimate changes.

Frank Gehrke,
California Cooperative Snow Surveys, DWR