

Climate trends in California and Fire Risk

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Daniel R. Cayan, SIO

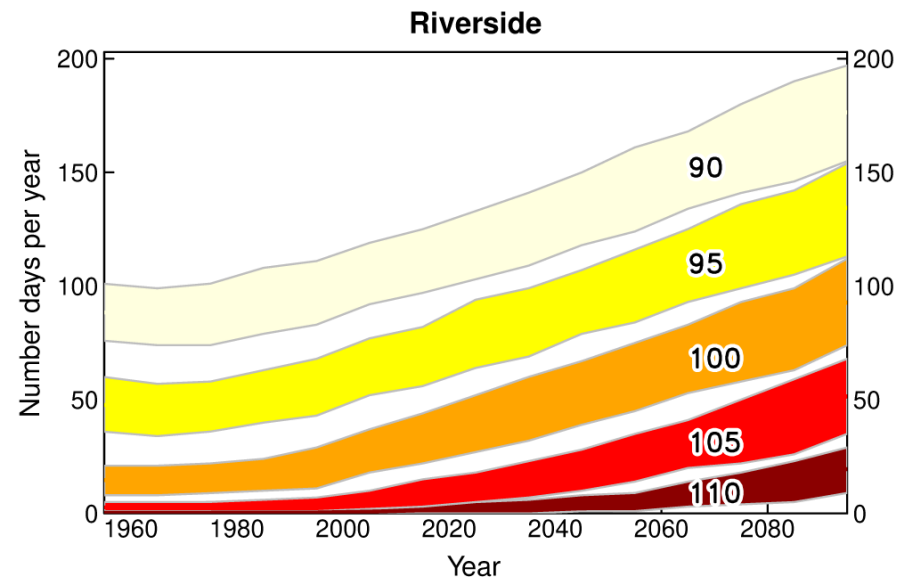
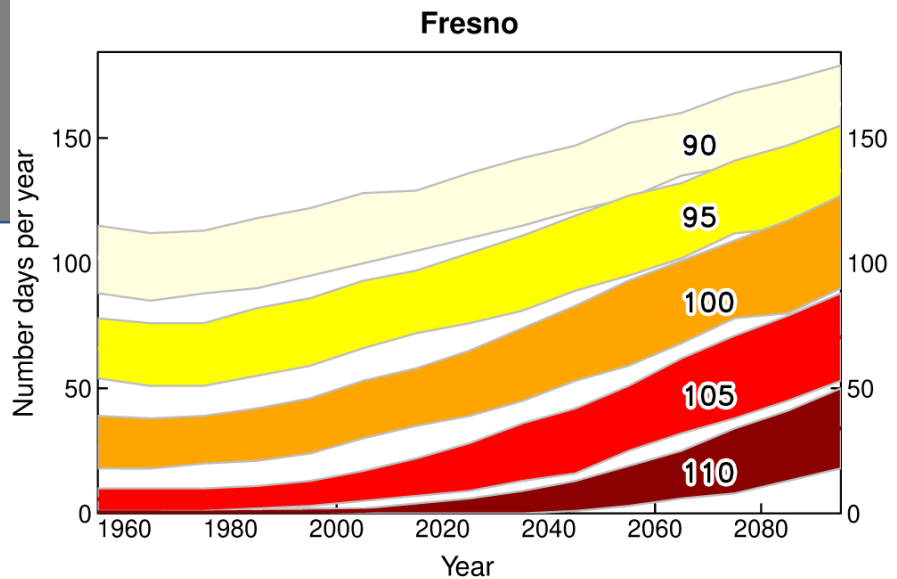
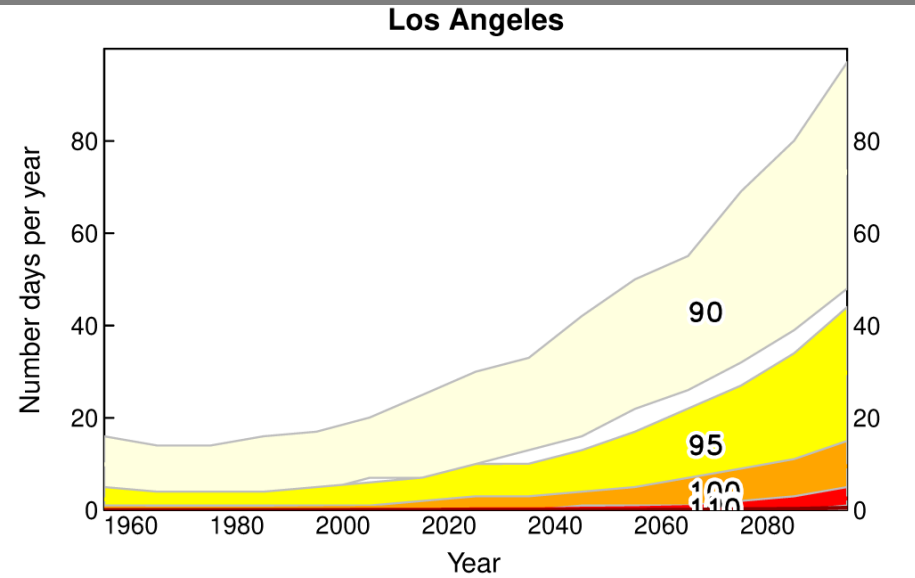
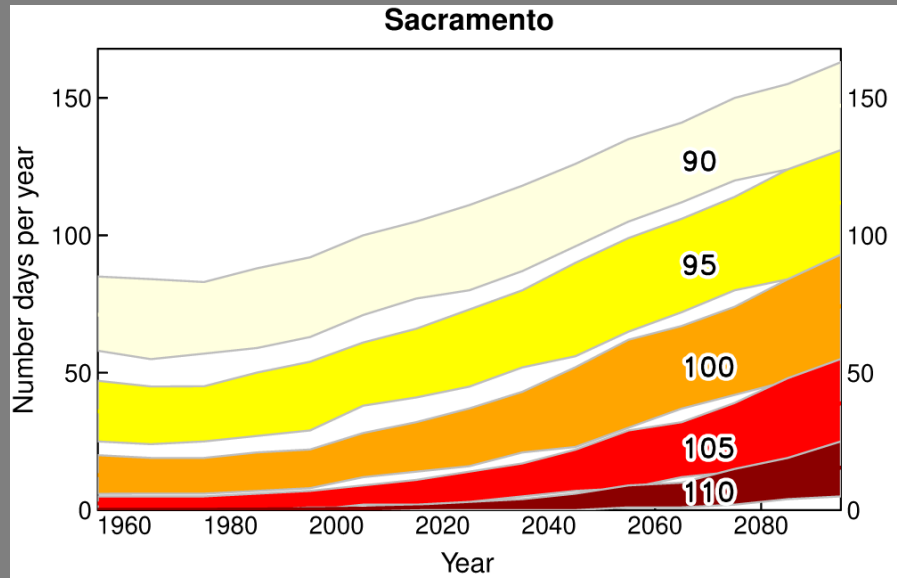
Julie Kalansky, SIO

Leroy Westerling, U.C. Merced

Alexander Gershunov, SIO



Extreme hot days have largest proportional increases

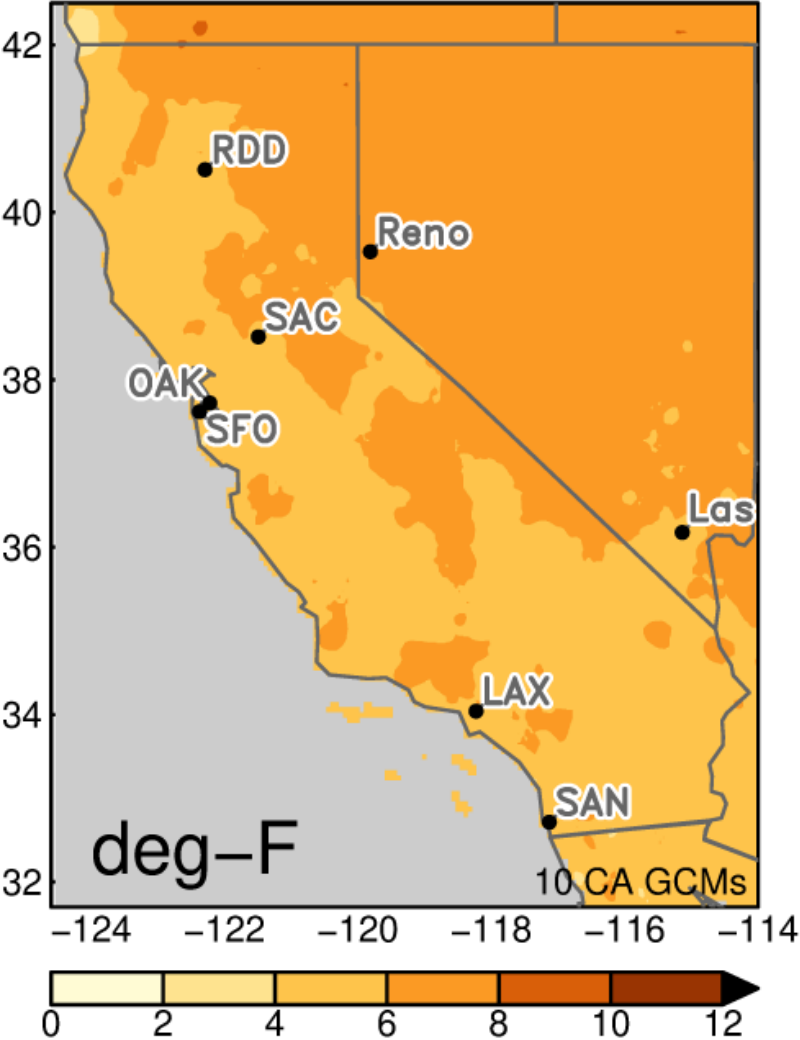


Pierce et al. 2018,
California 4th
Climate Change
Assessment

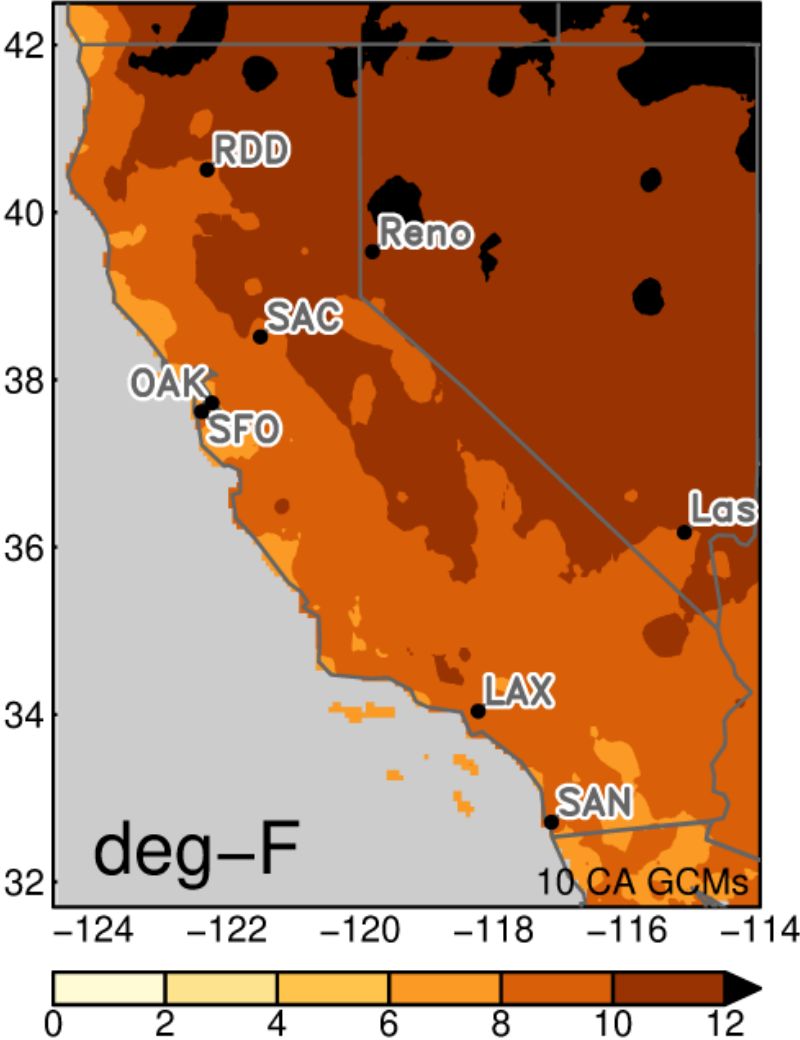


Most warming in the interior (Sierra Nevada)

Change in avg hottest day/yr rcp45



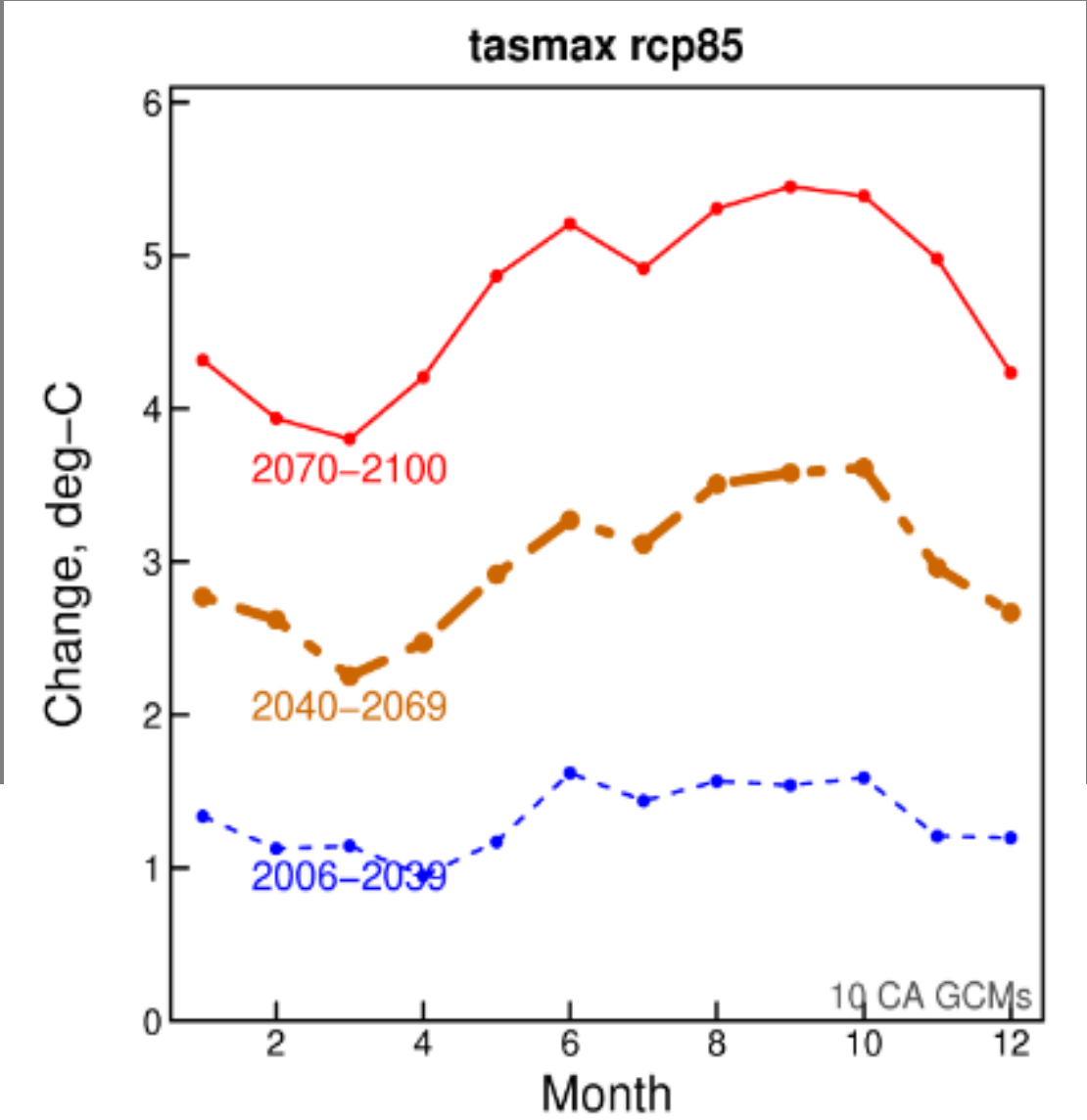
Change in avg hottest day/yr rcp85



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Most warming in the summer

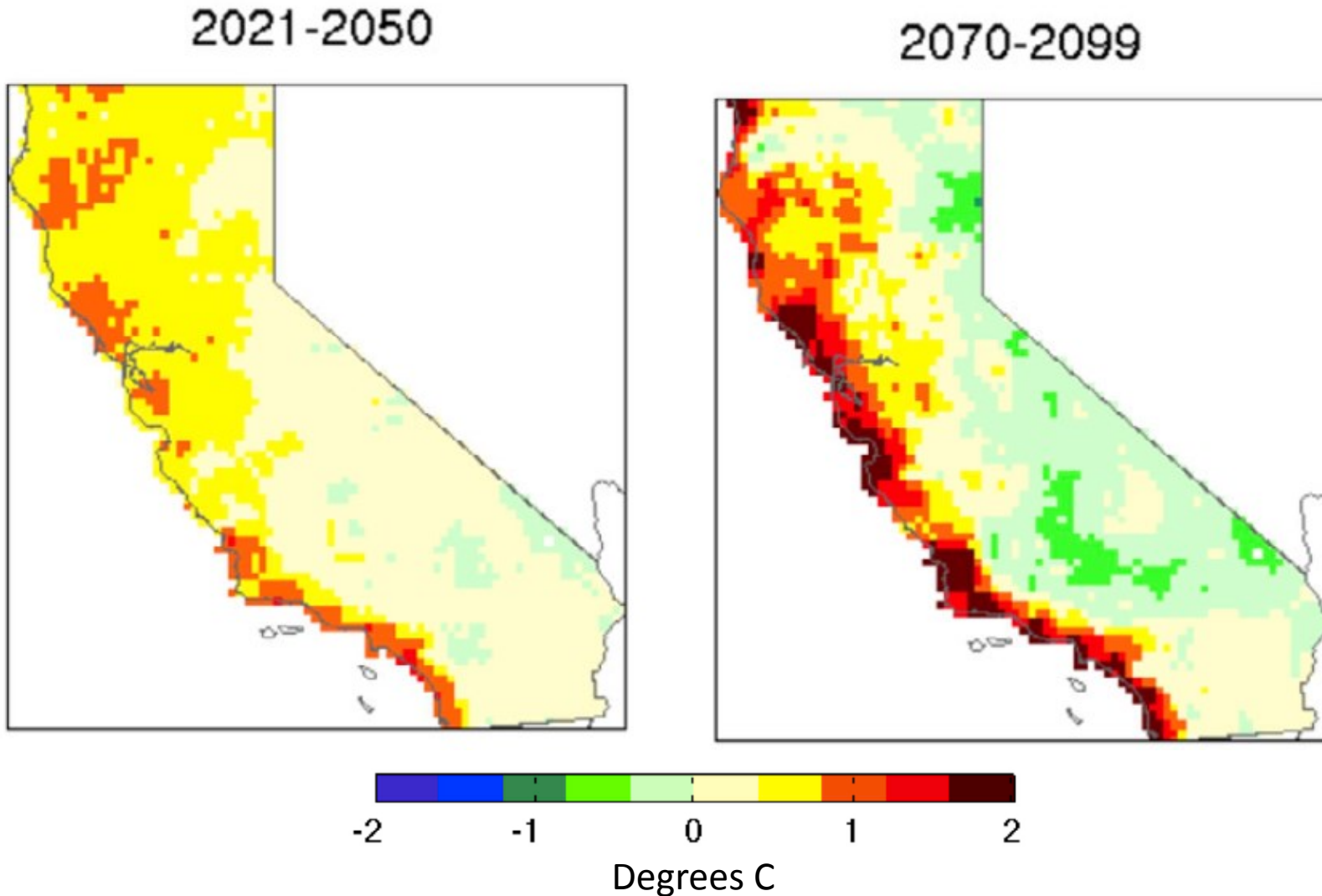


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Heat waves exaggerated at the coasts

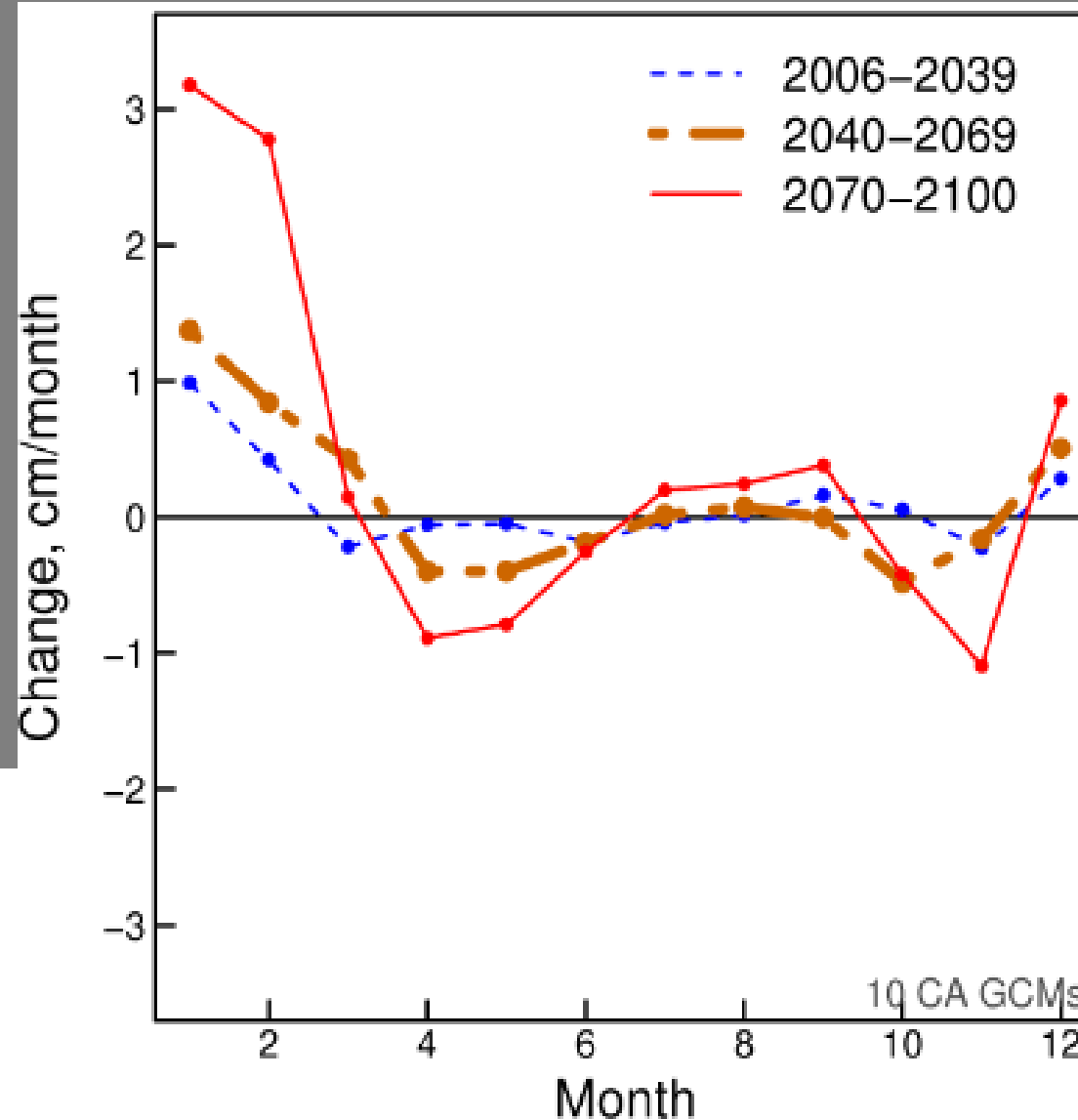
How much more heat waves warm than regular days



Gershunov and Guirguis,
Geophys. Res. Lett. Doi:
10.1029/2012GL052979,
2012



Winter gets wetter – spring and autumn get drier

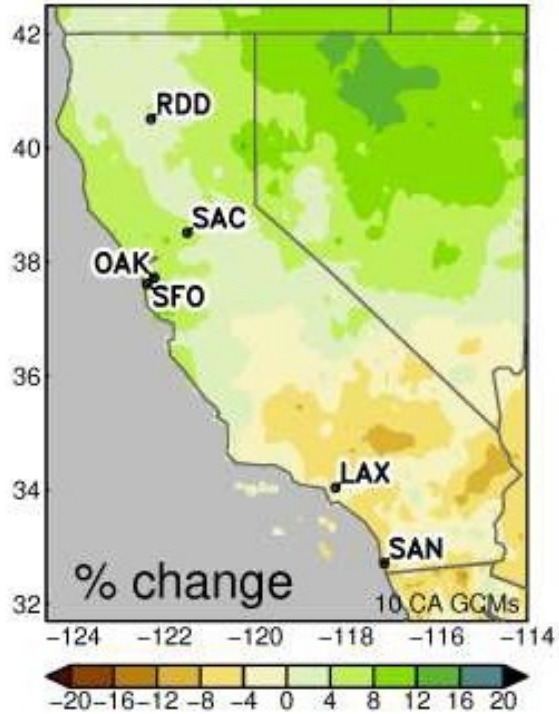


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Wetter in the North – drier in the South

yearly avg precip change by 2040–2069 rcp85

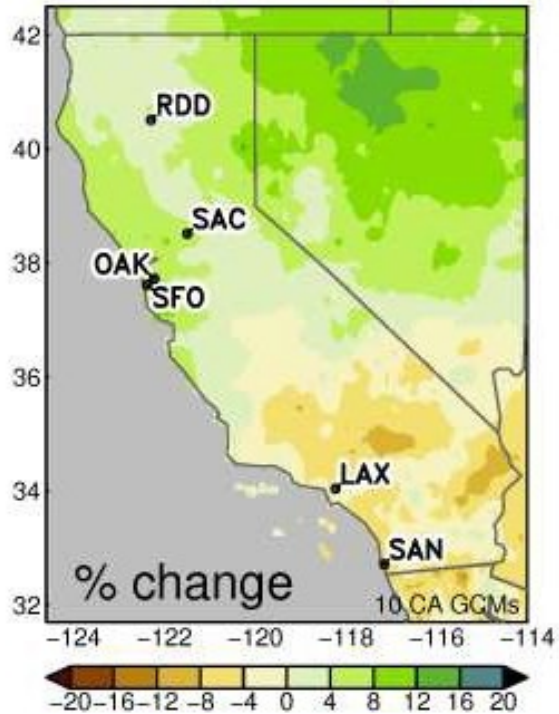


Pierce et al. 2018,
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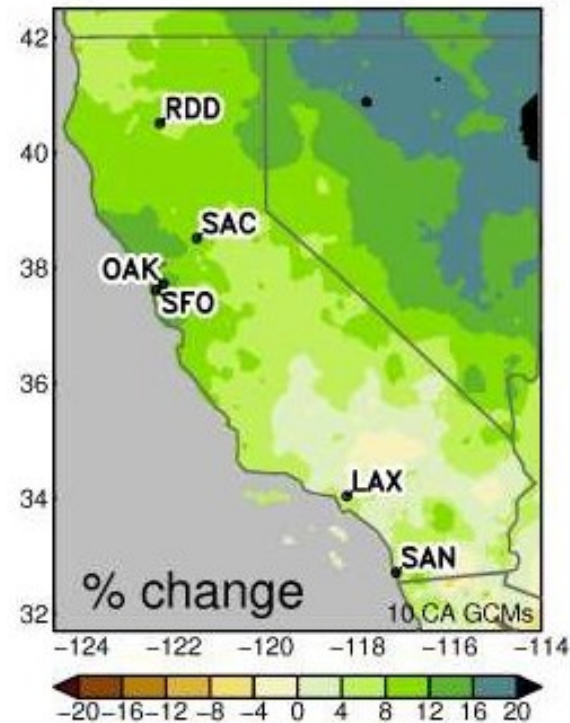


Wetter in the North – drier in the South

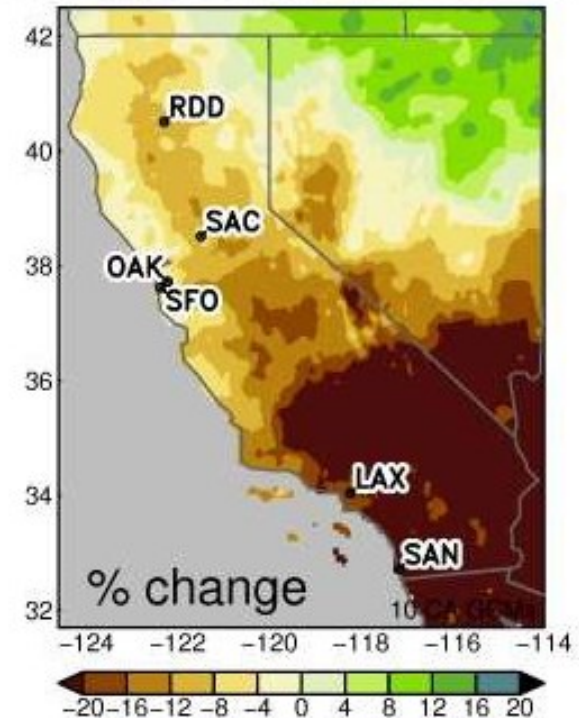
yearly avg precip change by 2040–2069 rcp85



DJF avg precip change by 2040–2069 rcp85



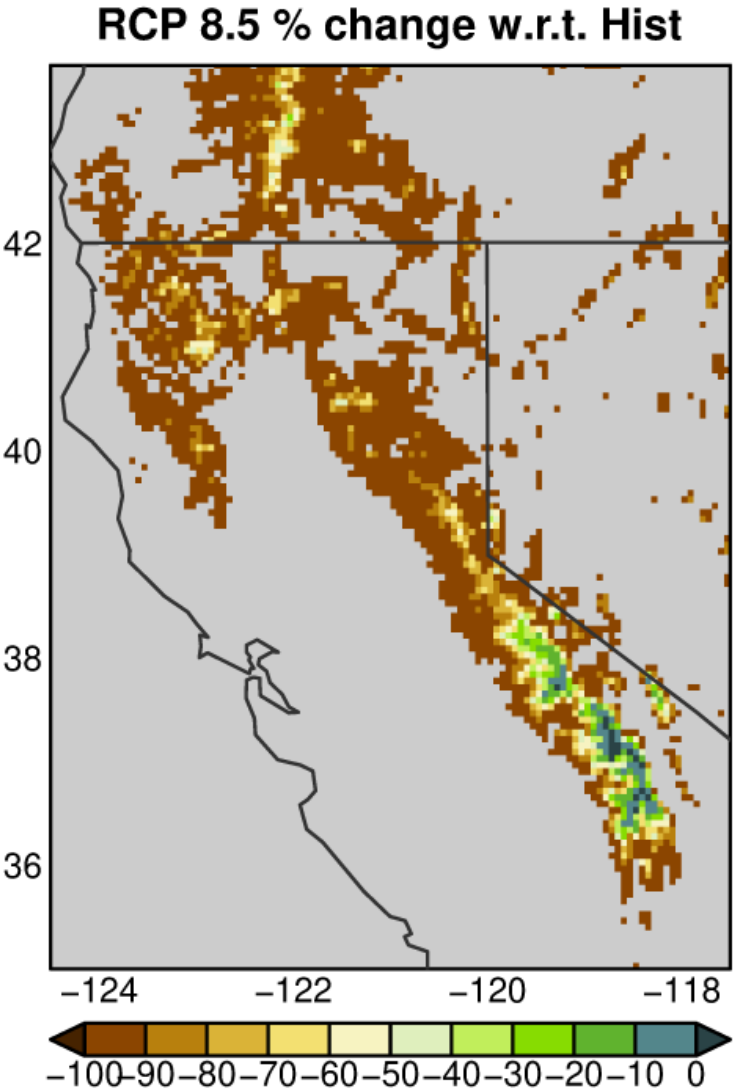
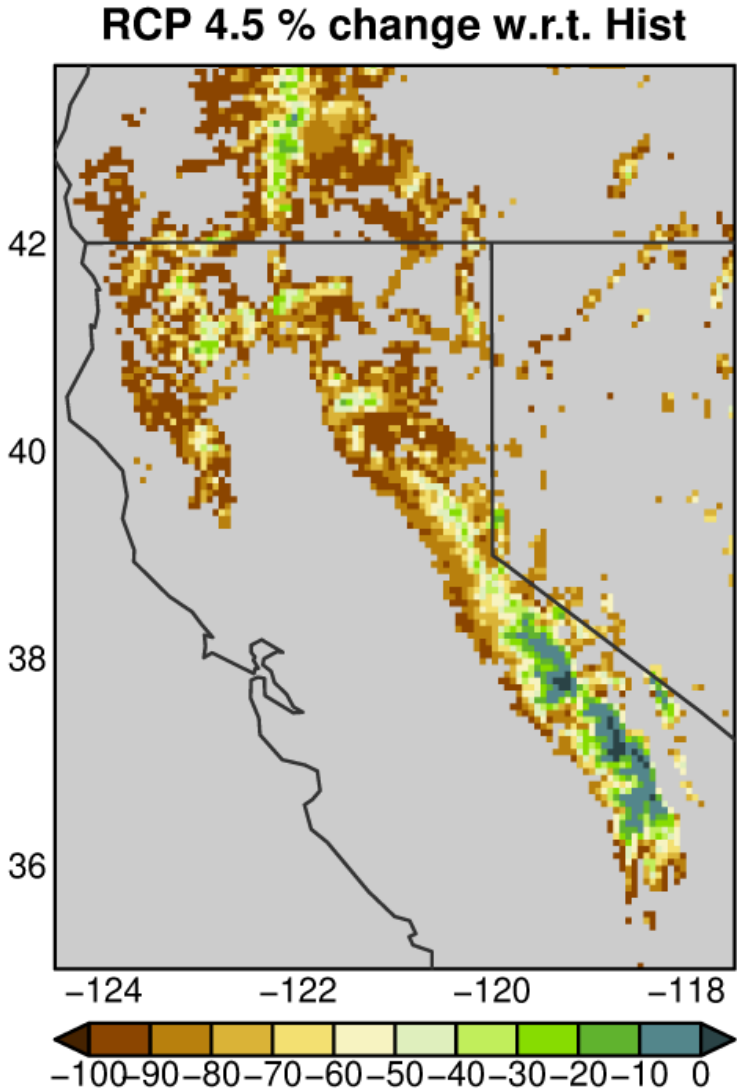
MAM avg precip change by 2070–2100 rcp85



Pierce et al. 2018,
California 4th
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Strong reduction in spring snowpack

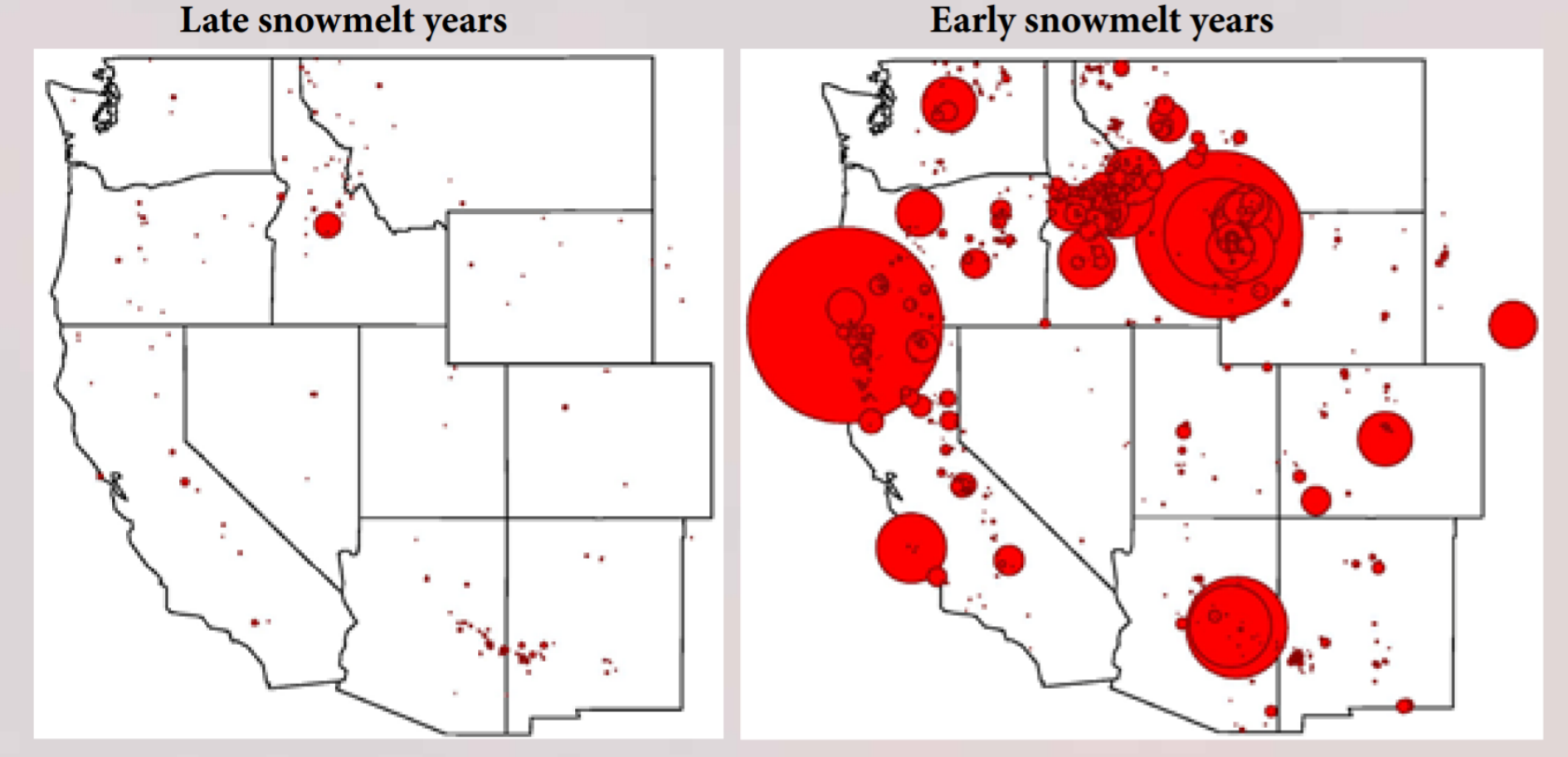
Change in
Apr 1st
snowpack
(%) by 2070-
2099



Pierce et al. 2018,
California 4th
Climate Change
Assessment



Earlier snowmelt linked to enhanced fire season



Historical fires
>= 1000 acres
(dot size
proportional
to fire size)

Leroy Westerling, U.C. Merced, appearing in Pierce, D. W. (ed.), California Climate Extremes Workshop Report, 2012

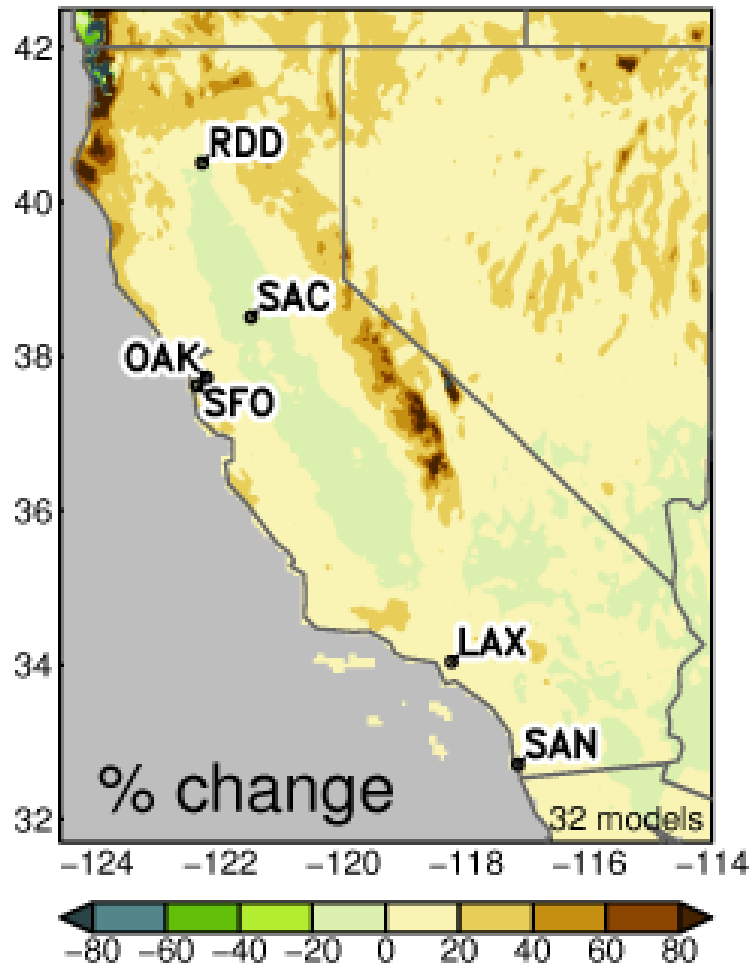
Analyzed fires are on Federal forest land.



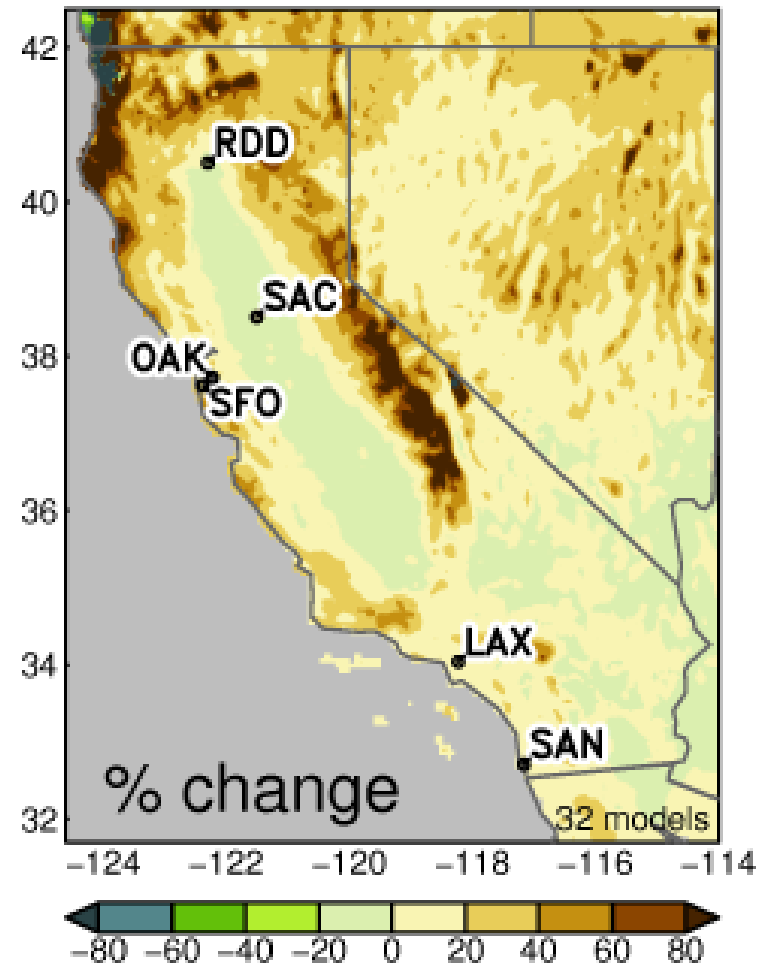
Drying land surface is major factor in more future fires

Projected change (%) in climatic water deficit

rcp45 change by 2070–2100 [%], yearly



rcp85 change by 2070–2100 [%], yearly



Pierce et al. 2018,
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Climatic water deficit is potential evapotranspiration minus actual

Fuel treatment can mitigate projected increases

Change in Sierra Nevada area burned/year under different fuel treatment scenarios

	No treatment	50% of potential	90% of potential
Mid century (2035-64)	+48%	+33%	+28%
End of century (2070-99)	+120%	+101%	+92%

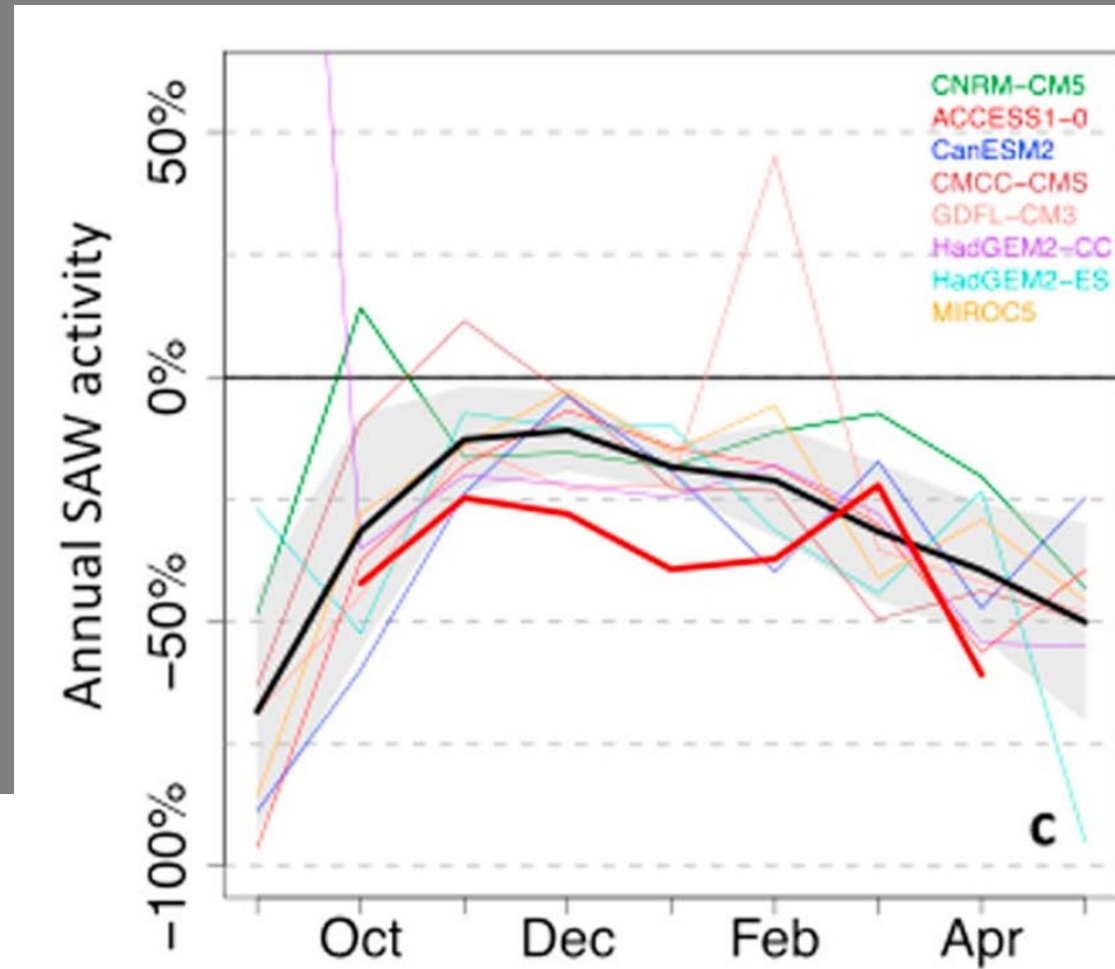
Westerling, A. L., 2018: Wildfire simulations for California’s Fourth Climate Change Assessment

- Treatment includes thinning and controlled burns to reduce fuel load
- “Potential” means area that can *potentially* be treated



Santa Ana winds decline in shoulder season

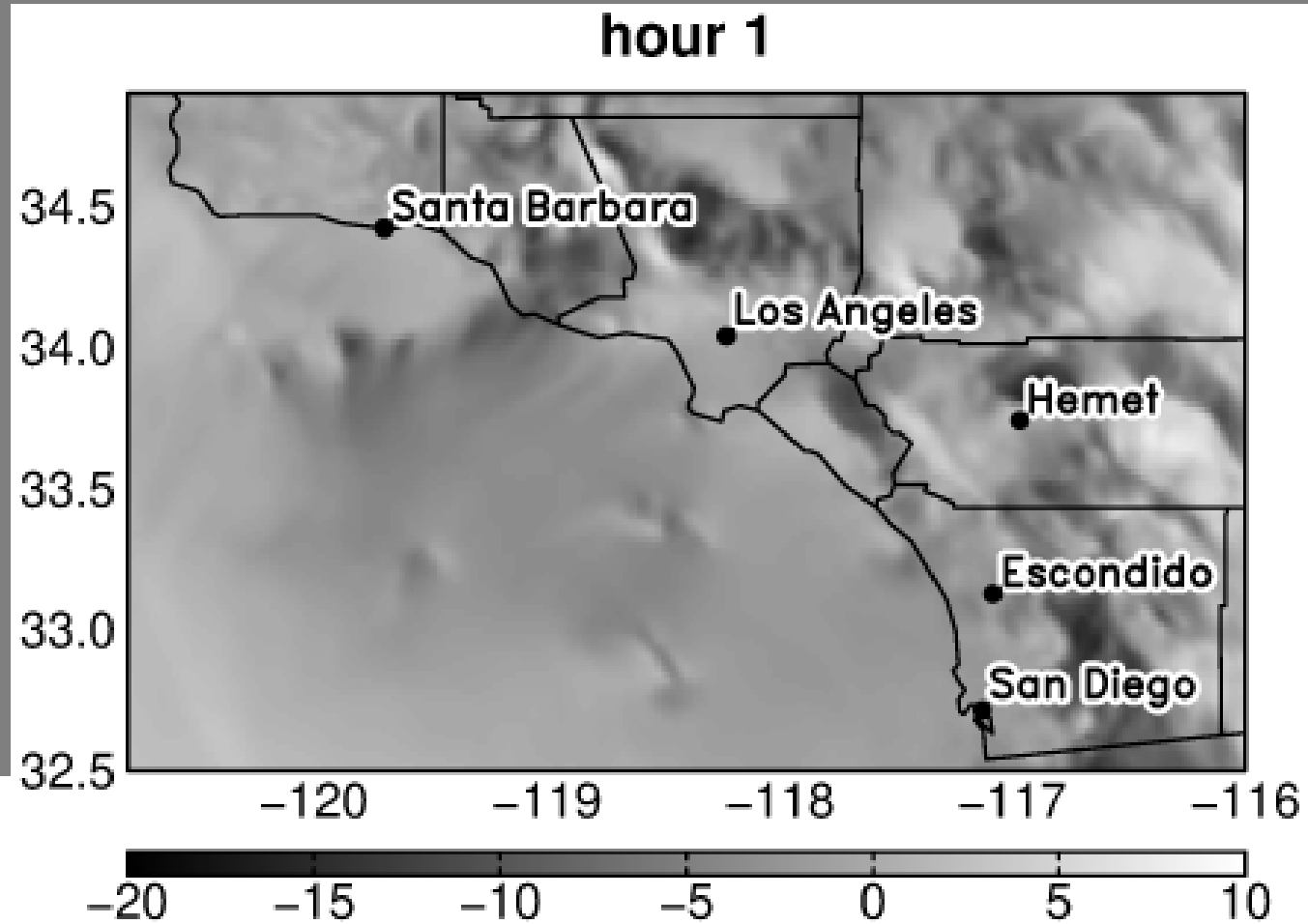
Projected changes
in Santa Ana Wind
activity
2045-2099 w.r.t
historical



Guzman-Morales and
Gershunov, Geophys.
Res. Lett. 2019, doi
10.1029/2018GL080261



2 km WRF model simulation, Dec 16, 2004



Tim Brown, Desert
Research Institute



Summary

- More warming over land than ocean, interior than coast
 - BUT heat wave magnitude increase stronger near coast
- Modestly wetter annual conditions
 - BUT wetter in winter, drier in summer; little to no increase in S. California
- Strong decrease in snowpack, especially in N. California
 - Linked to increase in wildfires
- Projections suggest ~50% increase in federal forest area burned by mid century
 - BUT can be mitigated by fuel treatment
- General narrowing of Santa Ana wind season
 - BUT small increase in most extreme dry Santa Ana days