

Lake Oroville, August 2014



How unusual was the 2011-2016 California drought?

Kevin Anchukaitis
The University of Arizona

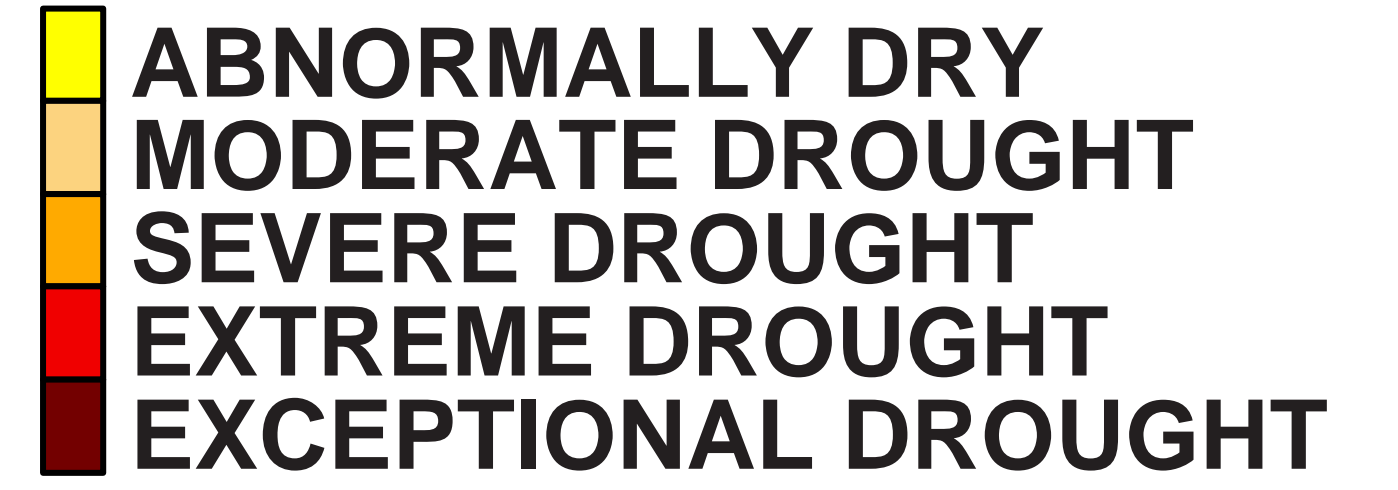
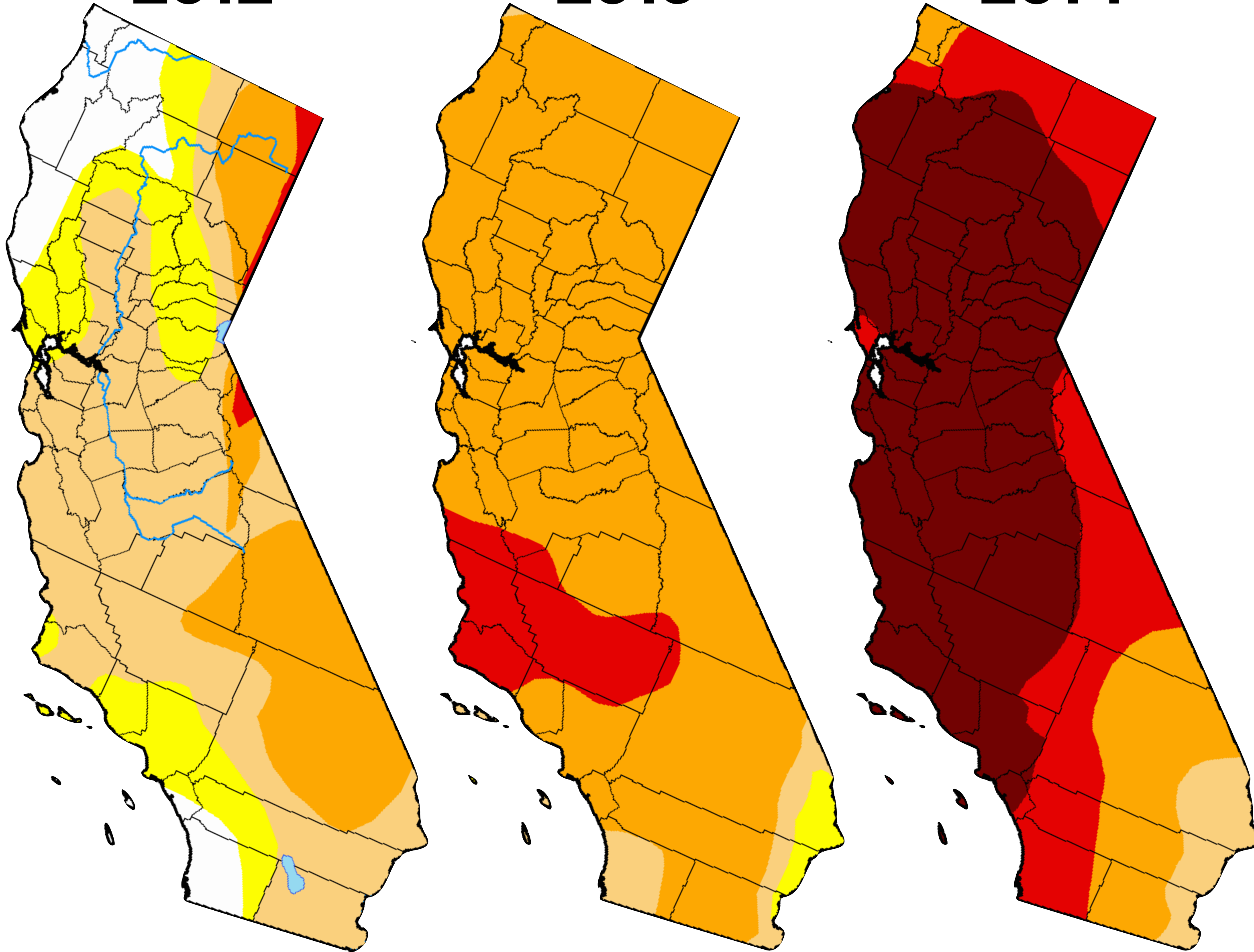
Dan Griffin
The University of Minnesota



2012

2013

2014



2014 had the **driest** summer Palmer Drought Severity Index value since 1895 in California Climate Divisions 4, 5, and 6

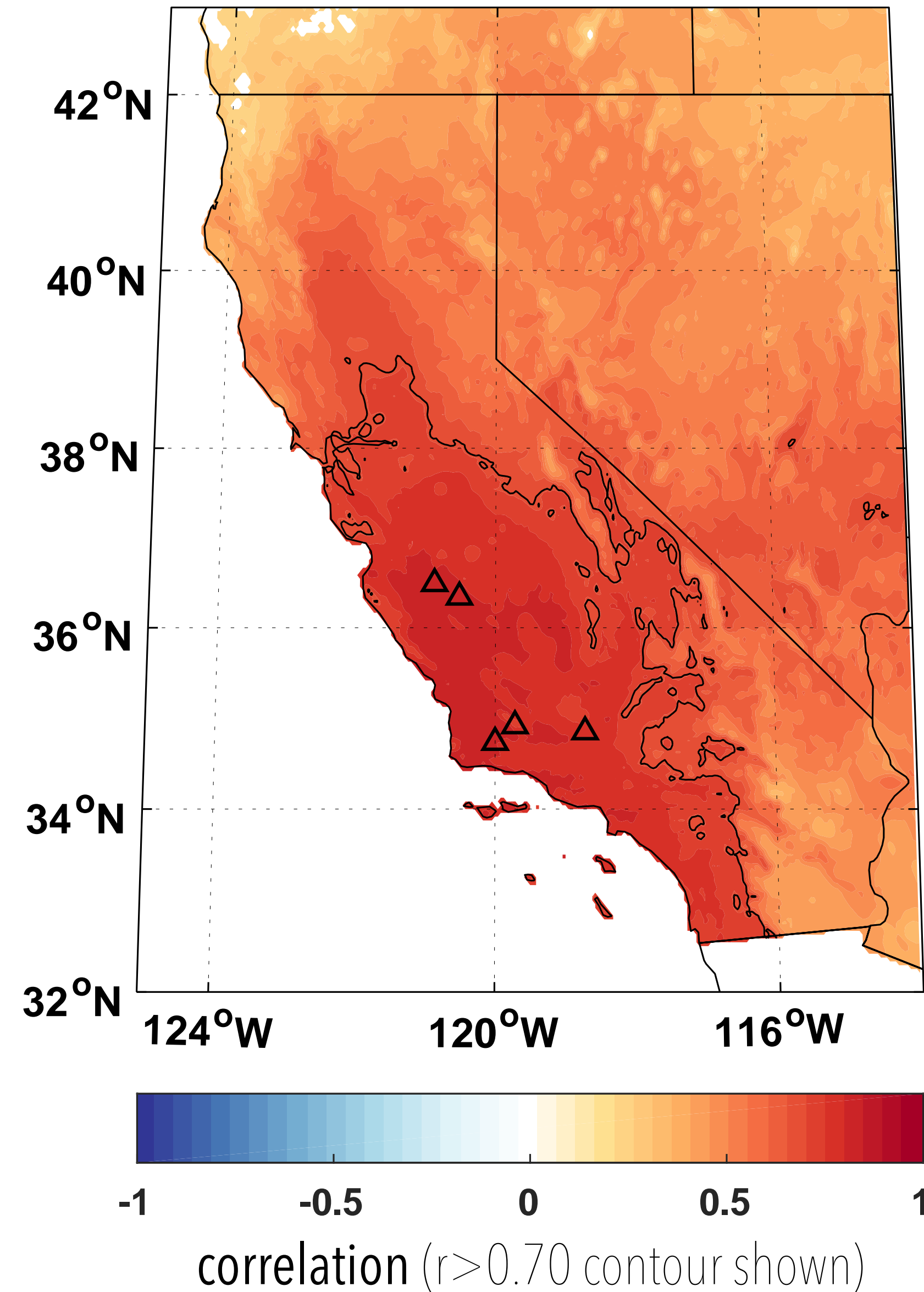
2014 was the **hottest** January-August temperature since 1895 in California Climate Divisions 4, 5, 6, and 7

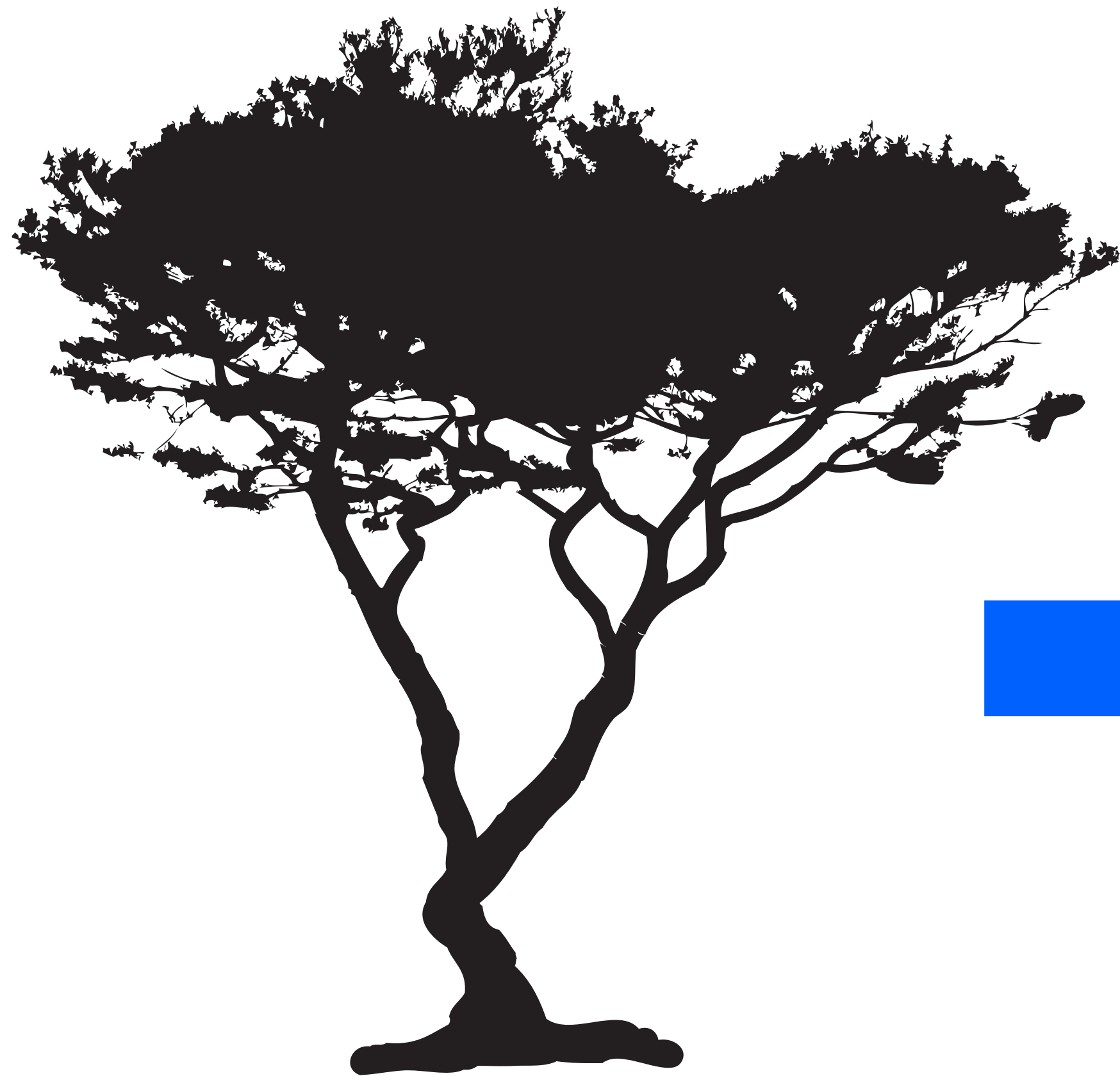
Source: US Drought Monitor, last week of August each year



BLUE OAK CLIMATE SIGNAL

composite ring width vs. PRISM water year precipitation





732 mm

612 mm

779 mm

808 mm

584 mm

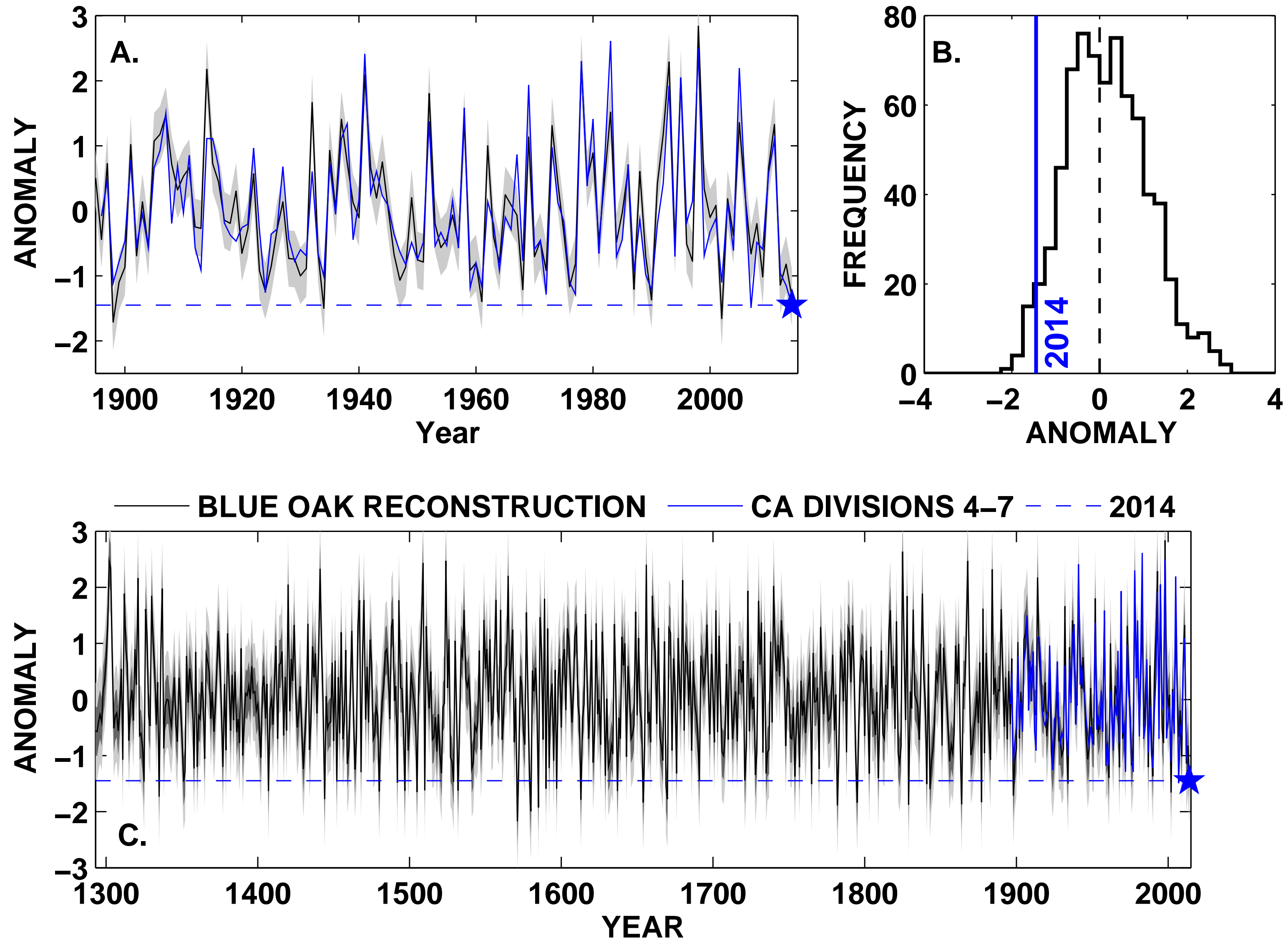
610 mm

855 mm

702 mm

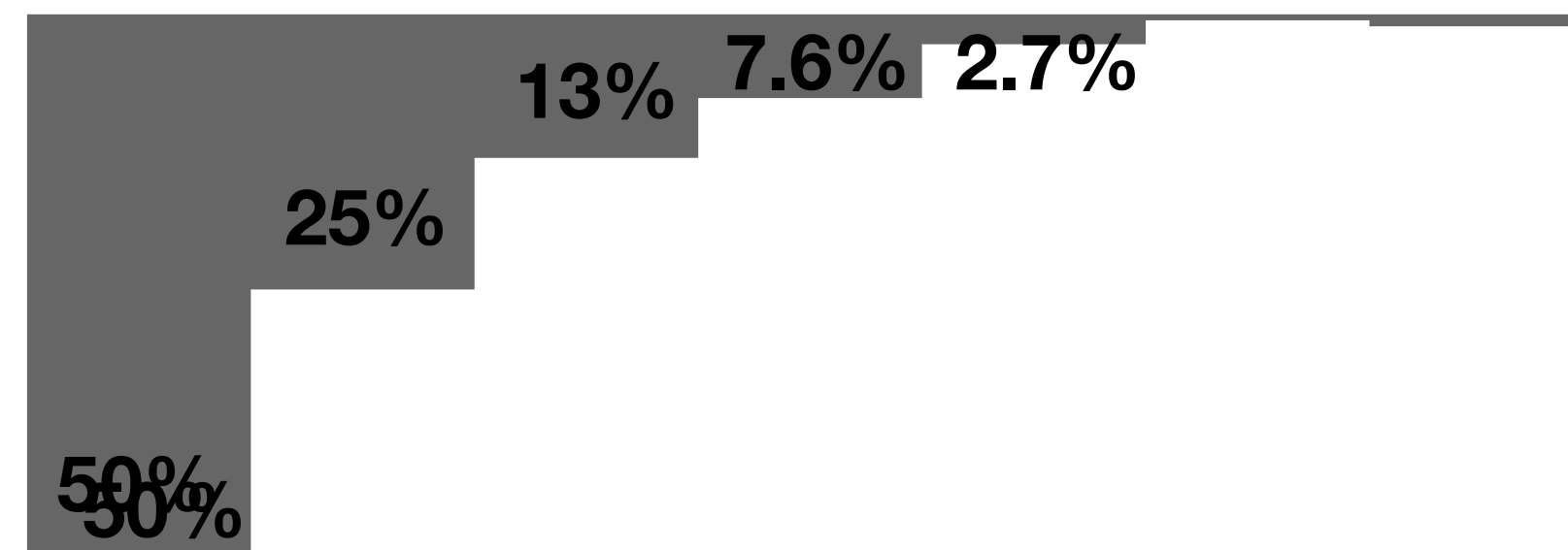
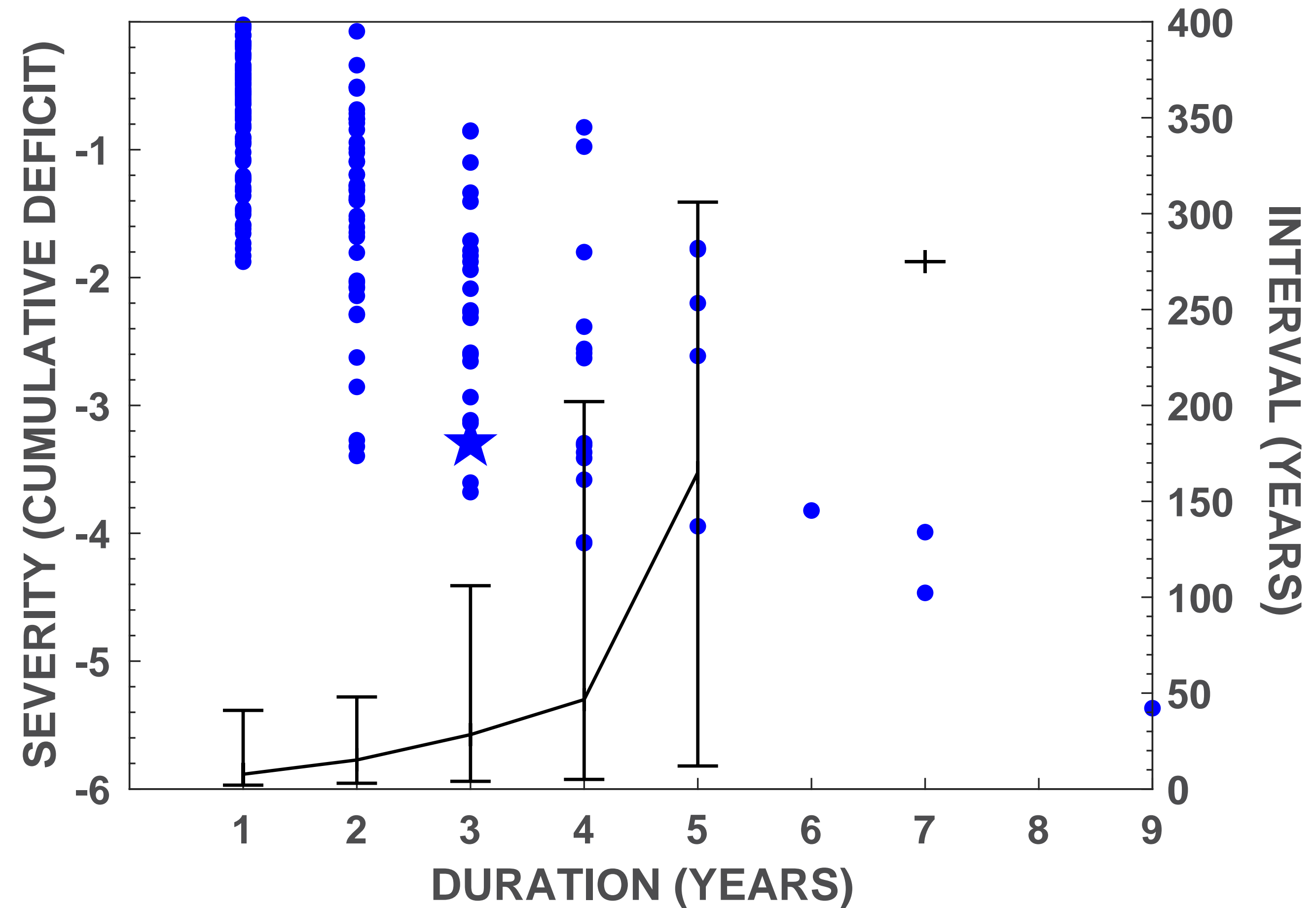
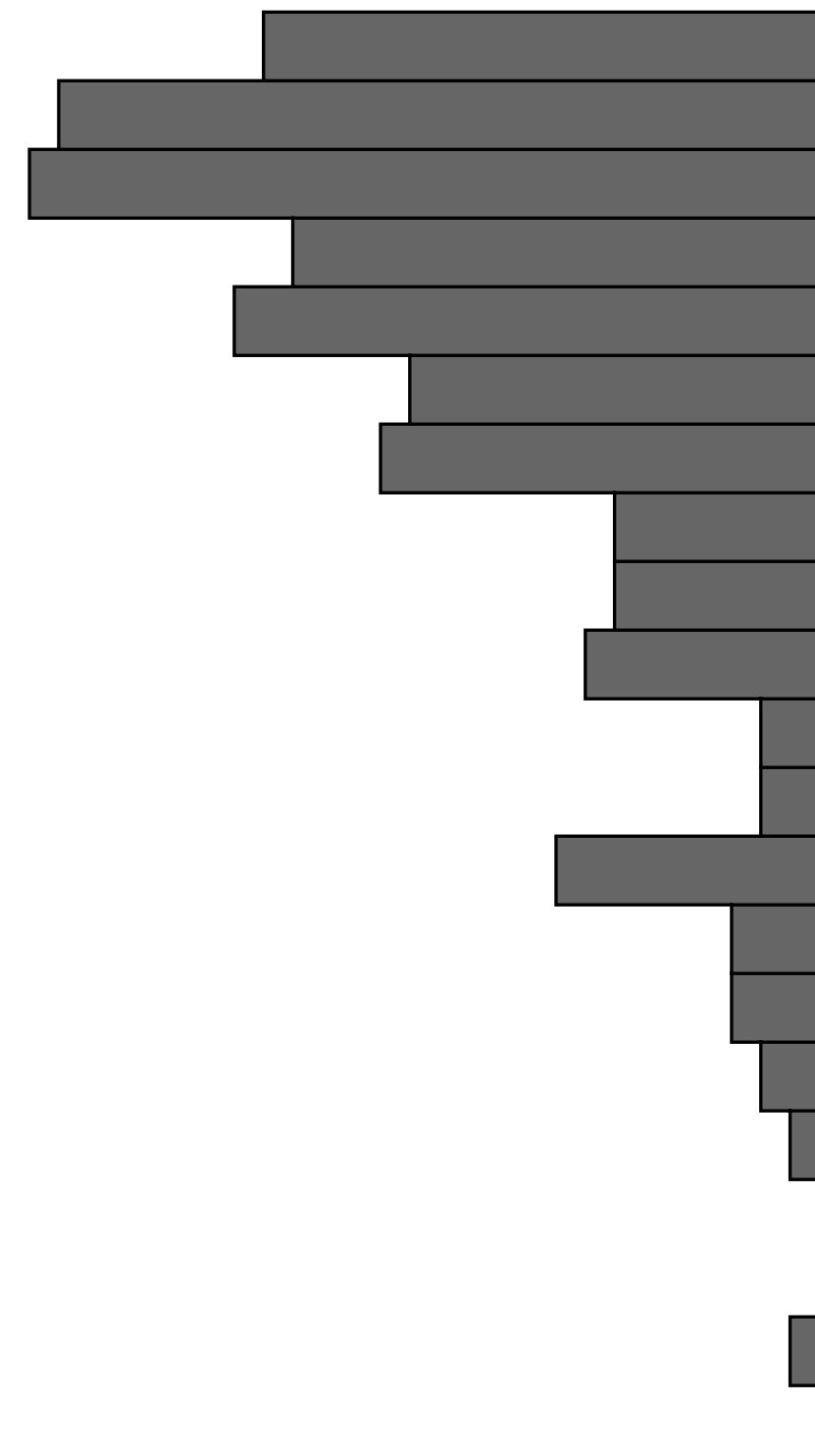
...

October-June Normalized Precipitation

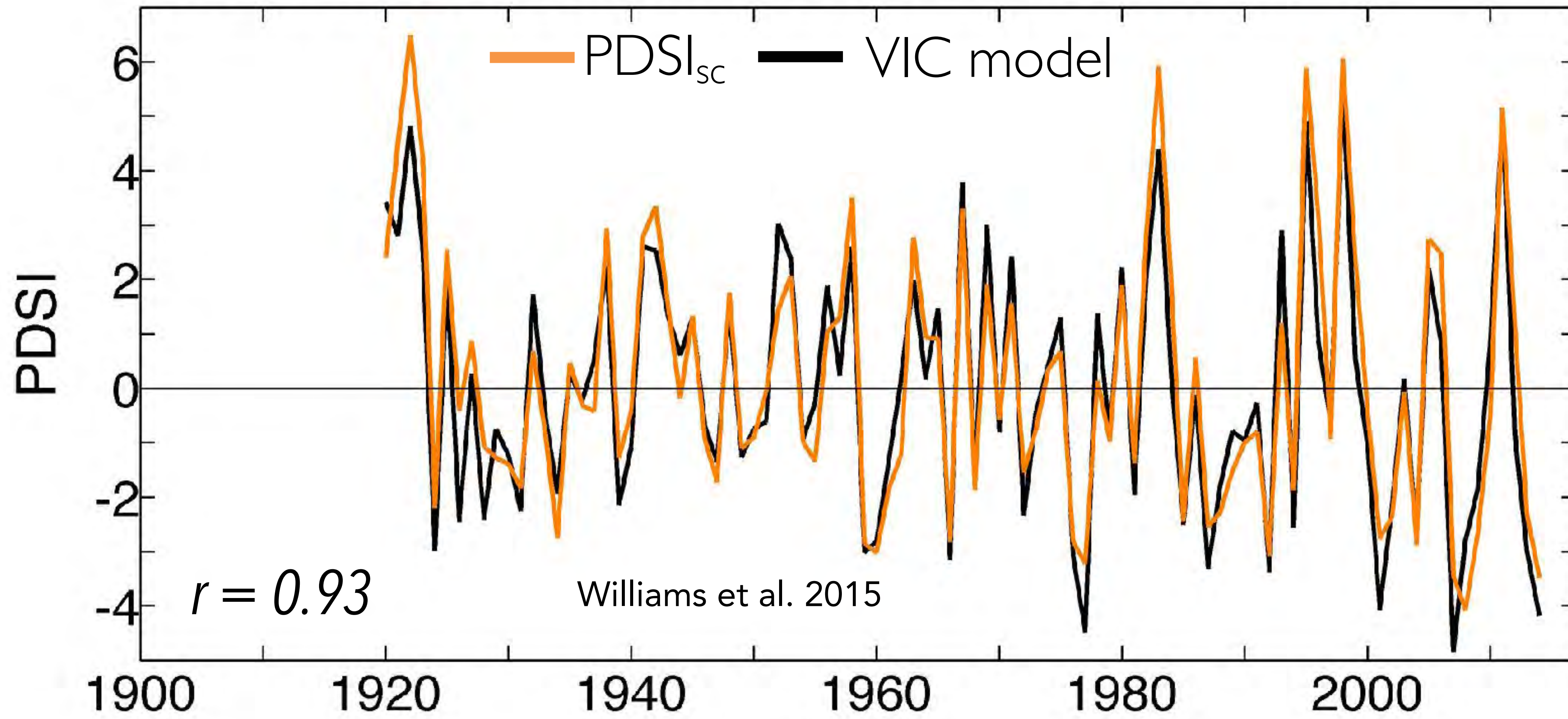


SOUTHERN/CENTRAL CALIFORNIA and NEVADA (1293-2014)

YEARS BELOW NORMAL PRECIPITATION

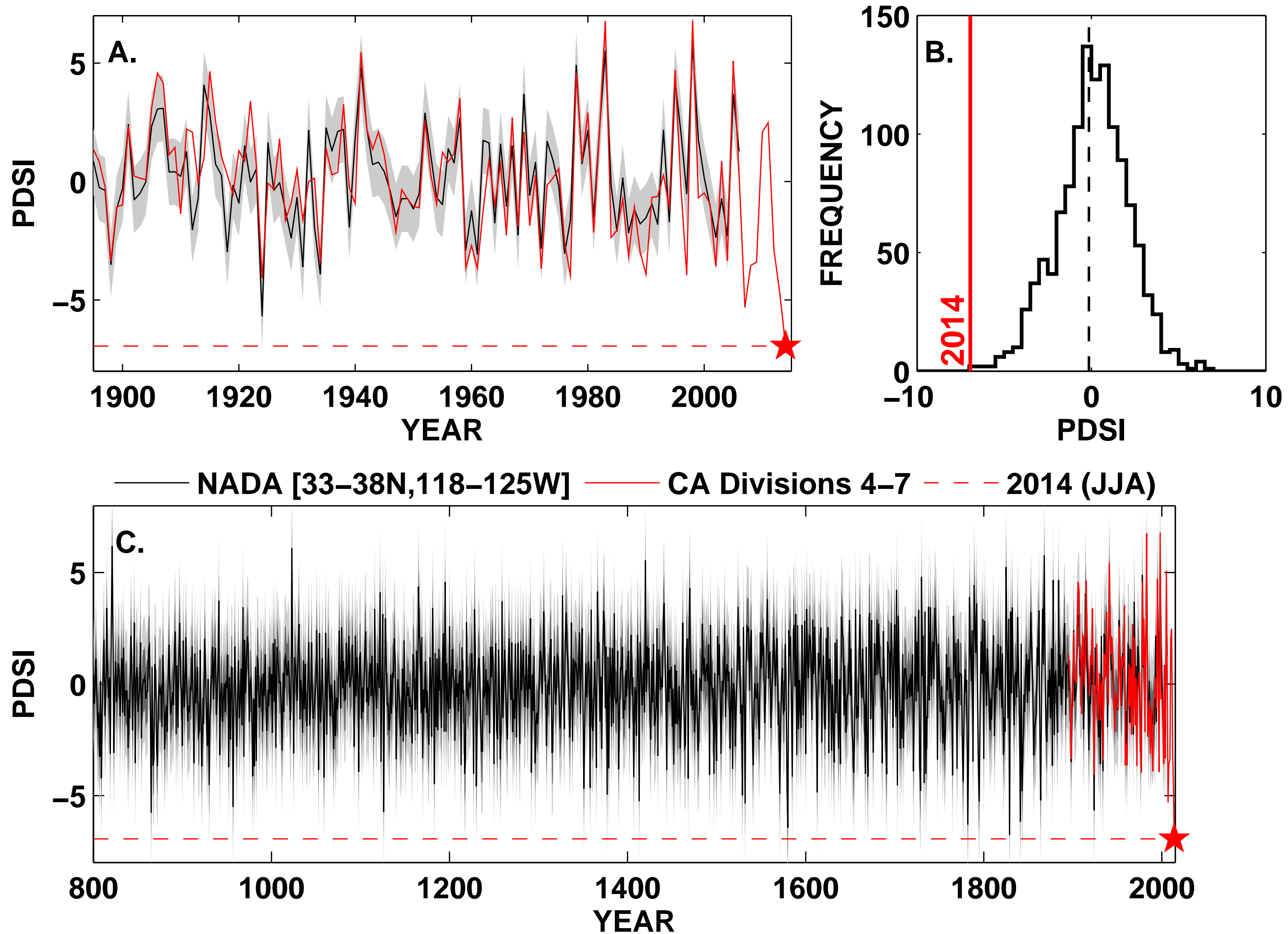


Palmer Drought Severity Index versus *VIC*, Sierra Nevada Mountains



slide courtesy of Ben Cook

June-August Palmer Drought Severity Index



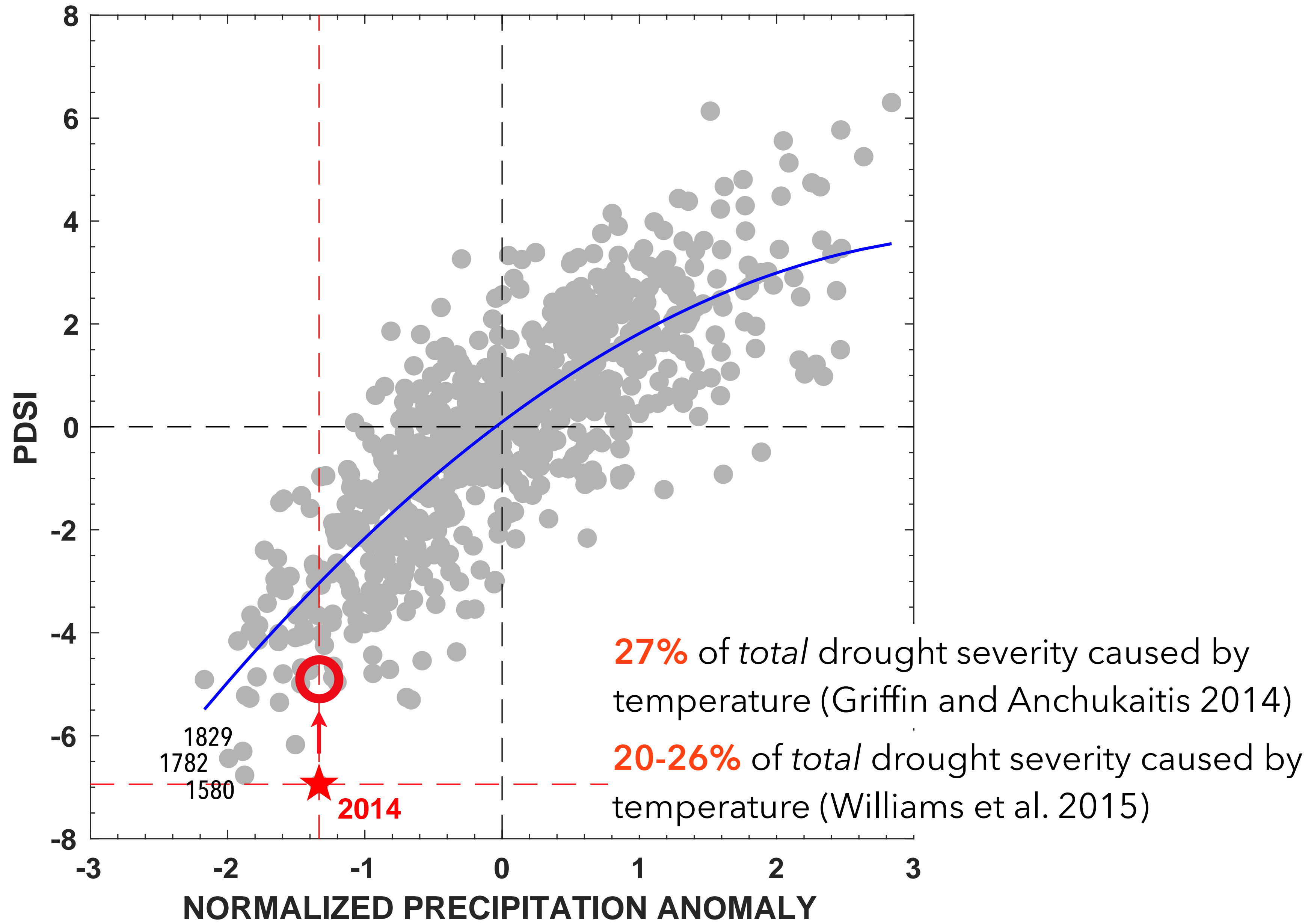
Griffin and Anchukaitis, 2014; Data from the North American Drought Atlas (Cook et al. 2004, 2010)

How unusual was the 2011-2016 California drought?

Over the last 1200 years, there were 37 occurrences of 3-year long continuous PDSI droughts and a total of 66 uninterrupted dry periods lasting between 3 and 9 years

Approximately 44% of 3 year droughts then continued on to last 4 years or longer.

SOUTHERN/CENTRAL CALIFORNIA and NEVADA (1293-2014)



2012

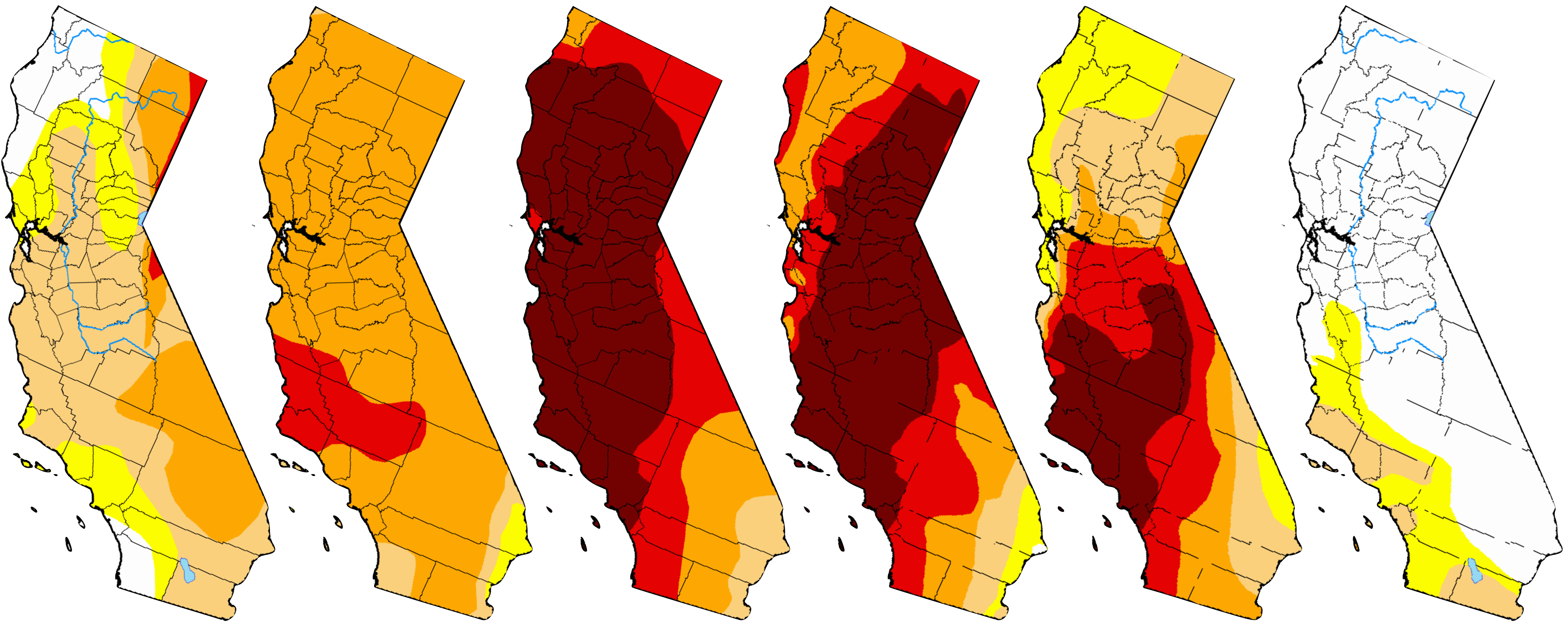
2013

2014

2015

2016

2017

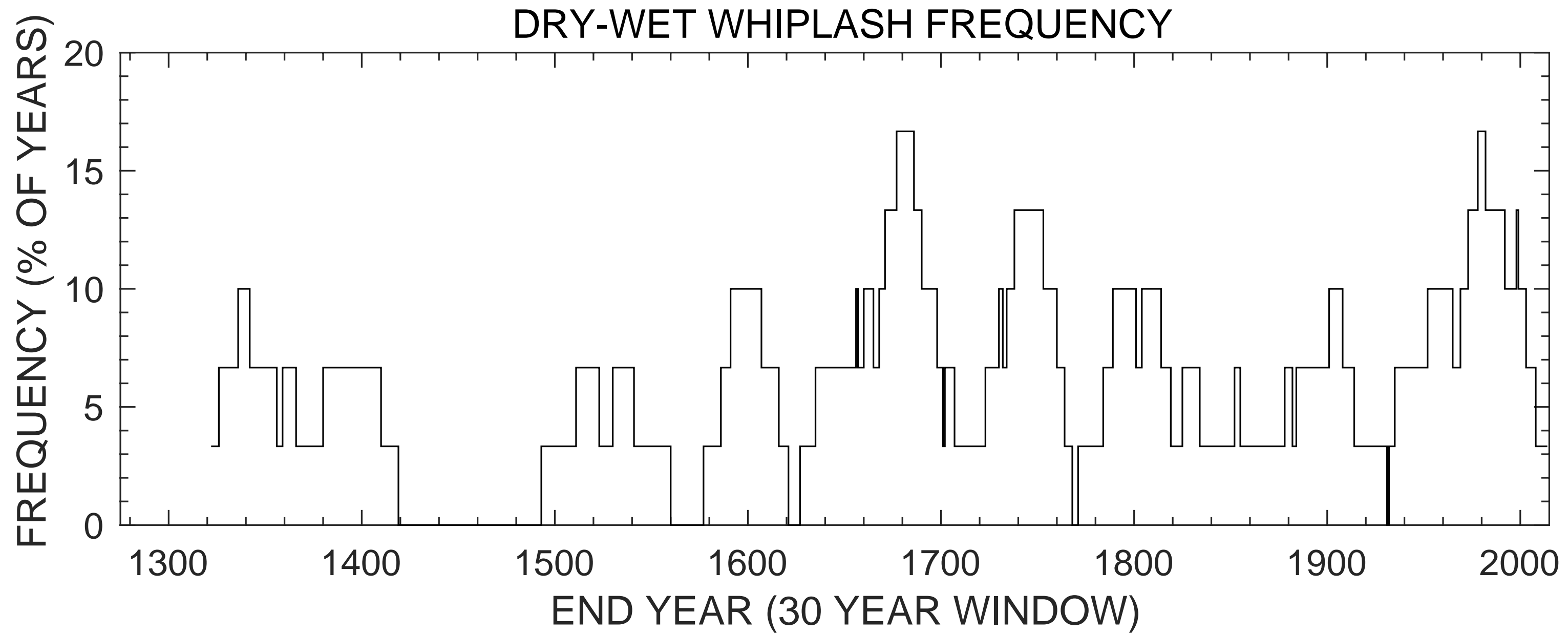
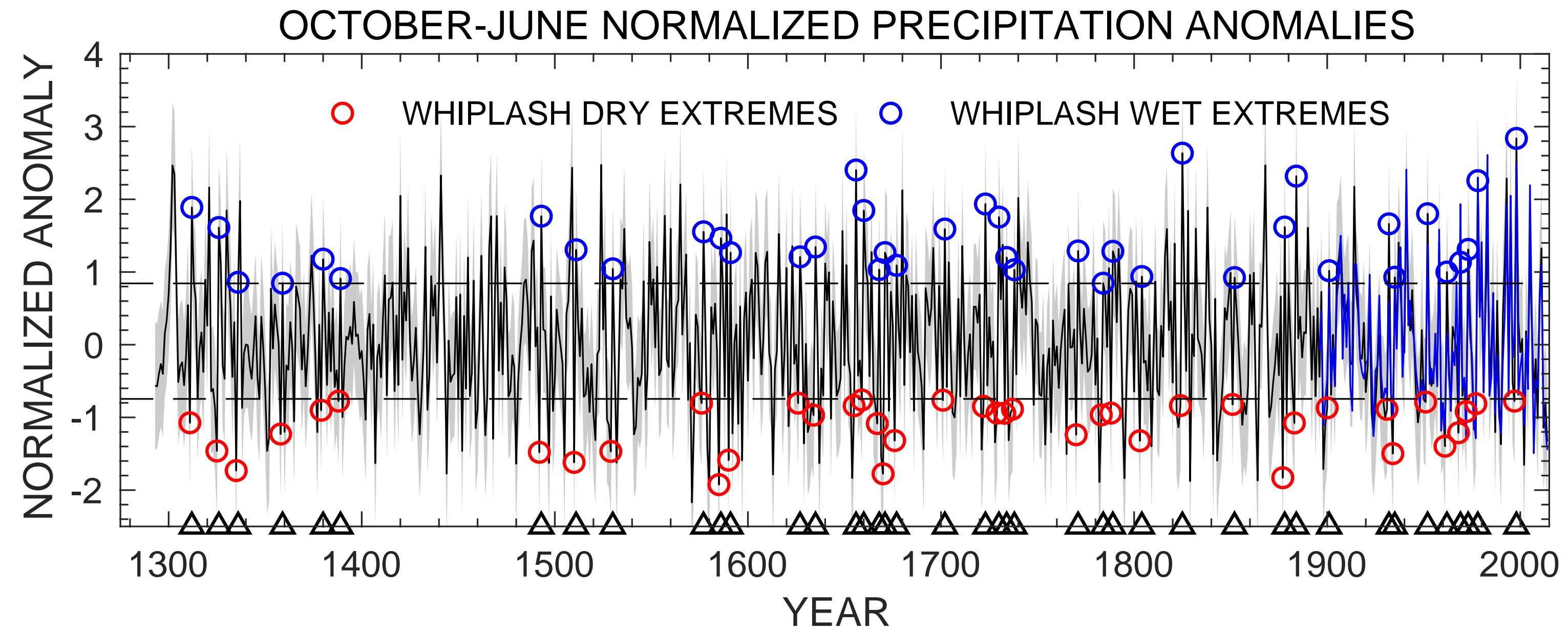


'whiplash' (Swain et al. 2018)

Source: US Drought Monitor, last week of August each year

Oroville dam, February 2017





How unusual was the 2011-2016 California drought?

In terms of **duration** (precipitation and soil moisture) such events are ***not*** outside the paleoclimate range

In terms of **severity**, the drought ***was*** unusual because of the influence of record-high temperatures on soil moisture - a '**hot drought**' - even though precipitation was not outside the paleoclimate range

Drought-ending '**Whiplash**' events are ***not*** unusual in the paleoclimate record, we can use tree rings for detection of changes in precipitation extremes

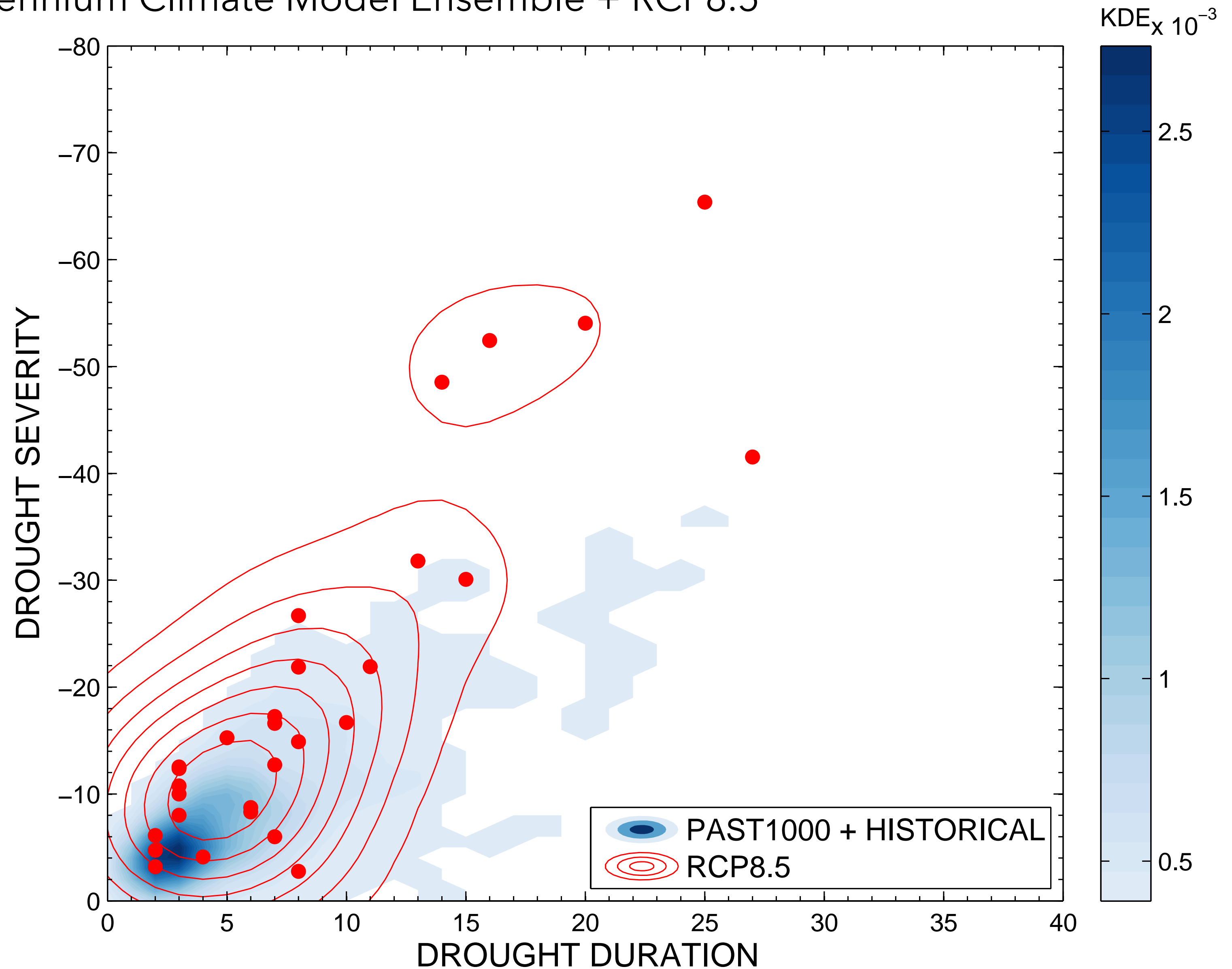
THE FUTURE in SOUTHERN/CENTRAL CALIFORNIA and NEVADA

CESM Last Millennium Climate Model Ensemble + RCP8.5

percent of droughts > 10 years
increases from 10 to 30%

percent of droughts worse than
-20 cumulative PDSI increases
from 15 to 47%

Uses 2x2 drought identification threshold
Runs Analysis: Gonzalez and Valdes 2003
Bivariate kernel density: Botev et al. 2010





THE UNIVERSITY
OF ARIZONA

CAUTION!
EXTREME
HEAT
DANGER

Not Applicable
to Arizona

