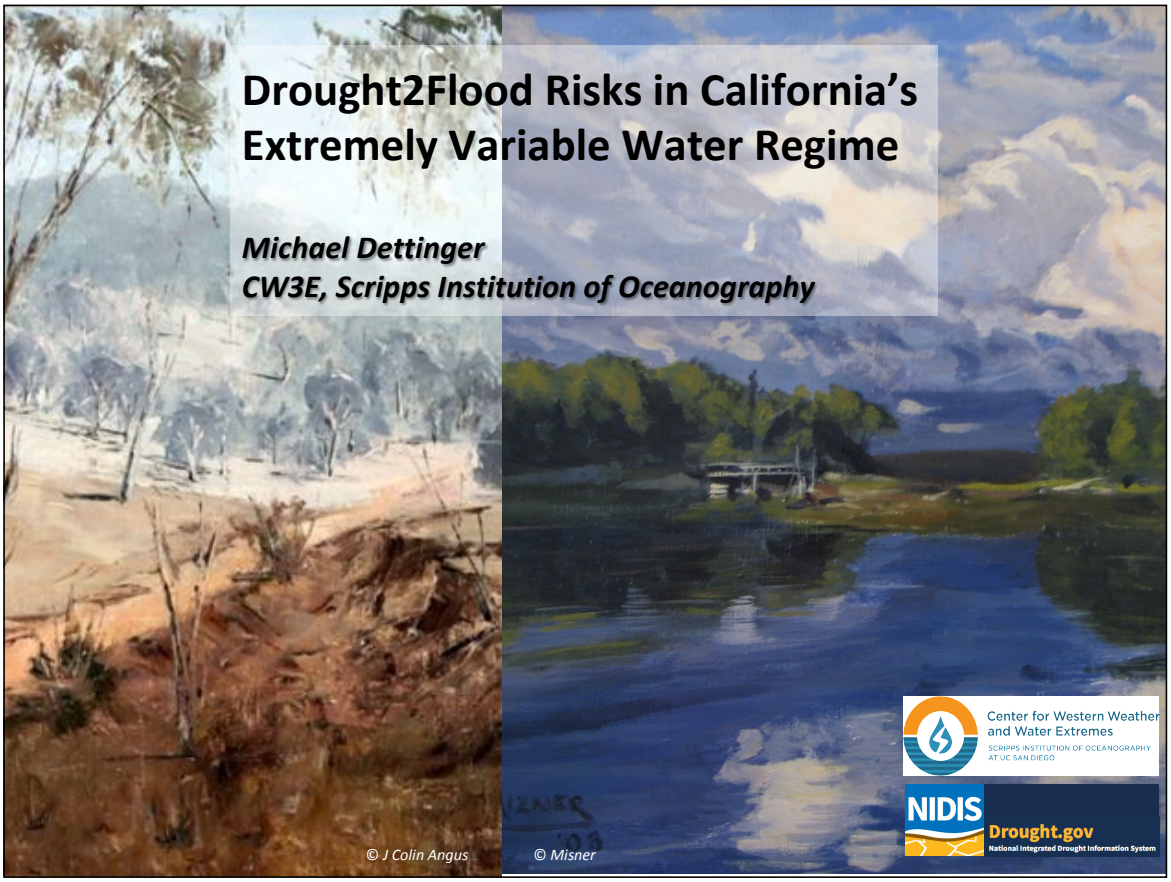
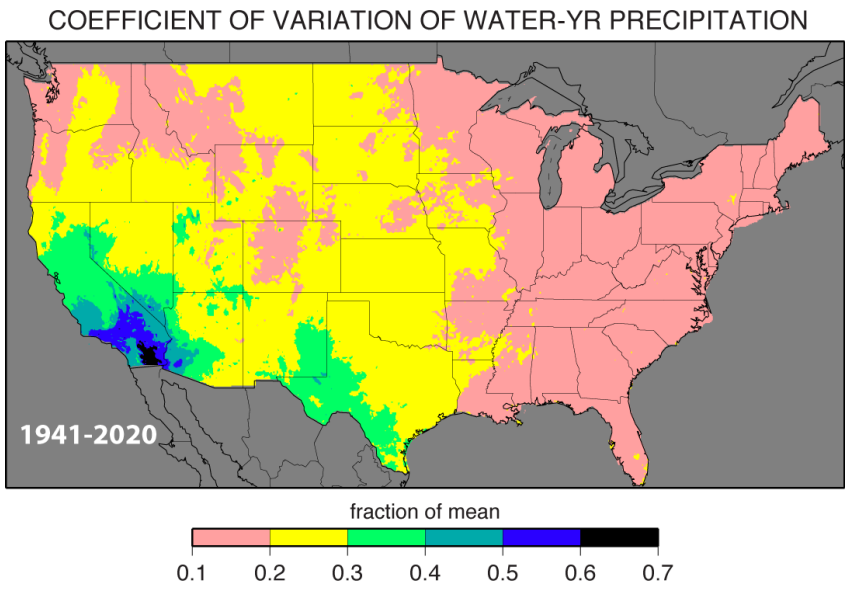
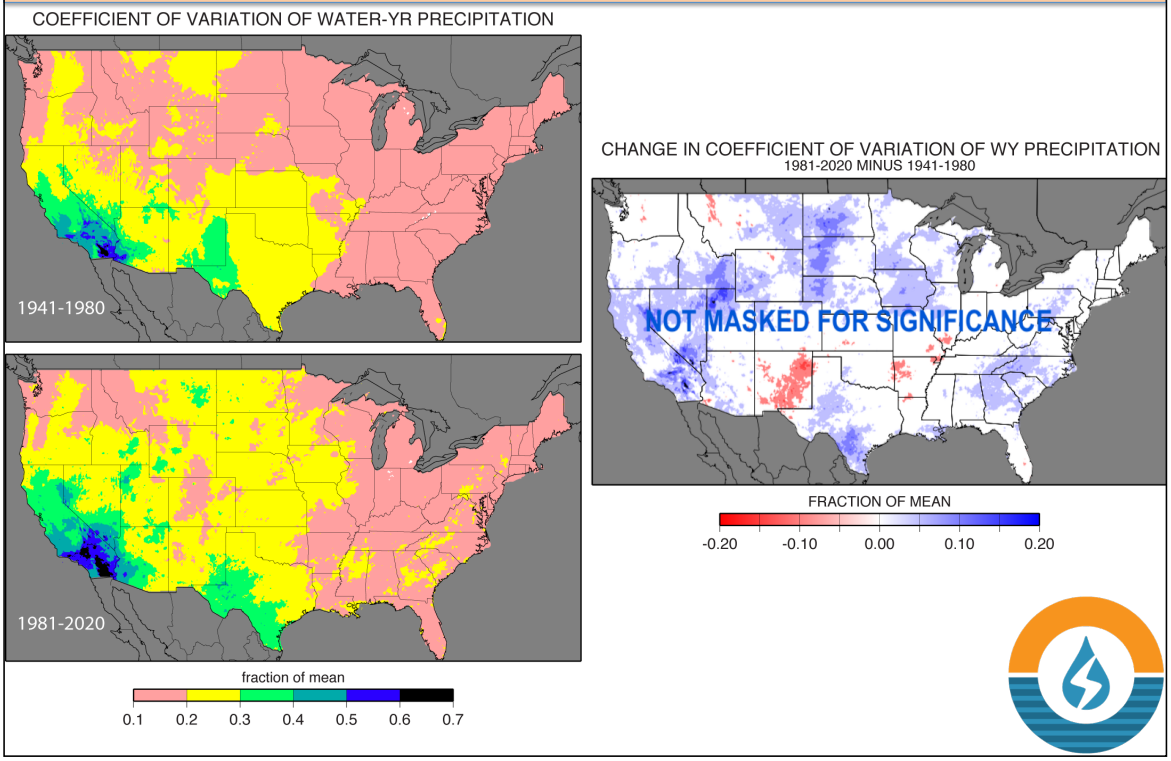


1. California's has a WILDLY Variable Precipitation Regime

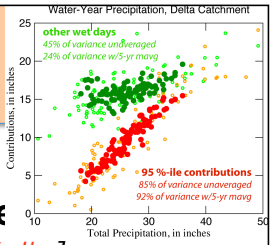


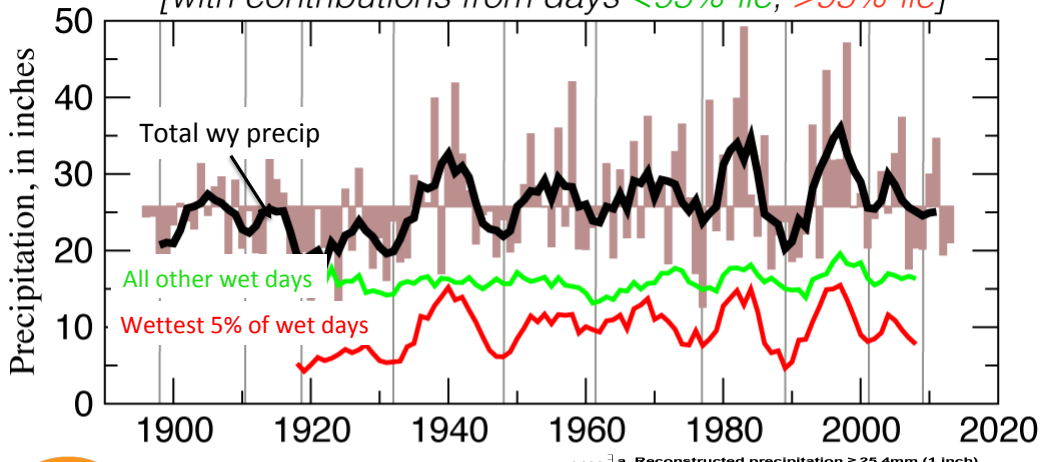
Based on prism.oregonstate.edu

… and its getting even wilder.

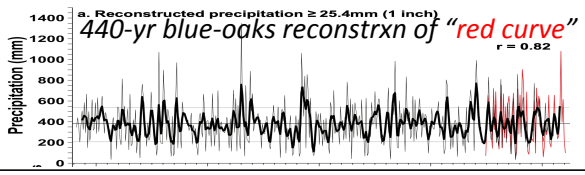


2. California's floods and droughts are BOTH driven by its largest storms.

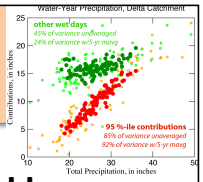




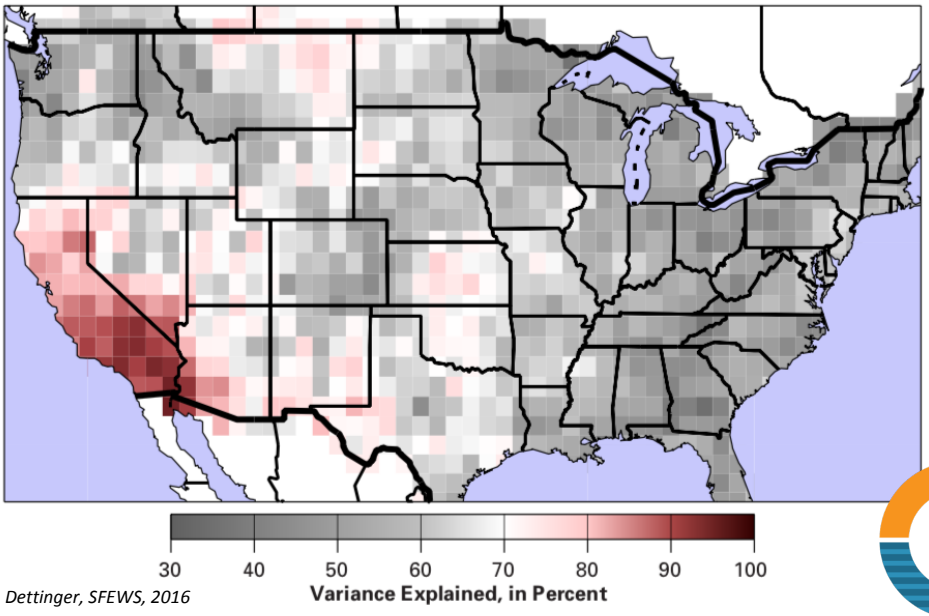
Dettinger & Cayan, SFEWS, 2014;
Dettinger, SFEWS, 2016;
Howard et al., JHydromet, in press



…and California's floods & droughts are UNIQUELY tied to each other



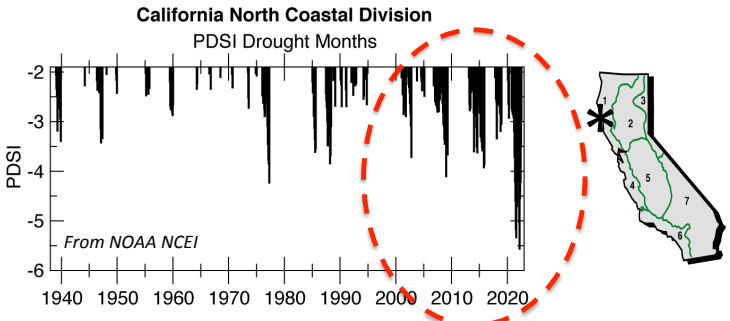
Percentage of Water-Year Precip Variance explained by Precip from wettest 7 days/yr



Dettinger, SFEWS, 2016

3. California drought have been intensifying over the past couple decades

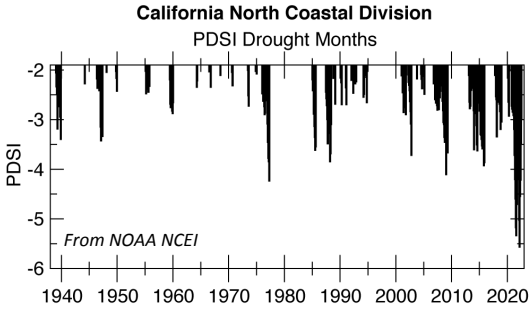
Palmer Drought Severity Index
(droughts only shown)



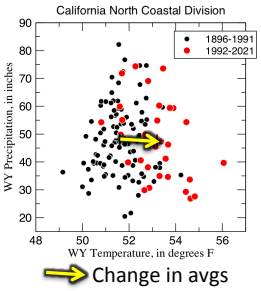
PDSI: -2 to -3, moderate drought
-3 to -4, severe drought
< -4, extreme drought

…because California's evaporative demand is responding to increasing warmth

Palmer Drought Severity Index
Is a function of monthly precip & temperature



PDSI: -2 to -3, moderate drought
-3 to -4, severe drought
< -4, extreme drought

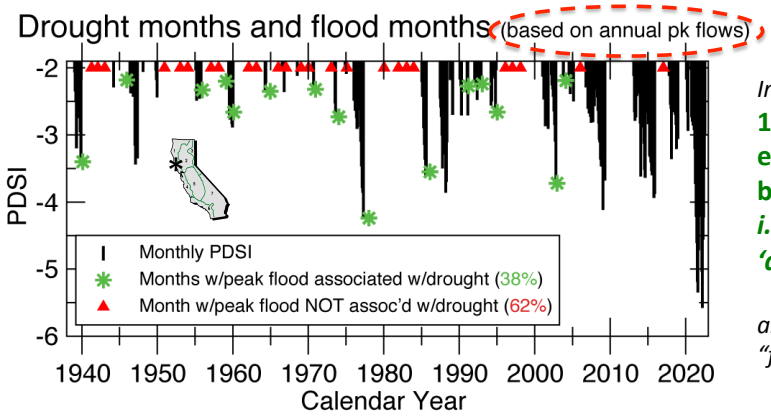


Change in avgs

4. Floods routinely occur before, during or after droughts in California → Drought does not mean that we should stop worrying about flooding

Russian River at Healdsburg

One of the floodiest basins in California (Corringham & Cayan, WCS, 2019)



Note (again): Floods identified in this talk as >45Kcfs

Thresholds
Flood stage = >45 Kcfs

PDSI: -2 to -3, moderate drought
-3 to -4, severe drought
< -4, extreme drought

In the 83-yr period shown here,
15 of 40 floods occurred at end of--or occasionally just before or amidst—drought,
i.e., 38% of floods fall in this 'drought-adjacent' category

albeit most floods were in the "floodier" pre-2000 era

4. Floods routinely occur before, during or after droughts in California → Drought does not mean that we should stop worrying about flooding

From 1940-2022, there is NO simple, chi-square significant association between drought years and the occurrence **(or not)** of major floods of the Russian River in the same yr; p=0.41, p>>0.05.

Drought WYear?

Flood WYear?	Yes	No
Yes	9 (11)	15 (13)
No	28 (26)	31 (33)

(Grey #) is expected if flood & drought are completely independent.

CA DWR Drought 2 Flood Symposium, Sacramento, October 17 2022

4. Floods routinely occur before, during or after droughts in California → Drought does not mean that we can stop worrying about flooding

From 1940-2022, there is also NO simple, chi-square significant association, at Russian R nr Healdsburg, between drought at beginning of water yr and the occurrence (or not) of floods later in the year. Result: p=0.27, p>>0.05.

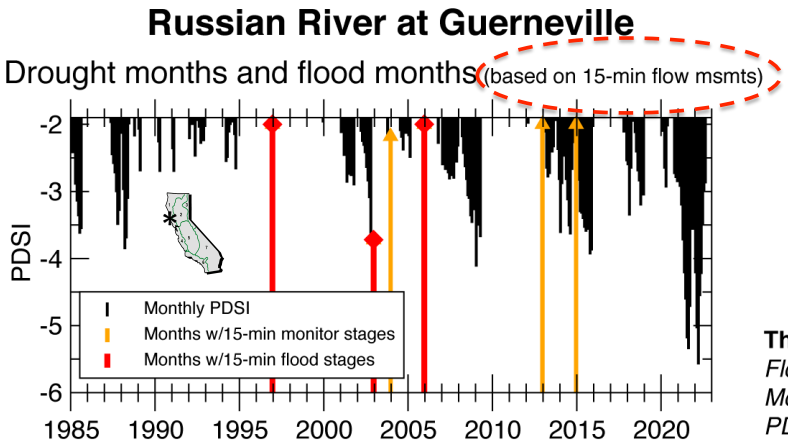
Sept&Oct both drought months?

Flood WYear?	Yes	No
Yes	4 (6)	36 (34)
No	8 (6)	35 (37)

(Grey #) is expected if flood & drought are completely independent.

Definitions: Drought month when PDSI < -2 && Flood Wyr when Peak Flow > 45 Kcfs

4. Floods routinely occur before, during and after droughts in California – Using modern 15-min msmts



In the recent era shown, **flood (& monitor) stages have occurred 'separately' from drought only 2 of 6 times.**

Thresholds
Flood stage = >45 Kcfs
Monitor stage = >38 Kcfs
PDSI: -2 to -3, moderate drought
-3 to -4, severe drought
< -4, extreme drought

Upshot: **There is no historical statistical relation between whether we will or will not have a flood of the Russian R just because we're in a drought. California's storm regime is just too extreme for that.**

Main Points

- **California has a uniquely wild precip/water regime**
  - ✧ ***Highest historical yr-to-yr variability in CONUS***
- **California's floods & drought are uniquely tied to each other**
  - ✧ ***Historically, it is almost entirely a lack of extreme storms that causes California "precip drought"***
- ***Drought does not protect us from flood in California***
  - ✧ ***Floods historically have happened before, during and after droughts*** *(e.g., almost 40% of the time in the Russian Basin)*
  - ✧ ***Floods & droughts are not separable problems in Northern California (and, btw, will be less & less so in the future)***