

Effects of extreme precipitation events on soil moisture in CESM2-LE

2022 Land Model WG Meeting

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When do extreme precipitation events “bust” droughts?

Will October Rain End Fire Season and the Drought? What Wet Weather Means for the Bay Area



LISTEN

By KQED News Staff and Wires Oct

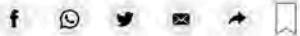
California's atmospheric river storms dropped 7,600,000,000,000 gallons of rain, drought buster

BY GARY ROBBINS

NOV. 1, 2021 6:35 PM

Heavy Rains Weren't Enough to Stop Winter Fires in California

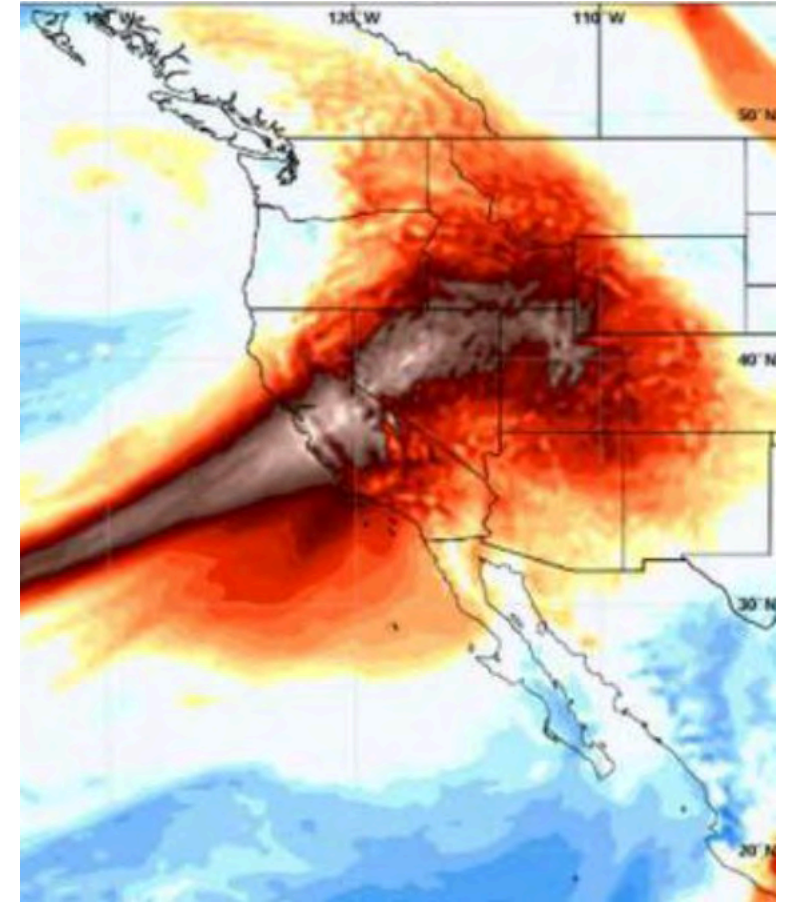
The National Weather Service called the fast-moving blaze “surreal,” given the recent storms.



By Soumya Karlamangla

Jan. 24, 2022

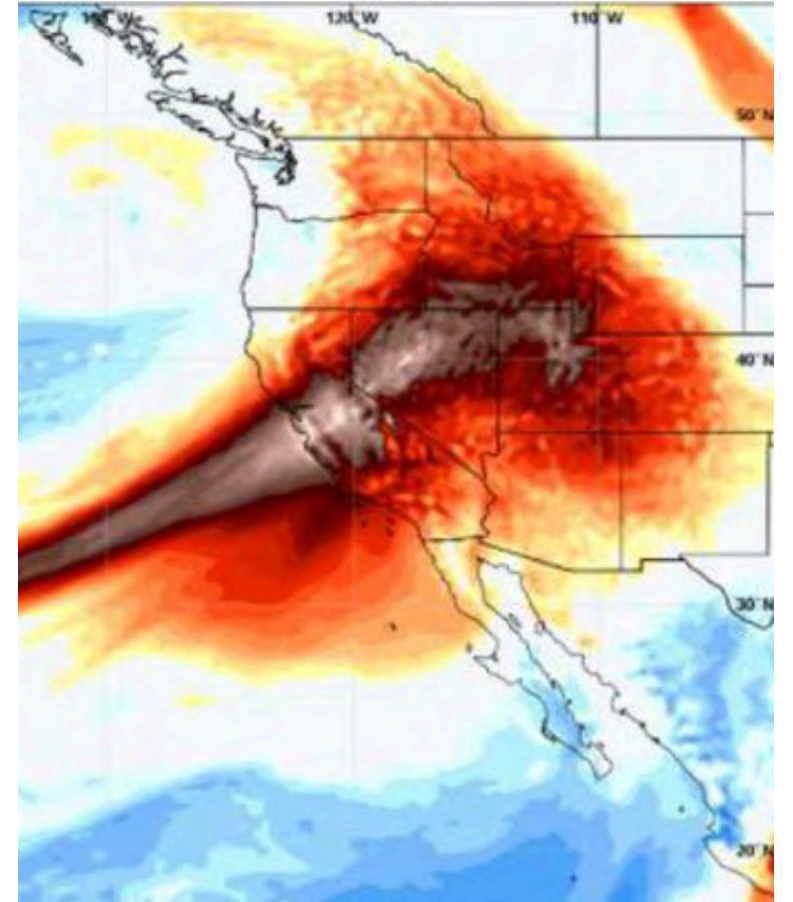
Oct 24 2021 Precipitable Water



Research Questions

- How do extreme precipitation events impact soil moisture and fire weather conditions in CESM2-LE?
- How and when do these events “bust” droughts or end fire seasons?
- How will these impacts change in future climates?

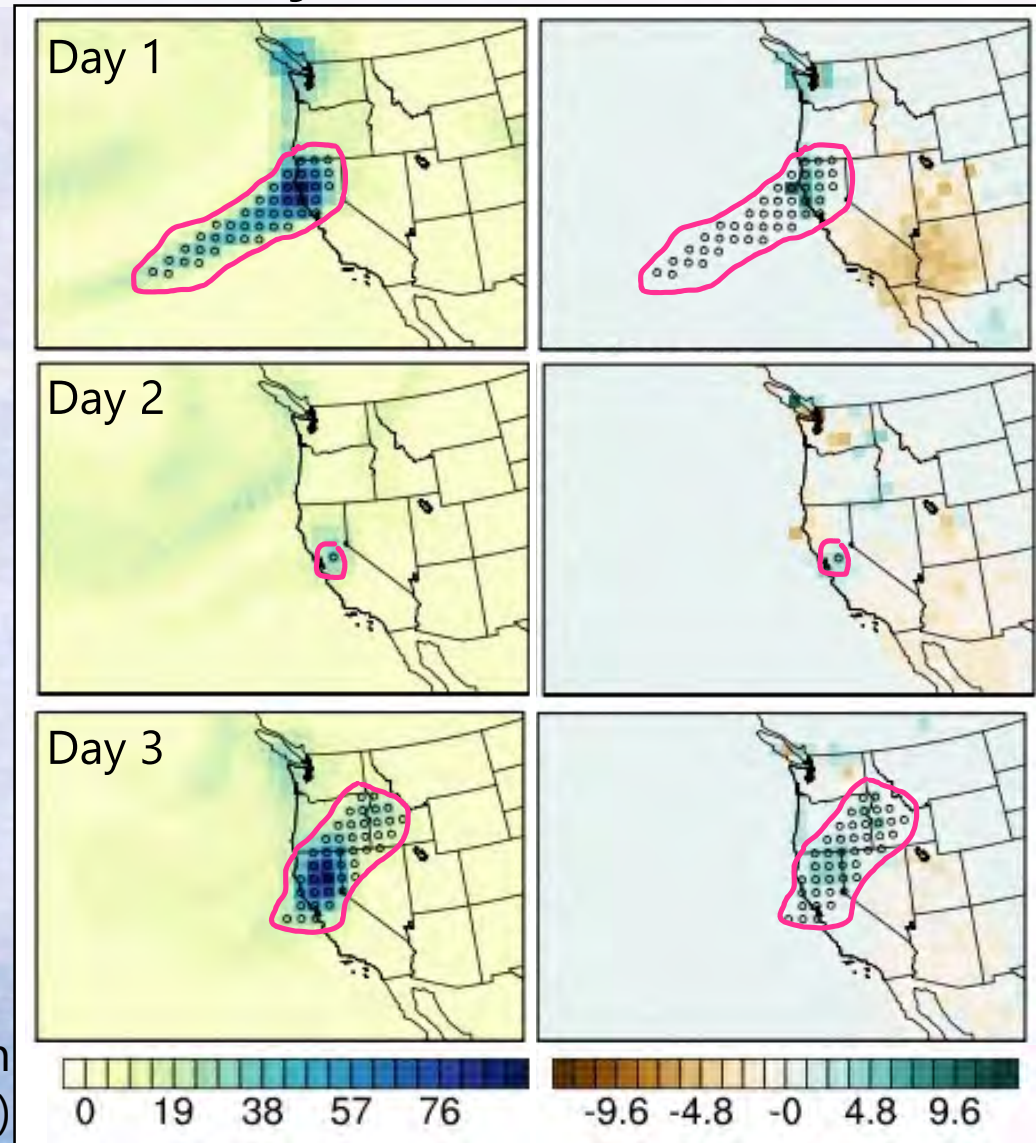
Oct 24 2021 Precipitable Water



Defining extreme precipitation events and their impact on daily soil moisture

Track extreme precipitation events in space and time*

(99th percentile of the 1979-2014 distribution)



Quantify change in 10cm soil moisture over their footprint

change in 10cm SM detrended 30-day anomaly (kg/m2)

Extreme precipitation events increase daily scale soil moisture anomalies



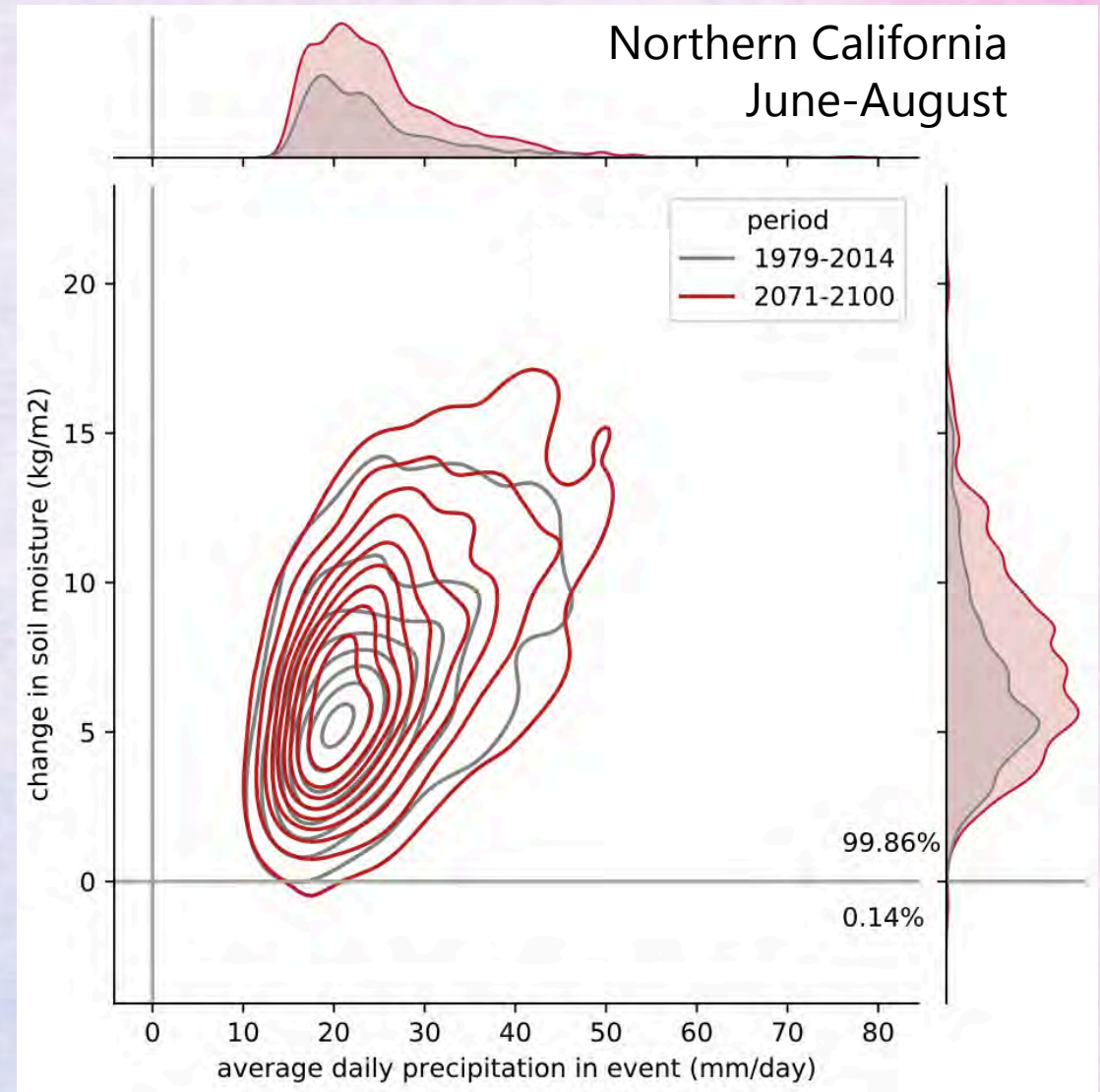
Almost all extreme precipitation events lead to an increase in daily soil moisture



Events with higher average precipitation lead to larger increases in soil moisture.



Both average precipitation during an extreme events and changes in soil moisture increase in the late 21st century



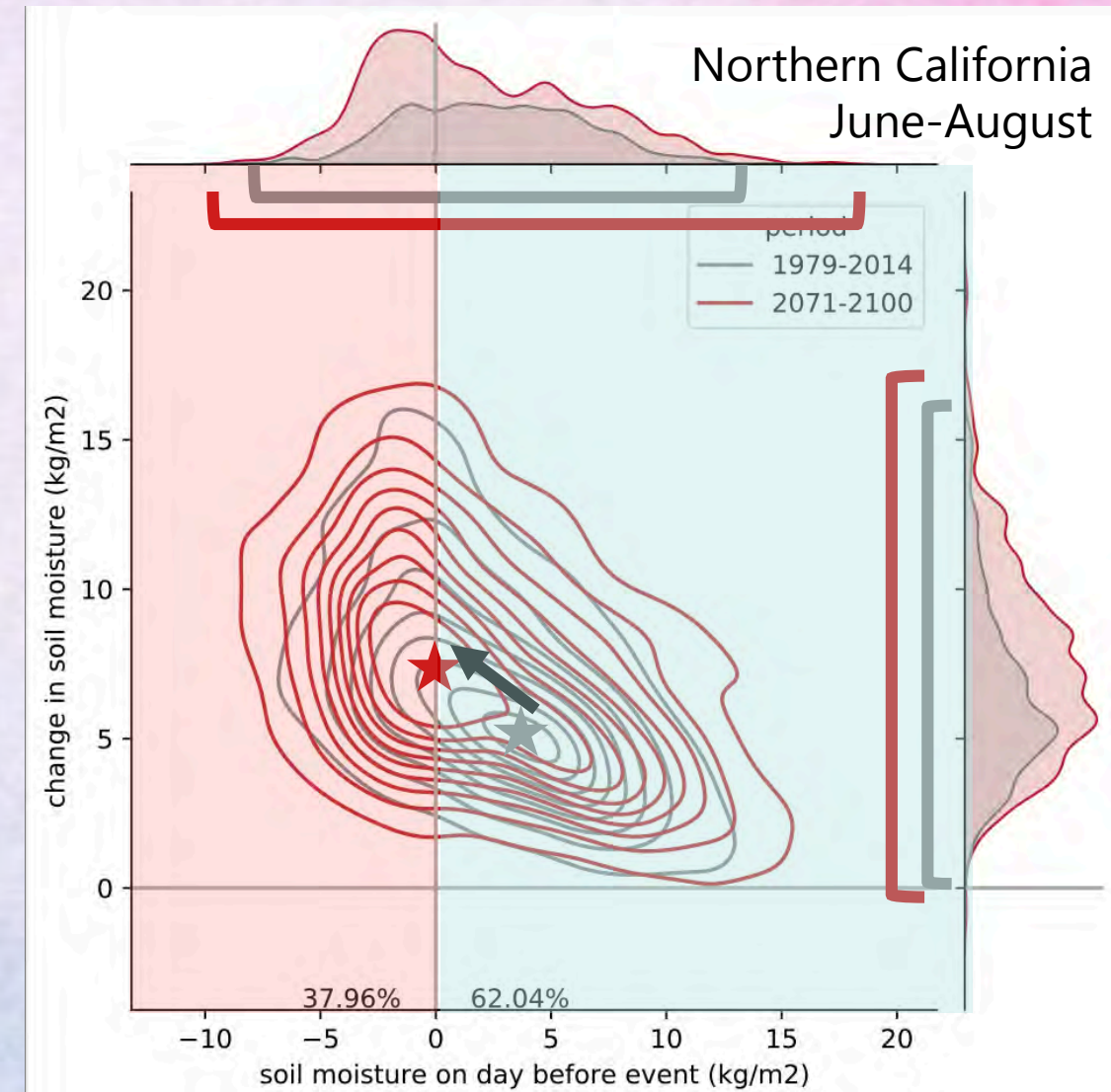
Drier soils have larger increases in daily soil moisture anomalies

38% of areas are dry before an event → larger increases over these footprints

62% of areas are wet before an event → increases in soil moisture are smaller

In the late 21st century, initial soil moisture tends to be drier, but changes in the soil moisture anomaly increases

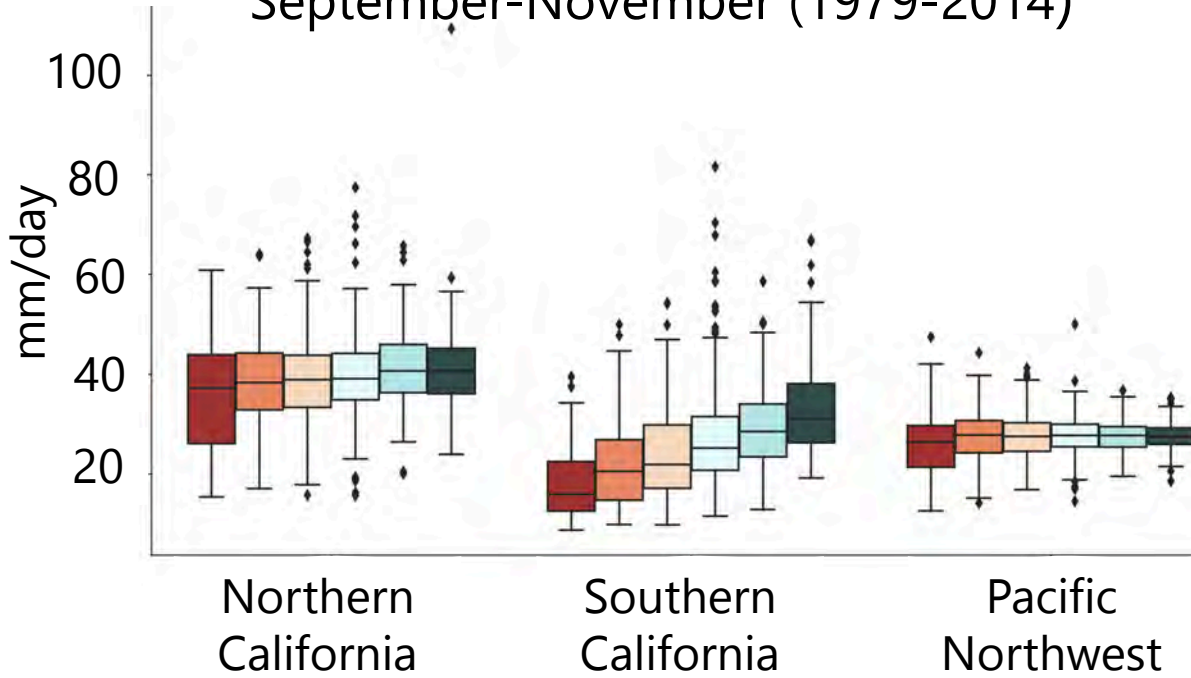
The tails of the distribution of both initial soil moisture conditions and changes in soil moisture become longer



Extreme precipitation events may have smaller impacts on seasonal/regional droughts

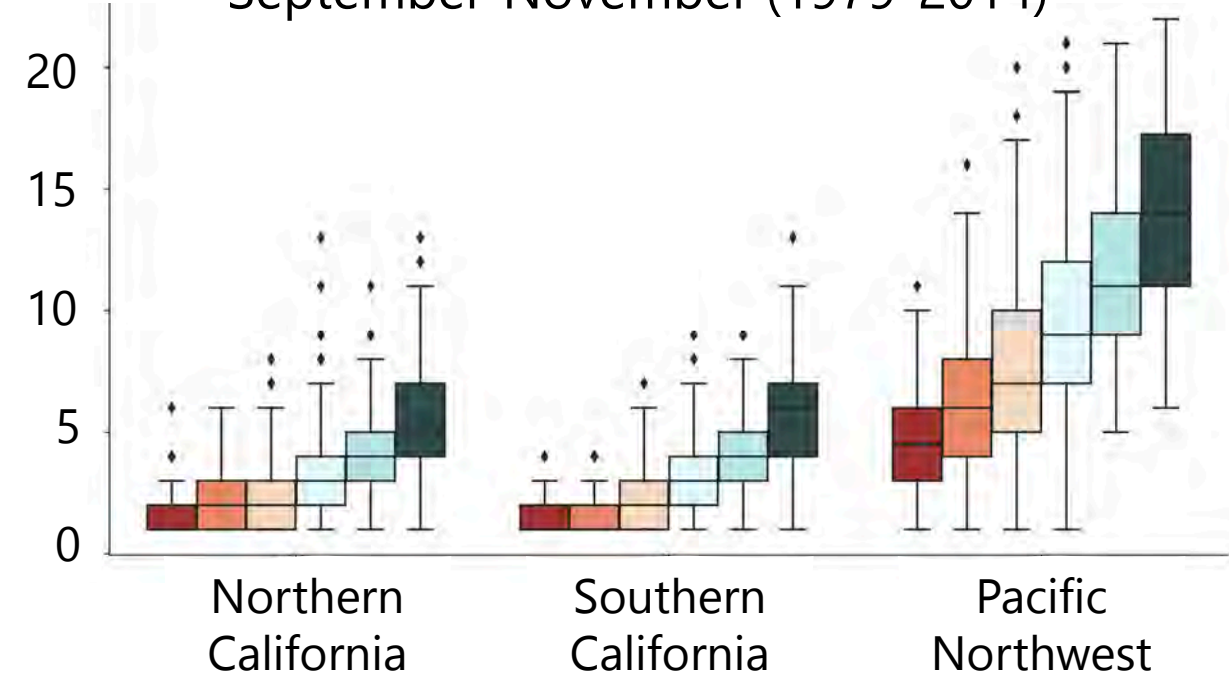
Average precipitation per event

September-November (1979-2014)



Number of extreme events

September-November (1979-2014)



very dry  very wet
Seasonal soil conditions

Next steps

- Investigate other variables could play a role on the impact of extreme precipitation on dry conditions (temperature, winds).
- Quantify the changes in the strengths of the relationships between extreme precipitation characteristics and impacts on soils and fire conditions.
- Compare to other observations and large ensembles – how realistic are these impacts?

Thank you! detouma@ucar.edu