

# Future Conditions of Wind and Rain Associated with Fall Wildfire Conditions in CMIP6 Models over Western North America

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## Introduction

In the Western United States, wildfires are often associated with strong winds occurring under dry fuel conditions. For most of the region, the coincidence of these conditions is most likely in the late summer or fall, before wetting rains moisten fuels, but after the likelihood of strong winds begins to increase. This study assesses downscaled climate model projections of changes in the timing of rain before strong winds in the western United States under future scenarios of global warming.

## Data

- ERA5 downscaled with WRF<sup>1</sup>
- CMIP6 downscaled with WRF, ssp-370<sup>2</sup>

## Research Questions

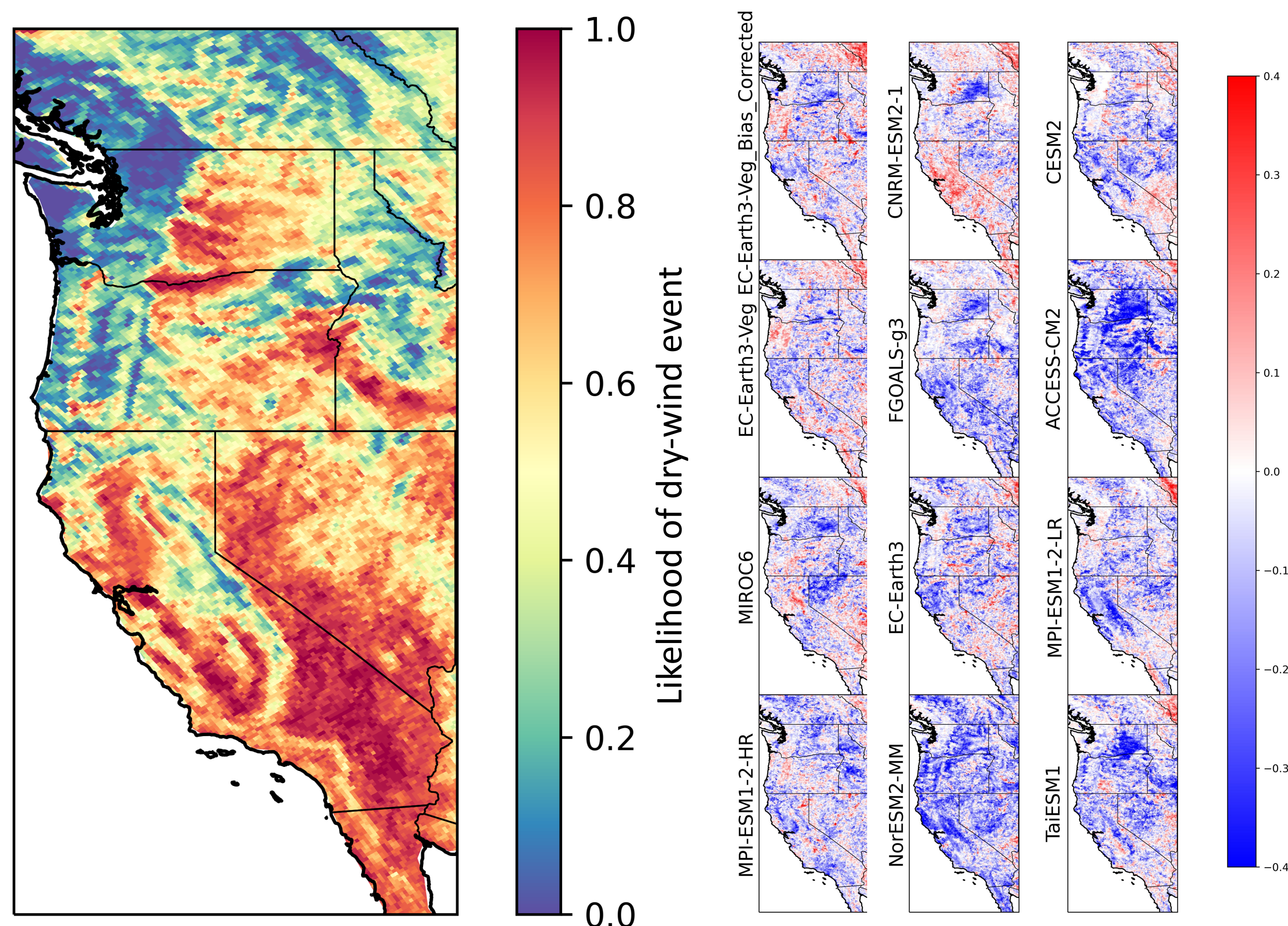
- Will the timing of fall rain and wind onset change in the western United States under global warming?
- Will the likelihood of strong wind during dry conditions during fall change under global warming?

## Methods

- Each year is assessed for dry-wind events using 95<sup>th</sup> percentile 2m wind and 2-week rainfall < 12mm.
- A likelihood of fall dry wind events is created from historical and future model runs over 30 years.
- Differences in likelihood between historical and future are assessed, as well as differences in rain and wind onset dates.

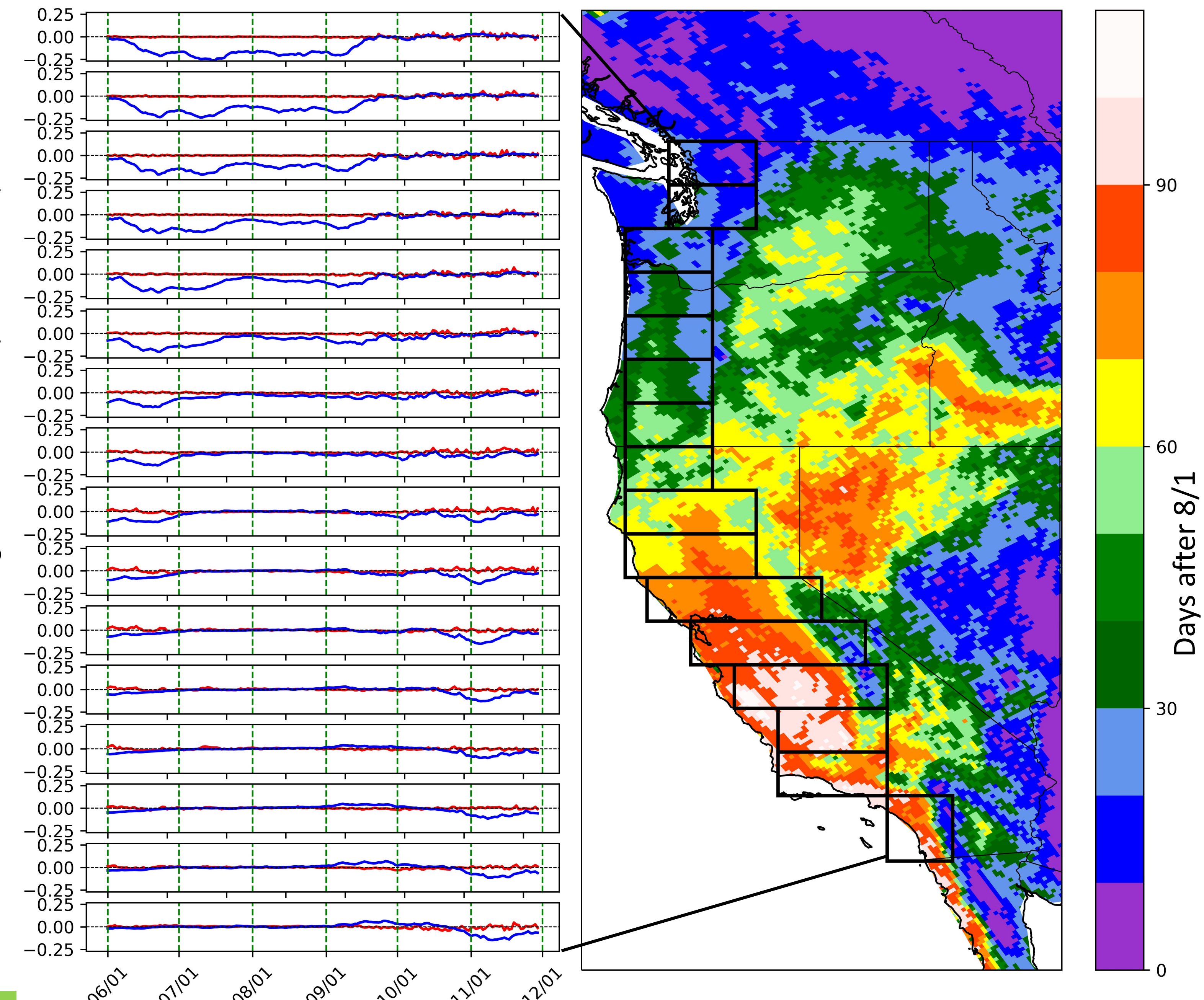
## Results

### Historical Dry Wind Likelihood – Little Future Change



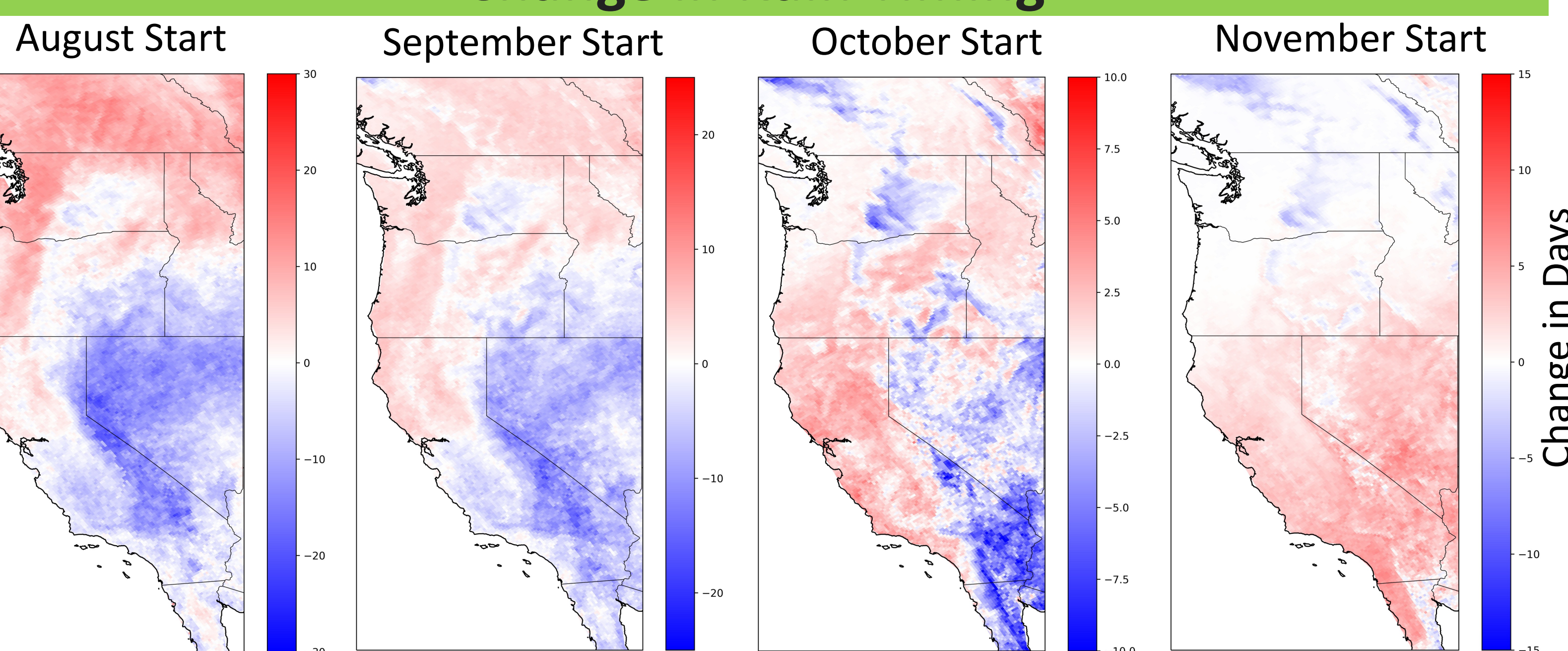
**Fig 1.** Left: The likelihood of 95<sup>th</sup> percentile surface wind occurring when the 2-week antecedent rainfall is less than 12mm (1981-2010) in ERA5 in August-November. Right: Model change in likelihood comparing 2070-2099 to 1981-2010, as an absolute difference in percentage.

### Wetting Rain & Strong Wind Likelihood



**Fig 3.** Left: Future change in likelihood of 2-week antecedent rainfall exceeding 12mm (blue) and 95<sup>th</sup> percentile wind (red) in latitudinal transects from 49N to 32.5N. Right: Average days after August 1<sup>st</sup> of first date of 2-week antecedent rainfall exceeding 12mm. Boxes indicate latitudinal transects plotted on the left.

### Change in Rain Timing



**Fig 2.** Change in date of rain onset (first date where the 2-week antecedent rainfall exceeds 12mm), starting from (a) Aug (b) Sep (c) Oct (d) Nov. Red – later onset. Blue – earlier onset.

- Onset date is calculated in each month to account for the meridional gradient in onset, and separate summer convection from fall synoptic rain.
- Later start to the early rainy season in the northwest.
- Decreased late fall rainfall in California.

- Less summer rain in the northwest, less fall rain in Southern California.
- Little change in strong wind likelihood.

## Conclusions

- Models show little change in the likelihood of 95<sup>th</sup> percentile wind events with dry conditions, with some decrease in Eastern Washington.
- Less summer rainfall in the northwest, and decreased late fall rain in Southern California.
- Models show change in the timing of rain, but little change in the timing of wind.