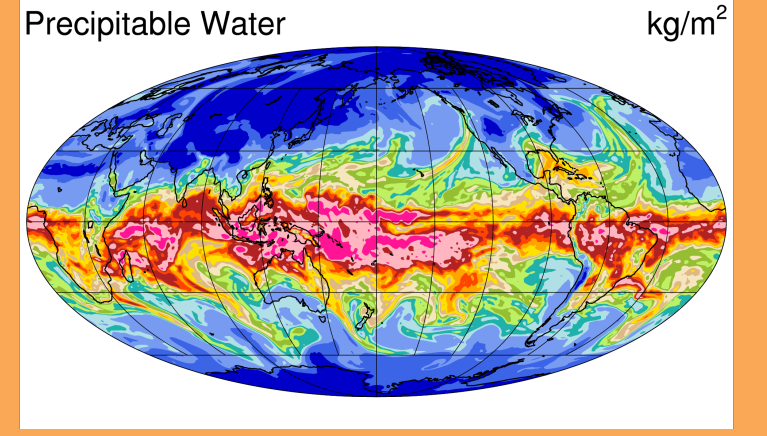


Atmospheric Rivers & Precipitation Extremes in CESM

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Summary

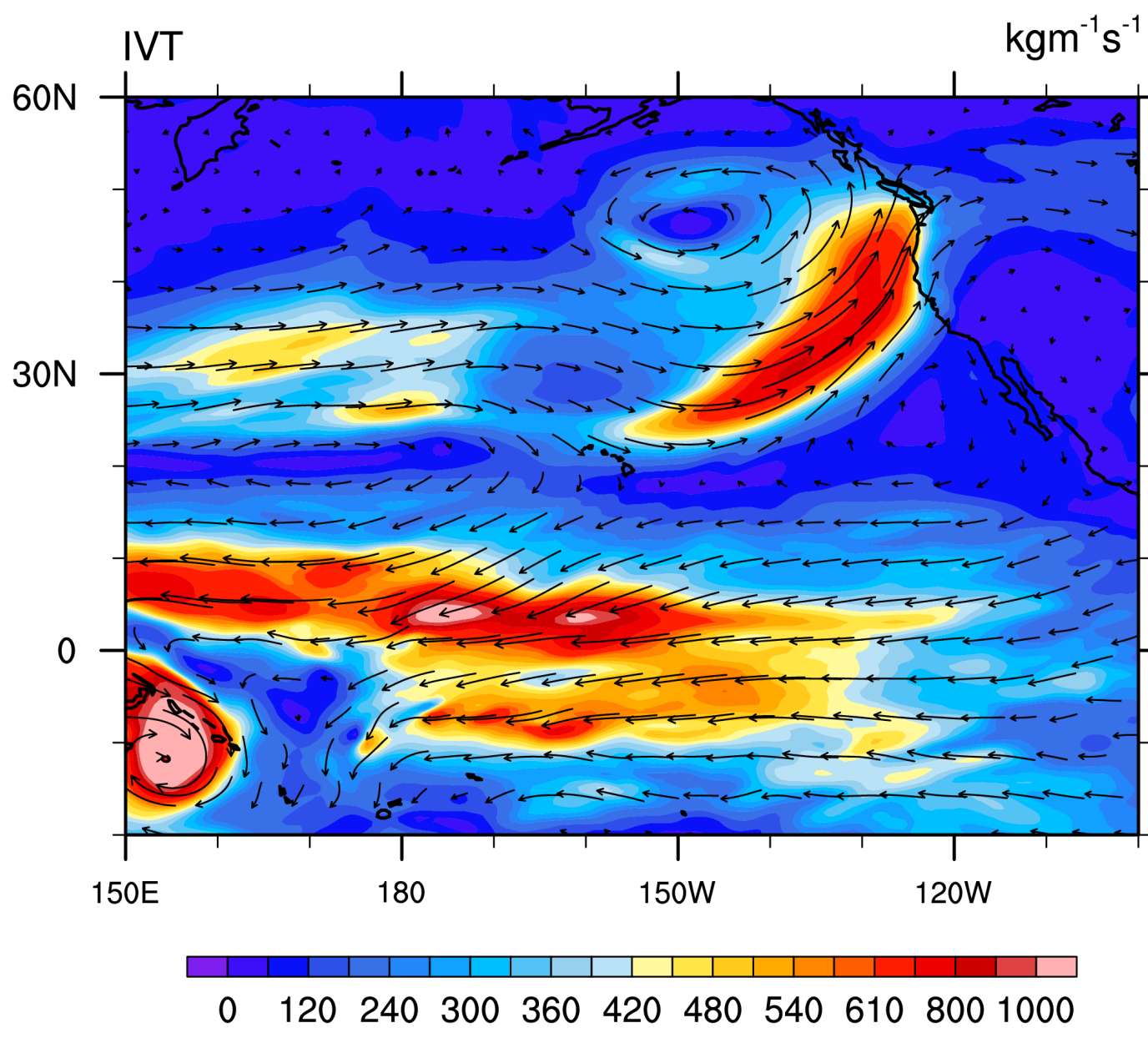
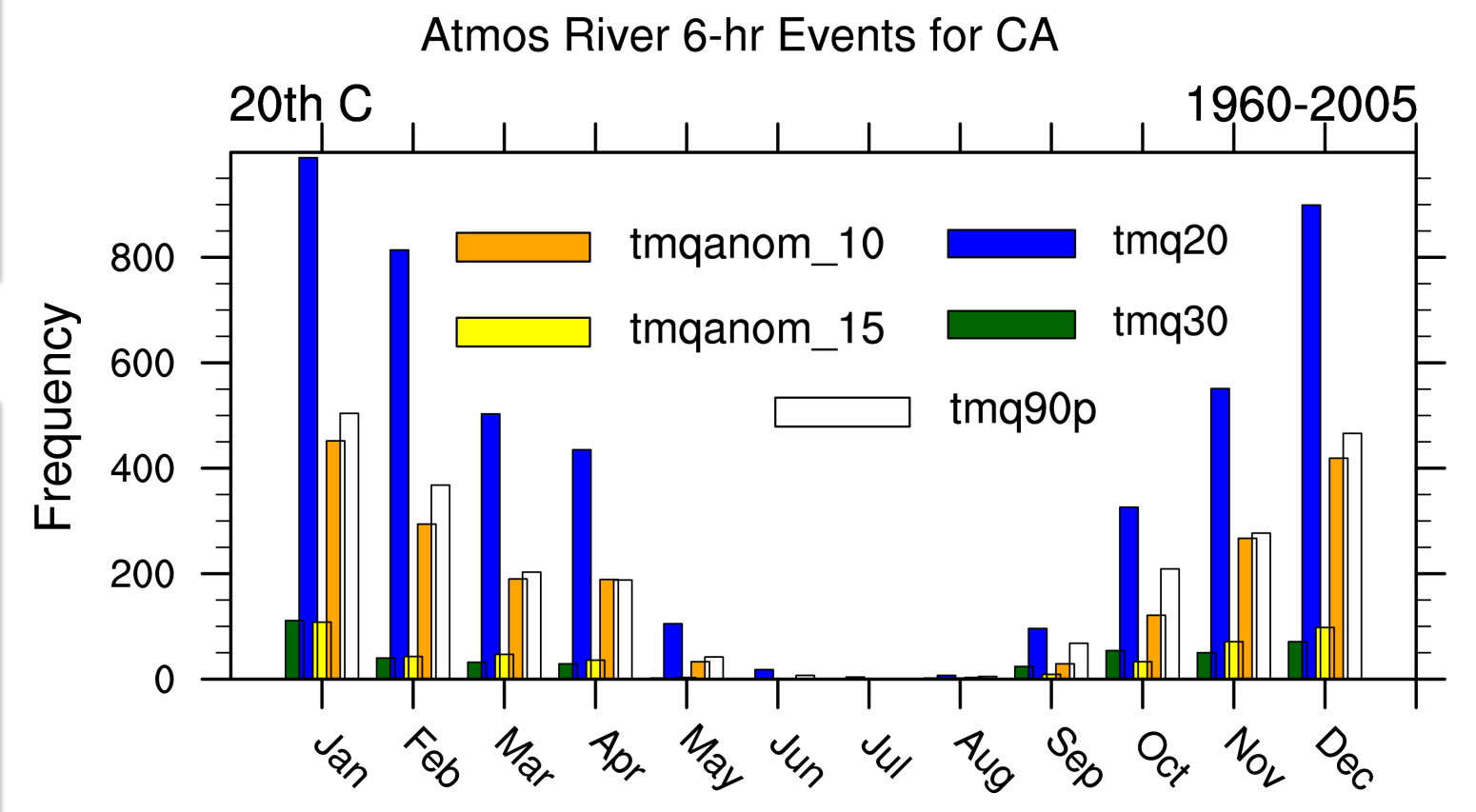
Atmospheric Rivers (ARs) are long, narrow, intense, and evolving filamentary structures responsible for transporting significant amounts of moisture from the tropics to mid-latitudes and are often associated with extreme winter-time precipitation for regions such as the West Coast of the U.S. CESM captures these synoptic scale structures as well as their extreme precipitation.

Definitions

CESM-hdeg: 0.5° atmosphere/land coupled to ~1° ocean/ice
20th Century and RCP8.5 transient CESM1-hdeg simulations analyzed.

AR Base Definition:

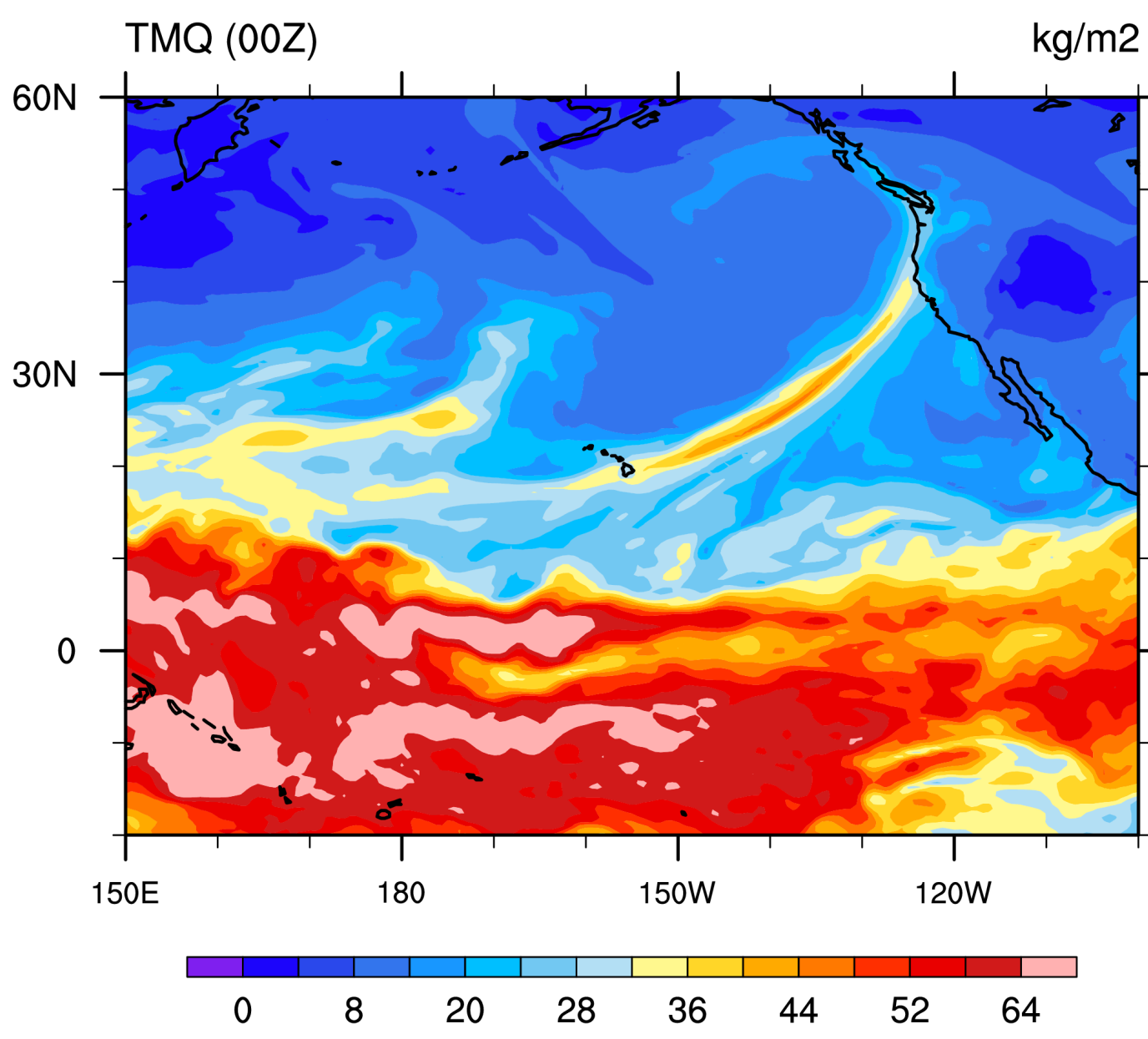
- 850 mb Wind Speed > 10 m/s
- 270° > Wind Direction > 180° (Focus on ARs arriving from the tropics, e.g. the Pineapple Express)
- $\Delta Y/\Delta X > 2$ (if above criteria)
- Must contact coastal land points



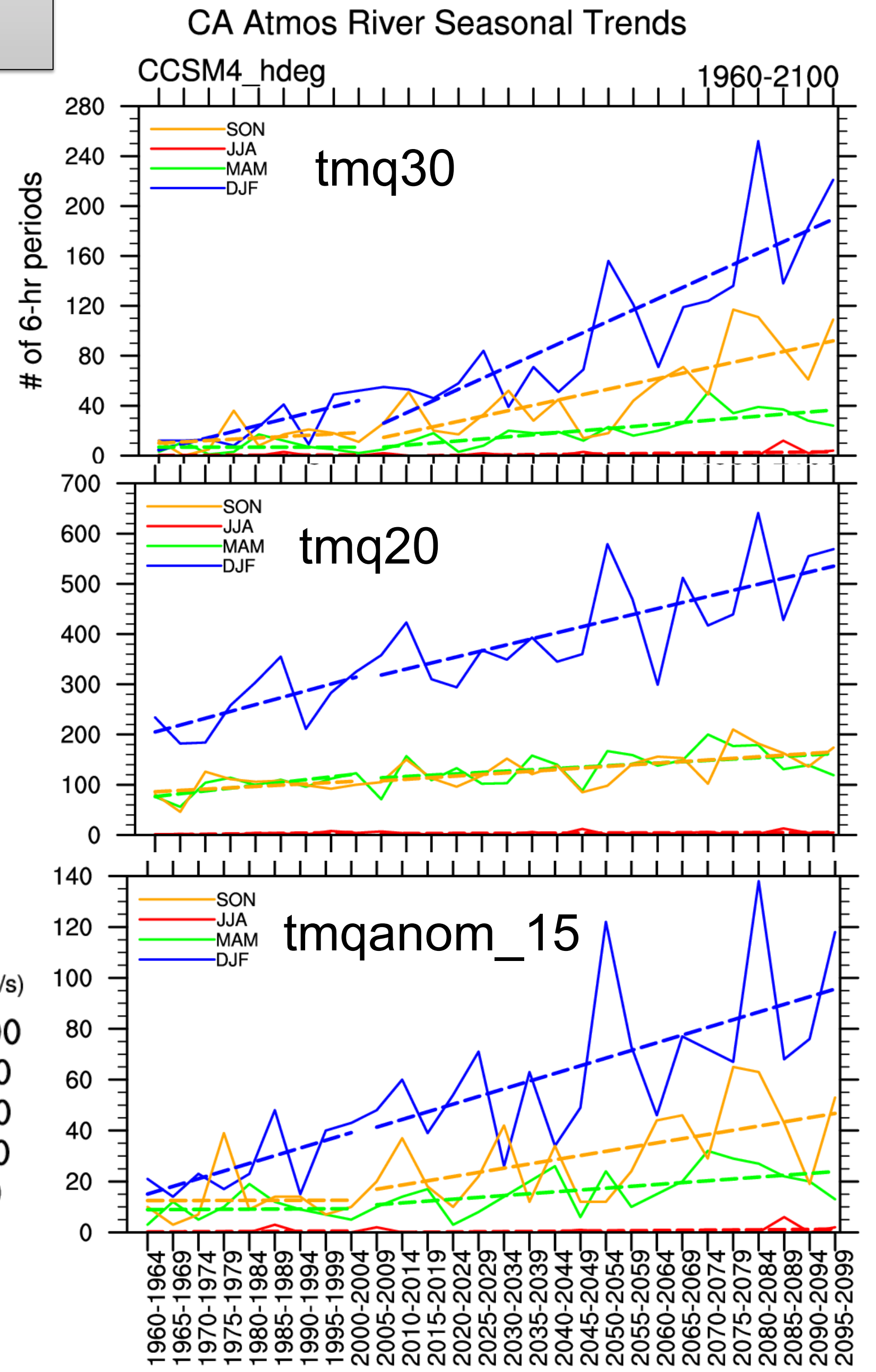
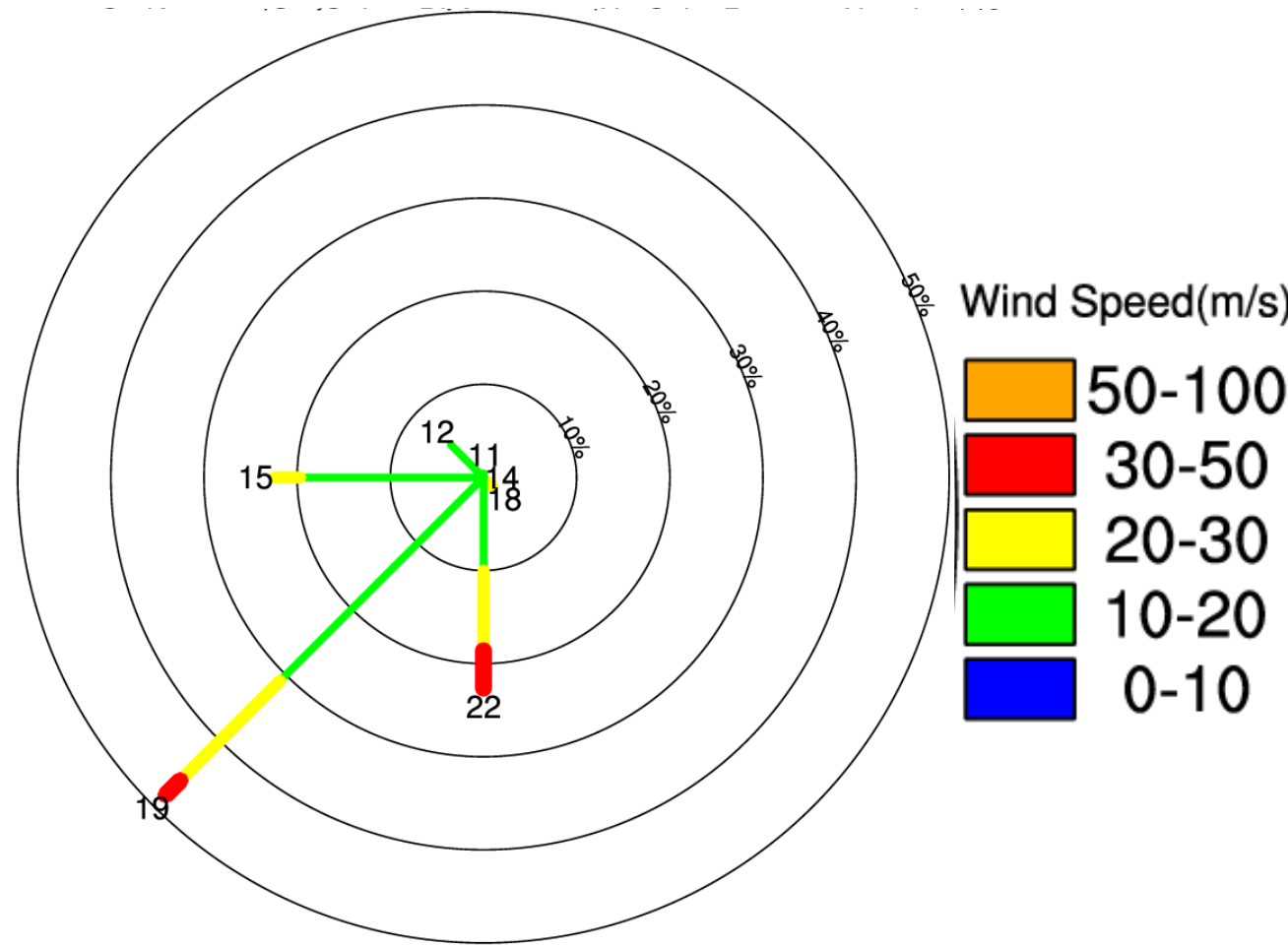
AR Moisture Thresholds

- (testing best method):
- tmq30 = TMQ > 30kg/m²
 - tmq20 = TMQ > 20kg/m²
 - tmqanom_15 = TMQ anomalies* > 15kg/m²
 - tmqanom_10 = TMQ anomalies* > 10kg/m²
 - tmq90p = TMQ > 90th Percentile (test strength of storms)

*Anomalies are computed for each 5 year period (5P) using means from the 20 year periods centered about each 5P. (example: anomalies from 2055 used means from 2045-2065).



CA850mb Wind Rose for Coastal Grid Points



California AR Trends Projections

Trends from three AR moisture threshold techniques are shown. The tmq30 threshold was chosen based on definitions used in current observational AR studies. However in a warming world, as moisture availability increases, the current AR definition may not accurately represent the base state. With no consideration for a warming world, trends increase steeply by year 2100. Thresholds of $tmq > 20 \text{ kg/m}^2$ and using anomalies of TMQ yield trends more consistent with the 20th century period.

California ARs and Precipitation Extremes

90th percentile precipitation distributions for AR events (tmq30) are shown below for the 20th Century and RCP8.5 simulations at 35N 120.6W. CESM-hdeg AR projections suggest that California's ARs will increase in frequency and intensity.

Atmos Rivers Composite Events for California

