

Characteristics of Extreme Precipitation Events Across the Pacific Northwest



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Introduction

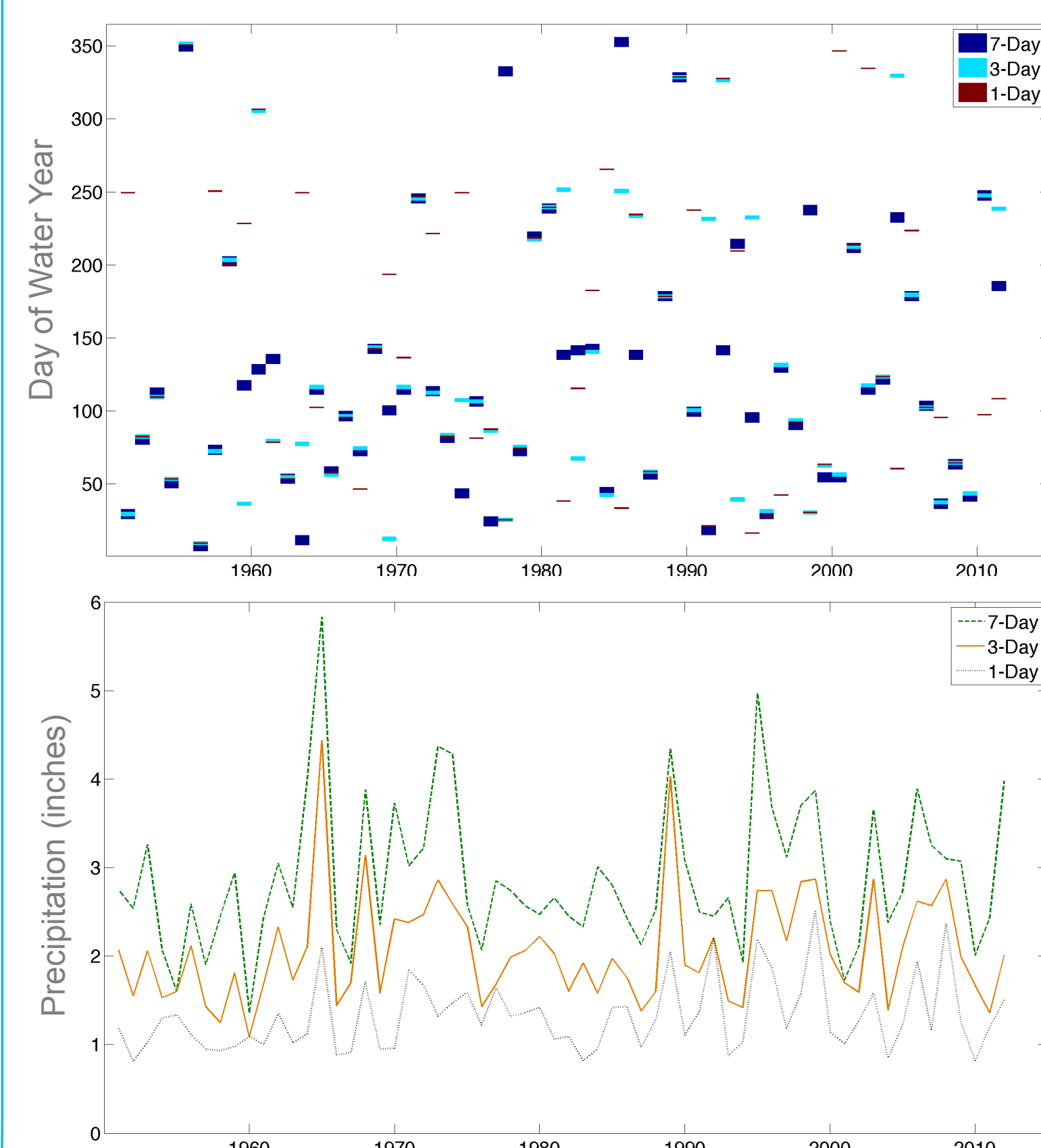
- In the Pacific Northwest (PNW), precipitation extremes have collectively impacted multiple sectors of society and resulted in billions of dollars in damages (e.g. Colle and Mass, 2000).
- Extreme precipitation events can have a profound impact on industries, namely through soil erosion, soil moisture retention and crop damage (e.g. Rosenzweig et al., 2002).
- Understanding the characteristics of extreme precipitation events is fundamental to understanding how these events impact the region.
- The objectives of this work are to explore these extreme precipitation events; this work will examine (1) intensity, duration and seasonality characteristics, (2) long-term trends in these characteristics, and (3) relationships to inter-annual climate variability.

Data

- Daily precipitation data from 116 United States Historical Climatology Network (USHCN) stations in WA, OR, ID and western MT covering 62 water years from 1951 – 2012.
- Dec-Mar Multivariate El Nino Index (MEI) were used to characterize El Nino years (MEI>1) and La Nina years (MEI<-1).

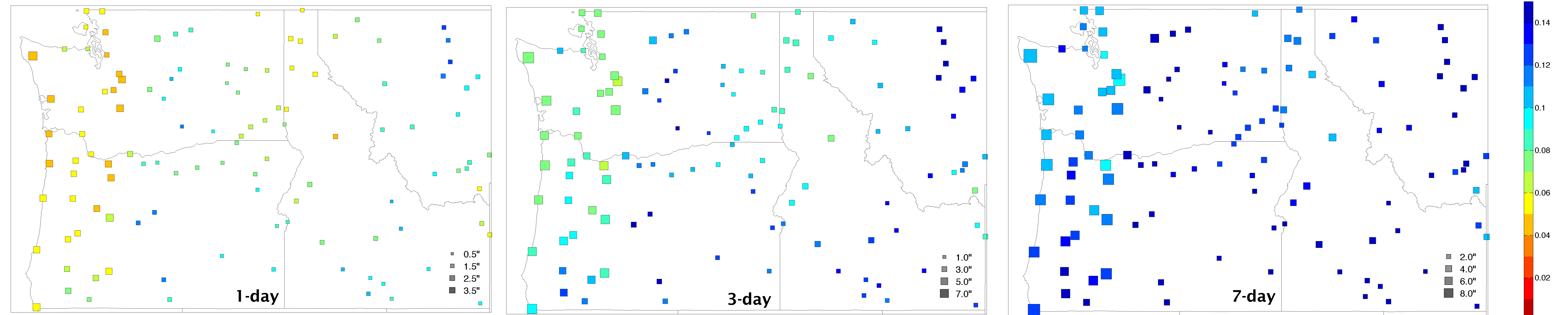
Extreme Events

- The largest single day, three-consecutive day, and seven-consecutive day precipitation totals were identified for each year and each station.
- Characteristics of note:
 - Cumulative precipitation amount
 - Percent of annual precipitation during event
 - Day of the water year of the event



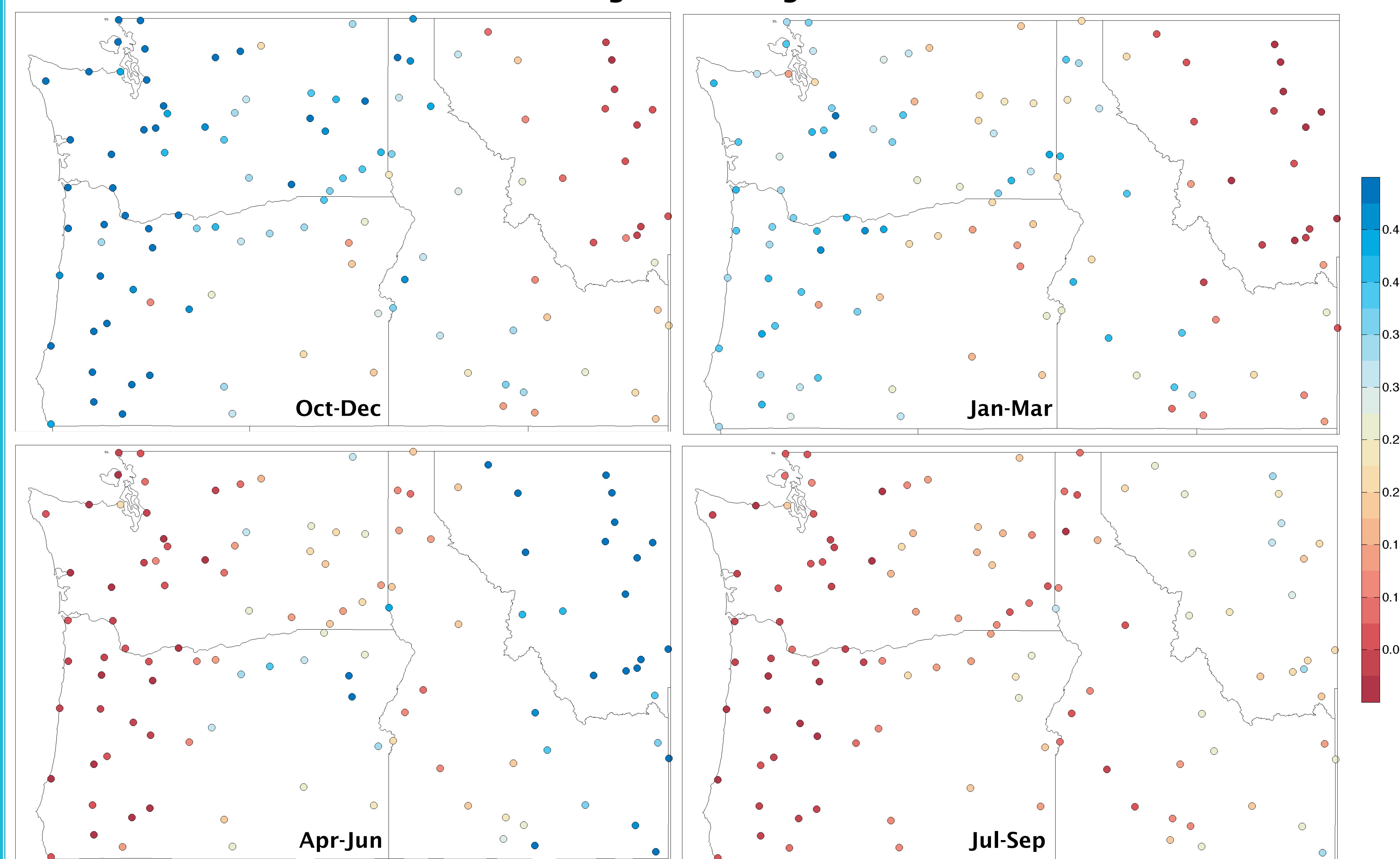
Figures 1 – 2: Day of Water Year of occurrence (above) and magnitude in inches (below) of 1, 3 and 7-day extreme precipitation events for the Moscow, Idaho USHCN station 1951-2012

Amount and Contribution of Annual Precipitation



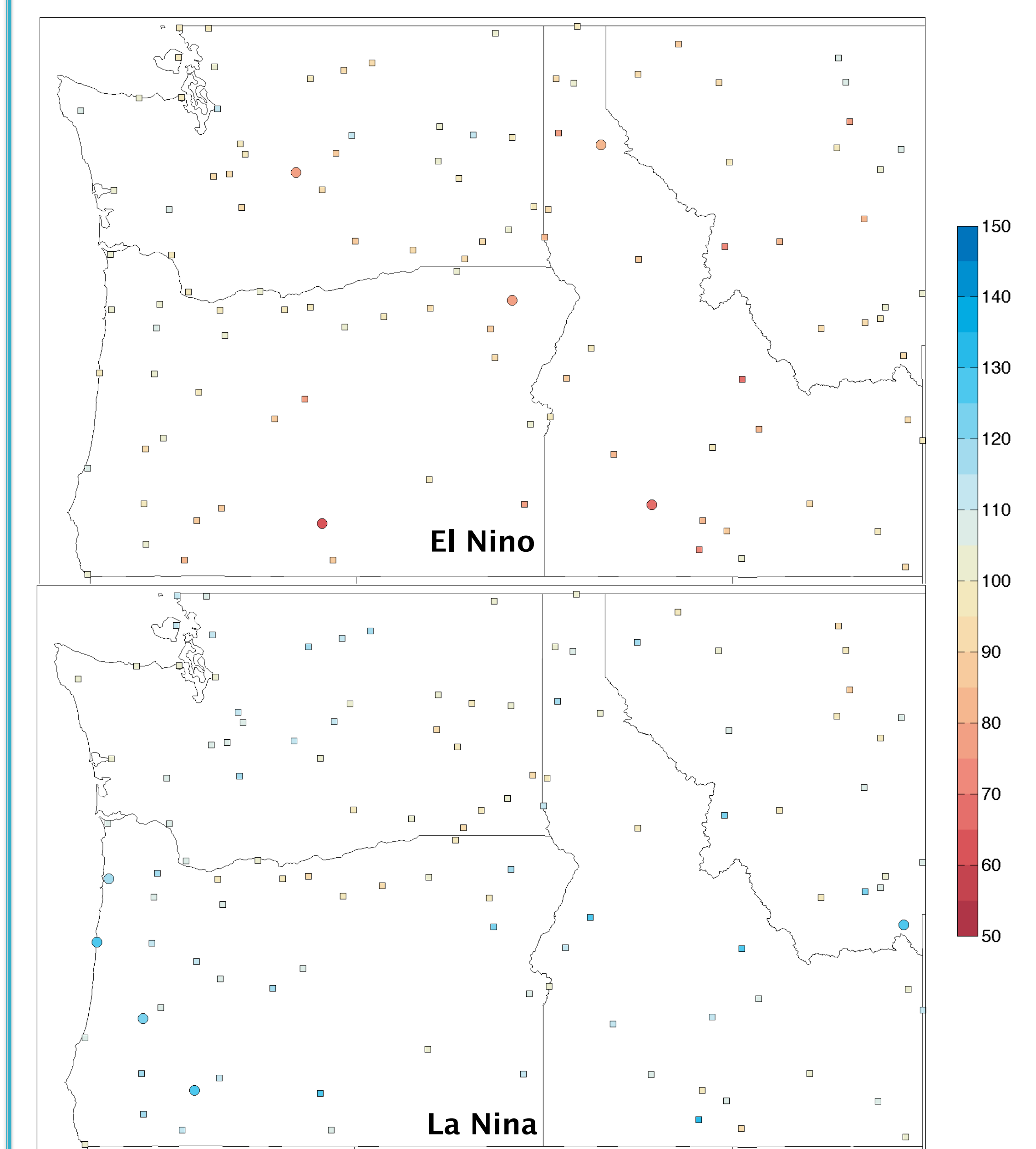
Figures 3 – 6: The amount of precipitation received in each of 1- 3- and 7- day events at each station, represented by relative marker size, and the fraction of precipitation the events contribute to the total water year precipitation for the station, expressed in the colorbar.

Seasonality of 7-Day Events



Figures 7 – 10: Fraction of all 7-day events that occur in each season. 7-day extreme events are most common October through December, with decreasing occurrence throughout the water year.

ENSO



Figures 11 – 12: Percent of normal precipitation for 7-day events during El Nino and La Nina years for the November – March wet season. Circles represent statistically significant ($p<0.05$) relationships.

Discussion

- Precipitation amounts for extreme events reflect the location of the station; stations west of the Cascades see the largest precipitation values, while inland stations receive less precipitation. Elevation increase can yield higher precipitation values relative to other stations at similar longitudes, particularly for stations on the windward side of mountains.
- Large precipitation amounts during extreme events do not necessarily equate to large contributions by those events to the annual precipitation total. Stations that receive less overall annual precipitation generally receive a larger fraction of their annual precipitation coincident to extreme events.
- Extreme events at western stations primarily occur October-December, and stations on the leeward side of the Rockies experienced extremes primarily between April and June.
- ENSO had insignificant relationships to extreme precipitation events (not field significant). This is in contrast to the strong relationships between cool season precipitation and ENSO across the region.