May 8th, 1:00 PM - 3:00 PM

Extreme Precipitation Climatology of the Contiguous U.S.

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Extreme Precipitation Climatology of the Contiguous US

Using Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2)

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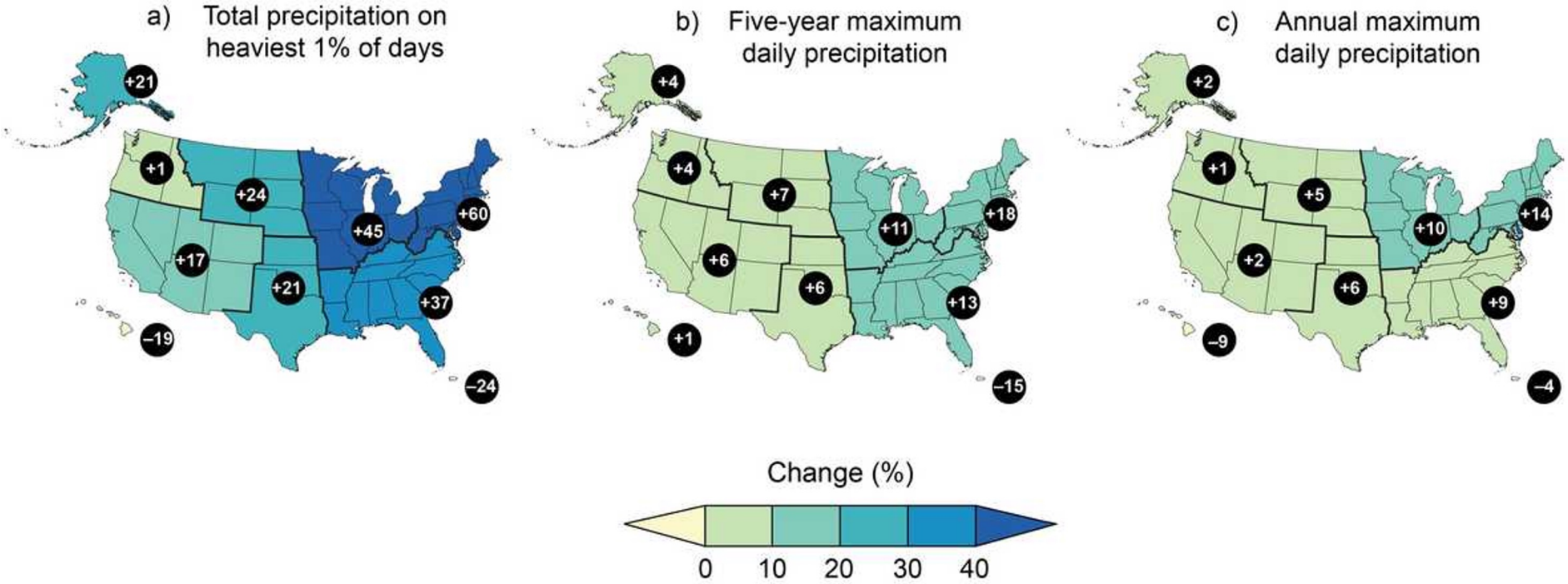
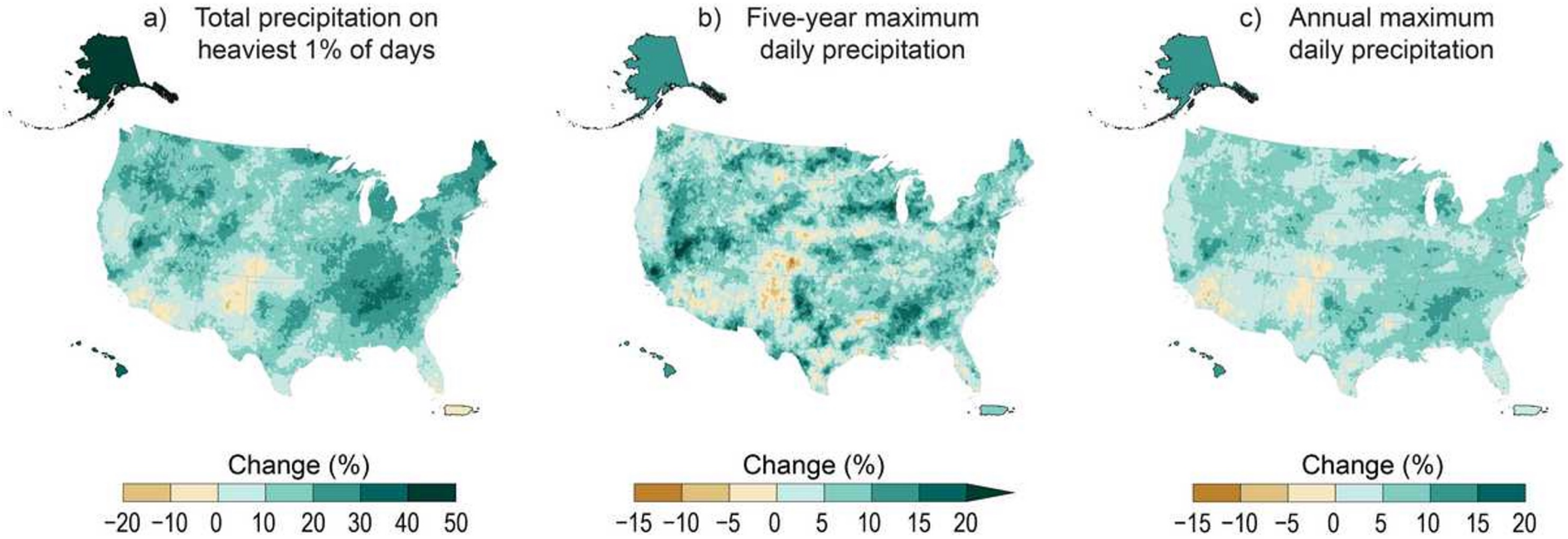
Department: Geography
May, 2024

Observed Changes in the Frequency and Severity of Heavy Precipitation Events



(Fifth National Climate Assessment, Ch 2, 2023 - Figure 2.8)

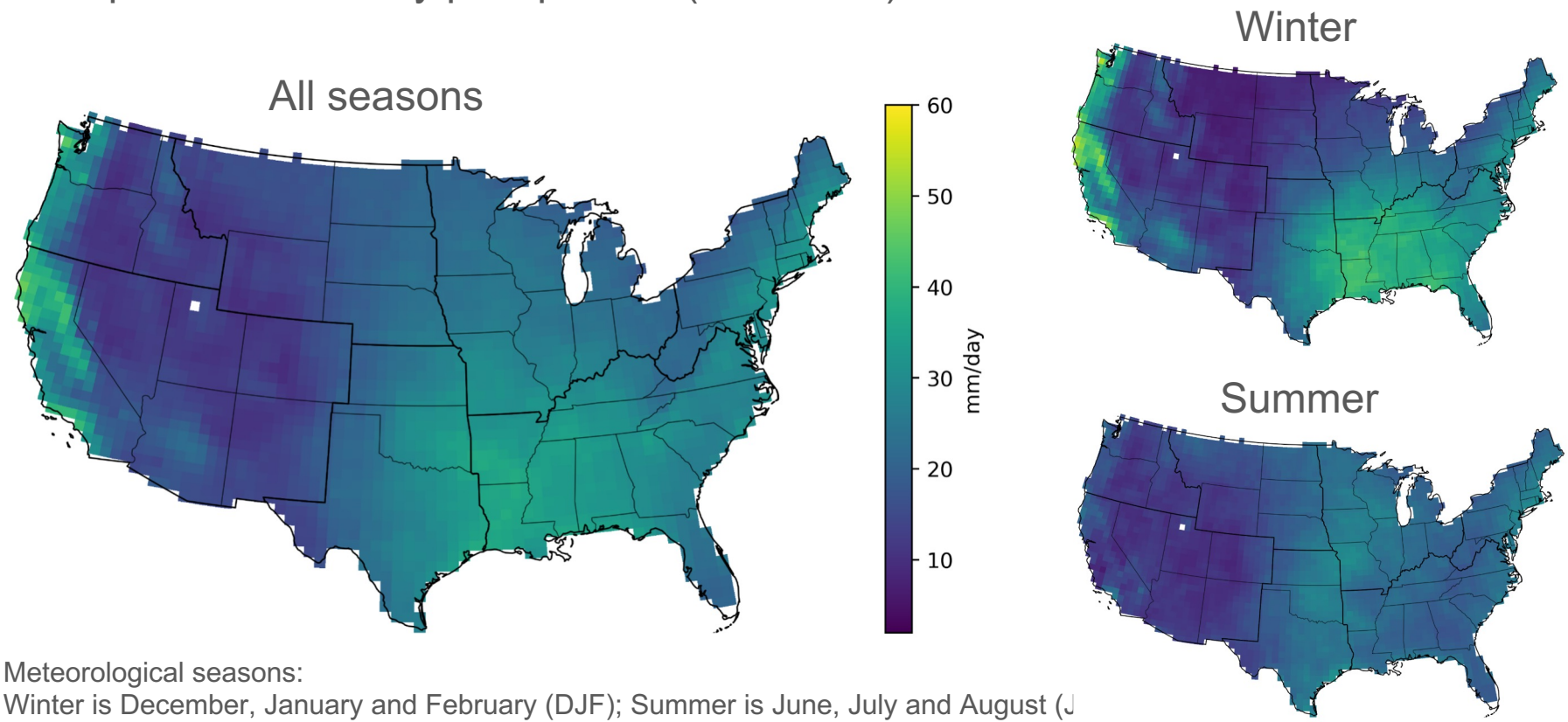
Projected Changes to Precipitation Extremes at 2°C of Global Warming



(Fifth National Climate Assessment, Ch 2, 2023 - Figure 2.12)

Extreme precipitation

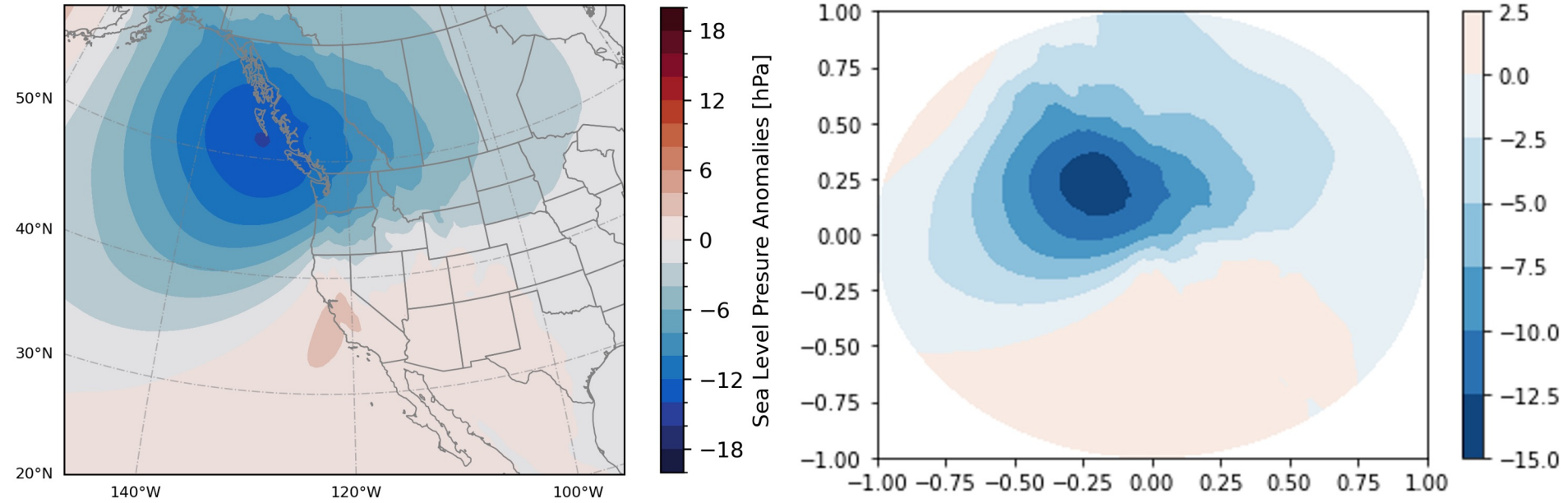
95th percentile of daily precipitation (over 2mm)



Meteorological seasons:
Winter is December, January and February (DJF); Summer is June, July and August (J

Radial Composite Example - Portland Sea Level Pressure Anomalies

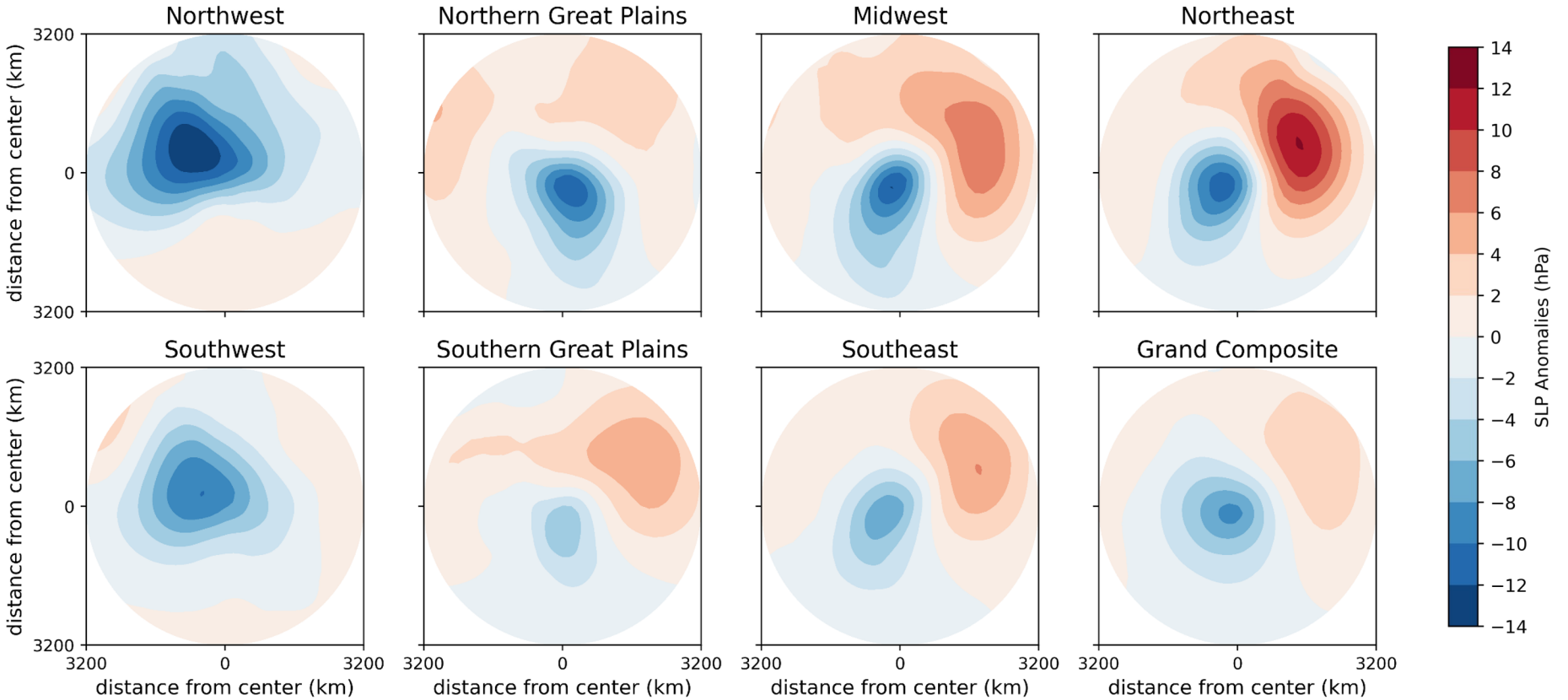
- Calculate Sea level pressure (SLP) anomalies for all days in study period
- Create composites: select days in the 95th percentile at each grid cell, average SLP anomaly values
- Interpolate values to a radial grid, a unit circle, the radius represents chosen radius (e.g. 1=4000km)
- Compute grand composite by averaging all radial composites in the CONUS
- Create regional composites
- Calculate summary statistics (repeat process for each season, and meteorological variable)



Regional Radial Composites - SLP Anomalies

Winter Extreme Precipitation days 1980-2023

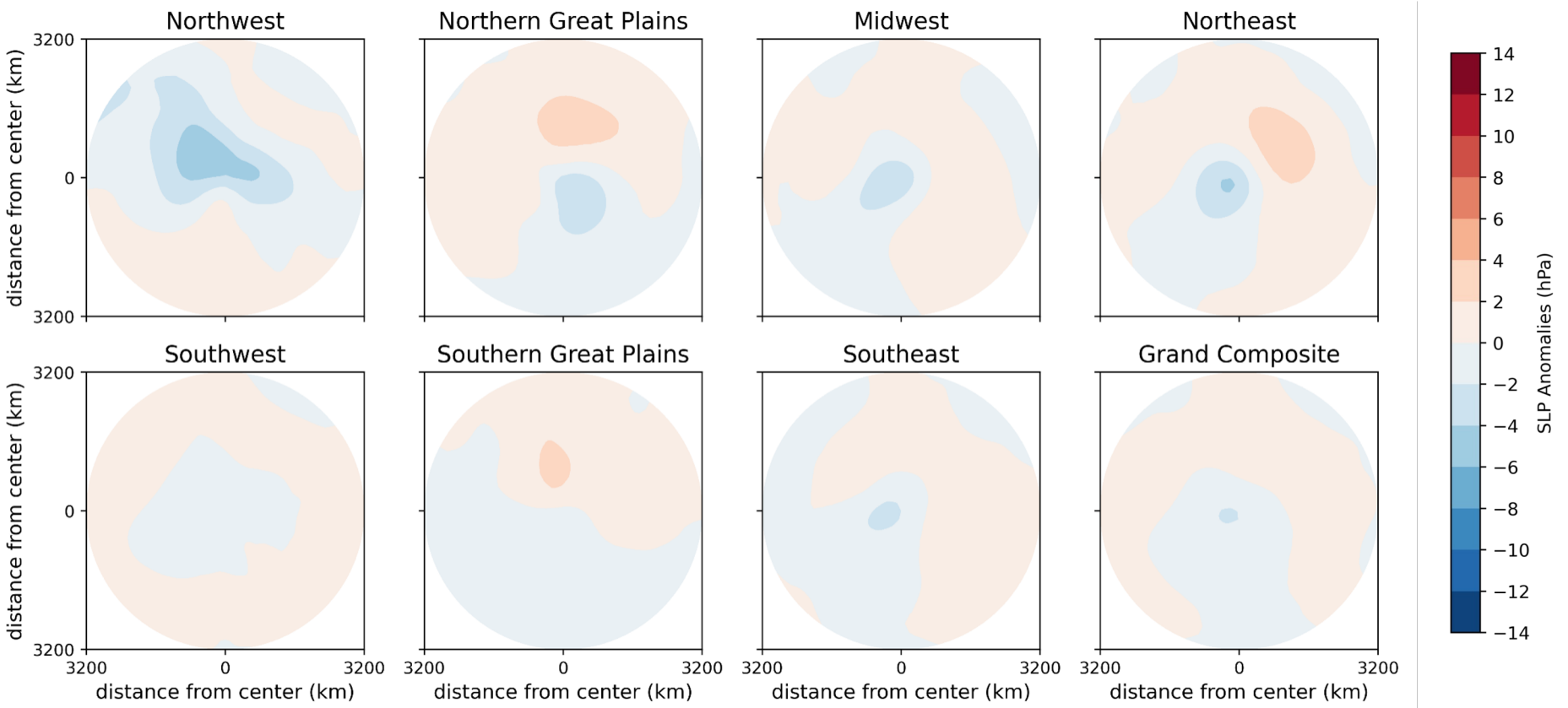
- Resemble patterns for all extreme days but intensified



Regional Radial Composites - SLP Anomalies

Summer Extreme Precipitation days 1980-2023

- Patterns altered and weaker

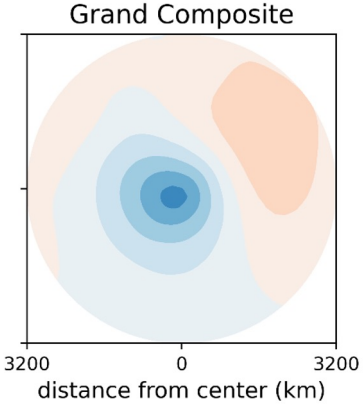


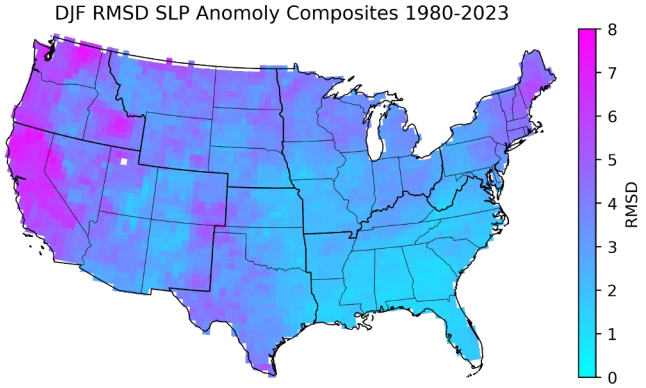
Seasonal Grand Composites
SLP Anomalies

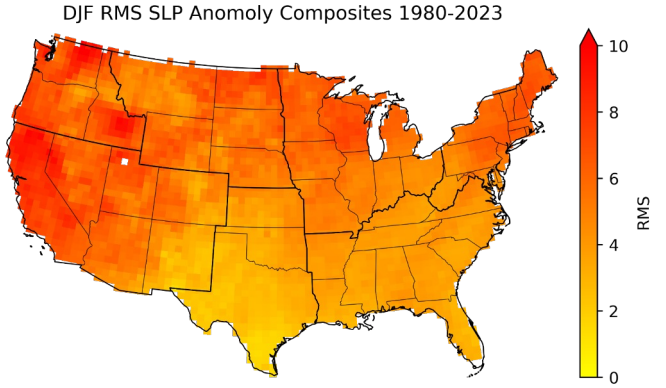
Root Mean Square Difference
Grid cell pattern similarity to grand composite

Root Mean Square
Grid cell pattern strength

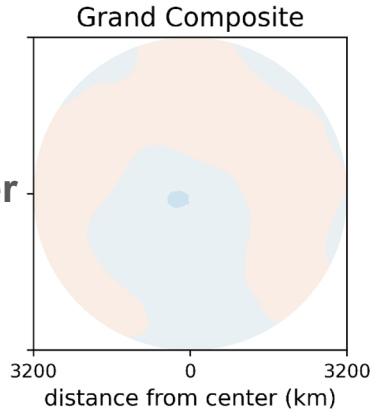
Winter

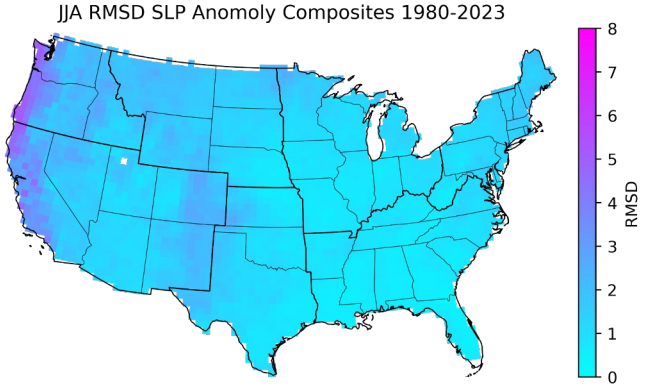


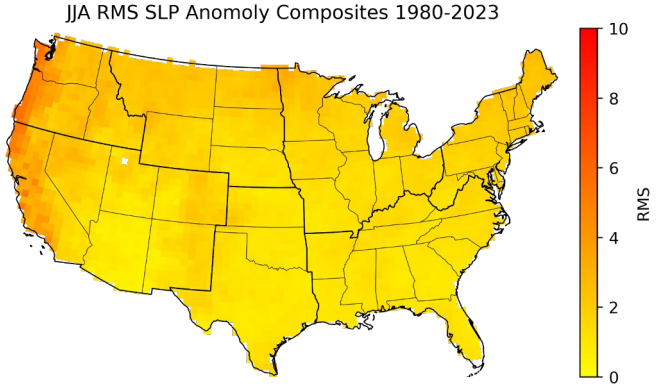




Summer







Summary Conclusions

- Study will compute synoptic scale extreme precipitation climatology for 1980-2023 using MERRA-2 data, including key diagnostic meteorological variables to study the weather that drives extreme precipitation
- Regional and seasonal patterns exist, for sea level pressure anomalies winter patterns are intensified summer patterns are weaker and altered
- Results could be used to examine how well climate models simulate the weather that drives extreme precipitation in historic runs and examine changes to patterns or pattern frequency in model projections

Acknowledgements

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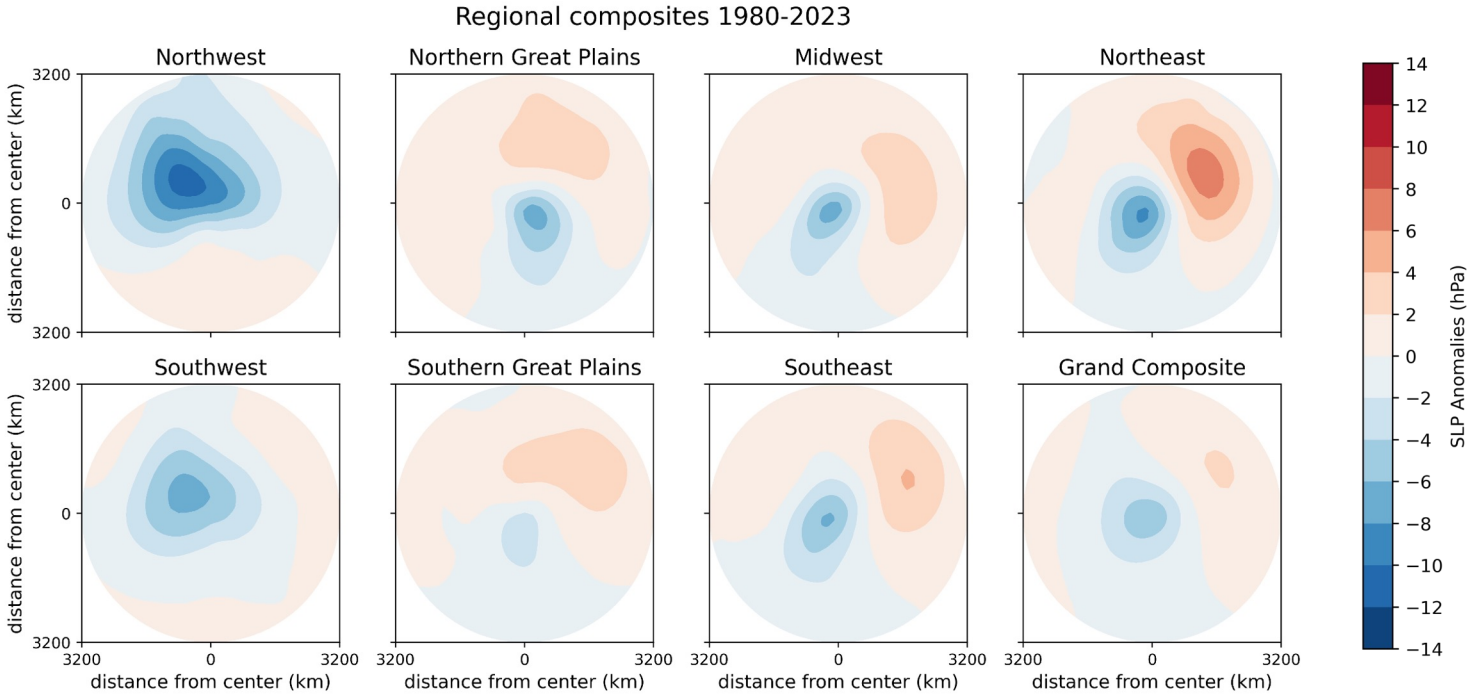
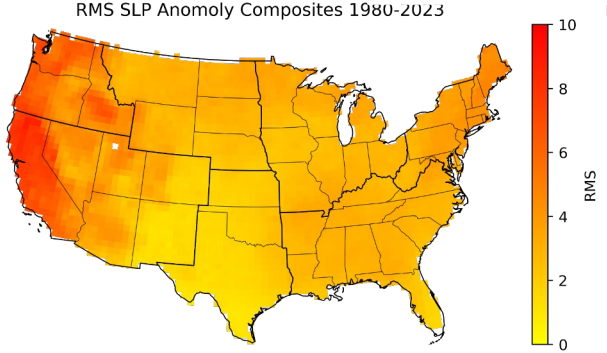
Regional Radial Composites

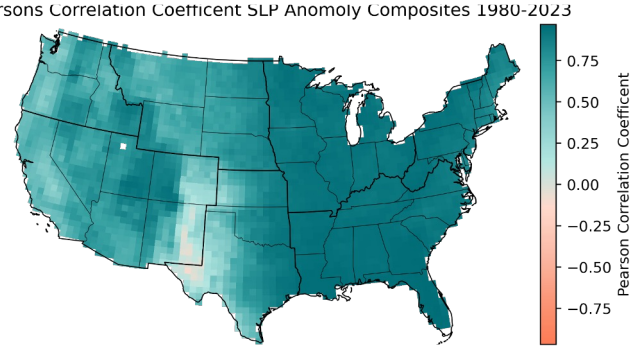
Extreme Precipitation days

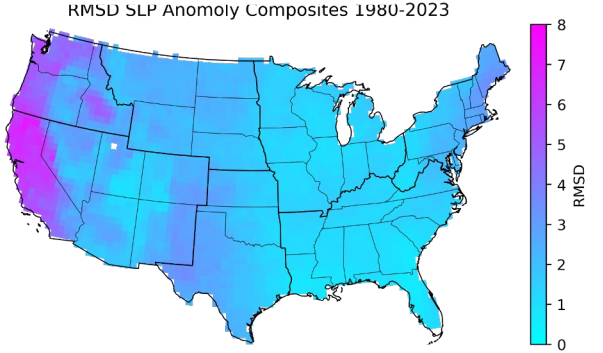
1980-2023

SLP Anomalies







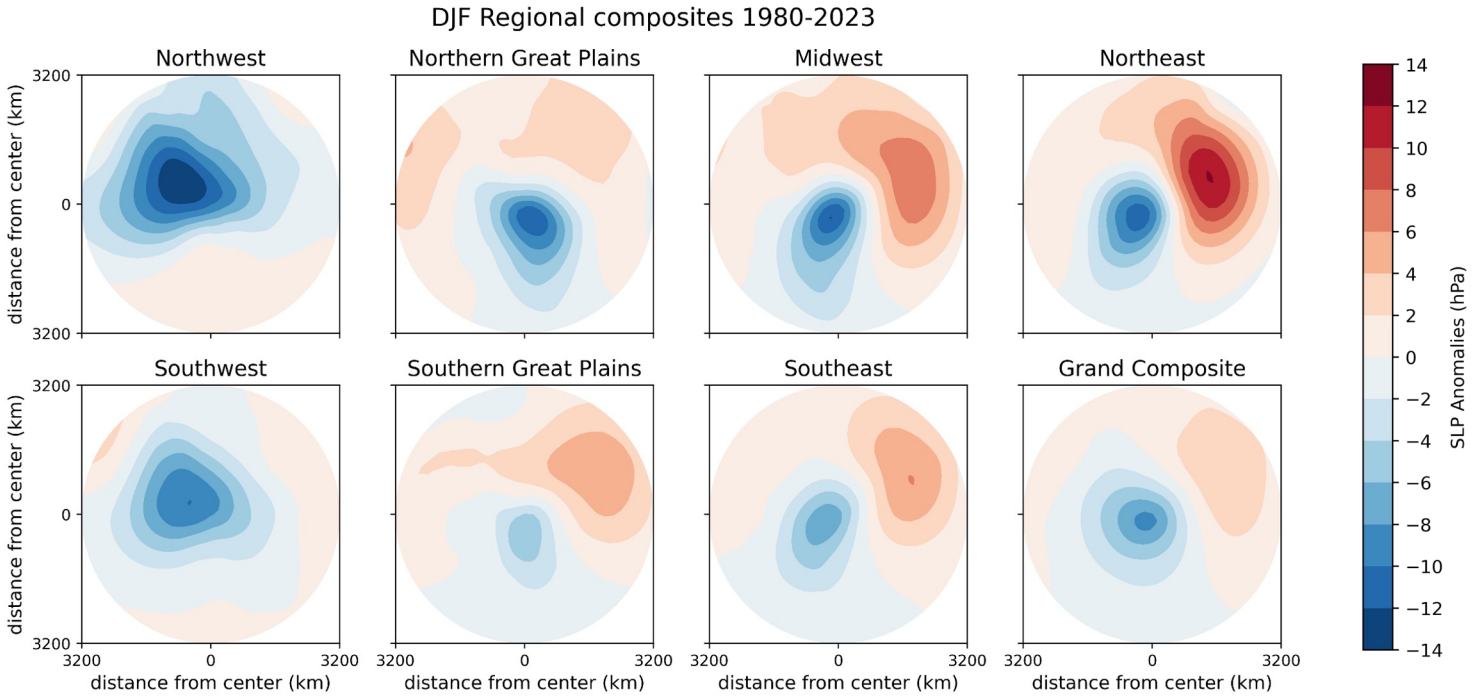


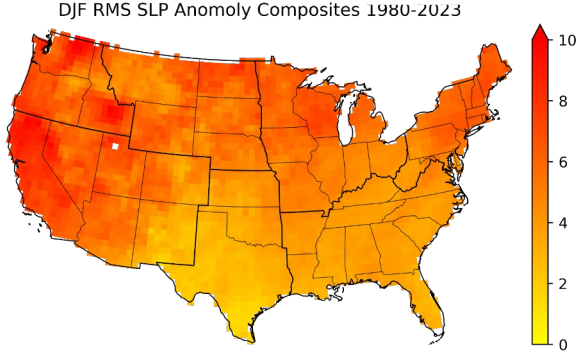
Regional Radial Composites

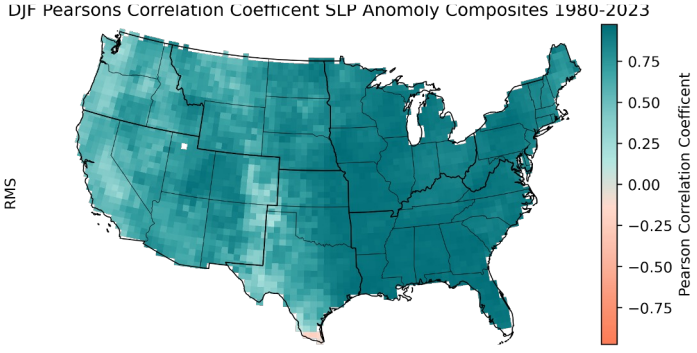
Winter
Extreme Precipitation days

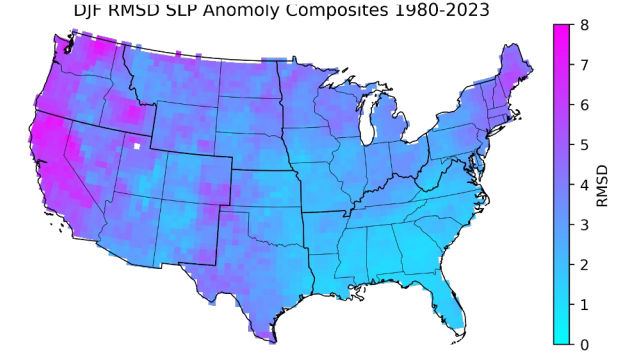
1980-2023

SLP Anomalies









Regional Radial Composites

Summer Extreme Precipitation days

1980-2023

SLP Anomalies