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# Seasonal classification of North American weather regimes and their effect on extreme weather

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Large-scale (synoptic to planetary), quasi-stationary circulation patterns in the atmosphere modulate the local weather dynamics from seasonal to sub-seasonal scale. These circulation patterns are known as Weather Regimes (WRs) and are a prominent feature in the midlatitudes. Most studies so far have focused on specific regions (such as the west coast of the United States or the European sector), and during a specific time of the year (namely the boreal winter season). Little work has been done on understanding the spatiotemporal characteristics (frequency, duration, and orientation) of seasonal North American WRs and how they affect local weather, especially in terms of extremes. This study aims to fill this knowledge gap with an investigation of North American WRs independently for all four seasons. Using a k-means clustering algorithm on daily geopotential height anomalies (de-seasonalized at monthly scale) at the 500-hPa pressure level, we identify five WRs in each of the four seasons across three independent reanalysis datasets: 1) MERRA2; 2) ERA5; and 3) NCEP-NCAR Reanalysis 1, for the period 1980-2022. Initial analysis shows that the spatial patterns of these WRs are robust but have non-trivial differences in the frequency and duration of occurrences across different reanalysis datasets. Additionally, we explore the occurrence of local extreme weather (precipitation and temperature) across the contiguous United States (CONUS) during the presence of these seasonal WRs. This study aims to improve the understanding of the seasonal to sub-seasonal variations of North American WRs and their influence on local extreme weather.