Using Weather Regimes to Diagnose Future Changes in Precipitation

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Mean sea level pressure over Europe and the North Atlantic can be clustered into a few distinct weather regimes. We show how these regimes can be used as predictors for precipitation.

Rain gauges in Denmark are used as a case study. The k-means clustering algorithm is applied to the daily pressure fields obtained from reanalysis data. We identify 5 weather regimes for the winter (DJF) mean sea level pressure. By this algorithm, a specific weather regime is assigned to each day in the record. The relation between these regimes and the North-Atlantic Oscillation is investigated. The station-by-station precipitation for each weather regime is analyzed, noting the geographical differences. Significant differences in both frequency and severity of precipitation conditioned on weather regimes are found.

Knowledge of the differences between weather regimes are valuable for future projections of precipitation and we use the weather regimes found in the reanalysis as a diagnostic tool to cluster the weather generated in a general circulation model for future scenarios. Analyzing the precipitation in the model conditioned on the weather regimes we find that the future winter precipitation changes as a result of changes in the weather regimes with more westerly flow and higher probability of precipitation.