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Multidecadal Surface Wind Variability Over Northeastern North America Via Statistical Downscaling: Seasonal Characterization and Extreme Analysis.

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The region of North Eastern North America is located in the pathway of many of the cyclones coming across this half of the continent. This situation accounts for high wind speeds all year round in the area, boosting the apparition of extreme wind situations as well. This behaviour is of great interest for the analysis of the relationships between the large-scale dynamics systems and the regional surface wind that is governed by them. The present work will be focused on the analysis of the monthly variability at different time scales during two extended seasons with differentiated circulation patterns and associated winds: winter (NDJFM) and summer (JJASO).

The analysis of the variability is conducted via a statistical downscaling method based on Empirical Orthogonal Functions (EOF) and Canonical Correlation Analysis (CCA). These methodologies exploit the relationships among the main modes of circulation that extend across the North Pacific and North Atlantic Sectors and the behaviour of an observational surface wind database. The statistical technique has been implemented with several combinations of predictor variables provided by 12 global reanalysis models. The observational dataset consists of a set of 525 sites distributed over North Eastern North America that span over a period of about 60 years (1953-2010). These data have been previously subjected to an exhaustive quality control process, height standardization and wind direction homogenization. A reanalysis intercomparison process has been carried out to analyse the goodness of their representativity both in local and regional scale. A systematic sampling of different model parameters such as those mentioned above allows for a sensitivity assessment of the downscaling methodology. Finally, the long observational period enables the study of intra to multidecadal variability.

The established statistical relationships between large-scale dynamics and local variability allow for a climatological description of the region. These relationships will be used to relate extremes events with the dynamics involved in the average monthly behaviour of the wind. This method also permits the reconstruction of the regional wind behaviour back to the mid 19th century, far beyond the observational dataset, through various 20th century reanalysis and instrumental sea level pressure datasets.