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Characterization of European wind speed variability using weather regimes

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Weather regimes allow to classify the complex dynamics of large-scale circulation in a few recurrent and persistent patterns, called "circulation regimes" or "weather regimes" (Michelan- geli et al., 1995). The rationale of this work is that weather regimes defined separately for each month by default are more representative of the monthly circulation variability than seasonal- or yearly-defined regimes; for this reason, they are usually more appropriate for developing products tailored to user's needs.

The aim of this study is threefold. Firstly, to present a representative set of large-scale weather regimes for each month of the year over the Euro-Atlantic region and compare them amongst three commonly employed global reanalyses: ERA-Interim, NCEP-NCAR v1 and JRA-55, in a way similar to the recent comparison performed by Stryhal and Huth (2017) for winter season, but extending the study period to each individual month of the year. Secondly, to relate such regimes with the four main Euro-Atlantic teleconnection indices defined in literature. Lastly, to measure the impact of the weather regimes on near-surface wind speed variability and validate their ability to reconstruct wind speed anomalies.

Results demonstrate the practical equivalence between the three reanalyses for the purpose of the monthly regime classification. Results are also in agreement with the impact of the WRs on wind speed measured by Grams et al (2017), proving that their results are robust and invariant to a change of reanalysis data, methodology and time scale. Finally, the wind speed reconstruction from the monthly frequencies of occurrence of the regimes provides useful information, revealing for the first time in which European areas wind speed is highly or poorly influenced by weather regimes for each month of the year. A few of the highly influenced areas, like northern Scandinavia and the Aegean Sea, might also play a crucial role in future to reduce weekly-to-monthly intermittency of total European wind power generation, so their wind forecasts could benefit from the added predictability provided by weather regimes.

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