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Drivers and seasonal predictability of extreme wind speeds over Europe

Michael A. Walz (1,2), Markus G. Donat (2), and Gregor C. Leckebusch (1)

(1) School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, United Kingdom (maw526@bham.ac.uk), (2) Climate Change Research Centre, University of New South Wales, Sydney, Australia

Extreme wind speeds are responsible for large socio-economic losses. Therefore a proficient prediction is of great benefit for both disaster prevention and the actuarial community. In this paper we evaluate patterns of large-scale atmospheric variability and their influence on the seasonal predictability of extreme wind speeds (e.g. >95th percentile) for the European domain in the dynamical seasonal forecast system ECMWF System 4. This is compared to the predictability based on a statistical prediction model.

The dominant patterns of atmospheric variability show distinct differences between reanalysis and ECMWF System 4, with most patterns in System 4 extended downstream in comparison to ERA-Interim. The contrasting manifestations of these patterns between dynamical prediction system and reanalysis lead to different drivers associated with the occurrence of extreme winds in Europe.

While System 4 has some predictive skill over Scandinavia and the Eastern Atlantic, only a few grid cells over Central Europe have significant correlations for extreme wind speeds in System 4 compared to ERA-Interim. In contrast, a statistical model trained using mean sea level pressure data of the preceding autumn predicts extreme wind speeds during the core winter months in better agreement with the reanalysis.

Our results imply that System 4 does not seem to capture the full potential predictability of extreme winds that exists in the real world. In particular, the inter-annual variability of extreme wind speeds is underestimated by System 4. One reason for that could be the unrealistic representation of large-scale patterns of atmospheric variability. Hence our study points to potential improvements of dynamical prediction skill by improving the simulation of large-scale atmospheric dynamics.