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Predicting high-impact weather based on the COSMO-DE ensemble prediction system

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Extremes in weather such as high wind speeds or heavy precipitation are associated with high impacts on both environment and society. It is thus of great importance to improve the quality of extreme wind and heavy precipitation forecasts. Numerical weather forecast models provide information about the general conditions in which extremes occur. However, strength, timing and location of such extremes are determined by small scale processes that are not, or only partly, resolved even by high-resolution weather forecast models. Thus, probabilistic prediction is likely to be the best choice of forecasting high-impact weather.

The study uses a mesoscale ensemble prediction system based on COSMO-DE (COSMO-DE-EPS). We will present ensemble postprocessing providing area-wide forecasts of extreme wind and heavy precipitation. The postprocessing for wind gusts employs extreme value theory: the response surfaces of the generalized extreme value distribution parameters are modeled, and the concept of max-stable spatial processes is employed in order to account for the spatial dependencies that are not explained by the conditioning variables.

The sources of uncertainty and predictability - initial and boundary conditions, and physical parameterizations - within the COSMO-DE-EPS are investigated. To that end, the influence of the uncertainty components on the predictive performance is assessed, and a scale dependent spread analysis is presented.