European Winter Storms in the ECMWF Ensemble Prediction System

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As European winter storms can provoke very large damages, estimations of the probability of occurrence are of economical and sociological importance. The estimations of return periods for the strongest events underlie large uncertainties, which arise from the limited available data, available from historical meteorological records or reanalysis data. A gain of information can be obtained from ensemble forecasts. In this work the Ensemble Prediction System (EPS) from the European Center of Medium-Range Weather Forecast (ECMWF) is analyzed for its suitability to improve the estimates of return periods of very rare and severe events. The EPS dataset contains up to 51 ensemble members, starting twice a day and each integrated over 10 days.

The storm systems are identified and characterized using a wind field tracking algorithm developed by Leckebusch et al. (2008). Exceedances of the local 98th percentile of 10m wind speed are used, and calculating the cube of these exceedances, accumulated spatially and temporally, an objective storm severity measure (SSI) is determined. Taking the distribution of values into account, the measure of storm severity relates to storm damages.

Using ERA-Interim as a reference dataset, it is shown that the general distributions of storm properties in the EPS are realistic. The EPS representations of a single ERA-Interim storm show a wide range of variability in terms of size, duration and severity. Hence better estimations of return periods of winter storms are possible using the EPS, as well as studies of general aspects of storms, like the correlation between intensification and storm duration. Nevertheless for an estimation of return periods, it must be taken into account, that the simulated events in the EPS are not independent of each other.