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Statistical Downscaling of Gusts During Extreme European Winter Storms Using Radial-Basis-Function Networks

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Winterstorms and related gusts can cause extensive socio–economic damages. Knowledge about the occurrence and the small scale structure of such events may help to make regional estimations of storm losses. For a high spatial and temporal representation, the use of dynamical downscaling methods (RCM) is a cost-intensive and time-consuming option and therefore only applicable for a limited number of events. The current study explores a methodology to provide a statistical downscaling, which offers small scale structured gust fields from an extended large scale structured eventset.

Radial-basis-function (RBF) networks in combination with bidirectional Kohonen (BDK) maps are used to generate the gustfields on a spatial resolution of 7 km from the 6-hourly mean sea level pressure field from ECMWF reanalysis data. BDK maps are a kind of neural network which handles supervised classification problems. In this study they are used to provide prototypes for the RBF network and give a first order approximation for the output data. A further interpolation is done by the RBF network.

For the training process the 50 most extreme storm events over the North Atlantic area from 1957 to 2011 are used, which have been selected from ECMWF reanalysis datasets ERA40 and ERA-Interim by an objective wind based tracking algorithm. These events were downscaled dynamically by application of the DWD model chain GME → COSMO-EU. Different model parameters and their influence on the quality of the generated high-resolution gustfields are studied. It is shown that the statistical RBF network approach delivers reasonable results in modeling the regional gust fields for untrained events.