Post-processing of spatial extremes

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Post-processing forecasts for extreme events addresses specifically the modeling of the tail distribution, and so may be best approached in light of extreme value theory. We use extreme value theory to formulate a post-processing approach for the spatial prediction of wind gusts. Predictors are provided by the COSMO-DE-EPS ensemble prediction system over a period of 5 years.

Multivariate extreme value theory and practice breaks down into two parts. First, one has to model the marginal distribution of each component of the multivariate extremes, and second a formulation of the dependence structure between standardized components is needed. The first step constitutes the statistical post-processing at each station location conditional on the ensembles forecasts. The second step is the description of the spatial dependence using a max-stable Brown-Resnick process. Latter works on the residuals which are derived by using the marginal distributions of the first step to transform the gust observations.

The observed and simulated residuals show non-negligible spatial dependence, with stronger dependence in the model than in the observations. Our approach takes into account and corrects for the spatial dependence in extremes, and thus provides a post-processing model for spatial wind gust forecasts.