European Wind Storms: an extreme value analysis of joint wind gust measured by anemometers across major cities.

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Extra-tropical wind storms are one of the most damaging types of natural catastrophe occurring in Europe. As a result, the extent to which statistical models can reproduce the statistical properties of such storms is of great interest for many insurance and financial applications.

Risk Management Solutions has developed a catalogue of the most prominent European storms from 1972 to 2010 collecting 3 second peak gust from anemometer at over 2000 weather stations.
In this work we focus our attention on the extreme value properties of a derived quantity: the wind gust speed that is exceeded at any two locations for a given storm, hereafter called Exceeded Gust (EG).

Two statistical approaches have been used to evaluate the return levels of EG; a simple fitting of a Generalized Pareto Distribution to the quantity itself and an indirect method based on copulas. Once a two-dimensional copula is fitted to gust data for any two locations, the return levels of EG can be estimated empirically by random sampling of the copula distribution. The two methods are then combined to produce a smooth estimate of EG return levels.

This analysis has been applied to major cities of 15 European countries and highlights relevant aspects of the spatial structure of wind gust correlation, albeit limiting its focus to location pairs.
Of particular interest is the possibility to use the outcome of this work as a correlation benchmark for stochastic catalogues of wind storm events that explicitly resolve the storm spatial structure by the means of statistical or numerical simulations.