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# Bayesian trend analysis of extreme wind hazard using observed and hindcast series off Catalan coast, NE Mediterranean Sea

J. J. Egozcue (1), M. I. Ortego (1), J. Cunillera (2), and R. Tolosana-Delgado (1)

(1) BarcelonaTech,Technical University of Catalonia, Spain (juan.jose.egozcue@upc.edu), (2) Servei Meteoròlogic de Catalunya, Spain (jcunillera@meteo.cat)

It has been suggested that climate change might modify the occurrence rate and magnitude of large ocean-wave and wind storms. The hypothesised reason is the increase of available energy in the atmosphere-ocean system. Forecasting models are commonly used to assess these effects, given that good quality data series are often too short. However, forecasting systems are often tuned to reproduce the average behaviour, and there is a doubt on their representativity for extremal regimes.

We present a methodology of simultaneous analysis of observed and hindcasted data with the aim of extracting potential time drifts as well as systematic regime discrepancies between the two data sources. The method is based on the Peak-Over-Threshold (POT) approach and the Generalized Pareto Distribution (GPD) within a Bayesian estimation framework. In this context, storm events are considered points in time, and modelled as a Poisson process. Storm magnitude over a reference threshold is modelled with a GPD. The GPD is a flexible model that captures the tail behaviour of the magnitude distribution, classifying it in three types (domains of attraction of extrema): bounded tail, exponentially decaying tail and heavy tail.

In a first step, one verifies that hindcasted and observed extremal data can be modelled with GPD's with a similar tail behaviour. The magnitudes are treated in two ways, in the original raw scale and in a logarithmic one. It is desired that GPD for both hindcasted and observed series belongs to the same domain of attraction in the same scale.
Once scale and domain of attraction are chosen, we introduce a time dependence in the model parameters. All model parameters, i.e. shape and location of the magnitude GPD and the Poisson occurrence rate, are affected by a trend in time. Moreover, a difference between parameters of hindcasted and observed series is considered. Finally, the posterior joint distribution of all these trend parameters is studied using a conventional Gibbs sampler.

This method is applied to compare hindcast and observed series of 10-minute average wind-speed at a deep buoy location off the Catalan coast (NE Spain, Western Mediterranean; buoy data from 2001; HIPOCAS wind hindcasting from 1958). Appropriate scale and domain of attraction are discussed, and the reliability of trends in time are addressed.

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