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Multifractal structure of storm Eleanor in France and predictions of the extremes

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In the beginning of the new year of 2018 an unusual extreme event happened in Europe. Storm Eleanor hit first the British Isles and then the continent with gust speeds of up to 200km/h tops in Switzerland and up to 110km/h around Paris (France). The estimated damage lies in the order of magnitude of 500 million Euros. Learning more about the early stages of such extreme event leads to better predictions of their complex trajectory and devastating impacts. This would help to prepare for such events where every hour and even minute counts.

This presentation discusses the multifractal analysis of the storm Eleanor development. The provided data originate from the SIRTA test site (www.sirta.ipsl.fr/sirta/data/data_search/), which is positioned in the south of Paris. Most of the data has been taken from a publicly accessible server and covers the period between the 22.12.2017 and the 3.1.2018. These data contain wind speeds with their directions measured at 10m height as well as temperature, humidity, pressure and precipitation measured at 2m height each and averaged over one minute originating from measurements every 5 seconds for the whole period of interest. Those are all the major properties to describe the appearance of such a storm.

The Universal Multifractals (UM) have been used to analyse the ensemble of available data. Contrary to more classical statistical techniques for estimating the extremes that are largely limited to statistical distributions that do not take into account the mechanisms generating the extreme variability of hydro-meteorological fields, multifractals are increasingly understood as a basic framework for handling such variability. This presentation provides an interesting example on the use of simultaneous time evolution in multifractal behaviour of several geophysical fields to get more reliable predictions of the extremes. The results could be also used to reduce serious misinterpretations of time series behaviour, such as the identification of spurious trends and transitions.