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Multifractal comparison of the extremes of rain rates and integrated vapour content

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Rainfall extremes are studied through the analyse of three related fields measured with the help of co-located devices installed in the roof of the Ecole des Ponts ParisTech building:
(i) Integrated Water Vapour (IWV); it corresponds the amount of water vapour present in the vertical columns between a GPS ground receiver and corresponding satellites. It is estimated from the time shift between the expected duration the signal needs to reach the receiver (the two positions are known) and the actual one
(ii) Rain rate measured by three optical disdrometers of two different types (Campbell Scientific PWS100 and OTT Parsivel2)
(iii) Relative humidity measured by a dedicated sensor

First the correlations between these quantities during significant events is analysed. It appears that although IWV tends to decrease (vapour condense to form drops that fall) and relative humidity to increase during a rainfall event, it turns out difficult to quantitatively characterize this link. It is possibly due to the fact that the scale gap between a punctual measure for the rain rate and an average over a few km height column for the IWV is too large.

Finally the scaling features of these three fields are investigated with the help of the Universal Multifractal framework which has been extensively used to analyse and simulate geophysical fields extremely variable over wide ranges of scales. Only three parameters are used to characterize variability across scales: C1 the mean intermittency, alpha the multifractality index and H the non-conservative exponent. Retrieved features are compared and the notion of maximum observable singularity is used to quantify the extremes of the various fields.

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