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Validation of a Universal Multifractal downscaling process with the help of dense networks of disdrometers

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The resolution of the rainfall data usually provided by operational C-band radar networks of Western European meteorological services is 1 km in space and 5 min in time. It has been shown that higher resolutions are needed for various applications, notably in the field of urban hydrology. A way of dealing with this unmeasured small scale rainfall variability is to input stochastically downscaled rainfall fields to urban hydrological models and simulate not a single response for the studied catchment but an ensemble.

In this paper we suggest to discuss a downscaling procedure for the rainfall field. It relies on the Universal Multifractals which have been extensively used to model and simulate geophysical fields extremely variable over a wide range of spatio-temporal scales such as rainfall. Here this standard framework of multiplicative cascades has been modified in a discrete case to better take into account the numerous zeros of the rainfall field (i.e. a pixel with no rainfall recorded). More precisely the zeros are introduced at each scale within the cascade process in a probabilistic scale invariant way. The downscaling suggested here consists in retrieving the scaling properties of the rainfall field on the available range of scales and stochastically continuing the underlying process below the scale of observation.

Rainfall data coming from a dense network of 16 optical disdrometers (Particle Size and Velocity, PARSIVEL, 1st generation) that was deployed for 16 month over an area of approximately 1 km2 in the campus of Ecole Polytechnique Federale de Lausanne (Switzerland) will be used to validate this downscaling procedure. Preliminary results with a network of second generation PARSIVEL currently under construction in Ecole des Ponts ParisTech (France) will also be shown. The methodology implemented consists in downscaling a rainfall field with a resolution of 1 km and 5 min to a resolution comparable with the disdrometers' one (few tens of cm and 1 min). The variability among the generated "virtual" disdrometers is then compared with the observed one. The impact of these results on the comparisons commonly performed between radar and rain gauge / disdrometer rainfall data will finally be briefly discussed.