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A new approach for simulation of rainfall time series

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The rainfall process is the main input to hydrological systems and its quantification is essential to a wide range of purposes related to the evaluation of floods, water resource, water quality and ecological studies. This may be possible using empirical observations, but there is often a need to extend available data in terms of record length, temporal resolution and/or spatial coverage. The generation of consistent rainfall synthetic series allows to investigate the temporal structure of the process and its description in terms of event sequences (exterior process) and individual events (interior process). The exterior process consists in the observation of wet and dry periods characterized by different durations and distributions. It is possible to model the sequence using particular assumptions for event durations and dry periods. The interior process describes the detailed fluctuations of rainfall intensity at subsynoptic scales. We assume that the duration of wet periods and intensity of individual storms can be best modeled by Levy-stable distribution. Furthermore, we take the distribution of the dry periods to be Weibull. The generation of continuous rainfall time series is based on a random sequence of arrival times and storm duration that represent the intermittent mechanism of rainfall process. In the same way, the storm rainfall intensity is generated with random sampling and, subsequently, downscaled using a multiplicative cascade. Generally, this procedure is used in modelling multifractals considering the scale-invariant behaviour of the process analyzed. Following the pattern above is possible the modelling temporal rainfall fields and their reliable simulation using a adequately fitted model. In this work, we have used a dataset of measurements from five raingauge stations located in Basilicata Region (Southern Italy). The original measurements have a temporal resolution of 15 minutes and cover a period of 10 years from 1991 to 2001.