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A model intercomparison for stochastic simulation of temporal precipitation

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Stochastic models, based on diverse stochastic processes, have been applied in the last decades for the simulation of precipitation time series. Different models target a good reproduction of statistical properties of precipitation across a specific range of temporal scales. The choice of the statistical properties and the respective range of scales are frequently dictated by the purpose for which each model is built.
Despite the large variety of stochastic precipitation modeling tools, an intercomparison has been rarely attempted. Moreover, a common practice is to validate a stochastic model only for the statistical properties for which it has been developed to perform well. It is our opinion that this practice may have negative implications, especially when stochastic models are used in hydrology as a black box. In this study we present an extensive comparison among some of the most widely applied stochastic precipitation models. Models based on point processes (e.g. Neyman-Scott rectangular pulses model, Bartlett-Lewis rectangular pulses model), Mutiplicative Random Cascades (e.g. canonical and microcanonical MRC), Markov chains, scaling processes and their combinations (e.g. Paschalis et al., 2013, Advances in Water resources) are used in order to assess their efficiency for a number of stations belonging to different climates, spanning from semiarid to wet oceanic. A complete model validation is performed, taking into account all the essential statistical properties of precipitation (e.g. probability distribution, extremes, autocorrelation, intermittency, etc.) for a wide range of temporal scales relevant for hydrological and ecological applications. The overall goal is to identify the general patterns of the strengths and weaknesses of the various modeling tools, and to provide insights for generally applicable guidelines in the model selection dependent on the specific hydrological/ecological application.