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Long tails of marginal distribution and autocorrelation function of rainfall produced by the maximum entropy principle

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The long tails of the marginal distribution and the autocorrelation function of rainfall are related to the observed rich patterns in hyetographs, the diversity of rainfall events and even the intermittent behaviour. However, maximization of the classical Boltzmann-Gibbs-Shannon entropy for rainfall at a specific time scale, assuming a specified mean, would result in an exponentially distributed Markovian process. Such a process, with short tails both in the marginal distribution and autocorrelation function, would produce unrealistic rainfall patterns characterized by monotony and without intermittency. Some modified methodologies, which involve the use of a generalized definition of entropy, have been already proposed to reinstate consistency of the maximum entropy principle and observed rainfall behaviour. Here we explore another method which uses the classical entropy definition but assumes that rainfall can be represented as a chain of stochastic processes, each member of which represents the mean of the previous process and has lag one autocorrelation greater than that of the previous process. Application of the method using Monte Carlo simulation demonstrates that such a chain with only three members can produce synthetic traces resembling actual hyetographs.