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On the dependencies between parameters of stochastic rectangular pulses models for generating rainfall

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For several hydrological applications, long time series of rainfall are necessary. If insufficient data are available, one may resort to using stochastically generated time series, such as rectangular pulses models. One commonly used type of these models is the Bartlett-Lewis model. Such model is characterized by several parameters, which define probability distribution functions of different properties of the rectangular pulses, including the height, the width, the timing of occurrence, etc. Generally, these models are being calibrated based on minimizing a cost function that is based on the comparison between a number of analytically calculated moments and those corresponding from observations.
Several problems have been reported with these models, especially with respect to the generation of extreme events. Different improvements have been made or suggested for these models. One option would be to include a dependence structure between parameters or between properties of the pulses. However, it remains unclear whether and, if so, which parameters show mutual dependence.
This study attempts to demonstrate the different dependences between the parameters of the Modified Bartlett-Lewis (MBL) model and the Modified Bartlett-Lewis Gamma (MBLG) model, based on a Monte Carlo experiment. The results of this analysis could be used for including copulas into the Bartlett-Lewis model which embed these dependencies into the model structure.