Stochastic rainfall modelling for hydrological design

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For the hydrological design of rivers, design criteria have to be defined, including the maximal frequency of the failure of hydraulic structures to be designed or a minimization of floods. As these events are generally caused by extreme rainfall, it is important to have tools that allow for generating representative extreme rainfall which can then be used in the design. Often, Intensity-Duration-Frequency curves are used in order to characterize a design storm with a given duration and return period. The internal storm structure can then be improved by using the mass curves or Huff curves concept. However, as this framework does not allow for much flexibility, alternative methods, making use of long time series of simulated rainfall, have been developed that may lead to an improved design as it allows for assessing the uncertainty on the failure of the system. Such time series can be obtained through stochastic rectangular pulses models, however, it is shown that these models may lead to incorrect extreme discharge behaviour of river basins.
In this talk, this problem is demonstrated and some solutions, including the introduction of a stochastic copula-based design storm generator, are given. Therefore, copulas, which are flexible functions for describing the dependence structure between two variables (in our case storm characteristics), are briefly introduced and their application in an alternative comparative frequency analysis is demonstrated.