Stochastic rainfall generators based on extreme value theory

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The first topic of this talk is to model the marginal distribution of rainfall data, extremes included. Precipitation amounts at daily or hourly scales are skewed to the right and heavy rainfall is poorly modeled by a simple gamma distribution. An important, yet challenging topic in hydrometeorology is to find a probability distribution that is able to model well low, moderate and heavy rainfall. In this context, another important aspect of your work is to completely bypass the threshold selection step, the latter being classically used to in Extreme Value Theory to deal with heavy rainfall. To address this issue, I will discuss different approaches and, in particular, I will emphasise a recent semiparametric distribution suitable for modeling the entire-range of rainfall amount. This joint work with P. Tencaliec, A.C. Favre and C. Prieur and it extends the article of Naveau P, Huser R, Ribereau P, Hannart A, (2016, WRR).

In a second step, I will focus on how to couple different sources of data to accurately simulate the multivariate dependence structure among extremes rainfall. This is a joint with Marco Oesting. A convenient starting poiny to model the dependence among block maxima from environmental datasets is the class of max-stable processes. A typical max-stable can be represented by a max-linear combination that merge independent copies of a hidden stochastic process weighted by a Poisson point process. In practice, other levels of complexity emerge. For our example at hand, the spatial structure of heavy rainfall may neither be anisotropic nor stationary in space. By combiming different data sources, we propose different types of data driven max-stables processes. They have the advantages to be parsimonious in parameters, easy to simulate and physically based (i.e. capable of incorporating nugget effects and reproducing spatial non-stationnarity). We also compare our new method with classical approaches such as Brown-Resnick types. All our multivariate models are based on the recent work of Oesting (2017).