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A distributed application of the SCHADEX stochastic method for extreme flood estimation

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The SCHADEX method (Paquet et al., 2013) is a reference method in France for the estimation of extreme flood for dam safety studies. It is based on a semi-continuous rainfall–runoff simulation process: hundreds of different rainy events, randomly drawn up to extreme values, are simulated independently in the hydrological conditions of each rainy day of a historical record. This allows the generation of an exhaustive set of crossings between precipitation and soil saturation hazards, which leads to compute a complete distribution of flood discharges up to extreme quantiles.

Since its introduction twelve years ago, the method has been applied to more than 150 catchments in France and abroad, with two types of rainfall-runoff models:
• Lumped models like MORDOR or GR4J.
• Semi-distributed models in which the modeled catchment is divided into several altitude bands, like MORDOR-SD, HBV or DDD.
To provide a better representation of the hydrological processes in large and heterogeneous catchments, a distributed modeling approach is advisable. In this respect, a distributed version of the MORDOR model has been recently achieved and documented (Rouhier et al., 2017).

In the SCHADEX method, the simulated rainy events are drawn and affected to a probability as areal rainfall values, i.e. uniformly on the catchment. The application with a distributed model thus requires these areal values to be disaggregated at an adequate resolution to feed the distributed rainfall-runoff model. This disaggregation is done thanks to a catalog of rain field shapes in which a relevant one is chosen according to the intensity of the simulated event, its season, weather type, etc. This catalog can be built by two methods:
• A spatial interpolation of observed rainfall build for each day of the 1948-2012 period (SPAZM, see Gottardi et al., 2012).
• A stochastic spatial rainfall generator accounting for spatial and temporal dependencies in daily precipitation fields (Vaittinada et al., 2019).

This study compares the extreme quantiles estimations provided by a “classical” application of SCHADEX (both with a lumped and a semi-distributed model), to a distributed application using different strategies for disaggregating the simulated events. Different features of the simulated floods will be compared in order to assess the contributions of a distributed approach (compared to a lumped one) and the sensitivity to the modeling options. It is illustrated with the example of Ardèche catchment at Sauze (south-east of France, 2260 km^2).

References:
Gottardi, F., Obled, C., Gailhard, J., & Paquet, E. (2012). Statistical reanalysis of precipitation fields based on ground network data and weather patterns: Application over French mountains. Journal of Hydrology, 432, 154-167.
Paquet, E., Garavaglia, F., Garçon, R., & Gailhard, J. (2013). The SCHADEX method: A semi-continuous rainfall–runoff simulation for extreme flood estimation. Journal of Hydrology, 495, 23-37.
Rouhier, L., Le Lay, M., Garavaglia, F., Le Moine, N., Hendrickx, F., Monteil, C., & Ribstein, P. (2017). Impact of mesoscale spatial variability of climatic inputs and parameters on the hydrological response. Journal of Hydrology, 553, 13-25.
Vaittinada, P., Blanchet, J., Paquet, E. & Penot, D. (2019). Space-time simulation of precipitation based on weather pattern sub-sampling and meta-Gaussian model. Submitted.