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Sensitivity of extreme flood quantile estimation to rainfall-runoff modeling

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EDF (Électricité de France) design floods of dam spillways are now computed using a probabilistic method named SCHADEX (Climatic-hydrological simulation of extreme foods (Paquet et al., 2006, Garavaglia et al., 2009, 2010). This method aims at estimating extreme flood quantiles by the combination of a weather pattern based rainfall probabilistic model and a conceptual rainfall-runoff model. Extreme floods quantiles are estimated through a runoff generation process that combines a stochastic generation of rainfall events and a semi-continuous rainfall-runoff simulation.

The aim of this paper is to investigate the sensitivity of extreme flood quantile estimation to the rainfall-runoff model (structure, parameters) used in the simulation framework. To explore this topic we have used two rainfall-runoff models (i.e. MORDOR model (Garçon et al., 1996) and GR4J model (Andreassian et al., 2006)) with four different objective functions (based on Nash-Sutcliffe and Kling-Gupta efficiencies) and a classical split-sample scheme. This testing strategy has been applied to calibrate models on a set of 30 French watersheds at different time-steps (mainly daily and 4 to 12 hours). When calibrated, models were used within the SCHADEX method and flood quantiles were evaluated at different return levels in interpolation and extrapolation (10, 100, 1000 years return-period).

The main result of this comparative study is that extreme flood quantile estimations are more sensitive to (i) the objective function used and (ii) the time series length and period used for model calibration then (iii) the rainfall-runoff structure. Within this comparative study, the mean variability on a 1000 years return-period is up to 20%. Another interesting result is that, for a same objective function and time series period, the influence of the rainfall-runoff model is relatively moderated in extrapolation domain because the two rainfall-runoff models converged towards their asymptotic behaviours, but relatively bigger in interpolation domain because rainfall-runoff modelling uncertainties could be higher.

Andréassian, V. et al., 2006. Catalogue of the models used in MOPEX 2004/2005. Large sample basin experiments for ydrological mode parameterisation : results of the Model Parameter Experiment, IAHS Publ. 307., 307:41–94.
Garçon, R. : Prévision opérationnelle des apports de la Durance à Serre-Ponçon à l'aide du modèle mordor. La Houille Blanche, 5:–, 1996.
Garavaglia, F., Gailhard, J., Paquet, E., Lang, M., Garçon,R., Bernardara, P., 2010. Introducing a rainfall compound distribution model based on weather patterns sub-sampling. Hydrology and Earth System Sciences, 14, 951–964.
Garavaglia, F., Lang, M., Paquet, E., Gailhard, J., Garçon,R., Renard, B., 2011. Reliability and robustness of rainfall compound distribution model based on weather pattern sub-sampling. Hydrology and Earth System Sciences, 15, 519–532.
Paquet, E., Gailhard, J., Garçon, R, 2006. Evolution of GRADEX method: improvement by atmospheric circulation classification and hydrological modelling, La Houille Blanche, 5, 80–90.