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Assessment of simulation-based calibration of rectangular pulse models

Willem Jan Vanhaute (1), Sander Vandenberghe (1), Patrick Willems (2), and Niko E.C. Verhoest (1)

(1) Laboratory of Hydrology and Water Management, Ghent University, Coupure links 653, 9000 Ghent, Belgium(willem.vanhaute@ugent.be), (2) Hydraulics Laboratory, Katholieke Universiteit Leuven, Kasteelpark Arenberg 40, B-3001 Heverlee (Leuven), Belgium

The use of stochastic rainfall models has become widespread in many hydrologic applications, especially when historical rainfall records lack in length or quality to be used for practical purposes. Among a variety of models, rectangular pulse models such as the Neyman-scott and Bartlett-Lewis type models are known for their parsimonious nature and relative ease in simulating long rainfall time series.

The aforementioned models are often calibrated using the generalized method of moments which fits modeled to observed moments. To ease the computational burden, the expected values of the modeled moments are usually expressed in function of the model parameters through analytical expressions. The derivation of such analytical expressions is considered to be an important bottleneck in the development of these rectangular pulse models. Any adjustment to the model structure must be accompanied by an adjustment of the analytical moments in order to be able to calibrate the adjusted model.

To avoid the use of analytical moments during calibration, a simulation-based calibration is needed. The latter would enable the modeler to make and validate adjustments in a more organic matter. However, such simulation-based calibration must be able to account for the randomness of the simulation. As such, ensemble runs must be made for every objective function evaluation, resulting in considerable computational requirements.

The presented research investigates how to exploit today's available computational resources in order to enable simulation-based calibration. Once such type of calibration is feasible, it will open doors to implementing adjustments to the model structure (such as the introduction of dependencies between model variables by using copulas) without the need to rely on analytical expressions of the different moments.