



## **Multimethod evolutionary search for the regional calibration of rainfall-runoff models**

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The study focuses on regional calibration for a generic rainfall-runoff model. The maximum likelihood function in the spectral domain proposed by Whittle is approximated in the time domain by maximising the simultaneous fit (through a multiobjective optimisation) of selected statistics of streamflow values, with the aim to propose a calibration procedure that can be applied at regional scale. The method may in fact be applied without the availability of actual time series of streamflow observations, since it is based exclusively on the selected statistics, that are here obtained on the basis of the dominant climate and catchment characteristics, through regional regression relationships.

The multiobjective optimisation was carried out by using a recently proposed multimethod evolutionary search algorithm (AMALGAM, Vrugt and Robinson, 2007), that runs simultaneously, for population evolution, a set of different optimisation methods (namely NSGA-II, Differential Evolution, Adaptive Metropolis Search and Particle Swarm Optimisation), resulting in a combination of the respective strengths by adaptively updating the weights of these individual methods based on their reproductive success. This ensures a fast, reliable and computationally efficient solution to multiobjective optimisation problems.

The proposed technique is applied to the case study of some catchments located in central Italy, which are treated as ungauged and are located in a region where detailed hydrological and geomorphoclimatic information is available. The results obtained with the regional calibration are compared with those provided by a classical least squares calibration in the time domain. The outcomes of the analysis confirm the potentialities of the proposed methodology.