



## **Comparative assessment of six automatic optimization techniques for calibration of a conceptual rainfall-runoff model**

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In this application-based study, six automated strategies for parameter optimisation are used for calibration of the conceptual SMAR (Soil Moisture Accounting and Routing) model for rainfall-runoff simulation of the Brosna catchment in Ireland. The techniques used are i) the Simplex downhill search, ii) the Rosenbrock search, iii) the Genetic Algorithm, iv) Particle Swarm Optimization, v) Simulated Annealing, and vi) the Shuffled Complex Evolution. A comparative assessment of the methods, when used individually and also sequentially, is made. Six performance evaluation criteria and a normalized scatter plot of residual against observed discharge are used to evaluate the efficiency of the optimization techniques. As expected, the global population-based optimization techniques perform more reliably than the local ones, albeit at the expense of computing time, and the danger of equifinality in parameter optimization can be alleviated, if not practically resolved, by using such techniques. The software package called the 'Galway Flow Modelling and Forecasting System (GFMFS)', developed by the present authors at the Department of Engineering Hydrology of the National University of Ireland, Galway, is used for the application of the optimisation techniques described here.

**Keywords:** Optimisation, SMAR, Genetic Algorithm, Rosenbrock, Simplex method, Particle Swarm Optimisation, Simulated Annealing, Shuffled Complex Evolution