A Hybrid SCE-UA-KNN optimisation method applied to the Calibration of HBV model

H. Dakhlaoui, Z. Bargaoui

Ecole Nationale d'ingénieurs de Tunis, Tunisia hammouda.dakhlaoui@laposte.net

The Calibration of Rainfall-Runoff models can be viewed as an optimisation problem involving an objective function that measures the model performance expressed as a distance between observed and calculated discharges. Effectiveness (ability to find the optimum) and efficiency (cost expressed in number of objective function evaluations to reach the optimum) are the main criteria of choose of the optimisation method. SCE-UA is known as one of the most effective and efficient optimisation method. In this work we tried to improve the SCE-UA efficiency, in the case of the calibration of HBV model by using KNN technique to estimate the objective function. In fact after a number of iterations by SCE-UA, when objective function is evaluated by model simulation, a data base of parameter explored and respective objective function values is constituted. Within this data base it is proposed to estimate the objective function in further iterations, by an interpolation using nearest neighbours in a normalised parameter space with weighted Euclidean distance. Weights are chosen proportional to the sensitivity of parameter to objective function that gives more importance to sensitive parameter. Evaluation of model output is done through the objective function $RV=R^2-w|RD|$ where R^2 is Nash Sutcliffe coefficient related to discharges, w : a weight and RD the relative bias. Applied to theoretical and practical cases in several catchments under different climatic conditions : Rottweil (Germany) and Tessa, Barbra, and Sejnane (Tunisia), the hybrid SCE-UA presents efficiency better then that of initial SCE-UA by about 20 to 30 %. By using other techniques as parameter space transformation and SCE-UA modification (2), we may obtain an algorithm two to three times faster.

(1) Avi Ostfeld, Shani Salomons, "A hybrid genetic-instance learning algorithm feor CE*QAL-W2 calibration", Journal of Hydrology 310 (2005) 122-125

(2) Nitin Mutil and Shie-Yui Liong, "Improved robustness and Efficiency of the SCE-

UA model calibrating algorithm"