Multi-Objective Calibration of Hydrological Model Parameters Using MOSCEM-UA

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In the past two decades, many evolutionary algorithms have been adopted in the auto-calibration of hydrological model such as NSGA-II, SCEM, etc., some of which has shown ideal performance. In this article, a detailed hydrological model auto-calibration algorithm Multi-objective Shuffled Complex Evolution Metropolis (MOSCEM-UA) has been introduced to carry out auto-calibration of hydrological model in order to clarify the equilibrium and the uncertainty of model parameters. The development and the implement flow chart of the advanced multi-objective algorithm (MOSCEM-UA) were interpreted in detail. Hymod, a conceptual hydrological model depending on Moore's concept, was then introduced as a lumped Rain-Runoff simulation approach with several principal parameters involved. The five important model parameters subjected to calibration includes maximum storage capacity, spatial variability of the soil moisture capacity, flow distributing factor between slow and quick reservoirs as well as slow tank and quick tank distribution factor. In this study, a test case on the up-stream area of KuanCheng hydrometric station in Haihe basin was studied to verify the performance of calibration. Two objectives including objective for high flow process and objective for low flow process are chosen in the process of calibration. The results emphasized that the interrelationship between objective functions could be described in correlation Pareto Front by using MOSCEM-UA. The Pareto Front can be draw after the iteration. Further more, post range of parameters corresponding to Pareto sets could also be drawn to identify the prediction range of the model. Then a set of balanced parameter was chosen to validate the model and the result showed an ideal prediction. Meanwhile, the correlation among parameters and their effects on the model performance could also be achieved.