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Parameter estimation of hydrologic model using approximate modelling approach

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In order to have a good prediction of streamflows using most hydrologic models, it is necessary to calibrate some or all of the model parameters. This is a necessity even in physically based models. Parameter estimation has been the concern of hydrologists for many decades. Still, there are many issues arising the increased complexity of models, changes in computing paradigms, and parameter estimation algorithms in addition to the perennial problem of excessive computing time. Most of existing calibration methods requires a large number of simulations to do a reasonable calibration, which is computationally expensive due to increased complexity in details and the size of catchments considered.

Regarding this limitation, we suggest a framework which is both robust and efficient. In this framework the calibration process would be carried out in an iterative manner. The efficiency of the process would be fulfilled through a precise approximation of the objective function in the desired region. This approximation would allow the calibration process to require fewer simulations. Furthermore, the approximate model would lead us toward the region were the objective function (error criteria) is minimum. The main advantage of this framework lies in its robustness, which is well suited for any kind of hydrologic model.

The accuracy of the parameters would be fulfilled in the course of the iterations. In each of the iterations, the region where the minimum of the objective function is located would become more accurate. In another word this process performance is similar to a microscope as it proceeds.

The hydrologic model we deal with is the WATCLASS, which is a merge of CLASS (developed by the Environment Canada) and WATFLOOD (developed by the University of Waterloo). The approximate model which was developed for this purpose was

a Fuzzy TSK model using epsilon-insensitive loss function and our objective function was Nash-Sutcliff criteria applied to the observed and predicted streamflows. Error function was mapped over the desired parameters using this approximate model. Promising results were obtained. In a short time with an acceptable accuracy, the optimum set of parameters was obtained.