Geophysical Research Abstracts
Vol. 18, EGU2016-13285, 2016
EGU General Assembly 2016

Parameter Estimation of Computationally Expensive Watershed Models Through Efficient Multi-objective Optimization and Interactive Decision Analytics

Taimoor Akhtar (1) and Christine Shoemaker (2)

(1) Department of Civil & Environmental Engineering, National University of Singapore, Singapore (taimoor.akhtar@gmail.com), (2) Department of Civil & Environmental Engineering and Industrial and Systems Engineering, National University of Singapore, Singapore (shoemaker@nus.edu.sg)

Watershed model calibration is inherently a multi-criteria problem. Conflicting trade-offs exist between different quantifiable calibration criterions indicating the non-existence of a single optimal parameterization. Hence, many experts prefer a manual approach to calibration where the inherent multi-objective nature of the calibration problem is addressed through an interactive, subjective, time-intensive and complex decision making process. Multi-objective optimization can be used to efficiently identify multiple plausible calibration alternatives and assist calibration experts during the parameter estimation process. However, there are key challenges to the use of multi objective optimization in the parameter estimation process which include: 1) multi-objective optimization usually requires many model simulations, which is difficult for complex simulation models that are computationally expensive; and 2) selection of one from numerous calibration alternatives provided by multi-objective optimization is non-trivial. This study proposes a "Hybrid Automatic Manual Strategy" (HAMS) for watershed model calibration to specifically address the above-mentioned challenges. HAMS employs a 3-stage framework for parameter estimation. Stage 1 incorporates the use of an efficient surrogate multi-objective algorithm, GOMORS, for identification of numerous calibration alternatives within a limited simulation evaluation budget. The novelty of HAMS is embedded in Stages 2 and 3 where an interactive visual and metric based analytics framework is available as a decision support tool to choose a single calibration from the numerous alternatives identified in Stage 1. Stage 2 of HAMS provides a goodness-of-fit measure / metric based interactive framework for identification of a small subset (typically less than 10) of meaningful and diverse set of calibration alternatives from the numerous alternatives obtained in Stage 1. Stage 3 incorporates the use of an interactive visual analytics framework for decision support in selection of one parameter combination from the alternatives identified in Stage 2. HAMS is applied for calibration of flow parameters of a SWAT model, (Soil and Water Assessment Tool) designed to simulate flow in the Cannonsville watershed in upstate New York. Results from the application of HAMS to Cannonsville indicate that efficient multi-objective optimization and interactive visual and metric based analytics can bridge the gap between the effective use of both automatic and manual strategies for parameter estimation of computationally expensive watershed models.