

Evaluation of Bayesian Uncertainty Analysis for Watershed Modeling

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Abstract. Modeling of complex watershed systems requires incorporation of a large number of parameters related to different physical processes. In recent years, the development of uncertainty analysis and data assimilation techniques has been expedited to account for model uncertainties arising from input, parameter and structural uncertainties. In this study, two Bayesian approaches, namely Uniform covering by Probabilistic Rejection (UCPR) and Metropolis-Hastings algorithm (MHA), are compared when dealing with high-dimensional watershed models. UCPR is a random search method which is able to find better solution from predefined domain space before starting relatively expensive model runs by rejection process. MHA is a well-known Markov Chain Monte Carlo method that can be used to generate the posterior distributions of model parameters. Moreover, a new method was developed by reconciling UCPR and MHA, which was evaluated in conjunction with the Soil and Water Assessment Tool (SWAT) in the Eagle Creek watershed, Indiana. In the case study, UCPR-MHA showed better capability in handling high dimensional problems than UCPR and/or MHA alone, while computational efficiency was maintained.

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