An Evaluation Procedure of Parameter Sampling Techniques in Watershed Modeling

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Abstract. In recent years, various parameter sampling techniques have been developed to generate realizations from feasible domain space of specified parameters in the applications of watershed models. In this study, a three-step evaluation procedure is developed to appraise the efficiency and effectiveness of candidate algorithms in the parameter sampling process. The first step is to compare the performance is minimizing the objective function by weighted model errors. The second step is to examine the effectiveness in drawing parameter sets that satisfy actual watershed behavior based on predefined statistical thresholds. The last step is to explore the distributing fashion of candidate parameter sets in the entire domain space. The proposed three-step evaluation procedure was implemented on six commonly adopted parameter sampling techniques including the Random Walk Metropolis-Hastings Algorithm (RW-MHA), the Random Walk Gibbs Sampling Algorithm (RW-GSA), Uniform Covering by Probabilistic Rejection (UCPR), and DiffeRential Evolution Adaptive Metropolis (DREAM), Dynamically Dimensioned Search (DDS), and the Shuffled Complex Evolution (SCE-UA). The six methods were evaluated to identify the advantages and disadvantages during watershed calibration. In a case study, the Soil and Water Assessment Tool (SWAT) was used as the watershed simulation model for the Eagle Creek Watershed, Indiana, USA. From the results, DDS outperformed other methods in the speed of convergence and the successful rate of statistical thresholds. In addition, solutions derived by DDS were distributed closely in relatively small regions of the whole domain space which enhanced the efficiency of parameter searching process.