Analyze the parameter uncertainty of SURR model using Bayesian Markov Chain Monte Carlo method with informal likelihood functions

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Abstract

In order to estimate parameter uncertainty of hydrological models, the consideration of the likelihood functions which provide reliable parameters of model is necessary. In this study, the Bayesian Markov Chain Monte Carlo (MCMC) method with informal likelihood functions is used to analyze the uncertainty of parameters of the SURR model for estimating the hourly streamflow of Gunnam station of Imjin basin, Korea. Three events were used to calibrate and one event was used to validate the posterior distributions of parameters. Moreover, the performance of four informal likelihood functions (Nash-Sutcliffe efficiency, Normalized absolute error, Index of agreement, and Chiew - McMahon efficiency) on uncertainty of parameter is assessed. The indicators used to assess the uncertainty of the streamflow simulation were P-factor (percentage of observed streamflow included in the uncertainty interval) and R-factor (the average width of the uncertainty interval). The results showed that the sensitivities of parameters strongly depend on the likelihood functions and vary for different likelihood functions. The uncertainty bounds illustrated the slight differences from various likelihood functions. This study confirms the importance of the likelihood function selection in the application of Bayesian MCMC to the uncertainty assessment of the SURR model.

Keywords: Uncertainty of parameter, SURR model, informal likelihood functions, Imjin River basin, Bayesian MCMC.

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