Global Sensitivity Analysis for the Hydrology of Major River Basins in Colorado

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Abstract. Watershed models are often used to predict flow regimes under varying land use and climate conditions. The credibility of such predictions, however, depends upon adequate representation of important hydrologic processes in the system. The present work investigates the importance of various hydrologic processes in Colorado's major river basins. To this end, the Soil and Water Assessment Tool was calibrated and validated for streamflow in five watersheds in Colorado, ranging from 1,056 sq miles to 3,453 sq miles in size on a monthly basis. Calibration results showed a good fit between measured and simulated streamflow values over a 25 year period with Nash-Sutcliffe efficiency coefficient ranging from 0.53 to 0.84. The corroborated model was reconciled with a global sensitivity analysis in an attempt to identify critical flow processes. Sensitivity of the parameters was assessed based on monthly streamflow outputs and the corresponding root mean square error (RMSE). We specifically aimed to identify similarities between the results of sensitivity analysis in the study watersheds. Interestingly, different sets of sensitive parameters were identified for the two cases. Snow and runoff processes were critical when RMSE was used, while evaporation, runoff, soil and groundwater processes became critical when streamflow was used for sensitivity analysis. It became evident that the consistency of the results improved with an increase in the number of simulations.

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