SWAT Model Application in a Data Scarce Tropical Complex Catchment in Tanzania

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Abstract

This study intended to validate the Soil and Water Assessment Tool (SWAT) model in data scarce environment in a complex tropical catchment in the Pangani River Basin located in northeast Tanzania. The validation process involved the model initialization, calibration, verification and sensitivity analysis. Both manual and auto-calibration procedures were used to facilitate the comparison of the results with past studies in the same catchment. For this study, some model parameters including Soil depth (SOL_Z) and Saturated hydraulic conductivity (SOL_K) were assumed uniform within the study catchment and were therefore lumped comprising the huge computation resource requirement of the SWAT model. Results indicated that the same set of important parameters was identified with or without the use of observed flows data. Some of the parameters had physical interpretation and could therefore relate directly to hydrological controlling factors within the catchment. Despite swapping ranking importance of parameters, these results suggest the suitability of the SWAT model for identifying hydrological controlling factors/parameters in ungauged catchments. Results of calibration and validation at the daily timescale gave moderately satisfactory Nash–Sutcliffe Coefficient of Efficiency (CE) of 54.6% for calibration and 68% for validation while simulated and observed mean annual flow discharges gave an Index of Volumetric Fit (IVF) of 100%. The study further indicated the improvement of model estimation when more reliable spatial representation of rainfall was used. Although in this study SWAT model has performed satisfactorily in data poor and complex catchment, the authors recommend a wider validation effort of the model before it is adopted for operational purpose.

Keywords

SWAT model; Auto-calibration; Sensitivity analysis