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Comparative Analysis of HEC-HMS and SWAT Model in Simulating Daily Streamflow of Stung Sen River Catchment, Cambodia

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Abstract

The use of hydrological models has been of interest for water resources assessment and now become increasingly important for water resources management. Currently, there are numerous hydrological models simulating the hydrological process at different spatial and temporal scales. The comparative analysis of different models can be useful to get satisfactory result. Therefore, the comparison can be done by applying of different models in a particular watershed and using statistics indicators between observation and simulation to evaluate their performances. In this study, HEC-HMS and SWAT model have been used to simulate the daily streamflow in a tributary of Tonle Sap Lake, called Stung Sen River with catchment area of 14,138 km² located at the Northern part of Cambodia. The calibration and validation were taken from 2004-2008 and 2009-2011, respectively for both models with observed data from Ministry of Water Resources and Meteorology of Cambodia. The evaluations of model performance were compared based on the statistic indicators known as Nash Sutcliffe Efficiency (NSE), Percentage bias (PBIAS) and Root Mean Square Error-Observed Standard Deviation Ratio (RSR). During the wet season, Stung Sen River discharges up to 700 m³/s but it decreases to lower than 10 m³/s during dry season. The comparison indicated that HEC-HMS (*NSE=0.78 and 0.77, PBIAS=+8.3% and +4.7%, RSR=0.46 and 0.47 respectively for calibration and validation*) can have better agreement between observation and simulation than SWAT (*NSE=0.7 and 0.68, PBIAS =+5% and -18.8%, RSR=0.55 and 0.61 respectively for calibration and validation*). In this study, the application of SWAT had difficulty in simulating peak flow and low flow as indicated by overestimated bias mainly in validation period. However, both calibration and validation periods for both models performed well with satisfactory criteria. Information of land use changes and water extraction need to be considered for improving model verification.

Keywords: Stung Sen; HEC-HMS; SWAT; Streamflow