JWARP> Vol.3 No.9, September 2011

OPEN ACCESS

Modelling of Streamflow of a Catchment in Kenya

PDF (Size:1708KB) PP. 667-677 DOI: 10.4236/jwarp.2011.39077

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ABSTRACT

Modeling stream flow forms a basis upon which policy makers, watershed planners and managers make appropriate decisions consistent with sustainable management of land and water resources in the watershed. The aim of this research is to provide a preliminary assessment of the performance of a complex watershed model in predicting stream flow on the Naro Moru river catchment in Ewaso Ng ' iro river basin, Kenya. The research involved model input data preparation, model set up and test running, sensitivity analysis and calibration of the Soil Water Assessment Tool (SWAT) model. Preliminary evaluation of the model performance involved the use of known quantitative evaluation statistics that included correlation coefficient, Nash Sutcliffe efficiency (NSE), Deviation Volume (D_v) and a graphical technique for comparing observed and simulated flows. Initial model runs yielded poor daily flow simulations compared to monthly simulations. Poor daily simulation was attributed to differences in the timing of observed and simulated hydrographs. The model was calibrated for a three year period followed by a three year validation period based on monthly flows. Calibration results indicated an acceptable, but modest, agreement between observed and simulated monthly stream flows with a correlation coefficient (r) of about 0.7, NSE = 5%, and D_v= 61.7%. After validation, the model performance was satisfactory with the coefficient of determination ($R^2 \approx 0.6$), Nash-Sutcliffe efficiency (NSE) of 0.51 and a deviation volume (D_v) value of 24.7%. The modest model performance was associated with input data deficiencies and model limitations. Even then, the results indicate that the model can possibly be adapted to the local conditions in the catchment for which it is being applied but with improvements involving better parameter calibration techniques, and collection of better quality data. Such a study may be used to predict the effect of climate change on river flows as well as the effect of land use changes on the hydrologic response of a catchment.

KEYWORDS

Stream Flow Simulation, Model Evaluation, Prediction, Calibration and Validation

Cite this paper

J. Obiero, M. Hassan and L. Gumbe, "Modelling of Streamflow of a Catchment in Kenya," *Journal of Water Resource and Protection*, Vol. 3 No. 9, 2011, pp. 667-677. doi: 10.4236/jwarp.2011.39077.

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