Abstract

To establish the effect of climate variability on annual discharge in Upper Njoro Catchment, hybrid models were developed by coupling Soil and Water Assessment Tool and Artificial Neural Networks. Daily surface runoff, lateral flow, and groundwater flow were first simulated with SWAT for the period (1978-1987) using climate variables from Egerton University weather station and LULC of 1978. The daily hydrologic variables simulated without calibration and validation of SWAT and observed discharge data were then used for ANN training, which led to the creation of discharge generation hybrid models for the dry, wet and wetter seasons. SWAT_ANN models generated discharges were compared with observed data and the performance rating were achieved at R^2 (0.94, 0.91, 0.92) and NSE (0.89, 0.87, 0.87) for DJFM, AMJJ, and ASON seasons respectively. SUFI-2 algorithm in SWAT-CUP was run separately to compare the performance of SWAT with that of SWAT_ANN. SWAT-CUP sensitivity analysis revealed satisfactory values of both the p-factor (0.61) and the r-factor (0.69). Calibration and validation of monthly streamflow were realized at R^2 (0.86 and 0.78) and NSE (0.83 and 0.74). The results showed that coupling SWAT and ANN improved flow prediction. Further, the potential of the SWAT_ANN modeling approach to separate the influence of climate variability on river regime from the effect of LULC was evaluated by comparing trends in the differences between observed and SWAT_ANN simulated monthly streamflow with trends of the quantified LULC changes. The findings provided sufficient evidence that the SWAT_ANN modeling approach was reliable and could also be applied to detect changes in LULC.