

Projected streamflow in the Kurau River Basin of Western Malaysia under future climate scenarios

ABSTRACT

Climate change-induced spatial and temporal variability of streamflow has significant implications for hydrological processes and water supplies at basin scale. This study investigated the impacts of climate change on streamflow of the Kurau River Basin in Malaysia using a Climate-Smart Decision Support System (CSDSS) to predict future climate sequences. For this, we used 25 realizations consisting from 10 Global Climate Models (GCMs) and three IPCC Representative Concentration Pathways (RCP4.5, RCP6.0 and RCP8.5). The generated climate sequences were used as input to Soil and Water Assessment Tool (SWAT) to simulate projected changes in hydrological processes in the basin over the period 2021–2080. The model performed fairly well for the Kurau River Basin, with coefficient of determination (R^2), Nash-Sutcliffe Efficiency (NSE) and Percent Bias (PBIAS) of 0.65, 0.65 and -3.0 , respectively for calibration period (1981–1998) and 0.60, 0.59 and -4.6 , respectively for validation period (1996–2005). Future projections over 2021–2080 period show an increase in rainfall during August to January (relatively wet season, called the main irrigation season) but a decrease in rainfall during February to July (relatively dry season, called the off season). Temperature projections show increase in both the maximum and minimum temperatures under the three RCP scenarios, with a maximum increase of $2.5\text{ }^\circ\text{C}$ by 2021–2080 relative to baseline period of 1976–2005 under RCP8.5 scenario. The model predicted reduced streamflow under all RCP scenarios compared to the baseline period. Compared to 2021–2050 period, the projected streamflow will be higher during 2051–2080 period by $1.5\text{ m}^3/\text{s}$ except in February for RCP8.5. The highest streamflow is predicted during August to December for both future periods under RCP8.5. The seasonal changes in streamflow range between -2.8% and -4.3% during the off season, and between 0% (nil) and -3.8% during the main season. The assessment of the impacts of climatic variabilities on the available water resources is necessary to identify adaptation strategies. It is supposed that such assessment on the Kurau River Basin under changing climate would improve operation policy for the Bukit Merah reservoir located at downstream of the basin. Thus, the predicted streamflow of the basin would be of importance to quantify potential

impacts of climate change on the Bukit Merah reservoir and to determine the best possible operational strategies for irrigation release.