ABSTRACT

Climate change and dam constructions bring freshwater ecosystem under stress by changing flow regime. It is important to analyse their impact at a regional scale along with the changes in the extremes of temperature and precipitation which further modify the flow regime components such as magnitude, timing, duration, frequency and rate of change. Changes in the temperature and precipitation extreme indices are calculated over the drought and flood prone Kangsabati basin using high-resolution regional climate model (RCM) simulations and their ensemble for the future period 2021-2050 compared to control period 1970-1999 based on SRES A1B scenario. The model validation results show that the RCMs simulate interannual variability and spatial distribution of extreme temperature events better than precipitation. Future simulations of extreme temperature indices generally agree with expected warming in the Kangsabati basin, with considerable spatial variation. Significantly warmer summers in the lower part of the basin along with increase in night temperature are expected. Increase in heavy precipitation indices, coupled with extended periods without precipitation; indicate an increase in the incidence of floods and droughts in the lower part of the basin. Further, the hydrologic alterations in the flow regime caused by dam, climate change and their combined impact are analysed using Soil and Water Assessment Tool (SWAT) and the Indicators of Hydrologic Alteration (IHA) program based on the Range of Variability Approach (RVA). Results indicate that flow variability has been significantly reduced due to dam construction with high flows being absorbed and pre-monsoon low flows being enhanced by the reservoir. Climate change alone reduces high peak flows while a combination of dam and climate change significantly reduces variability by affecting both high and low flows, thereby further disrupting the functioning of riverine ecosystems. Analysis shows that, in the Kangsabati basin, influence of dam is greater than that of the climate change, thereby emphasizing the significance of direct human intervention. Endangered fish species already facing decline may be further affected by future flow alterations caused by the combined effect of dam and climate change. Despite of uncertainty associated with future climate and streamflow projections, inclusion of both biotic and abiotic factors in the existing holistic methodologies for environmental flow assessment is proposed for projecting changing characteristics of occurrence of indicator species in the riverine ecosystem.

Keywords: *RCM, Climatic extremes, SWAT, dam, environmental flow, IHA, RVA, uncertainty*