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Impact of Climate Change on Flow Regime in Himalayan Basins, Nepal

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Abstract : This research studied the hydrological regime of three glacierized river basins in Khumbu, Langtang and Annapurna regions of Nepal using the Hydraologiska Byrans Vattenbalansavde (HBV), HVB-light 3.0 model. Future scenario of discharge is also studied using downscaled climate data derived from statistical downscaling method. General Circulation Models (GCMs) successfully simulate future climate variability and climate change on a global scale; however, poor spatial resolution constrains their application for impact studies at a regional or a local level. The dynamically downscaled precipitation and temperature data from Coupled Global Circulation Model 3 (CGCM3) was used for the climate projection, under A2 and A1B SRES scenarios. In addition, the observed historical temperature, precipitation and discharge data were collected from 14 different hydro-metrological locations for the implementation of this study, which include watershed and hydro-meteorological characteristics, trends analysis and water balance computation. The simulated precipitation and temperature were corrected for bias before implementing in the HVB-light 3.0 conceptual rainfall-runoff model to predict the flow regime, in which Groups Algorithms Programming (GAP) optimization approach and then calibration were used to obtain several parameter sets which were finally reproduced as observed stream flow. Except in summer, the analysis showed that the increasing trends in annual as well as seasonal precipitations during the period 2001 - 2060 for both A2 and A1B scenarios over three basins under investigation. In these river basins, the model projected warmer days in every seasons of entire period from 2001 to 2060 for both A1B and A2 scenarios. These warming trends are higher in maximum than in minimum temperatures throughout the year, indicating increasing trend of daily temperature range due to recent global warming phenomenon. Furthermore, there are decreasing trends in summer discharge in Langtang Khola (Langtang region) which is increasing in Modi Khola (Annapurna region) as well as Dudh Koshi (Khumbu region) river basin. The flow regime is more pronounced during later parts of the future decades than during earlier parts in all basins. The annual water surplus of 1419 mm, 177 mm and 49 mm are observed in Annapurna, Langtang and Khumbu region, respectively.

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