Coupling of Regional Climate Models (RCMs) and Hydrological Models

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Abstract

Climate change is a major concern for the mountainous river basins which is influenced by glacier melting. This study presents the coupling of REGional Climate Model (RegCM) with University of British Columbia (UBC) Hydrological Model for Upper Indus Basin (UIB) for the baseline period (2001-2010), future one (2041-2050) and future two (2071-2080) with emissions scenarios of RCP4.5 and RCP8.5. The output of RegCM downscaled from two GCMs is first bias-corrected and then used as input to UBC. For calibration and validation propose sensitivity of different parameters is analyzed for both models. The results shows RegCM capture seasonal variation of the monthly precipitation quit well. However, on the higher latitude the performance is passive e.g Himalayan region. There is significant improvement in the performance of RegCM using Tiedtke scheme, especially in simulation of precipitation. For temperature the results show higher correlation about 0.95 in JJA and DJF compare with CRU. In case of precipitation the correlation is lower and the difference of standardized deviation to the TRMM data is higher than that of temperature. Overall, for the base period (2001-2010) RegCM model simulations underestimate the temperature and overestimate the precipitation on UIB. On the basis of quantitative analyses, it is concluded that RegCM output needs bias correction being used for hydrological impact studies. The UBC results are quite satisfactory and indicate a higher increasing trend during 2041-2050 while increasing trend in 2071-2080 is relatively low. The possible reason may be that glaciers are melting faster and reducing in size which contributes to inflow more during first half decade of the century. In last half decade of the century, as the size of the glacier decreased, it shows little contribution to inflow in the form of a decreasing trend. RCP8.5 results show more inflow than RCP4.5.

Keywords: calibration and validation, RegCM (REGional Climate Model), Regional Climate Models (RCMs), Tiedtke Scheme, Hydrological Models, University of British Columbia (UBC) Hydrological Model