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Analysis of the Impact of Climate Change on the Streamflow at Chaghasrai Watershed in Afghanistan

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Abstract

Afghanistan is a water-scarce country and is host to only 12 % of its area as arable which is not enough to meet the food security demands of the country. Around 11 % of the total population of the country has been strongly hit by hunger and the situation might further escalate the already fragile conditions of the agriculture and water resources sector. Beside political instability and population pressure, climate change is another factor that is projected to melt down the permanent snow lying at the peaks of the watershed upstream. which may alter the flow regime of the rivers flowing downstrea*m.* In order to manage and mitigate the adverse impacts of climate change, it is vital to estimate the present and project the future flow of the rivers. Therefore, we used a semi-distributed physical based hydrologic model, SWAT (Soil Water Assessment Tool) to evaluate the impacts of climate change on the river hydrology of the Chaghasrai watershed in Afghanistan. The SWAT-model was calibrated and validated for streamflow observed at Chaghasrai gauging station during the prediction period. The performance of SWAT model was evaluated using the Nash–Sutcliffe Efficiency (NSE) and the Coefficient of determination (R^2). The future climate changes scenarios of RCP 4.5 and RCP 8.5 were extracted from the Coordinated Regional Downscaling Experiment (CORDEX). Upon calibration of the model, the streamflow was simulated for a period of 2014–2030 while using the selected climate change scenarios. The analyses show that the project site is expected to experience a temperature increase of 1.8 °C while mean annual precipitation is expected to increase by 3 % (20 mm) under both scenarios during 2014–2030. The overall streamflow is expected to be decreased by 20 % due to increase in temperature which triggers the rate of evapotranspiration during the study period. This study provides a base for estimation of the water supply (availability) in the watershed but future studies are required to consider water demand side (irrigation requirements.

Keywords: Climate change, Kabul river basin, precipitation, streamflow

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