

Potential Impacts of Warming Climate on Contributions of Runoff Components from Two Catchments of Upper Indus Basin, Karakoram, Pakistan

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Abstract : The hydrology of Upper Indus basin is not recognized well due to the intricacies in the climate and geography, and the scarcity of data above 5000 meters above sea level where most of the precipitation falls in the form of snow. The main objective of this study is to measure the contributions of different components of runoff in Upper Indus basin. To achieve this goal, the Modified positive degree-day model (MPDDM) was used to simulate the runoff and investigate its components in two catchments of Upper Indus basin, Hunza and Gilgit River basins. These two catchments were selected because of their different glacier coverage, contrasting area distribution at high altitudes and significant impact on the Upper Indus River flow. The components of runoff like snow-ice melt and rainfall-base flow were identified by the model. The simulation results show that the MPDDM shows a good agreement between observed and modeled runoff of these two catchments and the effects of snow-ice are mainly reliant on the catchment characteristics and the glaciated area. For Gilgit River basin, the largest contributor to runoff is rain-base flow, whereas large contribution of snow-ice melt observed in Hunza River basin due to its large fraction of glaciated area. This research will not only contribute to the better understanding of the impacts of climate change on the hydrological response in the Upper Indus, but will also provide guidance for the development of hydropower potential, water resources management and offer a possible evaluation of future water quantity and availability in these catchments.

Keywords : future discharge projection, positive degree day, regional climate model, water resource management

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