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The Resiliency of High-Altitude Watershed to Dry Condition Under the Changing Climate

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The hydrological cycle is generally known as a recurring result of various forms of water movement and changes in its physical state in nature over a specific area of the earth (river or Lake Basin, a continent, or the whole earth). It is most likely that the increase in global warming will intensively affect the hydrological cycle regionally and globally which will ultimately affect the ecosystem, public health, and municipal water demand. Therefore, the resiliency of watershed to extreme events play a vital role to understand the health of the watershed. This study aims to quantify the resiliency of the Hunza watershed, which lies in the Western Karakoram, to dry conditions under the climate change projections i.e. RCPs 2.6, 4.5, and 8.5. We used a fully distributed hydrological model SPHY to simulate the impact of climate change on future water availability. The SPHY Model was calibration and validation for the time periods (1994-2000) and (2001-2006) respectively. The performance of the model was tested through statistical analysis such as Nash-Sutcliffe efficiency (NSE), coefficient of determination (R^2), percentage of bias (PBIAS), and root mean square error (RMSE).To develop future water scenarios, the daily temperature, and precipitation data were obtained from the CORDEX South Asia domain under three Representative Concentration Pathways (RCPs). The empirical quantile mapping method was used for the correction of the daily temperature and precipitation biases under the regional scale. The model was run for near (2007-2036), mid (2037-2066), and far-future (2067-2096) climate projections i.e. RCP2.6, RCP4.5, and RCP8.5. The resilience of watershed defined as the speed of recovery from dry conditions. The monthly Streamflow Drought Index (SDI) was used as an indicator of the dry condition. The resiliency of the watershed determines with the threshold levels of -0.5 and -1.0. The analysis indicates that the resiliency of the watershed has increased from 0.3 to 0.5 in the future under the RCP of 2.6. The value of resilience under the RCP of 4.5 is 0.29, 0.45, and 0.52 for near, mid, and far futures respectively. Under extreme climate conditions RCP 8.5, the watershed

resilience is 0.2 in the near future and 0.3 in the mid-future, and 0.6 for the far future. Therefore, it can be concluded that the health of the reservoirs will be very good in the future to stabilize the drought.