IMPACT OF CLIMATE CHANGE ON SEDIMENT YIELD OF MOUNTAINOUS WATERSHED: A CASE STUDY OF NARAN BASIN

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ABSTRACT

Climate change is an influence of natural or human interventions with atmospheric conditions. The present research evaluates the impacts of climate change on stream discharges and sediment yields of the 21st century for the Naran Watershed, Pakistan. For this research purpose, the study area is explained and its climate is characterized. Data validity for trend detection from observed data of period 1961-2010 was carried out through non-parametric statistical analysis.

Analysis of extreme indices has shown an increase in summer days, warm days, warm spell duration and consecutive dry days while a decrease in very wet days, maximum one day precipitation and maximum 5 days precipitation. Site-specific long-term persistent trends were determined. Hydro-climatic scenarios were constructed from trends as per format of downscaling model. Intra annual trend analysis has shown mix trends in minimum and maximum temperature as well as in precipitation which are insignificant. The analysis of inter-annual trends movement depicted climate reversibility during 1996.

Output of Hadley Climate Model version 3 (HadCM3) and economic-based Greenhouse gases (GHGs) emission scenarios A1B and A2 were chosen and Long Aston Research Station Weather Generator (LARS-WG) was selected for statistical downscaling of daily scale potential climate. Hydrologic model, Systeme Hydrologque Europeen TRANsport (SHETRAN) was selected based upon model capability, watershed characteristics and intended function. The model was setup using the watershed characteristics and parameterized with best-fit values using manual sensitivity analysis. Models were calibrated and validated with the observed

surface air-temperature, precipitation, stream flows and sediment yield data and results were found reasonable.

Simulation up to end of 21st century aggregated on annual scale, predicted changes with A1B scenario +1.8°C in minimum temperature, +1.7°C in maximum temperature and +6.5% in precipitation, whereas changes with scenario A2 are +1.6°C in minimum temperature, +1.4°C in maximum temperature and -4.2% in precipitation. The simulation results under A1B scenarios predicted changes -14% in streamflow and +15% in sediment yield. Similarly, A2 scenarios predicted changes -12% in streamflow and +13% in sediment yield.

It is inferred that impact of climate change on sediment yield is adverse and strong than streamflows. These predictive quantified impacts of site-specific climate-change on streamflows, and sediment yield from the mountainous watershed are quite productive and would be helpful for policy makers, planner and decision makers in the field of water resources and irrigation engineering.

Key words: Trend analysis, Intra-annual hydroclimatic variability, Extreme indices, Potential scenarios, Climate Change, Downscaling, Hydrologic modeling, Sediment yield.