

Assessment of recent temperature trends in Mangla watershed

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Abstract

Climate change in the region in terms of changes in temperatures may seriously affect snow melting rates in the watershed and hence flows at dam. The main source of flows is snowmelt and rainfall that varies with temporal and spatial scale. So, understanding of spatial and temporal variability of climatic parameters is most important for the management of water resources. The present study was conducted to test the existence of monotonic trends and relative change (step change) in the annual and seasonal regional maximum, minimum, and mean and diurnal temperature data produced by Thiessen polygon method from a meteorological network of stations in Mangla watershed for the period 1971-2010. Significant trends were detected by applying the student t test, Mann Whitney U, Spearman and Mann Kendall tests in time series of temperature for Mangla catchment and its sub-basins (Kanshi, Poonch, Kunhar and Neelum).

The results of this study revealed that Climate change is occurring more severe with warming trends in lower part of Mangla catchment whereas cooling trends were in higher part. The prevailing trends, caused by climate change, have an effect on the flows that should be considered by the water managers for better water management in a water scarcity country like Pakistan.

Keywords: Mangla watershed; Climate change; Trends; Temperatures; Regional.

1. Introduction

Scientific evidence indicates that due to increased concentration of greenhouse gases in the atmosphere, the climate of the Earth is changing; temperature is increasing and the amount and distribution of rainfall is being altered (Yue and Hashino, 2003; Andrighetti et al., 2009). The IPCC Scientific Assessment suggests that global average temperature may increase between 1.5 and 4.5°C, with a 'best estimate' of 2.0°C, in the next century with a doubling of the CO₂ concentration in the atmosphere. Global warming induced changes in temperature and rainfall are already evident in many parts of the world, as well as in Pakistan (IPCC AR4, 2008, Bates et al., 2008; Fowler and Archer, 2006). According to International Panel on Climate Change (IPCC, 2008), the global temperature has been increased by 0.13 °C (\pm 0.03°C) per decade over the last 50 years due to changing climate. Climate change over the last

century has been a subject of great topical interest. The potential adverse impact due to climate change worries the scientific community, as it could have a major impact on natural and social systems at local, regional and national scales. The climatologists (Parker and Horton, 1999; IPCC, 2001; Jones and Moberg, 2003) agree that there has been a large-scale warming of the Earth's surface over the last one hundred years or so. The globe is warming due to anthropogenic factors such as emission of greenhouse gases. The climate is changing due to global warming in the Hindukush-Karakoram-Himalaya (HKH) region. The warming in the higher Himalaya of HKH is greater than the global average temperature. For instance warming in Nepal was 0.6°C per decade between 1977 and 2000 (Shrestha et al., 1999). Another recent study indicate that warming is undergoing in major part of eastern HKH and increasing trend in the temperature was found at the rate of 0.01°C per year (Shrestha and Devkota, 2010).