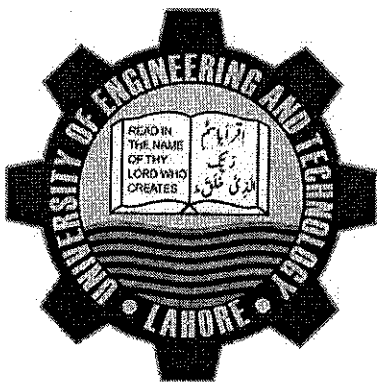
INVESTIGATION OF VARIABILITY IN HYDROLOGIC EXTREME EVENTS OVER UPPER INDUS RIVER BASIN



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ABSTRACT

Pakistan is a water stressed country and its available water resources are highly vulnerable to fluctuating climatic conditions. Investigation of streamflow variability is considered essential in providing the requisite assistance in the planning and management of agriculture, water conservation and hydropower projects. Therefore present study investigates the variations in the monthly, seasonal and annual streamflow timeseries at twenty (20) stations over the upper Indus river basin (UIRB) by using Mann-Kendall (MK), Spearman's rho (SR) and innovative trend analysis (ITA) methods. Moreover, variations in extreme flows were investigated by separating the daily streamflow timeseries into two categories; extremely low (< 10^{th} percentile) and extremely high (> 90^{th} percentile) flows.

At the monthly scale, 240 timeseries were investigated out which 134, 138 and 159 timeseries exhibited significant trends by using MK, SR and ITA methods, respectively. Whereas, seasonal and annual flows showed significant trends over 57, 62 and 75 timeseries based on MK, SR and ITA methods, respectively. Extremely low flows manifested significant increasing trends over seven (07) stations and significantly decreasing trend over three (03) stations whereas, only one (01) station exhibited significant increasing and four (04) stations significantly decreasing trends for extremely high flows. Therefore, it may be concluded that the variations in the extremely low flows will be more pronounced compared to extremely high lows in the future. This may constitute constant pressure on water resources availability in the lower Indus plains where most of the country's population is dependent on agricultural activities. It is believed that the results of this study could help to understand streamflow variability over UIRB and will have imperative insinuations for further studies.