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Detection and attribution of non-stationarity of flood characteristics across the Peninsular Basins of India

Anju K.v.¹ and Srinivas V.v.^{1,2}

¹Civil Engineering, Indian Institute of Science, Bangalore, India (anjukv@iisc.ac.in , vvs@iisc.ac.in)

²Interdisciplinary Centre for Water Research, Indian Institute of Science, Bangalore, India (vvs@iisc.ac.in)

The global hydrological cycle is substantially influenced by climate change, leading to notable alterations in hydroclimatic extremes. This encompasses extreme precipitation and temperature events, ultimately amplifying the frequency and intensity of floods. Analyzing the trends in floods and the related covariates provides insight into regional patterns of flood changes and shifts in flood generation mechanisms within the selected catchments. An improved understanding of the processes driving the historical changes in this natural hazard can provide basic information to enhance our preparation and mitigation efforts. Differences in significant trends (non-stationarities) in the magnitude and frequency of flood-related characteristics are determined for the river basins of Peninsular India through analysis of AMS (Annual Maximum Series) and POT (Peaks Over Threshold) series of streamflow over the period 1979–2019. Scrutiny of the trend detection results provided a better understanding of the strengths and limitations of AMS and PDS approaches in analyzing flood characteristics. Non-stationarity in the flood peaks is attributed to precipitation and temperature dynamics. This is accomplished by developing Generalised Pareto regression models to establish a relationship between the flood peaks and basin-averaged precipitation and temperature at different time scales preceding the flood events. Our findings emphasize the importance of understanding climatic conditions driving flood events and incorporating the same for assessing hydroclimatic risks with changing climate patterns, ultimately fostering more resilient and sustainable strategies.