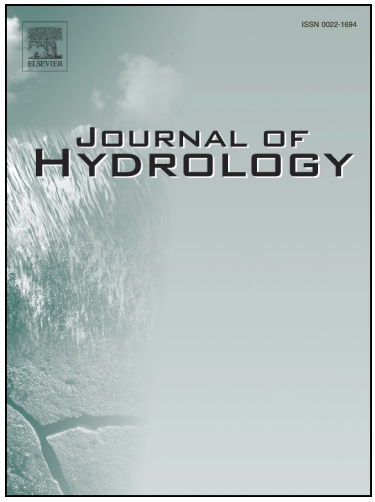

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Detection and attribution of non-stationarity in intensity and frequency of daily and 4-hour extreme rainfall of Hyderabad, India

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Abstract

The high intensity rainfall has a significant contribution in urban area flooding and understanding this high intensity rainfall over urban areas may help us to reduce the damage caused by urban floods. In this study, the changes in Hyderabad city daily and sub-daily (4-h) extreme rainfall are analyzed using various climate change detection indices. Our analysis indicates that there is increasing trend in intensity and frequency of Hyderabad city daily extreme rainfall. In addition, increasing trend in intensity and frequency of monsoon months' (June-August) 1 a.m. to 4 a.m., 5 p.m. to 8 p.m. and 9 p.m. to 12 a.m. and non-monsoon months' 5 p.m. to 8 p.m. extreme rainfall is also observed. Based on recent theoretical development in the Extreme Value Theory (EVT), the changes in extreme rainfall of Hyderabad city are further attributed through modelling the non-stationarity (trend) present in the extreme rainfall intensity and frequency. The extreme rainfall intensity is modelled with peaks-over-threshold (POT) based Generalized Pareto Distribution (GPD) and frequency is modelled using inhomogeneous Poisson distribution. The trend is incorporated as covariate in the scale parameter (σ) of the GPD and the rate parameter (λ) of the Poisson distribution. In this study, four physical processes, i.e. Urbanization, El Niño-Southern Oscillation (ENSO) cycle, local temperature changes, and global warming are used as covariates. Further, the combinations of these covariates are also considered for modelling the non-stationarity.

Based on covariates and their combinations, fifteen non-stationary models and one stationary model are constructed and the best model is chosen based on the corrected Akaike