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Gridwise Analysis of Trends in Precipitation and Temperature Indices for Climate Change Detection across India

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Abstract

The study analysed the spatio-temporal trends in extreme precipitation and temperature at the daily scale across India using six suitable indices of climate change suggested by the Expert Team on Climate Change Detection and Indices (ETCCDI). These indices are computed using gridded reanalysis products (derived from observed data) for the period 1979-2017 and the trends are evaluated using non-parametric Mann-Kendall (MK) test and regression analysis. The trends in extreme 'wet days' (daily precipitation greater than 95th percentile) and 'dry days' (daily precipitation lower than 5th percentile) are examined considering the entire year (annual) as well as monsoon months only (seasonal). Further, spatio-temporal trends in extreme 'warm days' (daily maximum temperature greater than 95th percentile) and 'warm nights' (daily minimum temperature greater than 95th percentile) and extreme 'cold days' (daily maximum temperature lower than 5th percentile) and 'cold nights' (daily minimum temperature lower than 5th percentile) are also investigated for the aforementioned period. About 12% of the total number of grid locations examined indicated significant increasing trend (at 5% significance level) in extreme 'wet days.' For 'dry days', 45% of the locations were found to have a significant decreasing trend. When the assessment is carried out for the monsoon season (June to September), 10% of the studied locations indicated significant increasing trend in extreme 'wet days' and 32% indicated significant decreasing trend in extreme 'dry days'. The number of 'warm days' per year increased significantly at 28% of the locations, while the number of 'cold days' per year decreased significantly at 37% of the locations. The number of 'warm nights' per year decreased significantly at 24% of the locations, while the number of 'cold nights' per year decreased significantly at 26% of the locations. Although the number of extreme warm- and cold- days and nights indicated remarkable changes in a substantial portion of the grid locations; the number of days (per year) with extreme diurnal temperature range (DTR) indicated significant change at only 3% of the locations. Such knowledge about spatial and temporal variations of precipitation and temperature extremes is expected to be helpful in understanding the changes in hydrological behaviour at regional scales.

Keywords: extreme precipitation and temperature, climate change indices, spatio-temporal trends