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Shifting precipitation pattern during Indian summer monsoon

Akanksha Sharma¹ and Ashok Priyadarshan Dimri^{1,2}

¹Jawaharlal Nehru University, School of Environmental Science, School of Environmental Science, New Delhi, India

²Indian Institute of Geomagnetism, Mumbai, India

Precipitation has a significant degree of temporal and spatial variability over the Indian region. A small change in precipitation frequency and its distribution may affect agriculture and water resources and can lead to extreme events such as flood and drought. Number of precipitating days and their spatial distribution has significant impact on many aspects of the socio-economic environment. In present study, 91-days climatology is used to enhance robustness and to reduce uncertainty of the time series. Further, Mann Kendall trend test and Pettitt's test for change point detection is used for analysis of the number of precipitating days and corresponding precipitation over India and its sub-regions. India Meteorological Department (IMD) gridded dataset and ERA5 reanalysis dataset having resolution $0.25^\circ \times 0.25^\circ$ is used for the period 1902-2020 and 1940-2020 respectively. Our results show that there is a positive trend of number of precipitating days and precipitation over northwest and negative trend over central northeast and northeast India. Indicating a westward shift of precipitation during monsoon season. Change point analysis shows majority of these changes occur after 1970. Positive precipitation anomaly is observed in the month of September over India, with the exception of the hilly and central northeast showing extension of higher precipitation from month of July-August to July-August-September. This extension is probably due to the strengthening of wind during recent time (1971-2020) which brought more moisture to the Indian landmass. Furthermore, increased moisture transfer from the Bay of Bengal has also been seen compared to the early period (1940-1970). Overall, the results of this study will help in understanding the impact of climate change on Indian summer monsoon that will assist in policy making and adapting water management practices.