

Title: Long-term trends and spatial variability in rainfall in the southeast region of Bangladesh: implication for sustainable water resources management

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Abstract: Accurate and in-depth rainfall studies are crucial for understanding and assessing precipitation events' patterns, intensities, and impacts, enabling effective planning and management of water resources, agriculture, and disaster preparedness. Despite many rainfall studies in Bangladesh at the national and regional scales, study on the spatiotemporal rainfall variability is still rare at the local scale. The current study aims to apply Mann–Kendall (MK), Modified Mann–Kendall (MMK), and Innovative Trend Analysis (ITA) techniques to assess the long-term annual and seasonal rainfall trends and variability over the southeast region of Bangladesh. Monthly rainfall data from ten Bangladesh Meteorological Department climate stations between 1981 and 2022 was used for the analysis on annual and four seasonal scales. The precipitation concentration index results showed significant variations in annual rainfall across the study area, whereas seasonal PCIs were consistent with moderate rainfall. According to standardized rainfall anomaly findings, each station experienced at least one severe to extremely severe drought episode during the 42-year study period. Homogeneity tests revealed significant breakpoints in some rainfall datasets, while 78% were declared homogeneous. MK, MMK, and ITA techniques revealed similar increasing and decreasing trend patterns throughout the study area. Annual rainfall showed an upward trend in the coastal part and a downward trend in the northern part of the study area, with monsoon rainfall exhibiting a similar trend pattern. The ITA technique outperformed the MK and MMK techniques in detecting trends, identifying significant increasing and decreasing trends in 76% (38 out of 50) of the observations, while the MK and MMK techniques detected trends in only 8% and 44% of the total observations, respectively. The outcome of the current study is expected to be helpful for the sustainable planning and management of water resources in the southeast region of Bangladesh.

Keywords: Mann–Kendall Test, Innovative Trend Analysis, Rainfall, Trend analysis, Sustainable water resources management

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