

Title: Comparative Trend Variability Analysis of Reference Evapotranspiration in Bangladesh Using Multiple Trend Detection Approaches

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Abstract: The identification of trends in reference evapotranspiration (ET_o) has an impact on regional and seasonal water resources, contributing to hydrological studies and effective water resource management. To that end, this study is intended to analyze the annual ET_o variability and trend from eighteen meteorological stations in Bangladesh from 1975 to 2017 using the Mann-Kendall (MK) test, the Modified Mann-Kendall (MMK) test, the trend-free pre-whitening Mann-Kendall (TFPW MK) test, and the Innovative Trend Analysis (ITA). A comparative investigation of those trend detection methods was carried out using the Pearson and Spearman correlation coefficient matrices. The detrended fluctuation model (DFM) was also used to examine the future sustainability of the ET_o trend. The MK and MMK test results show that fifteen and sixteen stations reported a negative trend, and of them, thirteen stations had significant negative trends ($p < 0.01$). The TFPW-MK test findings also reveal that thirteen stations had a significant negative trend ($p < 0.01$), while ITA identified seventeen stations as having significant negative trends ($p < 0.01$). Based on this study's test results and performance, the MK test appeared to be the best-performing method within the MK test family because it outperformed the others ($p < 0.01$). DFM results depicted improved future ET_o trends at seventeen locations, of which fourteen were significant. This study will be beneficial to climate-induced risks and provide a scientific base for rational guidelines for agricultural production in Bangladesh.

Key words: Reference Evapotranspiration (ET_o); Trend Analysis; Mann-Kendall Test (MK); Modified Mann-Kendall (MMK); Trend-Free Pre-Whitening Mann-Kendall (TFPW-MK);

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