

Title: Seasonal and annual trends in reference evapotranspiration and prediction using machine learning models across seven climatic zones of Bangladesh

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Abstract: The primary aim of this investigation is to examine the historical (1989–2020) and future trends and magnitude of Reference Evapotranspiration (ET_0) in terms of spatiotemporal measures, considering its significance as a hydro-meteorological parameter influenced by changing climate. The FAO-56 Penman-Monteith method is employed to analyze ET_0 , while the Modified Mann Kendall test is utilized to assess trends and Sen's Slope Estimator is used for magnitude analysis. The future prediction is conducted using Support Vector Machine (SVM), Artificial Neural Network (ANN), and Random Forest (RF) models. Results show an increasing ET_0 trend annually in the southeastern and northeastern zones, while decreased values are observed in other regions, particularly in the northwest (0.83 mm). Sen's slope estimator reveals distinct fluctuations in ET_0 , with notable disparities in the Southeastern, Northeastern, Southwestern, and South-Central zones. Notably, Chattogram and Sitakunda experience an ET_0 magnitude of 0.02 mm/Year, while other zones show a magnitude of 0.01 mm/Year. SVM outperformed other models, predicting rising ET_0 in various seasons. These findings offer insights for optimizing irrigation systems and sustainable water management under changing climatic conditions.

Keywords: Reference evapotranspiration Bangladesh machine learning spatial

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