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Abstract

Deep Learning Models for Reference Evapotranspiration Prediction in Bangladesh †

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Evapotranspiration is a critical component of water balance equations, playing a pivotal role in the water and energy cycle of the region. The accurate estimation of reference evapotranspiration (ETo) is crucial for effective regional water resource management and irrigation scheduling. This study employs deep learning models, including CNN, GRU, BiLSTM, and LSTM, to predict daily evapotranspiration using meteorological data from Bangladesh. In the present study, the dataset consisted of measured meteorological data collected on a daily basis, including parameters such as maximum temperature, minimum temperature, relative humidity, solar radiation, and wind speed. The dataset spanned a time period of 18 years, from 1 January 2000 to 31 December 2017. The dataset was split into two subsets: 70% of the data were allocated for training purposes, while the remaining 30% were allocated for the testing phase. The performance of these models was assessed using five accuracy matrices. A novel aspect of this research is that it utilized deep learning models to estimate reference ETo, an approach that is not commonly employed in the literature. In the case of the Sreemangal station, a comparative analysis of the CNN and GRU algorithms revealed superior performance, achieving the best values for various statistical matrices during both training and testing phases. The correlation coefficient values were approximately 0.95. Notably, the statistical parameter RMSE indicated superior results in the CNN and GRU models, approximately 0.225 and 0.174, respectively. The comparison suggests that deep learning models, particularly CNN and GRU, are well suited for accurate predictions with limited meteorological data. The outcomes of this research underscore the efficacy of deep learning methods in predicting evapotranspiration and identifying dominant variables influencing changes in the context of Bangladesh. These findings contribute valuable insights for regional water resource management and underscore the potential of advanced modeling techniques in enhancing predictive capabilities for critical hydrological processes.

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