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Application of Deep Recurrent Neural Networks for Flood Prediction and Assessment

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Recent years have seen an uptick in the frequency of flood records occurring in the United States, with South Carolina (SC) being particularly hard hit. This study developed various deep recurrent neural networks (DRNNs) such as Vanilla RNN, long short-term memory (LSTM), and Gated Recurrent Unit (GRU) for flood event simulation. Precipitation and the USGS gaging data were preprocessed and fed into the DRNNs to predict flood events across several catchments in SC. The DRNNs are trained and evaluated using hourly datasets, and the outcomes were then compared with the observed data and the National Water Model (NWM) simulations. Analysis suggested that LSTM and GRU networks skillfully predicted the shape of flood hydrographs, including rising/falling limb, peak rates, flood volume, and time to peak, while the NWM vastly overestimated flood hydrographs. Among different climatic variables that were forced into the DRNNs, rainfall amount and spatial distribution were the most dominant input variables for flood prediction in SC.