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Enhanced tropical cyclone inflow flood forecasts by using deep learning and spatial□temporal information

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Reliable Tropical Cyclone (TC) precipitation and flood nowcasting play an important role in disaster prevention and mitigation. Especially for small-scale reservoirs, timely and accurate inflow forecasts are required to provide safe space for capturing high flows without having to resort to hazardous and damaging releases. Numerous studies have investigated the ability of deep learning in TC precipitation nowcasts. However, few of them focus on the skill of deep-learned TC precipitation forecasts in inflow flood forecasts. In this study, a novel framework is developed by introducing TC track information together with antecedent precipitation in the Convolution LSTM model (PTC-ConvLSTM). The ConvLSTM forecast precipitation is then input to an event-based Xinanjiang hydrological model for inflow flood forecasting, and the propagation of errors from TC track forecasts to inflow forecasts is further analyzed. The results show that TC track information enables a further 5% improvement compared to outputs from ConvLSTM with only precipitation information. PTC-ConvLSTM precipitation nowcasts present a probability of detection (POD) greater than 0.34 for a threshold of 5mm/h in a lead time of 6h. The nowcasts-driven flood forecasts have an NSE greater than 0 with a lead time of 5h at least. It is also indicated that the 100km error in TC track forecasts could generally result in a 10% degradation in precipitation forecasts and a further 8% deterioration in the driven flood forecasts. The effectiveness of our model indicates that the precipitation nowcasts from deep learning have strong applicability in disaster mitigation.