Enhancing the radar-based mean areal precipitation forecasts to improve urban flood predictions and uncertainty quantification

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Abstract

The present study is aimed to correcting radar-based mean areal precipitation forecasts to improve urban flood predictions and uncertainty analysis of water levels contributed at each stage in the process. For this reason, a long short-term memory (LSTM) network is used to reproduce three-hour mean areal precipitation (MAP) forecasts from the quantitative precipitation forecasts (QPFs) of the McGill Algorithm for Precipitation nowcasting by Lagrangian Extrapolation (MAPLE). The Gangnam urban catchment located in Seoul, South Korea, was selected as a case study for the purpose. A database was established based on 24 heavy rainfall events, 22 grid points from the MAPLE system and the observed MAP values estimated from five ground rain gauges of KMA Automatic Weather System. The corrected MAP forecasts were input into the developed coupled 1D/2D model to predict water levels and relevant inundation areas. The results indicate the viability of the proposed framework for generating three-hour MAP forecasts and urban flooding predictions. For the analysis uncertainty contributions of the source related to the process, the Bayesian Markov Chain Monte Carlo (MCMC) using delayed rejection and adaptive metropolis algorithm is applied. For this purpose, the uncertainty contributions of the stages such as QPE input, QPF MAP source LSTM-corrected source, and MAP input and the coupled model is discussed.

Keywords : Mean areal precipitation forecasts, Long short-term memory, Bayesian approach, Uncertainty quantification, Urban flooding

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