Development of Precipitation nowcasting method using deep neural network based on XRAIN composite precipitation data

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Abstract

Precipitation not only affects daily life, but also leads to disasters due to sudden downpours and heavy rainfall. This article aims to improve the precipitation nowcasting method using a deep neural network. In this study, we use U-net, a deep convolutional neural network, for predicting continuous precipitation intensities at a lead time of 5 mins based on XRAIN (eXtended Radar Information Network) composite precipitation data, which is collected during warm seasons (June to October) from 2018 to 2022. In order to find the effect of the size of training dataset, two sizes of datasets are used for the U-net training. To improve U-net's performance, we tried adding batch normalization (BN) layers into it. CSI, FAR, and POD were used to evaluate the model's predictive capability for different precipitation intensities from 5 to 60 minutes ahead. To better understand and evaluate the precipitation nowcasting capability of the model, we chose the Extrapolation method based on Lucas-Kanade Method for Sparse Optical Flow as the object of comparison. The results show that U-net with BN layers performs more reliably than U-net and extrapolation methods with higher accuracy. U-net with BN layers cannot only predict precipitation field movement but also predict the change in precipitation intensity.