Comparison of key factors in radar-based quantitative precipitation nowcasting using deep learning

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Short-term rainfall forecasting within two hours is known as quantitative precipitation nowcasting (QPN), and it can be very useful in preventing damage from heavy rain in a short time. According to recent research, deep learning (DL) has become the leading method for QPN because of its improved performance when compared to traditional approaches. However, there has been little investigation of the various concerns for DL-QPN other than the DL model itself. In light of this, the following factors were investigated in this study: (1) the prediction design (single, recursive, or multiple prediction), (2) the DL model type (U-Net and ConvLSTM), (3) the input sequence length, and (4) the output future sequence length. We compared a total of 12 DL-QPN schemes while taking the four factors into account. The experiments were conducted over South Korea using weather radar data from 2011-2020. From the experiment, multiple time step prediction with U-Net showed better performance than other schemes. The length of the past and future sequences had a lower influence on the model performance than we expected. We also performed a sensitivity analysis for input time steps to determine the contribution of each prior time. The U-Net model depended significantly on the last time step of the input sequence, whereas ConvLSTM utilized information more evenly over all time steps. All DL-QPN methods showed the declining intensity problem as the lead time increased. With the comparison of McGill Algorithm for Prediction Nowcasting by Lagrangian Extrapolation (MAPLE), the common advantages and drawbacks of DL-QPN were discussed.

Key words: Quantitative precipitation nowcasting, Deep learning, U-Net, ConvLSTM

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