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Enhancing the Rainfall Forecasting Accuracy of Ensemble Numerical Prediction Systems via Convolutional Neural Networks

Abstract

Ensemble prediction systems are commonly used to demonstrate the potential uncertainty of weather forecasts. These systems also help provide weather predictions to prepare for disasters. Specifically, a type of prediction called a quantitative precipitation forecast (QPF) is calculated from the average of multiple forecasts. The probability-matched mean (PMM) method is used to improve these QPF predictions when they underestimate rainfall. However, the PMM method can exhibit limitations when dealing with certain types of rain patterns. To address this issue, this study focuses on improving short-term heavy rainfall predictions using an artificial intelligence (AI) algorithm that combines convolutional neural networks (CNNs), with a space-based attention mechanism [convolutional block attention module (CBAM)]. Four experiments were conducted to evaluate the new method, including those performed to optimize the timing of a 24-h QPF model, adjust the training dataset, and refine the training algorithm. Overall, the new approach successfully enhances rainfall prediction accuracy via AI techniques and has the potential to be applied in disaster preparedness operations.

Keyword

Ensemble prediction systems

Reference

Lin, K.-C., W.-T. Chen, P.-L. Chang, Z.-Y. Ye, and C.-C. Tsai, 2024: Enhancing the Rainfall Forecasting Accuracy of Ensemble Numerical Prediction Systems via Convolutional Neural Networks. *Artificial Intelligence for the Earth Systems*, **3**, 230105, https://doi.org/10.1175/AIES-D-23-0105.1.