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Evaluation of five global AI models for predicting weather in Eastern Asia and Western Pacific

Abstract

The recent advancements in artificial intelligence (AI) technology have significantly contributed to the development of machine learning-based weather prediction (MLWP) systems. This study evaluates five global AI weather prediction models—Pangu-Weather, FourCastNetv2 (FCN2), GraphCast, FuXi, and FengWu—using identical initial conditions from ERA5 to compare their performance in the Eastern Asia and Western Pacific region from June to November 2023. The evaluation employs Root Mean Square Error (RMSE) and Anomaly Correlation Coefficient (ACC) to assess forecast accuracy, along with analyses of typhoon track and intensity predictions. Results indicate that FengWu is the best-performing model, followed by FuXi and GraphCast, while FCN2 and Pangu-Weather rank lower. Furthermore, a simple multi-model ensemble approach—averaging forecasts from the five models—demonstrates improved accuracy, rivaling that of FengWu. However, despite FengWu's superior track predictions, it exhibits the largest intensity prediction errors.

Additionally, this study focuses on Typhoon Haikui as a case study to examine the performance of AI models in extreme weather events. Findings reveal that biases in predicting the position of the Western Pacific Subtropical High (WPSH) significantly impact typhoon track accuracy. While some AI models produce reasonable precipitation patterns, their resolution remains insufficient for regional applications, highlighting the continued necessity of high-resolution regional models. The study also finds variations in the AI models' ability to predict typhoon formation, with some models successfully forecasting it up to six days in advance. This research underscores the potential of AI-based weather models in terms of operational efficiency and forecast accuracy, while emphasizing the need for further improvements in resolution and extreme weather prediction capabilities.

Keyword
MLWP(Machine Learning Weather Prediction)

Reference
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