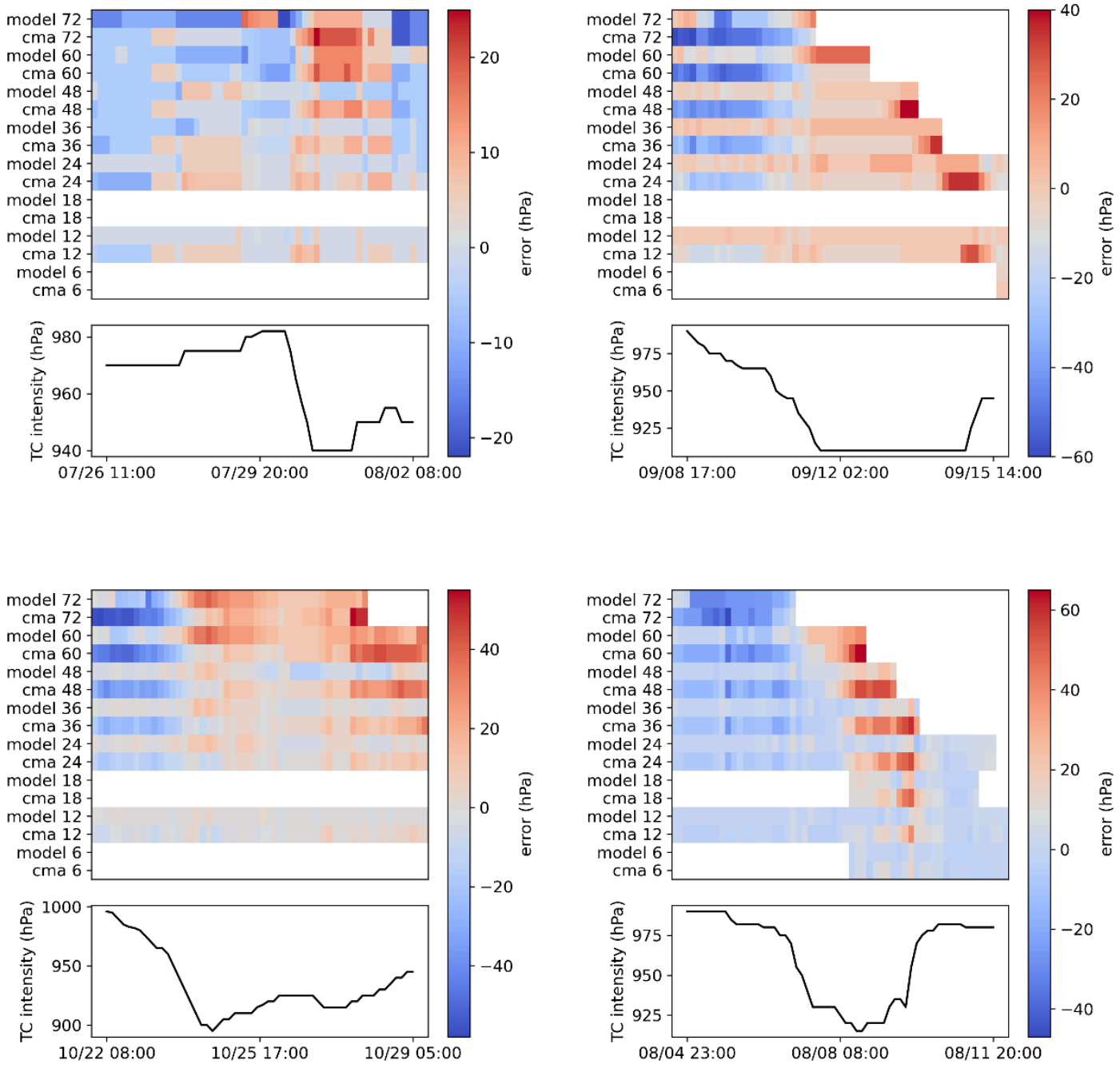
Using Machine Learing Method To Improve TC Intensity

Abstract

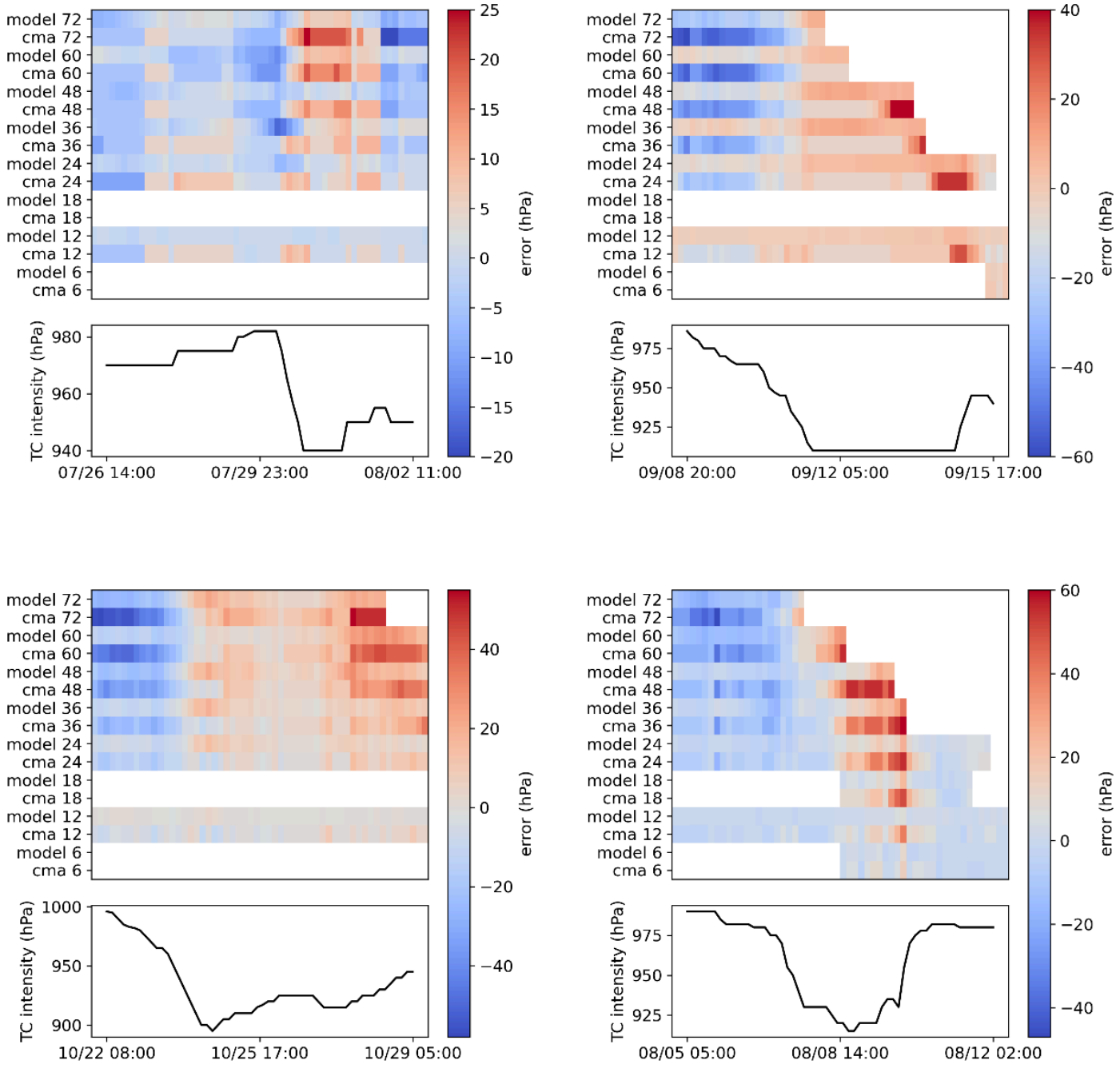
Tropical Cyclones (TC) have been a key research area in meteorology for the past 100 years. Despite numerous studies revealing dynamic mechanisms and forecasting techniques, TC intensity forecasting remains challenging due to the complexity of influencing factors. Machine Learning (ML), driven by big data, is gaining popularity in meteorological research for its outstanding performance in forecasting and classification. This study aims to use ML methods to reduce the error in TC intensity forecasts released by the China Meteorological Administration (CMA). By applying Long Short-Term Memory (LSTM) networks, this research examines the differences between the TC forecast data released by CMA and the TC best track data to provide more accurate TC intensity predictions. Preliminary results indicate that compared to the original CMA forecast data, the root mean squared error (RMSE) was reduced by 15% for 6-hourly forecasts and by 41% for 72-hourly forecasts. Additionally, compared to the model developed by Guangzhou University, which directly forecasts using LSTM, the RMSE was reduced by 16% for 6-hourly forecasts. Furthermore, the model's runtime has been significantly reduced due to the lightweight dataset.

Figures

the following figures arranged from top to bottom and left to right are Typhoon Nock-ten (201705), Typhoon Mangkhut (201822), Typhoon Yutu (201826), and Typhoon Lekima (201909). In the figure, the black line below represents the typhoon intensity data, and the colored grids above represent the forecast errors at different forecast times. Blank areas indicate the absence of forecast data at that time.



Comparison of Errors Between Meteorological Bureau Forecast Data and Classification Model Forecast Data for Four Cases (Pressure)



Comparison of Errors Between Meteorological Bureau Forecast Data and Classification Model Forecast Data for Four Cases (Pressure)