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Improvement of Hourly Precipitation Forecast Using a Time-lagged Ensemble based on Rapid Analysis and Forecasting NWP System

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The formation and development of short-term heavy precipitation caused by small and mesoscale convective systems are very rapid, and the prediction and warning of the location and period of precipitation are always difficult in the operational forecast. In recent years, the accuracy and resolution of the mesoscale model have been improved, and it plays more and more important role in forecasting and warning of strong convective weather. In this paper, based on hourly precipitation forecast from Rapid Analysis and Forecasting System GRAPES – RAFS (0.1 ° x 0.1 °) during August-September 2017, ensemble members are formed by the Time - Lagged ensemble forecast method, using the average TS score to calculate weight coefficients of corresponding ensemble members, and then frequency matching method is adopted to correct precipitation forecast bias. Six conclusions are drawn from this study: (1) for the Rapid Analysis and Forecast System GRAPES-RAFS, the most accurate precipitation forecast does not always come from the most recent ensemble member. Time-Lagged ensemble method can significantly improve the prediction ability of the model by automatic identifying the preferred forecast members; (2) the GRAPES-RAFS hourly precipitation forecast presents significantly systematic weak bias. After correcting by the frequency matching method, the hourly precipitation forecast is more close to the actual situation in the magnitude; (3) The more ensemble members, the higher the amplitude and percentage of the TS scores; (4) the Time-Lagged ensemble method works better for the Middle East China; (5) the frequency matching method works better for South of the Yangtze River, Southern China and southwest China, where precipitation exhibits higher frequency and greater strength; (6) the method can significantly improve the prediction capacity for the precipitation location, amount and the rainfall patterns in the strong precipitation process due to small and medium scale system.