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Meso-scale data assimilation experiments in low latitudes with GPS RO data

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It is important to prepare accurate initial fields for the forecast of typhoons with numerical models, and the resolution of the models is critical to predicted typhoon intensity. However we are usually forced to use the coarse-meshed initial fields produced by global model analysis in low latitudes, where tropical cyclones originate and develop. In this study, to prepare high-resolution (20 km horizontal grid spacing) initial fields for the simulation of tropical cyclones, the meso-scale 4-dimensional variational data assimilation (meso 4D-Var) system for the JMA hydrostatic meso-scale model (MSM) is modified so as to permit its use in low latitudes. In addition, the impact of GPS radio occultation (GPS RO) data on typhoon forecast is also investigated.

To investigate the effectiveness of the assimilation system and the influence of GPS RO refractivity both on the assimilated fields and subsequent model forecasts, the system is applied to the case of Typhoon USAGI in July 2007. The assimilation period of the experimental meso 4D-Var is 24-hour and typhoon bogus data is not assimilated. Numerical predictions are attempted using JMA NHM with 10km horizontal resolution. When the global analysis is used for the initial field, the typhoon is not formed in the forecast. By contrast, when the global analysis is replaced by the meso 4D-Var analysis in the experiment, the generation of the typhoon is successfully predicted. With GPS RO refractivity assimilated, the simulated typhoon intensity is closer to the best-track data. The results show that the modified meso 4D-Var system performs well in low latitudes and GPS radio occultation data is beneficial for typhoon forecasts.

Keywords: data assimilation, typhoon prediction, GPS radio occultation