Assimilation of Precipitation Data in Beijing Area

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The Meteorological Research Institute (MRI), collaborating with JMA, participates in the WWRP Beijing Olympic 2008 Research and Development Project (B08RDP). In this project, we developed the mesoscale ensemble system (MEPS), in which the JMA non-hydrostatic model (NHM) with a horizontal resolution of 15km (Saito *et al*. 2008) was employed. In a preliminary experiment conducted in 2006 and 2007 for B08RDP, the JMA operational regional analysis, which covers forecast domain of B08RDP, supplied initial condition of the control run. But in last November the regional analysis was replaced to the global analysis system, which has horizontal resolution of about 80km at the increment calculation of 4D-Var. To assimilate observation data without much thinning and to prepare accurate and high-resolution initial fields, the JMA operational meso-scale analysis system is modified so as to permit its use in China area.

Meso-scale analysis system is designed for the JMA meso-scale hydrostatic model. The domain of this system is 3600km×3200km over Beijing and 40 vertical levels up to 10hPa. Incremental method is used in the iteration of 4D-Var to save computational time, so inner model has 20km horizontal resolution, which is lower than outer model's 10km resolution. Assimilation window length is 3-hour, and observational data are collected into 1 hour time slot and assimilated 4 times in the window. Assimilated observational typical data are radiosonde, pilot balloon, wind profiler, aircraft, ship buoy, and Radar-AMeDAS analyzed rainfall. The satellite data such as, SSM/I, TMI, AMSR-E are also assimilated as retrieved one-hour precipitation amount and total precipitable water. And QuickSCAT sea surface wind can be assimilated. In this system, 3 hour rainfall amount observed by rain gauge data over China and 1 hour rainfall amount of STEPS (Bowler *et al.* 2006) data around Beijing area (500km×500km) are assimilated additionally. The rain gauge data are processed by averaging and interpolating before assimilation (Fig.1). These precipitation data are assimilated following the work of Koizumi *et al.* (2005). Because the initial time of B08RDP experiment is 12UTC, the assimilation cycle starts at 06UTC and the analysis field of 12UTC is utilized for initial condition of the control run.

Fig.2 shows the threat scores for 6-hour accumulated precipitation forecasts against the rain gauge observation over China. Verification period is 13 days from 25 July 2007. Meso-scale analysis is inferior to regional analysis to some extent because observation data during the 3-hour period just after the initial time are assimilated additionally in regional analysis. With rain gauge data assimilated, the threat score is slightly superior to others (Fig.2 (a)). Furthermore we can see STEPS analysis data also improve the forecast (Fig.2 (b)). But unnatural precipitation near the radar site was observed several times during test period, quality control of the observations is necessary to make better analysis fields.

Acknowledgement

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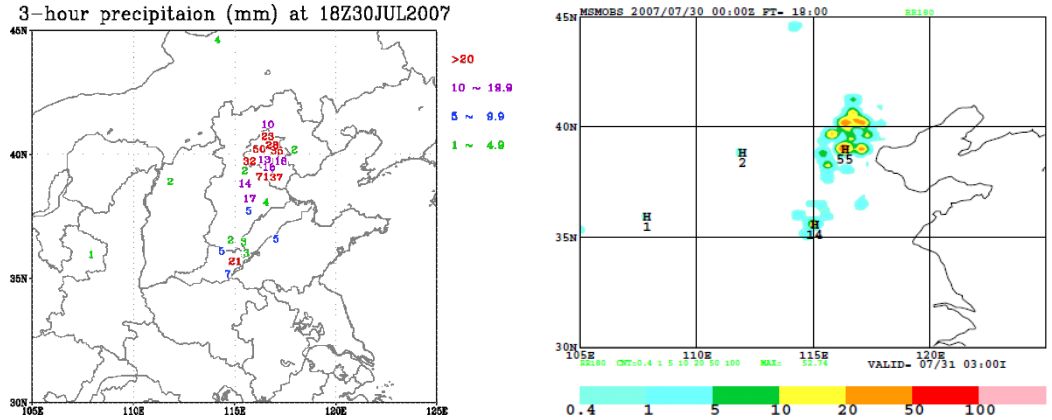

Fig.1. 3-hour accumulated precipitation data at 18UTC 30 July 2007. (a) rain gauge observations over China. (b) Processed assimilation data from rain gauge observations.

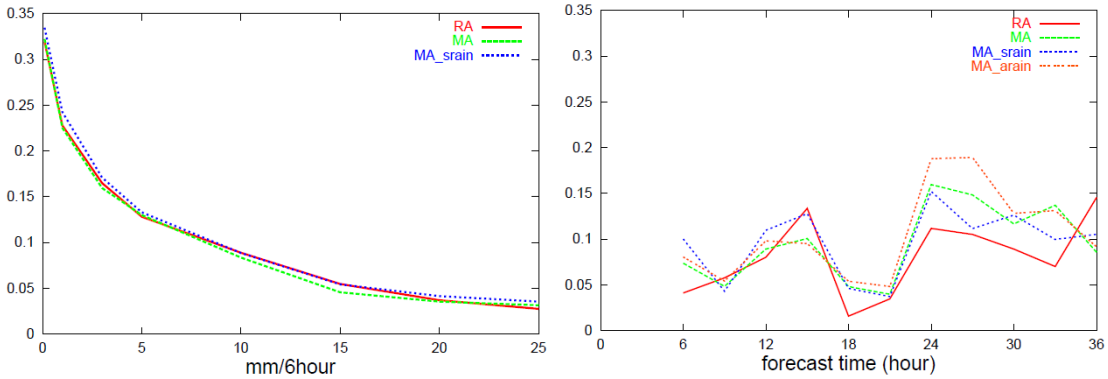

Fig.2. Threat score for 6-hour precipitation forecast against the rain gauge observation over China. Verification period is 13 days from 25 July 2007 (RA; regional analysis, MA; meso-scale analysis, MA_srain; meso-scale analysis with 3-hour accumulated rain gauge data, MA_arain; meso-scale analysis with STEPS analyzed rain data). (a) Verified in the domain of the common verification area (105°E-125°E, 30°N-45°N) of B08RDP (b) Threshold is 3.0mm/6hour and verified in the domain of STEPS data.

References

Saito, K. H. Seko, M. Kunii, M. Hara, T. Hara and M. Yamaguchi, 2008: Mesoscale Ensemble Prediction experiment for WWRP Beijing Olympic 2008 RDP -- 2007 preliminary experiment -- *CAS/JSC WGNE Research Activities in Atmospheric and Oceanic Modelling*. **38**. (submitted)

Bowler, N.E., Pierce, C.E., Seed, A.W., 2006: STEPS: A probabilistic precipitation forecasting scheme which merges an extrapolation nowcast with downscaled NWP. *Q. J. R. Meteorol. Soc.*, **132**, 2127–2155.

Koizumi, K., Y. Ishikawa, T. Tsuyuki, 2005: Assimilation of Precipitation Data to the JMA Mesoscale Model with a Four-dimensional Variational Method and its Impact on Precipitation Forecasts. *SOLA*, Vol.**1**, 45-48.