Japan area ensemble forecast using NHM-LETKF

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1. Introduction In WWRP Beijing 2008 Research and Development Project (B08RDP), inter-comparison of meso-scale ensemble forecast have been conducted. In the preliminary experiments of B08RDP, initial perturbations produced by normalizing the perturbation of operational one-week ensemble forecast (Saito, 2006) or by the global SV method were used. Besides these methods for initial perturbation, the performance of the perturbation produced by LETKF methods will be investigated. As the preliminary experiment, influences of the horizontal grid interval and horizontal resolution of observation data over the results of ensemble forecast are investigated.

2. Outline of ensemble experiments To investigate the influence of the grid interval and horizontal resolution of observation data, grid interval of 50km and 20km and observation data for global analysis (horizontal resolution 120km) and mesoscale model (20km) were used. From among the combination of the grid interval and observation data, following three experiments were performed; 50km-GA, 50km-MA and 20km-MA. Whole assimilation period is 12UTC 13th to 00UTC 17th August 2006. Period of one assimilation window is set to 6hours.

3. Results of ensemble experiment

a. Difference from observation data Number of observation data for GSM and MSM are 900-3800, 8000-16000, respectively, although the number of observation data varied with time (fig. 1). Figure 2 shows the RSM against the observation data. RMS from observation data in 20km-MA is much larger than those of 50km-GA and 50km-MA, especially in surface pressure and horizontal wind. When the experiment of 50km-GA and 50km-MA are compared, RMS of GA is slightly larger than that of MA, and RMS was gradually increased with time because the typhoon was approaching to Japan (fig. 2a and b). In 20km-MA, correction due to the assimilation of data became smaller with time (fig. 2c).

b. Horizontal distribution of ensemble mean and spread. Figure 3 shows the ensemble mean distribution of surface pressure and horizontal wind at the end of the assimilation, 00UTC 17th. The typhoons were reproduced in all experiments. However, when GA data was assimilated, pressure at the center of typhoon was larger and the weak rainfall region became wider. When the MA data was assimilated with the 20km-grid model, Typhoon was most developed and the depression of the center pressure became closer to the best truck data.

As for the spread, spreads in the experiments of 50km-GA and 50km-MA were large, although the spread at the boundary was small because the boundary was fixed (fig. 4). In 50km-GA, the spread was largest, and high spread region was seen on the southern part of typhoon. In the 20km-MA and 50km-MA, in which large number of observation data were assimilated, spread was smaller, and high spreads were seen only near the center of the typhoon. This difference seems to be caused by the resolution of the assimilated data.

4. Summary When the grid interval of 50 k m was used, GA data was not sufficient for the assimilation data.]When MA data of which data resolution is 20 km was used, the typhoon was developed, although the central pressure of the typhoon was still larger than the observed one. From these experiments, the proper resolution of observation data is needed to obtain the realistic analyses fields.

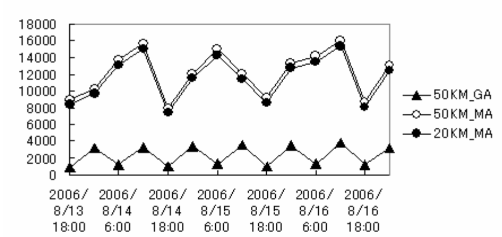

Fig. 1 Number of assimilation data at each cycle

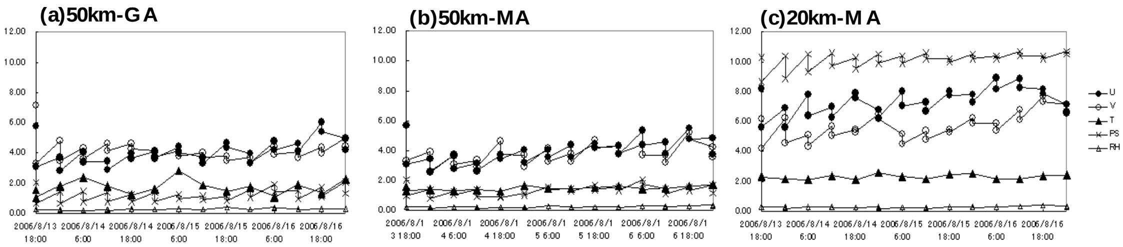

Fig. 2 Temporal variation of RMS in 50km-GA, 50km-MA and 20km-MA at each assimilation cycle. RMS was obtained from forecasted and analyzed values and the observation data

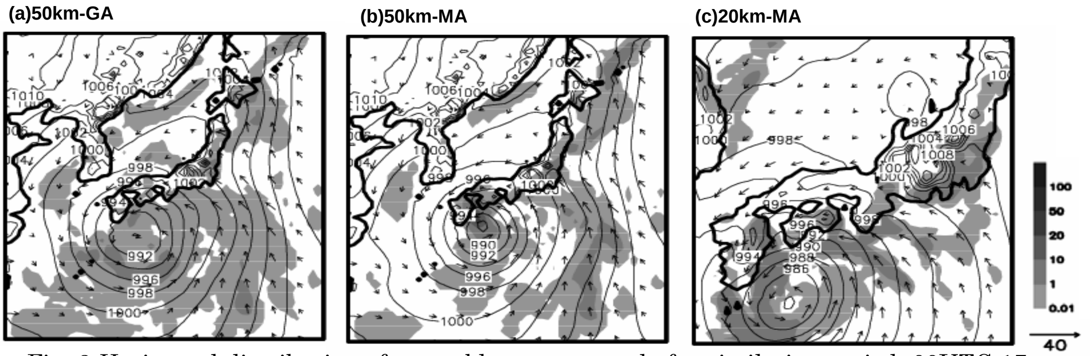

Fig. 3 Horizontal distribution of ensemble mean at end of assimilation period, 00UTC 17 August 2006. Shadow regions, contour and vectors indicate the rainfall, surface pressure and horizontal wind, respectively.

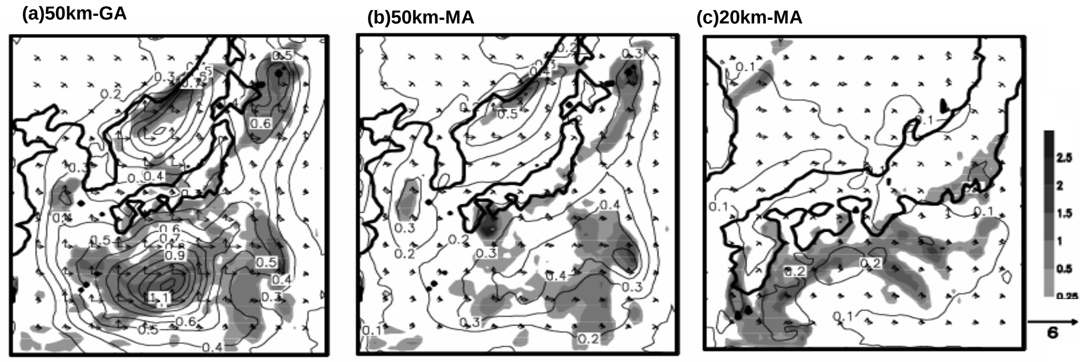

Fig.4 Horizontal distribution of ensemble spread at the end of assimilation period, 00UTC 17 August 2006. Shadow regions, contour and vectors indicate the rainfall, surface pressure and horizontal wind, respectively.