Preliminary Mesoscale Ensemble Prediction experiment for WWRP Beijing 2008 RDP

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The WWRP Beijing 2008 Forecast Demonstration / Research and Development Project (B08FDP/RDP) is an international research project for a short range forecast of the WMO World Weather Research Programme, which succeeds the Sydney Olympic 2000 Forecast Demonstration Project (Sydney 2000FDP). The B08FDP/RDP is divided into two components; the FDP component for a very short range forecast up to 6 hours based on the nowcasting, and the RDP component for a short range forecast up to 36 hours based on the mesoscale ensemble prediction system (MEPS). Collaborating with JMA, the Meteorological Research Institute (MRI) proposed its participation in the RDP component at the 1st WWRP B08 workshop held in 2005.

A preliminary test for B08RDP was performed for 8-24 August 2006 by five participant centers including MRI/JMA, NCEP, Meteorological Service of Canada, China Meteorological Administration and the Chinese Academy of Meteorological Sciences (CAMS). Main purposes of this test were construction of basic systems for MEPS and check of the data transfer. In the Tier 1 experiment, mesoscale ensemble predictions with a horizontal resolution of 15 km were conducted, and surface level data (2m temperature, 2m relative humidity, 10m winds, MSL pressure and 3 hour accumulated rain) at uniform 0.15 degrees common grids for a domain of 105°E-125°E, 30°N-45°N were transferred to CMA in the GRIB2 format.

MRI/JMA conducted 11 member meso-ensemble predictions with the JMA nonhydrostatic model (Saito et al., 2006a) which covers a domain of 3300 km x 3000 km (Fig. 1). This domain is slightly smaller than the recommended area in B08RDP (3500 km x 3000 km) and the southwestern corner of the verification domain is embedded in boundary relaxation layers (24 grids = 360 km).

Specifications of the experimental design are listed in Table. 1. Except horizontal resolution and domain size, most of them are same as in the JMA operational mesoscale model. Initial condition of the control run is given by the JMA operational regional analysis, while for the initial perturbations for ensemble members, perturbations from the JMA operational one week global EPS are employed after an appropriate normalization as in Saito et al. (2006b). Examples of the ensemble forecasts for a case of 15 August 2006 are shown in Fig. 2.

Figure 3 shows 24 hour forecast RMSEs of the control runs and the ensemble mean forecasts against the initial condition over the common verification domain. In all cases, RMSEs of the ensemble mean forecasts are smller than those of control runs. Similar tendencies are obtained for horizontal wind, relative hummidty and precipitation. Figure 4 indicates time sequences of the ensemble spreads during the verification period. Spreads of horizontal winds (U and V) increase up to FT=27, while the spread of MSL pressure slightly decreases after FT=7. These tendencies are attributable to the lateral boundary condition without perturbation. Compared with the forecast errors in Fig. 3, the forecast spreads are not necessarily large enough. Inclusion of perturbations in lateral boundary conditions as well as the alternative ways to give the initial perturbations are our next subjects. Developments of BGM and SV methods using JMA-NHM are underway.

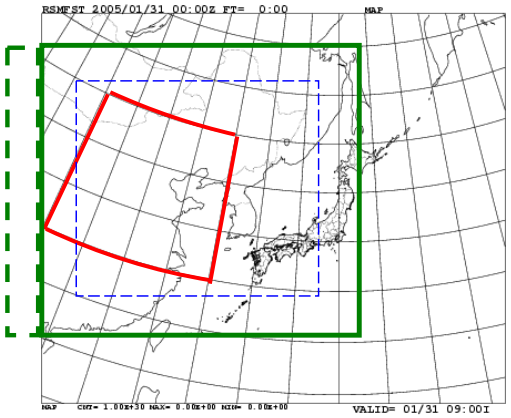

Fig. 1. Domain of the MRI/JMA preliminary experiment (solid rectangle). Fan-shaped sector over east China indicates the domain of 0.15 degree common verification grids (105°E-125°E, 30°N-45°N). Broken lines show the boundary relaxation area. Broken rectangle left of the model domain shows the size of the recommended domain.

Table 1. Specifications of the preliminary MEP experiment by MRI/JMA.

Forecast time (number of members)	36 hours (11 members)
Horizontal resolution (grid size)	Δx=15km (221×201) , Lambert conformal
Vertical levels	40 levels, Δz=40-1180 m
Initial condition for control run	JMA operational Regional analysis
Initial perturbation	JMA operational one week global EPS（normalized）
Lateral boundary condition	JMA operational Regional model 3 hourly (no perturbation)
Dynamics	HE-VI scheme, Δt=60 sec, Δτ=17 sec
Cloud microphysics	3 ice bulk method
Convective parameterization	Modified Kain-Fritsch scheme
Turbulence	Diagnostic TKE
Ground temperature	Prognostic 4 soil levels (no initial perturbations)

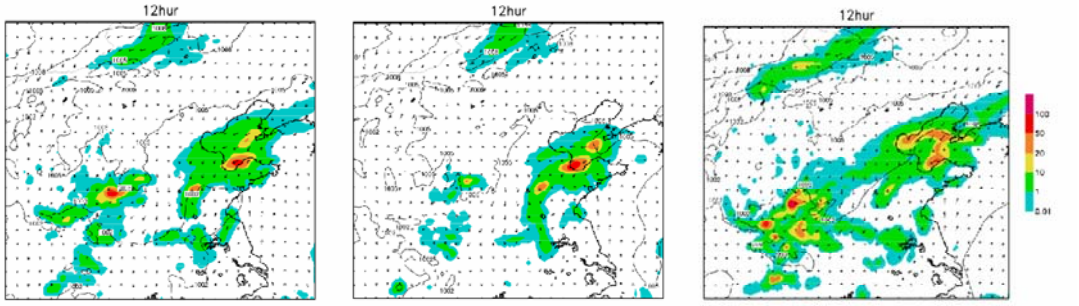

Fig. 2. 3 hour accumulated rain for 12 hour forecast of JMA-NHM with the control run (Left), member M02p (center), and member M02m (Right). Initial time is 12 UTC 14 August 2006.

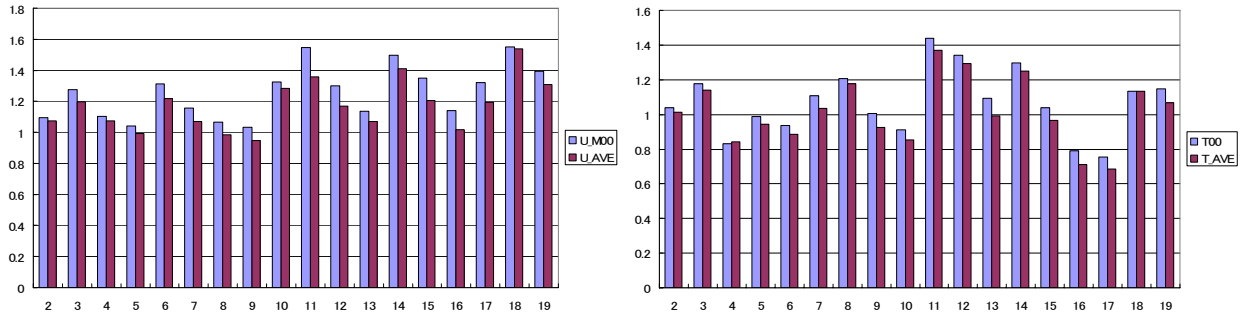

Fig. 3. 24 hour forecast RMSEs of the control run and the ensemble mean against initial condition over the verification domain. Verification period is 18 days from 2 to 19 August. Left） 10 m wind (U). Right） 2 m temperature.

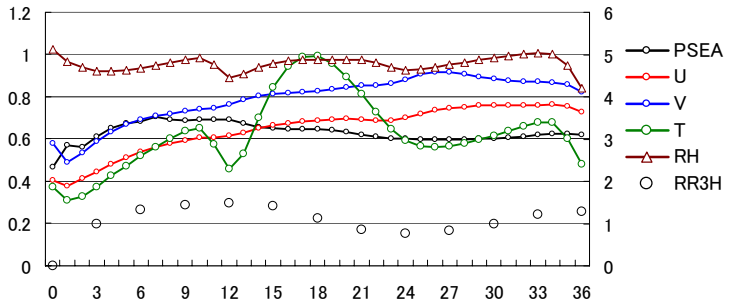

Fig. 4. Time sequences of the ensemble spreads. Unit of the left vertical axeis is ‘hPa’ for MSL pressure (PSEA), ‘m/s’ for horizontal winds (U and V), ‘K’ for 2m temperature (T), respectively. Unit of the right vertical axis is ‘%’ for relative humidity (RH) and ‘mm’ for 3 hour accumulated rain (RR3H), respectively.

References

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