Statistical verification of short range forecasts by NHM and WRF-ARW with 20 and 5 km resolution over Southeast Asia and Japan areas

Syugo Hayashi (shayashi @ mri-jma.go.jp)
Meteorological Research Institute, Japan

1. Introduction

In Southeast Asian countries, meteorological disasters (e.g. floods, windstorms) have frequently happened and caused much damage. To prevent and mitigate such meteorological disasters in Southeast Asia, we need an accurate numerical weather prediction (NWP) system. To investigate the NWP accuracy, we conduct 1.5-day forecast in 1-month by NHM (Saito et al., 2006) in the Southeast Asian region and validated the results. For the validation of the verifications of NHM, WRF-ARW (Skamarock et al. 2005) is also conducted with the same conditions of NHM with 20 and 5km horizontal resolutions. The verification results of both models are compared for the confirmation of the statistical NWP accuracy.

2. Experimental Design

For both models, the same domain size, time step and initial / boundary data are selected for fair comparison. The initial / boundary conditions are given by NCEP-GFS forecasts in every 3-hour by 1-degree. The Experimental settings of dynamical and physical processes are not changed from **the model's default namelist**. The domains of the models are 160 x 160 x 40 grids with 20 km in horizontal and 301 x 301 x 40 grids with 5 km horizontal resolution. The top heights of the models were 22km (about

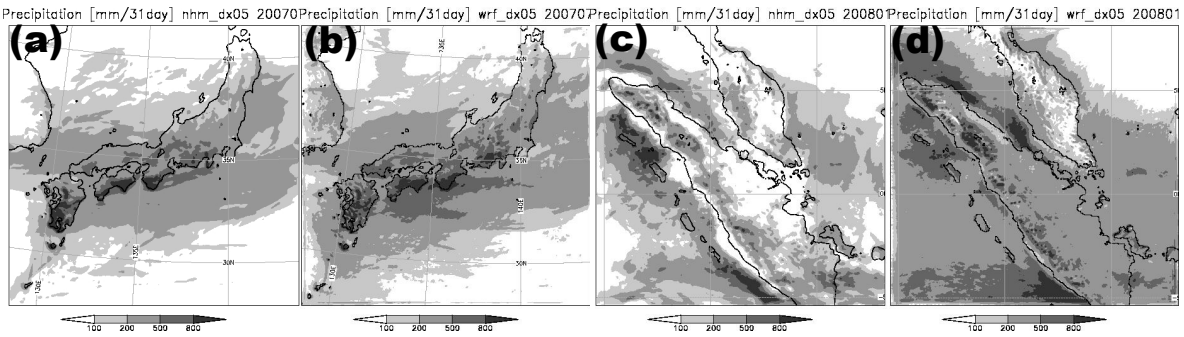

Fig. 1. (a) 2007-Jul. in Japan region, 1-month accumulated precipitation (later 24-hr x 31 forecasts) by NHM-5km over Japan. (b) by WRF-5km.
(c) 2008-Jan. in Southeast Asia region, by NHM-5km over Indonesia, (d) by WRF-5km.

45hPa). The 36-hour forecasts with 20 km models are conducted , and the 30-hour forecast with 5 km models are nested from 6-hour to 36-hour of 20 km models. The later 24-hours forecasts are analyzed for the verification. Two Simulation periods are selected. One is "July 2007 (31 days, rainy season in Japan)" for the Japan region, the other is "January 2008 (31 days, rainy season Indonesia)" for the Southeast Asia region.

3. Results

The accumulated precipitation by the 5 km models are shown in fig. 1. The Baiu-front on the Pacific side of Japan in July 2007 is well reproduced in both models (fig. 1ab). Figure 1cd the same as fig. 1ab except that it is for the Southeast Asia region in January 2008. The accumulated precipitation over the sea is overestimated in both models, especially the WRF's precipitation.

The equitable threat scores (ETS) against CMORPH of both models and both resolutions over the Japan region are shown in fig. 2a and over the Southeast Asia region are shown in fig. 2c. The ETS of the Southeast Asia region is one third of the ETS in July over the Japan region. The higher resolution model has the better ETS in both regions. NHM's ETS is slightly better than WRF's ETS. The bias scores (BS) are shown in fig. 2b over the Japan region and in fig. 2d over Southeast the Asia region. The BS of the Southeast Asia region is also worse than that of the Japan region, especially the WRF's BS for weak precipitation.

We are investigating the cause of these inaccuracy of NWPs in low-latitude. So, more improvements should be done for the simulations in low-latitude.

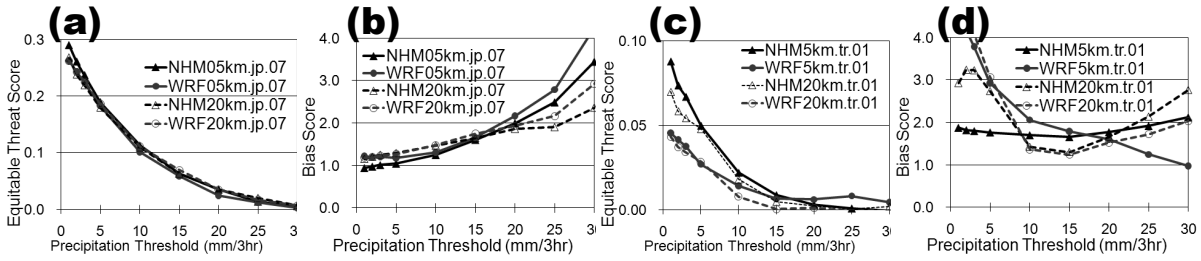

Fig. 2. (a) 2007-Jul., Equitable threat score over Japan. (b) Bias score over Japan. (c) 2008-Jan., Equitable threat score over Southeast Asia, (d) Bias score over SE Asia.

References

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