

Operational Implementation of the JMA Regional Four-Dimensional Variational Data Assimilation System

Toshiki Shimbori* and Ko Koizumi

Numerical Prediction Division, Japan Meteorological Agency

Tokyo 100-8122, Japan

The four-dimensional variational data assimilation (4D-Var) system for the meso-scale model (MSM) of Japan Meteorological Agency (JMA) has been operational since March 2002 (Ishikawa and Koizumi, 2002). In June 2003, JMA has also implemented the 4D-Var system for the regional spectral model (RSM) instead of the three-dimensional optimal interpolation system with a physical initialization (hereafter called 3D-OI). To support a short-term forecast up to 2 days, RSM makes forecasts over East Asia area with 20 km horizontal resolution and 40 vertical levels up to 10 hPa and also provides the lateral boundary condition for MSM. The 4D-Var system for RSM has 6-hour assimilation windows, i.e. ± 3 hours of the analysis time. Assimilated data are SYNOP, TEMP, Wind-Profiler, SHIP, BUOY, AIREP, AMW and Radar-AMeDAS precipitation analysis.

In order to evaluate the performance of the 4D-Var system for RSM in the operational environment, 6-hour forecast-analysis cycle experiments were performed for one-month period of June 2002 and January 2003. 51-hour forecasts were made twice a day (00 and 12 UTC initials). The root mean square error (RMSE) and the mean error of 500 hPa geopotential height for June 2002 are shown in Fig. 1. The RMSE of the 4D-Var system is smaller at every forecast time, which indicates that the 4D-Var has better performance than the 3D-OI system. On the other hand, the mean error that represents the bias of RSM does not differ so much in both systems. The threat and bias scores of precipitation forecasts over 1 mm/6 hour for June 2002 are shown in Fig. 2. The threat score of the 4D-Var surpasses that of the 3D-OI system for every forecast time. On the other hand, the change of the bias score is small. The errors and scores for January 2003 show similar results (figures not shown). An example of precipitation forecasts is shown in Fig. 3. In this case, heavy rain was observed at Tanegashima and Yakushima Islands, south of Kyushu. The forecast from the 4D-Var system shows a good agreement with the observation, while that from the 3D-OI system failed to predict the heavy rain.

* E-mail: shimbori@met.kishou.go.jp

Reference

Ishikawa, Y. and K. Koizumi, 2002: One month cycle experiments of the JMA mesoscale 4-dimensional variational data assimilation (4D-Var) system. Research Activities in Atmospheric and Oceanic Modelling, No. 32, WMO/TD-No. 1105, 01.26-01.27.

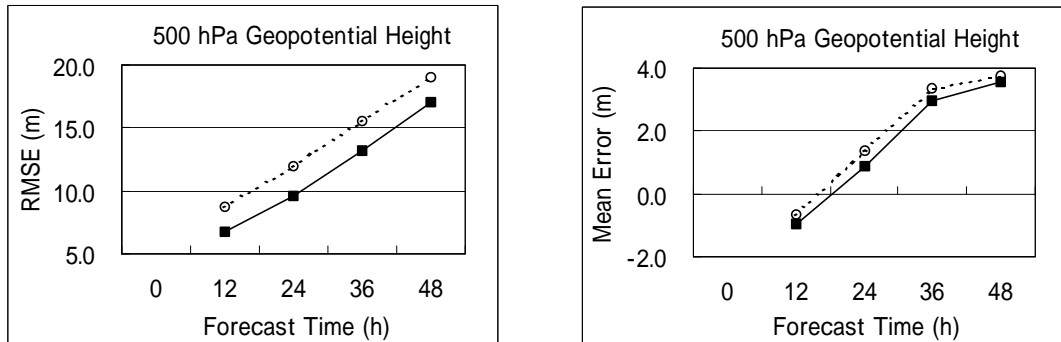


Fig. 1: Root mean square and mean errors of 500 hPa geopotential height against initialized analysis (1-30 June 2002), with 4D-Var (solid) and 3D-OI (dashed).

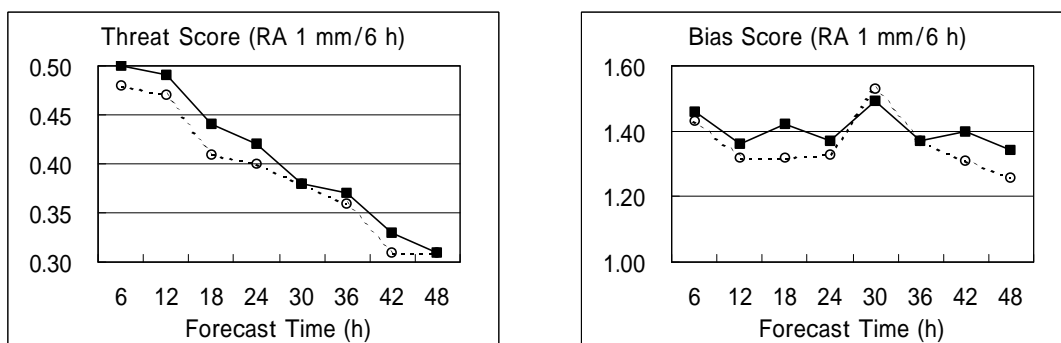


Fig. 2: Threat and bias scores of 1 mm/6 hour against 40 km-averaged Radar-AMeDAS precipitation analysis (1-30 June 2002), with 4D-Var (solid) and 3D-OI (dashed).

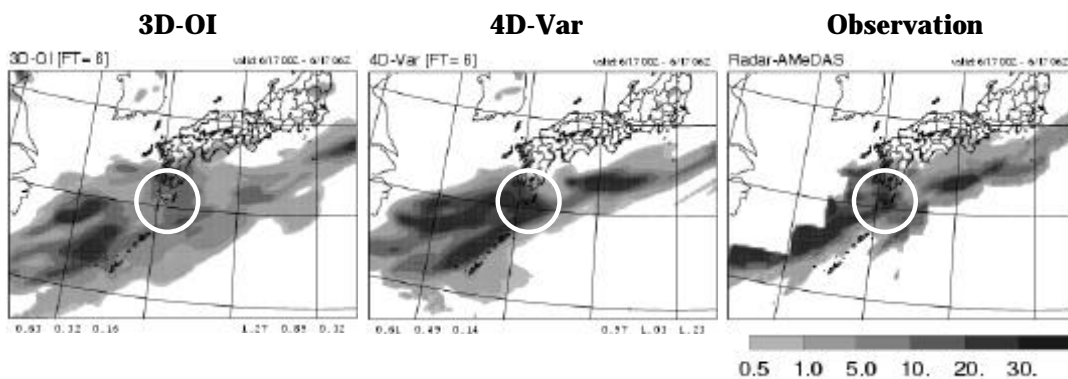


Fig. 3: 6-hour precipitation in 00-06 UTC 17 June 2002 (initial times are 00 UTC 17 June 2002).