

Changing the resolution of the inner loop of global 4D-Var at JMA

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1. Introduction

The four-dimensional variational data assimilation (4D-Var) was introduced into the JMA Global Spectral Model since February 2005. The incremental method (Coutier et al. 1994) is used for 4D-Var, and the resolutions of the outer and inner loops are TL319 and T63 respectively. Although T63 may be too rough for relatively small scale phenomena, especially for the analysis of typhoon, higher resolutions are not available due to the limitation of computer resources. As we are going to introduce a new computer system in 2006, which enable us to use a higher resolution inner loop for 4D-Var, we have developed 4D-Var of the higher resolution inner loop (T106) and examined its impact on the global model forecasts.

2. Parallel experiments

Parallel run tests to compare the performance of 4D-Var of T106 inner loop (Test) and that of T63 inner loop (Cntl) were conducted for each one-month period, August 2004 and January 2005. The model is Global Spectral Model and the resolution is TL319. The 216-hour forecasts were conducted from 12UTC for each day from 1st to 21st August and from 1st to 21st January and anomaly correlation was calculated from these 21 forecasts for each period.

Figure 1 is the comparison of the RMSE between the radio-sonde observation and the analysis fields at standard pressure levels for the experiment of August 2004. The RMSE of Test (red line) is smaller than Cntl (blue line) for both of temperature and zonal wind. It means the analysis field from the higher resolution inner loop is nearer to the observation.

Figure 2 is the comparison of the anomaly correlation of 500hPa height forecasts in the Northern Hemisphere between Test (red line) and Cntl (blue line) for August 2004 and January 2005. The anomaly correlation of Test is better than that of Cntl. Similar results were also obtained for almost all elements for all regions.

The T106 inner loop will be operational in March 2006.

3. References

Coutier, P., J.-N. Thepaut, and A. Hollingsworth, 1994: A strategy for operational implementation of 4D-Var, using an incremental approach. *Quart. J. Roy. Meteor. Soc.*, 120, 1367-1387.

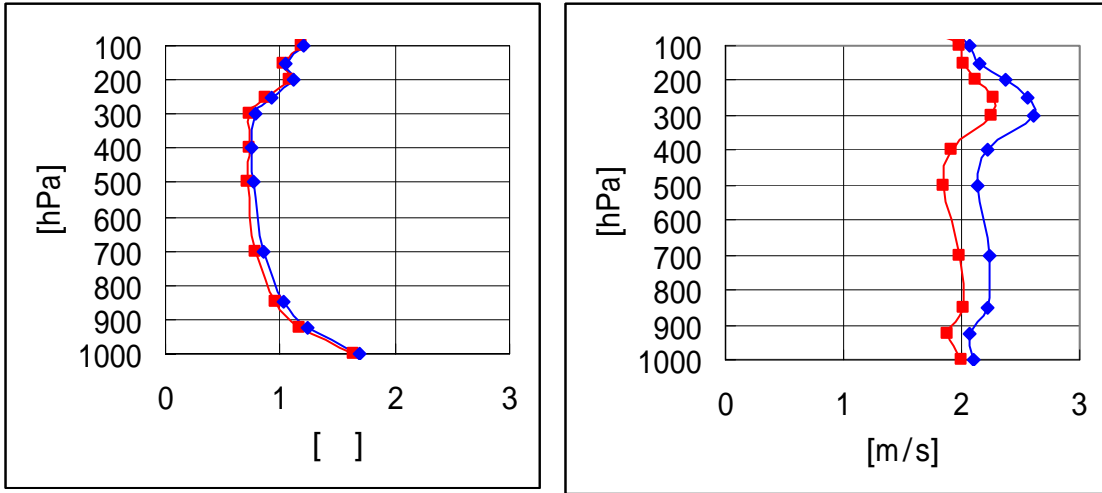


Fig.1 The comparison of the RMSE between the radio-sonde observation and the analysis fields at standard pressure levels for the experiment of August 2004. The left and right figures are for temperature and zonal wind respectively. The red line means Test and the blue line indicates Cntl.

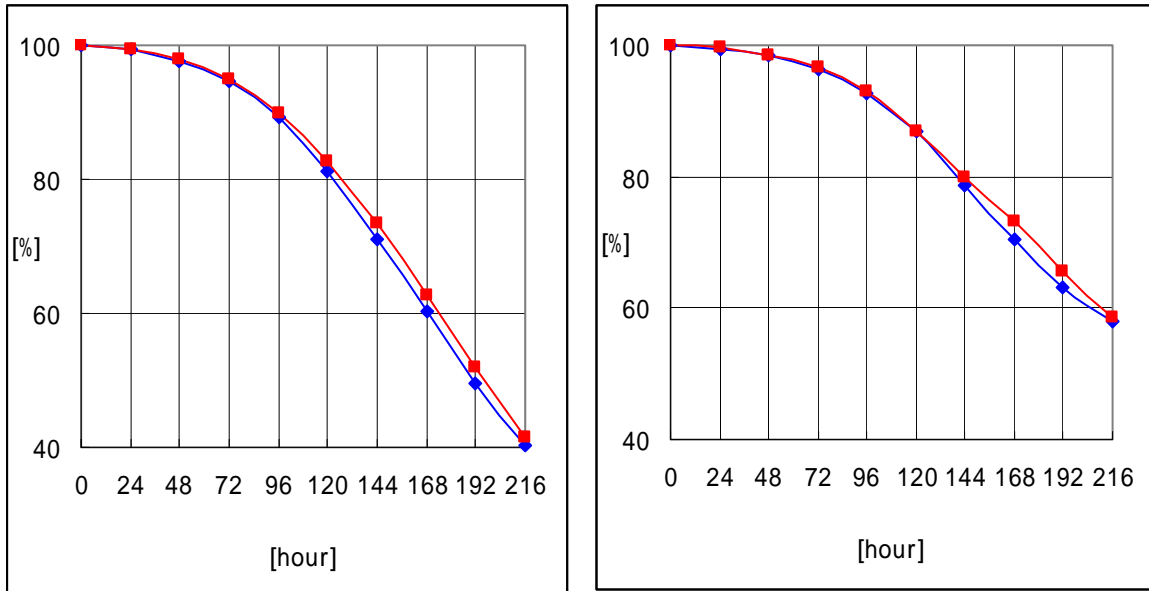


Fig.2 The comparison of the anomaly correlation (%) of 500hPa height forecasts in the Northern Hemisphere for August 2004 (left figure) and January 2005 (right figure) for each forecast hour. The red line means Test and the blue line indicates Cntl.