15A.2

HIGH RESOLUTION GLOBAL MODEL OF KMA – PRELIMINARY RESULTS

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1. INTRODUCTION

The Korea Meteorological Administration (KMA) has operated the Global Data and Assimilation and Prediction System (GDAPS) which has an origin in a global spectral model T106L21 GSM8911(JMA, 1992) developed by the Japan Meteorological Agency(JMA) since 1998. Since KMA constructed the GDAPS in 1998, many work have been conducted in an effort for improving analysis system and horizontal and vertical resolution of GDAPS(hereafter T213L30) has the 3dVar analysis system and T213L30 resolutions which represent a triangular truncation of 213 waves in horizontal and 30 levels in vertical. Additionally, the top of current GDAPS is 10hPa whose level can present up to lower stratosphere. The analysis system in the T213L30 also contained the direct 1dVar system for the assimilation of ATOVS in November 2001.

The T213L30 with 3dVar analysis system shows good performances for short range forecast by 3 days compared to the performance of global models operated by other meteorological centers. However, GDAPS still need to be improved in the performance of medium range forecast over 4 days. There exist a couple of prominent systematic errors in the T213L30 such as the rapid growth of a pressure system in the upper atmosphere for medium range forecast over 4 days and wrong forecast for typhoon system. Thus it has been a challengeable task for KMA to overcome above systematic errors in the T213L30. An intercomparison of the T213L30 and current JMA's global model was performed to understand the systematic errors described in the T213L30. Though the intercomparison work, KMA found that the systematic errors of the T213L30 resulted from unreasonable simulation for a couple of meteorological variables in the low stratosphere compared to the JMA's global model such as an unrealistic structure in zonal wind, an unbalanced radiation equilibrium, and the higher temperature fields.

Due to the results performed in the previous studies(e.g. Byron 1991) that extending the top of the model along with increasing vertical and horizontal resolutions of the model would be helpful for dealing with wrong structures in the low stratosphere, KMA considered a new GDAPS to improve the performance employing higher resolutions both vertically and horizontally and extending the model top. Owing to significant expansion of computer resources by successful installation of the new supercomputer Cray X1-3/192-L at KMA in November 2004, it was possible for KMA to establish the new high resolution model (hereafter T426L40). A little bit more detailed information about T426L40 and the preliminary results for the simulation of the T426L40 are presented in section2 and 3 respectively.

2. THE NEW RESOULTION MODEL

The T426L40 has been on the semi-operation four times a day with 6-hour analysis window expecting the production of more detailed information

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according to the increase of the resolution as well as reducing the systematic errors in the T213L30 since 18 February 2005. The T426L40 has a triangle truncation of 426 waves in horizontal which is correspond to about 30km and 40 levels of $\sigma - p$ hybrid coordinate in vertical with the top of 0.4hPa. This vertical height can contain up to the whole stratosphere from surface rather than up to only the low stratosphere in T213L30.

Although there were the significant changes for resolutions in T426L40, no changes attempted for the physical processes on the T426L40 compared to T213L30. The proper surface boundary data and climate data as well as the initial condition from the analysis system are also indispensable for constructing a numerical model. Thus the basic data sets related to the surface boundary condition, climate data for T426L40 are newly prepared to provide more realistic conditions in the T426L40 compared to T213L30(Fig.1)

3. PRELIMINARY RESULT

The T426L40 with the higher resolutions and the higher model top than those of T213L30 shows reasonable forecasts for the large-scale atmospheric structure compared to the T213L30. Fig. 2 depicts the differences for the zonal average temperature and wind structures between analysis fields and the forecasts of T426L40 (Fig 2.a) and T213L30 (Fig. 2.b) during October 2004. The T213L30 (Fig. 2.b) has an unreasonable warmer cold pool located in between tropopause and the lower stratosphere while the T426L40 (Fig 2.a) revises the warm bias for the cold pool and describes reasonable structures vertically. The location and the intensity of a polar cold pool over the Northern Hemisphere in the T426L40 are more realistic than those in the T213L30.

Compared to the T213L30, furthermore, the T426L40 shows better results for medium range forecast over 4 days. Fig. 3 depicts the monthly mean anomaly correlation for 850hPa temperature and 500hPa geopotential height. As shown in Fig. 3, the 426L40(the thick solid line) shows higher value for the medium range forecasting over 4 days over all of the verifying regions, especially over the tropical region with the prominent improvement of predictability.

Although KMA has a milestone for constructing the new high resolution global model T426L40, overall, the T426L40 should continually be tuned in the many fields, i.e. physical processes, to produce the best possible forecast.

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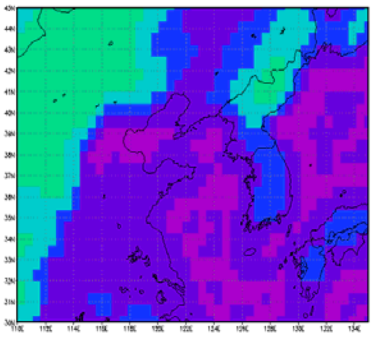
Table 1. The physical processes used in T426L40.

Radiation	Short wave: 2-stream approximation Long wave: Broad-band flux emissivity
PBL	Non local(Holtslag and Boville, 1993)
Cloud	Diagnostic(Satio et al, 1988) Sundquist(1978)
Convection	Kuo scheme (Kuo, 1974)
Land surface	SiB(Sellers et al., 1986)
Gravity drag	Iwasaki et. al. (1989)

a) T213L30



b)T426L40

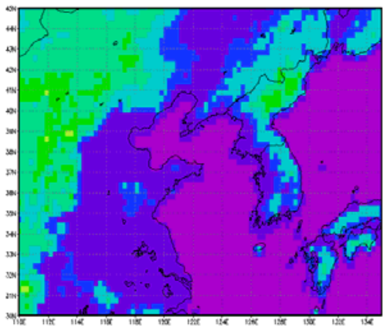
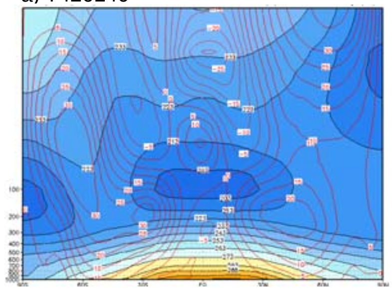


Fig.1. The model topographies over (in) the East Asia region including the Korean peninsula a) for the T213l30 and b) for the T426L40.

a) T426L40



b) T213L30

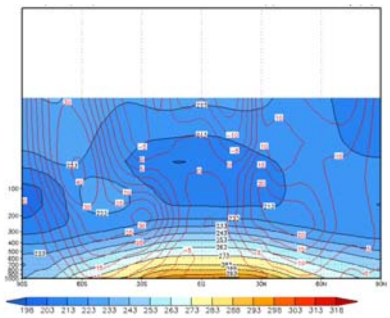


Fig.2. The zonal-mean cross sections of temperature(shaded) and zonal wind(contour) in October. a) for the T426L40 and b) for the T213L30

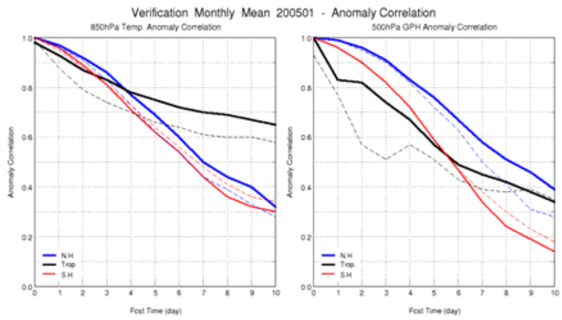


Fig.3. The monthly mean anomaly correlation scores for 850hPa temperature(left) and 500hPa geopotential height(right). The thick solid line and the dotted line indicate the anomaly correlation for T426L40 and for T213L30, respectively. The blue, the black and the red lines indicates the values over Tropic, Northern Hemisphere and Southern Hemispheres, respectively.