# Use of temperature data from radio-sonde observations in place of geopotential height in the JMA global 3D-VAR

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## 1. Introduction

JMA has a plan to introduce the variational quality control of observational data (VarQC) (Andersson 1999) to the global analysis in the near future. Since it is favorable for the VarQC that there is no correlation among observational data, assimilation of temperature data from radio-sondes was tested in place of geopotential height, which has strong vertical correlation of observation errors. Though the main purpose of the work is to prepare for the introduction of VarQC, the use of temperature data showed positive impacts on forecast skill. The assimilation of temperature data from radio-sondes has been operational since 15$^{th}$ April 2004.

## 2. Modification to the assimilation system

Several modifications were made to the assimilation system to introduce the temperature data assimilation.

First we removed the vertical correlation of observation errors in radio-sonde data. Geopotential height data at a certain level are usually made from temperature data below that level so their errors are strongly correlated. On the other hand the other elements including temperature are observed independently so their errors are less correlated than geopotential height data. Therefore we can assume that all radio-sonde data are mutually non-correlated when using temperature data instead of geopotential height data.

Second we decided to use the data at significant levels in addition to the data at standard pressure levels. Because geopotential height data at a certain level are usually made from temperature data below that level, we should use as much temperature data as possible to conserve the information content.

Third we recalculated all the observation errors at each level from the statistics of the departure values between the observational data and the first guess i.e. 6hour forecasts (Dee and da Silva 1999). The period of the statistics is one year in 2002.

## 3. Parallel experiment

Parallel experiment to compare the performance of assimilation of radio-sonde temperature described above (Test) and that of radio-sonde geopotential height (Control) were conducted for one-month periods, July 2002 and December 2002, respectively. The model is global spectral model with the resolution of T213. The 216-hour forecasts were

conducted from 12UTC for each day from 1st July to 21st July and from 1st December to 21st December and anomaly correlation was calculated from these 21 forecasts for each period.

Figure 1 is the comparison of the anomaly correlation of 500hPa height between Test (red line) and Control (blue line) for July 2002. The anomaly correlation of Test is slightly better than that of Control in all the regions. Similar results were also obtained for December 2002.

## 4. References

Andersson, E., and H. Jarvien, 1999: Variational quality control, Q. J. R. Meteorol. Soc., 125, 697-722.

Dee, D. P. and A. M. da Silva, 1999: Maximum-likelihood estimation of forecast and observation error covariance parameters. Part I: Methodology. Mon. Wea. Rev., 127, 1822-1834.

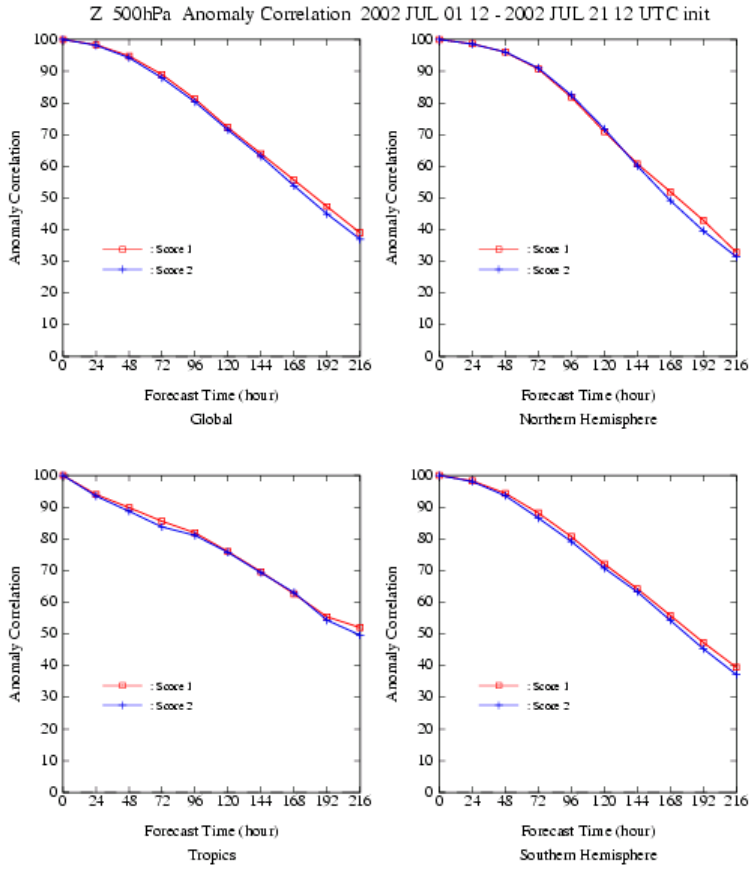


Fig.1 The comparison of the anomaly correlation(%) of 500hPa height of July 2002
The upper left panel is for the globe, the upper right one is for the northern hemisphere, the lower left one is for the tropics and the lower right one is for the southern hemisphere. The red line is for temperature assimilation (Test) and the blue line is for geopotential height assimilation (Control).