Operational use of ASCAT ocean vector wind data in JMA's mesoscale NWP system

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1. Introduction

Assimilation of scatterometer ocean vector wind (OVW) data is expected to improve lower-level initial wind fields for weather forecasting, as confirmed by JMA's use of ASCAT (-A and -B) OVW data in its global NWP system since July 2009 (Takahashi 2010, Moriya 2014). In December 2015, JMA began operational utilization of ASCAT OVW data in its mesoscale NWP system after results from observing system experiments (OSEs) had indicated related improvements in analysis and forecast fields. This report outlines the impact of ASCAT OVW data on JMA's mesoscale NWP system.

2. Data quality investigation

A data quality investigation was conducted by means of first-guess departure (observation – background) statistics using the whole data set for 2014. The results showed that the first-guess departure largely followed Gaussian distribution with a mean error of 0.14 m/s and a standard deviation of 1.4 m/s, which are comparable to the corresponding figures for the global NWP system.

3. Verification results

OSEs were performed using JMA's mesoscale NWP system for individual periods of approximately a month for winter 2014 and summer 2014 to determine the impacts of ASCAT OVW data. The control experiment (CNTL) had the same configuration as the operational system, and the test experiment (TEST) was exactly the same as CNTL except for the additional use of ASCAT OVW data.

Figure 1 shows the normalized difference of standard deviation (STDV) for the first-guess departure of wind speed with regard to several wind observations used as baselines. STDV is reduced in particular at lower levels, indicating that the difference in the first-guess wind field and observational data decreases with assimilation of ASCAT OVW data. Similar results were also found for other elements such as mean sea level pressure and brightness temperature from satellite observation.

Figures 2 and 3 show precipitation forecast scores. The equitable threat score for heavy rain (40 mm/3 hours) in the summer experiment and moderate rain (10 and 30 mm/3 hours) in the winter experiment improved, while no particular improvement was observed in the bias score for either experiment.

The benefits of ASCAT OVW data utilization in JMA's mesoscale system were thus identified, and JMA began operational assimilation of the data in December 2015.

References

Takahashi, M., 2010: Operational use of Metop-A/ASCAT Winds in the JMA Global Data Assimilation System. *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.*, **40**, 01.39-01.40.

Moriya, M., 2014: Utilization of Metop-B data in JMA's Operational Global and Mesoscale NWP Systems. *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.*, **44**, 01.13-01.14.

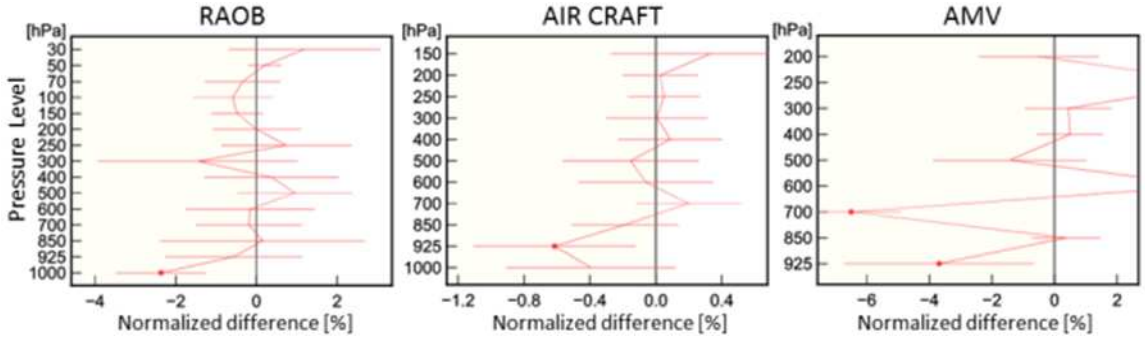

Figure 1: Normalized difference of STDV for the first-guess departure of wind speed ($(STDV_{TEST} - STDV_{CNTL}) / STDV_{CNTL}$) with regard to rawinsonde (RAOB) observation, aircraft observation and AMVs in the January 2014 experiment. Negative values represent improvement. The horizontal axis indicates normalized STDV difference and the vertical axis indicates vertical levels. The error bars represent a 95% confidence interval, and the red dots represent statistically significant values.

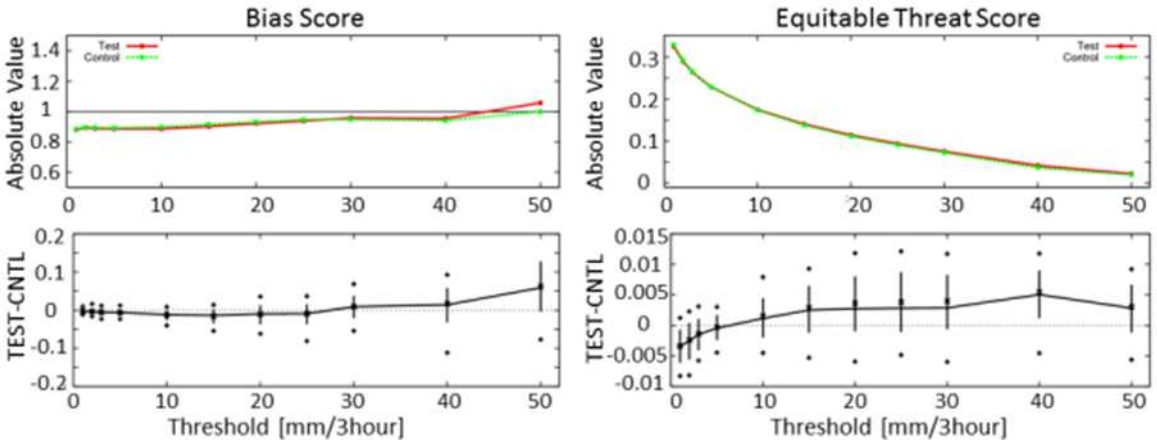

Figure 2: Precipitation forecast scores in the July 2014 experiment. The top figures show absolute bias scores (left) and equitable threat scores (right). The red and green lines represent TEST and CNTL, respectively. The bottom figures show TEST – CNTL for the bias score (left) and the equitable threat score (right). The error bars represent a 95% confidence interval, and the two dots at each threshold represent the max./min. difference.

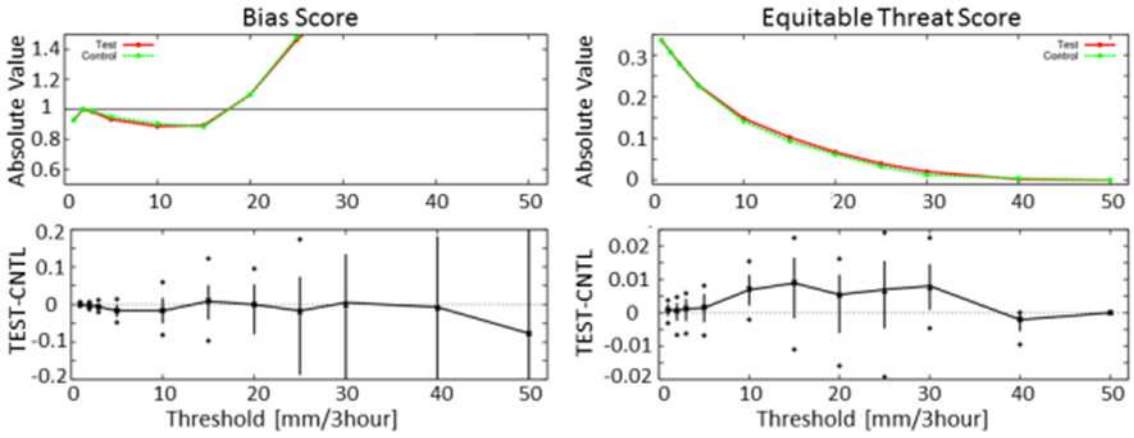

Figure 3: As per Fig. 2 but for January 2014