Recent Updates of the JMA Hourly Analysis

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1. Introduction

The JMA hourly analysis provides an hourly picture of three-dimensional temperature and wind distribution to assist forecasters in monitoring the atmosphere. A 3D-Var analysis is performed on a domain covering Japan and its surrounding area (about 3,600 km x 2,880 km) at a resolution of 5 km using the latest forecast from the operational mesoscale model (MSM) as the first guess. The observations assimilated in the analysis are from wind profilers (wind), Doppler radars (radial velocity), ACARS (Aircraft Communications Addressing and Reporting System, wind and temperature), satellite AMV (Atmospheric Motion Vector, wind), and AMeDAS (Automated Meteorological Data Acquisition System, surface station data over Japan, wind and temperature). The data cut-off time is set at 20 minutes past the hour to enable distribution of the product before 30 minutes past the hour.

2. Surface filter

A surface filter has recently been introduced to remedy the excessive analysis increment often found over the sea near the coastline. This unreasonably large increment is due to the assimilation of densely distributed surface observations on land (data from AMeDAS). In order to obtain a good fit to the surface observations on land, the 3D-Var analysis uses a short background error correlation distance and a small observation error on the surface. Thus, the surface field on land typically has a large increment. However, this

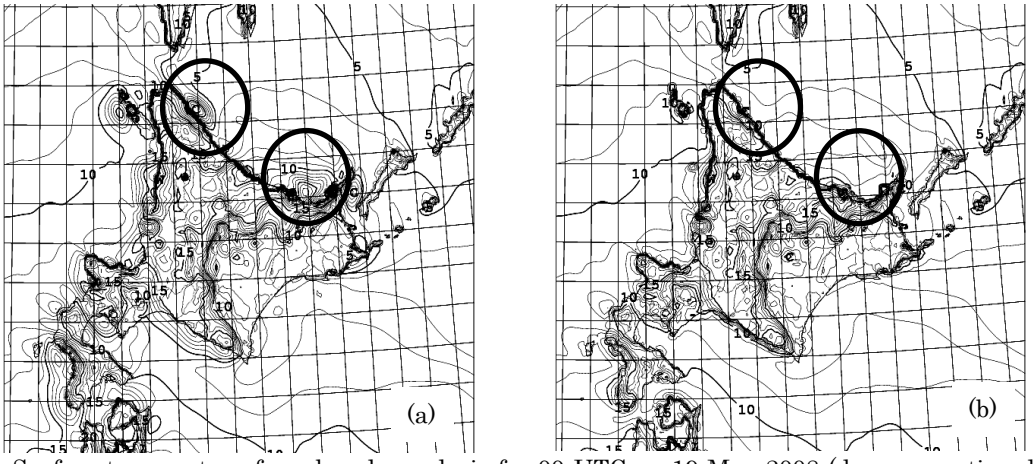

Fig. 1. Surface temperature from hourly analysis for 00 UTC on 19 May 2008 (degrees centigrade). (a) before applying the surface filter, (b) after applying the surface filter. Regions with an unreasonably large increment are marked with circles.

causes the problem of excessive increment in sea regions near the coastline located within the range of correlation from the land observations. Since no sea surface observation is currently used in the hourly analysis, the quality of the analysis in these regions is not necessarily high.

The surface filter is designed to attenuate the surface increment over the sea with distance from the coastline. This filter is applied to temperature and wind fields after the 3D-Var analysis. Figure 1 displays an example of surface temperature analysis before (Fig. 1 (a)) and after (Fig. 1 (b)) the surface filter is applied. It is found that the surface filter appropriately reduces the unreasonably large increment over the sea near the coastline (the circled parts).

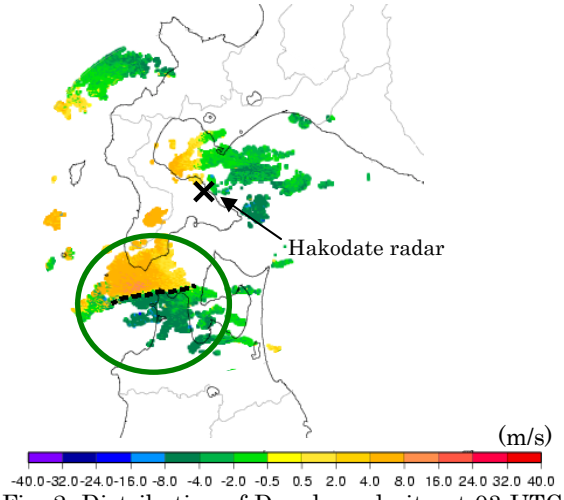

Fig. 2. Distribution of Doppler velocity at 03 UTC on 14 July 2008 from the Hakodate Doppler radar (elevation angle 0.4 deg.). 'x' indicates the location of the radar site. Cold colors show wind toward the site, and warm ones show wind away from it. The dashed curve shows the location of the wind shear line.

3. Radial velocity data from additional Doppler radar sites

In addition to radial velocity data from 12 JMA Doppler radar sites (including 8 airport sites) so far used in the hourly analysis, new radial velocity data from 7 more sites have been introduced. Figures 2 (observation) and 3 (analysis) show an example of the effect of the new data. Comparing the 850 hPa wind analysis fields obtained with (Fig. 3 (b)) and without (Fig. 3 (a)) radial velocity data from one of the additional sites (Hakodate), it is found that the new data help the analysis to better capture the location of the wind shear line (the black dashed curve).

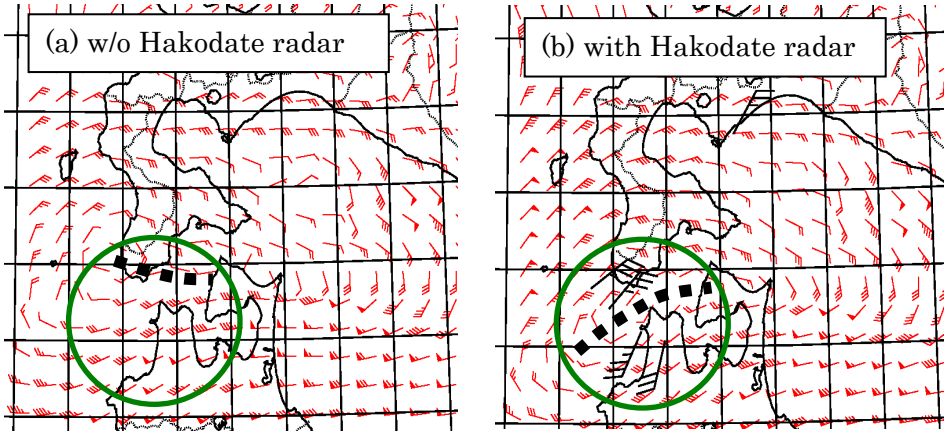

Fig. 3. 850 hPa wind from the hourly analysis for 03 UTC on 14 July 2008. (a) analysis without the Hakodate radar, (b) analysis with the Hakodate radar. Each half-flag of the wind barbs represents 1 m/s, full flag 2 m/s, pennant 10 m/s. The black wind barbs in (b) show the radial velocity used in the analysis. The dashed curves show the location of the wind shear line.