Validation of Prediction of Surface Meteorological Elements for Snow Disaster Forecasting System

Hiroki Motoyoshi[1], Sento Nakai[1], Takeshi Sato[1], Masaki Nemoto[1], and Satoru Yamaguchi[1]

[1] Snow and Ice Research Center, National Research Institute for Earth Science and Disaster Prevention, Japan

(Hiroki Motoyoshi, himotoyoshi@bosai.go.jp)

1. Introduction

The Snow Disaster Forecasting System (SDFS) has been developed in the Snow and Ice Research Center, National Research Institute for Earth Science and Disaster Prevention (SIRC/NIED). It consists of the cloud resolving non-hydrostatic meteorological model for forecasting snow distribution and surface meteorological elements and three snow disaster forecasting models for avalanche potential, snowy/icy road surface conditions and blowing snow and poor visibility. The surface elements calculated by the meteorological model are used as input data for the downstream snow disaster forecasting models. Since the accuracy of the prediction of surface meteorological elements affects the accuracy of snow disaster forecasting, the validations of the model calculation through the point-to-point comparisons with the observed surface elements (wind, air temperature, precipitation) are important for the improvement of the performance of SDFS.

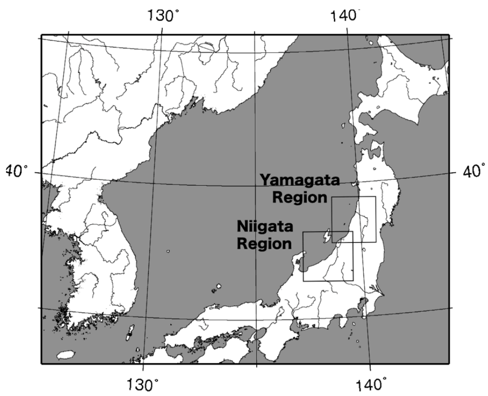

Fig.1: The outer domain and the inner domains shown by rectangles, which are called as Niigata region and Yamagata region.

2. Methods

The detailed surface meteorological elements in horizontal resolution in 1.2km / 1.5km were calculated using JMA-NHM (Saito et al., 2006) with double one-way nesting technique from GPV of JMA-MSM as the outmost model. The calculations for the outer domain includes the dominant part of the Sea of Japan (Fig. 1) were carried out in 10km resolution and subsequently the calculations for the nested inner domains, Niigata / Yamagata region in Fig. 1, were carried out in 1.2km / 1.5km resolution. The lowest atmospheric layer in 38 vertical layers was set to 10m above the surface. The surface parameters for each grid such as roughness length, surface albedo or ground heat capacity were given according to the land use data in the digital national land information from Ministry of Land, Infrastructure, Transport and Tourism (Japan). The predictions for 24 hours are calculated twice in a day using the outmost data with the initial time at 09UT/21UT for the initial and boundary conditions.

The point-to-point comparisons were made for the data during the period from 2009-12-15 to 2010-03-31. In the comparisons, AMeDAS hourly data from JMA and SW-Net hourly data from NIED are used as the observation data, and the sequence of the hourly data from FT09H to FT20H of each meteorological model calculations are used as the calculated data.

3. Results

For wind speed, the model results were positively biased at almost all points (ME=-0.7~4.0 m/s and RMSE=1.5~5.2 m/s). Fig.2 shows the comparison of wind speed and wind direction at the observation points (Karikawa in Yamagata region, Maki in Niigata region) with the suitable condition for wind measurement. For each element, the model results for these points show good agreement with the observation statistically. For temperature, the model results were positively biased at most points (ME=-0.5~2.3 and RMSE=1.4~3.5).

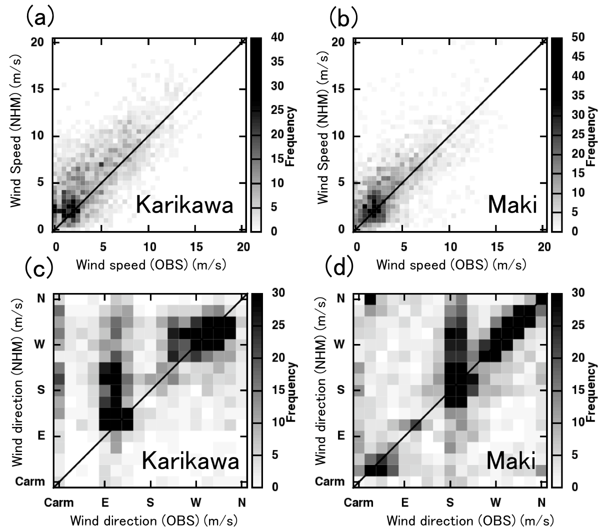

Fig.2: Scatter plot of observation and model calculation for (a)-(b) wind speed and (c)-(d) wind direction at the observation points, Karikawa and Maki.

In the point-to-point comparison of precipitation, the difference between the model calculation and the observation shows large variability because of the difficulty of the prediction of the location of precipitation band even when the shape of precipitation band is well reproduced.

References

Saito, K., T. Fujita, Y. Yamada, J. Ishida, Y. Kumagai, K. Aranami, S. Ohmori, R. Nagasawa, S. Kumagai, C. Muroi, T. Kato, H. Eito and Y. Yamazaki, 2006: The operational JMA nonhydrostatic mesoscale model. *Mon. Wea. Rev.*, **134**, 1266-1298.