Vertical profile of snowfall intensity in the Niigata region : A Comparison of numerical simulations and observations

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1. Introduction

The prediction of the snowfall amount and prevailing snowfall particle type is important for the prevention and mitigation of winter disasters related to avalanche and blizzard. The accuracy of the prediction become more critical as the resolution is finer, because the snowfall vary widely in time and space. Therefore, it is necessary to examine carefully the difference of snowfall between the model output and observation results.

2. Methods

The Snow and Ice Research Center (SIRC), National Research Institute for Earth Science and Disaster Prevention (NIED) made observations using an X-band polarimetric Doppler radar XPOL (Iwanami et al. 1996) during February 12-18, 2008. The numerical simulations of snowfall were also carried out by SIRC / NIED through the double nesting of JMANHM (Saito et al. 2006). The horizontal resolution of outer (inner) model was 10 km (1.2 km).

3. Results

The frequency of Ze (P(Ze)) increased downward in CFADs of observed and simulated Ze above 2000 m (Fig. 1(a,c)). The P(Ze) of large (small) Ze increased (decreased) downward below 2000 m in the observation. The P(Ze) of almost all Ze decreased downward below 1000 m in the simulation. The difference of observation and simulation was also confirmed by the profiles of area of precipitation relative to the total

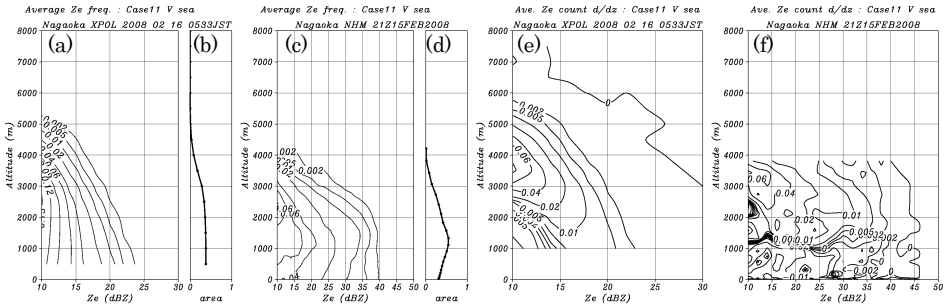

Fig. 1. Ze profiles of a case of 15-hour snowfall. (a,c) CFADs of Ze, (b,d) profiles of the ratio of the precipitation area relative to the total area, (e,f) the contoured vertical gradient of the Ze frequency by altitude. Observed (a,b,e) and simulated (c,d,f) profiles are shown.

area (Fig. 1(b,d)). These characteristics became more clear by plotting dP(Ze)/dz instead of P(Ze) in the same format (Fig. 1(e,f)).

4. Summary

A comparison of numerical simulation with observation is shown with emphasis on the vertical profile of snowfall intensity. The CFADs of observed Ze showed that the precipitation intensity increased downward except weak Ze at lower levels. The simulated frequency showed a tendency that the frequency decreased below a height about 1000 m. The cause of these differences may be 1) less heat and moisture supply from the sea surface, 2) less water vapor in the lower convective mixing layer, and 3) microphysical processes worked incorrectly, in the model atmosphere.

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References

Iwanami, K., M. Maki, T. Sato and M. Higashiura, 1996: Distribution of precipitation parameters estimated from observations with a Doppler radar and a polarimetric radar: Part 2, Results from polarimetric radar observation. *Proceedings, 12th International Conference on Clouds and Precipitation*, 190-192.

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.