SENSITIVITY OF THE WRF MICROPHYSICS TO THE SNOWFALL SIMULATION IN THE COASTAL AREA OF JAPAN SEA

Manami OHYA and Hiroyuki KUSAKA
Center for Computational Science, University of Tsukuba,
Tsukuba, Japan (Last Author)
s0921025@u.tsukuba.ac.jp

Abstract

Recently, the Weather Research and Forecasting model (WRF) is used all over the world for weather forecasting and academic researches. The WRF Version3.1 was released in April 2009. The WRFV3.1 adopts twelve kinds of bulk microphysics models. Some of them, WSM and WDM Microphysics were developed only for the WRF.

There are two patterns for heavy snowfall case in coastal area of Japan Sea, Yamayuki type and Satoyuki type. In Yamayuki type, heavy snowfall is brought in mountain area of Japan Sea side. In Satoyuki type, it is brought in the coastal plain area of Japan Sea. We first simulated these 2 types of snowfall case and estimated precipitation with using 3 microphysical models in WRF. We use WSM5, WSM6 and Morrison for this research. WSM5 has 6 prediction parameters; mixing ratio of water vapor, cloud water, rain, cloud ice and snow. WSM6 is added mixing ratio of graupel. Morrison predicts number concentration of water substance with mixing ratio. We pick up the event on December 22nd, 2005 for Yamayuki case, and January 23th, 2004 for Satoyuki case.

Precipitation distribution was well reproduced in both cases with 3 models, but in Yamayuki case, 3 models estimated larger precipitation impact than observation. On the other hand, models tend to estimate smaller in Satoyuki case. Precipitation of WSM6 was large in mountain slope of Japan Sea side where graupel is produced a lot. Prediction of number concentration reduces large estimation of precipitation in large mixing ratio area, so Morrison expressed this effect.

Compared WSM5 to WSM6 in conversion process of water substances, there was large difference in Yamayuki case. WSM5 expressed diffusional growth from water vapor to snow in mountain slope of Japan Sea side. However in WSM6, it expressed diffusional growth and riming from water vapor and supercooled cloud water to snow and graupel. WSM5 carried more water substances to inland mountain region than WSM6. Because, WSM5 wasn't express graupel, and precipitation was less then WSM6 in mountain slope. In Satoyuki case, there were little graupel in WSM6, so differences of conversion process ware quite small between WSM5 and WSM6. Precipitation of WSM6 was large in mountain slope of Japan Sea side where graupel is produced a lot in both cases.

We will also introduce the preliminary results of the WDM simulations and other snowfall events at the conference.

Acknowledgments: This work was supported by the Global Environment Research Fund (S-5-3) of the Ministry of the Environment.

Keywords: Microphysical parameterization, Microphysical model, WRF model, snowfall simulation, Japan Sea