High-resolution Numerical Weather Simulation with a Large Domain for Extreme Heavy Rainfall Events

*Tsutao OIZUMI[1,2], Kazuo Saito[4,3], le duc[1], Junshi Ito[3]

1. Japan Agency for Marine-Earth Science and Technology, 2. Meteorological Research Institute, 3. The Atmosphere and Ocean Research Institute, 4. Japan Meteorological Business Support Center

In Japan, heavy rainfall occasionally causes disasters such as debris flows. For example, debris flows induced severe societal damages in Izu Oshima Island on 15-16 October 2013 and in Hiroshima City on 19-20 August 2014, western Japan on July 5th –8th 2018. To mitigate these disasters damage and evacuate residents in a timely fashion, an accurate numerical weather prediction (NWP) system is important.

In this study, we conducted an ultra-high resolution NWP simulations (grid spacing is 5 km to 150 m) with a large and small domain area to above heavy rainfall events. Several important model factors (grid spacing, PBL scheme model domain size) influencing heavy rainfall forecasting in NWP models were investigated. The model was an optimized version of the Japan Meteorological Agency Non-Hydrostatic Model for the supercomputer "K".

The result showed the 2-km grid spacing models showed better precipitation performance than 5-km resolution models. And the 500-m resolution models showed better precipitation performance than 2-km grid spacing models. The 2-km and 500-m grid spacing models with the large model domain show better performance than those with the small domain. Overall, the results indicated that using a high-resolution model (500-m grid spacing) with the large model domain area provides an advantage for simulating heavy rain events.

Keywords: heavy rainfall, high resolution simulation, JMA-NHM