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Numerical Simulation of Volcanic Ash Transport for the Eruptions at Mt. Shinmoe-dake during 26-27 January 2011

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The volcanic ash transport associated with the eruptions at Mt. Shinmoe-dake during 26 to 27 January 2011 is simulated using Japan Meteorological Agency Non-Hydrostatic Model (JMA-NHM) to verify the model with satellite observation. In the model, the mixing ratio and number concentration of ash particles are prognosed with the advection, diffusion, sedimentation, and source terms to represent the behavior of ash cloud. Simulation has been performed in the calculation domain covering 2500 km x 2000 km wide area with the horizontal resolution of 5 km.

The model is coupled with one-dimensional eruption column model to define the source term of ash particles, which is simply given as a function of the column height, the level of the release point, and the size of released particle, following Suzuki (1983) and Shimbori et al. (2010). Although the simulated distribution of ash cloud roughly agrees with satellite observation, close examination of the simulation result shows that the model fails to reproduce some of the ash clouds observed by the satellite, which means that much room still remains for improvement in the eruption column model in terms of release point and size spectra of ash particles. Three-dimensional direct numerical simulation has been conducted on a major sub-Plinian eruption during the period at Mt. Shinmoe-dake (Suzuki and Koyaguchi, 2013), in order to make new eruption column model with more realistic function for the source term of ash particles. As a result, it is found that the maximum release rate of the ash particles smaller than 100 μm appears in the height lower than that predicted by the usual eruption column model for same column top height. The authors are developing new eruption column model with realistic profile of release rate, based on this result, so as to improve the reproducibility of the ash transport with JMA-NHM. The sensitivity of the ash transport to altering the new and usual eruption column models will be presented.

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