Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC48-01 Room:A05 Time:May 24 09:00-09:15

Estimation of the airborne ash density for Sakurajima using PUFF model

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Airborne volcanic ash is a danger object for the aviation safety. Once the jet aircraft encounters the ash cloud and engine failure occurs, the damage is estimated to reach to a billion of US dollar. Hence the real-time monitoring and estimation of the airborne ash density is an important research subject. According to ICAO report, the ash density above 2 mg/m3 is a threshold for the danger zone of the aircraft. A system to predict the airborne ash density is desired to develop in urgent based on the real-time observation of the emission rate and plume height.

In this study, we conducted numerical simulations of volcanic ash dispersal from Sakurajima volcano using the real-time volcanic ash dispersion transport model PUFF for one year period in 1985 when volcanic activity was considerably high. According to the numerical simulation by the Lagrangian formulae of PUFF model for one year given the observed emission rate and plume height, the total particle number of the ash fallout was 1,962,976. On the other hand, the total amount of the observed ash fallout for one year period was 28,870,000 ton. The comparison shows an important measure of the particle mass, which is estimated as 14.7 ton/particle in the PUFF model. Based on this mass measure, we are now able to estimate the airborne ash density as a function of 3D space and time. The developed new system at Sakurajima volcano will now be applied to other volcanoes in Indonesia under the SATREPS project by JST and JICA.

Keywords: Volcanic ash prediction, Emission rate of volcanic ash, Aviation safety, Sakurajima Volcano, PUFF model, SATREPS