Fluid structure in volcanic eruption column observed by Ka-band Doppler radar

*Takeshi Maesaka[1], Masayuki Maki[2], Tomofumi Kozono[3]

1.National Research Institute for Earth Science and Disaster Prevention, 2.Kagoshima University, 3.Tohoku University

Volcanic ash dispersion and falling with the explosive eruption affect aviation safety, so it is urgent necessary to develop its observation and prediction methods with high accuracy. For these problems, volcanic plume and ash dispersion modeling have been studied. The former physically solves the fluid-dynamical structure and the ash advection in the plume under the given condition of magma burst, however it is difficult to validate the results comparing with the observation data. The latter simulates the advection and dispersion of the ash, but the reliable initial conditions (e.g., three dimensional distribution of ash density) are needed for the accurate simulation. The ash observation by radar remote sensing are expected to be a solution for these problems.
So far some observational studies for the volcanic ash were demonstrated by using ordinary weather radar. But those could observe only relatively dense volcanic smoke, because radar reflectivity of the volcanic ash is smaller than that of the precipitation. In 2000, NIED developed Ka-band (35 GHz) Doppler radar, which can observe not only precipitations but also clouds. This radar is expected to detect the weak eruption. Moreover it is expected to retrieve a fluid structure in the smoke by detecting the Doppler effect of the radio wave. We deployed the radar at Kurokami branch observatory, Sakurajima Volcano Research Center, Kyoto University during March-June in 2014 for the observation of the Sakurajima eruption. In this presentation, our application of the meteorological radar analysis technique to the volcano eruption and the retrieved fluid dynamics will be reported.

Keywords: Volcanic eruption column, Meteorological Doppler radar, Ka-band

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