Consideration of Wind Effects on the Eruption Source for the Lapilli Fall Prediction

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When volcanic eruption occurs under strong wind condition, lapilli falling relatively in a short time are transported to a distant place. In several cases of recent eruptions in Japan, a few cm-sized lapilli fall were observed at resident area located a dozen km away from vent and caused human or property damage such as broken windshields of cars (e.g. JMA, 2013). For the purpose of mitigation of lapilli-fall disaster, the Japan Meteorological Agency (JMA) has been issued Volcanic Ash Fall Forecasts (VAFFs, Hasegawa et al., 2015; Sugai et al., 2015). In the scheduled and preliminary VAFFs, potential areas of lapilli fall are indicated with volcanic-ash fall area or quantity. The VAFFs are based on the calculations by the JMA Regional Atmospheric Transport Model (JMA-RATM), however, effects of wind are not considered in the eruption source which is the initial condition of the RATM. Then there is a problem which tends to underestimate the predicted volcanic-ash and lapilli fall areas.

In order to address this problem, we observed the wind around Sakurajima volcano with Aerological Observatory’s Doppler LIDAR (Hoshino et al., this volume) and have been improving of the eruption source of the RATM in the joint research of the Meteorological Research Institute and the Kagoshima Local Meteorological Office (FY2014-16). Instead of currently used empirical model of eruption source by Suzuki (1983), we consider the effects of wind especially for weak plume case based on the following methods; (i) not change the vertical distribution (i.e. Suzuki distribution) of volcanic ashes and lapilli, and (ii) shift only the horizontal distribution of them with wind GPVs according to Ida (2014). In this presentation, we will show the verifications of volcanic-ash and lapilli fall predictions for case studies of the eruptions at Sakurajima volcano in 2013, Kuchinoerabujima volcano in 2015 and so on.

Researches on the eruption column considering wind effects have been done by more sophisticated models, for example, BENT (Bursik, 2001), SK-3D (Suzuki and Koyaguchi, 2015) and JMA-NHM (Hashimoto et al., this volume). In order to apply the results of these physical models to the initial conditions of the operational RATM, under various weather conditions, it is required to make an eruption source immediately from observables for any active volcanoes in Japan. Therefore we consider that the eruption source including wind effects in this research is impermanent and provide a bridge from empirical models to physical ones. Furthermore improvements of eruption source make more accurate first guess in the volcanic-ash data assimilation system (Ishii et al., this volume) inputted the data observed by weather radars (e.g. Sato et al., this volume) and Himawari-8 (e.g. Hayashi et al., this volume).

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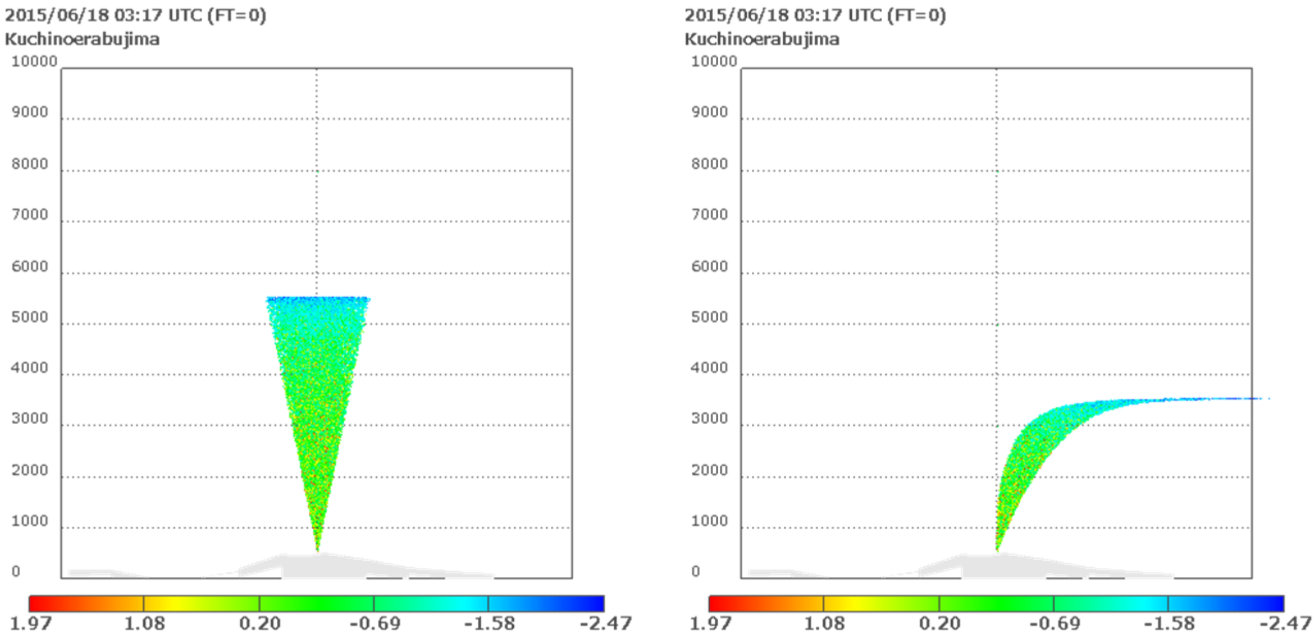

Examples of eruption sources (vertical cross-sections of initial tracers) in the JMA-RATM. Left: without wind effects based on Suzuki distribution. Right: with wind effects in this research. Colors indicate the logarithmic grain-sizes of tracers.

