Numerical Study on the Ejection Conditions of Ash Clouds during Recent Eruptions of Kuchinoerabujima Volcano

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Kuchinoerabujima Volcano in Kyushu, Japan have erupted in 2014 and 2015. The volcanic activities intensified again since October 2018 and generated explosive eruptions accompanying pyroclastic density currents on 18 December 2018, 17 and 29 January 2019. The pyroclastic density currents are so hazardous that it is crucial to assess the risk that residential area near the volcano could be affected by the currents.

We performed a series of numerical simulations on the ejection of volcanic ash clods and subsequent density currents with the parameter settings, which were based on the observational data acquired during the explosive eruptions of Kuchinoerabujima volcano from 2014 to 2018. The supercomputer system HOKUSAI, RIKEN was used (Project number: Q18431).

We assumed that the initial temperature, density and ejection speed of ash clouds significantly affect the dynamics of the ash clouds, and thus, we searched plausible combinations of the parameter set of the thee variables by conducting a series of numerical simulations. Some of the simulations yielded the results that are comparable with the observed eruptions accompanying pyroclastic density currents. In particular, the results implies that the pyroclastic density currents are prone to occur when the initial temperature of the ejected ash clouds is lower than 800K.

In addition, the numerical simulations exhibited that the small north-south trending ridge on the east of the volcanic vent of Kuchinoerabujima volcano had the main part of the pyroclastic density currents spread over the western flank of the volcanic edifice. This is consistent with our observation at Kuchinoerabujma volcano.

Keywords: Kuchinoerabujima volcano, Pyroclastic Density Current, Numerical Simulation

