

Temporal variation of the 2011 Shinmoe-dake subplinian eruption inferred from the stratigraphic GSD variation

*Yu Iriyama¹, Atsushi Toramaru²

1. Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University, 2. Department of Earth and Planetary Sciences, Faculty of Science, Kyushu University

Spatial variations of grain-size distributions (GSDs) in pyroclastic fall deposits reflect the effects of the temporal variations of the volcanic activity and of the transportation under the atmospheric condition. To reconstruct the temporal variation of GSD at the source position during the eruption, we have carried out theoretical studies in which we construct the relationship of GSD variations between at the source position and at a certain observation locality in the vertical and horizontal two-dimensional space (here after we call as two-dimensional model). We apply this relationship to the pyroclastic fall deposit produced by the 2011 Shinmoe-dake subplinian eruption and estimate the temporal variation of GSD at the source position.

Shinmoe-dake is an andesitic stratovolcano which belongs to the Kirishima volcano complex, south of Kyushu, southwest of Japan (the elevation is 1,421m asl). Three subplinian eruptions occurred on January 26 to 27, 2011. During the subplinian eruptions, temporal variations of the volcanic activity such as eruption column height (Shimbori et al., 2013) and geodetic rate of volumetric change (Ueda et al., 2013) were observed. The stratigraphic variations of GSDs in the pyroclastic fall deposits show a coarsening in the lower part and a fining in the upper part of the sediment produced by the first subplinian eruption on January 26 at locality Mk, 7.9 km SE from the vent (Iriyama and Toramaru, 2015). By using the observed stratigraphic GSD variations and the two-dimensional model, we estimated the temporal variation of GSD at the source position. We characterized GSDs as power-law distributions, then we obtained the temporal variation of the power-law exponent of the source GSD, which suggests coarsening in the early stage and fining in the late stage.

Applying the relationship among the source GSD, mass eruption rate, and the maximum plume height reported by steady-state calculation of the plume dynamics (Girault et al., 2014) to the 2011 Shinmoe-dake subplinian eruption together with the estimated source GSD and the observed eruption column height, we have the estimated temporal variation of the mass eruption rate consistent with the geodetic data of the volumetric change.

Keywords: grain-size distribution, pyroclasts, temporal variation, mass eruption rate