Transport of pyroclastic particles from 1959 Kilauea Iki eruption in Hawaii

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Details of the dynamics of transport of pyroclasts in Hawaiian fountains still remain unclear. Large pyroclasts are decoupled from the flux of finer particles and gas, and follow parabolic trajectories until they deposit on the ground. These large particles (> c. 10cm) are considered to be ballistic projectiles. It is important to predict the trajectory of such pyroclasts by numerical modeling to mitigate near-vent hazards of Hawaiian eruptions.

The Kilauea Iki 1959 eruption produced the highest fountaining observed among Kilauea historical eruptions. This eruption consists of 17 phases. We focused on the powerful 15th and 16th phases because the dispersal axes of these two phases are the same and we can observe particles of these phases at the ground surface.

According to our previous study, the spacial distribution of large pyroclasts was not produced by fully ballistic transport. If the transport is controlled only by initial velocity, gravity and drag force, larger pyroclasts are transported to farther distances than smaller particles because of their larger inertia. However, the distribution of large pyroclasts in the field shows that the larger particles deposit closer to vent. This means that the transport of larger particles is not purely ballistic. By combining simple calculations, it is shown that the particles are transported vertically by the fountain and then transported laterally.

To model the mechanism of transport made by Hawaiian fountains, we collected not only the size distribution of large clasts but also grainsize distribution of finer material. In the field, there are fine particles everywhere around large clasts. Size distributions of large clasts represent the maximum size of pyroclasts in each limited area. By analyzing spacial distribution of the two types of pyroclasts, we investigated the controlling mechanism of particle transport. Moreover, the results of numerical simulations are compared with these data. In this presentation, we suggest new features of numerical models of particle transport in Hawaiian fountains.