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Particle fallout from a eruption column - an analysis using Tephra2

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Tephra fall simulations sometimes give significantly inconsistent results from observed data. One of the sources of the error is the source model, which depicts the amount of particle released from a certain height of an eruption column. In this study, we modeled particle source of the 1986 Izu-Oshima eruption based on tephra fall simulation and observed data.

We calculated mass contribution (c_{ij}) of a certain height interval in the eruption column (i) to a certain observation point (j) using a tephra fall simulation code Tephra2. When the amount of released particle is r_i, amount deposit at a site j (S_j) equals to Sigmacijri. In this study we set evaluation function, which is the representative degree of fitness between calculated (S_{cj}) and observed (S_{oj}) S_j as E = log(S_j/S_{oj}). Then we obtained a set of r_i that shows minimum E using grid search.

Our result shows that most significant particle discharge takes place at 2 to 3 km high and up to 90% of released particle from the vent is lost from the column at this height. The particle of -2 and -3 phi also released from 6 to 7 km high and approximately 20% of released particle from the vent is lost from the column at this height. For the particles smaller than -2 phi, particle release more than several km in height is not known because these went beyond the island's shore and fell to the sea. For particles larger than -3 phi, particle release from several km high is not significant.

From the previous studies, height of the 1986 Izu-Oshima eruption column is considered to be 13km in maximum and 10km in most of the time. Thus the particle release from 6 to 7 km high implied in this study could be interpreted as particle from the umbrella cloud. On the other hand, the particle release from 2 to 3 km high may take place plume bending due to the high wind at the altitude.

Keywords: eruption column, volcanic ash, Izu-Oshima, tephra fall, simulation, Tephra2