Volume estimation of single vulcanian eruption during the activity of Showa crater, Sakurajima Volcano, Japan

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This study evaluates the eruptive volume of individual vulcanian eruption and continuous ash emission from Sakurajima Volcano, southern Kyushu, Japan, based on the detailed distributions of ash deposits. The result shows that continuous ash emission contributes about 77 % of total tephra emission during our observation.

Sakurajima Volcano repeats explosive eruption since 1956. Eruptive activities sifted to Showa crater located at eastern foot of Minamidake crater in 2008, and about one thousand of eruptions per year were observed. Recent activity of Showa crater is characterized with the intermittent explosion (vulcanian explosion) and continuous ash emission.

To evaluate the tephra volume from Sakurajima, we surveyed the tephra distribution in January 2010, February 2011, November 2011, March 2012, and January 2013. We set 30-60 ash traps of paper dish with 15 cm in diameter on a tripod with 20 cm height in the area from 3 to 43 km downwind of the volcano.

We also examine the heterogeneity of ash fall in a single site. We set 8 traps in a single site of 30 x 42 m. The variation of the tephra fall in the traps is less than 25 %.

We obtain distribution (isopleth) maps of 3 vulcanian explosion and 9 continuous ash emission. Based on the distribution map, we calculated the total volume of tephra of every period. The volumes of individual vulcanian eruptions of 1:22 pm of 16 November 2011 and 6:20 am of 6 March 2012 were evaluated as 3,500 t and 25,000 t, respectively. We also detect continuous ash fall during the period between major vulcanian explosions. The tephra volumes during continuous ash emission were calculated to be about 315-1,420 t per hour.

The total volume during our survey in November 2011 (50 hours) was calculated to be 24,306 t. Assuming the average emission rate during repose time as 375 t/h, 18,750 t of ash were emitted without major vulcanian explosion. It corresponds 77 % of the total ash emission during the entire period.

The isopleth maps also show the effect of the distribution of wind-direction on the ash dispersal. The distribution axes of ash fall near the crater are variable due to complex change of wind direction at low altitude. The axes in the distal area tend to extend to the east direction, due to westerlies. The wind direction below 4,000 m a.s.l. is complex, while main wind direction above about 4,000 m is to east during the champagne.