

Line-Array infrasound observation for volcanic eruptions at Sakurajima volcano

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As strikingly underlined by the recent Eyjafjallajokull, Grimsvotn, and Puyehue eruptions, once a enormous volume of ash is ejected social and economical activities in the vast areas, not only the proximal area from the volcanoes, become much sluggish. One of the reasons of this problem is vulnerability of aviation to ashes suspended in the air. We have to carefully monitor and mitigate the significant volcanic ash hazard to aviation. Infrasound observations can make a contribution of this construct; for example ASHE project (Garces et al., 2008EOS) make a clear the feasibility of acoustically detecting significant atmospheric ash emissions quantitatively (Fee et al., 2010JVGR) and rapidly notifying civil defense authorities. On the other hands, spectral features of infrasound signals from Vulcanian and Plinian eruption columns have a similarity to that empirically-derived from experiments of pure-air jets (Matoza et al., 2009GRL). They concluded that we may be able to estimate volcanic jet parameters such as the expanded jet diameter and velocity, volume flux, fluid composition, and vent over-pressure from broadband acoustic recording in the future. However, to date it is not sufficiently clear to substantial relations associated with the infrasound signals to behaviors of volcanic columns. Features of infrasound characteristics for various eruption column dynamics and the accurate source of locations in the columns should be investigated first. Therefore, we conducted a line-array observation for infrasound waves of eruptions at Sakurajima volcano during the last half year of 2011.

Eruption activity of Sakurajima volcano is comparatively high in Japan. Showa crater at the southeastern flank of the volcano have begun erupting since 2006 are now in the stage of intermittent small-scaled Vulcanian eruptions. Numbers of the eruptions in 2010 were counted to about 1000 reported by Japan Meteorological Agency. Minor scaled eruptions and ash emissions are almost always continues. Even when no eruptive phenomena are recognized in the crater, large sounds related to gas-exhausting often could be heard. These varieties of scale of eruptions and surface phenomena provide us a suitable field for infrasound observations. The array we used at Sakurajima was composed of 5 microphones with 3 data-loggers (1kHz sampling), and additional 4 sets of microphone and data-logger (200Hz sampling) was also used for a few days on December 2011. Results of our observations revealed several basic but suggestive facts for the future study of volcanic infrasound; for example, the first 10 s duration of the infrasound signal is made by explosion itself. Clear height change of the source from the crater altitude was not identified though slight differences were associated with breach of eruption column. Diffraction and reflection waves are dominant from characteristic topography around Sakurajima volcano, like a wall-like topography of the Aira caldera, after that time, which indicates that accurate characters of infrasound waves radiated from the column itself would be hidden by the strong explosive signals. Adequate new analytical methods will be developed to retrieve the information of pure infrasound signals from such polluted ones.