

Infrasonic activity of Sakurajima volcano in 2015, inferred from an infrasound array analysis.

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In Sakurajima volcano, explosive eruptions have occurred frequently at around 1000 times at a year since 2009, and continuous geological investigations, such as infrasound, seismicity, tilt, and Global Navigation Satellite System (GNSS) have been used to monitor the volcanic activities (Iguchi et al., 2013). On August 15, 2015, the magma intrusion event different from usual state occurred. It is reported that the frequency of the explosion decreased across that period. In this study, we report the outline of the infrasound activity of Sakurajima from January to December 2015 recorded by an infrasound array.

In October 2014, we installed the infrasound array (TKT) in the Kagoshima University research forest at Takatoge-Kogen (11 km southeast of the Sakurajima Showa crater, altitude of 540 m). Four stations of array were installed; three stations were placed at each vertex of the triangle whose aperture of 200 m, and the other at the center. Three of them are installed with sensor (differential pressure gauge) and digitizer, power is supplied by the solar panel. Power of the other station is supplied by commercial power and we also installed the sensor, digitizer and data aggregation-transmission system. The data were recorded at a sampling rate of 50 Hz and transmitted by fiber optic cables. The central station and the other stations are connected by fiber optic cables passed through a protective tube and buried in the 20-30 cm underground to avoid the influence of thunder and animals. However, in the vicinity of a rough ground situation covered with thick leaves, cable exposure due to rain fall accompanying the outflow of the ground surface cannot be avoided and it became impossible to communicate in about one and a half years after installation. Although there are data missing due to power of PC failure intermittently, data is acquired continuously from January to December 2015. In this time, we analyzed the data in that period.

Median filter processing and trend removal were performed on the obtained data, and then a 0.3-5 Hz band pass filter was applied. First, based on the Sakurajima eruption record table by the Japan Meteorological Agency (JMA), records in TKT 15 minutes before and after the JMA's explosion record time was cut out, and a semblance analysis was continuously performed while varying the time by 5 s at an analysis length of 10 s to event detection and estimate the direction of infrasound arrival. After that, with respect to each station, a cross correlation function assuming that the delay time when signal comes from the Showa crater is calculated every 1 s, a moving average of 5 min is applied, and from January to December 2015 to estimate the infrasound activity of Sakurajima.

636 explosions occurred during the TKT's operation among the 737 explosion records in 2015 by JMA, and all infrasound data were recorded in TKT. Of the explosion recorded in TKT, even for the one with the smallest infrasound amplitude in Seto (1.3 Pa), we confirmed that for the all signals predominantly arrived from Sakurajima direction (300°N). In the case of a large amplitude explosion, it was also confirmed that reflected waves from the topography around TKT arrived, as pointed out by Yokoo et al., (2014). The reflection wave arrived mainly from 180°N to 130°N. These are reflected waves from Mt. Yokodake and Mt. Takakuma, south and southeast to TKT station. In addition, the reflected waves from the 80°N direction are relatively weak, and these are considered to be due to the direction of the Kushira river, the altitude is lower than around.

Next, we analyzed the energy of infrasound continuously coming from Sakurajima, using the cross-correlation function. In order to distinguish the increase in the local noise, we also calculated the power of infrasound simultaneously arriving from the direction of the Kushira River (80°N) as a reference. As a result, also between the reported explosion-eruption, it is confirmed that weak infrasound activities occur continuously or intermittently. In the future, we will clarify what kind of surface activity corresponds when weak infrasound recorded at TKT, in combination with infrasound data and movies in the vicinity of Showa crater. Also, we would like to consider how much it affects the eruption cycle and scale.

Keywords: Volcanic eruption, Sakurajima Showa Crater, Infrasound array analysis