Observation of earthquake and air-shock accompanied with Strombolian eruption at Semeru volcano, Indonesia

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Semeru volcano, an andesitic stratovolcano in East Java, Indonesia has erupted intermittently since 1941. The eruptive activity has recently been continuing Strombolian eruption at the summit crater. The daily number of the explosive eruption is frequently over 100 events. When the eruption occurred, a part of lava dome is often ejected outside the crater and the emission of eruption cloud reaches to 300-1000m from the crater. In this study, we researched the relation between earthquakes and air-shocks accompanied with explosive eruption from the data of observation at Semeru volcano. And, we compared study about explosive eruption at Sakurajima volcano with one of Semeru volcano.

Broadband and short-period (natural period of 1 Hz) seismometers and an infrasonic microphone are installed at Semeru volcano in September 2002. The short-period seismometer and an infrasonic microphone were installed at LEK station, which was the distance of 6.6 km from the active crater, and broadband seismometer was installed at KAL station, which was distance of 2.6 km from the active crater. Signals were continuously recorded on data loggers (LS-8000SH) with an A/D resolution of 16 bit as velocity waveform with a sampling rate of 100 Hz. The 1502 explosive eruptions occurred during the observation. The 92 events were analyzed.

P-wave first motion is compression (up and away from the summit crater in the vertical and radial components, respectively) and is followed by a dilatational P-wave motion with larger amplitude than the first motion. Rayleigh wave with longer period appear 2 s after the arrival of the first motion. Characteristics of these phases are similar to the waveform of explosion earthquake observed at Sakurajima volcano (Tameguri et al., 2002). Arrival time of air-shock at LEK station was 19 s after arrival time of P-wave first motion at KAL station. The propagation velocity of air-shock seems to same velocity of sound. The first motions of the air-shocks were compressional in the all events. Amplitudes and pulse width of air-shocks were ranging from 0.03 to 1.11 Pa and 0.19 to 0.79 s, respectively. In the case of short pulse width, the amplitude of air-shock is larger.

In the study of explosive eruption at Sakurajima volcano, the amplitudes of the Rayleigh wave excited by an isotropic expansion at the shallow part correlated with the amplitudes of air-shocks. At Semeru volcano, the amplitudes of Rayleigh wave well correlated with the amplitudes of the air-shock rather than the P-wave first motion.

The amplitudes of the Rayleigh wave and air-shock at Semeru volcano is 2 orders smaller than those at Sakurajima volcano. From the same characteristics of the phases in the waveforms and correlation between the amplitudes of the Rayleigh wave and air-shocks, the mechanism of explosive eruption at Semeru volcano may be similar to Sakurajima volcanoes, except for magnitude.