Source process of eruption earthquake at Suwanosejima volcano

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1. Introduction

Suwanosejima is an andesitic volcano (located at 250 km apart from Kagoshima city) and currently repeats small-scale explosive eruptions from summit crater. Suwanosejima volcano has continued active eruption such as Sakurajima volcano and is possible to seismic observation at near the crater. In this study, we determined hypocenter of eruption earthquakes accompanied with small scale explosive eruption and reported characteristics of waveform of the first motion. Moment tensors of initial part of eruption earthquakes were estimated using waveform inversion.

2. Observation

The active crater at the summit of Suwanosejima volcano was surrounded with 4 seismic stations. Broadband seismometers (STS-2) with flat velocity response of 0.02-120 s were installed. Signals from the seismometers were continuously recorded on data loggers (LS-7000XT) with resolution of 24 bit with a sampling rate of 100 Hz. In this study, 8 events with clear first motion out of 47 eruption earthquakes that occurred in November 2, 2003 were analyzed.

3. Hypocenter location and characteristics of waveform

The first motion of eruption earthquake is dilatational (down and towered the crater in the vertical and radial components, respectively). Compressional wave dominated by the vertical component in the first dilatational motion appears 0.2-0.3 s after the arrival of the first motion. These characteristics is common at all stations. Particle motion of the first dilatational motion is linearized in the direction to the crater. The compressional motion comes from beneath the station. The hypocenters of the sources of the dilatational and compressional motions were determined from arrival times of each motion at 4 stations, assuming a homogeneous half-space with Vp=2.1km/s. The hypocenters of the dilatational and compressional motions were located at depths from 200 to 300m around the summit crater and located at depths from 400 to 600m beneath the summit crater, respectively.

4. Source mechanism

From hypocenter determination and characteristics of waveform of eruption earthquakes, it is inferred that the first dilatational and compressional motions are excited by contraction source at shallow part beneath the crater and expansion source at a slight deeper part than contraction source beneath the crater, respectively. To obtain more detail source mechanism of dilatational and compressional motions, we determine the moment tensor solutions using by waveform inversion method. Three diagonal components of the estimated moment tensor of the dilatatinaol motion were negative and had similar values. Non-diagonal components were less than 10% of the diagonal components. Moment tensor of compressional motion was dominated by positive Mzz component. Other components were less than 10% of the vertical dipole. The results of source mechanism showed that the eruption earthquake was initiated by an isotropic contraction at depths from 200 to 300m around the summit crater and expansion dominated by vertical dipole was generated 0.3s after the isotropic contraction at depths from 400 to 600m beneath the summit crater.