

Reinforcement of volcanic earthquake observations at Sakurajima volcano

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1. Introduction

Sakurajima, located at south Kyushu, is andesitic volcano. The eruptive activity at the summit crater Minamidake began in October 1955 and explosive eruptions have frequently occurred at the summit crater, producing more than 7800 explosive eruptions as of the end of 2007. In June 2006 and May 2007, eruptions occurred at east flank of Minamidake (Showa crater). The eruption at Showa crater was smaller than explosive eruption at the summit crater. This eruption is remarkable for prediction of volcanic activity of Sakurajima volcano in the future.

In hypocenter distribution determined by permanent seismic stations operated by Sakurajima Volcano Research Center (SVRC), Kyoto University, hypocenters of A-type earthquakes (Volcano-tectonic earthquakes) are located beneath the summit crater, depths ranging from 0 to 4 km and SW off Sakurajima, depths of about 10 km. And, hypocenters of earthquakes accompanied with eruption (BL-type and explosion earthquakes) range from 0 to 2 km beneath the crater.

We installed two temporary seismic stations for improvement of hypocenter determination of volcanic earthquakes beneath the summit crater and research of occurrence of earthquakes around Showa crater. We will discuss hypocenter distribution using data of temporary observation and relation with volcanic activity, and difference of hypocenter locations between using data of permanent stations and temporary ones.

2. Observation

At eight stations in Sakurajima, three-component short-period seismometers (natural period is 1 s, damping constant $h = 0$) are installed in boreholes at depths of 85 to 355 meters. Two stations are equipped with seismometers installed on the surface in vaults. Wider network of eight stations around Aira caldera also equipped with three-component short-period seismometers in tunnel. Seismic signals from the stations are transmitted to SVRC via telephone lines or radio and recorded as velocity waveform with a sampling rate of 200 Hz.

We installed two temporary stations at 2 km southwest and 2.5 km east of the summit crater. Three-component Short-period seismometers (Mark Products : L4C-3D) are included for hypocenter determinations of volcanic earthquakes. The temporary observations are conducted during the period from June in 2007 until now. Signals from the seismometers are continuously recorded on data loggers (LS-7000XT) with an A/D resolution of 24 bit, as velocity waveform with a sampling rate of 200 Hz.

3. Hypocenters

28 A-type, about 1000 B-type and 3 explosion earthquakes were observed during temporary observation period. We selected the events which have clear P-wave at 8 stations and S-wave at 4 stations for A-type earthquakes, which have clear P-wave at 8 stations for B-type and explosion earthquakes. We could determine the hypocenters of 18 A-type, 24 B-type and 3 explosion earthquakes.

Hypocenters of all events using only permanent stations were located around the summit crater Minamidake. In result adding data of temporary stations, epicenters of A-type earthquakes are concentrated around summit crater and depths became a few hundred meters shallower than result using only permanent stations. This result considered that hypocenter determination using only permanent stations was a lack of station at east part of the summit crater. Hypocenters of B-type and explosion earthquakes were more concentrated in the summit crater than those of A-type earthquakes. Seismic event did not occur beneath the Showa crater during temporary observation.