

Comparison between areas of VT earthquakes around Sakurajima Volcano and a 3-D velocity model of the upper crust

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Volcano-tectonic (VT) earthquakes associated with volcanic activities of Sakurajima Volcano also occur beneath Kagoshima Bay around the volcano (Hidayati et al., 2007). Not only seismic observations on land but also ones using Ocean Bottom Seismographs (OBSs) are need to detect micro VT earthquakes beneath the bay, and to improve accuracies of the hypocenter locations of the earthquakes. Authors therefore have performed OBS observations five times since 2009. In the present study, we summarize hypocenter distributions of the VT earthquakes obtained by OBS observations. We also compare the hypocenters and a three-dimensional seismic velocity model derived from regional earthquake data in order to extend knowledge for active area of the VT earthquakes.

The areas where the earthquakes occurred are summarized as follows: 1) Shallow VT earthquakes generated beneath Wakamiko Caldera. Most of the earthquakes were located shallower than or equal to 5 km depth. 2) Small number of VT earthquakes were also located at 5-10 km depth off the northeastern coast of the volcano. This activity may be steadily. 3) No earthquake was detected beneath the western half of Aira Caldera.

On the other hand, we also analyzed a three-dimensional seismic velocity model by use of regional earthquake data (Mera et al., 2013) to compare the hypocenter distribution and the velocity model. As a result of the 3-D inversions, we obtained reliable P- and S-wave velocities at the depth range of 5-12km under the area in and around the volcano. At shallower than 6 km depth, the model delineates an area of Low-V_p (5.3-5.4 km/s) and Low-V_s (3.0-3.1 km/s) beneath the area of south of Wakamiko Caldera. A peak of the low velocity area tends to close the volcano at the portion deeper than 6 km depth. At 10 km depth, a peak of Low-V_p (5.4-5.5 km/s) and Low-V_s (3.1-3.2 km/s) was imaged beneath an area off northeast coast of the volcano (beneath Shin-jima Island). Obviously low velocity areas also spread from the volcano to the area off the south coast of the volcano.

Because several recorder troubles happened among the five OBS observations, we selected the hypocenters of the VT earthquakes which were located using data recorded at common three OBS stations. As a result of the comparison between the hypocenters of the VT earthquakes and the 3-D velocity model, most of the VT earthquakes were located where intermediate velocities were estimated. Furthermore, some of VT earthquakes occurred in close vicinity of the peaks of Low-V_p and Low-V_s areas. The former suggests that the strains by crustal deformation hardly accumulate at areas of high and low velocities. The latter may reflect the increase of pore pressures and stress changes generated by existence of volcanic fluids.

Keywords: Sakurajima Volcano, Volcano-tectonic earthquakes, Three-dimensional seismic velocity model