

Three-dimensional Seismic Velocity Structure of Aira Caldera Using Controlled Source and Local Seismic Data

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Aira Caldera with a diameter of about 20 km is situated at Minami Kyushu, Japan and Sakurajima is the most active volcano in Japan is formed on south rim of the Aira caldera. Inflation source with about 10^7m^3 per year in the past 30 years is located at a depth of about 10km beneath the center of the Aira caldera revealed by levelling and GNSS measurement. In order to predict the scale of next large eruptions, it is necessary to know the total amount of magma accumulation beneath the Aira caldera. We estimated total magma accumulation and clarified magma supply system beneath the Aira caldera from seismic anomaly of 3D seismic velocity tomography analysis.

The structure around inflation source at 10km beneath the Aira caldera was not clear from controlled-source seismic experiment. So, we use natural earthquakes in order to clarify three-dimensional seismic velocity structure at deeper part of the Aira caldera. There are currently 48 seismic stations in southern Kyushu, and 424 natural earthquake events around the Aira caldera with the arrival times of 14,320 P waves and 8,453 S waves and 3,121 P waves of the seismic experiment in 2008 were used for the analysis. The velocity grid intervals are 4km in the vertical and horizontal directions and the velocity model is well resolved shallower than 20km around the Aira caldera. A region with P wave velocity about 10% lower than the surrounding area exists at a depth of about 5km in the northeastern part of the Aira caldera. The largest S-wave velocity anomaly with 20% slower than the surrounding area is seen over a depth of about 15km beneath the center of the Aira caldera at deeper part of the inflation pressure source revealed by GNSS and levelling measurements. The S-wave anomaly size is larger than 1 velocity grid.

Keywords: Sakurajima volcano, Seismic velocity structure