Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC45-P31 Room:Convention Hall Time:May 27 18:15-19:30

Locating sources of the continuous tremor at Aso Volcano

ICHIMURA, Misa[1*] ; YOKOO, Akihiko[1] ; KAGIYAMA, Tsuneomi[1] ; OHKURA, Takahiro[1] ; YOSHIKAWA, Shin[1] ; INOUE, Hiroyuki[1]

[1]Graduate School of Science, Kyoto University

At Aso Volcano in southwest Japan, volcanic tremors have been well-studied based on observations since early 1900s and have been classified into several types (e.g. Sassa, 1935). One of these tremors, a continuous tremor, dominates in the frequency of 3-10 Hz and its source location is determined in the area shallower than a depth of 600 m beneath the active crater (Takagi et al., 2006; 2009). This suggests that an intrusion of gas flow into an aquifer occurs at this depth. There is another idea about source process of this tremor; it might be associated with increasing a cross-sectional size of a conduit as change of seismic amplitude often corresponds to change of volcanic activity (Sudo, 2012). However, precise source location and source mechanism of the continuous tremor have not yet been elucidated in either case.

In January 2014, it was found that a new vent had been opened in the crater of Aso Volcano on the 7th day and that a small eruption occurred on the 13th day (Japan Meteorological Agency, 2014). A temporal change of the tremor amplitude was observed since more than one month before these surface phenomena. In a 5-10 Hz band-passed vertical seismogram at a station SUN, 1 km south from the crater, the RMS amplitude started to increase gradually in November 2013 (0.006 μm/s/day). After that, it increased rapidly for 2 weeks (0.16 μm/s/day) and then sharply decreased to the same level as in early November for 3 days (-0.25 μm/s/day). Similar changes of the amplitude were observed for 10 days afterward.

In this study, we focus a period from December 2013 to January 2014 and determine source locations of the continuous tremor. We then discuss a source process of the tremor linking to a shallow structure beneath the active crater.

For locating sources of the continuous tremor, we assume that the tremor is composed of the S-wave radiating isotropically (Vs=1.12 km/s; Q=204). Grid search method is applied to reproduce a spatial distribution of the seismic amplitude (vertical component) observed at our 7 stations around the crater. The space for searching is about 1,500 m$\times$1,500 m$\times$1,200 m at a 25 m interval. The terms when we have data with good azimuthal coverage by more than 4 stations are picked up to the calculation.

As a result, source locations of the tremor were determined at the depth of several tens m beneath the crater in early December when the amplitude increased gradually, and near the ground surface of the crater bottom in late December when the amplitude increased rapidly. In early January when we observed the similar change of amplitude to in December, the sources were located from the depth of a few hundreds m to just beneath the crater bottom.

These results indicate that we could shed a light on the distribution of a path of volcanic fluid beneath the active crater. Yamamoto et al. (1999) proposes that a crack-like conduit whose upper edge is situated in a depth of 300 m beneath the crater is the path of volcanic fluid. The fluids may always be supplied to the crater through the conduit (Terada et al., 2012). The tremor sources determined here are distributed to fill a space between upper edge of the crack-like conduit and the crater. In this area, there are a cap rock and a hydrothermal fluid reservoir (Kanda et al., 2008). We thus interpret source processes of the continuous tremor as follows. In December, fluid influx exceeded the usual amount as increasing of volcanic activity. This widened the path with radiation of the continuous tremor. Especially the tremor at shallower depth of the crater would associate with fracturing in the cap rock region. Since this phenomenon must have reached to the ground surface, we observed the new vent opened inside the crater on 7 January. In the next 10 days, as further increase of the influx causing the January 13 eruption would occur, the observed tremor amplitude changed like in December.

Keywords: volcanic tremor, Aso Volcano