Temporal changes in the resistivity structure beneath Aso volcano during the last eruption period from November 2014 to October 2016, inferred by ACTIVE observations

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Aso volcano, Central Kyushu, Japan is one of the most active volcanos in Japan. Recently, magmatic eruptions started in November 2014 and stopped due to blocking of the conduit in May 2015, and an explosive eruption took place in October 2016 with volcanic smoke reaching 1200m above the rim of the crater, followed by the present calm stage. An electromagnetic volcano monitoring system named ACTIVE (Utada et al., 2007), which consists of transmitters for accurately controlled electric current sources and induction-coil receivers for the vertical component of the magnetic field, were conducted as observation campaigns six times including the last active period of Aso volcano; May, August, and November 2014, February and August 2015, and August 2017. We found significant temporal changes in ACTIVE responses between August 2014 and November 2014. The change starting in November 2014 has a peak at the observation in February 2015 and slightly goes back to the state before the eruption at the observation in August 2015. Since the characteristic is consistent with the change of the averaged amplitude of volcanic tremors, resistivity structures corresponding to the ACTIVE responses may provide information on activities accompanied by volcanic tremors.

In this study, we developed a new three-dimensional (3-D) inversion code for ACTIVE responses by adopting an edge-based finite-element method (e.g. Schwartzbach and Haber, 2013) and the data-space inversion method (e.g. Siripunvaraporn et al., 2005), in order to infer a common background resistivity structure and temporal changes corresponding to ACTIVE responses between August 2014 and August 2015. A modified version of the 3-D resistivity structure obtained from AMT data in 2004 and 2005 (Kanda et al., 2015, JpGU) were used as an initial model for inversions for a common background resistivity structure. In inversions for the background structure, the inversion model space is the whole area beneath the ground surface, while the model space for inference of temporal changes is restricted to a prism located beneath the crater whose bases are squares 400m on a side. It was found from our inversions that the conductive zone is located 200m beneath the ground on the western side of the crater in the background structure. On the other hand, as temporal changes in the resistivity structure, a zone which became resistive were imaged just below the crater, while a conductive change was inferred 200 –400 m beneath the crater. The former change is attributed to the escape of ground water due to inclement of temperature and pressure before the magmatic eruptions, while the conductive change is to upcoming fresh magma from deeper part.
In this presentation, we report and discuss temporal changes in the resistivity structure between August 2014 and August 2015, inferred by the inversions mentioned above. Furthermore, we plan to comprehensively discuss changes in the resistivity structure beneath Aso volcano and related volcanic activities during the last active period using all the ACTIVE data available including August 2017.

Keywords: Aso, ACTIVE, controlled-source, monitoring, magma, resistivity structure

