ACTIVE データから推定される阿蘇山 2014-2016 年活動期の比抵抗構造時間変化

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Temporal variation in the resistivity structure of Aso volcano during the active period from 2014 to 2016

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In November 2014, magmatic eruptions started at Aso volcano approximately 20 years since the last magmatic events. The magmatic eruptions stopped in May 2015 due to subsidence of the bottom of the first Nakadake crater. However, subsequent eruptions followed the magmatic events, namely the phreatic eruption in September 2015 and the phreatomagmatic explosion in October 2016. After the explosion in October 2016, the activity of Aso volcano led to the current volcanic quiescence.

During the activity from November 2014 to October 2016, we conducted several campaign observations based on the ACTIVE system (Array of Controlled Transient- electromagnetics for Imaging Volcano Edifice; Utada et al. 2007). ACTIVE system installed at the first Nakadake crater of Aso volcano consisted of a transmitter located northwest of the crater with four or three receiver stations of vertical induction coils through the active period. The ACTIVE observations succeeded in detecting temporal variations in the resistivity structure over the magmatic eruption period. Response variations started in November 2014 has a peak in February 2015 and slightly returned to the values before the eruptions in August 2015.

We implemented three-dimensional (3-D) inversions based on the finite-element method with unstructured tetrahedral mesh, to interpret temporal variations in the ACTIVE response, accounting for topographic effects. The 3-D inversions revealed that temporal variations in the ACTIVE response were attributed to (1) a broad increase in resistivity at the peak elevation of 750 m to 850 m, present not only just beneath the crater bottom but also outside the crater, and (2) a decrease in resistivity at the elevation of 1050 m on the western side of the crater (Minami et al. 2018). The increase in resistivity can be ascribed to decrease of the amount of conductive groundwater in the upper part of the aquifer located at the elevation lower than 800 m. The decrease in resistivity might be due to a temporal hydrothermal fluid reservoir during the eruption period formed by high-pressure fluid escaping from the conduit zone. This study demonstrates that 3-D modelling of ACTIVE responses can be effective in understanding temporal variations of volcanic hydrothermal systems.

In the presentation, we propose a scenario for variation in the hydrothermal system during the active period from our inversion results. We also plan to add inversion results from ACTIVE data in August 2017 to the scenario, to extend our scenario to the present quiescent stage.