2014年11月阿蘇山マグマ噴火前後のACTIVE観測結果を説明する三次元比抵抗構造推定の試み

Attempt at three-dimensional modelling of temporal change in resistivity structure beneath Aso volcano through the magmatic eruption in November, 2014

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In Aso volcano in the center of Kyushu island, Japan, a magnetic eruption occurred on November 25th, 2014, for the first time since the last magmatic event in 1993. Since the magmatic eruption in 2014, phreatic/phreatomagmatic eruptions have occurred several times in Aso volcano recently. To monitor the activity of Aso volcano, a group in Kyoto University have been operating an electromagnetic monitoring system, ACTIVE (Array of Controlled Transient Electromagnetics for Imaging Volcano Edifice; Utada et al, 2007), around the active first crater of Aso volcano. ACTIVE system in Aso volcano consists of one transmitter that transmits electric currents into the ground through two electrodes, and several induction-coil receivers that observe only the vertical component of the magnetic field. In ACTIVE observation results before and after the magmatic eruption on November 25th, 2014, we found obvious temporal changes in the response function, the amplitude ratio of the received magnetic field to the transmitted electric current (nT/A). At the western rim of the first crater, larger amplitudes of the response function were observed over frequencies ranging 10 to 100 Hz after the magmatic eruption. Some movement of underground water/magma may be responsible for the temporal changes.
In order to interpret the ACTIVE data obtained before and after the magmatic eruption including topographic effects appropriately, we developed a three-dimensional forward code, by adopting a vector finite element method (FEM). In our forward modelling, the induction equation in terms of the vector potential, A, is solved with the gauge potential of phi=0 (Hano, 1991). We adopted unstructured tetrahedral mesh to represent arbitrary resistivity structure and complicated topography of volcanos. We demonstrated accuracy of our forward code in comparison to an analytical solution of Ward and Hohmann (1988), in a situation where a horizontal electric dipole is located just on one-dimensional layered structure. Currently, we are trying to apply an existing background conductivity structure obtained by AMT surveys to the background structure in our modelling, to investigate the cause of the temporal changes in the ACTIVE responses. In our presentation, we plan to show our results of forward modelling to interpret the temporal changes observed by ACTIVE system before and after the magmatic eruption in November, 2014.

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