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electromagnetic imaging of geofluids

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Geo-fluid plays an important role in the subduction system for the generation of magmatic melt and the earthquakes. One of the most sensitive physical parameters to the existence of fluid is the electrical conductivity (resistivity). Thus the distribution of geo-fluid at depth can be inferred from the resistivity structure by using electromagnetic induction. For the exploration of the deep crust and upper mantle, we usually use natural electromagnetic field in the period range 0.01s to 30,000 s, arising from lightning and magnetic storms.
In the last two decades, we have been successfully image deep resistivity structure in seismically active region and volcanic zone. In particular, we have found the inhomogeneous distribution of mid-crustal resistivity and its correlation to crustal deformation, seismicity, and geotherm. These previous studies usually assume the resistivity structure has two-dimensionality, partly because the limited 3d modeling codes and partly because of the difficulty in occupying the sites as gridsrather than a profile.
The new project Electromagnetic Imaging of Geofluidaims at obtaining the three-dimensional resistivity structure at the NE-Japan subduction system. Our final model will cover from crust to the upper mantle. For this work, we will have wide-band (periods 0.0003s - 2000s) magnetotelluric measurements with 3km grid spacing around the core region Naruko Volcano. In addition, we will have long period (periods 10s - 100,000s) measurements with 20km grid spacing.
In order to interpret fluid content and fluid geochemistry, modeled resistivity structure is not enough. We need a tool to interpret between resistivity and fluid. Thus, in the new project Electromagnetic Imaging of Geofluid, we also have an important laboratory work to measure fluid rsistivity and bulk resistivity at high pressure and high temperature.

In the presentation, I will introduce some preliminary results on the newly obtained magnetotelluric data in and around Onikobe caldera.

Keywords: geofluid, magnetotelluric method, resistivity