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How to image magmatic hydrothermal system by seismic and electromagnetic ACROSS

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Imaging of hydrothermal systems and its temporal changes in the volcanic area can be understood with discriminating the state of water as an supercritical or not. The key parameters are obviously heterogeneous distributions and their temporal variation of electrical conductivity as well as the elastic impedance and dispersion of hydrothermal systems. Understanding the behaviors of such heterogeneous distribution of physical properties in the hydrothermal systems, both seismic and electromagnetic methods should be systematically combined.

We have developed an active monitoring system named the ACROSS (Accurately Controlled Routinely Operated Signal System) in which a tensor transfer function with highly reliable error estimation are directly obtained. This approach will be the best way to discriminate very small temporal changes of the physical properties (and material dispersion) and heterogeneous structures in the hydrothermal systems, by utilizing both Seismic- and Electromagnetic (EM)-ACROSS.

Preliminary results obtained by the EM-ACROSS near Shizuoka University together with the Seismic ACROSS systems (Toki, Morimachi, and Toyohashi sources) operated near the Tokai region indicate that the more precise modeling of electromagnetic and seismic structures and their temporal changes should be needed with more dense observation sites as well as the longer duration of continuous observations.

Keywords: EM-ACROSS, Seismic ACROSS, Temporal variations of properties and structures, Detectability