3D resistivity structure of geothermal system at Kusatsu-Shirane Volcano, Japan

Nurhasan .[1]; Yasuo Ogawa[2]; Naoto Ujihara[1]; S. Bulent Tank[3]; Yoshimori Honkura[1]

[1] Earth and Planetary Sci., Tokyo Institute of Technology; [2] TITECH, VFRC; [3] Earth and Planetary Sci., Titech

AMT Measurements were carried out in different campaigns (2003, 2004 and 2005) around the summit area of the Kusatsu-Shirane volcano with the total of 38 sites and a spacing of approximately 200m. Frequency range of 1 to 1 kHz is used in this survey. All measurements involve 5 components (2 horizontal components of electric fields, 2 components of the magnetic fields and 1 vertical component of magnetic field).

We have analyzed these data by performing two dimensional inversion code(Ogawa and Uchida) and the three dimensional forward modeling codes(Mackie). Our 2D inversion result at Mizugama crater showed 800m thick conductive zone at 300m below surface. This conductive region is separated vertically by a more resistive zone. Another conductive zone is found at deeper part in west of the Yugama crater. In 3D forward modeling, two parameters including phase tensor, and induction vector are used as response functions during the forward modeling process. The previous two dimensional inversion results were used as a staring model.

The final 3D model shows that there are some shallow structures in particular conductive zones corresponding to the locations of fumarolic gases. The existence of this shallow inhomogenous structure can be clearly seen from irregularity of the induction vector direction at high frequency (100 Hz). In the deeper part which corresponds to 10 Hz and below, almost all induction vectors are pointing to the area around Mizugama crater corresponding to the 3D model where a cylindrically conductive zone is found around Mizugama crater. In addition within this conductive anomaly, at around 200m depth from the surface, an N-S elongated more resistive region exist. We interpreted this conductive zone is a clay mineral zone acting as a cap rock, whereas the resistive zone below this part represents a hydrothermal reservoir. By comparing to other previous observations such as LP event sources, demagnetization dipoles, and geochemical studies, our 3D model is also consistent with the previous studies.