Geophysical Research Abstracts
Vol. 14, EGU2012-9405-1, 2012
EGU General Assembly 2012

Magnetotelluric Exploration of the Sipoholon Geothermal Field, Indonesia

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Magnetotelluric (MT) measurements have been carried out at 96 sites around the Sipoholon Geothermal field, in the province of North Sumatra, Indonesia. The Sipoholon geothermal field is a low enthalpy geothermal system located in a pull-apart basin controlled by the Sumatra fault system. One of the main difficulties in understanding this system is an apparently random distribution of temperatures in 15 hot springs in the area. High levels of electromagnetic noise with several high voltage power lines in a densely populated area is challenging for natural source MT measurements. Noise at long periods and in the dead band (1s to 10s) could be removed with robust remote reference processing and high frequency noise could be suppressed with a delay line filter. After dimensionality and directionality analysis of the data, we found a regional strike direction consistent with the Sumatra fault.

We present results of 2D inversion of the data along several profiles perpendicular to the main strike direction. Modeling results indicate a shallow (< 1000 m) low resistivity layer, zones of high resistivity at intermediate depths (approximately 500 to 5000 m), and regions of low resistivity in the depth range of 2 to 4 km. These deep zones of low resistivity could be caused by hydrothermal alteration or hydrothermal fluids. The shallow low resistivity correlates spatially with the graben areas of the pull-apart system and is likely associated with (unconsolidated) sedimentary fill.