3D resistivity structure of the Matsukawa geothermal area using magnetotelluric data

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The Matsukawa area in Iwate Prefecture is located ˜30 km northwest of Morioka City and is the only vapor-dominated geothermal area in Japan. A 2D inversion was performed in 2009 using magnetotelluric data to explore the area's geothermal structure in detail and identify a new drilling target (TOUSEC, 2009). However, portions of the obtained data indicate strong three-dimensionality and resistivity anomalies may therefore have been falsely generated. In this study, we perform a 3D inversion using ModEM (Egbert and Kelbert, 2012). We used MT data of 45 stations around the Matsukawa Geothermal Power Plant provided by TOUSEC. By considering the calculation conditions as the initial resistivity, a smoothing parameter, and a Lagrange multiplier, we determine an optimized solution according to results obtained with the smallest root mean square value. The results of the 3D inversion are used to confirm the zones of clay alteration and faulting, both of which control the geothermal system in this area. The 3D resistivity structure matches well with electrical logging data obtained from as deep as 1 km and is therefore more reliable than the 2D inversion above sea level where logging data is available.

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