Three-dimensional Magnetotelluric Inversion to map geothermal structures in Eburru Geothermal field, Kenya.

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To explore the geothermal system in Eburru geothermal field in an attempt to delineate possible heat sources and fluid flow pathways governing the system, 107 Magnetotelluric (MT) soundings were deployed in the field. The MT data was analyzed using phase tensor to determine the dimensionality of the subsurface resistivity structure. These data were inverted to a fully three-dimensional resistivity model. Overall, the inverted resistivity model fits the MT data very well as evidenced by the data misfit curves. Consequently, 2-D inversion were carried out and a joint interpretation was made on the basis of the two models. The preferred 3-D model images a resistive top layer overlying a very conductive layer (˜ 10 ohm.m) interpreted as the hydrothermally altered clay cap of the system and a moderate resistivity layer (about 30 ohm.m). These layers are underlain by a higher resistivity zone (˜ 100 ohm.m). To characterize the resistivity structure in the field, resistivity profiles were extracted from the 3-D model in order to cut across the known geological structures. The profiles analysed show a deep reaching conductive channel connecting two conductors located at ˜ 1 km from the surface and at a depth of ˜ 4 km. This channel can be interpreted as potential path way used by geothermal fluid to migrate to the surface and manifests as fumaroles and hot spring. The occurrence of fumaroles along faults suggests leakage of steam where the cap is likely to have been cut by the faults. The resultant 3-D resistivity models are generally similar to the two-dimensional (2-D) inversion models, however, the deeper portion of the 3-D model seems to be more realistic than that of the 2-D model.

Keywords: Eburru geothermal field , Magnetotelluric, 3-D Inversion, Resistivity, 2-D inversion

