

Dual L-shape model: a possible cause of anomalous magnetotelluric phase in central India

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Summary

The anomalous magnetotelluric phase is a distinct characteristic of magnetotelluric (MT) data, which can be represented as a distortion in the MT data or anisotropy in the subsurface formations. In the present study, we notice an anomalous phase at several stations along the Narmada river course normal to the Tan Shear Zone (TSZ) in central India. We made efforts to derive a possible cause of the anomalous phase using synthetic studies and the obtained results are correlated with measured impedance tensor data as well as local geological conditions. In central India, multiple reactivations of the TSZ lead to the formation of a damage zone parallel to it and conjugate Riedel shear zone (parallel to the Narmada River course) normal to the TSZ. Based on the geographical position of the damage zone and conjugate Riedel shear zone in the study area we presented a dual L-shape model. From the response of the model, we noticed that near-surface 3-D heterogeneity across the TSZ critically distorted the transverse component of MT data (YX component of measured data) due to the strong current channeling. When the current flows across the conjugate Riedel shear zone i.e. along the Narmada river course, charges are accumulated at the boundaries of surficial 3-D structures. The charges associated with the current channeling leads to the reverse of the telluric current direction that is reflected in the form of anomalous phase in the transverse component of impedance tensor in measured data.

Keywords: Anomalous phase, dual L-shape model, CITZ, Tan shear zone, distortion, current channeling