An assessment of galvanic distortion effects contaminating MT data from Central Iran

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SUMMARY

Salt extrusions (Diapir, dome and glaciers) have a high electrical resistivity contrast with their surrounding sediments and consequently are good exploration targets for electromagnetic (EM) methods. However, diffusive EM fields, employed in MT exploration technique, have restrictions in resolution and sensitivity and cannot model the earth at the full scale. Furthermore, galvanic distortion effects caused by shallow and small scale lateral inhomogenities contaminate measured EM fields and cause unreliable imaging of subsurface electrical resistivity.

In this study, we investigate dimensionality, directionality and distortion analysis of an MT dataset from 35 stations recorded along a profile in Nasr Abad region, west central Iran. The region is composed of five salt diapirs, developing close to the Abshirin Shurab fault zone which is a dextral strike slip fault with a NNW-SSE strike direction in the west Central Iran.

Considering the limitations of different dimensionality analysis method, we applied a combined approach, comprising a subsequent use of the WAL invariants, phase tensors and the Groom-Baily (BG) decomposition methods. At the first step we classified dimensionality and distortion effects at different period bands. Then, for the bands where MT data appear to arise from a superimposed model of 3D/2D structures, we switched to the GB decomposition method for distortion effect removal and retrieving regional impedances. At the first step, the application of rotational invariants showed that there is no sign of electrical anisotropy in dimensionality pattern and the regional conductivity structure can be considered predominantly as 2D with some superimposed distortions from local 3D conductivities. 2-D inductive impedance responses were also retrieved by removing distortion effects from the measured data.

Keywords: magnetotellurics, electrical conductivity, salt diaper, Central Iran