GLOBAL OPTIMIZATION FOR THE INTERPRETATION OF MAGNETOTELLURIC SOUNDING DATA USING POLYNOMIAL APPROXIMATION AND ESTIMATION OF STATIC SHIFT

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Near surface conducting bodies can severely distort magnetotelluric (MT) apparent resistivity data. This distortion is due to an electric field generated from boundary charges on surficial inhomogenities, and persists throughout the entire MT recording range and is known as static shift (e.g., S) in Magnetotellurics. Frequency independent static shifts are manifested as a vertical, parallel shift that occurs in the dual logarithmic scale of apparent resistivity vs. time period plot. The phase of MT data remains unaffected by the static shift and can be used to remove the static shift. However, inversion of phase data alone will not work, as it will not lead to a unique solution. Inversions of the static shift corrected MT data provide better estimates of resistivity and thicknesses than the inversion of uncorrected data. Hence, static shift must be removed from the data before inverting it to get the reliable earth model. In the present study boundaries between various layers in subsurface are expressed in terms of polynomial. The coefficients of polynomial representing the boundary are optimized using very fast simulated annealing (VFSA) approach. Further, static shift is considered as one of the model parameter (different for each station along a profile) and optimized together with other model parameters using VFSA global inversion technique. As a result, model parameters as well as estimates of the static shift present in the data are determined simultaneously for a number of stations along a profile. Synthetic and noisy data generated for a number of models are used to show the efficacy of the approach in getting reliable estimate of the subsurface when the apparent resistivity data is affected by static shift. Study shows that the joint inversion of the apparent resistivity and phase data inverted together without or with considering static shift for optimization yields good fit between the observed and model data. Joint inversion results show that estimated resistivity are S times of the true resistivity and estimated thicknesses are square root (S) times of the true thicknesses without optimization of static shift. Further, joint inversion of the apparent resistivity and phase data inverted together and also optimized for the static shift yields the best estimate of the subsurface structures.

Magnetotellurics, Static-shift, global-inversion

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