A numerical study on the distortion of magnetotelluric data from topography, near-surface conductors and basins

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ABSTRACT

Magnetotelluric (MT) data may be distorted by a variety of structures, including near-surface inhomogeneities, topographic gradients and large conductive bodies. A synthetic study is undertaken to analyse these three factors in the Curnamona Province, South Australia. Firstly, the effect of topography in the northern Flinders Ranges is investigated by the use of forward models. The results show both a galvanic and an inductive distortion concentrated at high topographic gradients. The effect of near-surface conductors is also investigated with forward models, using data from Lake Frome as input. The models show a small area of galvanic distortion around the circumference of the lake, but no regional effect. These results are compared with distortion analyses of real data. Finally, thin-sheet modelling is used to determine the effect of a synthetically calculated conductance using data from the eastern Arrowie Basin. Results from the thin-sheet model show that the Arrowie Basin has the potential to inductively distort MT data on a regional scale. Using this result as motivation, two three-dimensional (3-D) inversions are undertaken on the Geoscience Australia "08GA-C1 MT" line; one incorporating the Arrowie Basin as a prior model and the other starting from a homogeneous half-space. The results of these inversions are overlain with interpretations from seismic data collected along the same line. The best agreement between the seismic and MT data is achieved with the prior-model inversion, supporting the hypothesis that basin scale conductivity structures distorts MT data and showing that this effect is alleviated by incorporating basin structure as a prior model during inversion.

KEYWORDS

Distortion, magnetotellurics, Curnamona Province, synthetic, topography, modelling

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