Geophysical Research Abstracts, Vol. 7, 10610, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10610

3D JOINT INVERSION OF SHALLOW ELECTROMAGNETICS AND DC RESISTIVITY DATA

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We have developed a 3D inversion technique for low-induction numbers (LIN) and direct-current resistivity (DC). LIN data are collected from a commercial company. The equipment consist of pair of loops interconnected. As the loops separation increase, the frequency used must be lower. The source loop generates a magnetic field and induce electric currents in the conductors bellow the ground The receiver loop gets the primary magnetic field from the source and a secondary magnetic field from the conductors in subsurface. Quadrate component of the magnetic field is the only sensible of spatial changes of the conductivity in the ground. Measurements are taken by moving the pair of loops over several lines covering an area. Measurements can be taken for coplanar horizontal and vertical loops. DC data can consist of any traditional array as dipole-dipole, Schlumberger, Wenner, etc. moving along lines and covering an area or using non co-lineal arrays. Individual 2D inversion was already solved by using quadratic programming and an analytical solutions in terms of elliptic integrals. This research is an extension to recover 3D conductive bodies bellow the ground using both LIN and/or DC data. The inversion process minimized the quadratic norm of residuals plus a regularized factor that also minimize the spatial derivatives of the conductivity with constraints in every cubic cell of constant conductivity. LIN data are more sensible for conductors and is usual to pose the problem in terms of the apparent conductivity measured. DC is sensible for conductor and resistives and is usual to pose the problem in terms of the logarithm of resistivity. For joint inversion several test were done, finding that in terms of the apparent conductivity the 3D structures are better defined. Inversion was test with synthetic data from 3D bodies with different orientations. It was also proof with real data.