EXAMPLES OF THE CONTRIBUTION OF A-PRIORI INFORMATION TO IMPROVING INVERSION OF AEM DATA

Andrea Viezzoli, Aarhus Geophysics Aps;
Tim Munday, CSIRO;
ANTONIO MENGHINI, Aarhus Geofisica;
Anne-Sophie Høyer, Aarhus University;
Esben Auken, Aarhus University

Abstract: We present a simple yet rigorous way of adding a-priori information to inversion of Airborne EM data, using the Spatially Constrained Inversion. Resistivity models are constrained spatially to reflect the lateral homeogeneity expected from the geology. These constraints, that can be considered “soft a-priori”, are fitted together with the AEM data, during the inversion. Moreover “hard a-priori” can be added: they can be, e.g., downhole resistivity logs, geological contacts and layers, hydrogeological units. The a-priori information is treated as an extra data set, by taking into account location, values, uncertainty, and expected lateral variability. The information it contains is spread to the location of the neighbouring AEM soundings. These fields enter the SCI formulations, with the Obs matrix containing the data (AEM and a priori), the Roughening matrix the constraints, the error matrix the uncertainties for all datasets. Constraints and uncertainties are usually different depending on data types and geology. Different datasets, collected by various AEM systems, have been used. The a-priori informations were provided by boreholes (e.g. the depth to the water table defined as thin conductive layer below more resistive layer) or by seismic data processing (e.g. the depth to a layer as interpreted from seismics was added to the inversion). Firstly, we inverted the whole dataset with a multilayers SCI with no extra a-priori information. Later on, we added the a-priori informations. Their effect varies from dataset to dataset. In one case, for example, the results obtained with a-priori recovered better the water table and could be used to derive meaningful information about the unsaturated zone. Even though the a-priori do not change the overall results significantly, they helped resolving better subtle model parameters. Furthermore, they can contribute to refine the resolution of otherwise poorly determined parameters.

No full paper available.