ADVANCED METHODS OF 3-D EM IMAGING, INVERSION AND RECOGNITION OF THE SUBSURFACE TARGET PARAMETERS

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Advanced 3-D interpretation tools based on imaging, Bayesian inversion and artificial neural network recognition methods developed by the author are reviewed.

The first one is based on Bayesian statistics and theory of Markov chains, and supports a new paradigm of the data interpretation, which takes into account the geological information known, noise level in the data, prior estimates of the unknown parameters, hypotheses formulated in probabilistic terms, data available from passive methods and formalized experience of the interpretator.

The second method is based on the Artificial Neural Network (ANN) recognition. Properties of the supervised ANN are studied using synthetic magnetotelluric data base. Different groups of the EM field transformations as well as data compression techniques are considered. The effect of noise is discussed and statistically grounded conclusions on the effect of the noise level in the data on the quality of the ANN - recognition are drawn. A methodology aimed at reliable 3-D intrerpretation of insufficient and noisy data based on using a special noise treatment technique is considered.

A number of case studies are demonstrated. In particular, three-dimensional geoelectrical structures of the Washington-Oregon subduction zone, Minami-Kayabe geothermal area and Minou fault zone determined using developed interpretation tools are discussed.