Geophysical Research Abstracts
Vol. 14, EGU2012-5169, 2012
EGU General Assembly 2012
© Author(s) 2012

Unconstrained inversion of magnetotelluric data using Bayesian information criterion

T. Danek (1), M. Wojdyla (2), M. Stefaniuk (2,3)

(1) Memorial University, Department of Earth Sciences, Canada (tdanek@mun.ca), (2) PBG Geophysical Exploration Co. Ltd., Warsaw, Poland, (3) AGH University of Science and Technology, Krakow, Poland

Inversion of magnetotelluric (MT) data is usually based on finding local minima. This approach required the construction of initial model which should be close to final. In this paper global solution is proposed. Method combining particle swarm optimization and underparametrized Bayesian inversion was used. Efficiency of such approach was tested on magnetotelluric data, both synthetic and real. One–dimensional (1D) model was chosen because of its computational simplicity and ease of further analysis of the results. Tested model was based on MT data acquired in southeastern part of Polish Carpathian Foredeep. This region can be generally assumed as 1D. From geological point of view there is ca 1.3 km thick and flat Miocene complex (sandstone-clay) which has low-resistivity characteristic and cover high-resistivity Precambrian basement. Three and four layer synthetic geoelectrical models were taken into account to analyze possibilities of efficiency of algorithm for accurate, quantitative interpretation. The final step was adopting the synthetic results to real MT data acquired near deep borehole. Results of inversion were compared to electric-log data. Obtained results show that global, unconstrained approach can resolve geoelectrical inverse problem with acceptable accuracy but the accuracy is not better than information encompassed in MT curves. An equivalence phenomenon was taken into consideration and it is well presented in maps of solutions which can be understood as databases of accepted results. If some external geological information can be included, the interpreter is able to choose the best result from it. Sometimes a non-optimal solution that nevertheless has an acceptable misfit can be in better agreement with the geological model then the global best result. After including additional information final models can return more thin layers and equivalence is more controlled. Analysis of dependence between number of layers and the reliability of final solution was made.