

Technique of simultaneous using electrical and electromagnetic data obtained with NORD equipment

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SUMMARY

Nowadays, one of the most important issues in application of geophysics mainly in mining and geothermal explorations is using the data obtained from different methods.

In the winter of 2024, experimental and methodological research was carried out in the area of the research and training fieldcamp "Aleksandrovka" of the Faculty of Geology of Lomonosov Moscow State University in the Kaluga Region using a measurement technique that allows to simultaneously obtain a whole set of electrical and EM data - audiomagnetotelluric (AMT), control source electromagnetic (CSEM) and deep electrical resistivity tomography with measurement of induced polarization (ERT-IP).

The work was carried out on a line about 5 km length that crosses the Neogene paleovalley of the Ugra River, which contains a large amount of sands with high resistivity. Measurements were carried out with current line (AB) of 450 m length. In total there were 10 AB locations with space 300 m between them. NORD equipment (Nord-West Ltd, Russia) with induction coils IMS-005 (Vega Ltd., Russia) were used for data acquisition. The space between sites was 150 m. The frequency range was from 1 Hz to 20 kHz. During the stop-by of current, AMT data (Ex, Ey, Hx, Hy) were acquired.

At the first stage of inversion, an automatic joint 2D inversion of the AMT and ERT-IP data was performed using Zond Software (by A. Kaminsky). The resulting model was used as a starting model for interactive two-dimensional inversion of CSEM data. Based on the results of a two-stage inversion of EM-data, a deep model of electrical resistivity was built, and the spatial boundaries of the paleovalley were estimated.

This study presents both the advantages and disadvantages of the proposed technique and the results of analysis and inversion.

Keywords: electromagnetics, audio magnetotellurics (AMT), control source electromagnetic (CSEM), electrical resistivity tomography with measurement of induced polarization (ERT-IP), paleovalley, joint inversion
