Static shift correction in sedimentary basins

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SUMMARY

The work considers the problem of static shift of magnetotelluric (MT) curves obtained in sedimentary basins. The MT data of recent years obtained in Argentina, Bolivia, Brazil, Iran, Kazakhstan and Russia were used. The problem of static shift is considered in detail on the data obtained in the Yenisei-Khatanga regional Megatrough (Northern Russia). This trough is composed of Jurassic-Cretaceous terrigenous rocks with almost horizontal bedding. To study the effect of near-surface inhomogeneities on MT curves, such conditions are ideal, since they make it possible to simplify the accounting for the effects of the background section, considering it to be one-dimensional. In the Yenisei-Khatanga regional Megatrough, about 25 thousand MT soundings were performed, accompanied by 2-D seismic and time-domain (TDEM) measurements. Such a large amount of data made it possible to test various methods for detecting static shift and correcting it.

As a reference result, a static shift correction was used based on geoelectric models obtained from the TDEM data. All other correction methods were compared with this reference result. The work shows that for regional studies, a statistical static shift correction based on the spatial filtering of the MT impedance at a certain frequency gives satisfactory results. For oil and gas and more detailed survey, it is necessary to use third-party data to correct the static shift. In more cases the best fit are the TDEM data. In their absence, seismic survey results can be used.

The work also shows examples when TDEM data cannot be used to correct static shift: due to complex topography (Bolivia), due to strongly inhomogeneous upper part of the section (Siberia), due to intensive high-frequency induced polarization effects in permafrost (Taimyr). Based on the TDEM data, examples of systematic underestimation of the level of amplitude MT curves (Bolivia, Taimyr) are shown.

Keywords: sedimentary basins, static shift correction, TDEM