Geophysical Research Abstracts
Vol. 19, EGU2017-19343, 2017
EGU General Assembly 2017

Quantifying estimation of “static-shift” distortions with the use of natural and controlled sources.

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Static distortions exert the frequency-independent influence on results of electromagnetic soundings as with natural so with controlled sources. They originate from subsurface heterogeneities having sizes smaller than the wavelength of electromagnetic field in the ground.
There are several ways to avoid the static distortions. The first one based on the use of measuring lines with lengths exceeding transversal dimensions of subsurface heterogeneities [Berdichevsky, 1968; Zhamaletdinov, 1990]. The second method based on the use of the global magnetovariational sounding (MVS) curve for the parallel displacement of magnetotelluric sounding (MTS) curves [Rokityansky 1971]. The third way is the OCCAM inversion [Constable et al., 1987]. It is based on the use of MVS results for correction of amplitude curves MTS with the use of phase measurements. The fourth, statistical approach is based on the joint analysis of amplitude and phase MTS curves on a sufficiently large array observations [Jones, 1988]. The fifth approach is based on separation of local and regional effects (decomposition methods) [Bahr, 1988, Groom & Bailey, 1989]. All these methods have qualitative character.
In this paper we propose a quantitative method, based on the use of soundings with natural and controlled sources made at one point. Below, for example, three expressions are presented for longitudinal electric (1) transversal magnetic (2) and impedance (3) for the grounded electric dipole on the homogeneous half-space in a quasi-stationary (plane-wave) band [Vanyan 1965].
The resistivity of undersurface half-space in the field of controlled source can be defined by electric (1) and magnetic (2) components separately and by their relation (3). But in MTS technique only impedance (3) can be used for that, because the source parameters are unknown. This property of electromagnetic field has been used in the experiment "Kovdor-2015" [Zhamaletdinov et al., 2016]. Frequency soundings were performed at distances 50 km between transmitter and receiver. Two digital stations (KVVN-7 and VMTU-10) were used for the synchronous measurements. The curves of apparent resistivity, calculated from the total horizontal magnetic field, were free from the influence of "static-shift." They were used to make the quantitative corrections for the "static-shift" distortions on the apparent resistivity curves by electric field and the input impedance in the controlled source and in MTS curves.