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Peculiarities of electric field measurements in magnetotelluric sounding.

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The study of deep structure of the Earth is of great interest for both applied (e. g., mineral exploration) and scientific research. For this the electromagnetic (EM) studies which enable to construct the distribution of electrical conductivity in the Earth's crust are of great use. The most common method of EM exploration is magnetotelluric sounding (MTS). This method is a passive method of research, which uses a wide range of natural geomagnetic variations as a powerful source of electromagnetic induction in the Earth. MTS technique includes first the measurements of variations of natural electric and magnetic fields in orthogonal directions at the surface of the Earth, and then the conductivity structure of the Earth's crust is determined by the obtained data processing and as a result the geoelectric cross-section for the depths of several tens of meters to several hundred kilometres is constructed.
Like other methods, MTS has its limitations. The mmeasurements of electric field are the most complicated metrological process mostly limiting the accuracy of magnetotelluric prospecting. We believe that the increase of the accuracy of the electric field measurement can significantly improve the quality of magnetotelluric data. It is known that the measurement of the electric field is the biggest problem during the MTS. First of all, this is due to quite small values of the measured variations of the electric field compared to the so-called contact potential arising at the interface of the contact of the electrode with the environment. The shortcomings of a construction of different kind of non-polarized electrode were studied and in the result a new improved design of non-polarized LEMI-701 electrode based on the combination of Cu - CuSO4 is proposed.
A number of specific requirements should be taken into account at electric field meter design because it must measure signals with periods ranging from fractions of seconds to about 100.000 second with minimal error in field conditions at sufficiently large environmental temperature variations. The results of the development of new version of the instrument for the measurements of electric field at MTS, especially of copper-based non-polarizing electrodes are described. The field tests results of the MT sounding performed in the pre-Carpathian region using novel instrumentation are discussed.