THE INDUCTION SOUNDINGS OF THE MANTLE IN THE ROTATING EARTH

VLADIMIR YU. SEMENOV 1, Milan Hvozdara 2, Jan Vozar 2,3

1 Institute of Geophysics Polish Acad. Sciences, Warsaw, e-mail: sem@igf.edu.pl
2 Geophysical Institute, Slovak Acad. Sciences, Bratislava, e-mail: geofhvoz@savba.sk
3 DIAS, Dublin, Ireland, e-mail: geofjavo@savba.sk

Mantle includes 83% of the volume and 68% of mass of our planet and has conductance of about 1,600 MS, concentrated just in the layer of 800 km thickness above the core-mantle boundary. No direct estimation of the core conductivity (assumed 300,000 S/m) is known for authors. The induction impedances depend on the exciting field that originates from sources of several different types in the period range of hours to years commonly used for the mantle soundings. Besides, impedances in general depend on the particular sounding methods, on the properties of the conductive medium, as well as on the adopted model of the space, the later aspect being important at considering the way in which the induced currents locking, even “at infinity”. Moreover, the mantle sounding on the rotating Earth considered in the frame of the low velocity relativistic electrodinamics includes two kinds of inductions: (i) induction in a skin-layer by the variable exiting fields, source fields of which can move relatively the conductive media and (ii) induction in the whole rotating Earth by the time-stable fields in the Earth – Sun system. So, we can quote of Guglielmi and Gokhberg: “the Earth has not its own impedance” that has been confirmed recently by the forward spherical modeling.

The classic (first) kind of induction bases de facto on the boundary conditions firstly derived theoretically about 70 years ago. These non-local conditions on the boundary between resistive (air) and conductive (earth) are used to find magnetotelluric (MT) and magnetovariation (MV) impedances from the observed fields that allow us ignore variable power of the exciting sources. Nevertheless, impedances can depend theoretically on the amplitudes of the magnetospheric variations with periods of 150-600 s. The second kind of induction has been theoretically derived and examples of their “variations” induced by the ionospheric and magnetospheric sources are presented for conductive and non-conductive Earth. Features of the homopolar induction on the Earth are also discussed.

induction, the rotating Earth, mantle

Jan Vozar, Geophysical Institute of the Slovak Academy of Sciences, Dubravska cesta 9, 845 28, Bratislava, Slovakia, tel: +421905584452, fax: +421259410607, e-mail: geofjavo@savba.sk