Retrieving time series of magnetospheric external and internal spherical harmonic coefficients: from potential method to an alternative approach

Alexander Grayver and Alexey Kuvshinov
ETH Zürich, Institute of Geophysics, Zurich, Switzerland

Three-dimensional electrical conductivity distribution in the lower mantle can be estimated by inverting so-called matrix Q-responses. These responses relate spherical harmonic coefficients of external (inducing) and internal (induced) parts of the magnetic potential which describes the signals of magnetospheric origin. Currently, time series of these coefficients are estimated using potential method and both observatory as well as Swarm satellite data. However, the quality of the estimated induced coefficients containing information about 3-D conductivity remains insufficient, thus limiting recovery of lateral conductivity variations in the mantle.

Here, we explore a feasibility of alternative approach for retrieving time series of inducing (and induced) coefficients. We utilize the fact that horizontal component of magnetic field is much less influenced by effects from 3-D inhomogeneities of the Earth when compared to the vertical component. Therefore, we first estimate time series of inducing coefficients by analysing only horizontal component assuming some prior Earth's background conductivity model. With the time series of inducing coefficients at hand, we determine induced coefficients by using radial component only.