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Constraints on electrical conductivity in the lowermost mantle from transient EM induction modeling of satellite geomagnetic data

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Frequency-domain inversions of satellite or observatory geomagnetic data provide only limited insight into the electrical conductivity of the lowermost mantle. The main reason is poor correlation of primary and induced fields at long periods. We attempt to bypass this limitation by using the time-domain technique applied to transient time-series of satellite-based spherical harmonic coefficients.

In the first part of this contribution we show the results of 1-D inversion using 5 years long time series of data provided by the CHAMP satellite. Night-side data are first corrected for static field (main and crustal) and for secular variation using the CHAOS field model. Spherical harmonic analysis is then used to yield time series of dipole coefficients corresponding to the external magnetospheric ring current and its induced internal counterpart. The time series are then inverted in terms of 1-D layered conductivity model. The results show good sensitivity to the lower mantle conductivity and suggest rather small increase up to the values of 10 S/m at the core-mantle boundary.

In the second part, we assemble a series of 3-D conductivity models with various distributions of highly conductive patches in the lower mantle. Using synthetic response of such models, we study we study sensitivity of the time-domain method to occurence of such areas and their mutual interconnection.