Constraining the 1-D electrical conductivity of the crust and mantle beneath continents by the joint inversion of multi-source electromagnetic transfer functions

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SUMMARY

In this study, we present an approach that enables probing the Earth's conductivity structure from the crust to the lower mantle beneath geomagnetic observatories equipped with electric field measurements. This approach is based on a joint inversion of multi-source electromagnetic (EM) responses, namely, magnetotelluric impedances and longer-period global-to-local (G2L) transfer functions (TFs) originating from signals due to ionospheric and magnetospheric sources. Using the G2L TFs paradigm instead of the conventionally used C-responses allows us to account for the spatial complexity of the external sources. We validate the approach by inverting the responses estimated from the magnetic and electric data collected at the Chambon-le-Foret (CLF) geomagnetic observatory in France. We discuss the incurred challenges when working with CLF data, which arise due to the contamination of daily variations of ionospheric origin with the signals induced by the oceanic tides. We mitigate this problem through a high-resolution 3-D modelling of tidal signals and their subtraction from the data.

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