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New constraints on Earth's radial conductivity structure

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We present a new model of Earth's radial (1-D) conductivity structure at depths between 10 km and the core-mantle boundary. It is based on CM5, the latest version in the Comprehensive Model series that has been derived using 13 years (September 2000 to September 2013) of magnetic data collected by the three satellites Oersted, CHAMP and SAC-C and at the global network of geomagnetic observatories. CM5 describes contributions due to sources in core, lithosphere, ionosphere and magnetosphere (and corresponding induced parts) in form of spherical harmonic expansion (SHE) coefficients.

Removing predictions of the core, lithospheric and ionospheric field contributions as given by CM5 from the observations, we determine time series of the dominating external and induced SHE coefficients of the magnetic potential due to the magnetospheric ring current. Scalar Q-responses are estimated from these coefficients. An iterative approach is used to correct the estimated responses for 3-D effects arising from lateral heterogeneities in the top 10 km. The corrected Q-responses are converted to C-responses; the latter are subsequently inverted for the layered 1-D mantle conductivity profile with the Newton method. The Hessian matrix of the misfit function, which is derived analytically, is used to estimate confidence limits for the conductivity of each layer. The resulting conductivity-depth profile is compared to 1-D conductivity models of Earth's mantle recovered in previous studies.