Geophysical Research Abstracts,
Vol. 11, EGU2009-8060, 2009
EGU General Assembly 2009

Phase shifts of the secular variation due to an electrically conducting earth mantle

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Phases or phase shifts are significant criteria in the study of oscillations or certain episodic events of the geomagnetic secular variation, like jerks. They are produced by diffusion in an electrically conducting mantle if the phenomena are moving upwards. The size of the phase shifts depends on the (modelled or real) conductivity as a function of depth between the earth surface and the core-mantle boundary, on the spectral content of the considered event or oscillation, and on the spherical-harmonics degree of the secular variation component (radial or tangential).

We apply the approach of non-harmonic downward continuation (Ballani et al., 2002; Greiner-Mai et al., 2004) to the geomagnetic secular variation given at the earth surface. Within this framework, two complementary possibilities for the determination of phase shifts are studied:

(i) a strict version by numerical integration of ordinary differential equations

(ii) an approximative access which allows explicitly to see the radially-weighted influence of the conductivity.

With different examples of mantle conductivities, we illustrate the global phase behavior of oscillations given at the earth´surface. We study the weighting of the conductivity influence on the phase shifts over the whole radial interval - particularly in the interesting range near the core-mantle boundary - for the radial and tangential components of the secular variation.

References:

Ballani L., Greiner-Mai H., and Stromeyer D., 2002. Determining the magnetic field in the core-mantle-boundary zone by non-harmonic downward continuation. Geophys. J. Int., vol.149, 374-389.

Greiner-Mai H., Ballani L., and Stromeyer D., 2004. The poloidal geomagnetic field in a differentially rotating upper core layer. Geophys. J. Int., vol.158, 864-873.