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Influence of electric conductivity profiles of the lower mantle on the electromagnetic core-mantle coupling torque

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The electromagnetic (EM) core-mantle coupling torque is commonly split into poloidal and toroidal contributions like the geomagnetic field. Both contributions of the geomagnetic field are affected by the electric conductivity profile of the lower mantle. Because the EM coupling torques acts on the core-mantle boundary (CMB) it is necessary to determine both geomagnetic field contributions in the conducting mantle at the CMB. Therefore, we have to consider the conductivity profile in the non-harmonic downward continuation of the poloidal geomagnetic field and in the determination of the toroidal geomagnetic field by solving the related time dependent induction equations.

The necessary theoretical description is here only summarized and presented in detail elsewhere (Hagedoorn et al., 2008). We present here a sensitivity study for the influence of the electric conductivity profile on the EM coupling torque, considering different profiles with similar conductance (integral measure for the conductivity profile) and the same geomagnetic field model (Wardinski & Holme, 2006). For the determination of the toroidal geomagnetic field at the CMB it is necessary to use an additional constraint, which is in our case the core velocity field. The velocity field at the CMB is obtained from fluid flow inversion (Wardinski, 2004), applied on the

downward continued poloidal geomagnetic field.

Moreover, we discuss our results on the background of a comparison with the so-called mechanical coupling torque, which is derived from reduced observations of Earth's orientation parameters (EOPs).

References

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