A numerical finite volume model of electromagnetic core-mantle coupling

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Observed changes in the length of a day on decadal time scales and the Earth's 18.6- and 1.0-year nutations can be explained by a momentum exchange between the fluid outer core and the solid lower mantle. Beside other models for this exchange of momentum, one explanation is an electromagnetic coupling. Although actually the mantle's electrical conductivity is very low recent research findings suggest a high electrical conductivity of post-perovskite at relevant pressure and temperature. Since the Earth's D" layer at the bottom of the mantle consists of post-perovskite temporal variations in the Earth's magnetic field cause induced currents in the D" layer. The resulting Lorentz force is capable of explaining the measured changes in the length of a day and nutations.
A spherical 3D finite volume model is presented to solve the induction equation for the Earth's mantle for lateral varying electrical conductivity. The model is based on a cubed sphere grid and capable for parallel computing. Numerical magnetohydrodynamic model data can be used as boundary conditions at the core mantle boundary.