

## Electromagnetic core-mantle coupling and length-of-day variation in numerical dynamo models

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Exchange of angular momentum between the core and the mantle is likely to be responsible for the decadal variations in the length-of-day (LOD). If the changes in the angular momentum of the mantle are balanced by the opposite changes of the core, some coupling mechanisms between the core and the mantle should be invoked. Here we examine the electromagnetic (EM) coupling as a possible mechanism of angular momentum exchange. We use numerical dynamo simulations to investigate the mechanism to explain the LOD variations with respect to time including the decadal time scale. In numerical dynamo models, we impose a uniformly electrically conducting layer of about 200 km-thick on the mantle side of the core-mantle boundary corresponding to the D'' layer. The electric current associated with the dynamo-generated magnetic field can flow in the conducting layer and the Lorentz force can yield a net EM torque with respect to the rotation axis. The electrical conductivity of the layer is varied from 200 - 500 S/m in dynamo models. The LOD variations can put some feedback effects on flows in the core through the changes in the angular velocity, which emerge as a change in the effective Ekman number and the Poincare force. Influences of such a feedback are also included in numerical models. The Ekman number adopted as a nominal value is  $10^{-4}$ . We have obtained the EM torque resulting in typical angular velocity variation of the order of  $10^{-6}$  relative to the nominal angular velocity in a time scale of the magnetic diffusion time. Much smaller changes in shorter time scale are also observed. Based on the findings in the present study, it is suggested that the EM core-mantle coupling in a likely range of the conductance within the D'' layer is a promising mechanism to yield LOD variations in decadal to longer time scale.

Keywords: dynamo, electromagnetic core-mantle coupling, LOD variation, D'' layer