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Viscous and Electromagnetic Coupling at the Core Mantle Boundary.

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Differential rotation between the liquid core and the solid mantle generates a thin layer at the top of the core where the lorentz and viscous forces may balance the Coriolis forces and play a major role. We solve the induction and the momentum equation to compute the velocity and the magnetic field in boundary layer. Different regimes are possible. On a hand, when the difference of conductivity between the mantle and the core is small, a pure magnetic case may take place where induced electrical currents are produced in a skin layer and loop into a conductive solid layer in the mantle. On an other hand , given that the fluid in the outer core is likely to be subject to high convection, we can assume an Ekman layer based on eddy viscosity of $10^{-1}m^2/s$, such a pure viscous case where an Ekman layer generate a viscous skin at the base of the mantle is possible as well. A visco-magnetic regime where both, viscous and magnetic torques work together to balance the change in angular momentum and influence the Earth's axis of rotation is also investigated. A study of the effects of the small scales of the imposed magnetic field on the magnetic torque is done. It shows that for this non-linear model, the contribution of the unknown part of the spectra is weak even with the hypothesis of high energy for degrees above 13. Results are compared with previous approaches, in particular with the weak field approximation (Buffet et Al, 1992).

Using the result of the nutation theory (Mathews et Al, 2002) we show that in order to retrieve VLBI (Very Long Baseline Interferometry) data,there is no need of the presence of a high conductivity layer at the base of the mantle. The magnetic field at the C.M.B has to be smaller than the value find by previous authors with a similar inviscid analysis (Buffet et Al, 2002).