Geophysical Research Abstracts
Vol. 16, EGU2014-15970, 2014
EGU General Assembly 2014

Numerical study on the thermo-chemically driven Geodynamo

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In our numerical study we consider magneto-convection in the Earth's outer core driven by buoyancy induced by heterogeneities both in the thermal and the chemical field. The outer core is thus treated as a self-gravitating, rotating, spherical shell with unstable thermal and chemical gradients across its radius. The thermal gradient is maintained by secular cooling of the core and the release of latent heat at the inner core freezing front. Simultaneously, the concentration of the light constituents of the liquid phase increases at the inner core boundary since only a smaller fraction of the light elements can be incorporated during solidification. Thus, the inner core boundary constitutes a source of compositional buoyancy. The molecular diffusivities of the driving agents differ by some orders of magnitude so that a double-diffusive model is employed in order to study the flow dynamics of this system. We investigate the influence of different thermo-chemical driving scenarios on the structure of the flow and the internal magnetic field. A constant ratio of the diffusivities (Le=10) and a constant Ekman number (Ek=10^{-4}) are adopted. Apart from testing different driving scenarios, the double-diffusive approach also allows to implement distinct boundary conditions on temperature and composition. Isochemical and fixed chemical flux boundary conditions are implemented in order to investigate their respective influence on the flow and magnetic field generation.