Kinematic dynamos associated with top-down and bottom-up convection in rotating spherical shells

*Hinami Taniguchi[1], Futoshi Takahashi[1]

1. Kyushu University

Terrestrial planets which maintain their intrinsic fields have convection driven by either thermal or compositional, or both kind of buoyancy in the cores. In case of the Earth, it is believed that compositional convection, which is fed by light element ejection from the ICB upon inner core growth, is currently dominant and powers the geodynamo: it is so-called “bottom-up” type convection. On the other hand, the geodynamo would be driven by thermal convection alone in the past mostly fueled by removal of core heat through the CMB by mantle convection: namely “top-down” type convection. Although it is well known that the velocity field powered by these driving forces and the resultantly generated magnetic fields are different from each other, the reason why they are distinct is not evident. In this study, the basic features of the two types of dynamo action are investigated by numerically solving a kinematic dynamo problem.

We consider an electrically conducting fluid contained in a rotating spherical shell, in which a stationary flow given by linear stability analysis for bottom-up and top-down convection exists. Ekman number *Ek* is adopted in the range of 2× *10-4* to *10-3*. The induction equation is solved by time-marching with an initial axial dipole field given as a seed. In results, it is found that the top-down dynamo is easier to be maintained the than the bottom-up one. We will report detail about these issues.

Keywords: kinematic dynamo

