Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SEM21-15 Room:301B Time:May 25 15:00-15:15

Effects of thermal boundary condition and anisotropic thermal diffusivity in the Earth's core

MATSUSHIMA, Masaki[1*]

[1]Tokyo Institute of Technology

Very small molecular viscosity of the Earth's core fluid gives rise to small-scale fluid motions, which are highly anisotropic because of the Earth's rapid rotation and a strong magnetic field. As a result, a large-scale diffusive process is to be enhanced by such flows in the core. This suggests that a thermal eddy diffusivity should not be a scalar but a tensor. We have been carrying out numerical simulations of magnetohydrodynamic (MHD) turbulence in a rapidly rotating system to investigate the effect of anisotropy on dynamics in the core, by prescribing elements of anisotropic thermal diffusion tensor.

It has been found that a certain degree of anisotropy has an insignificant effect on the character, like kinetic and magnetic energy, of magnetoconvection in a small region with periodic boundaries in the three-directions. However, in a region with top and bottom rigid boundary surfaces, the same degree of anisotropy can enhance kinetic and magnetic energy in magnetoconvection depending not only on prescribed anisotropic tensor diffusivity but also on location of the computational region expressed in terms of direction of gravity, or latitude. That is, anisotropic tensor diffusivity, consequent on the anisotropy of turbulent flows, affects dynamics in the core near the boundary surfaces depending on the latitude. We have so far imposed a fixed temperature boundary condition, but the argument above suggests that different thermal boundary condition may influence the dynamics in the core. We examine kinetic and magnetic energy in magnetoconvection for a fixed heat-flux boundary condition.

Keywords: anisotropic diffusivity, magnetoconvection, Earth's core