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The effect of anisotropic diffusivity on rotating magnetoconvection in the Earth's core

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A thermal diffusive process in the Earth's core is principally enhanced by small-scale flows that are highly anisotropic because of the Earth's rapid rotation and a strong magnetic field. This means that a thermal eddy diffusivity should not be a scholar but a tensor. The effect of such anisotropic tensor diffusivity, which is to be prescribed, on dynamics in the Earth's core is investigated through numerical simulations of magnetohydrodynamic (MHD) turbulence in a rapidly rotating system.

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, kinetic and magnetic energy in magnetoconvection can be altered by the same degree of anisotropy. This implies that anisotropic tensor diffusivity, consequent on the anisotropy of turbulent flows, affects dynamics in the core near the boundary surfaces.

Keywords: anisotropic diffusivity, magnetoconvection, Earth's core