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Effects of anisotropic turbulence on the core dynamics

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It is now possible to perform numerical simulations of MHD dynamos in rotating spherical shells. However, molecular diffusivities are replaced by much larger eddy diffusivities, of which anisotropy has not been taken into account. We carry out direct numerical simulations of MHD turbulence in a rotating system by giving tensor eddy diffusivity. The result is compared with that for scalar diffusivity. We discuss effects of anisotropic turbulent transport on the core dynamics.

It is now possible to perform numerical simulations of MHD dynamos in rotating spherical shells. There remain problems, however; it is likely that the Earth's core is in a turbulent state because of very small molecular diffusivities of core fluid, but it is impossible to resolve such small-scale phenomena in global simulations. Hence molecular diffusivities are replaced by much larger eddy diffusivities, of which anisotropy has not been taken into account.

We have been performing direct numerical simulations to examine the anisotropy of turbulent transport in the Earth's core. We have so far found that the turbulent transport has a preferred orientation determined by the directions of the rotation axis, the gravity, and the large-scale magnetic field. We have attempted to express the turbulent transport in terms of a second moment closure model and to estimate local tensor eddy diffusivity.

We here carry out direct numerical simulations of MHD turbulence in a rotating system by giving tensor eddy diffusivity. The result is compared with that for scalar diffusivity. We discuss effects of anisotropic turbulent transport on the core dynamics.