Global and local MHD turbulence in the Earth's core

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The Earth's magnetic field is generated by dynamo action due to convective motions in the electrically conducting outer core. The range of length-scale in the core is very broad, and it is impossible to resolve all the length-scale in global geodynamo simulations. Unresolved small-scale motions can enhance diffusive process of large-scale fields through the eddy diffusion, and therefore the effect of small-scale motions is important. Hence we have examined local turbulence in the Earth's core by performing direct numerical simulations of thermally-driven magneto-turbulence in a rotating system.

Small-scale motions in the core are strongly influenced by the Earth's rotation and its magnetic field, and the turbulent transport is likely to be highly anisotropic. Donald and Roberts (2004) examined the effect of anisotropic heat transport in intermediate dynamo models axisymmetric with respect to the rotation axis. They found that even a small degree of anisotropy can influence the character of the dynamo. In the meantime, we have found that a small degree of anisotropy has an insignificant effect on the character of local turbulence. To clarify this discrepancy, we carry out direct numerical simulations of MHD turbulence in a rotating system.