Scale variability in convection-driven dynamos at low Ekman number

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We undertook a numerical study of convection-driven MHD dynamos in a rapidly rotating spherical shell with the Ekman number down to 10^{-6} and the magnetic Prandtl number down to 0.2. Focused are the characteristic scales of the flow and the magnetic field. Smaller-scale convection vortices responsible for generating the magnetic field appear at a lower Ekman number, while the scale of the magnetic field shows insignificant variation. As a result scale separation between the flow and the magnetic field occurs as the Ekman number is decreased. By calculating the scales, we estimated the viscous and the Ohmic dissipations in the Earth's core, the latter of which is in reasonable agreement with the other estimates. It is suggested that scale separation works and is potentially applicable to the condition of the planetary core.