コアーマントル結合熱史シミュレーションによって推定される磁場進化史

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On magnetic evolution inferred from a coupled core-mantle evolution

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We investigate the magnetic evolution over the geologic time-scale in a coupled core-mantle evolution model. The core evolution model is updated to include the pressure-dependent density profile fitted with PREM model and higher order effects. Evaluating the magnetic evolution, we use magnetic dissipation from core energetics and magnetic moment calculated from scaling law derived from geodynamo simulations. The heat flow across the core-mantle boundary (CMB) is substantially lower than the isentropic heat flow. This results that the thermal buoyancy flux caused by the core convection is likely to be the negative and completely cancels out the compositional buoyancy flux if the core thermal conductivity uses the recent range provided from high P-T physics. In this situation, the magnetic field generation is stopped. Thus, the continuous magnetic evolution over geologic time is difficult with high core thermal conductivity. Whereas, the continuous magnetic field generation would be expected when the core thermal conductivity is smaller than the lower-bound from recent high P-T physics. In addition, the sub-isentropic region below the CMB would be found with O(1000) km thickness. This means that the entropy production would not be uniform thus the assumption for computing magnetic dissipation and magnetic moment should be improved.