Toroidal magnaetic field in the Earth's core

Yozo Hamano[1]

[1] Dept. Earth & Planetary Physics, Univ. of Tokyo

Main part of the Earth's magnetic field is generated by dynamo action in the electrically conducting fluid iron core. Within the core, two modes, i.e., poloidal and toroidal modes, of the magnetic field exist, among which only the poloidal part can be observed at the Earth's surface. The toroidal field is trapped within the conducting part of the Earth's interior, and vanishes at the Earth's surface. However, if the electrical conductivity in the mantle is horizontally non-uniform, the heterogeneous structure produces a poloidal field from the toroidal source field by the coupling effects between the magnetic fields and the structure. Results of the calculation of the magnetic field generated in the laterally heterogeneous lowermost layer of the mantle is reported here, where the pattern of the conductivity heterogeneity is inferred from the seismic heterogeneity is well investigated. The result shows that the zonal toroidal field at the core-mantle boundary efficiently generates the higher harmonics of the poloidal field. suggesting that a significant portion of the geomagnetic field is possibly generated in the lowermost layer from a toroidal field of core origin. The estimated toroidal field is compared and validated with the results of the geodynamo simulations.