Forecasts of geomagnetic secular variation using core surface flow models (2)

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The International Geomagnetic Reference Field (IGRF) is a standard mathematical description in terms of spherical harmonic coefficients, known as the Gauss coefficients, for the Earth’ s main magnetic field and its secular variation. On December 19, 2019, the working group V-MOD of the International Association of Geomagnetism and Aeronomy (IAGA) released the 13th generation of IGRF, which consists of three constituents; a Definitive IGRF (DGRF) for 2015, an IGRF for 2020, and a secular variation (SV) model from 2020 to 2025. We submitted a candidate model for SV from 2020 to 2025, relying on our strong points, such as geodynamo numerical simulation, data assimilation, and core surface flow modeling.

We can estimate core flow near the core-mantle boundary (CMB)from distribution of geomagnetic field and its secular variation. Such a flow model can be obtained for actual physical parameters of the Earth. However, numerical simulations of geodynamo were carried out for physical parameters far from actual ones. Therefore, a core flow model to be used for data assimilation had to be obtained on a condition relevant to the numerical simulations. To obtain the candidate model for SV, we adjusted time-scale of a geodynamo model (Takahashi 2012, 2014) to that of actual SV of geomagnetic field as given by Christensen and Tilgner (2004).

In this presentation, we first investigate temporal variations of geomagnetic field due to the magnetic diffusion only. Next, we investigate temporal variations of geomagnetic field due to the motional induction caused by some core flow models as well as the magnetic diffusion. Then we compare secular variations of geomagnetic field forecasted by these methods.

Keywords: IGRF, secular variation, core surface flow

