Geodynamo data assimilation for candidate models of IGRF13-SV from Japan team

*南 拓人[1]、中野 慎也[2]、高橋 太[3]、松島 政貴[4]、清水 久芳[1]、藤 浩明[5]
*Takuto Minami[1], Shin ya Nakano[2], Futoshi Takahashi[3], Masaki Matsushima[4], Hisayoshi Shimizu[1], Hiroaki TOH[5]

1. 東京大学地震研究所海半球観測研究センター、2. 統計数理研究所、3. 九州大学大学院理学研究院、4. 東京工業大学理学院地球惑星科学系、5. 京都大学大学院理学研究科
1. Ocean Hemisphere Research Institute, Earthquake Research Institute,The University of Tokyo, 2. The Institute of Statistical Mathematics, 3. Faculty of Science, Kyushu University, 4. School of Science, Tokyo Institute of Technology, 5. Graduate School of Science, Kyoto University

International Geomagnetic Reference Field (IGRF) is a series of standard global geomagnetic field models that consist of Gauss coefficients to represent spatial distribution. International Association of Geomagnetism and Aeronomy (IAGA) produces IGRF every five years, the last version of which, the 12th generation of IGRF (IGRF-12), was released in December 2014 (Thebault et al., 2015). Each generation of IGRF comprises not only the main field part but secular variation (SV) part (first time derivative of the main field) to forecast evolution of the geomagnetic field for the next five years to come. The next generation, IGRF-13, will be published around December 2019, comprising the spatial distribution of the field at epoch 2020.0 and its secular variation in the period from 2020.0 to 2025.0. We plan to submit a candidate SV model to contribute for determining IGRF13-SV.
We employ data assimilation with geodynamo calculations to generate a SV candidate model for the period from 2020.0 to 2025.0. Although the two standard approaches, (1) adoption of SV at the IGRF release time and (2) spline extrapolation of the main field in the future, are common for generating SV candidates, they are not “physics-based” forecasts, and, intrinsically, cannot alleviate the effect of sudden changes in the SV field called “geomagnetic jerks” (Mandea et al., 2010). In this context, data assimilation is one of novel approach to obtain an appropriate initial condition for geodynamo calculations at the time of IGRF release time. Since the parameters used in geodynamo calculations are apart by some orders of magnitude from those for the Earth's core, it is not appropriate to take geodynamo solutions as they are for the predictions. Nevertheless, it is possible to rescale the time-axis of geodynamo calculations using the ratio of the so-called “secular-variation time-scale” (Chlistensen and Tilgner, 2004) between the geomagnetic field and geodynamo calculations. In this presentation, we are going to show candidate models of secular variation obtained by geodynamo data assimilation with discussions on the time-scales, the method of assimilation, and data-set employed for the assimilation.

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