# A core surface flow and acceleration model toward building IGRF-13SV

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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. It is used not only for scientific studies but also for practical application, such as navigation and physical surveys. We are going to submit a candidate model to the next IGRF revision, the 13th generation of IGRF (IGRF-13), in 2020. We plan to model a geomagnetic secular variation (SV) rather than the geomagnetic field itself using our strong points, such as geodynamo numerical simulations, data assimilation, and core surface flow modeling.

To predict a geomagnetic secular variation, a geomagnetic secular acceleration, the second derivative of the geomagnetic field with respect to time, must appropriately be described. The geomagnetic secular acceleration is given by the time derivative of the magnetic induction equation, in which not only core fluid velocity but also core fluid acceleration should be investigated.

According to Fournier et al. (2015), core fluid acceleration could be neglected to forecast the geomagnetic secular variation through data assimilation to build a candidate model of IGRF-12. It should be pointed out, however, that this procedure might not be applicable to a period during which a geomagnetic jerk, defined as a sudden change in the geomagnetic acceleration, occurs. That is, acceleration of core fluid is likely to have a large effect on the geomagnetic secular acceleration.

Hence, in this presentation, we attempt to model the velocity and acceleration of core fluid near the core surface toward building IGRF-13SV. Modifying the method of Matsushima (2015), we estimate fluid acceleration as well as fluid velocity inside and below the viscous boundary layer at the core-mantle boundary from geomagnetic field models. This leads to estimation of the first and second derivatives of the radial component of geomagnetic field inside and below the viscous boundary layer. Then we investigate influence of fluid acceleration on the geomagnetic secular acceleration related with short-term geomagnetic secular variation. The velocity and acceleration of core fluid can be used as an initial state in geomagnetic data assimilation and geodynamo numerical simulations.