Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SIT03-25 会場:418 時間:4 月 29 日 17:00-17:15

Can a stably stratified layer interrupt the top-down dynamics of Earth’ s core?
Can a stably stratified layer interrupt the top-down dynamics of Earth’s core?

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In some of previous studies of numerical dynamo simulation with a stably stratified region below the outer boundary, the long-wavelength feature of radial magnetic field can be only found on the outer boundary because a stratified layer can filter small-scale features of radial magnetic field generated in the convective region below the stratified boundary [Christensen, 2006; Nakagawa, 2011]. The existence of stably stratified region below the core-mantle boundary (CMB) is recently exposed from high pressure mineral physics [e.g. Pozzo et al., 2012] and seismological data analysis [e.g. Helffrich and Kaneshima, 2013].

Regarding the modeling on geomagnetic secular variation from numerical dynamo simulations, the heterogeneous thermal/chemical anomalies at the core-mantle boundary is important for understanding the time-scale of secular variation such as polarity reversals and excursions suggested from paleomagnetic observations [e.g. Olson et al., 2011; Olson et al., 2013] and current observational magnetic field [Aubert et al., 2013]. However, their investigation was not included in the effects of stably stratified region below the CMB in their dynamo simulations.

Here we introduce several examples of numerical dynamo simulations with both heterogeneous outer boundary prescribed by the CMB heat flux calculated from numerical mantle convection simulations and a stably stratified layer. Preliminary results are found that the large-scale and ?amplitude of thermal/chemical anomalies induced by the heterogeneous boundary condition, that is, thermal wind type flow, may be trapped at the imposed stratified boundary. This may imply that the geomagnetic secular variations related to the core-mantle coupling may be suggested that the core surface flow would be a key physics.

キーワード: Earth’s core, heterogeneity, core-mantle boundary, stably stratified layer, thermal wind
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