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二重拡散対流と安定成層を考慮した地球ダイナモモデル
A geodynamo model with double diffusive convection and stable stratification

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In the Earth's fluid outer core, thermal convection is driven by superadiabatic temperature gradient due to internal heating and latent heat release at the inner core boundary, while compositional convection is fed by chemical buoyancy arising from inner core crystallization. In order to examine effects of co-existence of different driving sources of convection on dynamo action, double diffusive convection should be adopted by solving heat and compositional transport equations separately. In such a case, different diffusivities of heat and composition should be taken into consideration.

A stably stratified layer at the top of the Earth's outer core is inferred from seismic wave observations. The stratified layer is likely to be a result from light element accumulation due to inner core growth. The thickness of the stratified layer is estimated to be roughly O(100) km, which may be thick enough to affect convection and also dynamo action in the core, because the Ekman and thermal boundary layers are much thinner. In numerical dynamo models, the effects of the stratified layer is examined mostly by adopting the codensity approach. Codensity is modeled based on an assumption that thermal and compositional diffusion coefficients are equal because of turbulent diffusion, which should not hold in a stratified region. Thus, an approach of double diffusive convection is more suitable to investigate effects of the stably stratified layer.

Here, we perform a numerical study on convection-driven dynamo in a rotating spherical shell to explore the effects of different thermal and compositional state of the Earth's core. We take two effects into account in our numerical dynamo modeling: co-existence of thermal and compositional sources of convection, and stably stratified layer at the top of the core. Effects of the layer on convection and dynamo action with double diffusive convection are examined and will be reported.

キーワード: ダイナモ, 二重拡散対流, 安定成層
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