Effects of a thin stably stratified layer below the core mantle boundary on the dynamo action in the core

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By seismic and geomagnetic field observations, a stably stratified layer below the core-mantle boundary (CMB) has been detected. Chemical or thermal origin of the stable stratification is suggested (Helffrich and Kaneshima, 2010; Buffett and Seagle, 2010; Pozzo et al. 2012; Ohta et al. 2016). The geomagnetic field is generated by thermally and chemically driven convection, that is, dynamo action. Assuming the turbulent diffusivity in the core, the co-density has been preferred modeling thermo-chemically driven dynamo. However, the origin of stable stratification cannot be distinguished with the co-density approach. Therefore, thermal and compositional buoyancy must be treated separately. In this study effects of a stable layer of either origin below the CMB are examined, adopting thermochemical double diffusive convection. We have found in a suite of runs that the morphology of dynamos is strongly affected by a thick stably stratified layer (~400 km according to seismic observations) regardless its origin. Then, we focus on the effects of a stable layer, of which thickness is about 150 km close to that detected by geomagnetic observations. We will show results of our dynamo modeling with a thin stably stratified layer of either origin, and discuss its effects on the observed magnetic field and implications for the origin of the stable layer.

Keywords: stably stratified layer, dynamo, double diffusive convection

