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On the compositional stratification below the core-mantle boundary in geodynamo simulations

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A stratified region below the core-mantle boundary (CMB) has been found from seismological data analysis, which seems to be generated from thermo-chemical origin [e.g. Helffrich, 2014]. A series of our previous studies have been investigated with purely a thermal origin for stratified region below the CMB [Nakagawa, 2011; Nakagawa, revised]. In these studies, purely thermal origin on a stably stratified region is difficult to explain the magnetic field generation in the realistic core parameters. Here we investigate numerical dynamo simulations in double diffusive convection in a rotating spherical shell for reconciling the behavior of thermo-chemical origin of stratified region below the core-mantle boundary with the numerical code 'Calypso' [Matsui et al., 2014]. The initial thickness of compositionally-stratified region is assumed as 140 km suggested from data analysis of geomagnetic field [Buffett et al., 2014]. The frequency ratio between planetary Rossby and buoyancy waves can be modified as a function of buoyancy ratio and Lewis number (diffusivity ratio), which is one indicator for strength of stratified region. Here we examine two typical cases with fixed Lewis number (Le = 20): Thermal convection dominant and compositional convection dominant. A preliminary result suggests that a case with compositional convection dominant is more likely to preserve the stratified region below the CMB over t = 1.0 scaled as the magnetic diffusion time, which would be needed around several percent of density difference between stratified and convective regions. Otherwise, for a thermal convection dominant case, the initial stratification is rapidly collapsed in about t = 0.1 due to cold downwelling flow near the poles. The morphology of radial magnetic field is similar to cases with purely thermal stratification, which is filtered dipolar field at the CMB. In the presentation, we will look into more details and further discussion.