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低粘性ポストペロブスカイトを考慮した３次元球殻熱化学マントル対流モデルによるマントル深部への力学的な影響

Dynamical response of the low viscosity post-perovskite in thermo-chemical mantle convection in a 3-D spherical shell

中川 貴司 [1*], Tackley Paul [1]
Takashi Nakagawa[1*], Paul Tackley[1]

[1] スイス連邦工科大学チューリッヒ校
[1] Institute of Geophysics, ETH Zurich

Both high pressure experiment and theory suggested that the rheological property of post-peorvskite phase could be much weaker than of perovskite, which could have O(10^{-3}) to O(10^{-4}) [Hunt et al., 2009; Ammann et al., 2010]. Recent our study indicated that the scale of heat flux across the core-mantle boundary and thermo-chemical anomalies were the larger-scale when the post-perovskite is weaker than the perovskite [Nakagawa and Tackley, 2011]. Other important physical response caused by the low viscosity post-perovskite is to check the geoid anomalies and anisotropic features induced by flow in the post-perovskite phase. Several previous studies indicated that the viscosity reduction due to the post-perovskite phase transition could affect the large-scale geoid anomalies [Tosi et al., 2009; Gosh et al., 2010]. In addition, high pressure mineral physics also implied that the weak post-perovskite could induce the anisotropic feature in the deep mantle [Yamazaki et al., 2006; Shim, 2008]. Here we test two important physical response caused by the low viscosity post-perovskite in thermo-chemical mantel convection simulations in a 3-D spherical shell varying the density difference at the core-mantle boundary that would affect thermo-chemical structures in the deep mantle. Comparing between the weaker post-perovskite and regular post-perovskite, the amplitude of geoid anomalies is not very different but the scale of geoid would be somewhat organized to be the larger-scale when the viscosity of post-perovskite is weaker than of perovskite. The anisotropic structure would also affect to enhance the horizontal flow structure then making an alignment to the horizontal direction when the low viscosity post-perovskite is assumed, which could be related to the anisotropic structure in the deep mantle.
Keywords: Postperovskite, thermochemical mantle convection, geoid, anisotropy