

Stability of compositional stratification in the lower mantle: Influence of the seismic structure

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Numerical simulations have been performed to understand the parameter dependence of thermo-chemical convection and its influence of the seismic structure. The parameters which is affected with the style of thermo-chemical convection are assumed to be the density difference, viscosity contrast and heat source concentration between the dense and regular material.

The dependence of density difference and viscosity contrast is found that the unstable regime is obtained in 2.7% of density difference and less than 0.1 of viscosity contrast between the dense and regular material. This implies that the decoupling between the less viscous (dense) and viscous material (regular) is occurred to the large viscosity contrast. Then the stable layering is easy to generate in the lower density difference. The dependence of heat source concentration is also found that the unstable regime is obtained in which the density difference is 8.1 % and the heat source in the dense material is more than 8 times higher than regular material. This implies that the heat source in the dense material is heated up at the compositional boundary then the upwelling plume could be generated by the interaction between such plume and downwelling flow from the surface.

The influence of the seismic structure obtained from our results is found that the flattened structure in the lower mantle is observed in the unstable regime. On the other hand, in the stable regime, the strong heterogeneity is remained by the compositional boundary caused by stable layering.