Geophysical Research Abstracts, Vol. 9, 07395, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07395
© European Geosciences Union 2007

Exploring the model space of thermo-chemical convection and comparing with probabilistic tomography

F. Deschamps (1), and P.J. Tackley (1)
(1) Federal Institute of Technology Zurich (deschamps@erdw.ethz.ch)

Inferring the thermo-chemical structure of the Earth's mantle is a key problem in geophysics. Both thermal and chemical sources contribute to lateral variations in density, and the mode of convection strongly depends on the relative strength of these two sources. The thermo-chemical structure of the Earth's mantle is a central framework, because it can be linked to many fields of geophysics: mineral physics gives insight on the thermo-chemical properties of the mantle mineral assemblage; seismic tomography maps heterogeneities in the mantle from observed seismic data; geodynamics, and in particular numerical models of convection, predict mantle flow and structure for a given set of input parameters and properties. Among the important parameters that control the mode of convection are the buoyancy ratio, the thermal expansion, the geometry, and the presence of a phase transition. Because each mode of convection predicts a distribution of temperature and composition, it can be tested against geophysical observations that are sensitive to these distributions, mainly seismic data. In a preliminary study, we tested various models of thermo-chemical convection against models from probabilistic tomography. This approach revealed to be a promising tool to decide the thermo-chemical structure of the mantle, but more cases needed to be run and tested. Here, we explore more intensively the model space of thermo-chemical convection. We run new 3D models of thermo-chemical convection in which we vary important parameters and properties, including the buoyancy ratio and the volume of dense material, the mode of heating, the spherical geometry, and the presence of a phase transition at the bottom of the fluid. We then test snapshots of these models at different time against existing models of probabilistic tomography. Such comparisons give new insights on important questions such as the degree of chemical heterogeneity of the mantle, and the role of the post-perovskite phase transition.