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Selfconsistent Formation of complex layered mantle flow with a Rough Core-Mantle Boundary

Ulrich Hansen and Claudia Stein
Münster University, Inst. für Geophysik, Münster, Germany (hansen@earth.uni-muenster.de)

Thermal boundary layers play a key role for the dynamics of the Earth's mantle. They mark the transition between the core and the mantle and, at least locally and transiently, the transition between the upper and the lower mantle at a depth of 670 km.
There is much evidence that these boundary layers do not resemble the picture of a simple thermal boundary layer, as known from thermal convection at high Rayleigh numbers. Especially the core-mantle boundary (CMB) seems to be of complex structure, possible induced by compositionally dense material.
Present models of mantle convection, aiming at simulating the complex structure and dynamics of the CMB require several ad hoc assumptions. Especially the density excess and the mass of compositionally distinct material need to be assumed. Both conditions are critical for the dynamics but hardly constrained.
We have developed models where the internal boundary as well as a thermochemical CMB develop selfconsistently without the named ad hoc assumptions. As a starting condition we assume that a chemically stratified mantle, as resulting from fractional crystallization in an early magma ocean, is heated by the hot core. Double diffusive convection in material with strongly variable viscosity leads then to layering and, in a later state to the formation of a rough lower thermochemical boundary layer, displaying compositionally distinct piles.