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Evolution in plate-mode mantle convection: Implications for plumes and thermochemical piles

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Thermal plumes and thermochemical piles forming at the core-mantle boundary (CMB) play an important role in the evolution of the mantle. Both have been considered as possible origins of the two large shear wave velocity provinces (LLSVP) and the many small-scale ultra-low velocity zones (ULVZ) that have been seismically imaged at the CMB. Tectonic plates are a further aspect of mantle convection: they shield the interior from effective cooling and subduction processes affect the structure and dynamics of the interior.
We perform 2D numerical modelling of mantle convection to investigate the structure and evolution of the mantle in thermochemical convection. In our model plates form in a self-consistent manner, so that in particular we can study the effect of plate-mode convection.
During plate evolution we find a variety of plume classes leaving a complex structure in the CMB topography. In thermochemical convection dense material is viscously trapped by the flow and piled up beneath plumes. The CMB topography is affected by both the temperature and chemical component. Besides discussing the signals plumes and piles leave at the CMB, we will present the effect of a dense CMB layer on the plate-mode convection.