Interaction Between the Continental Lithosphere and Mantle Convection in 3-D Model

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We conduct numerical simulations of incompressible infinite Prandtl number convection in a spherical shell with a localized high viscosity lid (HVL) on the top surface to understand the possible effects of the continental lithosphere on plume generation. The temperature under the HVL increases after the emplacement of the HVL on convection with internal and bottom heatings. Later, upwellings at the bottom merge into a large scale flow and, a large plume emerges under the HVL. Our model cases, whose Rayleigh number is 10^6, show that the large plume is formed on a time-scale of 1 Gyr. A simple scaling suggests that this time-scale may be reduced by a several times. Despite the complicated 3-D thermal structure, it is dominated by an l=1 pattern controlled by the position of the HVL.