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The influence of plate boundary motion on mantle planform and heat flux in viscously stratified convection models

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A number of studies examining the influence of plates on mantle convection have concluded that planform and thermal structure are strongly influenced by the plate geometry.However, studies that have modeled evolving plate geometries over periods greater than a mantle transit time indicate that mantle planform may not correlate with plate geometry. To assess the influence of plate boundary motion on mantle convection, we investigate convection in a plane-layer geometry system featuring four polygon-shaped plates. Plate boundaries are moved at specified velocities that are consistent with the velocities associated with the convection driven flow in the system interior. Plate velocities are time-dependent and use a force-balance method to ensure that the plate motion neither drives nor resists the convection. The influence of the plate boundary motion on convection is compared in models featuring viscosity profiles that increase by factors of 30, 90, 300 and 1000 across the lower mantle. The effective Rayleigh numbers of these systems is held at a nearly constant value. We find that convection planform is sensitive to both divergent and convergent plate boundary motion for a system featuring as much as a 90-fold contrast in viscosity between the upper and lower mantle. However, as the viscosity stratification is increased the response of the convection planform to the motion of *divergent* plate boundaries diminishes. In contrast, we find planform and specifically plume positions respond to the motion of *convergent* plate boundaries even when the lower mantle viscosity is 1000 times greater than the upper mantle viscosity.