

Planforms of self consistently generated plate tectonics in 3D spherical models of mantle convection

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Abstract

In the past decade, several studies have documented the effectiveness of plastic yielding in causing a basic approximation of plate tectonic behavior in mantle convection models with strongly temperature dependent viscosity, strong enough to form a rigid lid in the absence of yielding. The vast majority of such research to date has been in either two-dimensional, or three-dimensional cartesian geometry. In the present study, mantle convection calculations were done to investigate the planform of self consistent tectonic plates in three-dimensional spherical geometry. The results are compared to the outcome of similar calculations where a three dimensional cartesian geometry is used, as by Tackley (2000). In general, the observed structures are in line with the structures observed in cartesian geometry. Two previously unobserved planforms were found. At low lithospheric yield stresses one greatcircle downwelling formed, with fragmented oceanic plates at both hemispheres. At intermediate yield stresses two hemispherical plates formed, separated by a spreading centre and a downwelling.

References

Tackley, P. J., Self-consistent generation of tectonic plates in time-dependent, three-dimensional mantle convection simulations, 2, Strain weakening and asthenosphere, *Geochem. Geophys. Geosyst.*, 1, 2000GC000043, 2000d.