Comment on “Busse, F. H., M. A. Richards and A. Lenardic, A simple model of high Prandtl and high Rayleigh number convection bounded by thin low-viscosity layers, *Geophys. J. Int.*, **164**, 160-167, doi:10.1111/j.1365-246X.2005.02836.x, 2006”

Don L. Anderson
dla@gps.caltech.edu

Global plate motions represent a highly unusual response if they are due to thermal convection in the Earth's deep mantle (*Busse et al*., 2006). There are a number of features that are difficult to explain with standard convection theory: piecewise-constant surface velocities over distances that far exceed the depth of convection, relative fixity of hotspots, one-sided subduction and stable ridge-transform fault systems. These are more easily understood if mantle convection and plate motions are driven by plate tectonic forces that induce a shallow return flow, counter to the plate motion direction (*Harper*, 1978; *Chase*, 1979) instead of large-scale convection that drags the plates (e.g. *Lithgow-Bertelloni & Richards*, 1998). Similarly, melting anomalies are most readily understood in terms of entrained fertility anomalies than fixed thermal anomalies.

Geophysical evidence suggest that a zone of low viscosity in the Earth's mantle (just beneath the plates) plays a prominent role in plate tectonics and mantle convection. Asthenospheric and upper mantle motions are probably governed by fluxes generated at plate boundaries, the drag of the plates on the underlying mantle, and the need for mass balance. In the Plate, or counterflow model, mantle flow beneath most plates in the opposite direction of plate motion (the return flow direction) maintains the mass balance.

The coherent surface motions of hotspots are readily understood with the GT (Galileo Thermometer) model of short-lived warm blobs and the slow shallow return flow of the mantle in which they are embedded.

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