

Interactive comment on “Influence of the Ringwoodite-Perovskite transition on mantle convection in spherical geometry as a function of Clapeyron slope and Rayleigh number” by M. Wolstencroft and J. H. Davies

Anonymous Referee #1

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This is a nice systematic study of effect of the endothermic phase transition at 660 km depth on mantle convection, and should probably be published in some form. However, it is unfortunate that another group (Yanagisawa et al. 2010) undertook a similar parameter study at the same time with the same convection code, and published it earlier. This reduces the impact of the work, even though it is still useful to see results confirmed by a different group and the authors do include a good and fair discussion of the comparison with this and other work. As it stands, the paper is well written, but a bit thin in content, especially since figures 3-6 display a lot of the same information.

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The conclusion that the Archean Earth was likely more in the transitional regime/closer to the layered regime is consistent with what other studies proposed.

My suggestion for strengthening the paper would be to perform more simulations to actually map out the boundary of the episodic layering regime and characterize what behavior occurs in the rest of the transitional regime. As the transitional regime is the one most relevant for the Earth, this would much increase the impact of the work.

Some other minor comments: - The thermal effects of latent heat of the transitions are ignored, consistent with using a Boussinesq approximation in the Stokes equations, which also ignores adiabatic and viscous heating. However, this point is not discussed until section 4.1. This approximation needs to be motivated in the method section.

-Similarly, the experimental constraints on the Clapeyron slopes of the ringwoodite to perovskite+magnesiowüstite transition and olivine to wadsleyite transitions are only mentioned in the discussion. These constraints should be used to motivate the range of Clapeyron slopes studied, especially since the '660' slopes start at the higher end of the experimental constraints and the '410' slope chosen falls below the experimental range.

- The figures could be clearer. Symbols are quite small and different dashed line styles are similar. And figures 3-6 could probably be condensed into a maximum of 2 figures.

Interactive comment on Solid Earth Discuss., 3, 713, 2011.

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