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On the use of boussinesq approximation for lithospheric scale problem.

Laetitia Le Pourhiet
UPMC, ISTEP, PARIS, France (laetitia.le_pourhiet@upmc.fr)

Boussinesq approximation is widely use to model mantle convection with success. Yet mantle convection problem are not long term tectonic problems. First of all, it is very difficult to define a reference temperature profile, second when you model a long term lithospheric problem it is necessary to use a free surface.
The main difference between a free surface and using a freeslip boundary condition is that in the later case the dynamics is driven only by density variations at a given depth and true density of rock is not important.
Using a free surface true density becomes very important for the dynamics of the flow because it interplays with topography. My poster will present the spurious effect of boussinesq approximation with free surface based mainly on subduction set up and my failed and less failed attempts to fix it.