Mantle dynamics is controlled by heat transfer

The variations in density due to temperature variations are generally small and yet are the cause of the mantle motion

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(ρ - ρ0)gi.

Consider the Stokes equation (1.17) and split the term $\rho F_i = \rho g_i$ into two parts: $\rho_0 g_i + (\rho - \rho_0)g_i$. The first part can be included with pressure and the density variation is retained in the gravitational term. The remaining term can be expressed as:

$$(\rho - \rho_0)g_i = -\rho_0 g_i \alpha (T - T_0). \tag{1.39}$$

Such simplification of the model is called the Boussinesq approximation. In the strict form of this, all physical properties except viscosity are constant. The dimensionless mass and energy conservation equations then become

$$-\frac{\partial P}{\partial x_i} + \frac{\partial}{\partial x_j}\left\{\eta\left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}\right)\right\} = RaT\delta_{i3}, \quad \frac{\partial T}{\partial t} + u_j\frac{\partial T}{\partial x_j} = \frac{\partial^2 T}{\partial x_j^2} + H. \tag{1.40}$$