Time coordinates (t) and velocity coordinates (v) are non-dimensionalized using the thermal diffusivity and layer thickenss as:

$$t' = \frac{tD^2}{\kappa} \tag{1.28}$$

$$v' = \frac{vD}{\kappa}. \tag{1.29}$$

The dynamic topography resulting from thermal bouyancy is output in units of pressure, which can be converted to heights using $p = \rho g h$ as:

$$h_{topo} = \frac{p'\eta_o\kappa}{\rho g D^2}. \tag{1.30}$$

Mass fluxes ($M = \rho v^2$) due to convection are re-dimensionalized using

$$M = \rho(v')^2\kappa D, \tag{1.31}$$

where an implicit assumption has been made that the structure of the convective flow field in the third (unsued) y dimension, is identical to the x direction.

1.5.3 Viscosity Functions

A series of temperature-, strain rate-, and stress-dependent viscosity functions for ice I are implemented in Citcom to allow the model to apply to icy satellites. In this thesis, the temperature dependence in the ice flow laws are expressed using an Arrhenius law, which is common practice for icy satellite studies. In this formulation, the lab-derived flow law of form

$$\eta(T) = A\exp\left(\frac{Q^*}{nRT}\right), \tag{1.32}$$

is non-dimensionalized by dividing by the viscosity evaluated at the melting point,

$$\eta'(T') = \exp\left(\frac{E}{T' + T_o'} - \frac{E}{1 + T_o'}\right), \tag{1.33}$$

where $E = Q^*/nR\Delta T$ and $T_o' = T_s/\Delta T$. This procedure retains the exact temperature dependence determined by laboratory experiments, and predicts very large viscosities