$$M\ddot{z} = (P_b - P_a)A - Mg \tag{1}$$

$$\dot{P}_b = \frac{\gamma RT}{Az} (\dot{m}_{in} - \dot{m}_{escape} - \frac{P_b A \dot{z}}{RT})$$
 (2)

$$Mz = (P_b - P_a)A - Mg$$

$$\dot{P}_b = \frac{\gamma RT}{Az} (\dot{m}_{in} - \dot{m}_{escape} - \frac{P_b A \dot{z}}{RT})$$

$$\rho \frac{\partial P}{\partial x} = \frac{\beta}{L^2} (\frac{\dot{m}_{escape}}{z})^2 + \frac{\mu}{\kappa L} (\frac{\dot{m}_{escape}}{z})$$

$$\frac{\partial P}{\partial x} = \frac{P_b - P_a}{\ell}$$
(4)

$$\frac{\partial P}{\partial x} = \frac{P_b - P_a}{\ell} \tag{4}$$