Continuity Equation:

$$\frac{\partial n_j}{\partial t} + \nabla \cdot (n_j u_j) = -\frac{3 n_j u_j}{r} + P_j - L_j \tag{1}$$

Momentum Equation:

$$\begin{aligned} \frac{\partial \bar{u}_j}{\partial t} + \nabla \cdot (\bar{u}_j \bar{u}_j) &= \bar{u}_j (\nabla \cdot \bar{u}_j) - \frac{\nabla p_j}{n_j m_j} \\ &- \nabla \cdot \bar{\Pi}_j + \frac{e_j \bar{E}}{m_j} + \bar{G} + \sum_k \Pi_{jk} (\bar{u}_k - \bar{u}_j) \Delta_{jk} \\ &+ \sum \frac{P_j}{n_j} (\bar{u}_{j'} - \bar{u}_j) - \sum \frac{L_j}{n_j} (\bar{u}_{j'} - \bar{u}_j) \end{aligned} \tag{2}$$

Charge Exchange Reactions:

$$O^+ + H \underset{k_r}{\overset{k_f}{\rightleftharpoons}} O + H^+ \tag{3}$$

$$H^+ + H \rightarrow H + H^+ \tag{4}$$

$$O^+ + O \rightarrow O + O^+ . \tag{5}$$

Figure 1: Charge Exchange Graphic

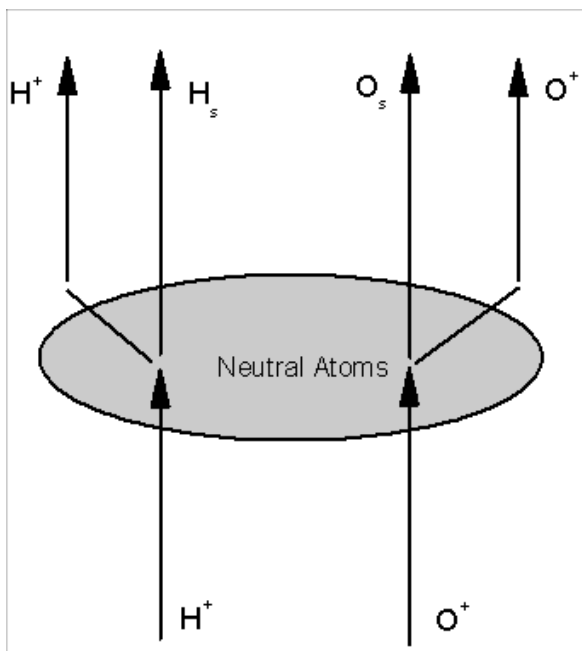

Figure 2: Hydrogen ions in the protonosphere

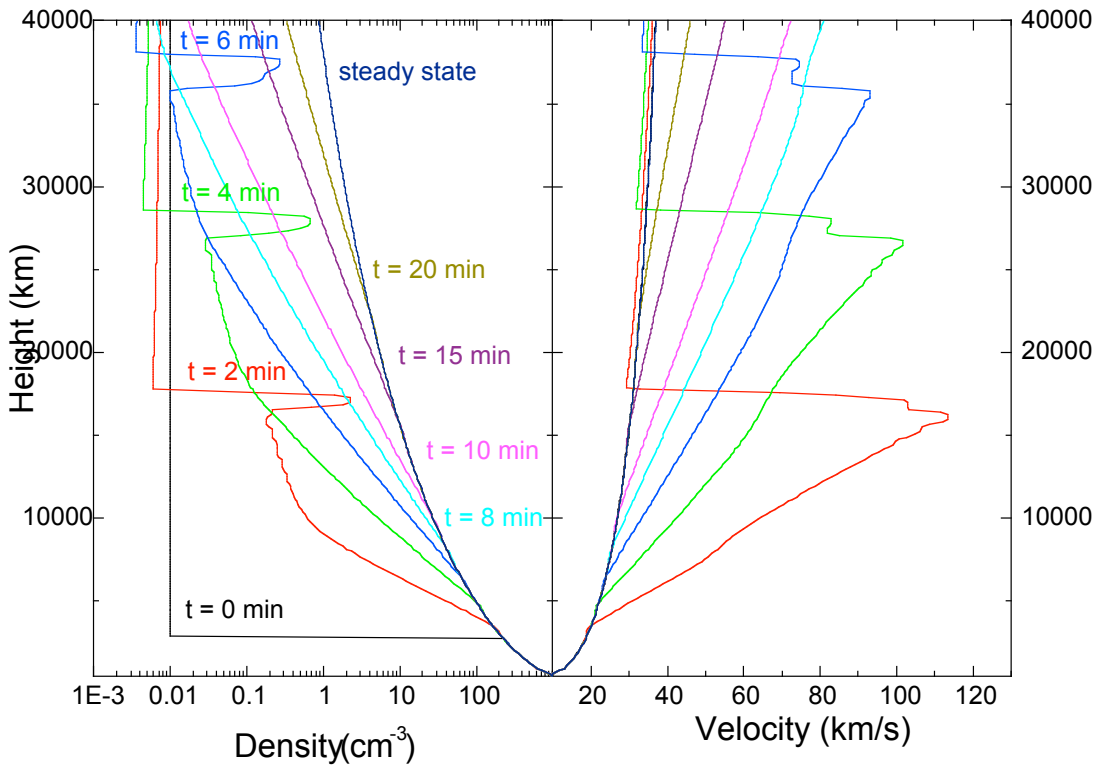

Figure 3: Oxygen ion atmosphere

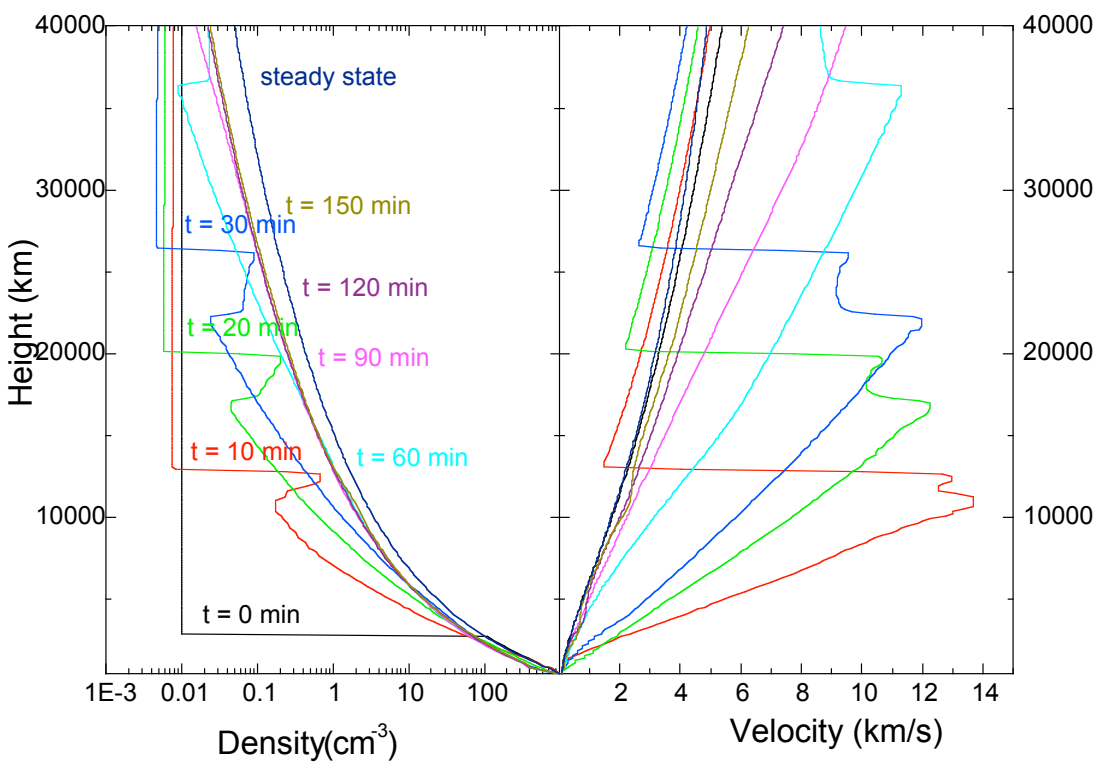

Figure 4: Graphic showing two possible geocorona configurations

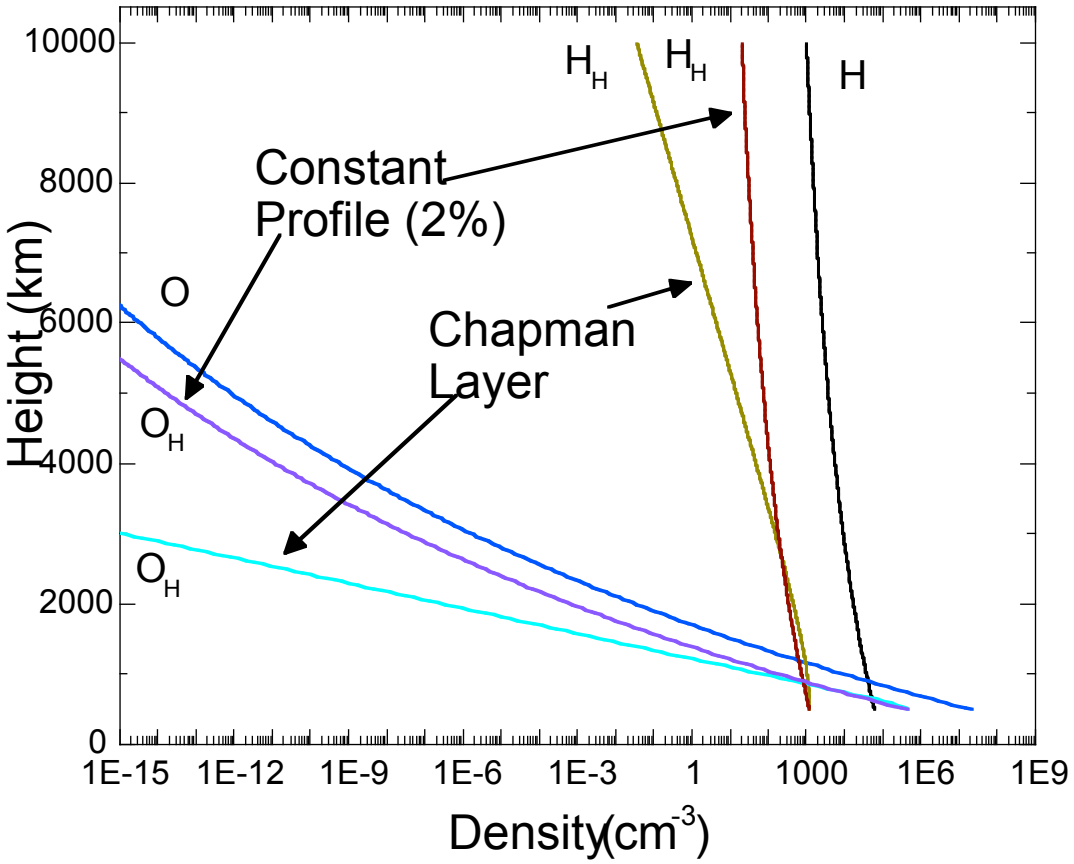
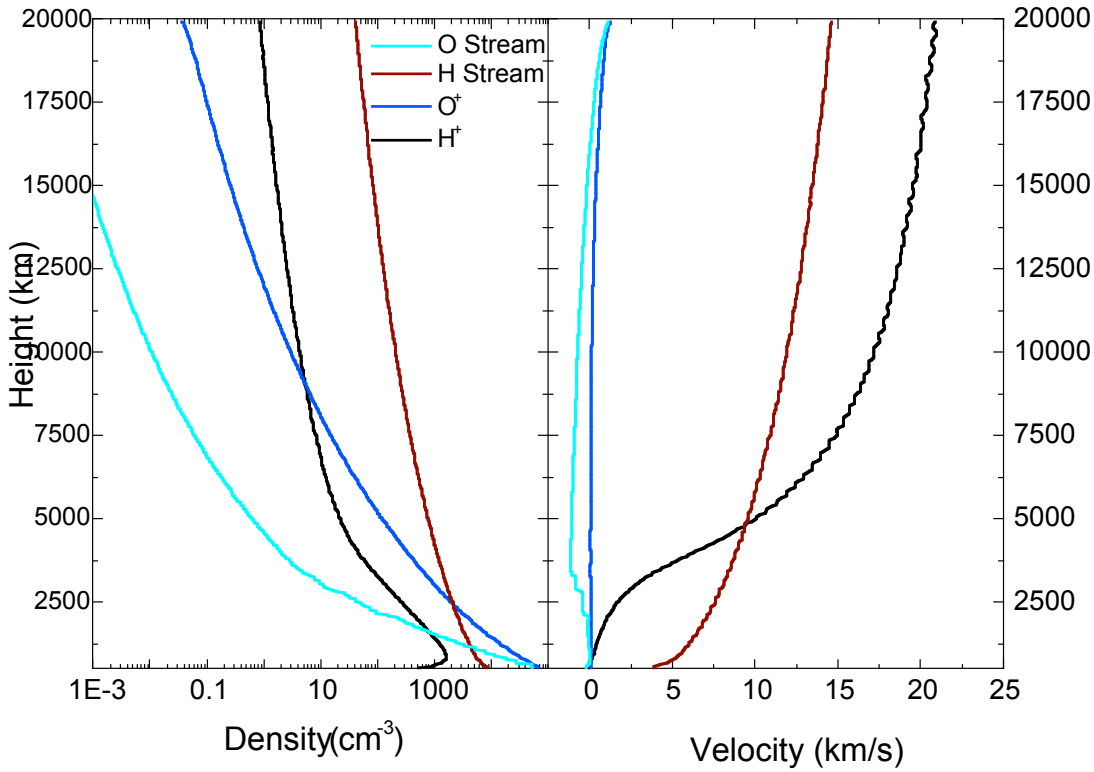
Figure 5: Example output from 1-D charge exchange polar wind model