HW Questions for Session 3: S. W. Bougher (July 3, 2013)

1. Planet Imaginus (after Andy Nagy). Thought experiments making use of table on slide #15 of presentation. What do you expect to happen to the Earth ITM structure and dynamics as you make the following changes to the input parameters to an ITM model simulation (one change per simulation):
   a. Set rotation rate to zero (no rotation).
   b. Set intrinsic magnetic field to zero (describe changes in solar wind interaction and likely impacts on the ITM system).
   c. Set obliquity to zero (no seasons).
   d. Set heliocentric distance variation of solar fluxes (over the year) to be as large as that of Mars (±20%). Large eccentricity Earth.

2. Why is the Venus dayside thermosphere the coldest of all the terrestrial planets, yet it is the closet to the sun? Consider how/why the role of CO_2 cooling likely varies on the 3-planets.

3. What is the major ion of the Venus and Mars ionospheres near the ion peak? What chemical processes cause it to be different than originally predicted? How is this different than Earth?

4. What causes the dayside (i.e. sub-solar) $\tau = 1$ altitude (level of peak absorption and ionization) to be different for Venus, Earth, and Mars? Focus on solar EUV flux region (only). Recall that τ = sigma*n*H (where sigma = cross sections; n*H = column density; H = scale height).

5. Thought experiment. It is not surprising that the dayside homopause of Venus, Earth, and Mars are at distinctly different levels (~110-135 km). What processes are at play to make this so? What processes determine the location where the relevant coefficients (K and D) are equal? Here K = vertical eddy coefficient (cm^2/s); D = molecular diffusion coefficient (cm^2/s).

6. Photolysis of CO_2 and O_2 provide key dayside sources of atomic O for Venus/Mars and Earth, respectively. Describe how changes in heliocentric distance impact the production rate for O and the resulting impact on the ion chemistry for the three planets (see slide # 13).