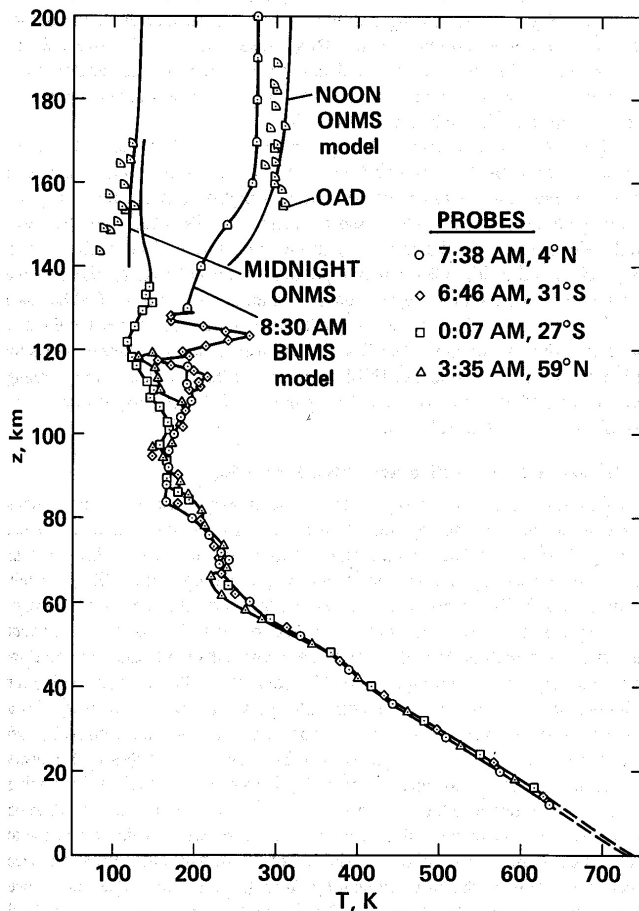


Planetary Geology 4460 Homework #8 Due Friday Nov. 3, 2017

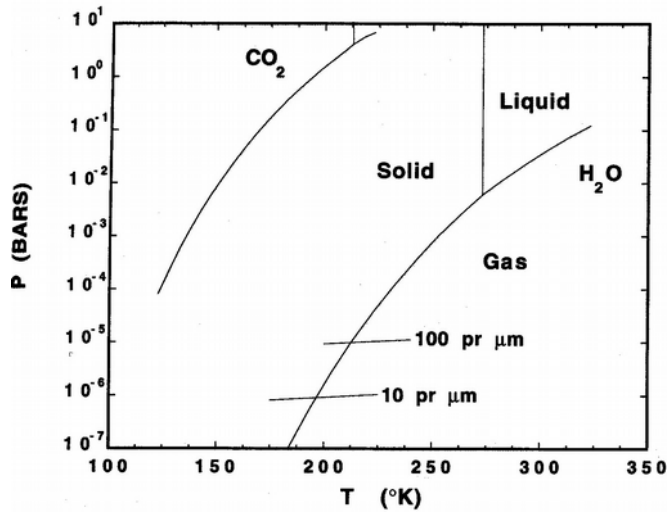
For those problems which require calculations, show your work and be careful to use correct “units”. You may need to convert some units to compatible values.

1) (5 points) Calculate the expected scale height H (in km) for a CO_2 atmosphere on Venus, assuming a temperature of 700 K. You'll need to look up one additional critical parameter related to Venus.

2) (10 points) Using $\gamma = 4/3$ for a polyatomic gas like CO_2 , calculate the adiabatic lapse rate in the lower regions of the Venus atmosphere, in degrees K per km. How does it compare to the lapse rate which you can measure from the figure below? Note it will not match exactly, because of some approximations made in our formulas, which we will discuss later.



3) Interpreting the H₂O phase diagram for atmospheres (10 points)



Part A. (5 points) The vertical reference level used for elevations on Mars (i.e. the Mars replacement for Earth “sea level”) is somewhat arbitrarily chosen to be the average elevation where the pressure is equal to 6.1 millibars. That pressure level was chosen because it corresponds to a special point in the above diagram. Some parts of Mars are above this elevation and some parts of Mars are below this elevation.

Suppose you have an equatorial location where the temperature reaches 280 K at noon, and suppose you expose some H₂O ice on the surface there. Explain what happens to the ice as it heats up if the location is higher than the reference level, then explain what happens to the ice if the location is lower than the reference level.

Part B. (5 points) The phase diagram can also be used to understand the formation of clouds. The almost horizontal lines labeled 100 pr μm and 10 pr μm (i.e. percipitable microns) represent the surface partial pressure of H₂O when the atmosphere contains an amount of water which if condensed would form a layer 100 or 10 microns deep on the surface.

If the atmosphere contained 50 pr μm of H₂O, how cold would it have to get at night before the water condensed as a fog of ice particles (or perhaps as a surface frost)? When interpolating between 10 and 100 pr μm on the plot, remember that the vertical axis is the log of pressure.