UCF Physics: AST 6165 Planetary Atmospheres

Spring 2020 Homework 4, DUE Thursday, 6 February 2020

Reading for this assignment: Andrews, sections 2.7 – 2.10, 3.1 – 3.2.

Problems:

1. (3×3 points $= 9$ points) On Jupiter, the abundance of ammonia is four times the solar value (solar mole fraction of N is 0.000187). Using the pressure-temperature profile given below, calculate the highest pressure at which ammonia condensation will occur. Do not interpolate to get the exact pressure, use only the tabulated values. Assuming that all the supersaturation turns into cloud ice, what is the mixing ratio of cloud ice at that pressure level? What is the relative humidity in the layer immediately below? Assume $m_{\mathrm{dry,Jupiter}} = 2.285$ g/mol, and the saturation vapor pressure of ammonia ice is given by $\log_{10} e_s(T) = 11.9 - 1588.0\,\mathrm{K}/T$ (e_s in Pa, T in K).

p[mbar]	T[K]
3.500e+02	123.81
3.981e+02	127.03
4.500e+02	131.07
5.012e+02	134.63
5.500e+02	138.26
6.000e+02	141.66
6.310e+02	143.63
7.000e+02	148.40
7.500e+02	151.56
7.943e+02	154.20
8.500e+02	157.64
9.000e+02	160.54
9.500e+02	163.29
1.000e+03	165.89
1.050e+03	168.59
1.100e+03	171.16
1.150e+03	173.62
1.200e+03	175.97

2. (i: 5 points, ii: 3×5 + 3×3 points; 4×3 points) Andrews 3.1