**12.800:  F04 Problem set 8**

1) Estimate the geostrophic and ageostropic winds in the regions specified in the attached plot of 500mb heights.

2) In order to interpret thermal wind as an expression of multi-level geostrophy, it is necessary to convince yourself that the slope of lines of constant pressure increase with decreasing pressure under the influence of a surface temperature gradient. Assume constant temperature with height that ranges from 25C at the equator to 0C at the north pole, and that pressure and density are accurately related through the ideal gas law.

(a) Plot lines of constant pressure as a function of latitude (0 degrees north to 90 degrees north) and height (0km to 10km) and discuss why their slope increases with decreasing pressure.

(b) Plot the resulting geostrophic wind as a function of height at or near 45 degrees north to show that it increases with height.

Turn in well commented code along with your figures and any written derivations.