METR 130: Assignment 1 (Spring 2011)
Due Date: February 10, 2011

Question 1: Calculate a value for the neutral ABL depth, h_n, assuming the following:

- u_* can be related to the geostrophic wind speed, G, as $u_* = C_g^{1/2}G$. Here, C_g is called the "geostrophic drag coefficient".

- C_g can be related to the "surface Rossby number" $Ro = G/fz_0$ according to graph handed out in class (dashed line is for neutral conditions, others are for either stable or unstable).

- A value for "surface roughness length" (z_0) that seems suitable to you (use Figure 10.5 in Arya for determining value, justifying your choice of value).

- Values for 'f' and 'G' would seem suitable for globally average conditions at the 850 mb level. Discuss the rationale behind the values you chose to suit these conditions.

- Assume c = 0.6.

Question 2: Download the 00Z and 12Z radiosonde profiles for some day and some place in the United States. Apply methods 1 through 4 of Seidel et al. to determine ABL depths based on these radiosonde data. Report the depths you determined using each method both in a table and as a vertical profile plot, along with the raw data. Be careful to pick a day/place that isn't subject to any extreme weather event. You can find radiosonde data at http://weather.uwyo.edu/upperair/sounding.html.

Question 3: From Seidel et al., what were typical values of ABL heights determined from radiosonde data? Answer with respect to the stable boundary layer and boundary layers capped by an elevated stable layer.

Question 4: Based on your findings from Questions 1 through 3, what may be a more appropriate value for the parameter 'c' for predicting the depth of ABLs found in nature (typically capped by elevated stable layers or inversions) rather than the value of ~ 0.6 for exactly neutral ABLs? Show you determined this alternative value for 'c'.