Answer the following questions on a separate sheet of paper. **SHOW ALL WORK!**

1. Derive the mean thermodynamic equation from the Boussinesq set of equations given in the notes. Hint: Use similar steps to what we used in class for the momentum equations.

2. The wind at Albany International Airport is 10 m s$^{-1}$ at 240°. The pressure is 1010 hPa, which is 4 hPa higher than Glens Falls, and the temperature is 5°C. Determine the drag coefficient at this location assuming the boundary layer top is 300 m above the ground.

3. At sunrise, a station measures a potential temperature profile that has the form $0.000005 \times z^2 + 290$ for 0 km $\leq z \leq$ 1 km and $\theta = 320$ K above that ($z$ given in meters). How long would it take the profile to become well-mixed (i.e., $\theta$ = constant) assuming $K_h = 0.01$ m$^2$ s$^{-1}$ and no mean vertical motion?

4. Determine an expression for the Richardson number in terms of temperature (i.e., not a function of wind). Hint: Use K theory in your derivation.