ATM 645/445 Homework 3
Fall 2014
Given out: Tuesday Sep 23, 2014 Due: Sept. 29 2014

1) (Problem 1.5 Holton) If a baseball player throws a ball a horizontal distance of 100m at 30˚N in 4 s, by how much is it deflected laterally as a results of the rotation of the earth?

2) (Problem 1.12 Holton) Calculate the 100- to 500-hPa thickness for isothermal conditions with temperatures of 273- and 250 K, respectively.

3) (Problem 1.17 Holton) Calculate the 1000- to 500-hPa thickness for a constant lapse rate atmosphere with γ=6.5 K/km and To=273K. Compare your results with those in Problem 1.12 (2 above).

4) (Problem 3.8 Lynch and Cassano) Calculate the Brunt-Vaisala frequency using the data in the Table below for the layers:
a) 843 to 500 hPa, b) 500 to 300 hPa, and c) 300-100hPa

Pressure	Height	Temperature	Mixing Ratio
843 hPa	1625 m	5C	6.2 g/kg
500 hPa	5840 m	-9C	0.8 g/kg
300 hPa	9570 m	-38 C	0.3 g/kg
100 hPa	16520 m	-64 C	0.091 g/kg

5) (Problem 4.4 Lynch and Cassano) a) Write an equation for the geopotential height at a given pressure level for an atmosphere in which the vertical temperature profile is given by T(z) = To +Γz, where To is temperature at an elevation of 0m and Γ = -dT/dz is the lapse rate.
b) Calculate the height of the 300 hPa pressure surface for G=6C/km and To=-30, 0, and 30C.

6) (Problem 2.1 Holton) A ship is steaming northward at a rate of 10 km/h. The surface pressure increases toward the northwest at the rate of 5 Pa/km. What is the pressure tendency recorded at a nearby island station if the pressure aboard the ship decreases at a rate of 100 Pa/3 h?

7) (Problem 2.3 Holton) Derive the relationship

$$\vec{\Omega} \times (\vec{\Omega} \times \vec{r}) = -\Omega^2 \vec{R}$$