22 Jan 2016

Problems from today's class (finish at home and hand in on Monday 25th Jan):

1. Show that in an atmosphere with uniform lapse rate γ (where $\gamma \equiv -dT/dz$) the geopotential height at pressure level p_1 is given by

$$Z = \frac{T_0}{\gamma}\left[1 - \left(\frac{p_0}{p_1}\right)^{-R\gamma/g}\right]$$

where T_0 and p_0 are the sea level temperature and pressure, respectively.

2. A ship is heading northward at a rate of 10 km h^{-1}. The surface pressure increases toward the northwest at a rate of 5 Pa km^{-1}. 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?

3. The temperature at a point 50 km north of a station is 3°C cooler than at the station. If the wind is blowing from the northeast at 20 m s^{-1} and the air is being heated by radiation at the rate of 1°C h^{-1}, what is the local temperature change at the station?

4. If a baseball player throws a ball a horizontal distance of 100 m at 30° latitude in 4 s, by how much is it deflected laterally as a result of the rotation of Earth? (tip: assume that the ball is thrown eastward)