309/B3090 Fall 2019

Worksheet Week 6

(1) If you draw a box around NYC that is 2˚ of longitude by 2˚ of latitude, then what is the approximate area of the box? Recall, NYC is at approximately: 40.5˚N by 74˚W. Use the longitude length at NYC to approximate the zonal width of the box.

(2) The observed lapse rate is 6 K/km-1 from 0 to 3km and 8 K/km-1 from 3 to 5km, and -1 K/km-1 from 5 to 6km and 11 K/km from 6km to 8km, sketch the vertical profile of temperature from 0 to 8km for this scenario.

(3) If an unsaturated air parcel rises adiabatically and cools by 17K, without saturating, then how many km did it rise?

(4) If an air parcel descends 2300m without gaining any moisture, and its initial temperature is 210K, what is its new temperature?

(5) If an air parcel at 850 hPa has a potential temperature of 275 K, what temperature would it have if it descends adiabatically to the 1000 hPa pressure level?

(6) If a layer between 850 hPa and 500 hPa is 2 km thick, then what is the mass-weighted vertical mean temperature of the layer (in K)?

(7) If an air parcel cools 17K while rising 2km but it reached saturation after the first 1500m of rising, then what is the approximate saturated adiabatic (or pseudoadiabatic) lapse rate experienced by the air parcel?

(8) If an airparcel rises 3km dry adiabatically and another 4 km at a saturated lapse rate of 7 K/km then how much did the parcel cool in total?

(9) If RH =65%, at 1000 hPa and the observed water vapor mixing ratio is 15g/kg, then what is the air temperature in degrees C?

(10) If an air parcel has a dew point temperature of 22˚C and a relative humidity of 60%, find the saturation vapor pressure.

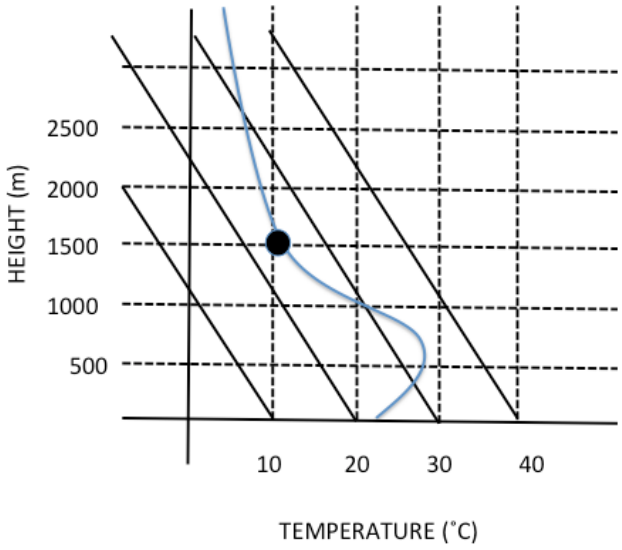
(11) An air parcel is lifted 4 km and then brought back to its original height.

a. If the final temperature is equal to the initial temperature of the parcel at, then what do we know about its RH during the trip?
b. If the final temperature is greater than the initial temperature, what has happened? (assuming radiative and sensible heating rates are zero).

(12) What are the slanted solid lines in the schematic?

(13) What is the top height of the inversion layer?

(14) If an air parcel at the black dot is forcibly lifted to 2500 m, then what will happen to the parcel it the forcing is turned off.



Worksheet Week 6 Answers:

1. 2*111*2*111*cos(40.5)
2. In class
3. 17/9.8 = 1.73 km
4. 210 + 2.3*9.8= 232.5
5. 275 K
6. In class
7. 4.6 K/km
8. 57.4 K

Page 2 – in class.