Homework #2 EAS 309/B3090

Due: Weds. Oct 16, start of class.

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

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(2) If an air parcel at 850 hPa has a temperature of 225 K, what temperature would it have if it descends adiabatically to the 1000 hPa pressure level?

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(3) 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)?

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(4) Under what condition is moist static energy (MSE) conserved while dry static energy (DSE) is not?

_____

(5) What is the equation for MSE: _____

(6) When air is pumped into an airplane cabin that is flying at 10,000 km, the air pressure has to be increased. Why?

(7) … then the air has to be cooled. Why?

_____

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(8) What are four variables that we have learned about that remain constant during adiabatic ascent?

_____, _____, _____, _____

(9) If an air parcel in New York is cooled past saturation, less latent heat will be added to the parcel as compared to a similar, saturated parcel in Tahiti. Why is this?

(10) Calculate the relative humidity of a parcel at 1000 hPa that has a temperature of 287 K and a mixing ratio of 3 g kg^{-1}.

(11) Assume that you have used a radiosonde to measure the temperature profile of the atmosphere and have the following measurements:

(a) Plot the temperature profile

(b) On the same plot, diagram the ascent of a parcel that has T_{surf}=284 K and an LCL at 3 km and a saturate lapse rate of 4 K km^{-1}

(c) Estimate the height of the level of free convection for the parcel.

Height (km)	Temp. (K)
0.0	280
0.5	287
1.0	285
1.5	280
2.0	275
2.5	268
3.0	260
3.5	257
4.0	253
4.5	251
5.0	250