Appendix C

Sounding Analysis Exercise

The purpose of this exercise is to take you through an analysis process that evaluates a 1200Z sounding for the potential of afternoon thunderstorms. After looking at initial morning values, you modify the sounding to reflect afternoon heating and increases in moisture, and reassess the potential instability.

… A sounding is found on page 4 of this appendix …

1. Plot the temperature and dew point curves for the attached 1200Z sounding on your skew T-ln p diagram.

2. What are the actual and saturation mixing ratio values at the Earth's surface based on the skew T-ln p diagram?

   Mixing Ratio _____

   Saturation Mixing Ratio _____

3. When lifting low level air parcels upward to estimate thunderstorm potential, it is good to lift a parcel of boundary layer air based on the average mixing ratio in the lowest layer of the sounding (instead of just the surface air).

   Determine the mean mixing ratio in the lowest 100 mb layer of the sounding. Show the averaging process on the sounding.

   _____

4. Determine the mean potential temperature (θ) for the lowest 100 mb layer of the sounding. Show the averaging process on the sounding.

   _____

5. Use the mean mixing ratio found in #3 and the mean potential temperature in #4 to find the LCL. Then lift the LCL parcel upward to determine the LFC, and EL. Draw the path of a raised parcel on your chart.

   LCL _____ LFC _____ EL _____

6. 12Z soundings can be modified for afternoon heating to better estimate the impact of this heating on stability estimates.

   Assume that daytime heating raises the surface temperature to 28°C (82°F).

   Assume that the lapse rate is dry adiabatic from this new temperature to the observed sounding. Draw this modified sounding on your skew T-ln p diagram.

7. Using the modified temperature curve from #6 and the mean mixing ratio from #3, find a new LCL, LFC and EL by drawing the path of the raised parcel on your skew T-ln p diagram.

   LCL _____

   LFC _____

   EL _____

8. If you assume that the modification described in #6 represents typical daytime heating of a morning sounding, what impact does this heating have on instability?

9. Increase the mean mixing ratio in the lowest 100 mb layer by 3 g/kg. Draw this revised mean mixing ratio on your skew T diagram.

10. Using the modified temperature curve from #6 and the revised mean mixing ratio from #9, find a new LCL, LFC and EL by drawing the path of the raised parcel on your skew T-ln p diagram.

    LCL _____

    LFC _____

    EL _____

11. What impact did the increased low level moisture have on instability?

12. Calculate or use the skew T-ln p plot to determine the following stability indices.

    a. K Index (for the original sounding)

b. Total Totals Index (for the original sounding)

c. Convective Temperature (for the original sounding)

d. Lifted Index

i. based on results from #3, #4 and #5

ii. based on modifications in #6 and #7

iii. based on modifications in #9 and #10

Notes:

Show all your lifted parcel curves on the skew T-ln p diagram in order to demonstrate your understanding of the processes involved. The LCL, LFC, and EL in #5, #7, and #10 should be answered in millibars (mb).

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Sounding Exercise Data

Topeka, KS for 1200Z 23 JUN 2010

Pressure (mb)	Height (m)	Temp (°C)	DewPt (°C)	Pressure (mb)	Height (m)	Temp (°C)	DewPt (°C)
981	270	27.2	22.2	444	6842	-13.5	-15.2
978	297	27.2	22.2	435	6998	-14.5	-18.1
958	481	26.0	21.5	421	7245	-16.5	-19.5
943	621	26.2	21.2	412	7408	-17.5	-20.7
928	763	27.6	18.6	408	7481	-17.3	-20.4
925	792	27.6	18.6	405	7537	-17.3	-22.1
876	1272	24.6	14.6	400	7630	-18.1	-22.8
870	1333	24.6	14.6	396	7705	-18.7	-22.4
855	1485	25.2	8.2	392	7781	-18.9	-23.0
850	1537	24.8	8.8	389	7838	-19.1	-25.1
843	1609	24.4	10.4	384	7934	-19.7	-26.7
837	1672	24.4	8.4	369	8229	-22.1	-26.9
825	1798	23.2	10.2	362	8370	-21.5	-28.5
813	1926	23.2	6.2	345	8724	-23.7	-32.7
792	2153	22.2	4.2	321	9246	-27.9	-36.9
766	2442	20.0	-1.0	300	9730	-30.9	-43.9
700	3209	13.2	-0.8	295	9848	-31.3	-46.3
689	3342	12.2	0.2	265	10593	-37.7	-63.7
662	3675	9.6	-1.4	250	10990	-41.1	-65.1
650	3826	9.2	-3.8	220	11848	-48.7	-66.7
594	4563	2.8	-9.2	200	12470	-53.7	-68.7
583	4714	1.8	-8.2	172	13420	-61.7	-73.7
565	4966	0.2	-11.8	166	13640	-61.9	-73.9
532	5445	-4.3	-13.3	150	14260	-65.9	-76.9
526	5534	-4.7	-11.7	131	15070	-71.1	-80.1
502	5899	-8.1	-15.1	119	15637	-71.5	-80.5
500	5930	-8.5	-15.5	113	15941	-73.1	-82.1
470	6407	-13.1	-16.4	111	16045	-72.1	-81.1
464	6505	-13.1	-14.3	108	16206	-72.7	-81.7
450	6739	-13.5	-13.8	100	16660	-70.3	-80.3