Geo165 Meteorology

Lab #3

Crossing a Cold Front

In this lab we go back to traditional paper and analyze several data sets to peer into the structure of a cold front in the horizontal and in the vertical.

What we know:

- A front is the boundary of an air mass
- An air mass is a quasi-homogeneous body of air originating over a source region. The air mass acquired the characteristics of the surface with which it was in contact.
- As the air mass moves it is modified. Air that is warmer than the surface over which it is moving is stabilized while air that is cooler than the surface is destabilized.
- Stabilization can lead to drizzle while destabilization can lead to showery weather.
- The leading edge of an advancing air mass is a cold front if polar or arctic air replaces warmer air.
- If warmer air is advancing into a region the front is a warm front.
- The colder air is more dense and hugs the ground forcing warmer air to rise over it.
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Data:

Six weather maps from 12z 05Feb2008

- Observations, isobars, front
- Grid temperatures, isotherms, front, plot line
- Grid sea level pressure, isobars, front, plot line
- Wind streamlines, front
- Grid wind barbs, front plot line
- Grid dew point, front plot line

Sounding data for:
ILX (Lincoln, IL) and ILN (Wilmington, OH) from 12z 05Feb2008

Materials:

Blank Stüve Diagrams – for plotting soundings
Blank Cross-over charts – for plotting observations

Tasks: I will walk you through this in class and explain Stüve Diagrams (don't panic it is just a piece of graph paper – right now only worry about the horizontal and vertical lines not the curved or slanted lines).

Plot the soundings from ILX and ILN on separate Stüve diagrams.
Plot a cross-over chart using the grid data from the maps
On the cross-over plot enter the position of the front, the state boundaries and both Lincoln and Wilmington.
Answer the questions.

1. There is an important difference above the surface between the Lincoln, IL sounding and the Wilmington, OH sounding that indicates the front has passed through Lincoln. Explain it.

2. Label the cloud layers on each sounding?

3. Explain the difference in surface temperatures between Lincoln and Wilmington.

4. What happens to atmospheric pressure as you cross the front traveling from SE to NW? Why?

5. What happens to the wind as you cross the front traveling from SE to NW? Why?

6. What happens to the temperature as you cross the front traveling from SE to NW? Why?

7. What happens to the dew point as you cross the front traveling from SE to NW? Why?

74560 ILX Lincoln Observations at 12Z 05 Feb 2008

PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot	THTA K	THTE K	THTV K
1000.0	106									
991.0	178	2.4	2.4	100	4.61	305	5	276.3	289.0	277.0
979.0	277	2.6	2.2	97	4.60	313	9	277.4	290.2	278.2
945.0	563	1.8	1.4	97	4.50	336	20	279.4	292.0	280.2
939.6	610	3.0	2.7	98	4.99	340	22	281.1	295.1	281.9
933.0	667	4.4	4.4	100	5.65	284	16	283.1	299.0	284.1
926.0	729	5.4	5.2	99	6.02	224	9	284.7	301.7	285.8
925.0	738	5.6	4.8	95	5.86	215	8	285.0	301.6	286.0
923.0	756	5.6	1.3	74	4.58	221	9	285.2	298.3	286.0
920.0	782	6.6	-0.4	61	4.06	230	9	286.5	298.3	287.2
914.0	836	9.8	-1.2	46	3.85	249	11	290.3	301.7	291.0
908.0	891	11.8	-0.2	44	4.17	267	12	292.9	305.4	293.7
905.5	914	11.7	0.4	46	4.36	275	13	293.0	306.0	293.8
898.0	984	11.2	2.2	54	5.02	278	14	293.2	308.1	294.1
877.0	1181	10.6	-7.4	28	2.51	288	18	294.6	302.4	295.0
873.0	1219	10.3	-7.4	28	2.51	290	19	294.7	302.5	295.2
858.0	1363	9.4	-7.6	29	2.53	277	22	295.2	303.0	295.6
850.0	1441	9.8	-9.2	25	2.25	270	23	296.4	303.4	296.8
841.5	1524	10.5	-15.3	15	1.39	270	23	298.0	302.5	298.2
840.0	1539	10.6	-16.4	13	1.27	271	23	298.2	302.4	298.5
829.0	1649	10.0	-20.0	10	0.95	274	26	298.7	301.9	298.9
811.1	1829	8.4	-16.1	16	1.35	280	31	298.9	303.3	299.2
787.0	2077	6.2	-10.8	28	2.14	272	31	299.1	305.9	299.5
781.5	2134	5.7	-11.0	29	2.12	270	31	299.2	306.0	299.6
752.6	2438	3.2	-12.1	31	2.02	290	31	299.8	306.2	300.1
724.8	2743	0.7	-13.2	34	1.92	275	29	300.3	306.4	300.6
707.0	2944	-0.9	-13.9	37	1.86	268	32	300.6	306.6	300.9
700.0	3023	-1.1	-17.1	29	1.44	265	33	301.2	305.9	301.5
697.8	3048	-1.2	-18.7	25	1.26	265	33	301.3	305.5	301.6
697.0	3057	-1.3	-19.3	24	1.20	265	33	301.4	305.4	301.6
666.0	3417	-4.1	-17.1	36	1.51	274	39	302.2	307.1	302.5
664.0	3441	-3.9	-16.9	36	1.54	275	39	302.7	307.7	302.9
663.0	3453	-3.5	-23.5	20	0.87	275	40	303.2	306.2	303.4
659.0	3500	-2.9	-30.9	9	0.44	276	40	304.4	306.0	304.5
649.0	3621	-2.9	-44.9	2	0.11	279	42	305.8	306.2	305.8
646.0	3658	-3.0	-43.5	3	0.13	280	43	306.1	306.6	306.1
629.0	3868	-3.3	-35.3	6	0.30	270	45	308.1	309.2	308.1
597.7	4267	-6.7	-31.8	12	0.45	250	49	308.7	310.3	308.7
580.0	4501	-8.7	-29.7	17	0.57	246	52	309.0	311.0	309.1
574.0	4582	-8.9	-24.9	26	0.89	245	53	309.7	312.8	309.8
566.0	4690	-9.5	-25.5	26	0.85	243	54	310.2	313.2	310.4
552.3	4877	-11.2	-25.7	29	0.86	240	56	310.4	313.4	310.5
521.0	5321	-15.3	-26.3	38	0.86	243	62	310.6	313.7	310.8
502.0	5600	-17.7	-24.7	54	1.03	245	66	311.0	314.6	311.2
500.0	5630	-17.9	-23.9	59	1.12	245	66	311.1	315.0	311.4
493.0	5735	-18.1	-22.6	68	1.27	245	67	312.2	316.5	312.4
469.6	6096	-20.1	-24.4	69	1.14	245	71	314.0	317.9	314.2
444.0	6512	-22.5	-26.5	70	0.99	231	69	316.1	319.6	316.3
432.3	6706	-23.9	-28.1	69	0.88	225	68	316.7	319.9	316.9
400.0	7270	-28.1	-32.6	65	0.62	230	68	318.4	320.7	318.5

72426 ILN Wilmington Observations at 12Z 05 Feb 2008

PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot	THTA K	THTE K	THTV K
1000.0	84									
972.0	317	16.0	14.2	89	10.58	210	11	291.5	321.6	293.4
939.6	610	14.1	13.0	93	10.09	215	36	292.4	321.3	294.2
925.0	745	13.2	12.4	95	9.87	220	45	292.8	321.1	294.5
924.0	754	13.2	12.5	96	9.95	220	45	292.9	321.4	294.6
906.6	914	12.7	12.1	96	9.87	220	48	294.0	322.4	295.7
874.3	1219	11.7	11.3	97	9.71	235	56	296.0	324.3	297.8
850.0	1456	11.0	10.7	98	9.59	245	59	297.7	325.8	299.4
846.0	1495	10.8	10.5	98	9.51	245	59	297.9	325.8	299.6
843.1	1524	10.6	10.2	97	9.35	245	59	297.9	325.4	299.6
812.8	1829	8.6	7.0	90	7.79	245	53	298.9	322.1	300.3
810.0	1857	8.4	6.7	89	7.65	245	53	299.0	321.8	300.4
783.1	2134	6.8	5.3	90	7.18	250	54	300.2	321.7	301.5
754.5	2438	5.0	3.8	92	6.69	255	57	301.4	321.6	302.6
726.9	2743	3.1	2.2	94	6.23	260	60	302.7	321.6	303.8
707.0	2970	1.8	1.1	95	5.90	256	64	303.6	321.6	304.7
700.0	3050	0.6	-1.0	89	5.11	255	65	303.1	318.8	304.1
693.0	3131	0.0	-1.4	90	5.01	253	65	303.3	318.8	304.2
674.0	3354	-0.5	-1.9	90	4.96	248	66	305.2	320.6	306.1
648.8	3658	-2.3	-3.3	93	4.64	240	67	306.4	321.0	307.3
644.0	3717	-2.7	-3.6	94	4.58	239	67	306.7	321.0	307.5
624.3	3962	-4.2	-6.0	88	3.95	235	67	307.7	320.2	308.4
600.6	4267	-6.2	-8.9	81	3.27	240	73	308.9	319.4	309.5
594.0	4354	-6.7	-9.7	79	3.10	241	74	309.2	319.2	309.8
577.5	4572	-8.0	-10.7	81	2.95	245	75	310.2	319.8	310.7
555.3	4877	-9.8	-12.0	84	2.76	245	74	311.5	320.6	312.0
552.0	4923	-10.1	-12.2	85	2.73	245	74	311.7	320.7	312.2
500.0	5680	-14.7	-17.4	80	1.96	250	66	315.1	321.7	315.4
472.9	6096	-17.5	-21.0	74	1.52	250	67	316.6	321.9	316.9
454.0	6401	-19.6	-23.6	70	1.26	255	60	317.7	322.1	317.9
441.0	6618	-21.1	-25.5	68	1.10	255	62	318.5	322.4	318.7
400.0	7330	-26.1	-31.1	63	0.72	255	69	321.0	323.6	321.1