ATM OCN (Meteorology) 100
SUMMER 2004
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HOMEWORK 5 SURFACE WEATHER MAP ANALYSIS

The first attached map is a plot of the surface weather observations made over the upper Midwest at 6:00 AM CST on Friday, 10 November 1998. The second map is the plot of the sea level pressure for that time. Several isobars have been added to a portion of this chart to help you see the process of making an isobar analysis. You can use this second chart to complete your initial isobar analysis.

A. STATION MODEL

At each station on the first map the following abbreviated surface station model has been utilized:

\[ \begin{array}{c}
\text{TT} \\
\text{WW} \\
\text{TdTd} \\
\text{PPP}
\end{array} \]

Where

- \( \text{TT} \) = air temperature (deg F)
- \( \text{TdTd} \) = dewpoint temperature (deg F)
- \( \text{PPP} \) = sea-level corrected pressure (tenths of mb) with decimal and lead "9" or "10" missing
- \( \text{WW} \) = significant weather or obstruction to visibility (symbol)

\( \bigcirc \) = Clear; \( \blacksquare \) = Scattered; \( \bigotimes \) = Broken; \( \bullet \) = Overcast; \( \Box \) = Obscured.

Wind arrows fly with the wind. Each full barb equals 10 knot wind speed. [Sample station reports a 15 knot wind from the southeast (SE)]. Missing values are indicated by an "M".

What were the conditions reported at Madison, WI at map time? (Include units)

- Temperature: ______________________
- Dewpoint: ______________________
- Pressure: ______________________
- Sky cover: ______________________
- Wind Speed: ______________________
- Wind Direction: ______________________
- Precipitation type or significant weather phenomenon: ______________________

B. ISOBAR ANALYSIS

Remember that isobars portray the sea-level corrected pressure field. Using the second chart, analyze the sea-level pressure field (on the second map) by drawing isobars spaced every 4 mb, centered upon 1000 mb (e.g., ..., 992, 996, 1000, 1004, 1008, ...). The reported values may not necessarily equal the desired values. Therefore, you would have to interpolate between those stations with pressures within \( \pm 4 \) mb of the desired value. When performing your analysis make a light sketch of the isobars with a pencil initially; then smooth the isobars. Use the include isobars to help you in your analysis. After smoothing and checking your analysis, isobars may then be inked onto the first chart with a black pen and each labeled neatly.

Points to consider during your isobar analysis:

1. Where is the low- or high-pressure center(s) located?
   (Identify the pressure feature and state or province)

   \[ \text{Hint: you should look for the regions with a distinct, closed wind circulation. Locate the center of the low or high pressure system and mark with a large red block "L" (for the low) or a large blue "H" (for the high). Give an estimate of the value of the central pressure for that pressure feature.} \]

2. Since the atmosphere is a continuous fluid, no discontinuities nor sharp kinks should appear in your isobar analysis. The spacing between isobars should suggest a smooth horizontal pressure gradient, if possible. Some kinks in the isobars should be expected, especially near wind shift lines and fronts.

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3. The isobars are usually spaced closer in regions where the wind speed is greatest.
4. Does your smoothed analysis conform to the above items? _______________________

C. ISOTHERM ANALYSIS

Analyze the surface temperature field on the first chart by drawing isotherms every 10°F (e.g., 10°, 20°, 30°,...). Some smoothing may be necessary. Attempt to follow the same rules as for drawing isobars noted above; however, the temperature field is usually more variable than the pressure field. The finished isotherm analysis should be drawn in dashed red lines and each isotherm should be labeled accordingly.

Points to consider during your isotherm analysis:
1. Where are the warmest and coldest regions (by state) found?
   a. Warmest ________________________;
   b. Coldest ________________________.
2. Where are the sharpest horizontal temperature contrasts located?
   ________________________

D. INTERPRETATION OF THE SURFACE ANALYSIS

Answer the following questions using your analyzed Midwest map.
1. Where are the regions of highest and lowest dewpoints?
   a. Highest dewpoint (humid) ________________________;
   b. Lowest dewpoint (dry) ________________________.
2. Describing in words, what type of precipitation is found in:
   a. Central Illinois ________________________;
   b. Eastern Nebraska ________________________;
   c. North central Iowa–Southeast Minnesota ________________________.
3. What is the prevailing wind direction that is observed in the following locales?
   a. North Dakota ________________________;
   b. Central Illinois ________________________.
4. In what region do you find the strongest winds on the map? ________________________
   Are the isobars closer or farther apart in this area? ________________________
5. What region(s) is experiencing warm air advection, where winds are transporting warm air toward colder regions?
   ________________________
   What region(s) is experiencing cold air advection, where winds are transporting cold air toward warmer regions?
   ________________________

E. FRONTAL ANALYSIS

With the aid of your isotherm analysis, the distribution of dewpoint temperatures and the wind field through the regions of distinct wind shifts, can you identify a cold front? A warm front? Using the conventional frontal symbols (see Figure 1.3 on page 4 of your textbook), draw the appropriate surface fronts on your analysis.

Please hand in your finished surface analysis with this worksheet. Print your name on the map.
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HOMEWORK #5 PART II. WEATHER SEQUENCES & FRONTAL PASSAGES

Please print carefully and clearly! For each of the weather elements listed, describe the time sequence that you would expect to observe at your "weather station" during the following three situations:

1. A warm frontal passage in autumn resulting when an idealized cyclone passes from south to north, while staying west of you:

   | CLOUDS (type) | PRE-FRONTAL* | FRONTAL PASSAGE | POST-FRONTAL |
   | PRECIPITATION (type) | | | |
   | TEMPERATURE (trend) | | | |
   | WINDS (direction) | | | |
   | PRESSURE TENDENCY | | | |

2. A cold frontal passage in the spring of the year when an idealized cyclone moving eastward passes from the northwest to the northeast of you:

   | CLOUDS (type) | PRE-FRONTAL | FRONTAL PASSAGE | POST-FRONTAL |
   | PRECIPITATION (type) | | | |
   | TEMPERATURE (trend) | | | |
   | WINDS (direction) | | | |
   | PRESSURE TENDENCY | | | |

3. The passage of an idealized snow producing cyclone (and attendant trough line) in winter traveling from southwest to northeast, but remaining just south of you:

   | CLOUDS (type) | PRE-TROUGH | TROUGH PASSAGE | POST-TROUGH |
   | PRECIPITATION (type) | | | |
   | TEMPERATURE (trend) | | | |
   | WINDS (direction) | | | |
   | PRESSURE TENDENCY | | | |

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