LAB I - ATMOSPHERE AND CLIMATE LAB III
AIR MASSES, FRONTS AND STORMS

Introduction

This lab will provide students the opportunity to operationalize all of the concepts introduced in Chapters 3-7. Students will initially review the types of air masses and frontal systems, then construct a basic weather map for the United States from sample pressure and temperature data and plot the probable location and movement of frontal systems.

Materials needed: pencil, calculator and colored pencils

Part I. Air Masses and Fronts

Air masses are large bodies of air (over 1,000 miles in diameter) that possess similar temperature, pressure and moisture characteristics throughout. They are formed in the Subtropics and at the Poles and influence weather in the Tropics and Midlatitudes. They acquire the characteristics of that part of the Earth's surface over which they develop. In order for the air masses to acquire these surface characteristics they must remain over a homogeneous piece of the Earth's surface for at least a few days. A **front** is the area along which two different air masses meet. A cold front occurs where a cold air mass is actively displacing (underriding) a warm air mass and a warm front occurs where a warm air mass is actively overriding a cold air mass.

A. Are air masses formed in regions experiencing high pressure or low pressure? Why?

B. Describe the five types of **air masses** and where each might *originate*. Use **North America** as the geographic reference. Be specific.

cP:____

mP:____

cT:____

mT: ____

cA or A:____

C. Which three air masses influence weather in Arizona, and during what seasons?
Summer:
Winter:

D. Diagram (side view) both a **cold** and **warm** front.

Cold Front | Warm Front

E. What happens to atmospheric pressure, air temperature, dew point, wind and precipitation as a **cold front** passes? Comment on conditions before passage and after passage.

F. How does **cold front precipitation** differ from warm front precipitation?

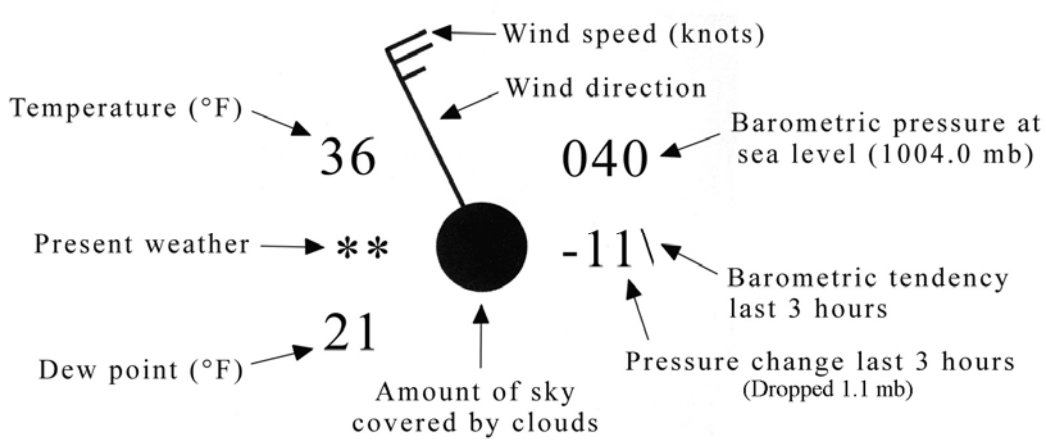
Part II. Frontal Systems and Surface Analysis of Weather Maps

A surface analysis consists of drawing isobars (lines of equal barometric pressure), marking locations of closed high and low pressure systems, and locating and drawing fronts. We will also be shading in the areas experiencing precipitation.

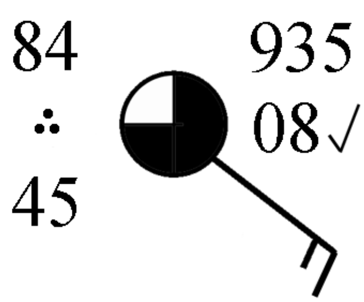
Decoding the Weather Station Model
To understand the symbols and locations of data around the station, a simplified example is provided below. See also Appendix IV, pages A13-A18 of your textbook for further information.

As you will find, each piece of weather information has a specific location in relation to the station circle. For example, the temperature is always located to the upper left side of the station circle. Here the temperature is 36°F. Dew point temperature is found to the lower left of the station. The dew point temperature is 21°F. Units are not plotted on the station model. The pennant for wind direction is attached to the station on the side from which the wind is blowing.

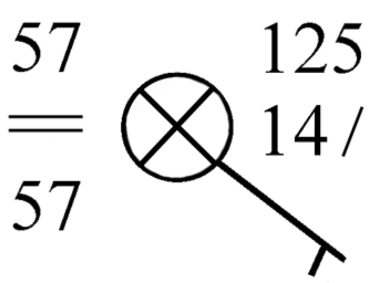
Barometric pressure is coded such that you must add a "9" or "10" in front of the numbers (040) and a decimal between the last two digits. A good rule: if the number is less than 500, add a "10", and greater than 500, add a "9". In our example: 040 = 1004.0 mb



Decode the following two station models.



Temperature = ____________________________
Dew point = ______________________________
Pressure = _______________________________
Present Weather = __________________________
Wind direction = ___________________________
Wind speed = ______________________________
Sky covered by clouds = _____________________
Pressure change last 3 hours = ________________
Pressure tendency last 3 hours = _______________



Temperature = ____________________________
Dew point = ______________________________
Pressure = _______________________________
Present Weather = __________________________
Wind direction = ___________________________
Wind speed = ______________________________
Sky covered by clouds = _____________________
Pressure change last 3 hours = ________________
Pressure tendency last 3 hours = _______________

In the box on the right, create a station model using the weather information below. Be sure to use the proper symbols and format. Remember, units are not plotted on the station model.

Temperature = 15°F
Dew point = 9°F
Pressure = 1006.7 mb
Present Weather = snow showers
Wind direction = NW
Wind speed = 10 knots
Sky covered by clouds = 10/10 or overcast
Pressure change last 3 hours = 1.2 mb drop last 3 hours
Pressure tendency last 3 hours = dropping then steady

Using the map provided (Figure I-1 on page **I-5**), perform a surface analysis.

Use the following steps to complete the analysis…be careful and neat…

1. Decode pressures by putting a “9” or “10” in front *(normally, this is not done)*
2. Draw in the isobars using a **4 mb interval**, e.g., 996mb, 1000mb, 1004 mb, etc. Label all of the isobars clearly with values but no units! (no mb after the number)
3. Place an "**L**" in the center of the low pressure cell.
4. Locate and draw in the cold front and the warm front.
5. Shade in the areas of precipitation associated with both fronts.

If you have colored pencils…

Isobars = black
Low “L” = red
High “H” = blue (not on this map)
Cold front = blue
Warm front = red
Occluded front = purple
Precipitation = green shading
Fog = yellow shading

Note: not all items will be on this map

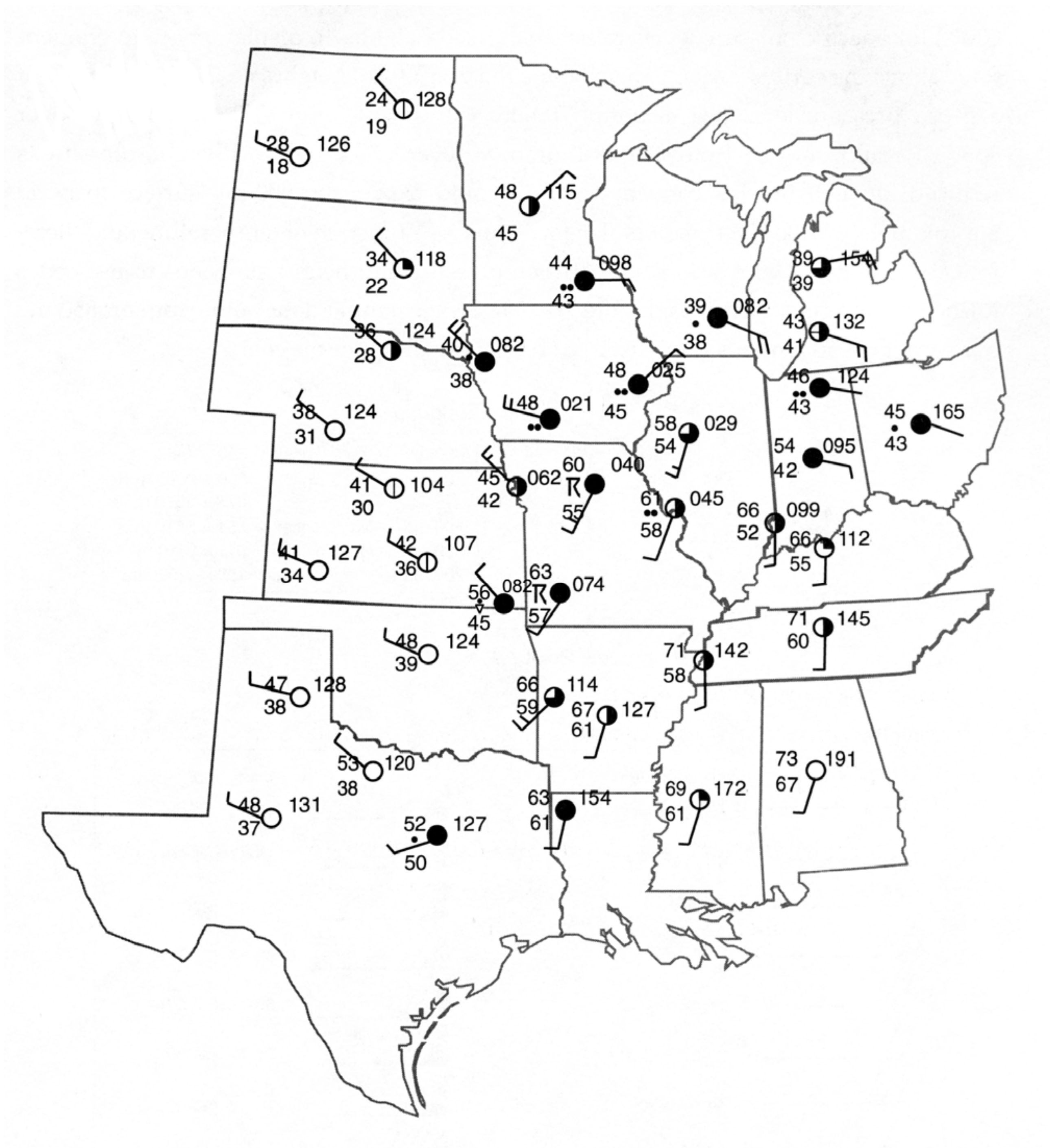


Figure I-1: Map for surface analysis

A. What is the general trend of air movement around a **low pressure cell** in the **Northern Hemisphere**? What evidence supports this observation? Use three fairly large arrows to diagram this cyclonic movement of air on the weather map you just analyzed.

B. What is the general trend of air movement around a **high pressure cell** in the **Northern Hemisphere**?

C. You are now a weather forecaster. Using figure I-1, describe the weather changes expected for Little Rock, AR (temperature, dew point, wind direction, pressure, precipitation) with the passing of the front.

D. On Figure I-2 (below), draw in a **midlatitude cyclone** as it moves across the country. Using the cyclone for Feb 21 as a model, draw in the cyclone and the position of its fronts for **Feb 22, Feb 23 and Feb 24**.

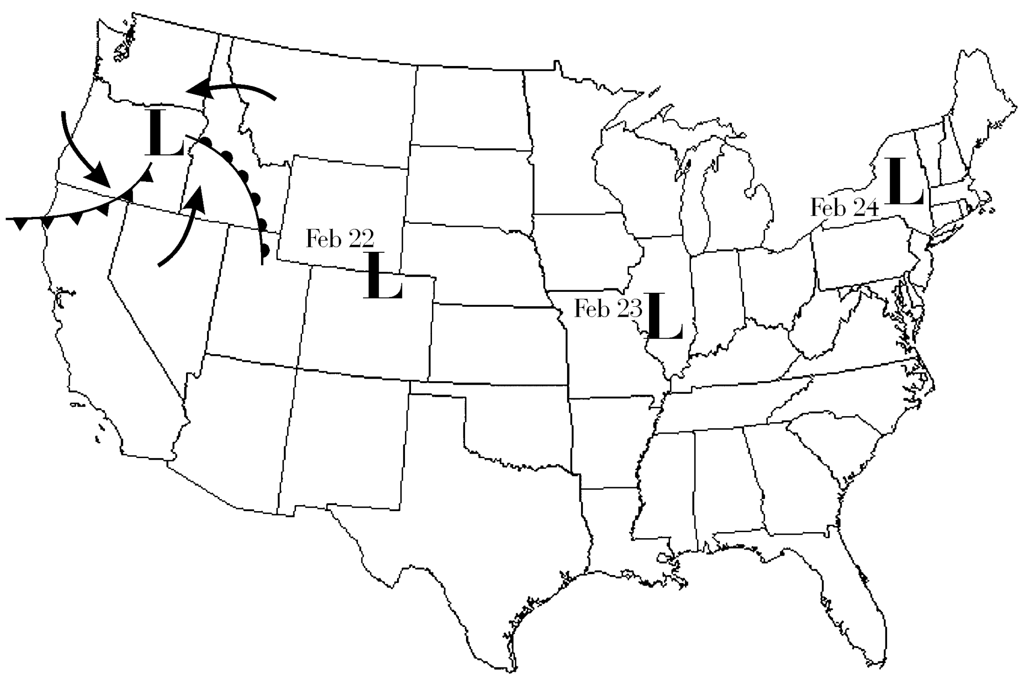


Figure I-2: United States, Midlatitude Cyclone 21-24 February