LAB 11

WEATHER MAP ANALYSIS

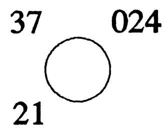
INTRODUCTION

Mid-latitude weather is largely influenced by processes that redistribute excess energy from the subtropics to higher latitudes. It is in the mid-latitudes that warm tropical air masses come in contact with cold polar air masses. Understanding the weather patterns that result from such clashes requires knowledge of weather maps and how they are constructed. The purpose of this lab is to illustrate the construction and use of weather maps, and to help you identify air masses, fronts, and mid-latitude cyclones on these maps.

SURFACE WEATHER MAPS

Every six hours atmospheric data are collected at approximately 10,000 surface weather stations. These data are transmitted to one of three World Meteorological Centers in Melbourne, Australia; Moscow, Russia; or Washington, D.C. Weather data are disseminated to national meteorological centers where *synoptic-scale* maps are generated. (Synoptic literally means coincident in time and a synoptic map is a map of weather conditions for a specific time.) Since each station collects data for as many as eighteen weather characteristics, a compact method of symbolization must be used to include all this information on a single weather map. The station model, developed by the World Meteorological Organization, is the standard format for symbolizing weather characteristics. Figure 1 illustrates the arrangement of data in the WMO model. A complete list of symbols used in the model can be found in your textbook.

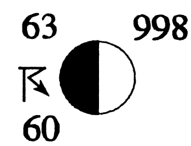
1. ***Decode information from each of the following station models:***



Barometric Pressure ______

Temperature ______

Dew-point Temperature ______



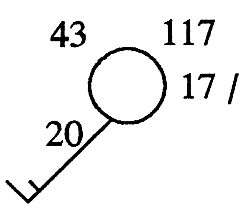
Barometric Pressure ______

Temperature ______

Dew-point Temperature ______

Sky Coverage ______

Current Weather ______



Barometric Pressure ______

Temperature ______

Dew-point Temperature ______

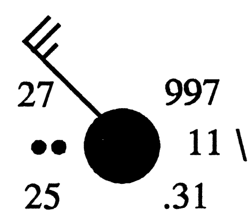
Sky Coverage ______

Wind Speed ______

Wind Direction ______

Pressure Change during last 3 hours ______

Pressure Tendency ______



Barometric Pressure ______

Temperature ______

Dew-point Temperature ______

Sky Coverage ______

Current Weather ______

Wind Speed ______

Wind Direction ______

Pressure Change during last 3 hours ______

Pressure Tendency ______

Weather maps are most useful when their information is analyzed in some fashion. One means of analysis is to highlight the spatial patterns of specific variables. This can be done by constructing isolines (lines of constant value). In Figure 2 an *isotherm* (line of constant temperature) is constructed through 80° F.

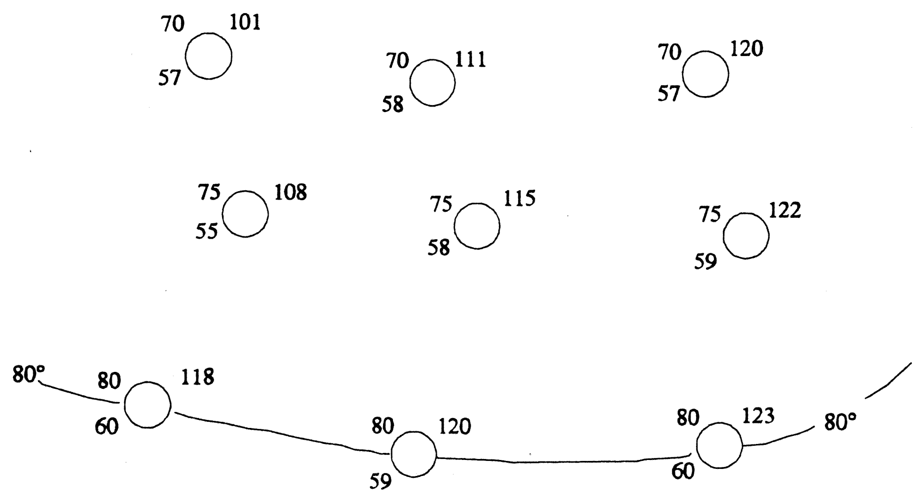
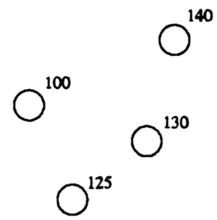


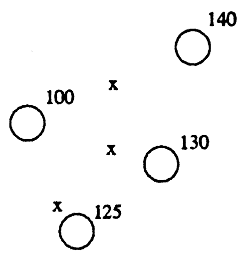
Figure 2

2. Complete the analysis in Figure 2 by constructing isotherms at 70° F and 75° F.

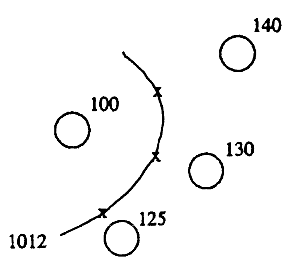
Drawing isolines in the example above was straightforward since the temperature at each station was exactly 80°, 75° or 70° F. Since such patterns rarely occur in nature it is often necessary to *interpolate* between points. For example, we may want to draw a 1012 mb *isobar* (line of constant barometric pressure) using the following station data:



In a simple interpolation scheme we might decide that 1012 mb is exactly between 1010.0 and 1014.0 mb and would indicate this position with a small "x." A value of 1012 mb would also exist two-thirds the distance between 1010.0 and 1013.0 mb, and four-fifths the distance between 1010.0 and 1012.5 mb.



The "x's" that we draw represent new data points with a value of 1012 mb, through which we construct an isoline labelled "1012."



3. ***Construct isotherms at 5°F intervals (e.g., 40°F, 45°F, 50°F) on the simplified weather map shown below.***

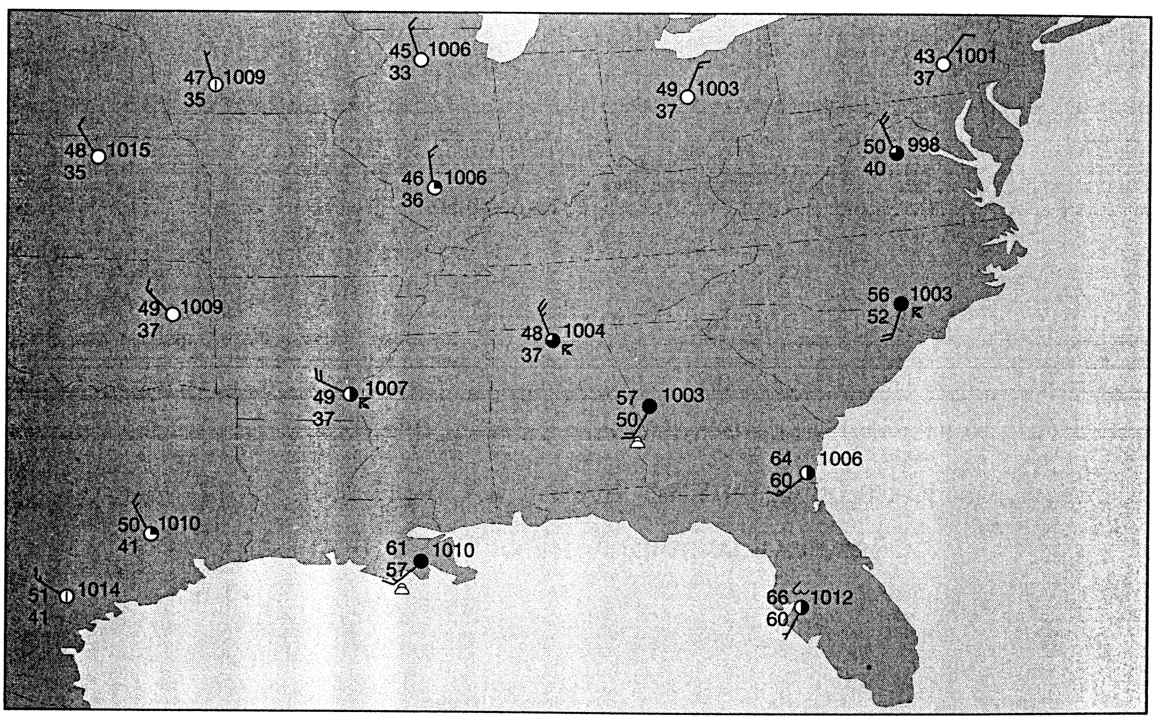


Figure 3

AIR MASSES AND FRONTS

An *air mass* is a large body of air with relatively uniform temperature and humidity characteristics. Air masses form over large land or water surfaces and take on the temperature and moisture characteristics of these surfaces where they remain stationary for days or even weeks. Their moisture characteristics are classified as maritime or continental; and their temperature characteristics as equatorial, tropical, polar, or arctic. The following types of air masses result:

- maritime equatorial (mE)
- maritime tropical (mT)
- maritime polar (mP)
- continental tropical (cT)
- continental polar (cP)
- continental arctic (cA)

(Maritime arctic and continental equatorial air masses are rarely found and therefore are not listed.)

Air masses often migrate from their source regions and affect mid-latitude weather. Examine the diagram below showing air masses affecting North America.

4. Based on the source regions shown by the ovals, indicate each type of air mass influencing North America (mT, mP, cT, cP, and cA).

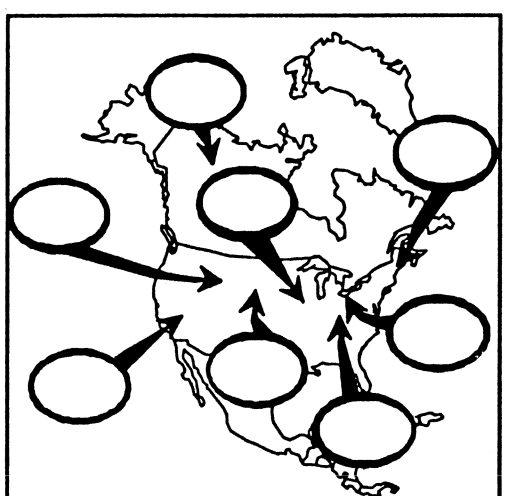


Figure 4

The boundary between two unlike air masses is called a *front* and can be identified by any of the following characteristics:

- a sharp temperature gradient
- a sharp moisture gradient
- a sharp change in wind direction

5. Draw the frontal boundary in Figure 5 below.

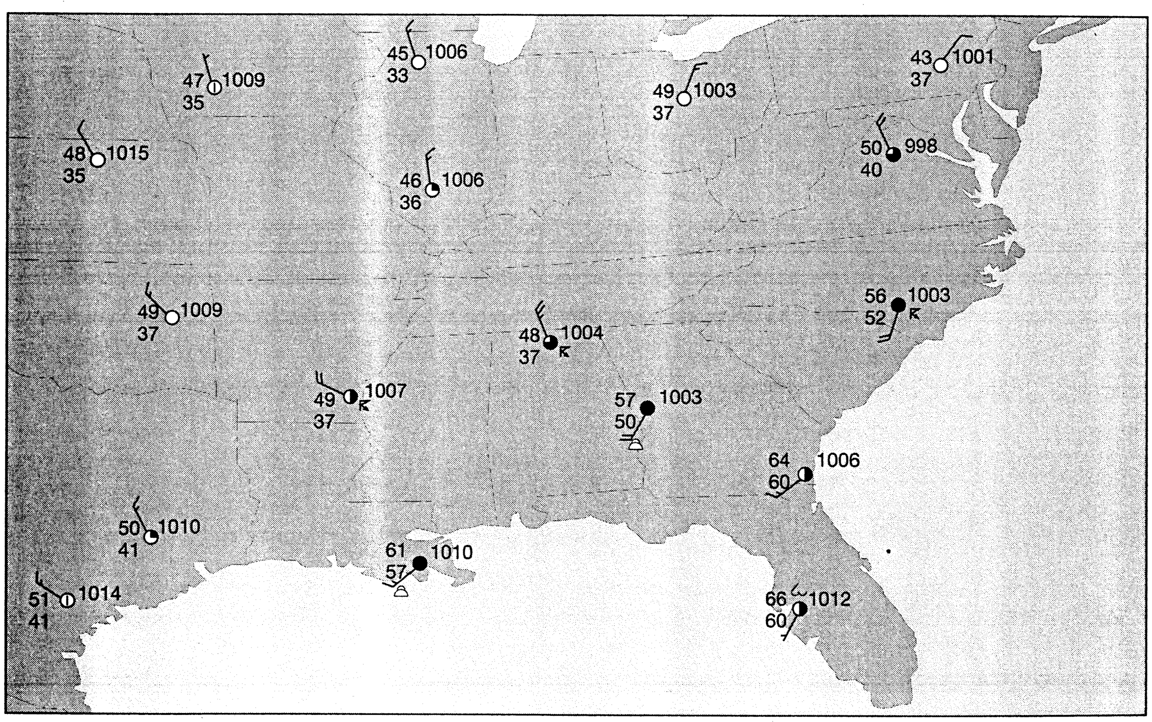


Figure 5

The front shown in Figure 5 is referred to as a *cold front* since cold air is advancing on warmer air. Figure 6 shows the symbols used to depict surface weather fronts. A *warm front* denotes a zone where warm air is advancing on colder air. A *stationary front* is a boundary between two air masses which are not advancing toward one another. An *occluded front* indicates a zone where a cold front has overtaken a warm front.

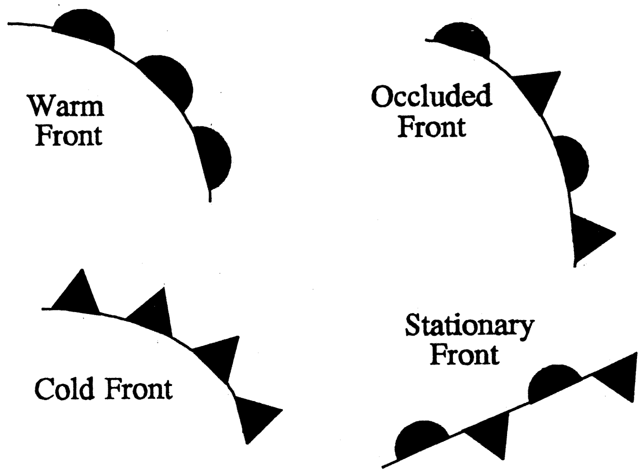


Figure 6

Occasionally, waves along a frontal boundary form a low pressure center. As air circulates around the low, warm and cold air masses advance resulting in storm systems such as that illustrated in Figure 7.

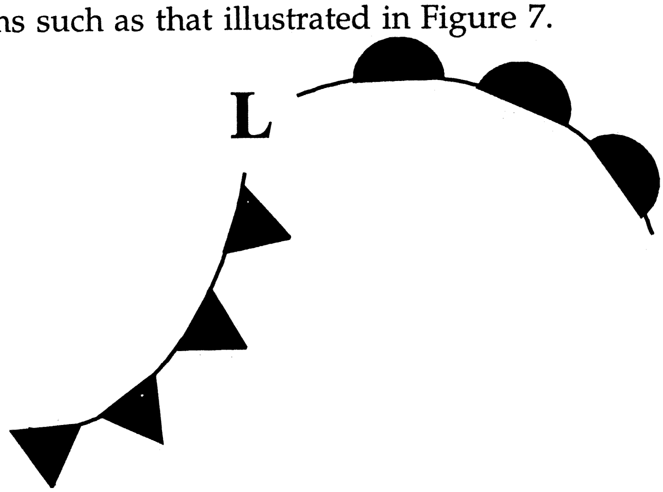


Figure 7

6. ***Using the map below:***

a. Draw isobars at 4 mb intervals (e.g., 1004 mb, 1008 mb, 1012 mb).

b. Label the low pressure center with an "L."

c. Label a maritime tropical (mT) and continental polar air mass (cP).

d. Draw the warm and cold fronts.

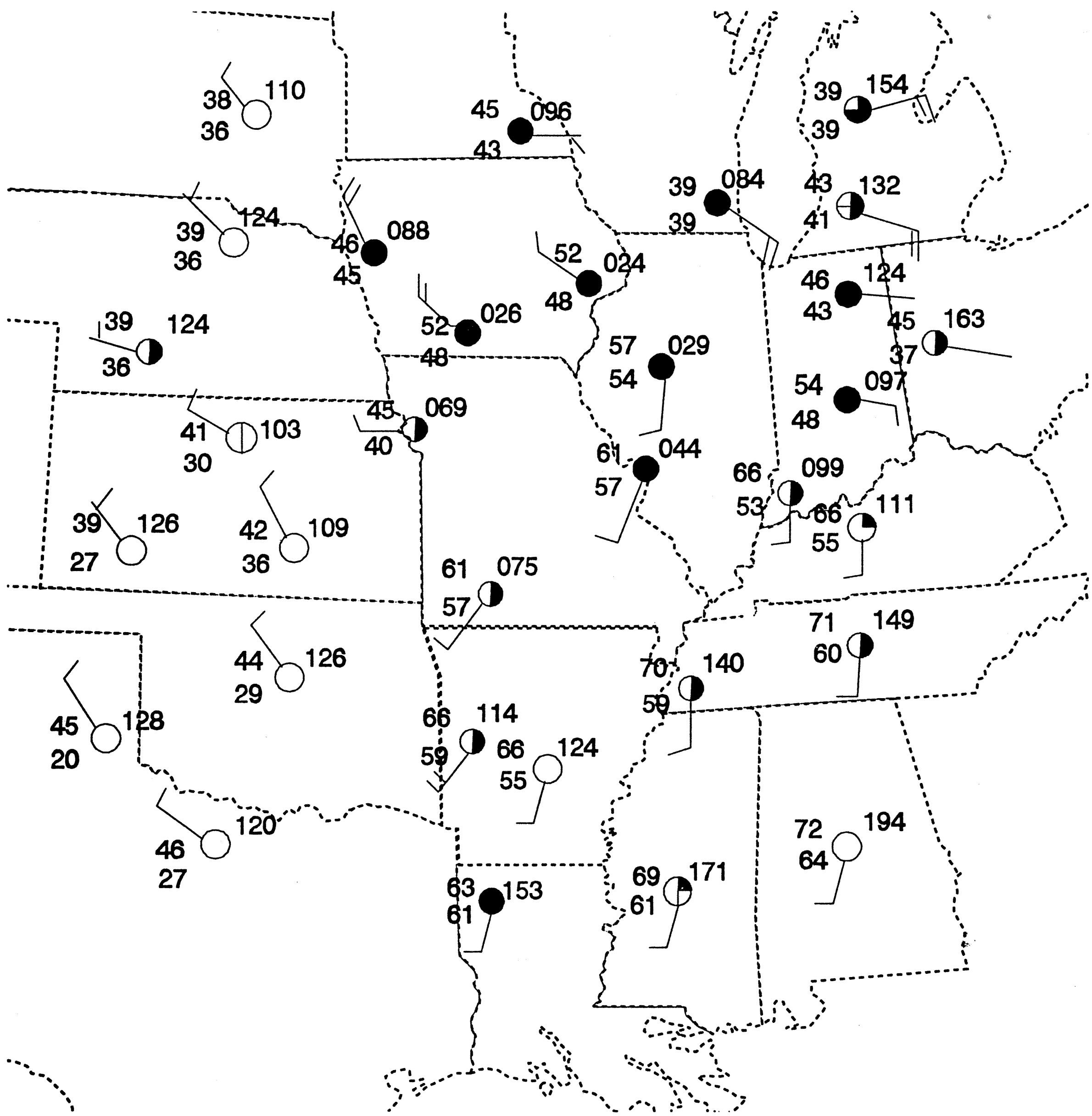


Figure 8