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Laboratory Investigation

Chapter 16 What Is Weather? **38**

Investigating Weather Maps

Background Information

Weather forecasting is made possible through the analysis of detailed information that describes atmospheric conditions from several locations. In the United States, weather data from more than 300 local weather stations are used to prepare daily weather maps that present an overall picture of the weather throughout the country for a particular time. A detailed map may contain more than 10,000 items of weather data. Such a map will become the basis for making weather predictions.

In this investigation you will prepare a simplified weather map from limited data. Then you will analyze the map to discover relationships between atmospheric variables.

Problem

How are weather maps prepared? How can weather maps be used to better understand relationships between atmospheric variables?

Materials *(per group)*

pencil
colored pencils or crayons

Procedure

Part A Information From Observation Stations

1. Figure 1 illustrates the correct placement of some weather data recorded at an observation station. You will plot similar data on a map of the United States.
2. The circle in Figure 1 represents the observation station. Weather data are placed in specific positions inside and outside the circle.

Station Circle

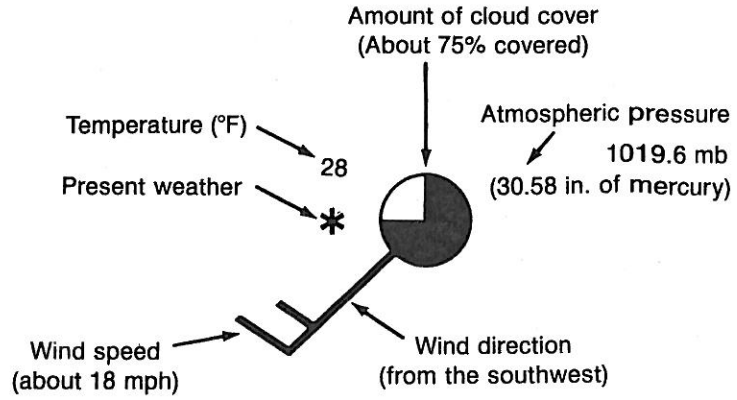

Figure 1

3. *Wind direction:* You should think of the station circle as the point of an arrow. Attached to the station circle is a line, which is the arrow's shaft. The wind direction is represented as moving along the arrow's shaft *toward* the center of the station circle. Wind directions are given in degrees and represent the direction *from which* the wind is blowing. In Figure 1, the wind is blowing from the southwest toward the northeast. Figure 2 will help you determine wind direction.

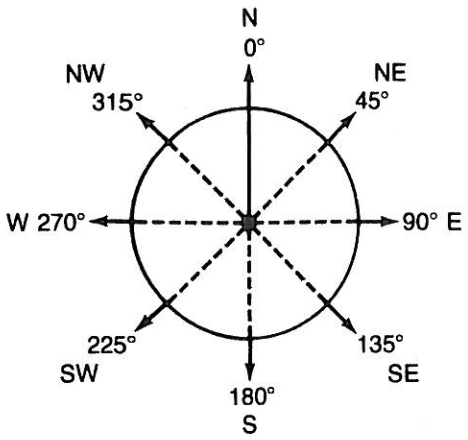

Figure 2

4. *Wind speed:* Often there are small lines that resemble arrow feathers at the end of the shaft. These lines are symbols for wind speed. Each full line represents an increase in speed of about 10 miles per hour. Half a line is about 5 miles per hour. If there is only one "feather," place it at the end of the arrow if it is a full feather, and slightly farther in if it is a half feather. Although the metric unit of speed is kilometers per hour, miles per hour has been used in this investigation because it is the unit most commonly found on weather maps.

5. *Atmospheric pressure:* Look at a weather map in your local newspaper. You will see long, curving lines that have a number attached to them. These lines are called isobars. Some of the curves are closed; some, open. Isobars are lines joining places on a weather map that have the same atmospheric pressure. The numbers associated with these lines are the atmospheric pressure recorded at each observation station. These pressures are measured in millibars. So isobars are measured in millibars. Look at the column of atmospheric pressures in Figure 6. To determine the pressure in millibars, use only the last three digits of the pressures listed and omit the decimal point. An example (196) is given in Figure 1.

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6. *Temperature:* The average daily temperature is usually recorded in degrees Fahrenheit.
7. *Present weather:* From the list in Figure 3, select the symbol that most accurately describes the weather existing at each observation station listed in Figure 6 when the data were collected.
8. *Cloud coverage:* Using Figure 4, indicate the amount of cloud cover at each observation station. This information is enclosed within each circle. Put this information in the circles on the map in Figure 7.
9. Now transfer all the weather information listed in Figure 6 to the specific observation stations shown in Figure 7.

Weather Symbols

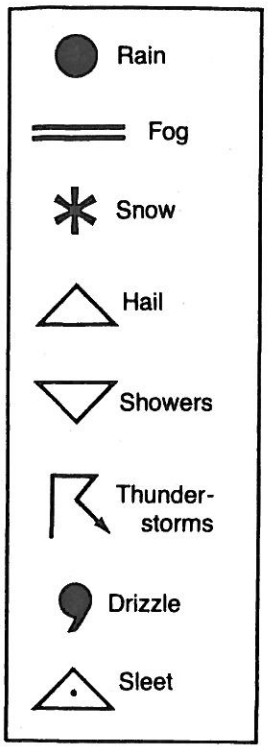

Figure 3

Cloud Cover

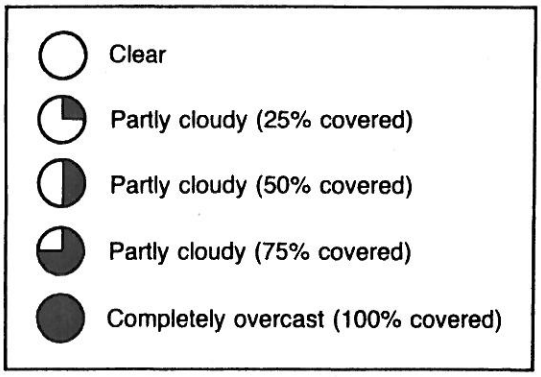

Figure 4

Fronts

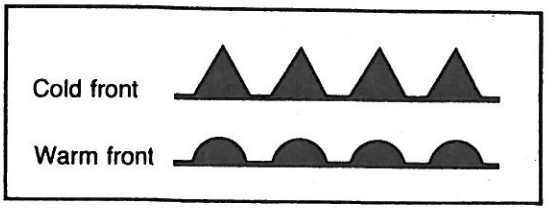

Figure 5

Part B Additional Weather Map Information

1. In Figure 7, locate the observation station with the lowest atmospheric pressure and write the word "Low" just above it. Starting at this point, which is the center of a low-pressure area, draw in the cold and warm fronts. The symbols are shown in Figure 5.

The cold front comes out of the high-pressure center. This front, when placed in Figure 7, will be located between stations where winds change from southwest to northwest and temperatures decrease suddenly. The warm front comes out of the low-pressure center. This front, when placed in Figure 7, will be located between stations where winds change from east to southeast and temperatures rise suddenly.

OBSERVATION STATIONS

Weather Station	Wind Speed (mph)	Wind Direction	Atmospheric Pressure (mb)	Temperature (°F)	Type of Precipitation	Cloud Cover (%)
Seattle	7	260°	1020.8	42		0
Bend	10	200°	1023.5	40		0
San Francisco	8	135°	1020.0	48	Fog	25
Los Angeles	0		1021.1	41	Fog	25
Phoenix	11	50°	1021.1	45		0
Ely	0		1025.1	37		0
Dubois	18	225°	1024.0	38		0
Helena	15	315°	1020.0	41		0
Medicine Hat	20	345°	1020.1	40		0
Bismarck	18	0°	1014.3	48		0
Casper	12	350°	1016.0	50		0
Pueblo	8	315°	1015.3	47		0
Roswell	22	350°	1016.0	48		0
Del Rio	38	315°	1012.0	50	Thunderstorms	100
Galveston	5	225°	1016.0	72		25
Dallas	29	315°	1007.9	60	Hail	100
Oklahoma City	45	315°	1007.7	57	Thunderstorms	100
Kansas City	0		1002.3	58	Rain	100
Burwell	22	325°	1009.3	52	Rain	100
Minneapolis	15	45°	1008.2	51	Drizzle	100
Sioux Lookout	20	50°	1016.8	46		25
Chicago	10	45°	1005.2	58	Drizzle	100
Little Rock	8	225°	1009.3	67		25
New Orleans	5	225°	1017.9	73		0
Nashville	5	220°	1011.1	68		25
Cincinnati	7	90°	1009.8	57	Rain	100
Detroit	10	75°	1011.9	54	Drizzle	100
Sault Ste. Marie	15	45°	1013.1	50	Drizzle	100
Ert	5	100°	1017.2	48		0
Quebec	0		1017.0	50		25
Boston	12	100°	1018.1	52	Fog	25
Buffalo	7	75°	1016.0	52	Drizzle	100
New York	10	80°	1017.6	56	Fog	50
Hatteras	14	90°	1019.1	60		50
Charleston	15	225°	1017.8	70		25
Atlanta	3	225°	1014.6	70		0
Jacksonville	2	200°	1018.1	73		0
Tampa	2	230°	1018.0	74		25
Miami	0		1019.8	78		0

Figure 6

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2. Locate the observation station in Figure 7 with the highest atmospheric pressure and write the word "High" just above it. This is the center of an area of high pressure.
3. Draw the following isobars in Figure 7: 1004 mb, 1008 mb, 1012 mb, 1016 mb, 1020 mb, and 1024 mb. Draw these isobars so that they point away from the center of the low-pressure area when they cross cold or warm fronts. Label each isobar. Remember that isobars are long, curving lines. They connect locations on a weather map that have the same atmospheric pressure. It will be helpful to review the atmospheric pressures listed in Figure 6.
4. In Figure 7, draw a line around all the locations where precipitation has fallen. Either use a pencil and shade in the area with precipitation or use a colored pencil or crayon and color in this area.

Observations

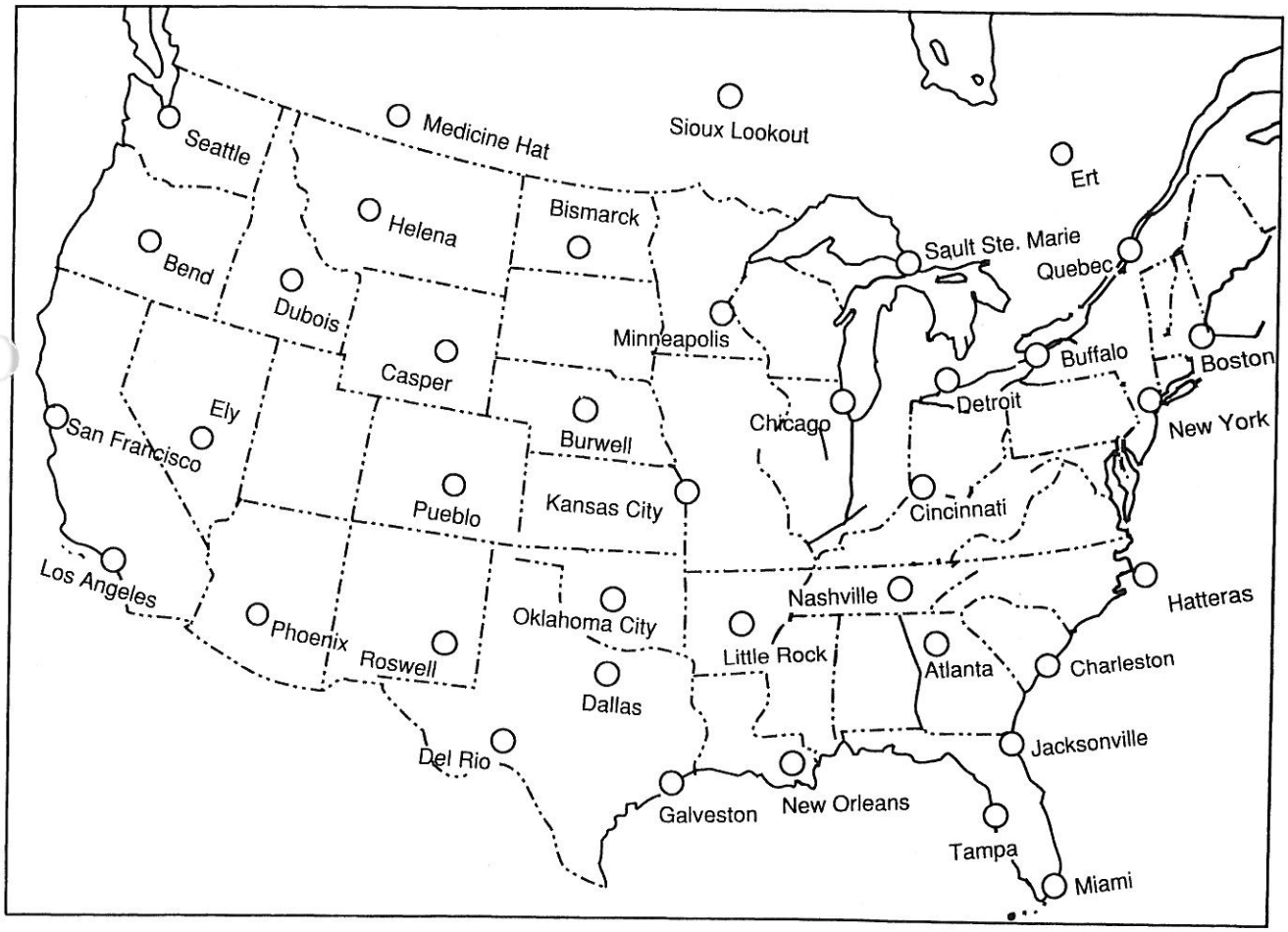

Figure 7

Analysis and Conclusions

1. An area of high pressure is referred to as an anticyclone, and an area of low pressure is called a cyclone. According to your weather map, is precipitation generally associated with a cyclone or an anticyclone? _____

2. Compare wind direction of air around a low-pressure center with wind direction around a high-pressure center. _____

3. Compare the type of precipitation associated with the cold front to that associated with the warm front. _____

4. Describe the location of the precipitation associated with the warm front as compared to the precipitation associated with the cold front. _____

5. Describe changes in temperature, wind direction, and atmospheric pressure associated with the passage of a warm front. _____

6. Describe changes in temperature, wind direction, and atmospheric pressure associated with the passage of a cold front. _____

Critical Thinking and Application

1. Refer to Figure 7. Assume that the storm center is moving in a northeasterly direction. Describe at least three changes in the weather in Cincinnati, Ohio, if the center of the low-pressure area becomes located directly over Detroit, Michigan.

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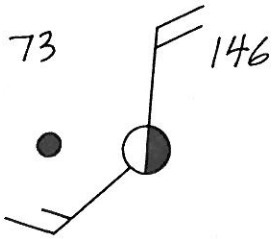
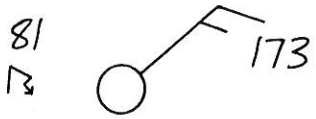
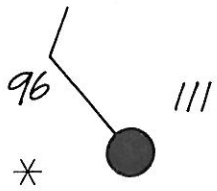
2. Identify the error in each of the following observation station reports.

a. 

b. 

c. 

3. Is it possible for yesterday's weather map to help you to predict tomorrow's weather?

Explain your answer. _____

_____

_____

_____

Going Further

1. Wind speed is normally given in miles per hour on a weather map. Change all the wind speeds listed in Figure 6 to kilometers per hour.
2. There are four major types of air masses that affect the weather in the United States. Each of them brings different weather conditions. Look up information in the library about these air masses. Then label the areas on your weather map behind the cold front, in front of the cold front, and in front of the warm front with the appropriate air mass symbol. The names and symbols for these air masses are continental polar (cP), continental tropical (cT), maritime tropical (mT), and maritime polar (mP).