Global Warming Some scientists hypothesize that Earth's ocean temperatures are increasing due to global warming. In your Science Journal, predict what might happen to the strength of hurricanes if Earth's oceans become warmer.

Figure 15 In this hurricane cross section, the small, red arrows indicate rising, warm, moist air. This air forms cumulus and cumulonimbus clouds in bands around the eye. The green arrows indicate cool, dry air sinking in the eye and between the cloud bands.

Hurricanes The most powerful storm is the hurricane. A **hurricane,** illustrated in **Figure 15,** is a large, swirling, low-pressure system that forms over the warm Atlantic Ocean. It is like a machine that turns heat energy from the ocean into wind. A storm must have winds of at least 119 km/h to be called a hurricane. Similar storms are called typhoons in the Pacific Ocean and cyclones in the Indian Ocean.

Hurricanes are similar to low-pressure systems on land, but they are much stronger. In the Atlantic and Pacific Oceans, low pressure sometimes develops near the equator. In the northern hemisphere, winds around this low pressure begin rotating counterclockwise. The strongest hurricanes affecting North America usually begin as a low-pressure system west of Africa. Steered by surface winds, these storms can travel west, gaining strength from the heat and moisture of warm ocean water.

When a hurricane strikes land, high winds, tornadoes, heavy rains, and high waves can cause a lot of damage. Floods from the heavy rains can cause additional damage. Hurricane weather can destroy crops, demolish buildings, and kill people and other animals. As long as a hurricane is over water, the warm, moist air rises and provides energy for the storm. When a hurricane reaches land, however, its supply of energy disappears and the storm loses power.

Descending air

Warm, moist air

Outflow

Eye

Spiral rain bands

Blizzards Severe storms also can occur in winter. If you live in the northern United States, you may have awakened from a winter night's sleep to a cold, howling wind and blowing snow, like the storm in **Figure 16.** The National Weather Service classifies a winter storm as a **blizzard** if the winds are 56 km/h, the temperature is low, the visibility is less than 400 m in falling or blowing snow, and if these conditions persist for three hours or more.

Severe Weather Safety When severe weather threatens, the National Weather Service issues a watch or warning. Watches are issued when conditions are favorable for severe thunderstorms, tornadoes, floods, blizzards, and hurricanes. During a watch, stay tuned to a radio or television station reporting the weather. When a warning is issued, severe weather conditions already exist. You should take immediate action. During a severe thunderstorm or tornado warning, take shelter in the basement or a room in the middle of the house away from windows. When a hurricane or flood watch is issued, be prepared to leave your home and move farther inland.

Blizzards can be blinding and have dangerously low temperatures with high winds. During a blizzard, stay indoors. Spending too much time outside can result in severe frostbite.

Figure 16 Blizzards can be extremely dangerous because of their high winds, low temperatures, and poor visibility.

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section 2 review

Summary

Weather Changes

- Air masses tend to have temperature and moisture properties similar to Earth's surface.
- Winds blow from areas of high pressure to areas of lower pressure.

Fronts

- A boundary between different air masses is called a front.

Severe Weather

- The National Weather Service issues watches or warnings, depending on the severity of the storm, for people's safety.

Self Check

1. **Draw Conclusions** Why is fair weather common during periods of high pressure?
2. **Describe** how a cold front affects weather.
3. **Explain** what causes lightning and thunder.
4. **Compare and contrast** a watch and a warning. How can you keep safe during a tornado warning?
5. **Think Critically** Explain why some fronts produce stronger storms than others.

Applying Skills

6. **Recognize Cause and Effect** Describe how an occluded front may form over your city and what effects it can have on the weather.

Weather Forecasts

What You'll Learn

- **Explain** how data are collected for weather maps and forecasts.
- **Identify** the symbols used in a weather station model.

Why It's Important

Weather observations help you predict future weather events.

Review Vocabulary

forecast: to predict a condition or event on the basis of observations

New Vocabulary

- meteorologist
- isotherm
- station model
- isobar

Figure 17 A meteorologist uses Doppler radar to track a tornado. Since the nineteenth century, technology has greatly improved weather forecasting.

Weather Observations

You can determine current weather conditions by checking the thermometer and looking to see whether clouds are in the sky. You know when it's raining. You have a general idea of the weather because you are familiar with the typical weather where you live. If you live in Florida, you don't expect snow in the forecast. If you live in Maine, you assume it will snow every winter. What weather concerns do you have in your region?

A **meteorologist** (mee tee uh RAH luh jist) is a person who studies the weather. Meteorologists take measurements of temperature, air pressure, winds, humidity, and precipitation. Computers, weather satellites, Doppler radar shown in **Figure 17,** and instruments attached to balloons are used to gather data. Such instruments improve meteorologists' ability to predict the weather. Meteorologists use the information provided by weather instruments to make weather maps. These maps are used to make weather forecasts.

Forecasting Weather

Meteorologists gather information about current weather and use computers to make predictions about future weather patterns. Because storms can be dangerous, you do not want to be unprepared for threatening weather. However, meteorologists cannot always predict the weather exactly because conditions can change rapidly.

The National Weather Service depends on two sources for its information—data collected from the upper atmosphere and data collected on Earth's surface. Meteorologists of the National Weather Service collect information recorded by satellites, instruments attached to weather balloons, and from radar. This information is used to describe weather conditions in the atmosphere above Earth's surface.
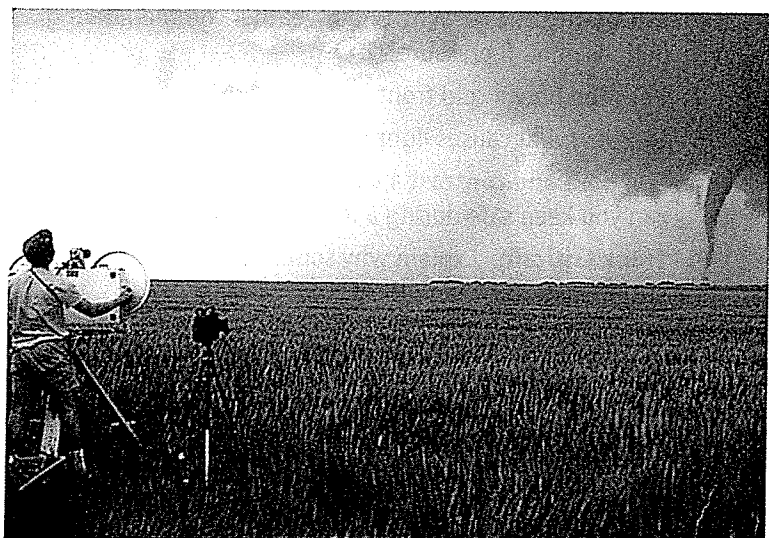
Station Models When meteorologists gather data from Earth's surface, it is recorded on a map using a combination of symbols, forming a **station model.** A station model, like the one in **Figure 18,** shows the weather conditions at a specific location on Earth's surface. Information provided by station models and instruments in the upper atmosphere is entered into computers and used to forecast weather.

Temperature and Pressure In addition to station models, weather maps have lines that connect locations of equal temperature or pressure. A line that connects points of equal temperature is called an **isotherm** (I suh thurm). *Iso* means "same" and *therm* means "temperature." You probably have seen isotherms on weather maps on TV or in the newspaper.

An **isobar** is a line drawn to connect points of equal atmospheric pressure. You can tell how fast wind is blowing in an area by noting how closely isobars are spaced. Isobars that are close together indicate a large pressure difference over a small area. A large pressure difference causes strong winds. Isobars that are spread apart indicate a smaller difference in pressure. Winds in this area are gentler. Isobars also indicate the locations of high- and low-pressure areas.
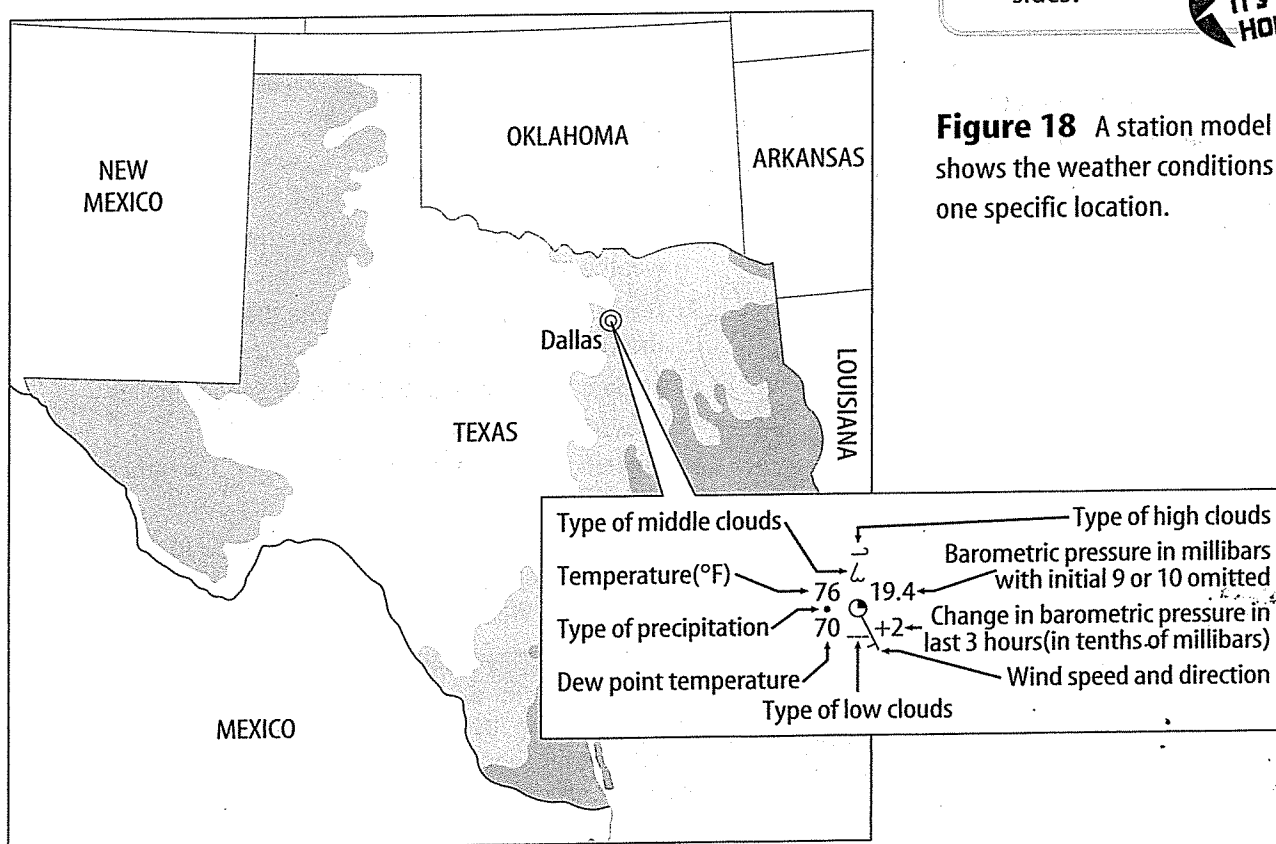
✔ Reading Check *How do isobars indicate wind speed?*

Figure 18 A station model shows the weather conditions at one specific location.

Type of middle clouds
Temperature(°F)
Type of precipitation
Dew point temperature
Type of low clouds
Type of high clouds
Barometric pressure in millibars with initial 9 or 10 omitted
Change in barometric pressure in last 3 hours(in tenths of millibars)
Wind speed and direction
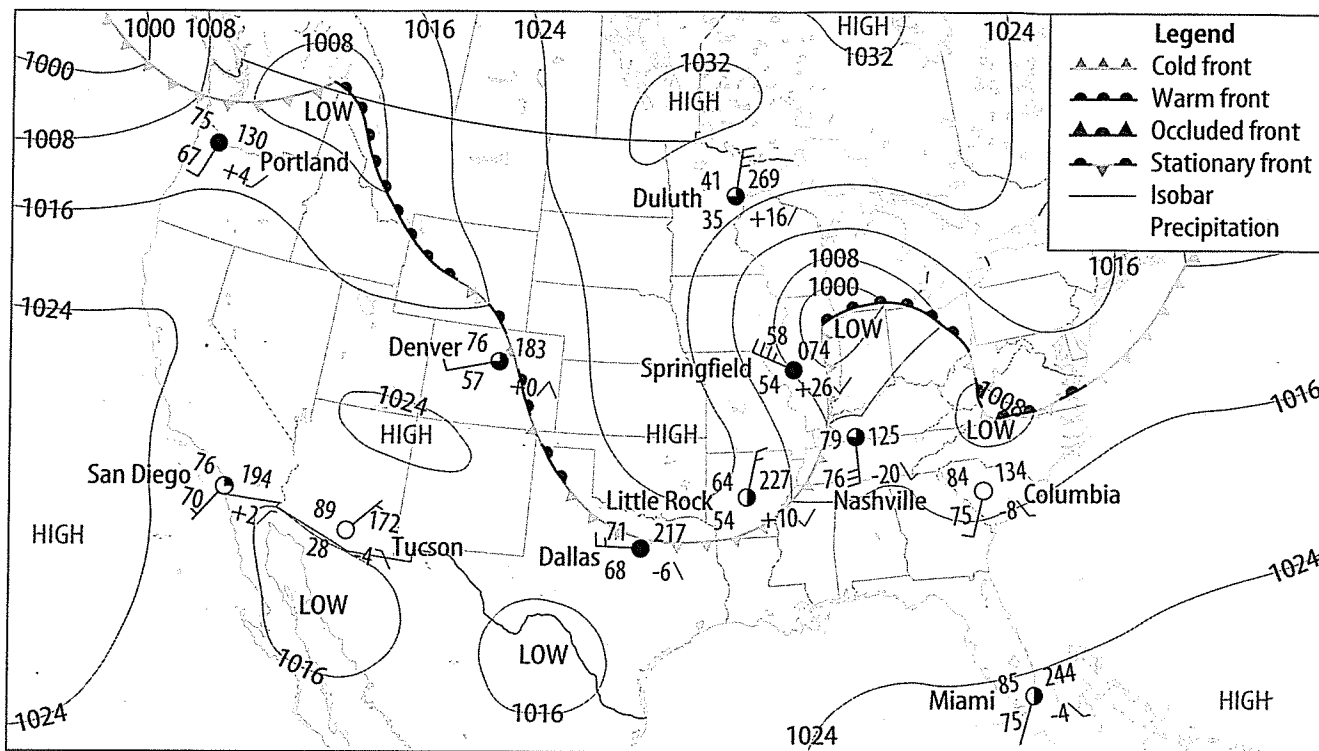
76 19.4
70 +2

Figure 19 Highs, lows, isobars, and fronts on this weather map help meteorologists forecast the weather.

Weather Maps On a weather map like the one in **Figure 19,** pressure areas are drawn as circles with the word High or Low in the middle of the circle. Fronts are drawn as lines and symbols. When you watch weather forecasts on television, notice how weather fronts move from west to east. This is a pattern that meteorologists depend on to forecast weather.

section 3 review

Summary

Weather Observations

- Meteorologists are people who study the weather and make weather maps.

Forecasting Weather

- Meteorologists gather information about current weather and make predictions about future weather patterns.

- A station model shows weather conditions at a specific location on Earth's surface by using symbols to record meteorological data.

- On weather maps, isotherms are lines that connect points of equal temperature.

- An isobar is a line drawn on a weather map that connects points of equal atmospheric pressure.
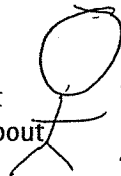
Self Check

1. **List** some instruments that are used to collect weather data.

2. **Describe** at least six items of data that might be recorded in a station model.

3. **Explain** how the National Weather Service makes weather maps.

4. **Explain** what closely spaced isobars on a weather map indicate.

5. **Think Critically** In the morning you hear a meteorologist forecast today's weather as sunny and warm. After school, it is raining. Why is the weather so hard to predict?

Applying Skills

6. **Concept Map** Using a computer, make an events-chain concept map for how a weather forecast is made.

Science Online earth.msscience.com/self_check_quiz