



Seasons and Weather

A HUMAN PERSPECTIVE The smell of thousands of decaying corpses hung in the air in what was once the thriving seaport of Galveston, Texas. The day before, winds estimated at 130 miles per hour roared through the city. A storm surge of seawater more than 15 feet high pushed a wall of debris across the island of Galveston. Through this turmoil, Isaac Cline’s family huddled in their home. A trolley trestle rammed the house until at last it collapsed, and the waves poured in. Cline survived, but some of his family did not. With a toll of 8,000 human lives, the “Great Galveston Hurricane” would be the deadliest hurricane to hit the United States. The storm date was September 8, 1900.

Main Ideas

- Seasons and weather occur because of the changing position of the earth in relation to the sun.
- Weather extremes are related to location on earth.

Places & Terms

solstice	hurricane
equinox	typhoon
weather	tornado
climate	blizzard
precipitation	drought
rain shadow	

Seasons

Hurricanes occur frequently in the southern and eastern United States during summer and fall. During these seasons, storm systems with strong winds form over warm ocean water.

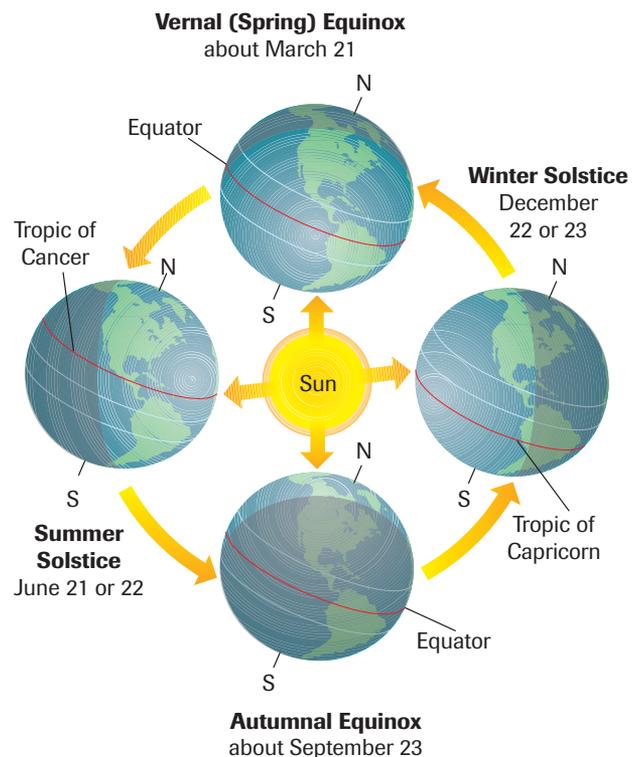
EARTH’S TILT Seasons have an enormous impact on us, affecting the conditions in the atmosphere and on the earth that create our weather. As the earth revolves around the sun, it is tilted at a 23.5° angle in relation to the sun. Because of the earth’s revolution and its tilt, different parts of the earth receive the direct rays of the sun for more hours of the day at certain times in the year. This causes the changing seasons on the earth. Notice in the diagram to the right that the northern half of the earth tilts toward the sun in summer and away from the sun in winter.

Two lines of latitude—the tropic of Cancer and the tropic of Capricorn—mark the points farthest north and south that the sun’s rays shine directly overhead at noon. The day on which this occurs is called a **solstice**. In the Northern Hemisphere, the summer solstice, or the beginning of summer, is the longest day of the year. Winter solstice, the beginning of winter, is the shortest.

Another signal of seasonal change are the equinoxes. Twice a year on the **equinox**, the days and nights all over the world are equal in length. The equinoxes mark the beginning of spring and autumn.

Seasons: Northern Hemisphere

The seasons are related to the earth’s tilt and revolution. Some locations receive more direct sun rays because of the earth’s tilt.



Weather

Weather and climate are often confused. **Weather** is the condition of the atmosphere at a particular location and time. **Climate** is the term for weather conditions at a particular location over a long period of time. Northern Russia, for example, has a cold climate. 

WHAT CAUSES THE WEATHER? Daily weather is the complex result of several conditions. For example, the amount of solar energy received by a location varies according to the earth's position in relation to the sun. Large masses of air absorb and distribute this solar energy, which in turn affects the weather. Other factors include:

- **water vapor** This determines whether there will be **precipitation**—falling water droplets in the form of rain, sleet, snow, or hail.
- **cloud cover** Clouds may hold water vapor.
- **landforms and bodies of water** Water heats slowly but also loses heat slowly. Land heats rapidly but loses heat quickly as well.
- **elevation** As elevation above sea level increases, the air becomes thinner and loses its ability to hold moisture.
- **air movement** Winds move the air and the solar energy and moisture that it holds. As a result, weather can change very rapidly.

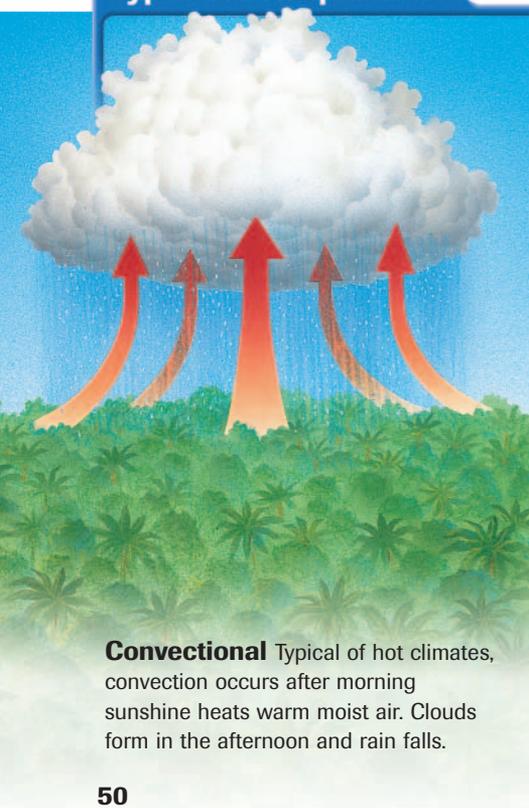
PRECIPITATION Precipitation depends on the amount of water vapor in the air and the movement of that air. As warm air rises, it cools and loses its ability to hold water vapor. The water vapor condenses, and the water droplets form into clouds. When the amount of water in a cloud is too heavy for the air to hold, rain or snow falls from the cloud. Geographers classify precipitation as convective, orographic, or frontal, as illustrated in the diagram below.



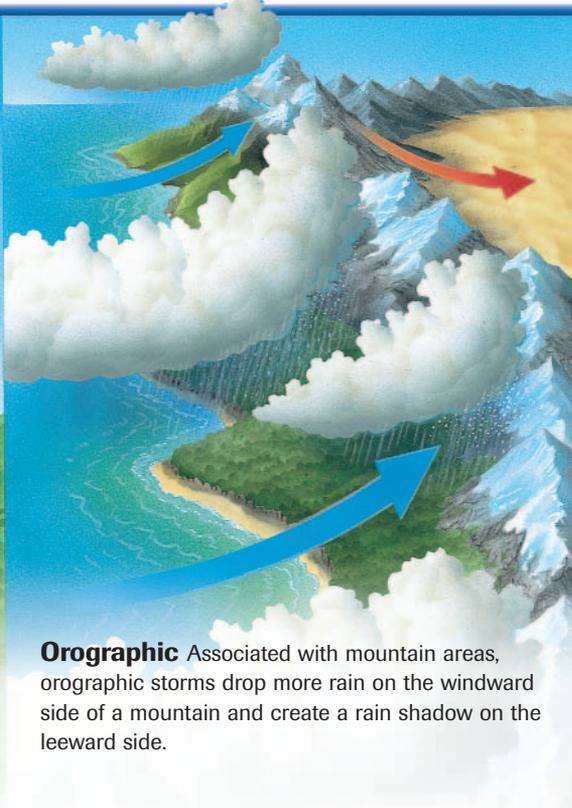
Making Comparisons

A Why might geographers be more interested in the climate of a place than its weather?

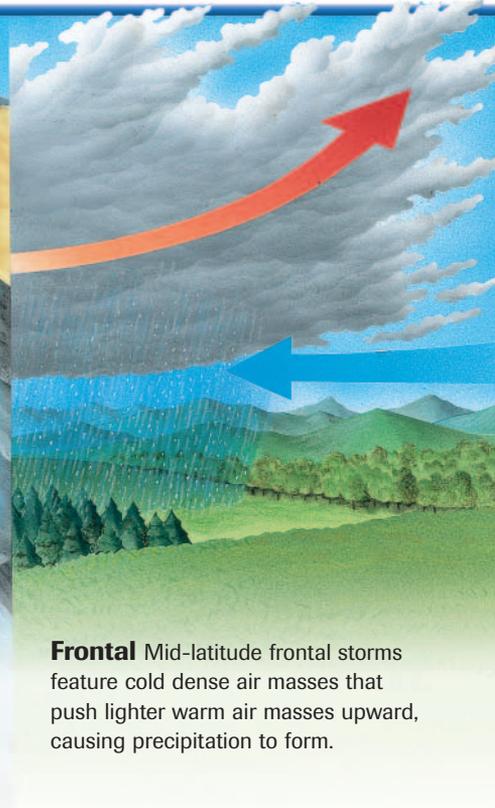
Types of Precipitation



Convectional Typical of hot climates, convection occurs after morning sunshine heats warm moist air. Clouds form in the afternoon and rain falls.



Orographic Associated with mountain areas, orographic storms drop more rain on the windward side of a mountain and create a rain shadow on the leeward side.



Frontal Mid-latitude frontal storms feature cold dense air masses that push lighter warm air masses upward, causing precipitation to form.

Convictional precipitation occurs in hot, moist climates where the sun quickly heats the air. The heated air rises, and by afternoon clouds form and rain falls. Orographic precipitation falls on the windward side of hills or mountains that block moist air and force it upward. The air cools and rain or snow falls. The land on the leeward side is called a **rain shadow** because it gets little rain from the descending dry air. Frontal movement causes most precipitation in the middle latitudes. A front is the boundary between two air masses of different temperatures or density. Rain or snow occurs when lighter, warm air is pushed upward by the colder, denser air. The rising air cools, water vapor condenses, and precipitation falls.

Weather Extremes

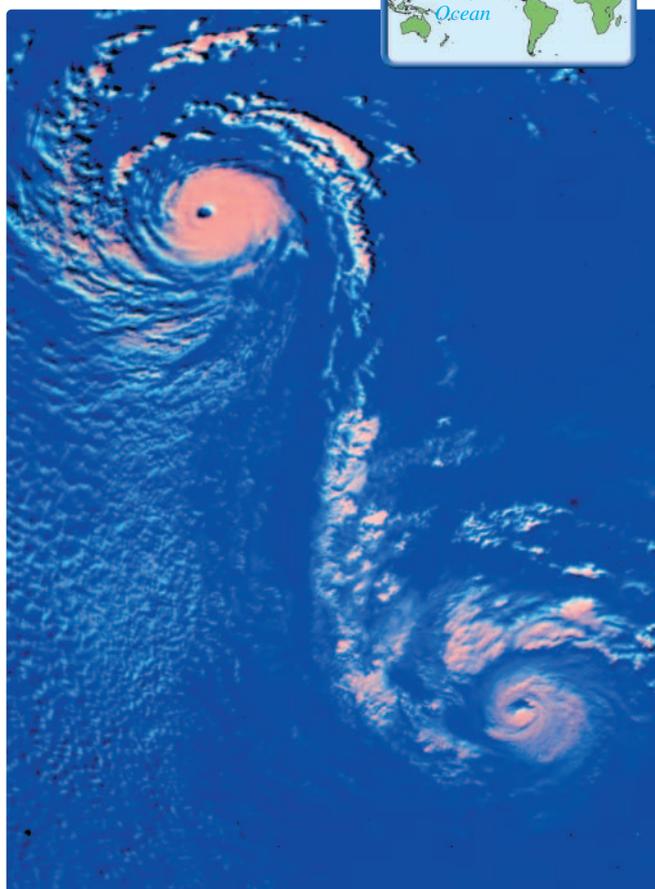
As air masses warm and cool and move across the earth's surface, they create weather. Sometimes the clashes between air masses cause storms, which can be severe. They disrupt the usual patterns of life and often cause major property damage and loss of human life. Hurricanes, tornadoes, blizzards, droughts, and floods are examples of extreme weather.

HURRICANES Storms that form over warm, tropical ocean waters are called **hurricanes**—also known as **typhoons** in Asia. These storms are called different names around the globe: tropical cyclones, willy-willies (Australia), *baguios* (Philippines), and *chubascos* (Mexico). Hurricanes are one way heat from the tropics is moved out of the region. Air flowing over an ocean with a water temperature of 80°F or higher picks up huge amounts of moisture and heat energy. As these water-laden winds flow into a low-pressure core, they tighten to form an “eye.” The eye is usually 10 to 20 miles across and has clear, calm skies. But the winds moving around the eye may be as strong as 200 miles per hour.

The clouds and winds stretch over a vast area, sometimes as wide as 500 miles. Upper air currents blowing from the east steer the hurricanes in a westerly direction. As the hurricane hits land, it pounds the area with howling winds and very heavy rains. It may also cause a storm surge along coastal regions. This wall of seawater, pushed ashore by the winds, may rise to 16 feet or more. The low-lying coastal regions of Bangladesh in South Asia are especially vulnerable to storm surges from tropical cyclones. ◀

TORNADOES Unlike hurricanes, which take days to develop, tornadoes form quickly and sometimes without warning. A **tornado**, or twister, is a powerful funnel-shaped column of spiraling air.

MOVEMENT A pair of typhoons move across the Pacific Ocean. Notice the “eye” in each storm. **What is the weather inside the “eye” like?**



Using the Atlas

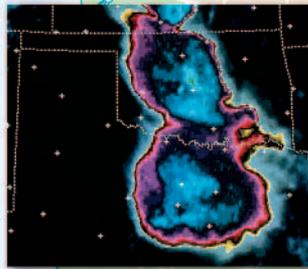
B Use the map on page A20. On which river delta is Bangladesh located?

REGION

Tornado Alley

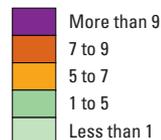
When cold, dry air collides with warm, moist air, a tornado can brew. In the United States, these violent funnel clouds occur frequently between May and October in a region known as “Tornado Alley.”

The flat plains stretching from Texas through Nebraska present an ideal staging ground for tornadoes. Cold, dry air from Canada rushes south and collides with warm, moist air moving north from the Gulf of Mexico. Between 200 and 300 major storms erupt there each year, spawning hundreds of tornadoes.

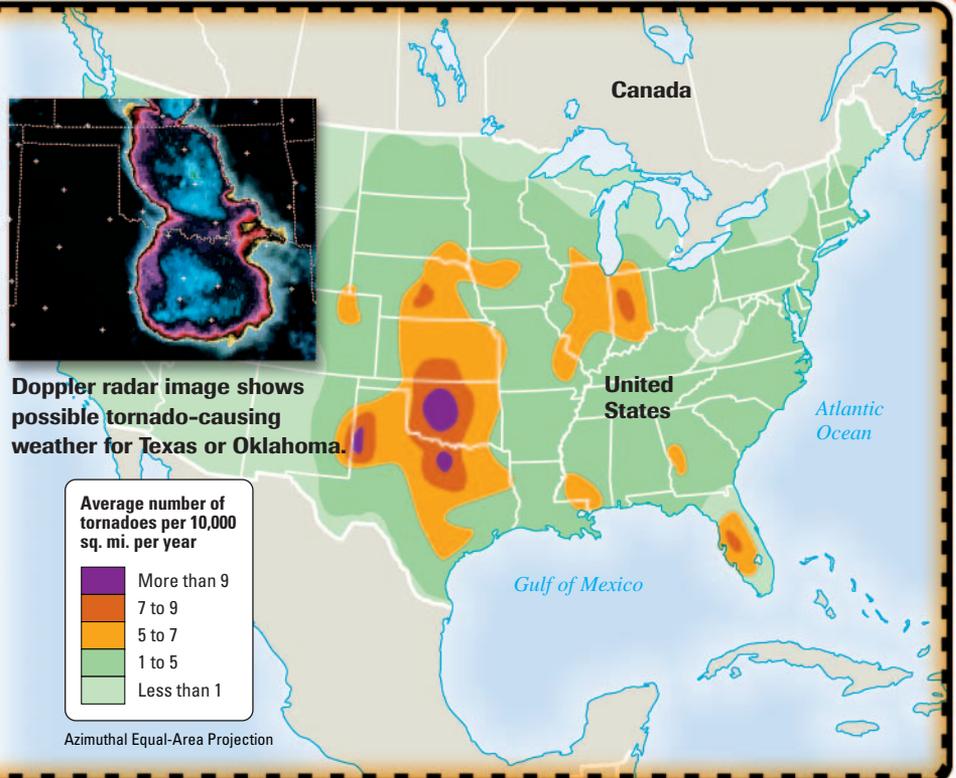


Doppler radar image shows possible tornado-causing weather for Texas or Oklahoma.

Average number of tornadoes per 10,000 sq. mi. per year



Azimuthal Equal-Area Projection



Born from strong thunderstorms, tornadoes are capable of immense damage. In a tornado, winds swirl counter-clockwise around a low-pressure center. These winds may reach speeds of 300 miles per hour, blasting apart buildings and lifting objects as large as cars and mobile homes. Generally, tornadoes have small diameters (about 300 feet), travel about a mile, and last only a few minutes. However, the largest and most forceful can reach a mile across and stay on the ground for hours, hopscotching from one location to another. The largest outbreak of tornadoes in the United States occurred during a 16-hour period, April 3 and 4, 1974. A total of 148 tornadoes ripped through the Ohio and Tennessee valleys, killing 330 people. The largest share of tornadoes, about 3 of every 4, hit in the United States. On average, the U.S. National Weather Service counts 700 tornadoes each year. 

BLIZZARDS A **blizzard** is a heavy snowstorm with winds of more than 35 miles per hour and reduced visibility. These weather conditions snarl traffic, endanger livestock, and trap travelers. The greatest snowfall for a 24-hour period was 76 inches (6 feet 4 inches) in Silver Lake, Colorado, in 1921. A snowstorm that lasted from February 13 to 19, 1959, dumped 189 inches (almost 16 feet) of snow on Mt. Shasta, California.

Because of their location, some areas of the country are frequently hit with snowstorms that produce huge amounts of snow. For example, the eastern and southern shores of the Great Lakes are snowbelts that experience days and days of heavy snow resulting in enormous snow depths. Around the Lake Erie and Lake Ontario areas, the annual snowfall can be as much as 450 inches (37.5 feet).



Making Comparisons

 How are tornadoes different from hurricanes?

DROUGHTS A **drought** is a long period of time without rain or with very minimal rainfall. This lack of rain results in crop failures and drastically reduced levels in water storage facilities. In the early 1930s, a drought hit the Great Plains in the United States. Dust storms damaged farms across a 150,000-square-mile region that became known as the “Dust Bowl.” Suffering the effects of a harsh climate, thousands of families were forced to leave their land to find work elsewhere. (See the Dust Bowl Disaster feature on pages 150-151.) In 2000, a large portion of the southern United States was struck with a long drought. Northern Texas was particularly hard hit, with 84 straight days of no rain and extremely high temperatures.



REGION Before the drought in Texas, this boat floated on the waters of a lake now barely visible in the background.
How is life affected by drought?

BACKGROUND
 A series of droughts in Texas between 1996 and 2000 caused \$5.3 billion in damages.

FLOODS When water spreads over land not normally covered with water, it is called a flood. Melting snow or rainwater fills streams or rivers until they reach flood stage, the point at which the banks can no longer contain the water. The water then flows into the surrounding area, called a floodplain.

Floods take lives every year, especially in low, flat places like Bangladesh, where millions of people live on the flood plains and the delta. In 1993, flooding along the Mississippi and Missouri rivers claimed 50 lives and caused about \$15 billion in damage. Nearly 150 rivers and their tributaries were involved. It was the largest flood ever to hit the United States.

In the next section, you will learn about how climate affects people’s lives and how humans adapt to changes in climate.



Assessment

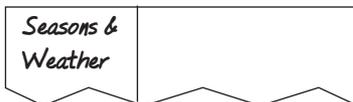
1 Places & Terms

Explain the meaning of each of the following terms.

- solstice
- equinox
- weather
- climate
- precipitation

2 Taking Notes

MOVEMENT Review the notes you took for this section.



- Which latitude lines mark the summer and winter solstices?
- How do moving air masses create weather?

3 Main Ideas

- a. How do the earth’s revolution and tilt affect the seasons?
- b. What is the difference between weather and climate?
- c. What are some examples of extreme weather?

4 Geographic Thinking

Determining Cause and Effect What must be present for any type of precipitation to occur? **Think about:**

- the cause of precipitation
- the types of precipitation

S See Skillbuilder Handbook, page R9.



EXPLORING LOCAL GEOGRAPHY Using your local newspaper, television, or an Internet weather forecast, make a **chart** showing predicted temperature highs and lows and precipitation for several days. Then record the actual weather on those days. Write a summary of your observations of the accuracy of the weather forecast.