

58 The Causes of Climate



Climates are described by the same conditions used to describe weather, such as temperature, precipitation, and wind. You now know that oceans have an important effect on climate, but oceans are only one of the factors that influence climates. In this reading, you will find out what other factors cause places to have different climates.

CHALLENGE

Why do different parts of the world have different climates?



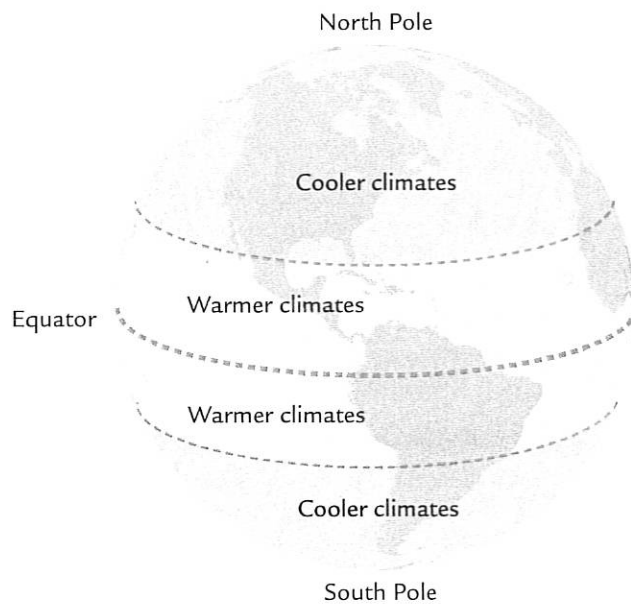
READING

When reading, answer the Stopping to Think questions in your mind. They can help you find out whether you understand the main ideas.

You examined a map of climates in the United States in Activity 53, “Weather and Climate.” You may have noticed that the southern part of Florida has a tropical climate, with warm temperatures and lots of rain year-round. The northern part of Florida has a mild climate with much cooler winters. Why does climate vary so much from place to place? Many factors influence climate. Some factors, like the energy from the sun, are global and affect climates on every part of the earth. Other factors, like landforms, affect local climates.

Energy from the Sun

The most important factor affecting the earth’s climates is energy from the sun. The temperature of a place depends a lot on the sun’s energy, because some parts of the earth’s surface receive more intense sunlight than others.



Some of the earth’s warmest climates are along the equator. In general, the areas around the equator receive more of the sun’s energy, while the North and South Poles receive less. In Unit F, “The Earth in Space,” you will learn why this is so. The result is that areas around the equator have warmer climates, and areas around the poles have colder climates, as you can see at left.

STOPPING TO THINK 1

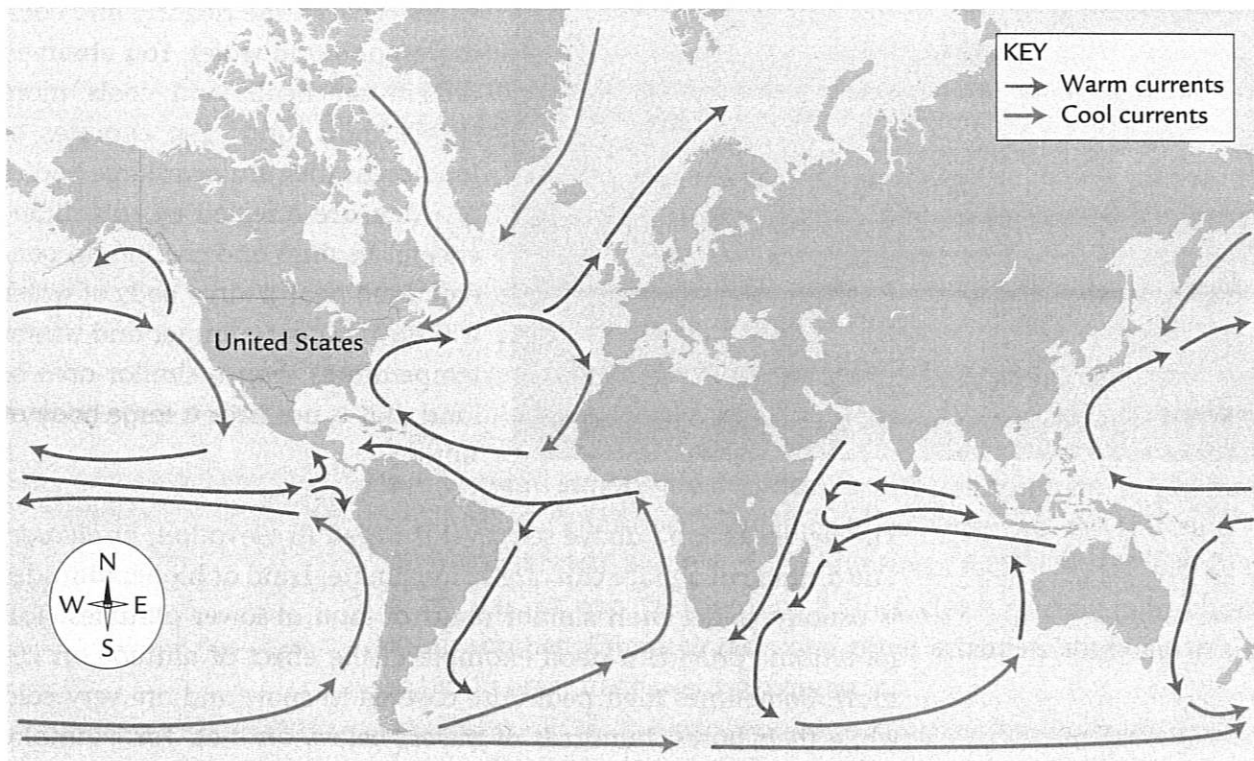
Imagine holding a tennis ball in front of a heat lamp for five minutes. What do you predict will happen to the temperature along the “equator” of the ball compared to the top and bottom?

The Role of Oceans

Another major factor influencing the earth's climates are oceans. This is because the water in the oceans holds a large amount of heat. Ocean currents transfer this heat from one part of the earth to another. Some surface currents move water as warm as 25°C (77°F), while other currents move water as cool as 10°C (50°F). Look carefully at the map below, which shows both warm and cold currents on the ocean surface.

The temperature of ocean currents affects the temperature and moisture content of air. Warm surface currents heat and moisten the air above them. This warm, moist air is carried to different parts of the world, where it makes climates warmer and wetter. Cold surface currents cause air to become cooler, resulting in cooler climates.

The movement of ocean currents depends on heat from the sun. Without the energy from the sun, ocean currents would stop and climates all over the world would be very different.



Currents on the Ocean's Surface

STOPPING TO THINK 2

- a. Which coast of the United States is warmed by warm ocean currents? Hint: Look at Figure 1.
 - b. Which coast of the United States is cooled by cool ocean currents? Hint: Look at Figure 1.
 - c. Do you predict that the climate of southeastern states along the ocean (such as Georgia and North Carolina) would be warmer or cooler without ocean currents? Explain.
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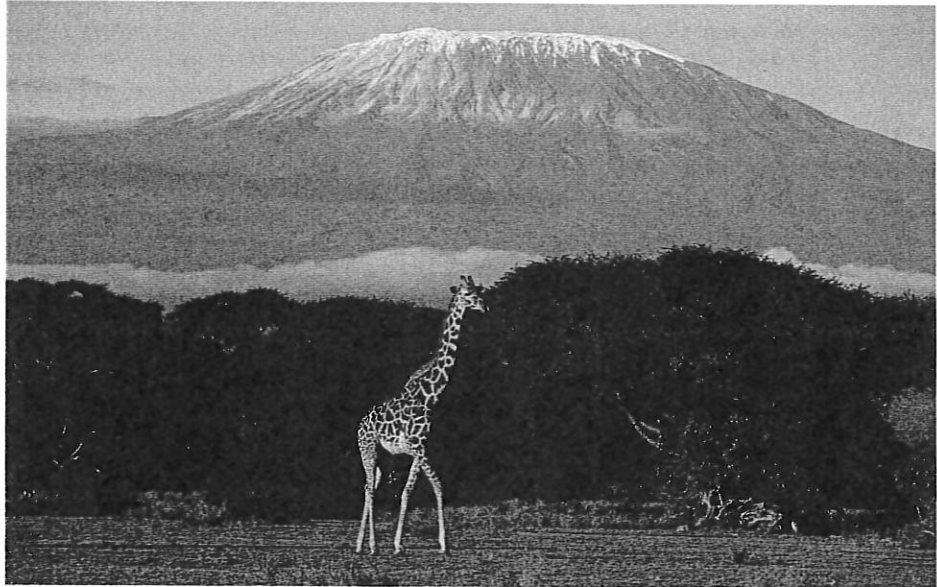
Factors Affecting Local Climates

In Unit C, "Erosion and Deposition," you learned that the shape of the land and its closeness to water vary from place to place. Some features of local topography can affect climate. These include the presence of large bodies of water, the height of land above sea level, and large landforms such as mountains.



In Activity 55, "Heating Earth Surfaces," you investigated the differences between the heating and cooling of land and water. You observed that water heats and cools more slowly than land. The climates of land areas that are near large bodies of water are affected by this difference in heating and cooling. In general, land near a large body of water will have milder summer and winter temperatures than a similar area of land that is not near a large body of water.

The height of land above sea level is called its elevation, or *altitude*. The altitude of a place can affect its climate. Land at higher altitudes is usually colder than similar areas of land at lower altitudes. Tall mountains provide a good example of the effect of altitude on climate. Sometimes their peaks are covered in snow and are very cold while their bases, hundreds of meters below, are hot. For example,



Africa's Mount Kilimanjaro (shown above), is very close to the equator and has a tropical climate at its base and glaciers at its peak.



Landforms such as mountain ranges, hills, and valleys can also affect climate. When winds blow toward mountains, the air is pushed upward. As the air gains elevation, it cools and begins to release moisture that is in the air. This released moisture often forms clouds and then rain or snow. Because of this, the side of a mountain that is facing the most common wind direction is usually wetter, while the other side is usually drier.

STOPPING TO THINK 3

What three factors affect local climates? Which of these factors do you think affect your local climate?

Climate and weather are a result of complex interactions between the sun's energy, surfaces on the earth, and the atmosphere. Today, many scientists are concerned that human activities are also affecting climates worldwide. Because of the number of factors that influence climate, it is not easy to determine if one factor is causing more change than another. Climatologists and other scientists study earth's climates in order to answer such questions.

ANALYSIS

1. Which factors affecting climate were described in the reading in this activity?
2. Oceans can store large amounts of heat. How does this affect climate?
-  3. Imagine that the sun suddenly disappeared forever. What do you think would happen to the earth's climates? Explain.
-  4. **Reflection:** In this activity, you learned that many factors influence climate. If you were a climatologist, which factor would you most like to study? Why?