

Section 3

Air Movement and Wind

Key Concept Global winds and local winds are produced by the uneven heating of Earth's surface.

What You Will Learn

- Uneven heating of Earth's surface by the sun causes differences in air pressure that cause wind.
- Wind patterns can be global or local and are influenced by the rotation of Earth and by geography.

Why It Matters

Winds influence overall climate and daily weather on Earth globally and locally.

As you lie in the park with the sun warming your face, a gentle breeze ruffles your hair. What caused that breeze? The movement of air is caused by differences in air pressure. Differences in air pressure are generally caused by the unequal heating of Earth's surface.

What Causes Wind ?

When the sun warms the surface of Earth, the surface heats the air above it. As a result, the air becomes less dense, which forms an area of low pressure. Areas where cold air sinks toward the surface are areas of high pressure. Colder, denser air from a high-pressure area will flow toward a low-pressure area. As the cold air moves, it pushes the warm, less dense air out of the way. This movement of air is called **wind**. The greater the pressure difference is, the faster the air moves, and the stronger the wind is. As shown in **Figure 1**, these areas of high and low pressure are part of convection cells.

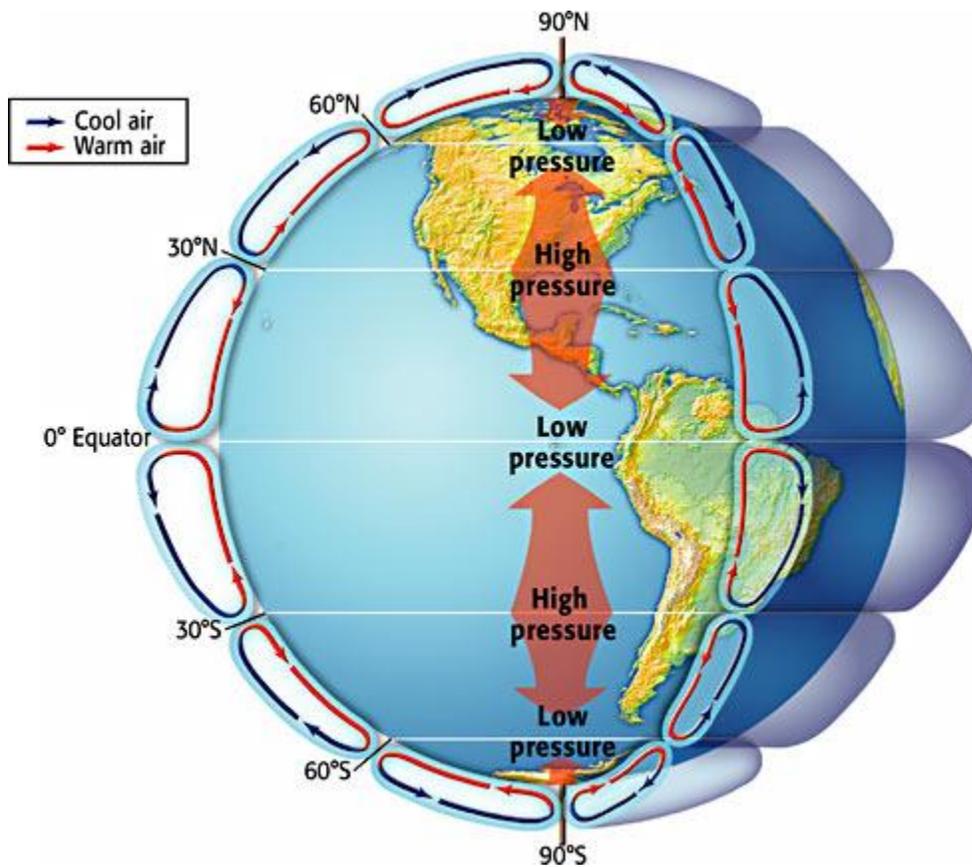


Figure 1 The uneven heating of Earth's surface produces pressure belts. These belts occur at about every 30° of latitude.

Standards Check What causes wind?



The Coriolis Effect

At the equator, Earth's surface receives a lot of direct sunlight that heats the ground and the air. As a result, air pressure is low at the equator. The poles, however, receive much less direct sunlight. Therefore, the

ground and air are not as warm, and air pressure at the poles is high. These pressure differences cause air to circulate from the poles toward the equator. However, winds do not travel directly north or south, because Earth is rotating. The apparent curving of the path of winds and ocean currents due to Earth's rotation is called the **Coriolis effect**. Because of the Coriolis effect in the Northern Hemisphere, winds traveling north curve to the east and winds traveling south curve to the west.

Global Winds

Convection cells, pressure belts, and winds combine with the Coriolis effect to produce air-circulation patterns called *global winds*. **Figure 2** shows the major global wind systems: polar easterlies, westerlies, and trade winds. Winds such as easterlies and westerlies are named for the direction from which they blow. Global winds distribute heat around Earth's surface and affect ocean currents and weather patterns.

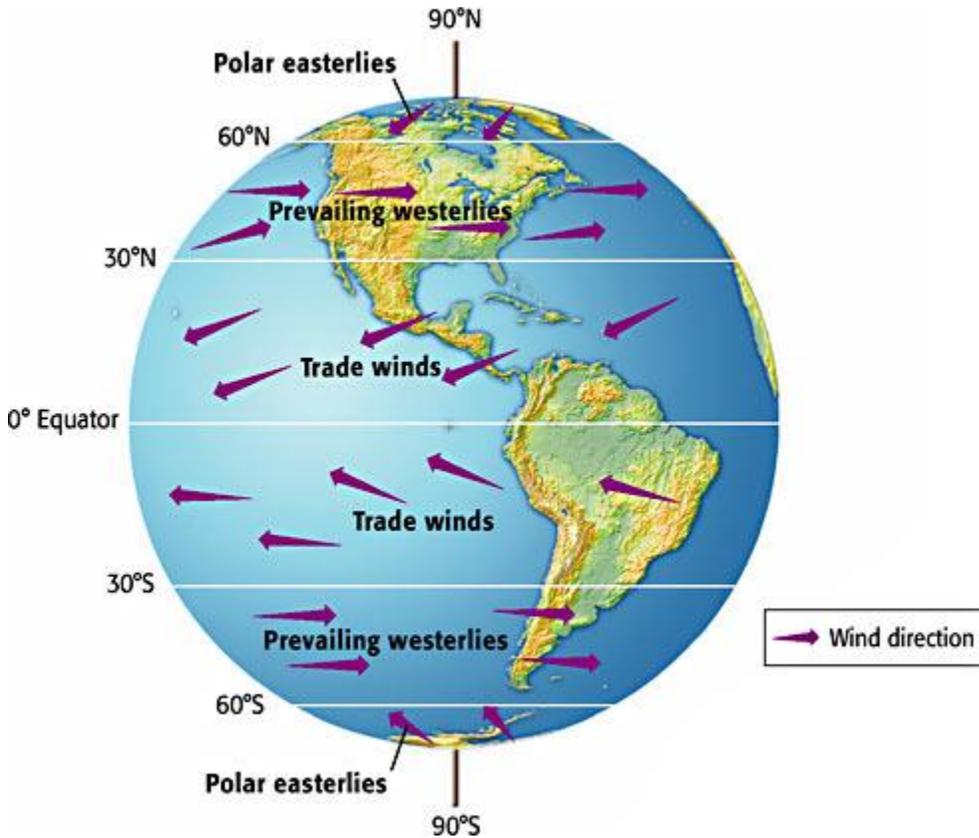


Figure 2 The major global wind systems are the polar easterlies, westerlies, and trade winds.

Standards Check What causes global wind patterns?

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Local Winds

Local winds generally move short distances and can blow from any direction. Like global winds, most local winds result from differences in pressure that are caused by the uneven heating of Earth's surface. However, these pressure differences result from a different process. The pressure differences that cause local winds are caused by the properties of the matter that makes up Earth's surface. For example, some materials, such as rock, heat up more rapidly than other materials. Areas of low pressure form over material that heats up quickly.

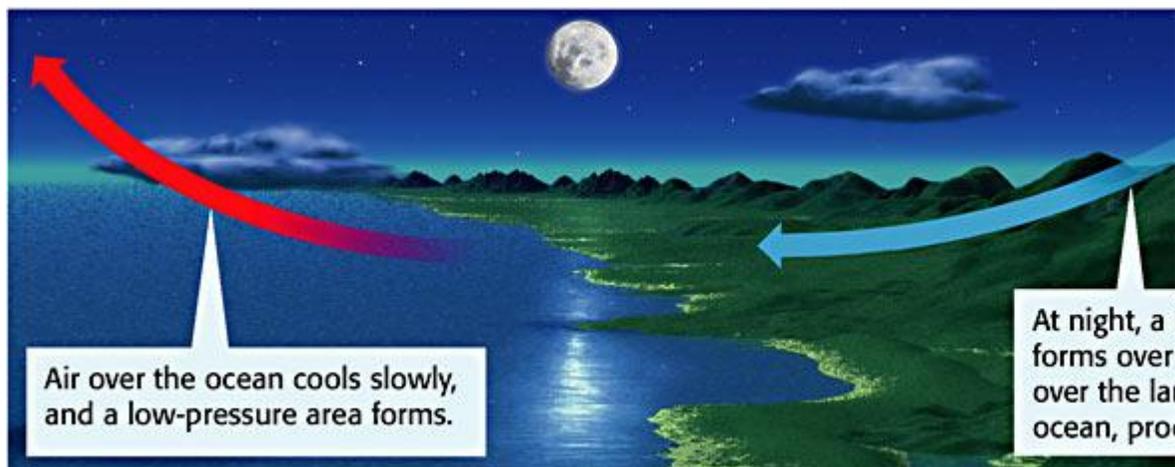
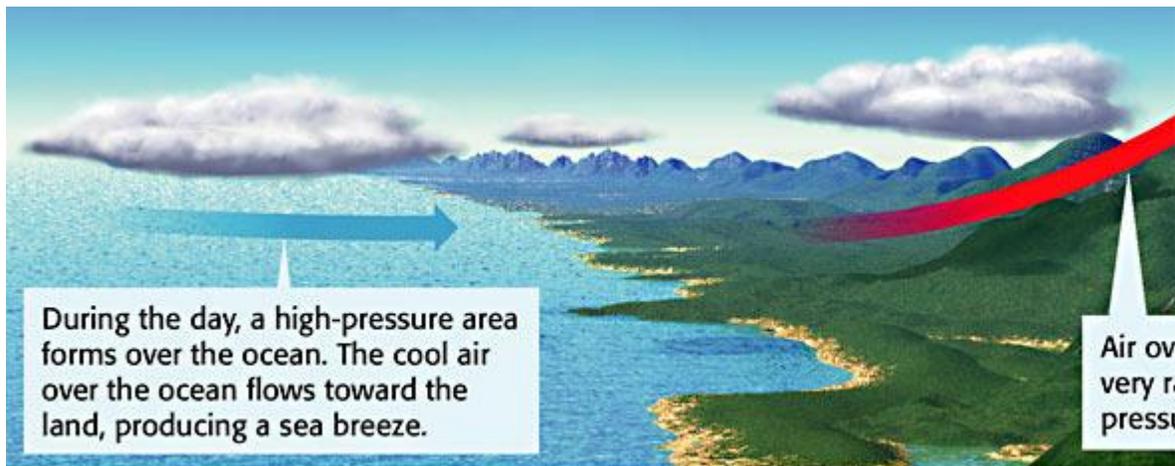
Standards Check What causes local winds?

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Sea Breezes and Land Breezes

The formation of sea and land breezes is shown in **Figure 3**. During the day, the land heats up faster than the water does. The air above the land becomes warmer than the air above the water. The warm air above the land rises, and the cold ocean air flows in to replace it. At night, the land cools faster than water does. The cold air above the land flows toward the ocean. So, the wind blows toward the ocean at night.

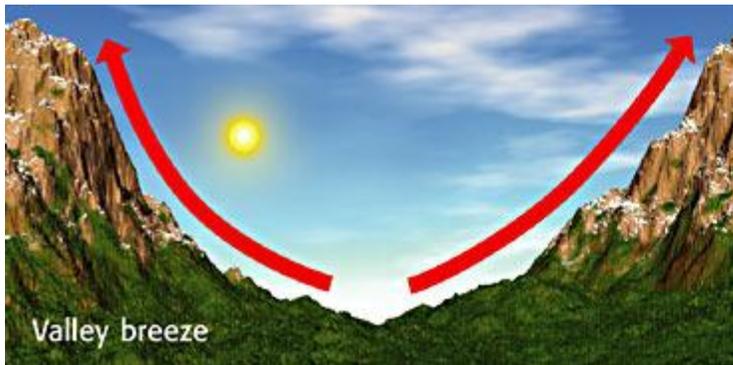
Figure 3 Sea Breezes and Land Breezes



Valley Breezes and Mountain Breezes

The formation of valley and mountain breezes is shown in **Figure 4**. During the day, the air along the mountain slopes heats up rapidly. This warm air rises up the mountain slopes, creating a valley breeze. At night, the air along the mountain slopes cools. This cool air moves down the slopes into the valley, producing a mountain breeze.

Figure 4 Valley Breezes and Mountain Breezes



Section Summary

- Winds blow from areas of high pressure to areas of low pressure.
- Pressure belts are caused by the uneven heating of Earth's surface by the sun.
- The Coriolis effect causes wind to appear to curve as it moves across Earth's surface.
- Global winds include the polar easterlies, the westerlies, and the trade winds.
- Local winds include sea and land breezes and valley and mountain breezes.

