Lesson Labs

Quick Labs

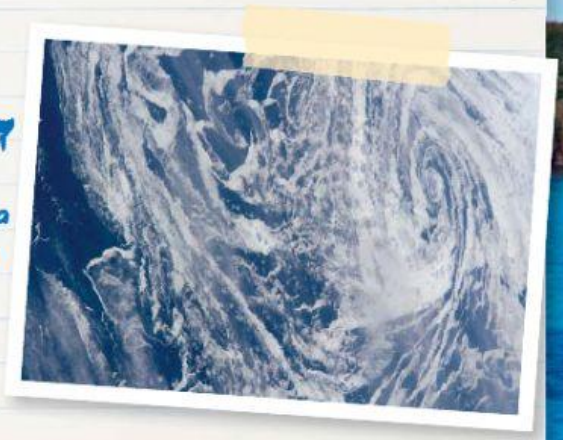
- Modeling the Coriolis Effect
- The Formation of Deep Currents
- Can Messages Travel on Ocean Water?

Engage Your Brain

1 Predict Check T or F to show whether you think each statement is true or false.

T	F	
☐	☐	Ocean currents are always cold.
☐	☐	Continents affect the directions of currents.
☐	☐	Currents only flow near the surface of the ocean.
☐	☐	Wind affects currents.
☐	☐	The sun affects currents near the surface of the ocean.

2 Analyze What can you learn about ocean currents from this image?



This image shows sea ice caught in ocean currents.

Active Reading

3 Synthesize You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the word *upwelling*.

Word part	Meaning
up-	from beneath the ground or water
well	to rise

Example Sentence

In areas where upwelling occurs, plankton feed on nutrients from deep in the ocean.

upwelling:

Vocabulary Terms

- **ocean current**
- **deep current**
- **surface current**
- **convection current**
- **Coriolis effect**
- **upwelling**

4 Apply As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.

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Going with the **Flow**

What are ocean currents?

The oceans contain streamlike movements of water called **ocean currents**. Ocean currents that occur at or near the surface of the ocean, caused by wind, are called **surface currents**. Most surface currents reach depths of about 100 m, but some go deeper. Surface currents also reach lengths of several thousand kilometers and can stretch across oceans. An example of a surface current is the Gulf Stream. The Gulf Stream is one of the strongest surface currents on Earth. The Gulf Stream transports, or moves, more water each year than is transported by all the rivers in the world combined.

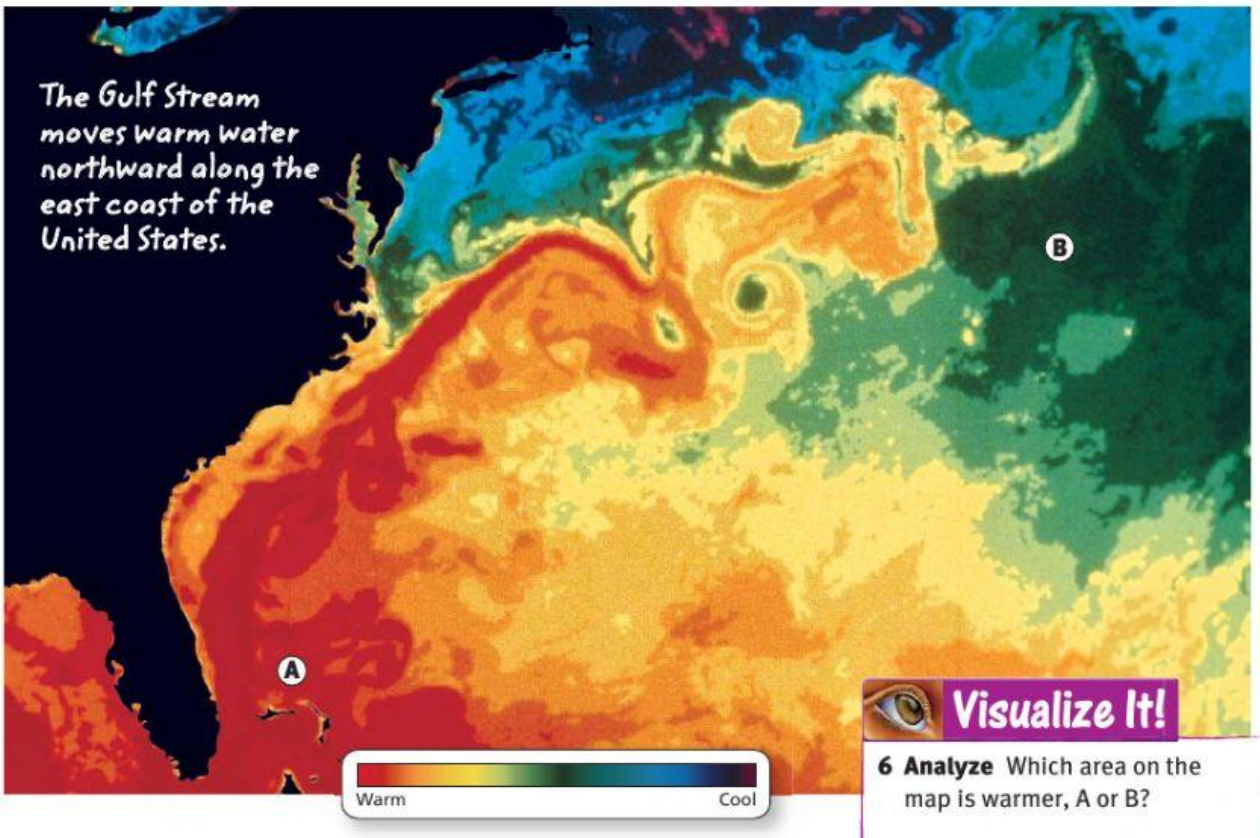
Infrared cameras on satellites provide images that show differences in temperature. Scientists add color to the images afterward to highlight the different temperatures, as shown below.

What affects surface currents?

Surface currents are affected by three factors: continental deflections, the Coriolis effect, and global winds. These factors keep surface currents flowing in distinct patterns around Earth.

Active Reading

5 Identify As you read, underline three factors that affect surface currents.



Visualize It!

6 Analyze Which area on the map is warmer, A or B?

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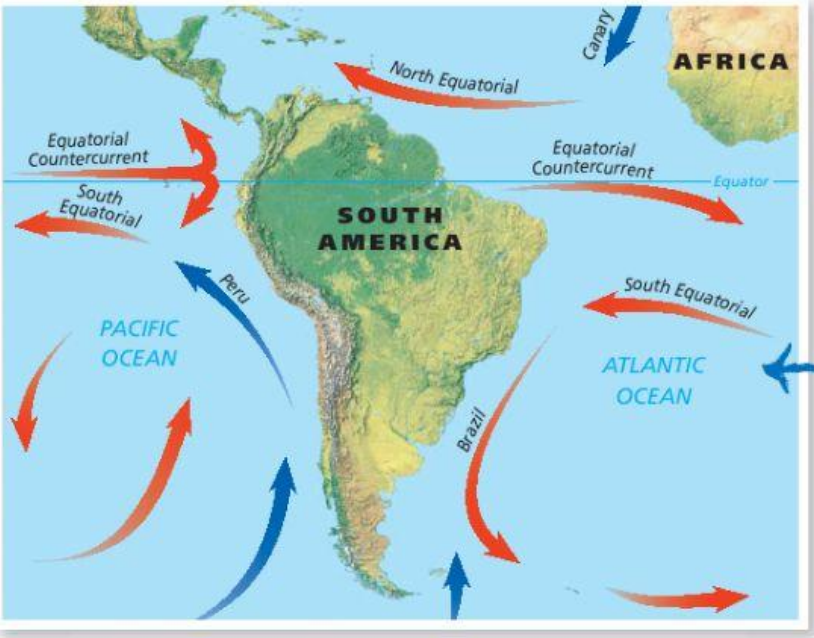


7 Identify Circle areas on the map where ocean currents have been deflected by a land mass.

Currents change direction when they meet continents.

Continental Deflections

If Earth's surface were covered only with water, surface currents would simply travel continually in one direction. However, water does not cover the entire surface of Earth. Continents rise above sea level over about one-third of Earth's surface. When surface currents meet continents, the currents are deflected and change direction. For example, the South Equatorial Current turns southward as it meets the coast of South America.

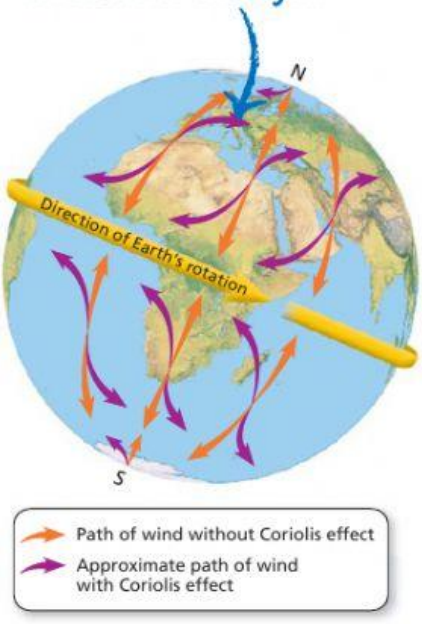
The Coriolis Effect

Earth's rotation causes all wind and ocean currents, except on the equator, to be deflected from the paths they would take if Earth did not rotate. The deflection of moving objects from a straight path due to Earth's rotation is called the **Coriolis effect** (kawr•ee•OH•lis ih•FEKT). Earth is spherical, so Earth's circumference at latitudes above and below the equator is shorter than the circumference at the equator. But the period of rotation is always 24 hours. Therefore, points on Earth near the equator travel faster than points closer to the poles.

The difference in speed of rotation causes the Coriolis effect. For example, wind and water traveling south from the North Pole actually go toward the southwest instead of straight south. Wind and water deflect to the right because the wind and water move east more slowly than Earth rotates beneath them. In the Northern Hemisphere, currents are deflected to the right. In the Southern Hemisphere, currents are deflected to the left.

The Coriolis effect is most noticeable for objects that travel over long distances, without any interruptions. Over short distances, the difference in Earth's rotational speed from one point to another point is not great enough to cause noticeable deflection.

In the Northern Hemisphere, currents are deflected to the right.



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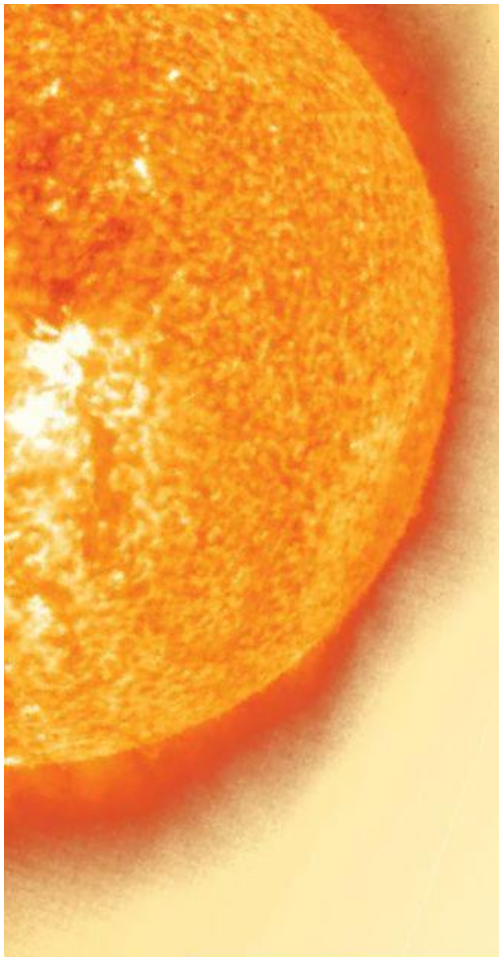


Global Winds

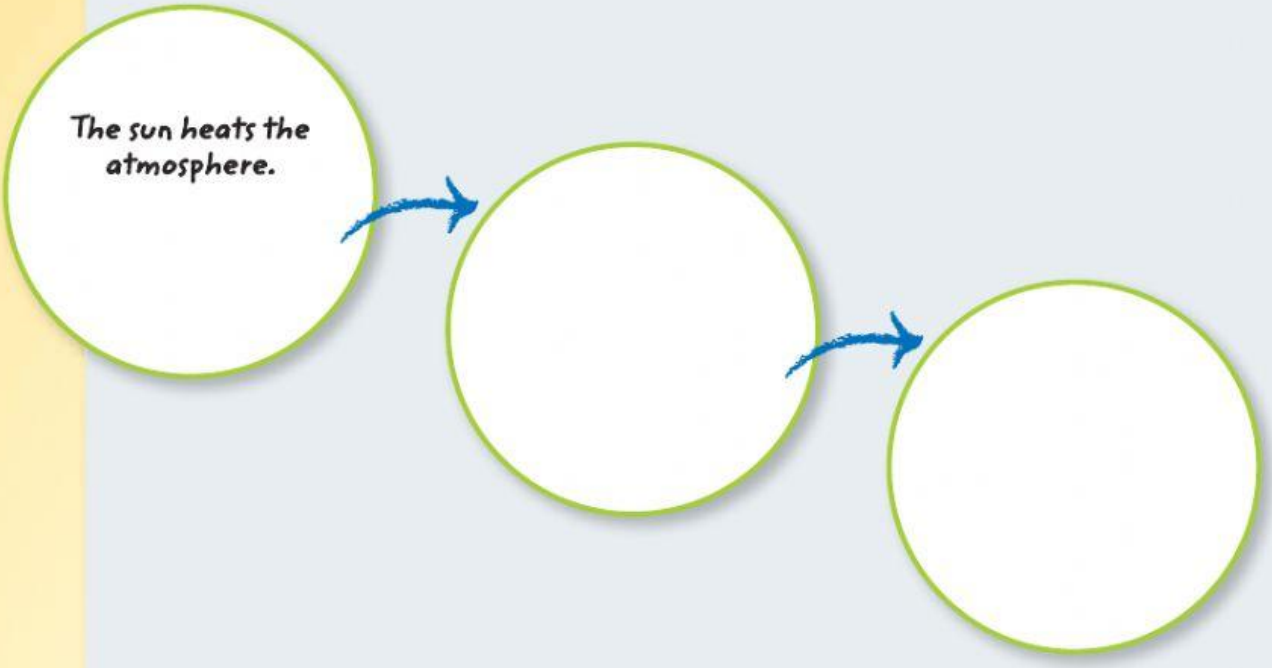
Have you ever blown gently on a cup of hot chocolate? You may have noticed that your breath makes ripples that push the hot chocolate across the surface of the liquid. Similarly, winds that blow across the surface of Earth's oceans push water across Earth's surface. This process causes surface currents in the ocean.

Different winds cause currents to flow in different directions. For example, near the equator, the winds blow east to west for the most part. Most surface currents in the same area follow a similar pattern.

What powers surface currents?

The sun heats air near the equator more than it heats air at other latitudes. Pressure differences form because of these differences in heating. For example, the air that is heated near the equator is warmer and less dense than air at other latitudes. The rising of warm air creates an area of low pressure near the equator. Pressure differences in the atmosphere cause the wind to form. So, the sun causes winds to form, and winds cause surface currents to form. Therefore, the major source of the energy that powers surface currents is the sun.

8 Analyze Fill in the cause-and-effect chart to show how the sun's energy powers surface ocean currents.



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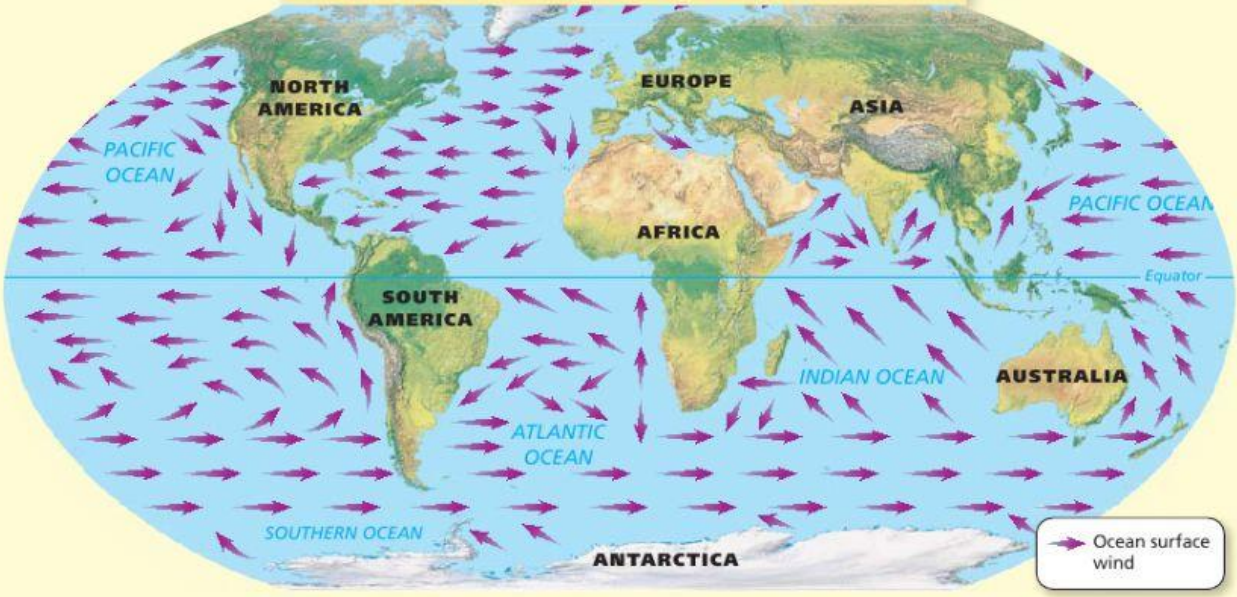
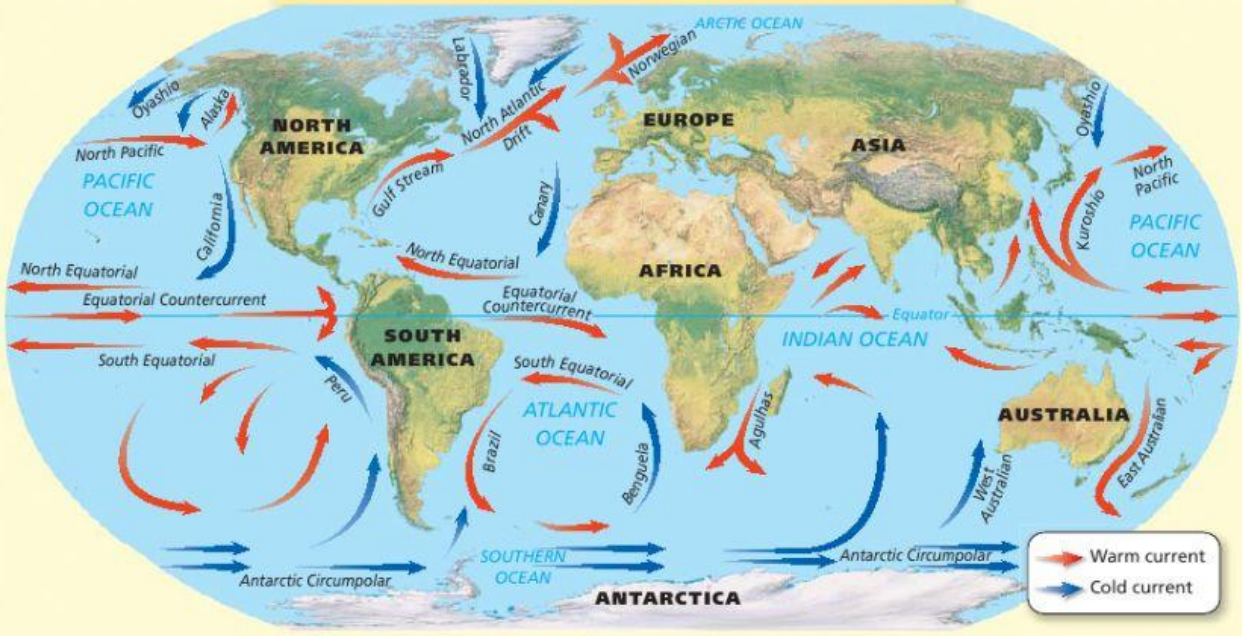
Global Surface Winds



Global Surface Currents



Visualize It!

9 Analyze Circle the same area on each map. Describe what you observe about these two areas.

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