

CHAPTER 14 The Movement of Ocean Water

SECTION 2 **Currents and Climate**

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How do surface currents affect climate?
- How do changes in surface currents affect climate?

National Science Education Standards
ES 1j

How Do Surface Currents Affect Climate?

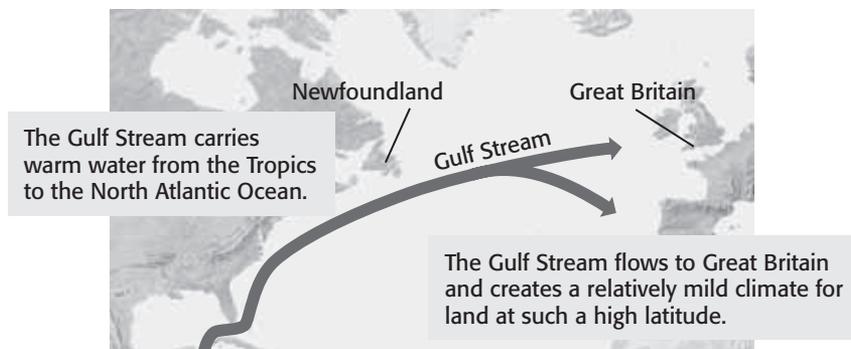
Surface currents can have a large impact on climate. The temperature of the water at the surface of the ocean affects the air above it. Warm water can heat air and produce warmer air temperatures. Cold water can absorb heat and produce cooler air temperatures.



Summarize in Pairs Read this section quietly to yourself. Then, talk about the section with a partner. Together, try to answer any questions that you have.

WARM-WATER CURRENTS AND CLIMATE

Surface currents can make coastal areas warmer than inland areas at the same latitude. For example, Great Britain and Newfoundland, Canada, are located at about the same latitude. However, the Gulf Stream flows close to Great Britain. The warm water of the Gulf Stream warms the air around Great Britain. As a result, Great Britain has a milder climate than Newfoundland.



STANDARDS CHECK

ES 1j Global patterns of atmospheric movement influence local weather. Oceans have a **major** effect on climate, because water in the oceans holds a large amount of heat.

Word Help: major of great importance or large scale

1. Explain Why is Great Britain's climate milder than Newfoundland's?

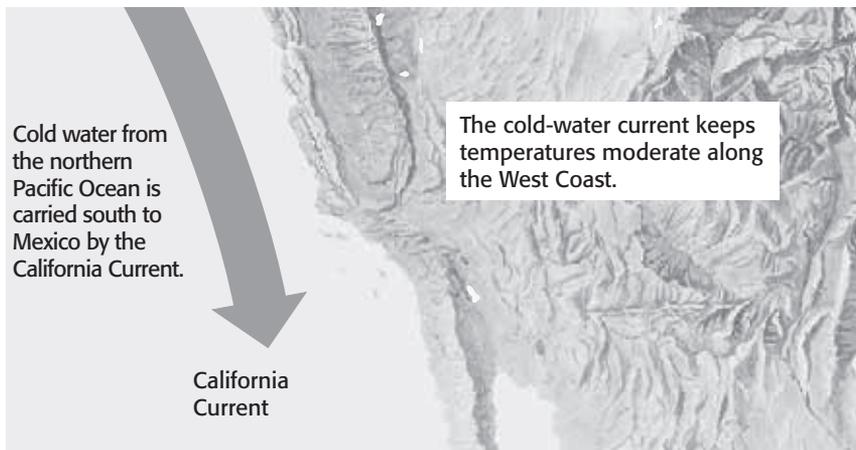
COLD-WATER CURRENTS AND CLIMATE

Cold-water currents also affect coastal areas. Coastal areas near cold currents tend to have cooler climates than inland areas at the same latitude. For example, the California Current is a cold-water current that flows near the West Coast of the United States. As a result, the climate along the West Coast is usually cooler than the climate of areas further inland. The figure on the top of the next page shows the location of the California Current.

SECTION 2 Currents and Climate *continued*

TAKE A LOOK

2. Identify In which direction does the California Current flow?



UPWELLING

Ocean **upwelling** happens when cold, nutrient-rich water from the deep ocean replaces warm surface water. Upwelling is caused by local winds. These winds blow toward the equator along the northwest coast of South America and west coast of North America. The winds cause the local surface currents to move away from the shore. Cold water then replaces the warm surface water. ✓

Upwelling is important for ocean life. Nutrients support the growth of *plankton*, which are the base of the food chain in the ocean. Climate disturbances, such as El Niño, can interrupt the process of upwelling. This causes the diversity of organisms near the ocean's surface to decrease.

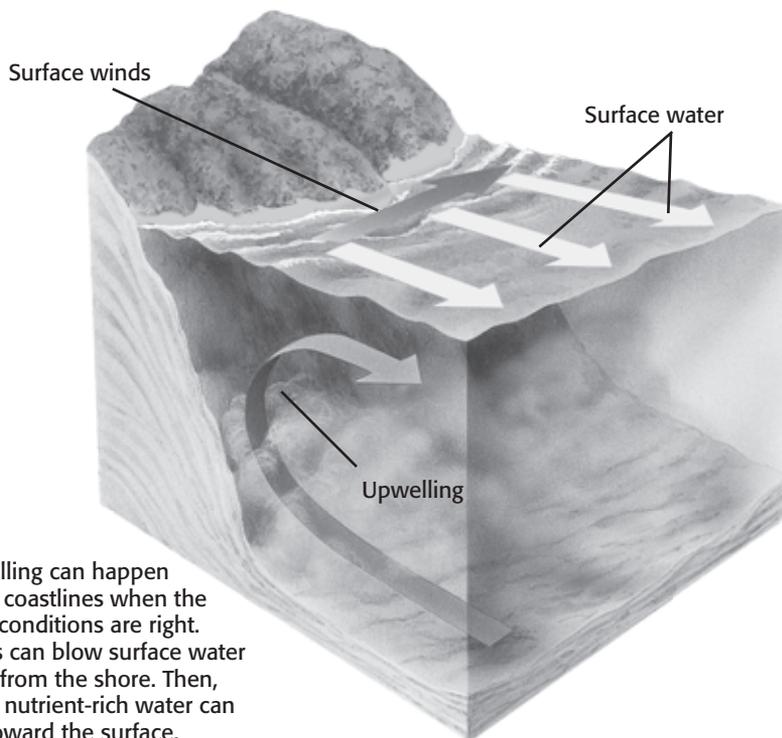
READING CHECK

3. Define What is upwelling?

TAKE A LOOK

4. Explain How do winds cause upwelling?

Upwelling can happen along coastlines when the wind conditions are right. Winds can blow surface water away from the shore. Then, deep, nutrient-rich water can rise toward the surface.



SECTION 2 Currents and Climate *continued*

How Do El Niño and La Niña Affect Climate?

Every 2 to 12 years, the South Pacific trade winds move less warm water to the western Pacific than usual. As a result, surface-water temperatures along the west coast of South America rise. Over time, this warming spreads westward. This periodic change in the location of warm and cool surface waters is called **El Niño**. El Niño events can last a year or longer.

Sometimes, El Niño is followed by **La Niña**. La Niña happens when surface-water temperatures in the eastern Pacific become unusually cool. La Niña also affects weather patterns.



Discuss You may have heard news reports about the effects of El Niño. In a small group, talk about some of the effects of El Niño that you heard about on the news.

Name	When does it happen?
El Niño	
La Niña	

TAKE A LOOK

5. Describe Fill in the blank spaces in the table.

EFFECTS OF EL NIÑO

El Niño can have a major effect on weather patterns. Flash floods and mudslides may happen in areas of the world that usually receive little rain, such as Peru. Other areas of the world, such as Indonesia and Australia, may receive less rain than usual.

El Niño changes the way the ocean and atmosphere interact. Changes in the weather during El Niño show how the atmosphere, ocean, and weather patterns are related. Scientists can predict the changes in the weather on land that might be caused by El Niño by studying the atmosphere and the ocean.

To study El Niño, scientists collect data with buoys anchored to the ocean floor along the equator. The buoys record data about water temperature, air temperature, currents, and winds. The data sometimes show that the South Pacific trade winds are weaker than usual. The data may also show that the surface-water temperatures in the oceans have increased. Either of these changes can tell scientists that El Niño is likely to happen.

Critical Thinking

6. Apply Concepts El Niño happens when there is warmer water near the west coast of South America. Why do scientists collect information about air temperatures in order to help them predict El Niño and La Niña?

Section 2 Review

SECTION VOCABULARY

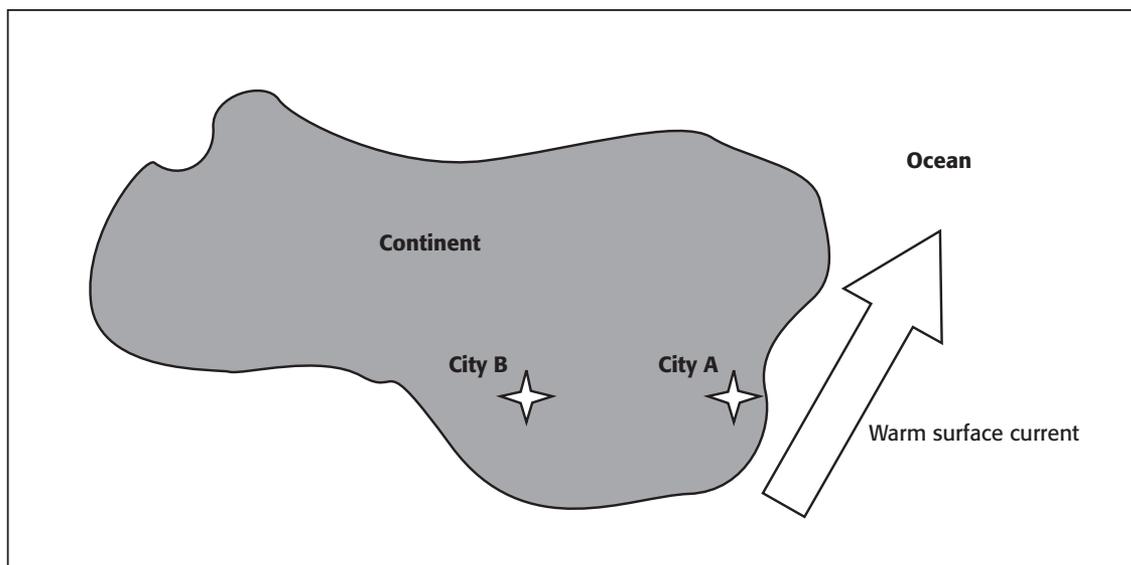
El Niño a change in the surface water temperature in the Pacific Ocean that produces a warm current

La Niña a change in the eastern Pacific Ocean in which the surface water temperature becomes unusually cool

upwelling the movement of deep, cold, and nutrient-rich water to the surface

1. Explain Why do surface-water temperatures on the west coast of South America rise during El Niño?

2. Apply Concepts City A and City B are the same height above sea level. Based on the figure below, make a prediction about the average temperature in City A compared to City B. Explain your answer.



3. Explain Why is upwelling important for marine life?
