chapter 28 Weather and Climate

section 3 Climate

Before You Read

Have you ever seen photographs or movies of a tropical rain forest? What type of climate does a tropical rain forest seem to have? How does it differ from the climate in your area?

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What You'll Learn

- what determines climate
- about the different climate systems
- how climates are distributed around the United States

Read to Learn

Climate and Weather

Climate is the long-term weather conditions in an area. Climate includes precipitation, temperature, wind, moisture, and other factors. Climate also describes the annual variations of these factors and their extremes.

What is the climate system?

It is best to think about climate as part of a whole Earth system. There are five parts, or spheres, to this system. One part is the atmosphere, or the air around us. The second part is the biosphere. The **biosphere** is all the living things on Earth, including plants, animals, and humans.

The third part, the hydrosphere, is mostly the liquid water in the oceans, lakes, and rivers, as well as groundwater. The fourth part, the cryosphere, is frozen water in snow, ice, and glaciers. The lithosphere is the fifth part. It includes the solid Earth with its soil, rocks, and mantle.

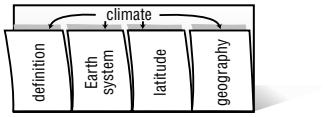
Interacting Spheres Gases, water, energy, and particles are exchanged among these spheres. Each sphere affects all the others. For example, a volcano erupts and sends gases and particles from the lithosphere into the atmosphere. The atmosphere provides and controls the amount of water in the hydroshpere and cryosphere.

Study Coach

Sticky-Note Discussion
As you read, use sticky-notes to mark those passages that you have a question about or that you think are particularly interesting. After you finish this section, discuss your questions or comments with the class.

FOLDABLES™

Identify Make a four-tab Foldable to organize the major ideas about climate.



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What causes climate?

Latitude is the main factor that determines a place's climate. The amount of solar radiation an area receives and its usual air circulation depend on the latitude. Other factors that affect climate are location near high mountains, location on the east or west sides of a continent, and distance from a large body of water.

Why does temperature vary?

The amount of solar radiation hitting Earth and surface temperatures vary greatly from the equator to the poles. In winter, the farther a place is from the equator, the smaller the angle at which sunlight hits it. Therefore, temperatures decrease rapidly with increasing latitude. At high latitudes, snow and ice cover reflect most sunlight into space, lowering the temperature still further. In summer, temperature decrease is less pronounced as sunlight hits these regions at a higher angle, and periods of daylight are longer. The climatic temperature patterns in the United States are shown in the figure below.

Picture This

1. **Analyze** During which season, summer or winter, do U.S. temperatures differ the most?

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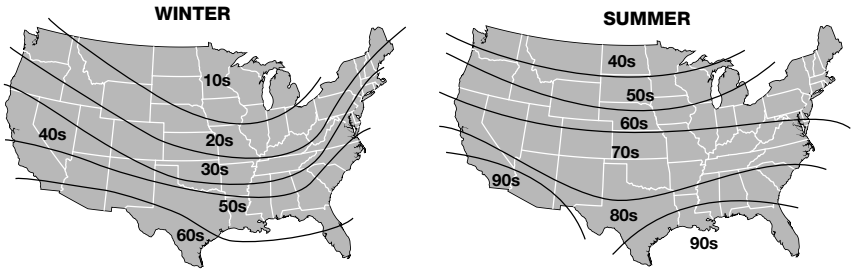

How do oceans and land influence climate?

Oceans and ocean currents affect climate. **Continental climates** occur in areas of land with little direct ocean influence. Continental climates undergo great changes between summer and winter temperatures. A **maritime climate** is a climate that is strongly influenced by an ocean. Maritime climates are generally mild. They have relatively small changes in temperature. ✔

Peoria, Illinois, and San Francisco, California have the same latitude. San Francisco is on the Pacific Ocean. Its maritime climate is mild. The average change between the summer and winter temperatures is 8°C. Peoria is in the Midwest and has a continental climate. It has an average summer to winter temperature change of 30°C.

✔ Reading Check

2. **Identify** What is a maritime climate?

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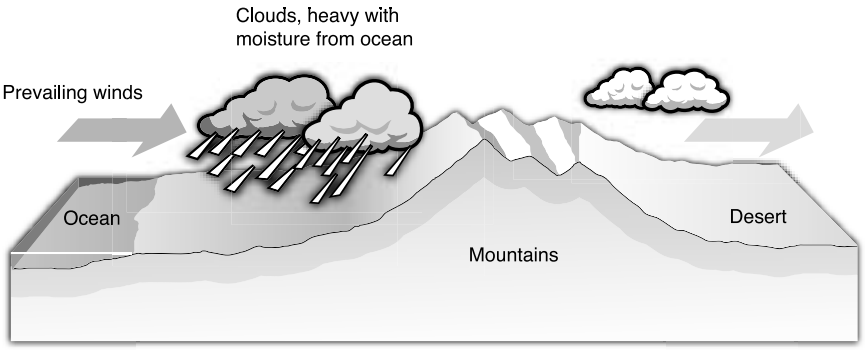
Why does precipitation vary by climate?

Precipitation is determined by an area's wind and air pressure patterns. Humid climates in the tropics and at mid-latitudes are associated with low pressure. In the region around the equator, rainfall is abundant because the trade winds from the northern and southern hemispheres meet there. Lots of water evaporates from the ocean and rises to form clouds. High pressure occurs in dry, or arid, climates. Dry climates occur mainly in the subtropics on the eastern sides of tropical high-pressure zones. Areas between these extremes have seasons that alternate between wet and dry.

Location In addition to this general pattern, precipitation is affected by an area's location on a continent. In the United States, the west coast lies east of a subtropical high. This high pressure creates the dry climates of California and the Southwest. The east coast lies west of a subtropical high. Southerly winds carry in warm, unstable air from the Gulf of Mexico. The moist air increases precipitation.

Winds Prevailing winds also affect precipitation. Because westerlies prevail in the middle latitudes, the maritime influence is stronger on the west coast than the east coast. This is why San Francisco has a maritime climate and Boston has a continental climate.

Mountains The Rocky Mountains and the Sierra Nevada mountains influence the climate of the west. These mountains block the weather systems moving in from the west and alter patterns of precipitation. A lee rain shadow is a relatively arid area that forms on the opposite side of a mountain range when the wind blows perpendicular to one side of the mountain range. This effect is shown in the figure below. The Great Plains lie in the lee shadow of the Rocky Mountains and are relatively dry.



Think it Over

3. **Explain** Why do San Francisco and Boston have different climates?

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Picture This

4. **Mark and Draw** Mark the side of the diagram that is the west. Draw an arrow that shows the direction of the westerlies.

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How does water influence climate?

Coasts and lakeshores affect climate in several ways. In the winter, areas of heavy snow, called snowbelts, form around the Great Lakes. As cold continental air from the north passes over the warmer lake water, it picks up heat and moisture. As the air moves back over colder land, heavy snows result.

A **sea breeze** (or lake breeze) blows from the water to the land in the afternoon, when the land is warmer than the water. As warm air rises over the land, cool dense air from the sea blows toward land. The reverse happens at night when the land is cooler than the water. A land breeze blows from the land toward the water.

Reading Check

5. **Identify** What direction do the sea breezes blow in the afternoon? What direction do they blow in the evening?

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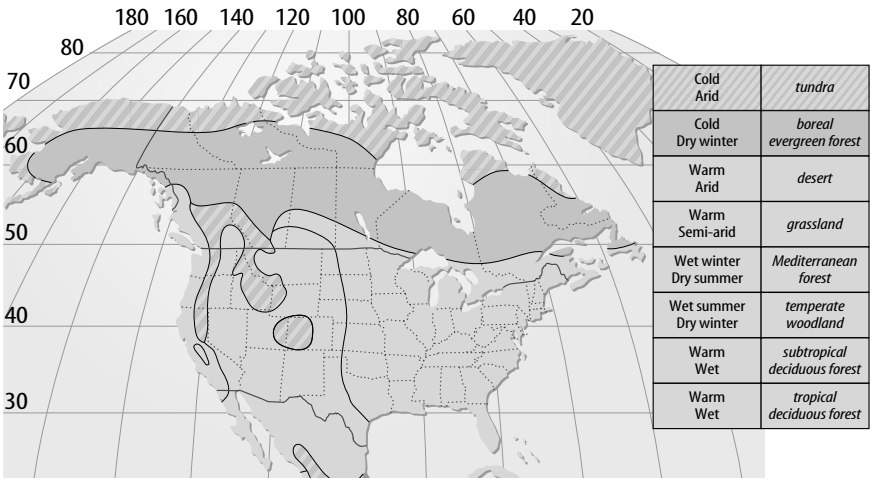
What are small-scale climate variations?

Many small-scale variations in climate occur within the larger climate patterns. Regional climate variations occur over a fairly wide area. Local climate variations include changes in climate caused by cities. Cities create a condition called the heat island effect. Buildings and roads heat more quickly than bare soil, and pollution from cars and industry tends to hold heat in the city. Air rises over a heat island, pulling in air from the surrounding countryside. On some calm, clear nights, San Fransisco can be as much as 8°C warmer than the rural areas near it.

Types of Climates

Scientists have classified climates into three basic types. There are the boreal, or cold, climates of most polar regions and high altitude areas. The arid and semi-arid desert climates have little rainfall. Last are the temperate, subtropical, and tropical climates. Climate types are related to the types of plants that grow in them.



Picture This

6. **Mark** Circle the climate zone where you live.

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After You Read

Mini Glossary

continental climate: a climate with little direct ocean influence

maritime climate: a climate that is strongly influenced by the ocean

sea breeze: winds that blow toward the land from a body of water in the afternoon

1. Review the vocabulary terms and their meanings in the Mini Glossary. Write a sentence or two describing a continental climate and what influences it.

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2. Describe at least one way that each of Earth's spheres affects the global climate.

Sphere	How it Influences Climate
biosphere	
lithosphere	
cryosphere	
hydrosphere	
atmosphere	

3. Study Coach You used sticky-notes to mark those places in the text that you found interesting or that you had questions about. How did using sticky-notes help you understand the information in this section?

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End of Section