

13-2 What factors determine climate?

Objective

Identify and describe the conditions that determine climate.

Key Terms

latitude (LAI-juh-TOOdi): distance north or south of the equator in degrees
altitude (AL-tuh-TOOdi): height above sea level

Latitude The climate of an area is affected by its latitude. **Latitude** is the distance in degrees north or south of the equator. Latitude determines how much heat energy an area gets from the Sun. At the equator, the Sun's rays fall almost directly on Earth. The closer an area is to the equator, the warmer is its climate. At higher latitudes, the Sun's rays strike Earth at more of an angle. The heat energy from the Sun is spread out, and the climate is colder. Global wind patterns at different latitudes also alter the number and kinds of storms in an area.

1 **RELATE:** How does latitude affect climate?

Altitude The height above sea level is called **altitude**. Air is warmer at sea level than it is at higher altitudes. The average air temperature drops about 1°C for every 100-m rise in altitude. Even near the equator, mountaintops are snow-covered all year.



▲ Figure 13-5 This picture shows the kinds of vegetation that can be found at different altitudes, from mountaintop to sea level.

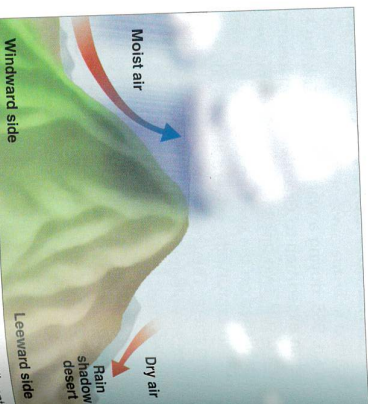
2 **DEFINE:** What is altitude?

Ocean Currents Ocean currents have an effect on the climate of areas along the seacoast. An ocean current is like a river of water within the ocean. Some ocean currents are warm. Other ocean currents are cold. Winds passing over ocean currents are either warmed or cooled by them. When these winds reach nearby land areas, they heat or cool the land.

3 **DESCRIBE:** How do ocean currents affect land temperatures?

Mountains When air passes over a mountain range, the air rises and cools. The side on which the air rises is called the windward side. Moisture condenses from the cooled air, causing it to either rain or snow.

As the air moves down the other side of the mountain, the leeward side, it is warmed and most of the moisture is removed. It rarely rains on the leeward side of a mountain. Many deserts, such as Death Valley, are found on the leeward sides of mountains. These areas are sometimes called rain shadow deserts.



▲ Figure 13-6 Different sides of a mountain often have different weather patterns.

4 **OBSERVE:** What side of a mountain faces the wind?

✓ CHECKING CONCEPTS

1. The closer an area is to the equator, the _____ its climate.
2. At _____ latitudes, the Sun's rays strike Earth at more of an angle.
3. Air at sea level is _____ than air at higher altitudes.
4. Land areas near cold-water currents usually have _____ temperatures.

THINKING CRITICALLY

5. **CALCULATE:** How much lower will the temperature be on top of a 1,500-m mountain than at sea level?
6. **INFER:** Miami, Florida, is at a lower latitude than San Francisco, California. Which city probably has a warmer climate? Explain.

Web InfoSearch

The Butterfly Effect There are many factors influencing the weather. A change in any one can affect the others in unpredictable ways. This is chaos theory. Weather patterns do repeat over the years. This is climate. However, past patterns are never repeated exactly. This is partly the result of the butterfly effect, which is the idea that a butterfly's wings stirring the air in one place can lead to large storms a month later far away.

SEARCH: Use the Internet to find out more about chaos theory. What besides the weather does it affect? Start your search at www.conceptsandchallenges.com. Some key search words are **chaos theory**, **climate change**, and **weather patterns**.



Real-Life Science

THE RAINIEST PLACES ON EARTH

You might think that the rain forests are the rainiest places on Earth. They do get more than 150 cm of rain per year. Some get up to 1,000 cm each year. Where could it rain more than that?

Actually, some of the rainiest places on Earth are found on windward mountain slopes. Mount Waialeale (wy-ah-lee-ay-AHL-ay) in Hawaii gets 1,150 cm per year, the highest average annual rainfall in the world. Cherrapunji (cher-uh-PUN-jee), India, is second, with about 1,125 cm a year. Cherrapunji holds the record for the most rainfall in one year, at 2,605 cm. Most of this rain fell in one month, July. Compare this with Seattle, Washington, which is known for its rainy weather. The average rainfall there is about 98 cm per year. Mountain areas get a lot of rain and snow. Runoff from mountains such as the Rockies can be a source of water for dry areas in the southwestern United States. Reservoirs in mountain areas can store spring runoff. This water can then be delivered to Los Angeles and other cities by a network of canals.

Thinking Critically What is the average monthly rainfall in Mt. Waialeale, Hawaii?



▲ Figure 13-7 Mt. Waialeale in Hawaii has the highest annual rainfall in the world.