

Chapter 4 Global Climates and Biomes

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Climates and Biomes

- **Climate** The average weather that occurs in a given region over a long period of time.
- **Weather** The short-term conditions of the atmosphere in a local area, which include temperature, humidity, clouds, precipitation, and wind speed.

Module 9

The Unequal Heating of Earth

After reading this module you should be able to

- identify the five layers of the atmosphere.
- discuss the factors that cause unequal heating of Earth.
- describe how Earth's tilt affects seasonal differences in temperatures.

Earth's atmosphere is composed of layers

- **Troposphere** A layer of the atmosphere closest to the surface of Earth, extending up to approximately 16 km (10 miles).
- **Stratosphere** The layer of the atmosphere above the troposphere, extending roughly 16 to 50 km (10–31 miles) above the surface of Earth.

Earth's Atmosphere

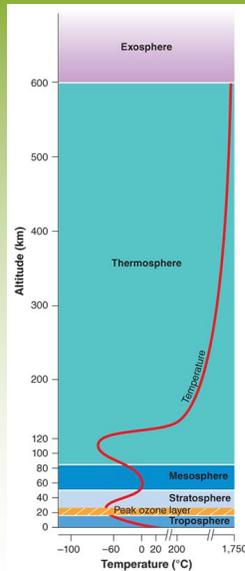


Figure 9.1
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After http://www.nasa.gov/audience/forstudents/9-12/features/912_liftoff_atm.html

The layers of Earth's atmosphere.

The troposphere is the atmospheric layer closest to Earth. Because the density of air decreases with altitude, the troposphere's temperature also decreases with altitude. Temperature increases with altitude in the stratosphere because the Sun's UV-B and UV-C rays warm the upper part of this layer. Temperatures in the thermosphere can reach 1,750° C (3,182° F).

The amount of solar energy reaching Earth varies with location

As the Sun's energy passes through the atmosphere and strikes land and water, it warms the surface of Earth. But this warming does not occur evenly across the planet because:

- The angle at which the Sun's rays strike varies.
- The amount of surface area over which the Sun's rays are distributed varies.
- Some areas of Earth reflect more solar energy than others.
- **Albedo** The percentage of incoming sunlight reflected from a surface.

The Amount of Solar Energy Reaching Earth

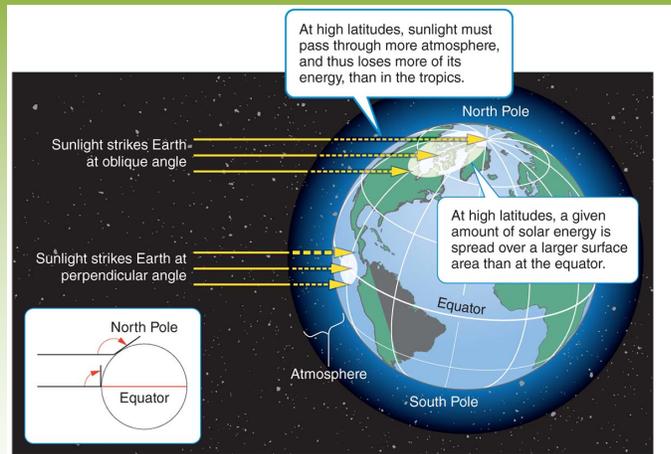


Figure 9.3
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Differential heating of Earth. Tropical regions near the equator receive more solar energy than mid-latitude and polar regions, where the Sun's rays strike Earth's surface at an oblique angle.

The Amount of Solar Energy Reaching Earth

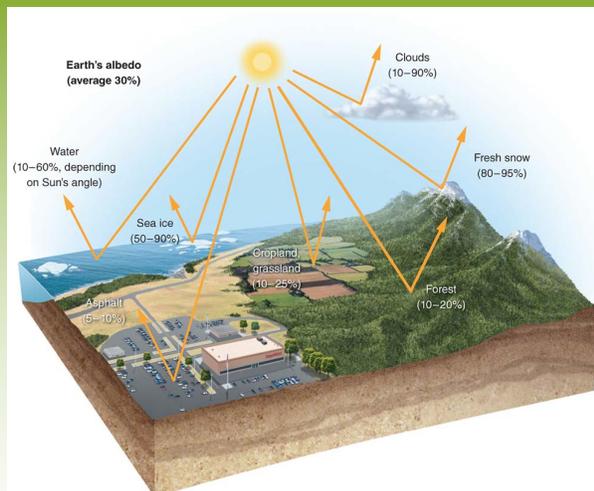


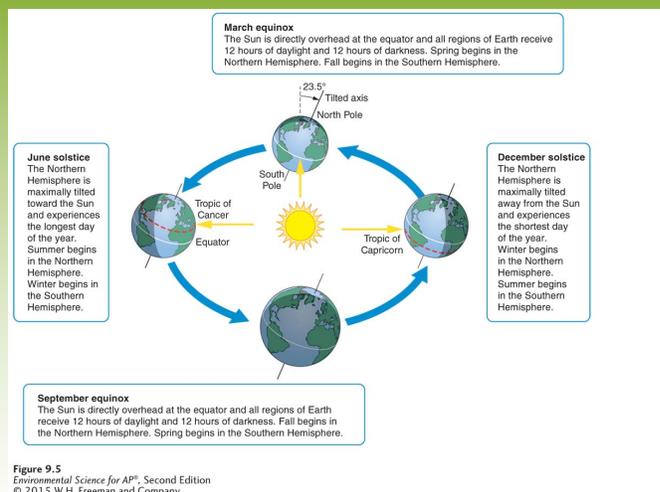
Figure 9.4
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Albedo. The albedo of a surface is the percentage of the incoming solar energy that it reflects. Snow and ice reflect much of the solar energy that they receive, but darker objects such as forests and asphalt paving reflect very little energy, which means that they absorb most of the solar energy that strikes them.

Earth's tilt causes seasonal changes in climate

- The Earth's axis of rotation is tilted 23.5° .
- When the Northern Hemisphere is tilted toward the Sun, the Southern Hemisphere is tilted away from the Sun, and vice versa.

Earth's Tilt and the Seasons



Earth's seasons. Because Earth's axis of rotation is tilted 23.5° , the latitude that receives the most direct rays of the Sun and the most hours of daylight changes throughout the year as Earth orbits the Sun. Thus Earth's tilt produces predictable seasons. This diagram illustrates the pattern of seasons in the Northern Hemisphere.