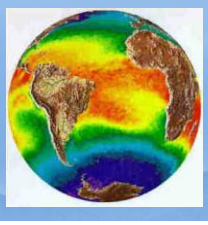
Chapter 4:
Ecosystems and Communities

Section 4.1 Climate

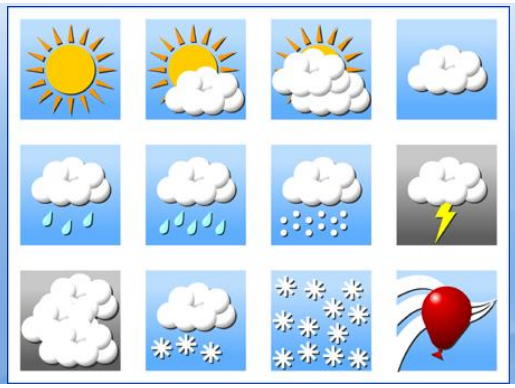
Mrs. Michaelsen



Weather and Climate

- **Weather** is the day-to-day condition of Earth's atmosphere.
- **Climate** refers to average conditions over long periods and is defined by year-after-year patterns of temperature and precipitation.
- Climate is rarely uniform even within a region. Environmental conditions can vary over small distances, creating **microclimates.**
- For example, in the Northern Hemisphere, south-facing sides of trees and buildings receive more sunlight, and are often warmer and drier, than north-facing sides. These differences can be very important to many organisms.

Weather

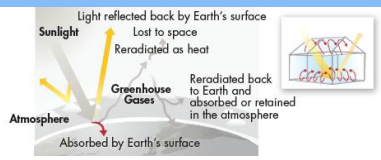


Climate

Lesson Overview Climate

Solar Energy and the Greenhouse Effect

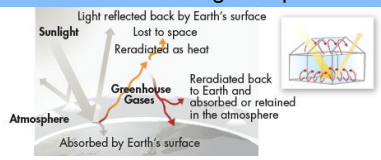
- The main force that shapes our climate is solar energy that arrives as sunlight that strikes Earth's surface.
- Some of that energy is reflected back into space, and some is absorbed and converted into heat.



Lesson Overview Climate

Solar Energy and the Greenhouse Effect

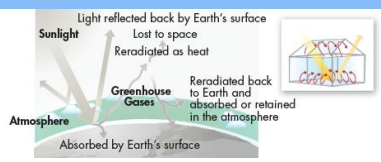
- Some of the heat also radiates back into space, and some is trapped in the biosphere.
- The balance between heat that stays in the biosphere and heat lost to space determines Earth's average temperature.



Lesson Overview Climate

Solar Energy and the Greenhouse Effect

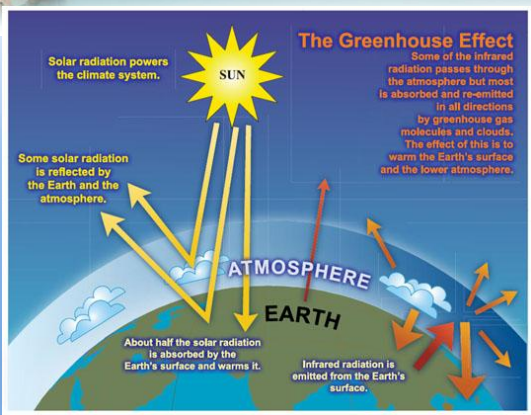
- Largely controlled by the amount of three atmospheric gases—carbon dioxide, methane, and water vapor.
- These "greenhouse gases" function like glass in a greenhouse, allowing visible light to enter but trapping heat: Called the **greenhouse effect.**



Lesson Overview Climate

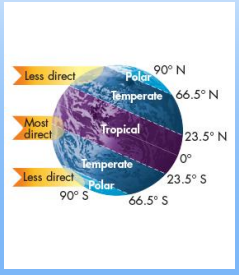
Solar Energy and the Greenhouse Effect

- If greenhouse gas concentrations rise, they trap more heat, so Earth warms. If their concentrations fall, more heat escapes, and Earth cools.
- Without the greenhouse effect, Earth would be about 30 C cooler than it is today.



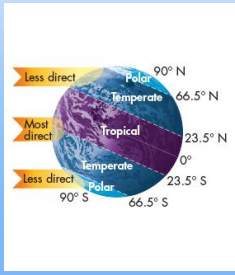
Latitude and Solar Energy

- Near the equator, solar energy is intense, the sun is almost directly overhead at noon all year. Very warm.
- The curvature of Earth causes the solar energy to spread out over a much larger area near the poles.



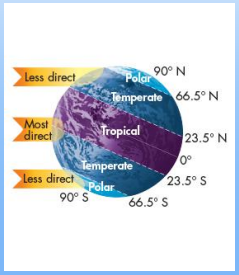
Latitude and Solar Energy

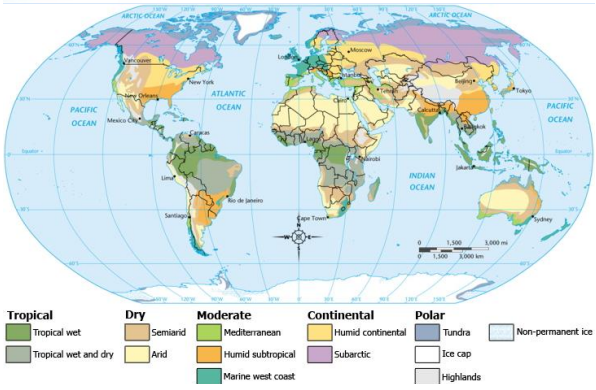
- Earth's polar areas annually receive less intense solar energy, and therefore heat, from the sun.
- The difference in heat creates three different climate zones: tropical, temperate, and polar.



Latitude and Solar Energy

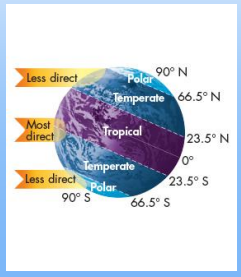
- The tropical zone, which includes the equator, receives nearly direct sunlight all year.
- On either side of the tropical zone are the two temperate zones, between 23.5° and 66.5° north and south latitudes.
- Beyond the temperate zones are the polar zones, between 66.5° and 90° north and south latitudes.





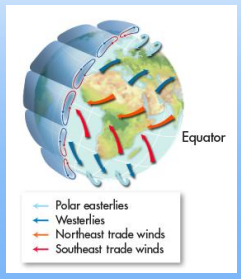
Latitude and Solar Energy

- Temperate and polar zones receive very different amounts of solar energy at different times of the year because Earth's axis is tilted.
- As Earth revolves around the sun, solar radiation strikes different regions at angles that vary from summer to winter.
- During winter in the temperate and polar zones, the sun is much lower in the sky, days are shorter, and solar energy is less intense.



Heat Transport in the Biosphere

- The unequal distribution of heat across the globe creates wind and ocean currents, which transport heat and moisture.
- Earth has winds because warm air is less dense and rises, and cool air is more dense and sinks.



Heat Transport in the Biosphere

- Air that is heated by warm areas of Earth's surface—such as near the equator—rises, expands, and spreads north and south, losing heat along the way.
- As the warm air cools, it sinks.

Lesson Overview Climate

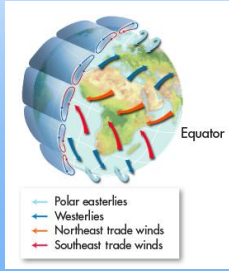
Heat Transport in the Biosphere

- In cooler regions, near the poles, chilled air sinks toward Earth's surface, pushing air at the surface outward.
- This air warms as it travels over the surface and rises.

Lesson Overview Climate

Heat Transport in the Biosphere

- These upward and downward movements of air create winds.
- Winds transport heat from regions of rising warmer air to regions of sinking cooler air.
- Earth's rotation causes winds to blow generally from west to east over the temperate zones and from east to west over the tropics and the poles.



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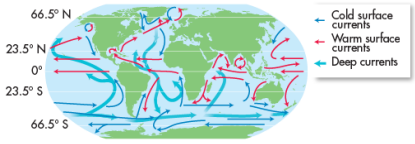
Heat Transport in the Biosphere

- Similar patterns of heating and cooling occur in the oceans.
- Surface water is pushed by winds.
- Ocean currents, like air currents, transport enormous amounts of heat.



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Heat Transport in the Biosphere

- Warm surface currents add moisture and heat to air that passes over them.
- Cool surface currents cool air that passes over them.
- In this way, surface currents affect the weather and climate of nearby landmasses.

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Heat Transport in the Biosphere

- Deep ocean currents are caused by cold water near the poles sinking and flowing along the ocean floor.
- This water rises in warmer regions through a process called upwelling.