

## 4-1 The Role of Climate

### What Is Climate?

**Weather** is the day-to-day condition of Earth's atmosphere at a particular time and place.

**Climate** refers to the average year-after-year conditions of temperature and precipitation in a particular region.

Climate is caused by:

- trapping of heat by the atmosphere
- latitude
- transport of heat by winds and ocean currents
- amount of precipitation
- shape and elevation of landmasses

### The Greenhouse Effect

**How does the greenhouse effect maintain the biosphere's temperature range?**

**Atmospheric gases that trap the heat energy of sunlight and maintain Earth's temperature range include:**

- carbon dioxide
- methane
- water vapor

**The natural situation in which heat is retained in Earth's atmosphere by this layer of gases is called the greenhouse effect**

**Carbon dioxide, water vapor, and several other gases in the atmosphere allow solar radiation to enter the biosphere but slow down the loss of heat to space.** These greenhouse gases cause the greenhouse effect, which helps maintain Earth's temperature range.

### The Effect of Latitude on Climate

Solar radiation strikes different parts of Earth's surface at an angle that varies throughout the year.

At the equator, energy from the sun strikes Earth almost directly.

At the North and South Poles, the sun's rays strike Earth's surface at a lower angle.

**As a result of differences in latitude and thus the angle of heating, Earth has three main climate zones:**

- polar,
- temperate, and
- tropical

The **polar zones** are cold areas where the sun's rays strike Earth at a very low angle.

Polar zones are located in the areas around the North and South poles, between 66.5° and 90° North and South latitudes.

The **temperate zones** sit between the polar zones and the tropics.

Temperate zones are more affected by the changing angle of the sun over the course of a year.

As a result, the climate in these zones ranges from hot to cold, depending on the season.

The **tropical zone**, or tropics, is near the equator, between 23.5° North and 23.5° South latitudes.

The tropics receive direct or nearly direct sunlight year-round, making the climate almost always warm.

### Heat Transport in the Biosphere

Unequal heating of Earth's surface drives winds and ocean currents, which transport heat throughout the biosphere. Warm air over the equator rises, while cooler air over the poles sinks toward the ground.

The upward and downward movement of air creates air currents, or winds, that move heat throughout the atmosphere. Earth's winds and ocean currents interact to help produce Earth's climates. The curved paths of some currents and winds are the result of Earth's rotation.

Similar patterns of heating and cooling occur in Earth's oceans. Cold water near the poles sinks, then flows parallel to the ocean bottom, and rises in warmer regions. Water is also moved at the surface by winds.

The movement of the water creates ocean currents, which transport heat energy throughout the biosphere.

Surface ocean currents warm or cool the air above them, affecting the weather and climate of nearby landmasses.

