

Climate

Climates of Earth

..... Read to Learn

What is climate?

Weather is the atmospheric conditions and short term changes of a certain place at a certain time. The weather changes from day to day in many places on Earth. However, the weather is more constant in other places. In Antarctica, temperatures are rarely above 0°C. Areas in Africa's Sahara have temperatures above 20°C every day of the year.

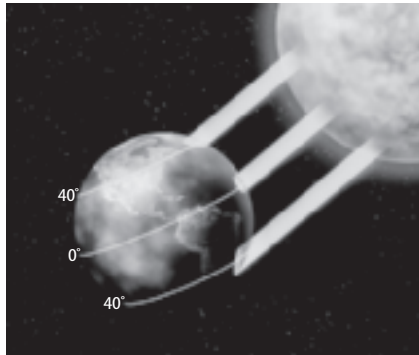
Climate is the long-term average weather conditions that occur in a particular region. A region's climate depends on average temperature and precipitation. It also depends on how these variables change throughout the year.

What affects climate?

Several factors determine a region's climate. The latitude of a location affects climate. For example, areas close to the equator have the warmest climates. Large bodies of water, such as lakes and oceans, also influence the climate of a region. Along coastlines, weather is more constant throughout the year. Hot summers and cold winters often occur in the center of continents. The altitude of an area affects climate. Mountainous areas are often rainy and snowy. Temperatures are often higher in urban areas because the buildings and concrete retain solar energy.

Latitude

The equator is 0° latitude. Latitude increases from 0° to 90° as you move toward the North Pole or the South Pole. The amount of solar energy per unit of Earth's surface area depends on latitude. The figure below shows that locations close to the equator receive more solar energy per unit of surface area each year than locations farther north or south. This is mainly because Earth's curved surface causes the angle of the Sun's rays to spread out over a larger area. Locations near the equator also tend to have warmer climates than locations at higher latitudes. Polar regions are colder because they receive less solar energy per unit of surface area annually. In the middle latitudes, between 30° and 60° , summers are generally hot and winters are usually cold.



Altitude

Altitude can also influence climate. Temperature decreases as altitude increases in the troposphere. So, as you climb a tall mountain, you might experience the same cold, snowy climate that is near the poles.

Rain Shadows

Mountains influence climate because they are barriers to prevailing winds. This leads to unique precipitation patterns called rain shadows. *An area of low rainfall on the downwind slope of a mountain is called a **rain shadow**.* Rain shadows form as prevailing winds carry moist, warm air over Earth's surface. As the air nears mountains, it rises and cools. Water vapor in the air condenses and rain or snow falls on the upwind slope. The dry air then passes over the mountains. The air warms as it sinks. This causes dry weather on the downwind slope.

Because there are different amounts of precipitation on either side of a mountain, there are different types and amounts of vegetation. Large quantities of vegetation grow on the side of the mountain that receives precipitation. Very little vegetation grows on the dry downwind slope.

Large Bodies of Water

On a sunny day at the beach, you might notice that the sand feels warmer than the water. The water is cooler than the sand on a sunny day because water has a high specific heat. **Specific heat** is the amount (measured in joules) of thermal energy needed to raise the temperature of 1 kg of a material by 1°C.

The specific heat of water is about six times higher than the specific heat of sand. This means that the water would have to absorb six times as much thermal energy to be the same temperature as the sand.

The high specific heat of water causes the climates along coastlines to remain more constant than climates in the middle of a continent. For example, the West Coast of the United States has moderate temperatures year-round.

Ocean currents can also affect climate. The Gulf Stream is a warm current that flows northward along the coast of eastern North America. This warm current causes temperatures to be warmer along parts of the East Coast of the United States and parts of Europe.

Classifying Climates

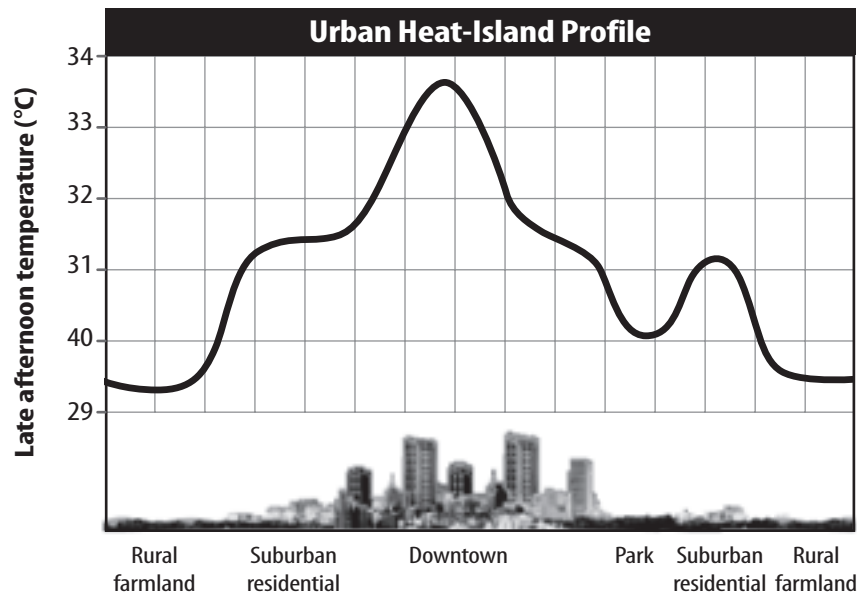
Many factors affect climate. In 1918, Wladimir Köppen (vlah DEE mihr • KAWP pehn) developed a system for classifying the world's many climates. Köppen, a German scientist, classified a region's climate by its temperature, precipitation, and native vegetation.

Native vegetation is often limited to particular climate conditions. For example, you would not expect to find a warm-desert cactus growing in the cold, snowy Arctic. Wladimir Köppen identified five climate types. The characteristics of these five types are given below.

Climate	Temperature	Precipitation
Polar	cold year-round	little precipitation
Continental	warm summers, cold winters	moderate precipitation
Dry	hot summers, cooler winters	very little precipitation
Tropical	warm year-round	high precipitation
Mild	warm summers, mild winters	humid, with high precipitation

Microclimates

Cities have more roads and buildings made of concrete than the rural areas around them. Concrete absorbs solar radiation. This causes warmer temperatures in urban areas than in the surrounding countryside. The result is a common microclimate called an urban heat island, shown by the graph below. A **microclimate** is a localized climate that is different from the climate of the larger area surrounding it. A forest is a microclimate. Forests are often cooler and less windy than the surrounding countryside. Hilltops are microclimates as well. Hilltops are windier than nearby lower land.



How Climate Affects Living Organisms

Organisms have adaptations for the climates where they live. Polar bears have thick fur and a layer of fat that helps keep them warm. Many animals that live in deserts, such as camels, have adaptations for hot, dry conditions. Some desert plants have large, shallow root systems that collect rainwater. Deciduous trees in continental climates lose their leaves during the winter. This reduces water loss.

Climate also influences humans in many ways. Average temperature and rainfall help determine what types of crops humans will grow in an area. Orange trees grow in Florida, where the climate is mild. Wisconsin's continental climate is good for growing cranberries.

Humans often design buildings with climate in mind. In polar climates, the soil is frozen year-round. This is a condition called permafrost. Humans build houses and other buildings on stilts so that thermal energy from the buildings does not melt the permafrost.