

What is climate?

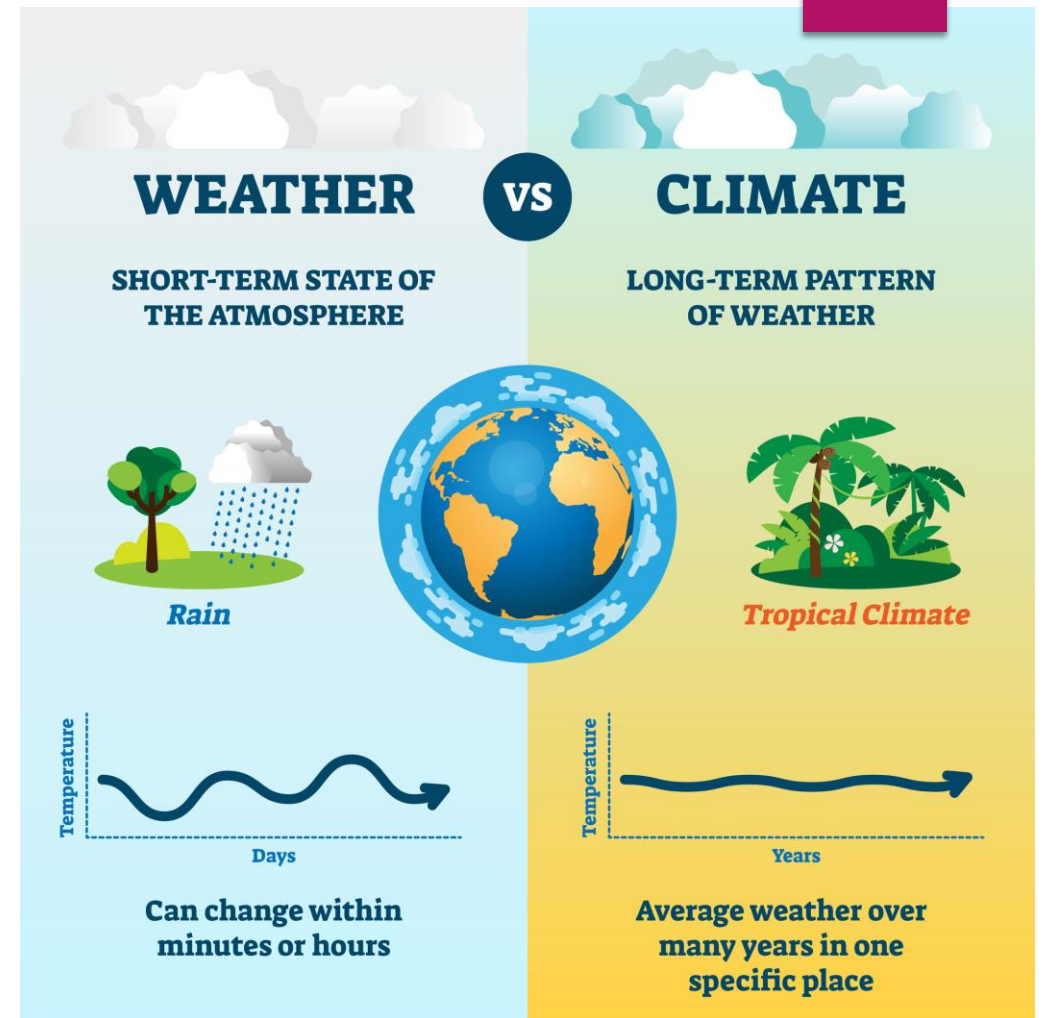
QUESTION OF THE DAY



Climate and Climate Change

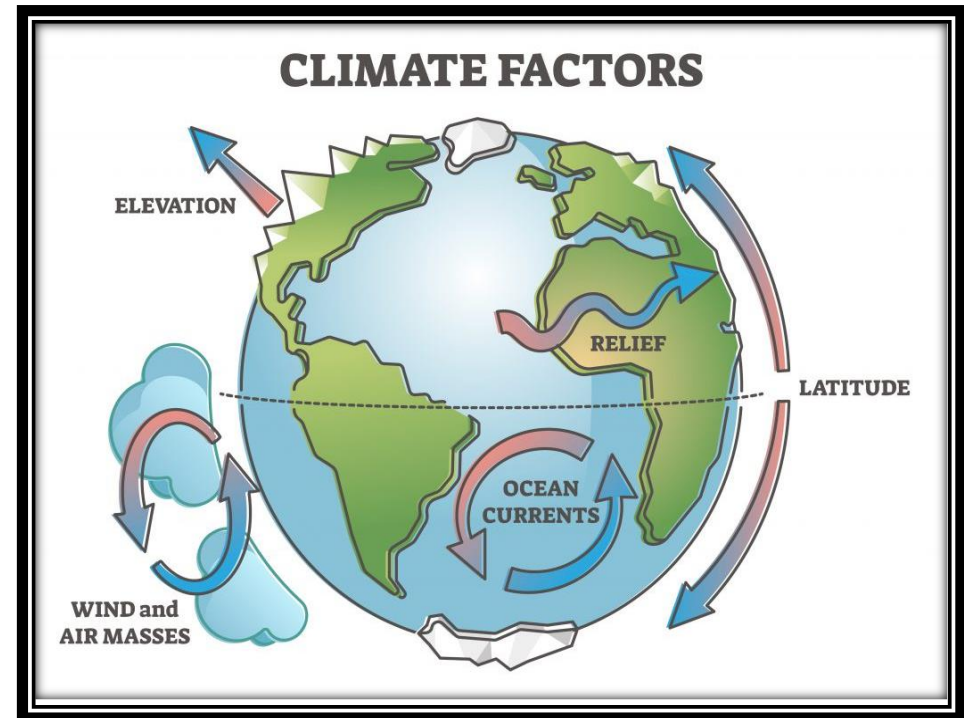
Climate vs Weather

- ▶ Weather is the state of the atmosphere at a particular place at a particular moment.
- ▶ Climate is the average weather conditions in an area over a long period of time.



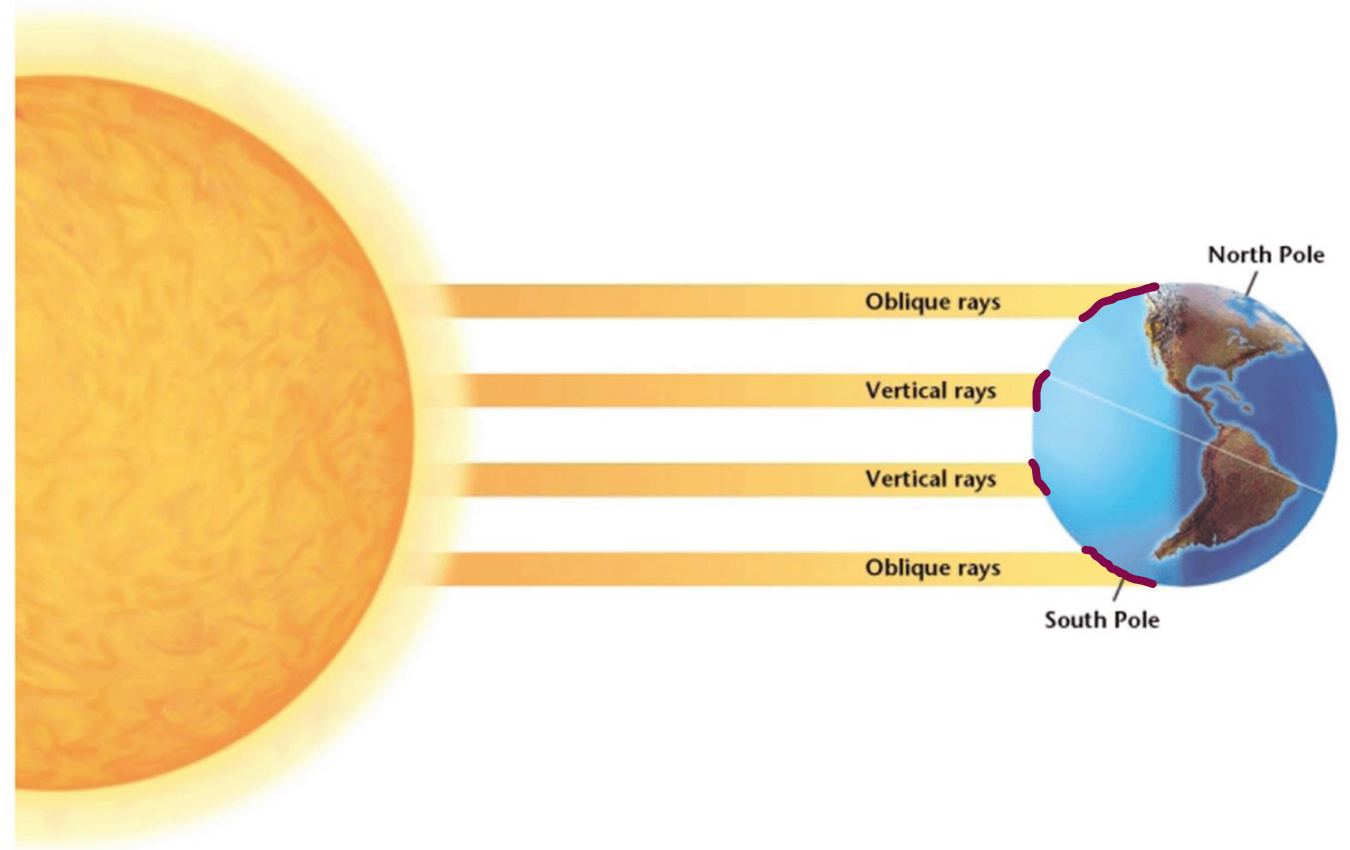
What Determines Climate?

- ▶ Climate is determined by a variety of factors that include:
 - ▶ atmospheric circulation patterns
 - ▶ oceanic circulation patterns
 - ▶ local geography of an area
- ▶ The most important of these factors is latitude



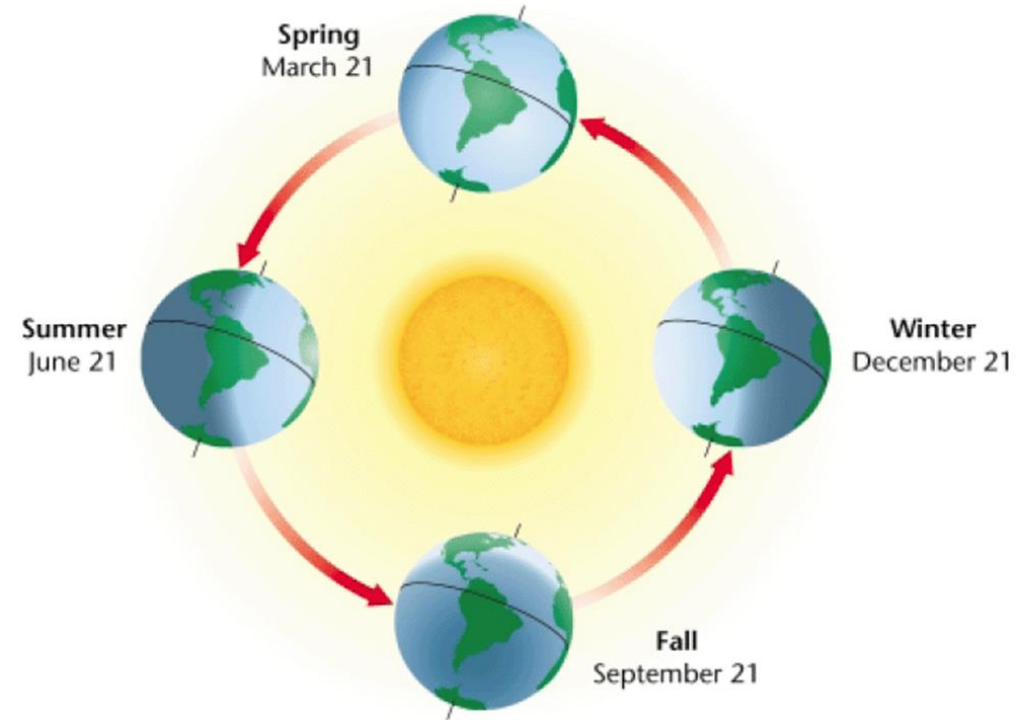
Latitude

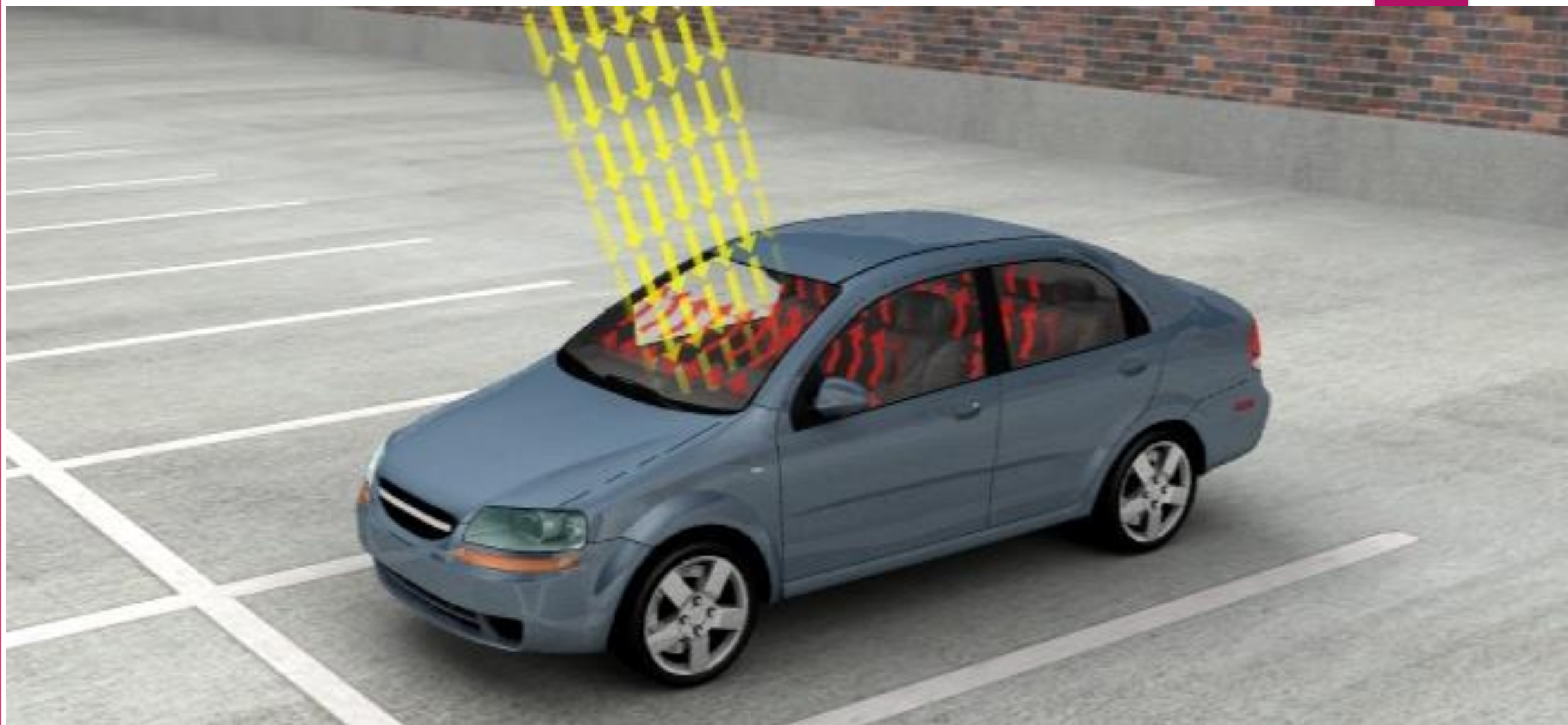
- ▶ Latitude is the distance north or south from the equator and is expressed in degrees.
- ▶ 0° latitude = equator
- ▶ 90° north = North Pole
- ▶ 90° south = South Pole
- ▶ Latitude affects climate because the amount of solar energy an area receives depends on its latitude.



Seasonal Changes in Climate

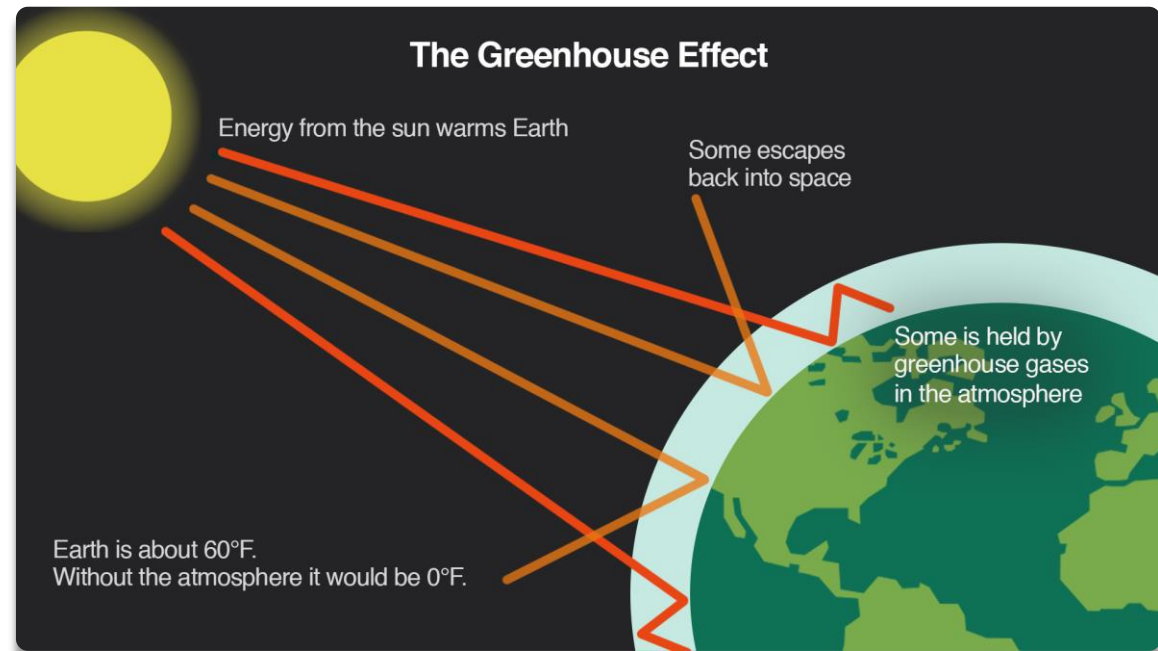
- ▶ During summer in the Northern Hemisphere, the Northern Hemisphere tilts toward the sun and receives direct sunlight.
- ▶ Therefore, the amount of time available for the sun to heat the Earth becomes greater.
- ▶ During summer in the Northern Hemisphere, the Southern Hemisphere tilts away from the sun and receives less direct sunlight.
- ▶ But, during the summer in the Southern Hemisphere, the situation is reversed.





The Greenhouse Effect

- ▶ Solar radiation enters the atmosphere warming Earth's surface.
- ▶ Energy is then reradiated off Earth's surface.
- ▶ Some of that energy escapes back into space.
- ▶ The rest of it undergoes the greenhouse effect. It is absorbed by the atmosphere and warms the air.
- ▶ Without the greenhouse effect, the Earth would be too cold for life to exist.



Greenhouse Gases

Major Greenhouse Gases and Their Sources

Carbon dioxide, CO₂: burning fossil fuels and deforestation

Chlorofluorocarbons (CFCs): refrigerants, aerosols, foams, propellants, and solvents

Methane, CH₄: animal waste, biomass burning, fossil fuels, landfills, livestock, rice paddies, sewage, and wetlands

Nitrous Oxide, N₂O: biomass burning, deforestation, burning of fossil fuels, and microbial activity on fertilizers in the soil

Water vapor, H₂O: evaporation, plant respiration

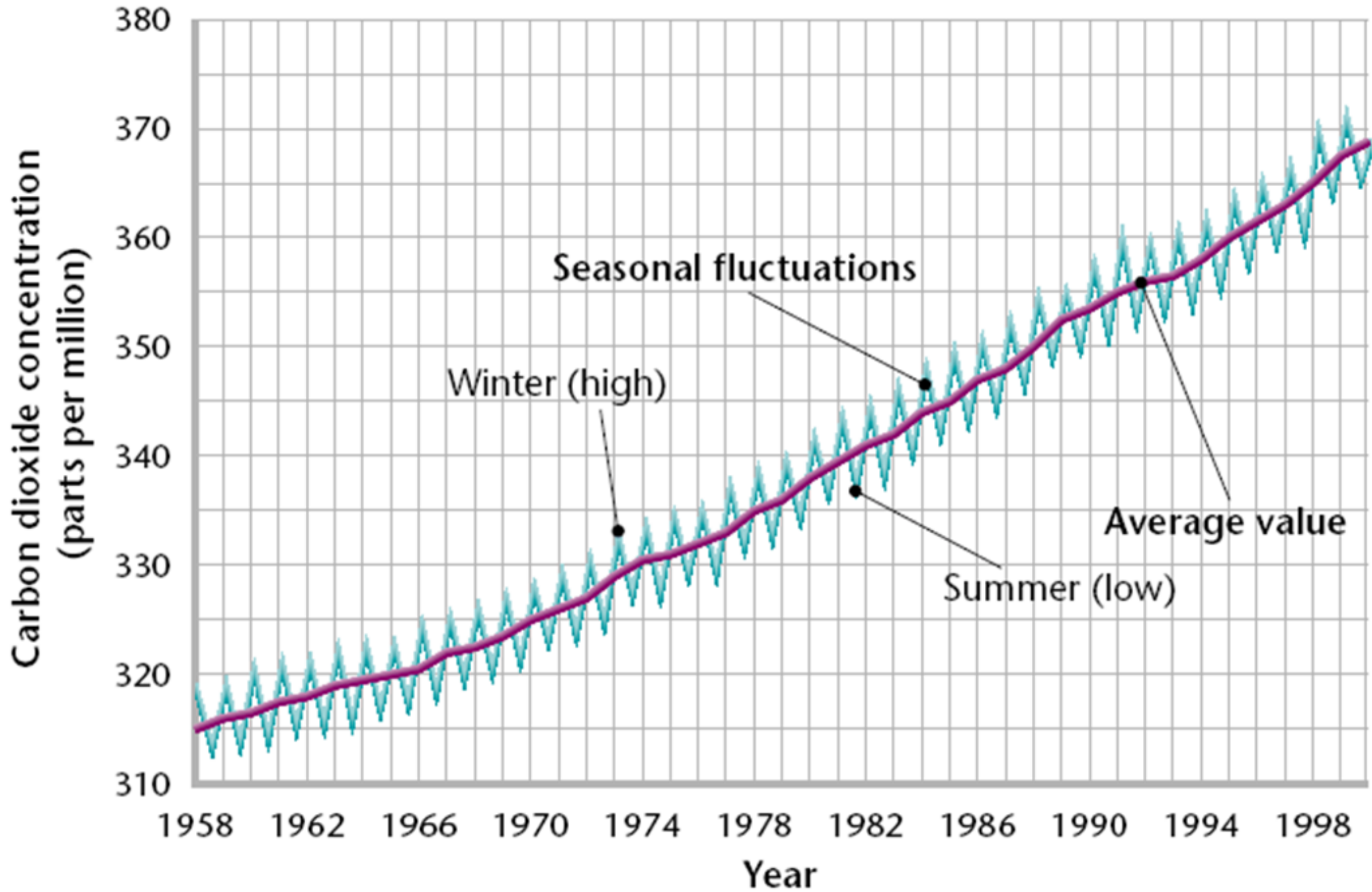
- ▶ Not every gas in our atmosphere absorbs heat in this way.
- ▶ A greenhouse gas is a gas composed of molecules that absorb and radiate infrared radiation from the sun.
- ▶ The major greenhouse gases are water vapor, carbon dioxide, methane, and nitrous oxide.

Charles Keeling

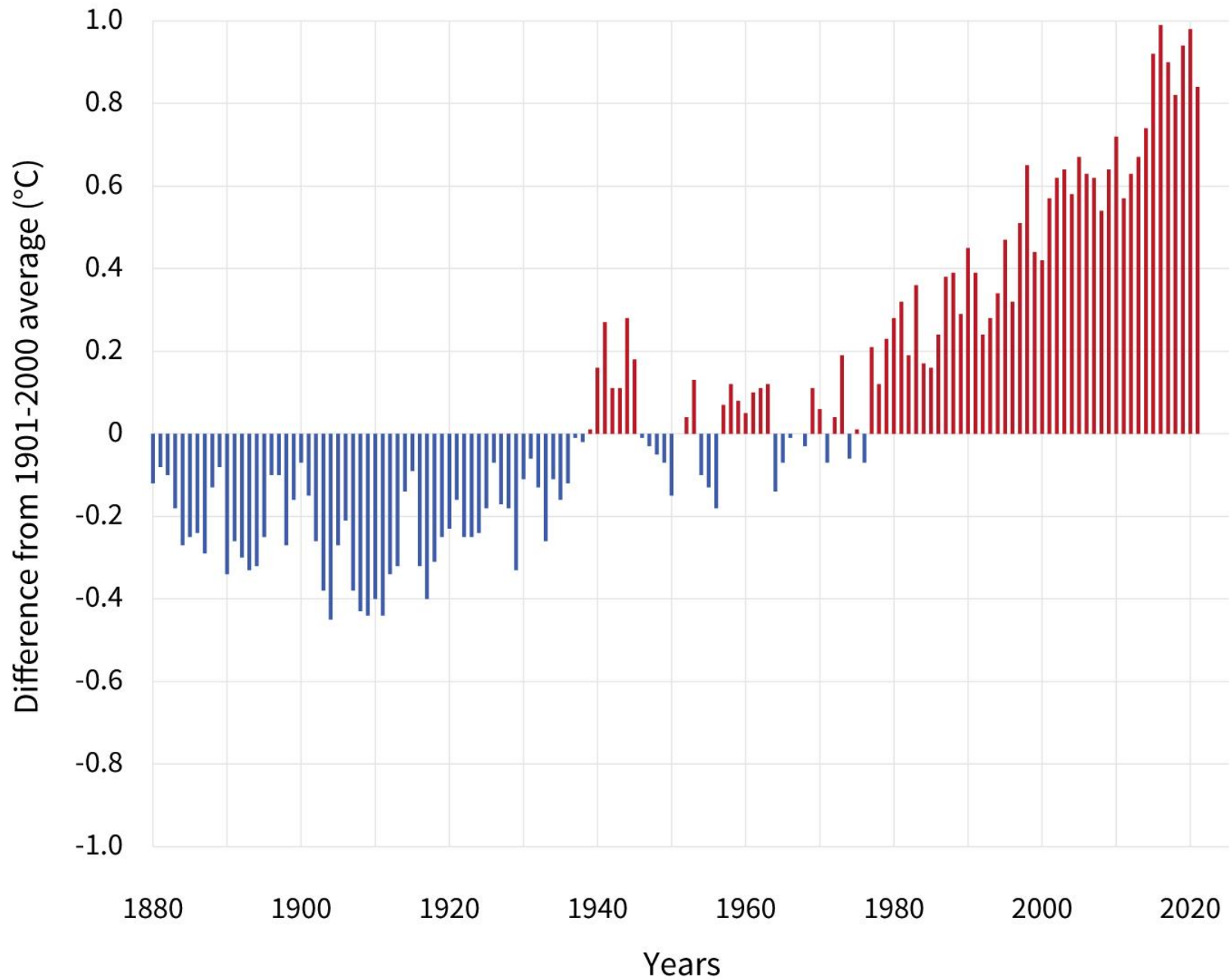
- ▶ In 1958, Charles Keeling installed an instrument at the top of the volcano Mauna Loa in Hawaii.
 - ▶ He wanted to measure the amount of carbon dioxide in the air, far away from forests and cities.
- ▶ After a few years, it was obvious that the levels of carbon dioxide were changing.



Increase in Atmospheric Carbon Dioxide, 1958–2000



GLOBAL AVERAGE SURFACE TEMPERATURE



Greenhouse Gases and the Earth's Temperature

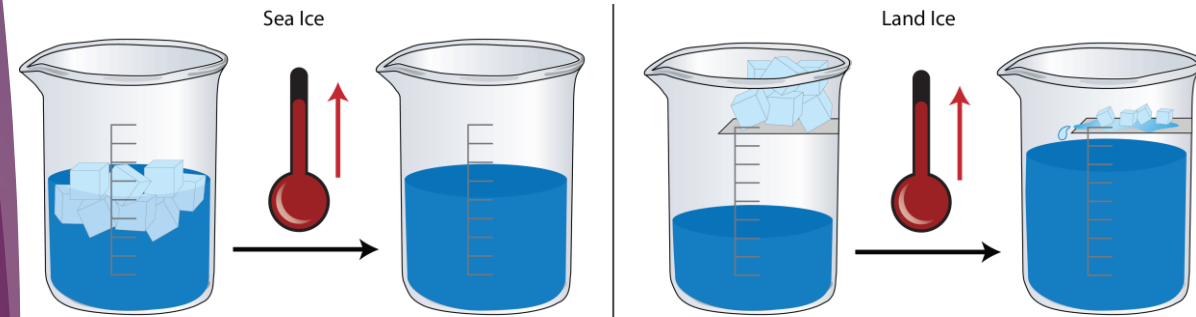
- ▶ Today, we are releasing more carbon dioxide than any other greenhouse gas into the atmosphere.
- ▶ The number one cause of this is the burning fossil fuels.
- ▶ Other causes include...
 - ▶ Deforestation of tropical rainforest
 - ▶ Cattle Farming



The Consequences of a Warmer Earth

- ▶ The impacts of global warming could include a number of potentially serious environmental problems.
 - ▶ global rise in sea level
 - ▶ global weather patterns
 - ▶ impacts on human health
 - ▶ agriculture
 - ▶ animal and plant populations

<https://www.youtube.com/watch?v=1Kkrlh0FbBM>



Reducing the Risk

- ▶ The **Kyoto Protocol** is an international treaty in which countries agreed to reduce their emissions of carbon dioxide and other gases that may contribute to global warming.
 - ▶ In March of 2001, the United States decided not to ratify the Kyoto Protocol.
- ▶ The **Paris Agreement** is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse-gas-emissions signed in 2016.
 - ▶ On June 1, 2017, the United States announced that it would cease all participation in the 2015 Paris Agreement on climate change mitigation.

