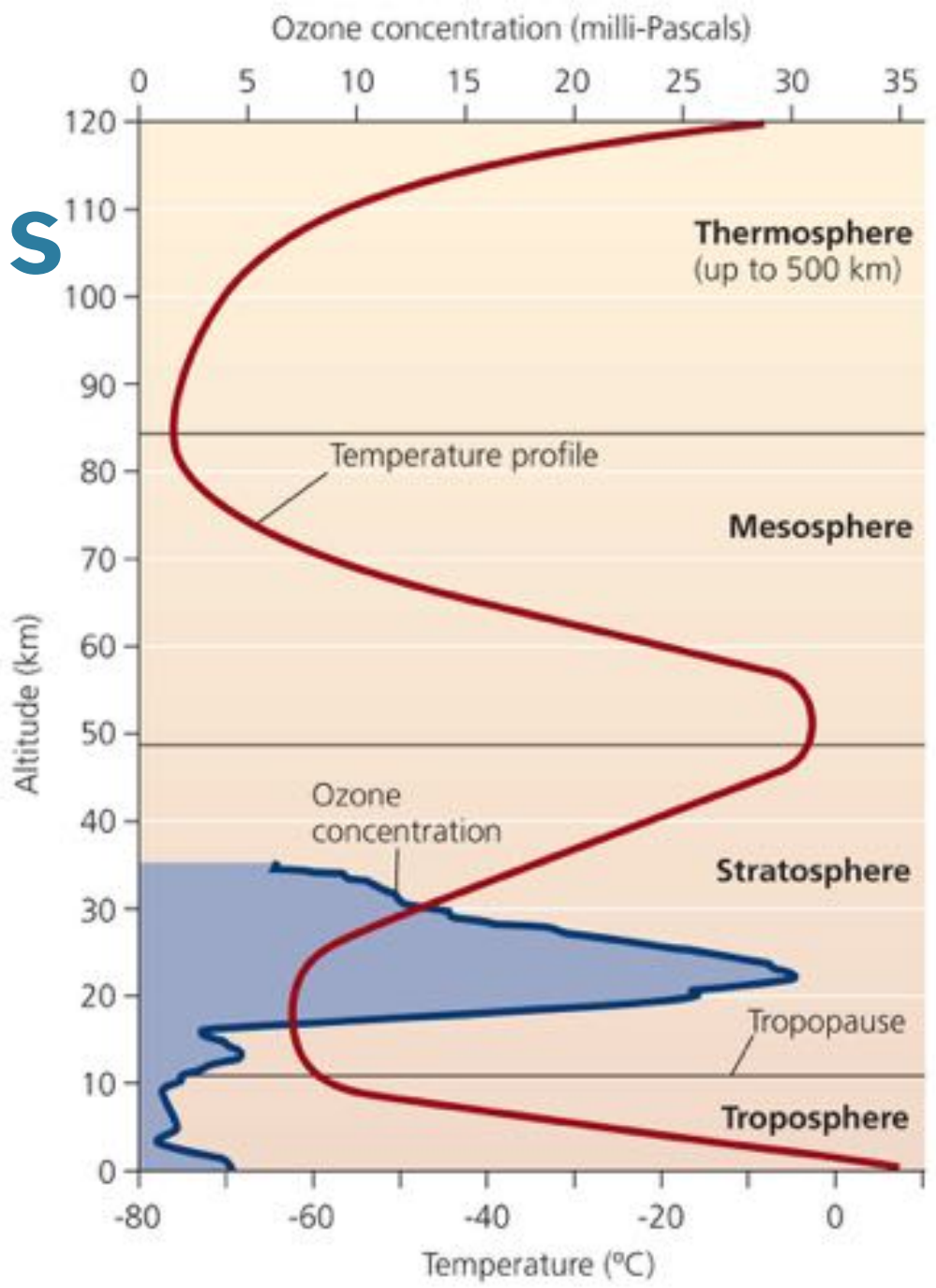
Skydiving: Queenstown, NZ

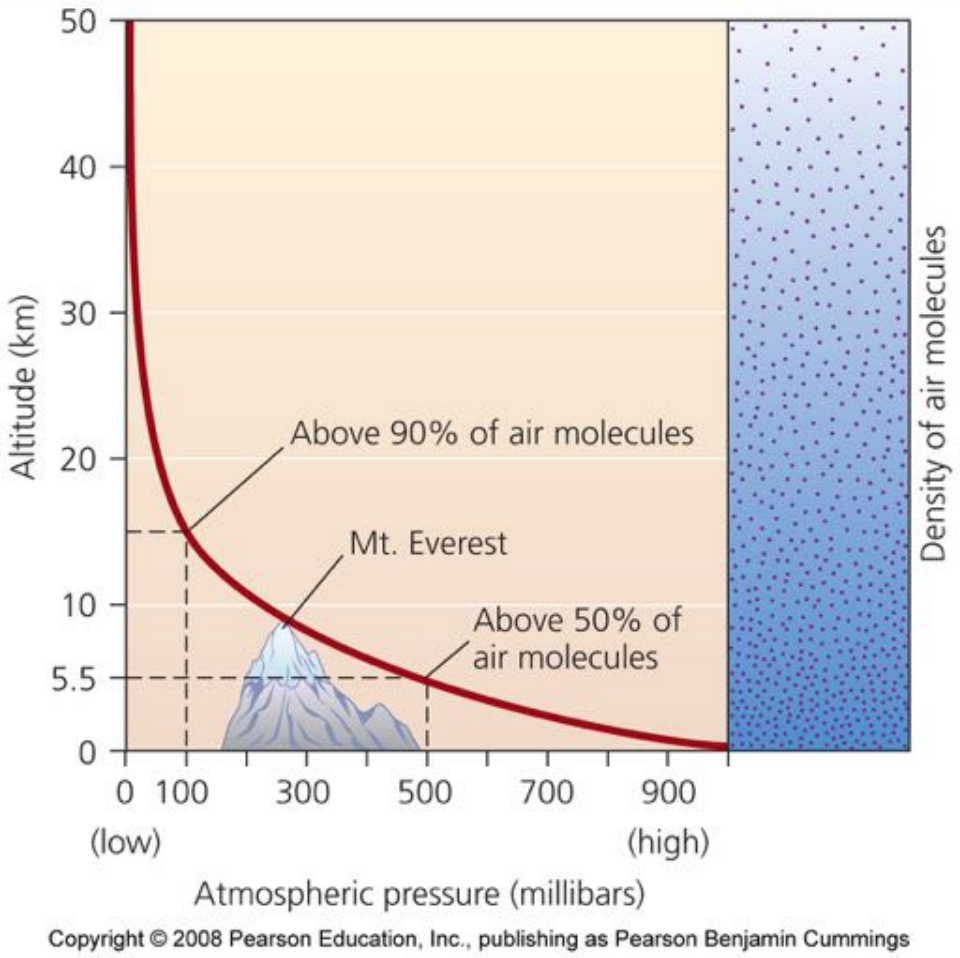
The Layers of the Atmosphere

The Atmosphere's Four Layers



Atmospheric Properties

- **Atmospheric Pressure:** Measures the force per unit area produced by a column of air
  - Decreases with altitude



Coors Field, Denver CO:

Why do baseballs fly more efficiently at high altitudes?

Atmospheric Properties

- **Relative Humidity:** The ratio of water vapor a given volume of air contains to the amount it could contain at a given temperature
- **Temperature:** Varies with location and time

Colorado Springs, CO:

- Need to drink a lot of water
- Altitude sickness

Humidity


IN THIS HUMIDITY, I MAY SERIOUSLY CONSIDER USING the COMMUTER SWIM LANES...
HEATWAVE

Solar Energy: Did You Know

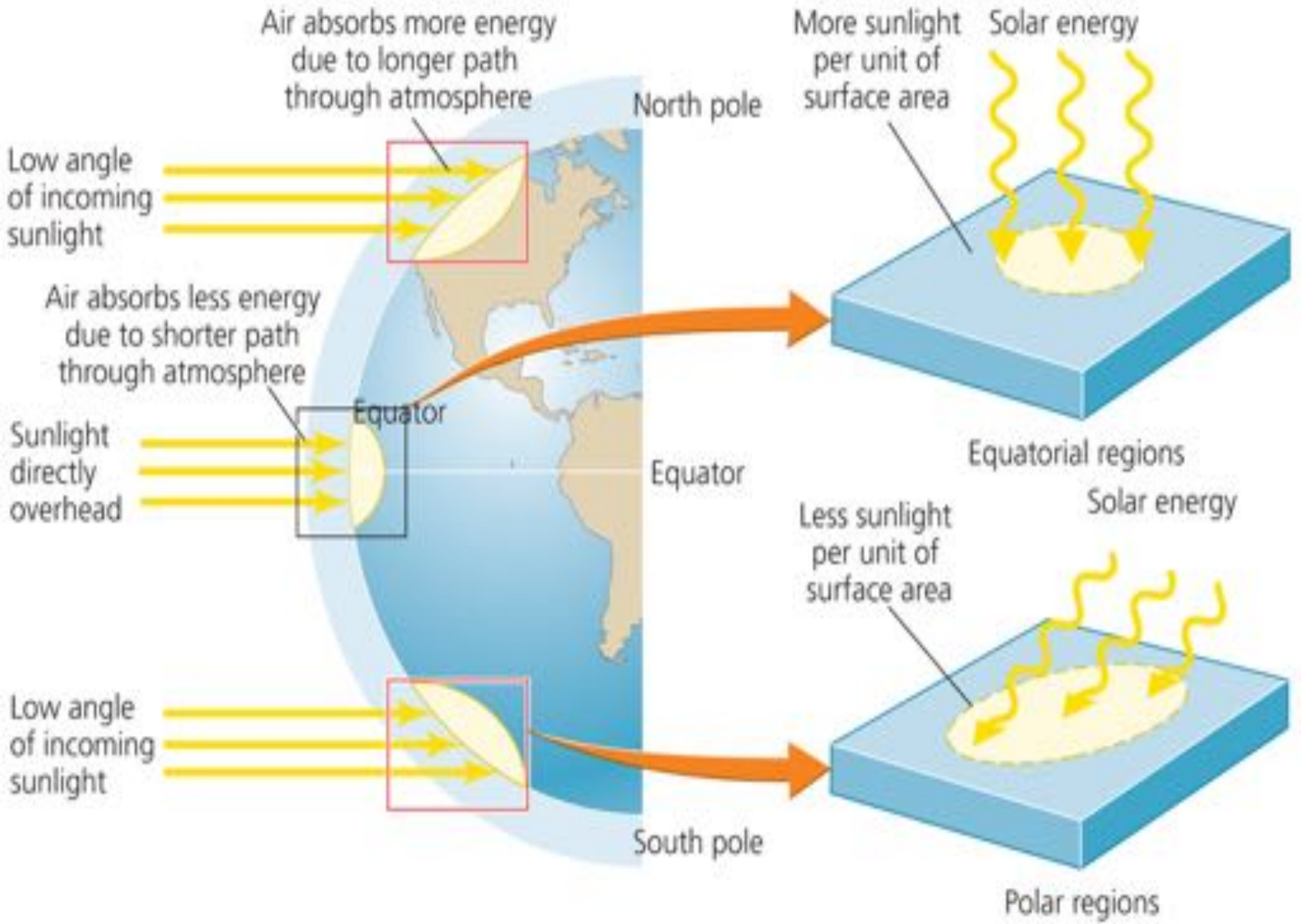
- It would take 44 million power plants to equal the energy coming from the Sun?
- With all of that energy out there, it seems as if Earth should just keep getting hotter. Why doesn't this happen?

Not ALL heat energy reaches the surface of the Earth.

- The energy that does is called *insolation.*
- This is either reflected or absorbed when it reaches the surface of the Earth.

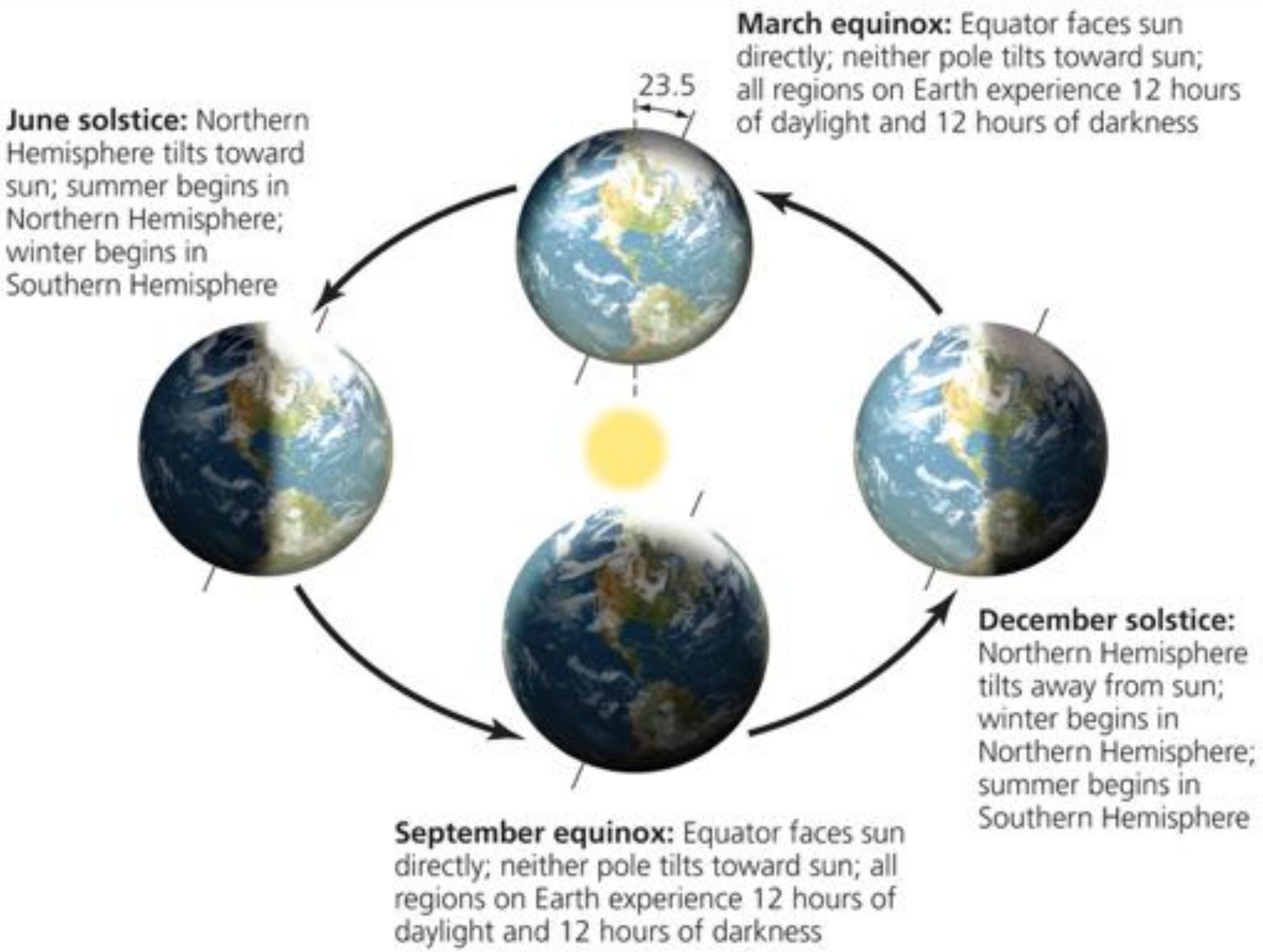
Solar Energy Heats The Atmosphere

- The spatial relationship between the Earth and sun determines the amount of solar energy striking the Earth
- Energy from the sun :
  - Heats air
  - Moves air
  - Creates seasons
  - Influences weather and climate
- Solar radiation is highest near the equator



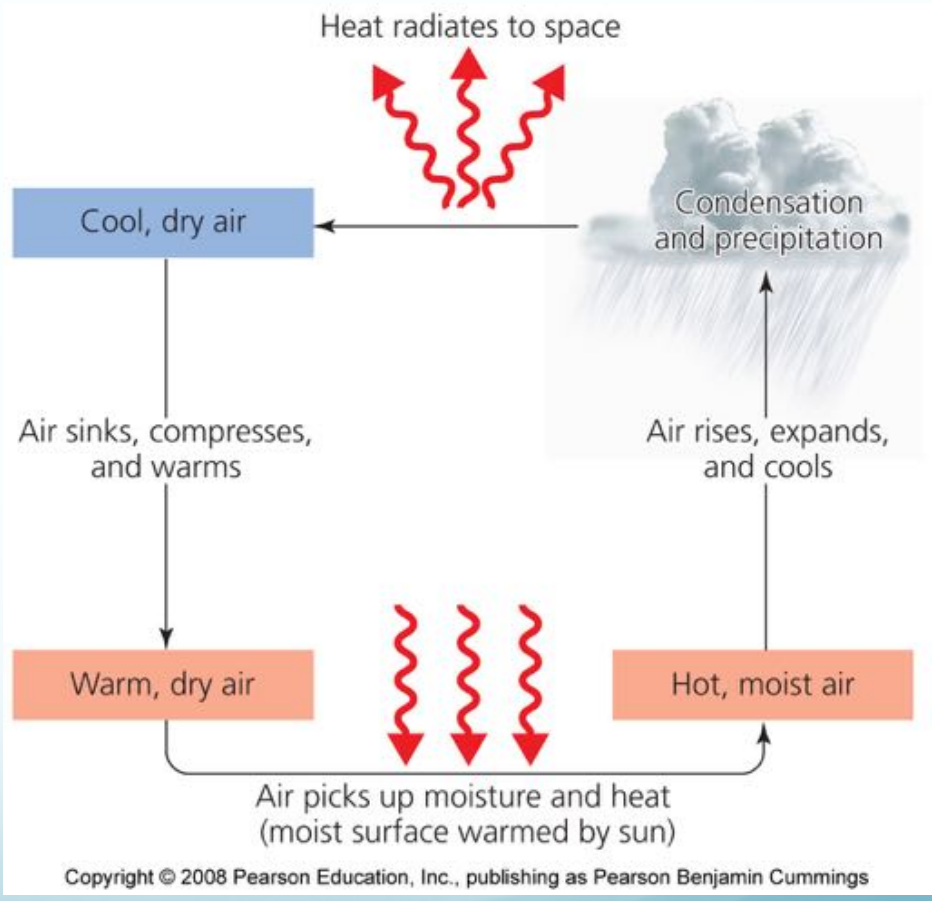
Solar Energy Creates Seasons

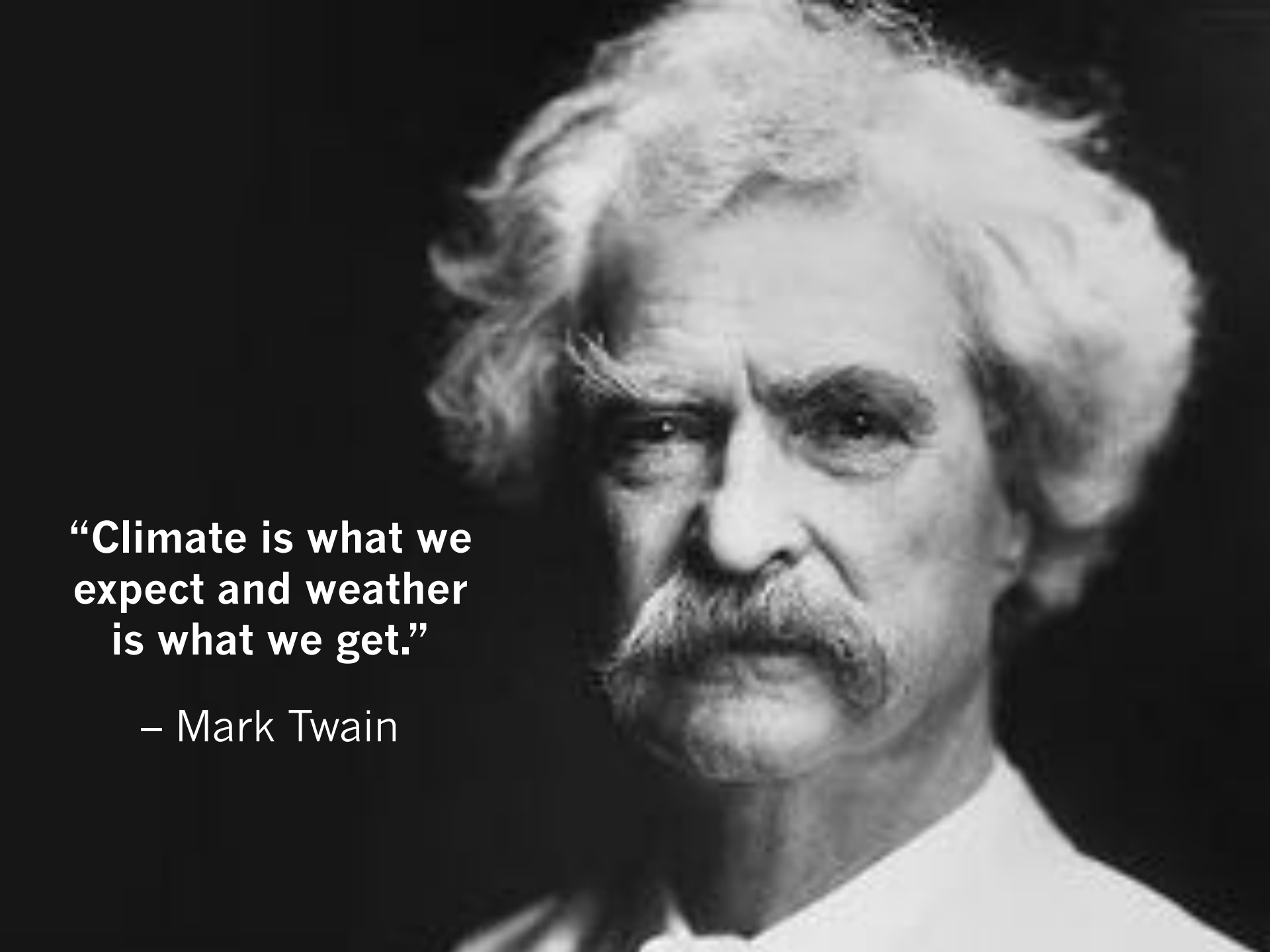
- Because the Earth is tilted (23.5°)
  - Each hemisphere tilts toward the sun (and will experience summer during the periods of most intense sunlight exposure) for half the year
  - Results in a change of seasons
  - Equatorial regions are unaffected by this tilt, so days average 12 hours through the year



Solar Energy Causes Air To Circulate

- Air near Earth's surface is warmer and moister than air at higher latitudes
- **Convective Circulation:** Less dense, warmer air rises and creates vertical currents
  - Rising air expands and cools
  - Cool air descends and becomes denser, replacing warm air
  - Influences both weather and climate



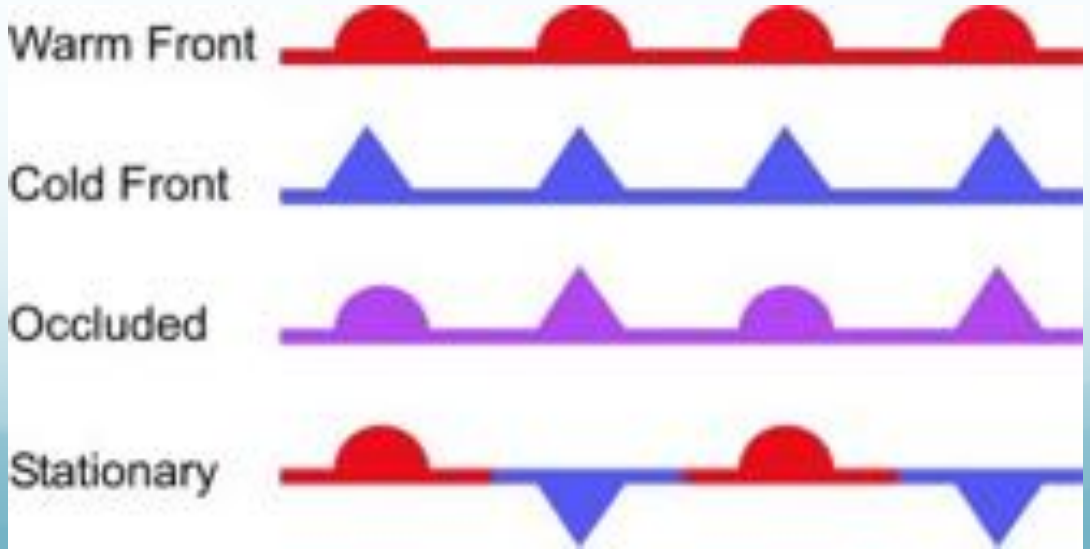

“Climate is what we expect and weather is what we get.”
– Mark Twain

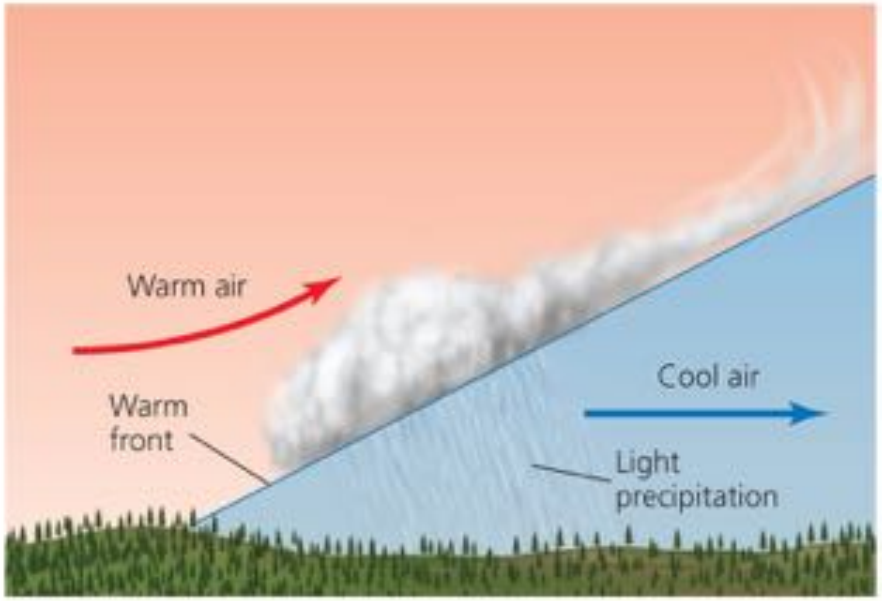
The Atmosphere Drives Weather and Climate

- **Weather:** Specifies atmospheric conditions over short time periods and within a small geographic areas
- **Climate:** Describes patterns of atmospheric conditions across large geographic regions over long periods of time
- Mark Twain said "Climate is what we expect; weather is what we get"

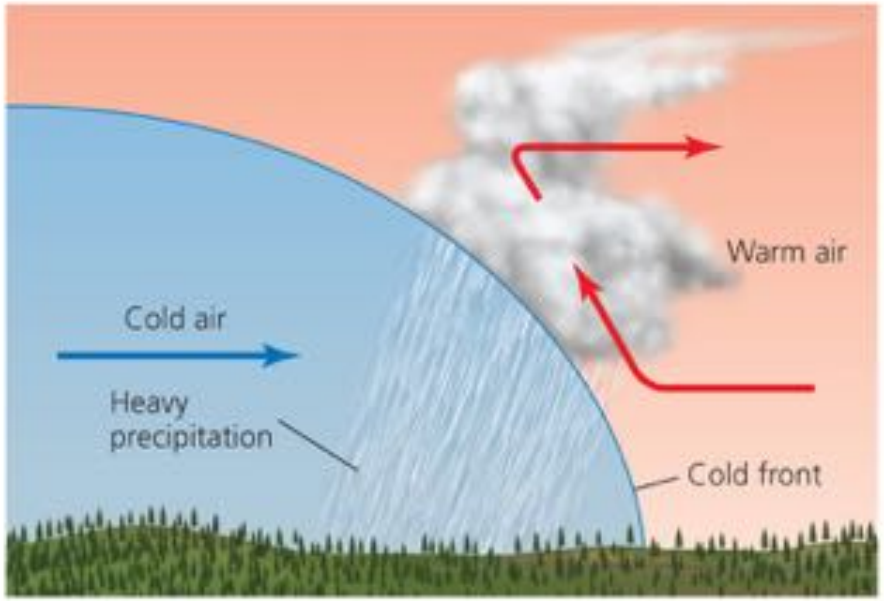
Air Masses Produce Weather

- **Front:** The boundary between air masses that differ in temperature, moisture, and density
- **Warm Front:** The boundary where warm moist air replaces colder, drier air
- **Cold Front:** The boundary where colder, drier air displaces warmer, moister air





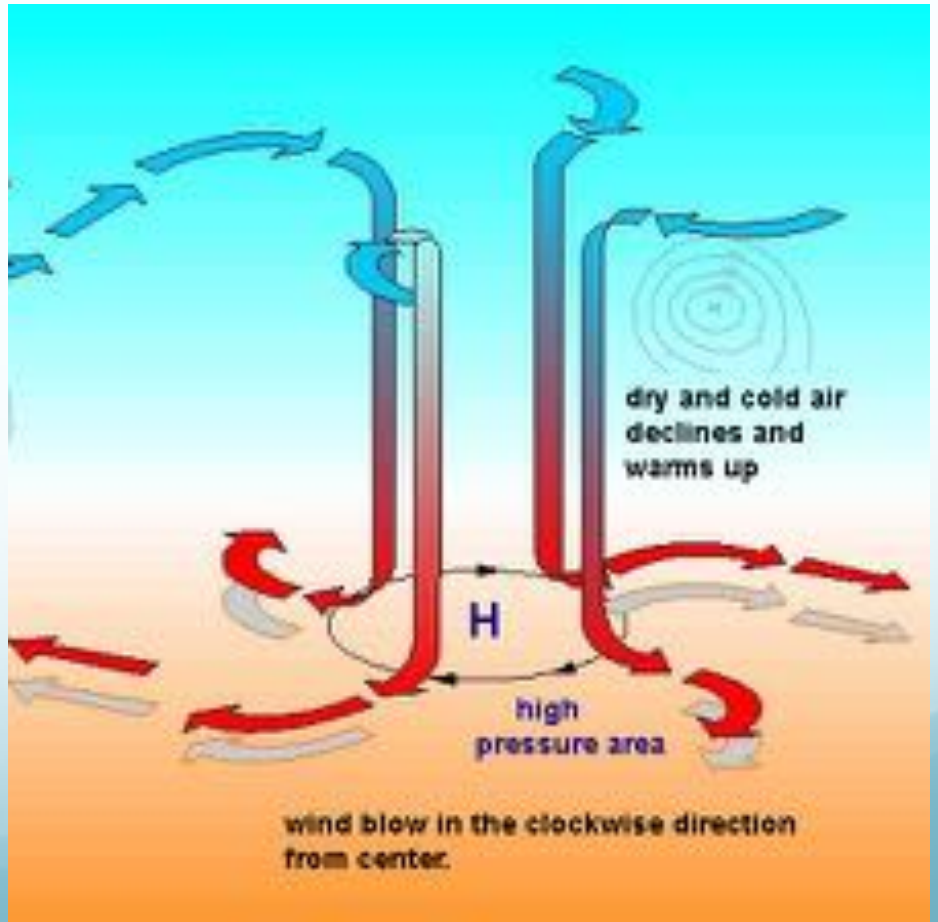
(a) Warm front



(b) Cold front

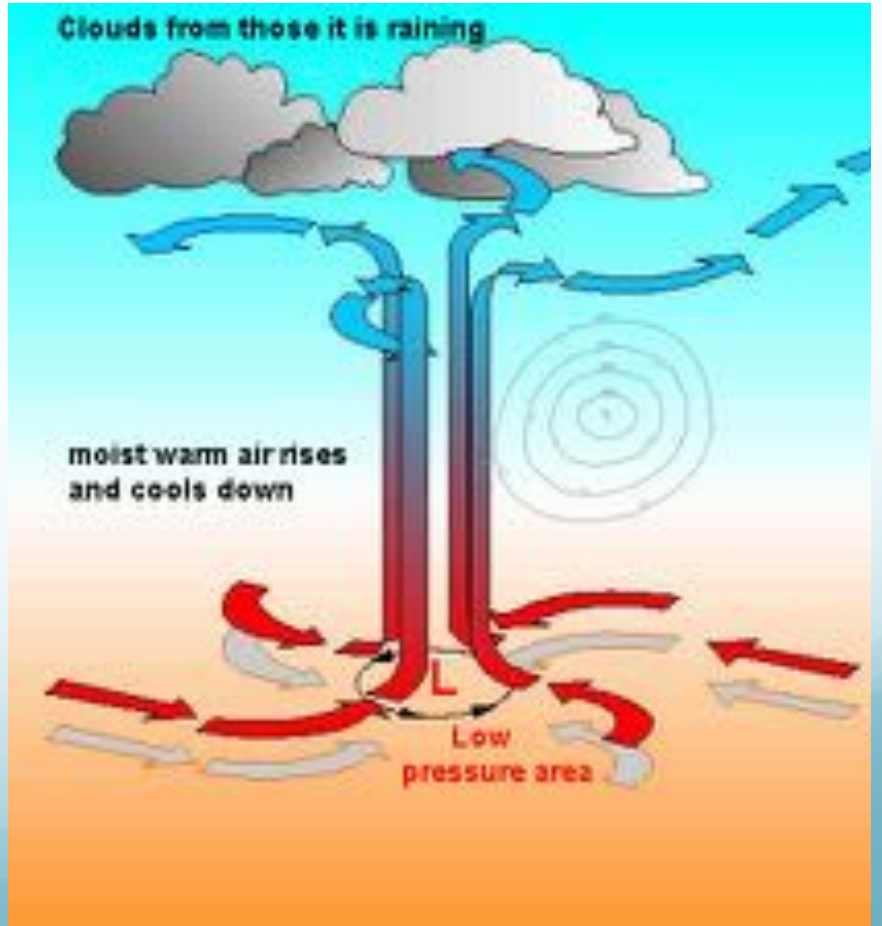
Air Masses Have Different Atmospheric Pressures

- **High-Pressure System:** Air that moves away from a center of high pressure as it descends
  - Brings fair weather



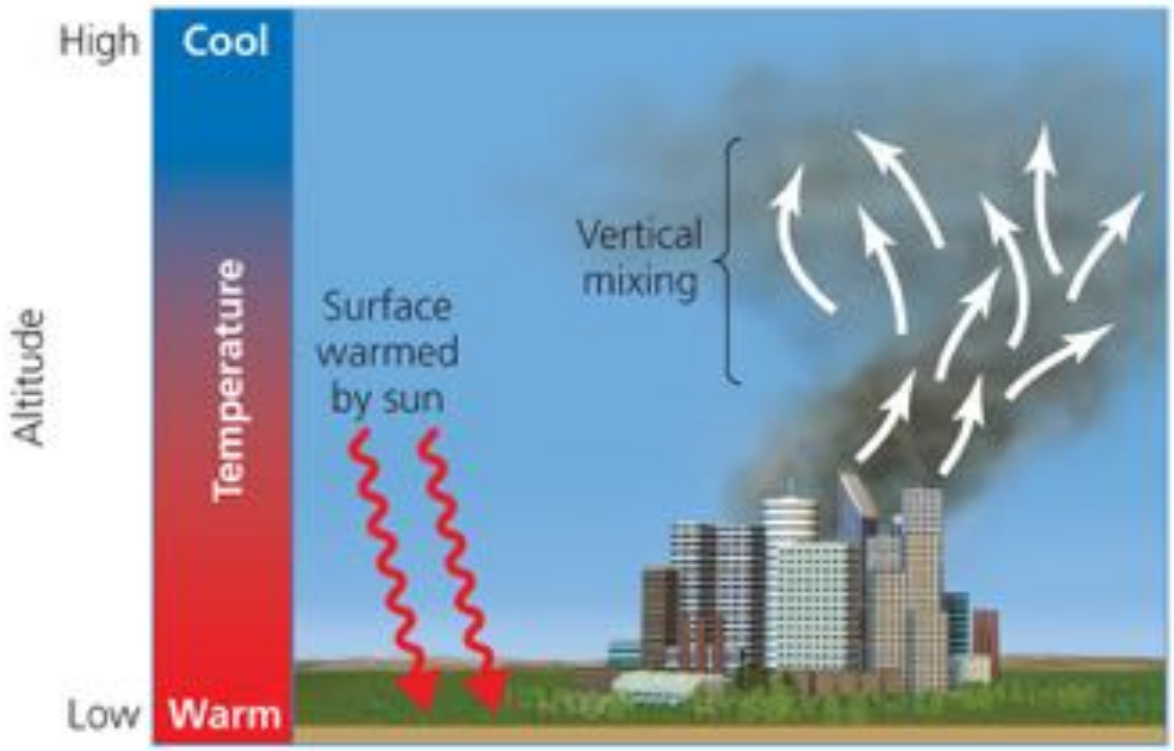
Air Masses Have Different Atmospheric Pressures

- **Low-Pressure System:** Air moves toward the low atmospheric pressure at the center of the system and spirals upward
  - Clouds and precipitation



Normal Conditions

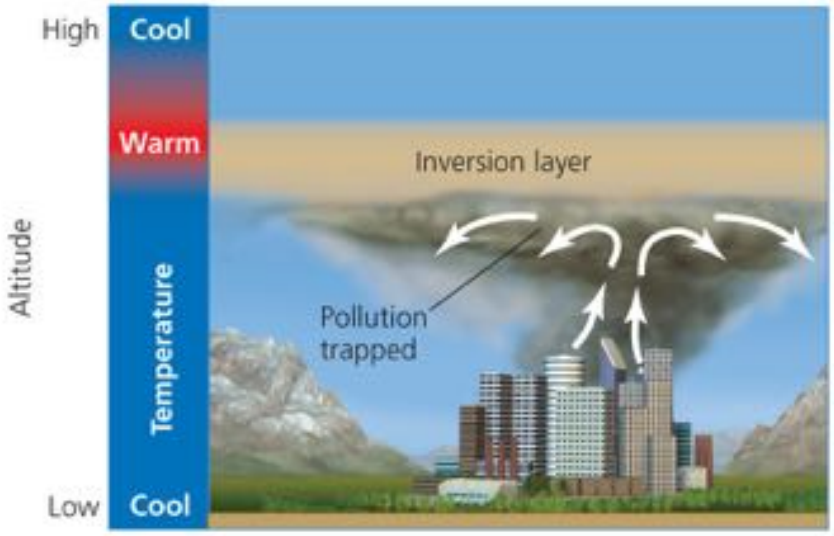
- Usually, tropospheric air temperature decreases as altitude increases
  - Warm air rises, causing vertical mixing



(a) Normal conditions

Thermal Inversion

- **Thermal Inversion:** A layer of cool air occurs beneath a layer of warmer air
- **Inversion Layer:** The band of air in which temperature rises with altitude
  - Denser, cooler air at the bottom of the layer resists mixing

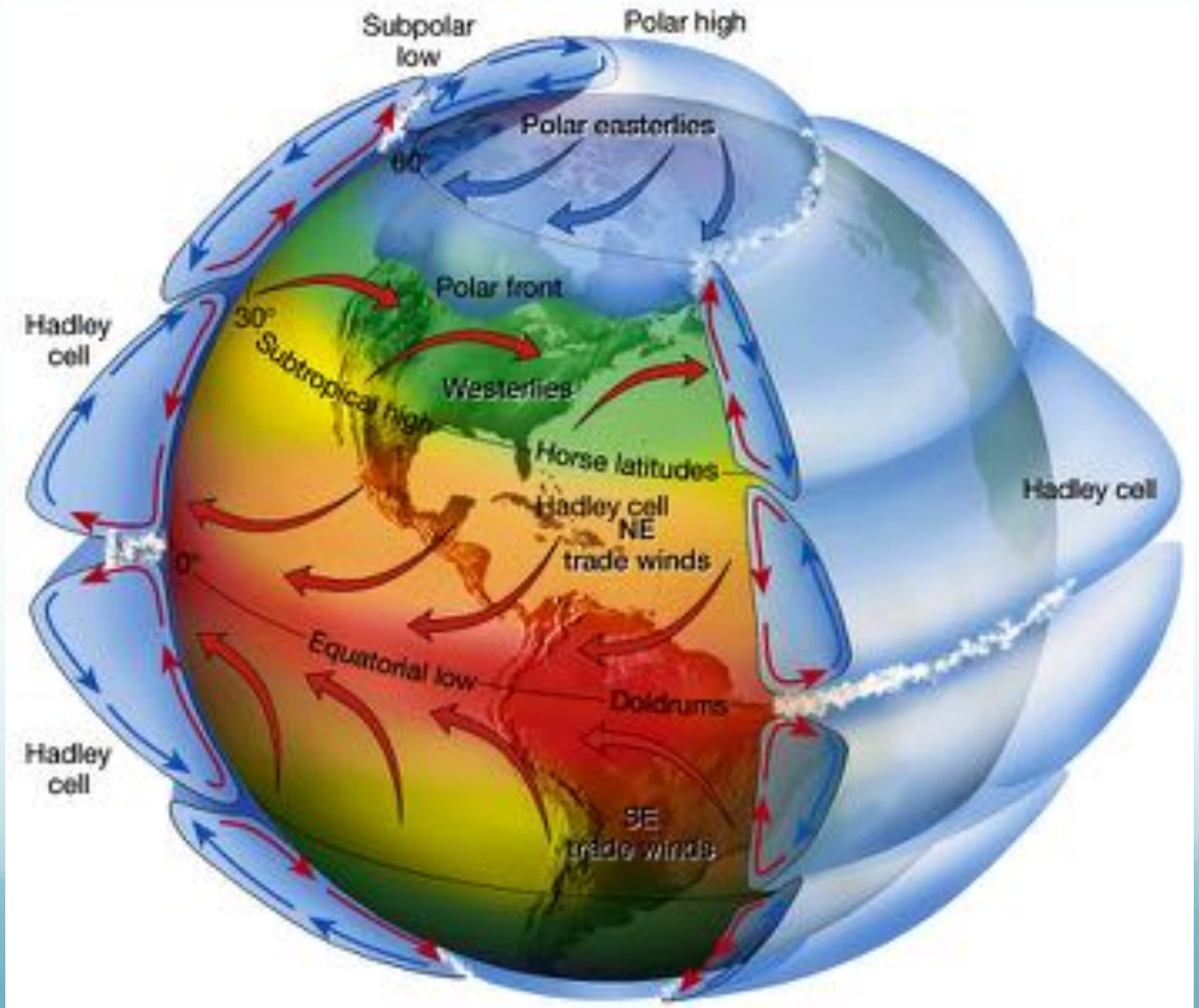


(b) Thermal inversion

The Atmosphere

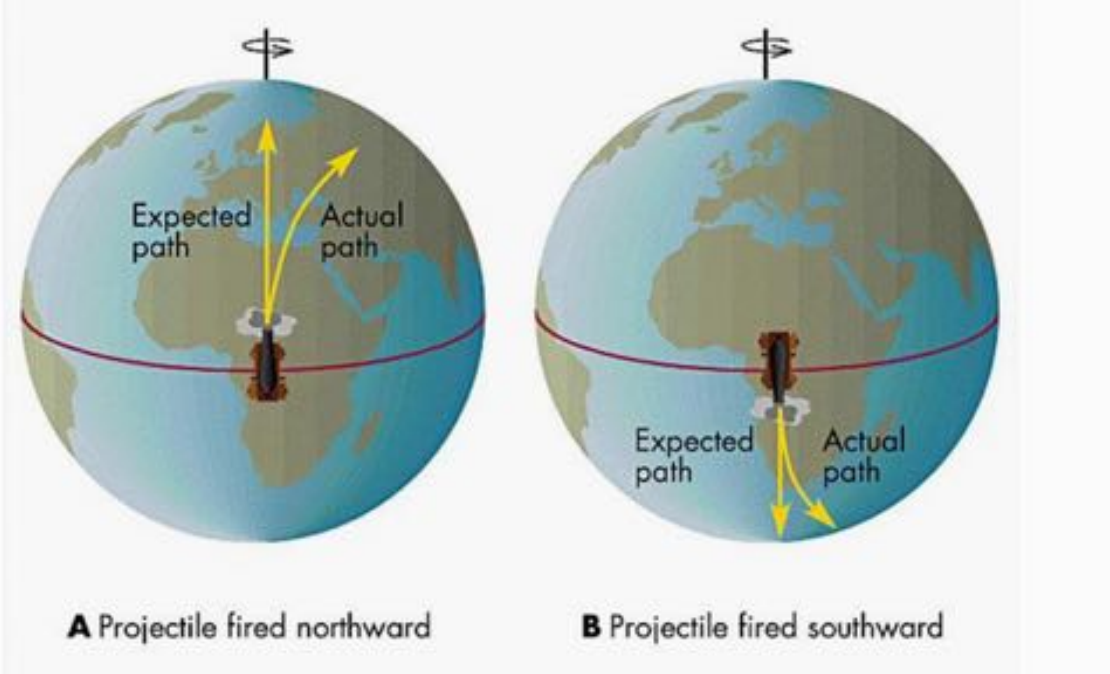
- Convective currents contribute to climatic patterns and affect moisture distribution
- **Hadley Cells:** Near the equator, surface air warms, rises, and expands
  - Releases moisture and heavy rainfall near the equator
- **Ferrel Cells and Polar Cells:** Lift air
  - Creates precipitation at 60 degrees latitude north and south
  - Causes air to descend at 30 degrees latitude

Atmospheric Convection Cells



Global Wind Patterns

- The atmospheric cells interact with Earth's rotation to produce global wind patterns
  - As Earth rotates, equatorial regions spin faster
- **Coriolis Effect:** The north-south air currents of the convective cells appear to be deflected from a straight path
  - Results in curving global wind patterns



Wind Patterns

- **Doldrums:** Near the equator
  - Few winds
- **Trade Winds:** Between the equator and 30 degrees latitude
  - Blow from east to west
- **Westerlies:** From 30 to 60 degrees latitude
  - Originate from the west and blow east
- People used these winds to sail their ships across the ocean

Essay Question:
Turn & Talk

1. How does solar energy influence weather and climate?
2. How do Hadley, Ferrel, and polar cells help to determine long-term climatic patterns and the location of biomes?

Essay Question:
Turn & Talk

1. What factors led to the deadly smog in London in 1952?
2. Describe a thermal inversion.