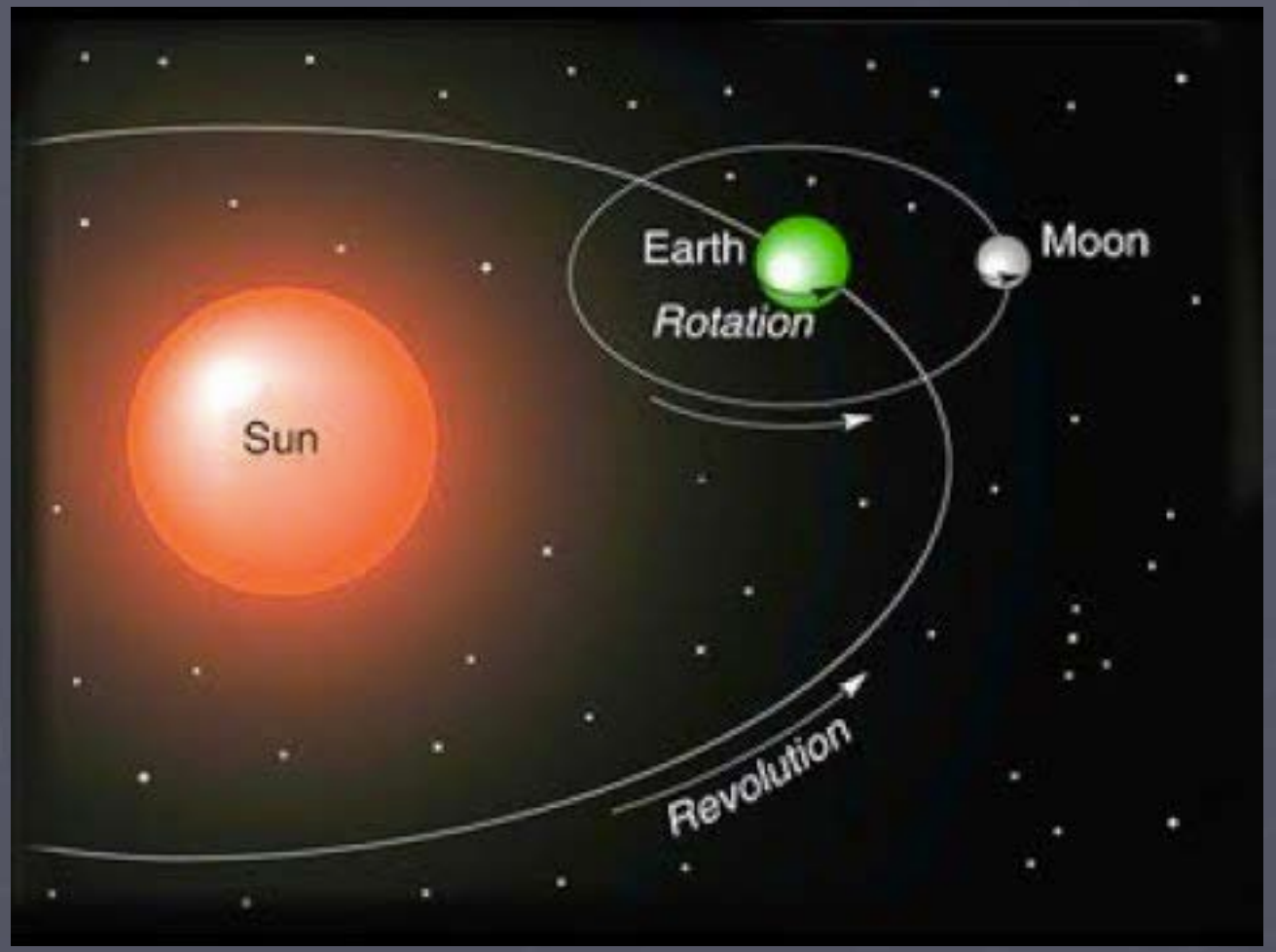
Earth-Sun Relations

Influence of the Sun on Earth

Chapter 2

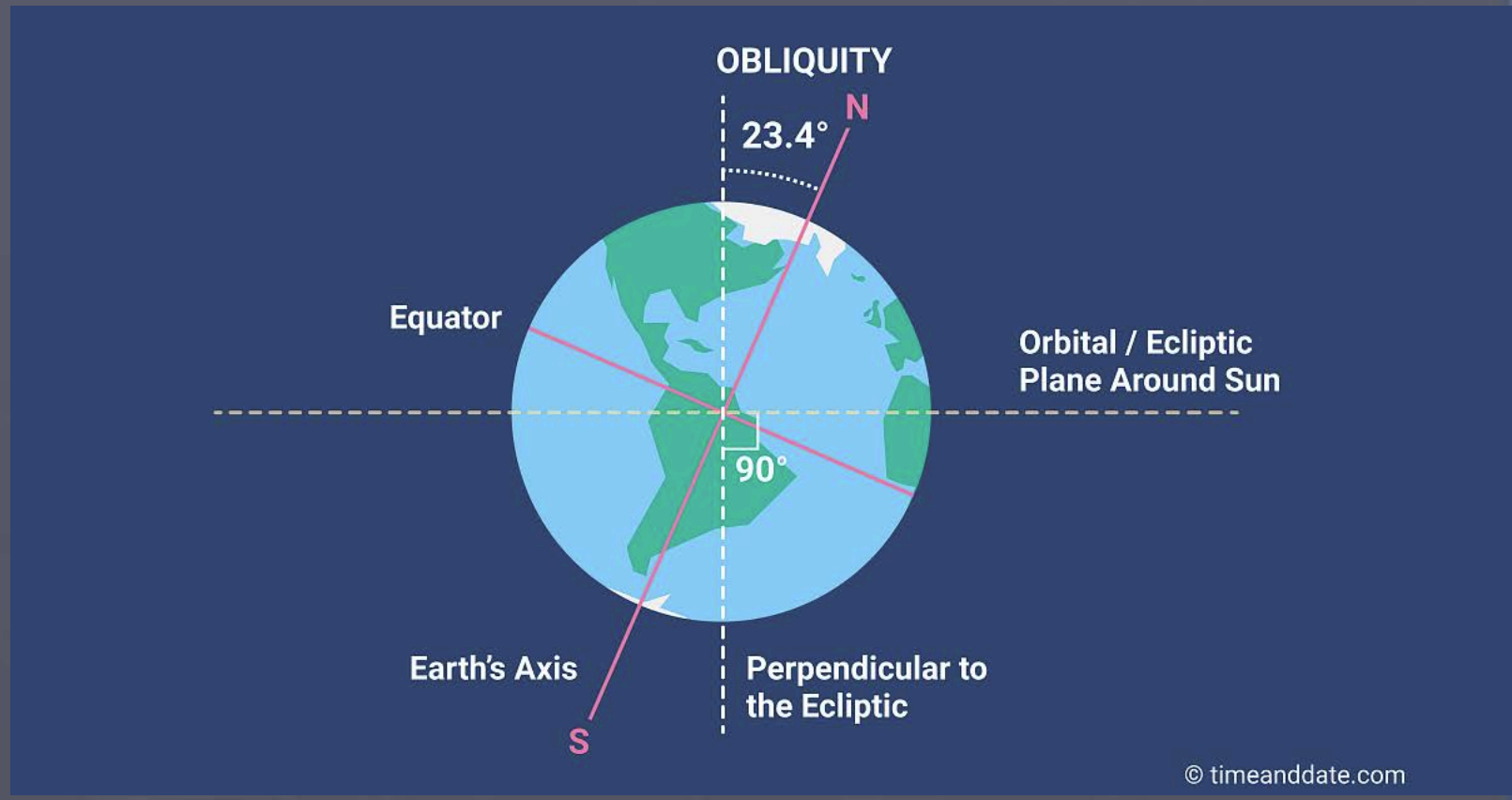
Earth's Rotations and Revolutions

- Earth completes one Revolution around the sun every 365 ¼ days
  - 30 kilometers a second or 67,000 miles an hour
- Earth completes one rotation every 24 hours
  - 460 meters a second or 1000 miles an hour



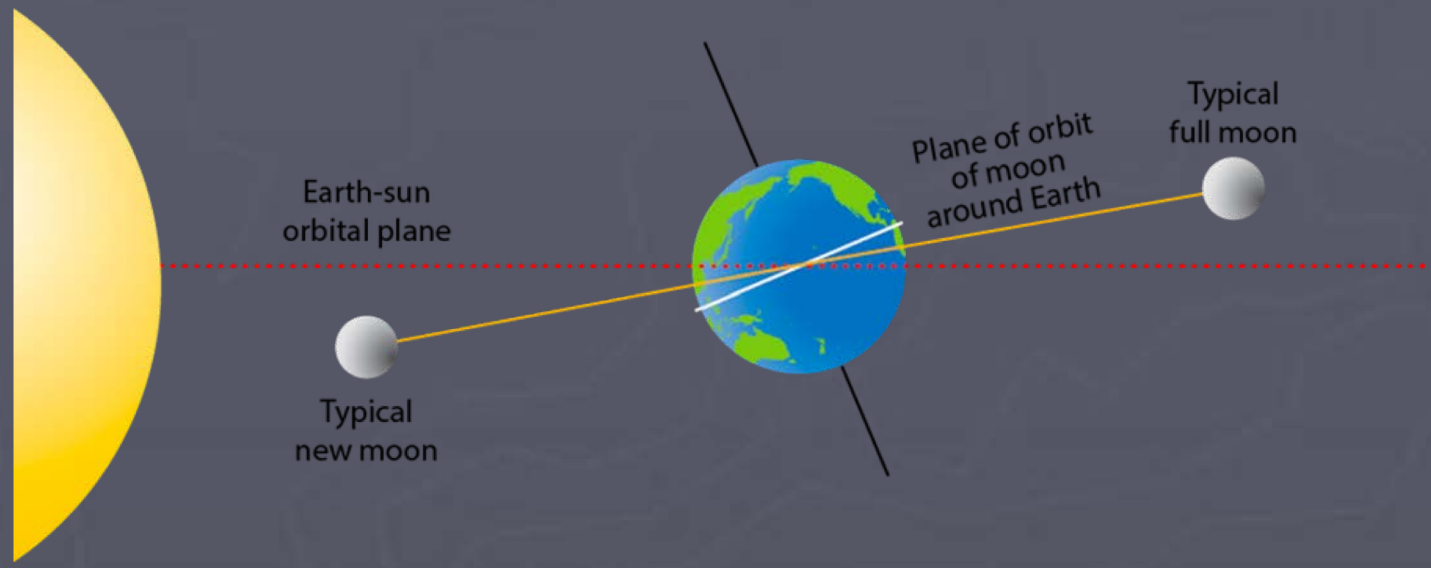
Earth’s Obliquity

- Earth’s tilt is roughly 23.45 degrees perpendicular relative to the Elliptical Plane
  - Roughly point’s to Polaris
- Earth’s precesses (wobbles) leads to variation of up to 1 degree every 72 years

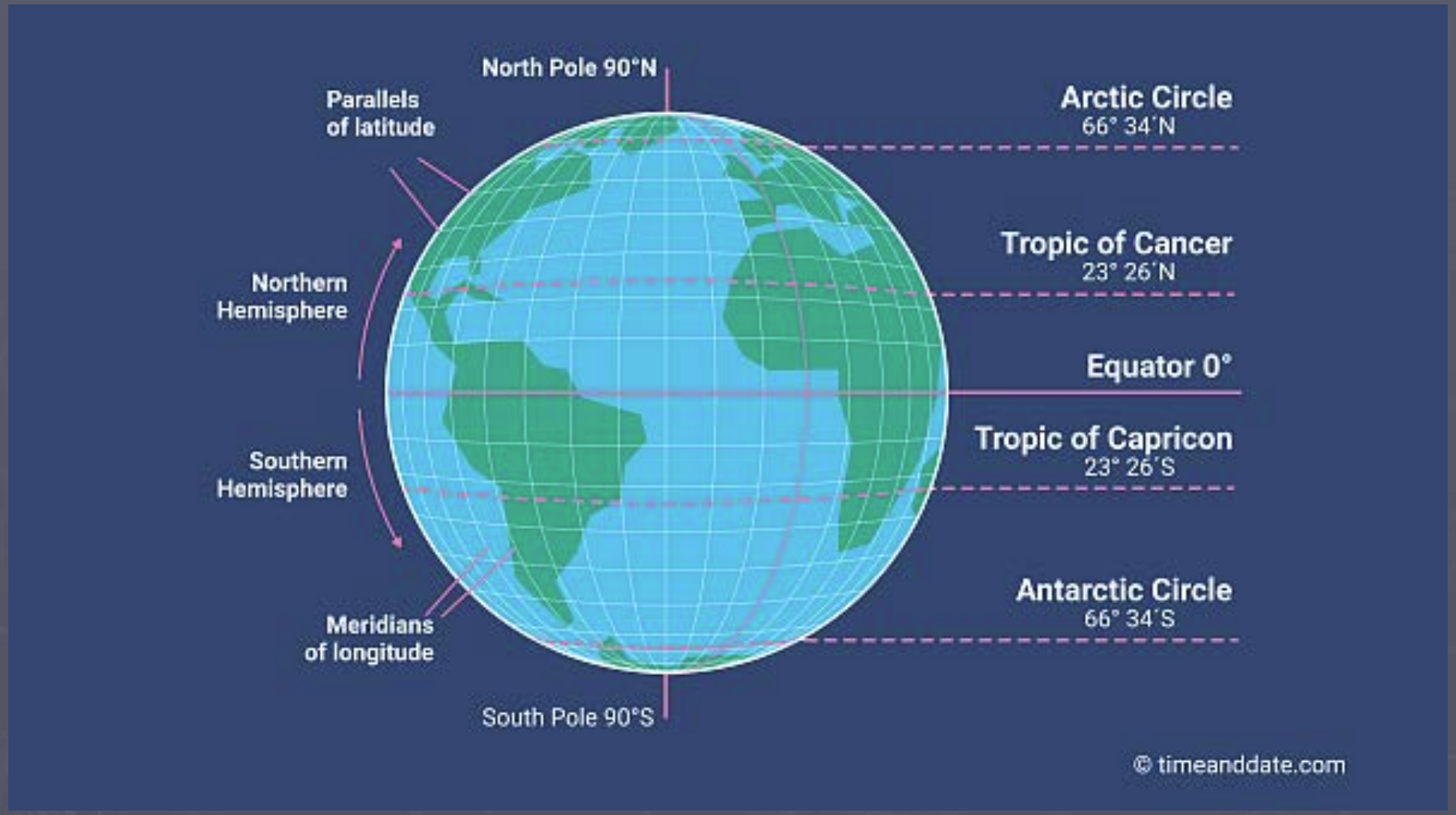


Plane of Orbit and tilt

- Earth orbits the sun along the orbital plane
- Earth spins on its axis which is about 23.45 degrees in relation to the plane
- Moon rotates around the Earth about 5 degrees of the Earth's Equatorial plane

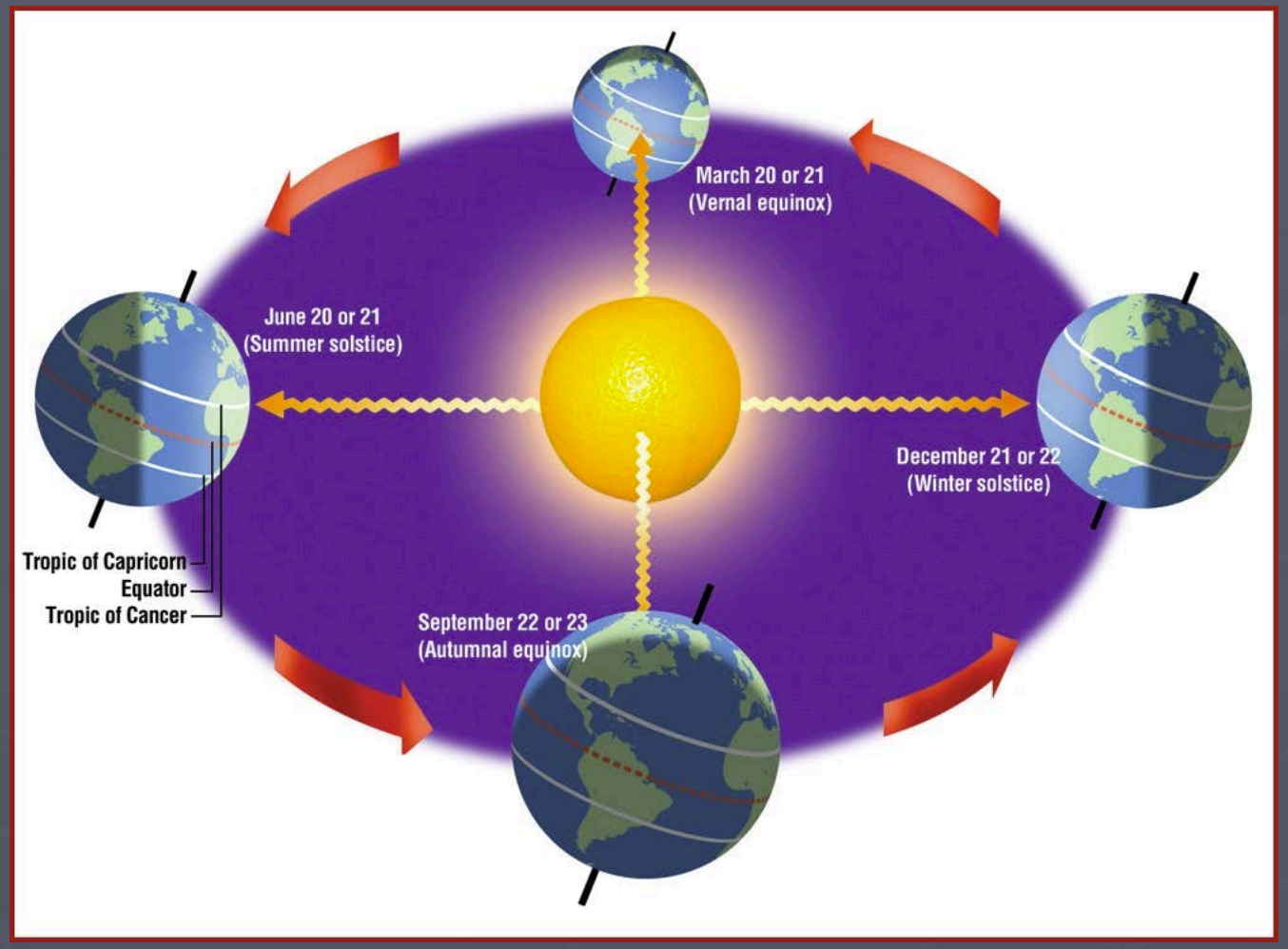


The Tropics and Polar Circles



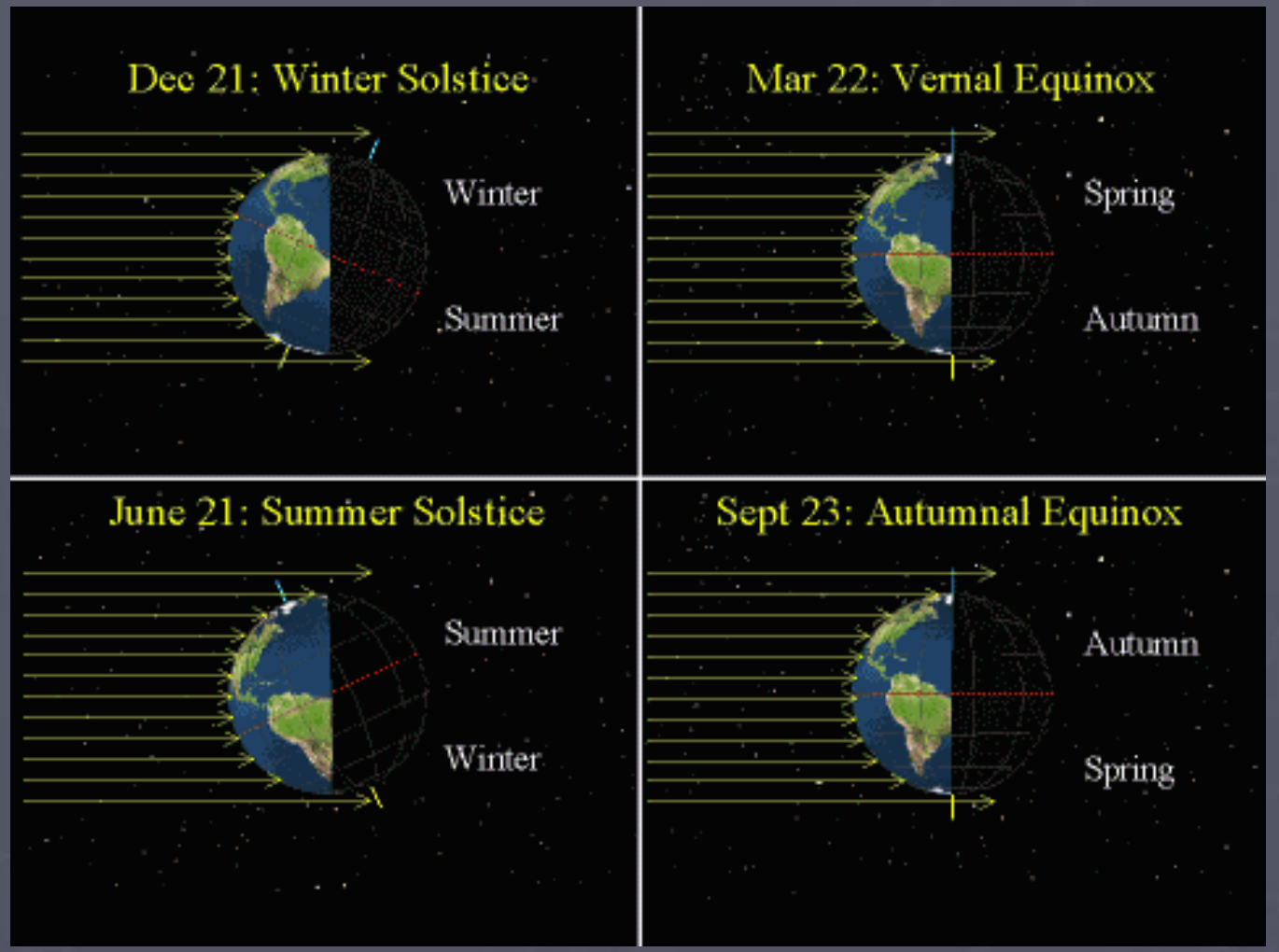
The Solstices and Equinoxes

- Winter Solstice (Roughly December 21)
  - Maximum southern declination
- Summer Solstice (Roughly June 21)
  - Maximum northern declination
- Equinoxes (Roughly March 21 for Vernal and September 21 for Autumnal)
  - Sun on the Celestial Equator



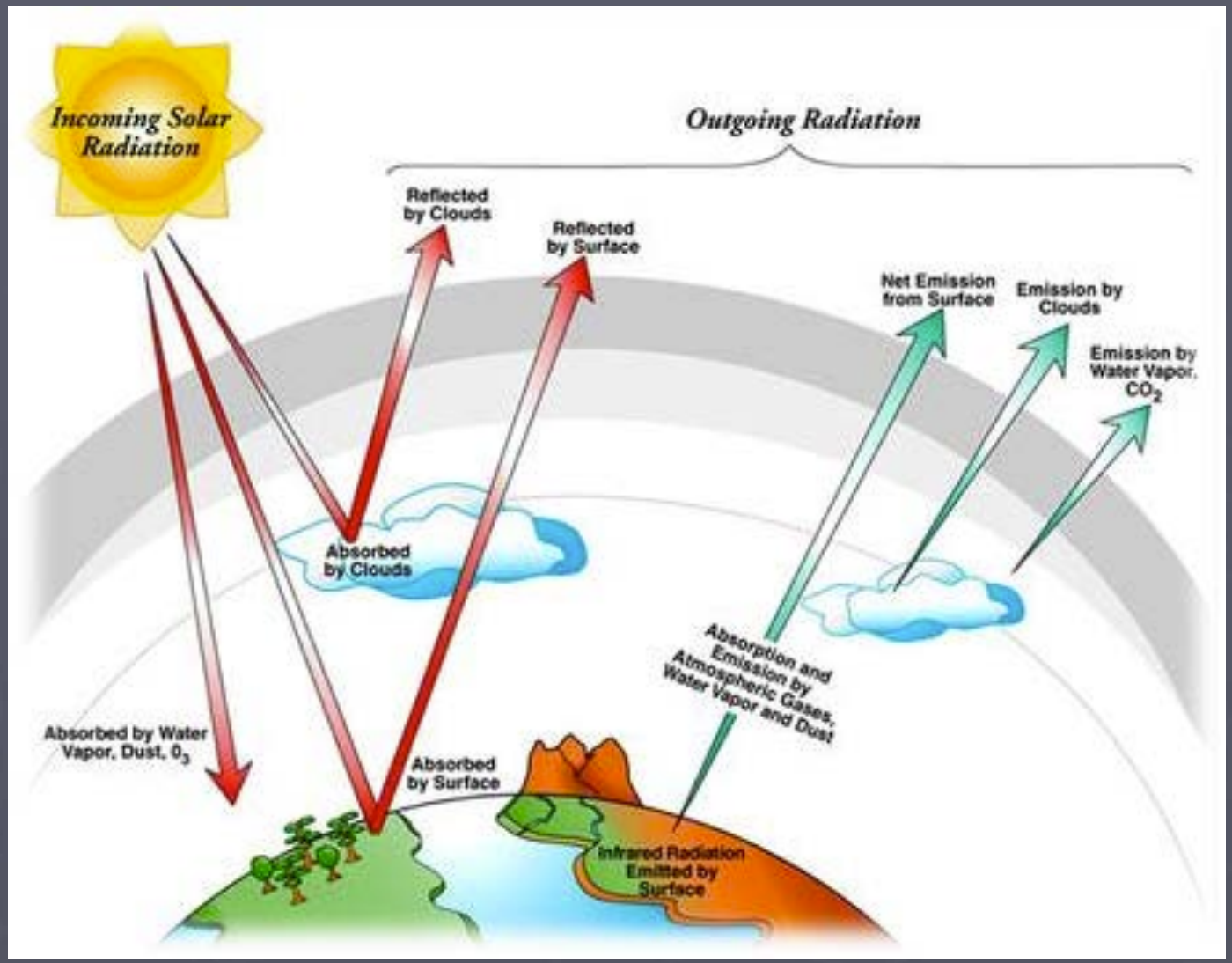
Seasonal Changes

- Seasonal Variations due to tilt of the Earth
  - NOT distance from the sun
- Seasonal variations dependent upon amount of sunlight



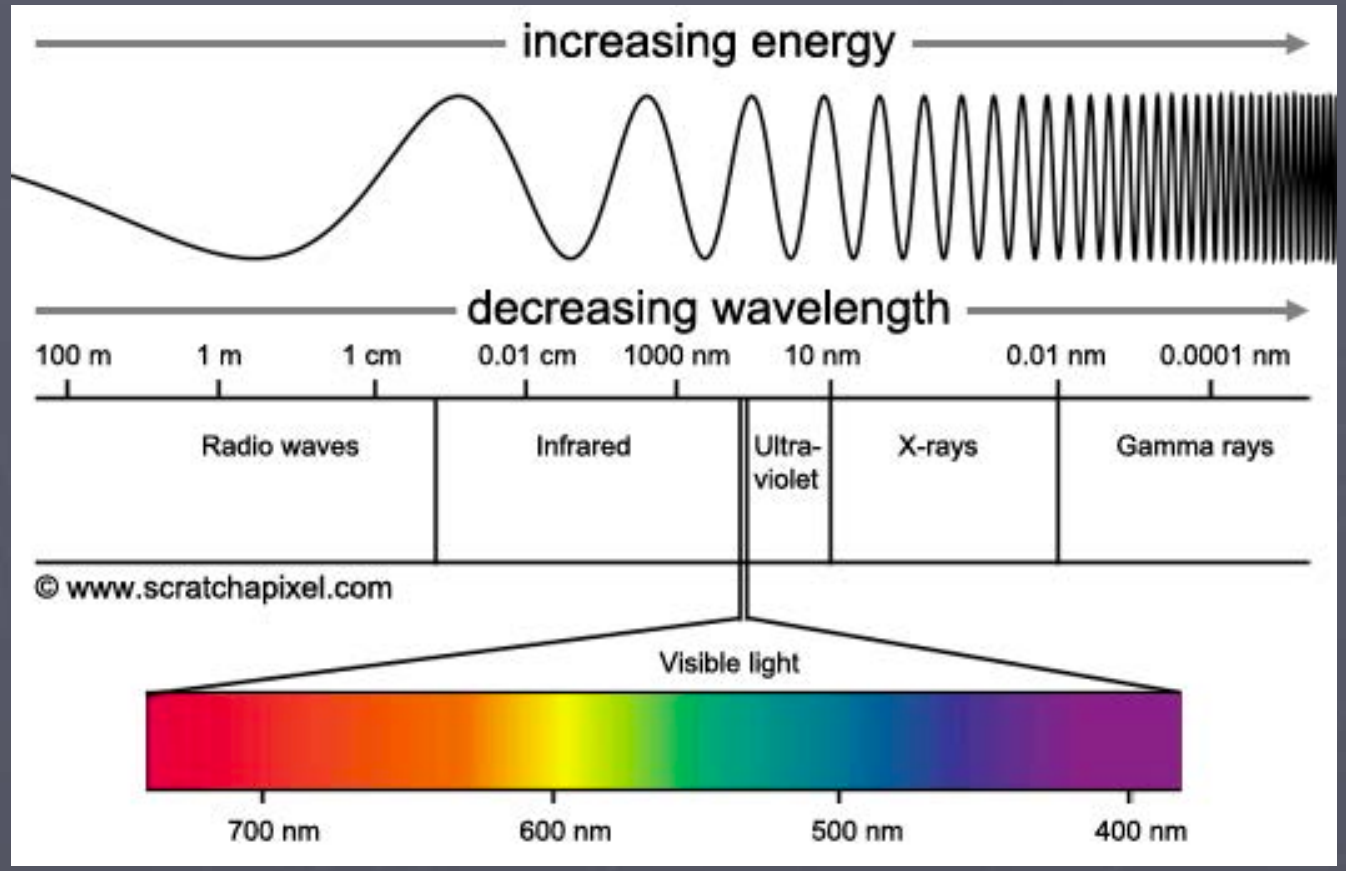
Insolation

- *INcoming SOLar radiATION*
- Insolation refers to the amount of solar radiation that the Earth's atmosphere and surface receives
  - Only about half of insolation reaches Earth's surface
    - Rest is absorbed by particles in the air or reflected



Electromagnetic Spectrum

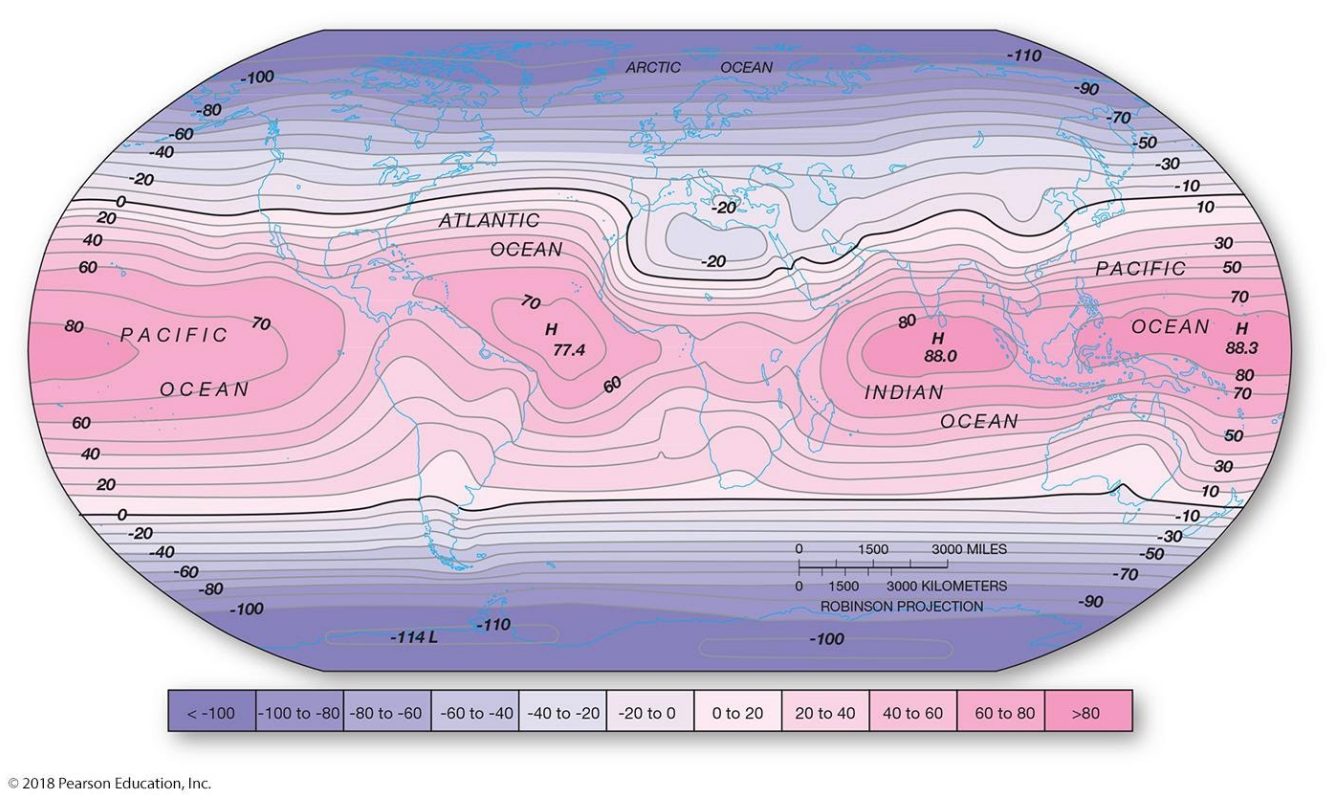
- The Sun releases electromagnetic energy
  - 8% UV, X-Ray, Gamma Ray
  - 47% Visible Light
  - 45% Infrared
- Transfers energy to the Earth to regulate temperature
  - Temperature is a measure of Kinetic Energy



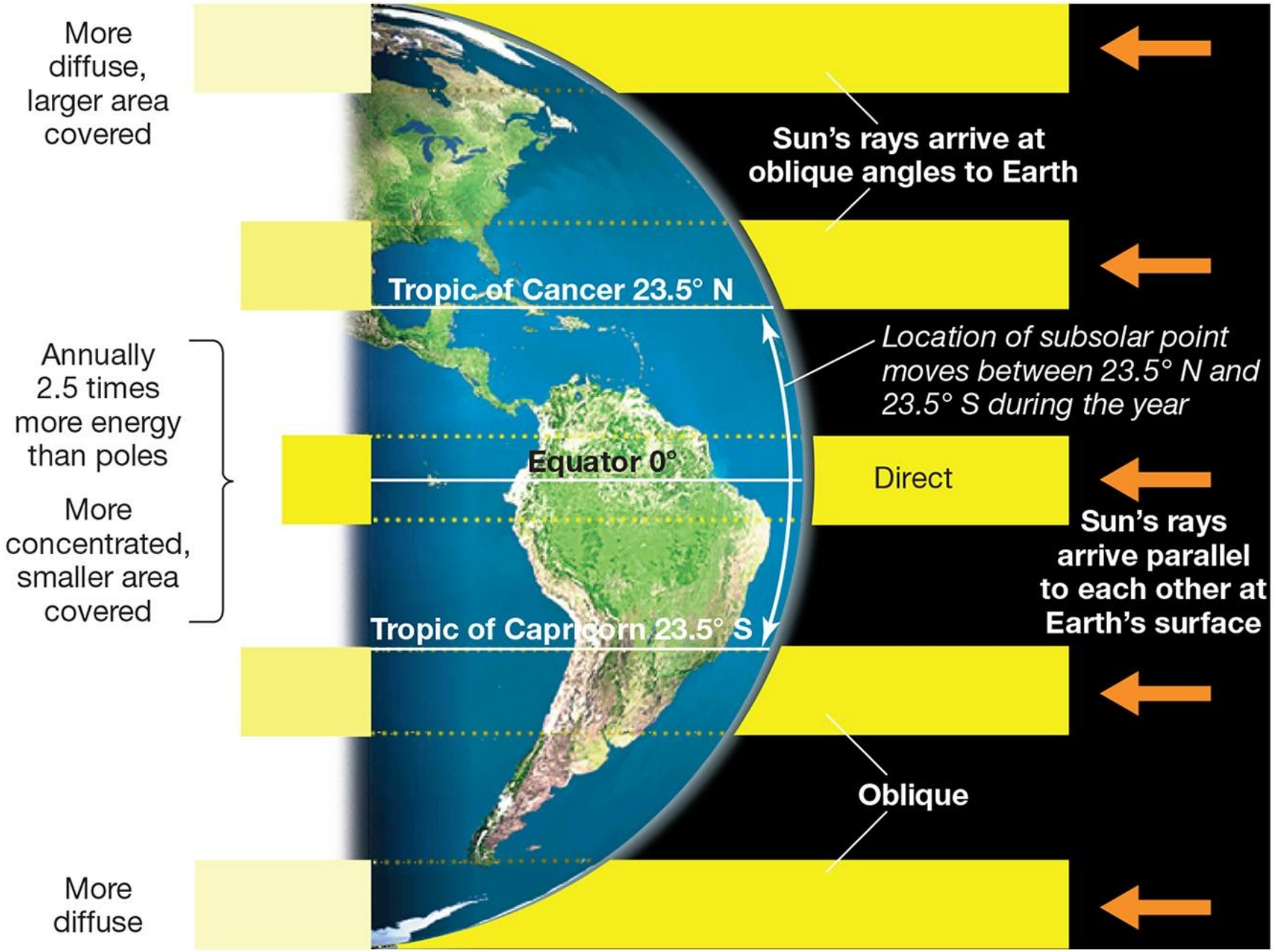
PBS Learning: The Electromagnetic Spectrum

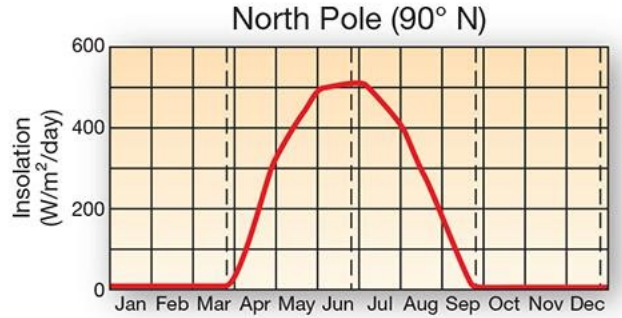
Global Net Radiation

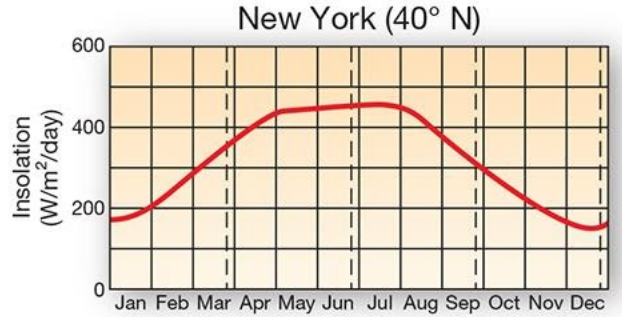
- Net Radiation = Incoming Shortwave Radiation – Outgoing Longwave Radiation

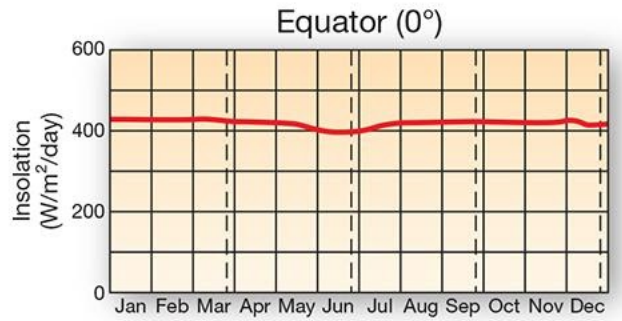


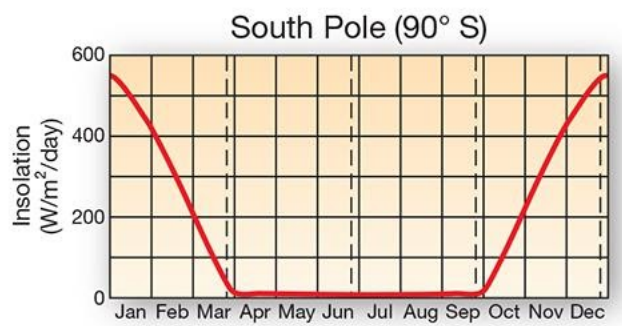
Surface area receiving insolation





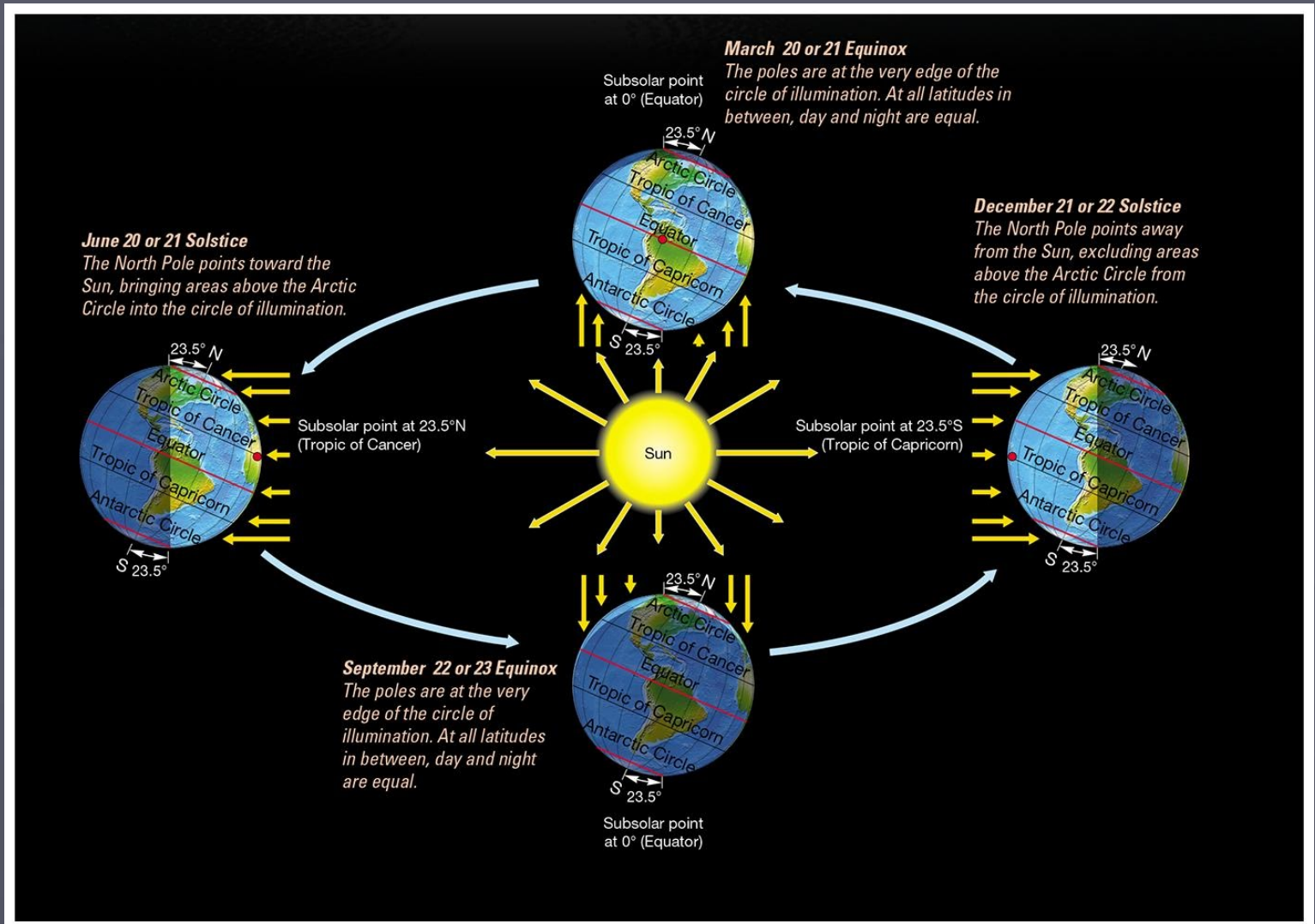






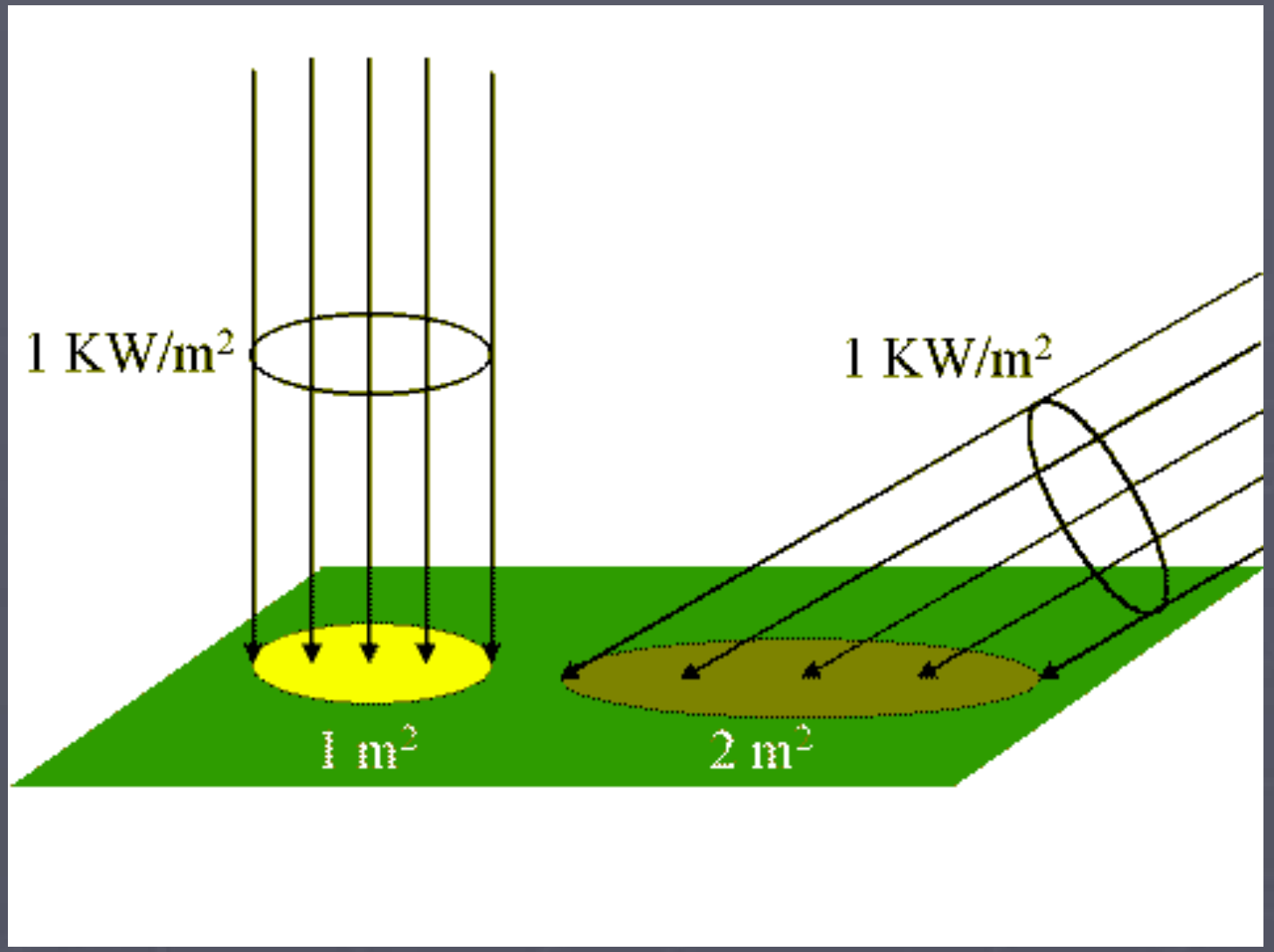
Seasonal Variations in Insolation

Seasonality: the changes in the Sun's position above the horizon
and daylengths during the year



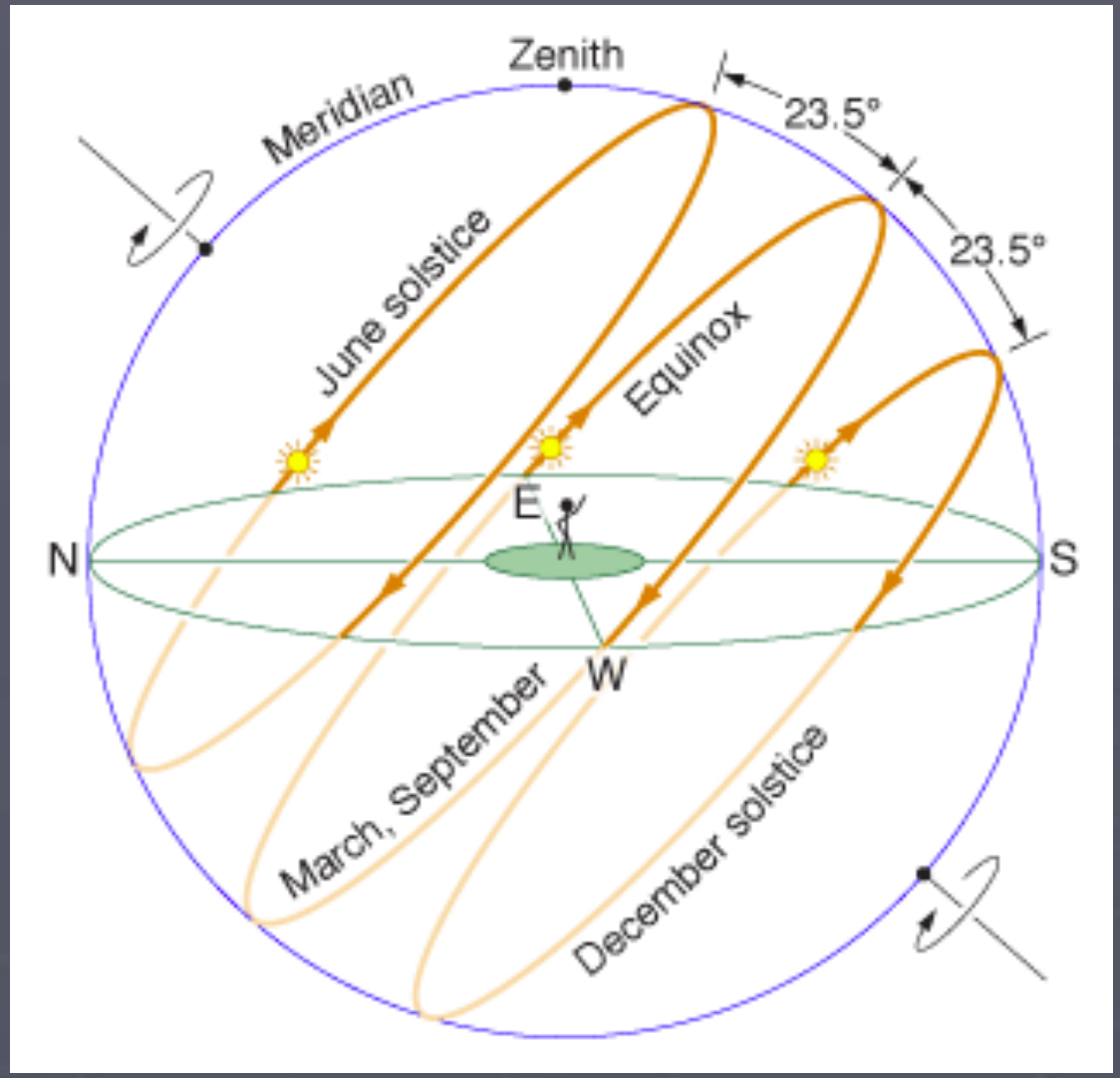
Sun’s Direct and Indirect light at Equinox and Solstice

Effect of Direct vs. Indirect Sunlight



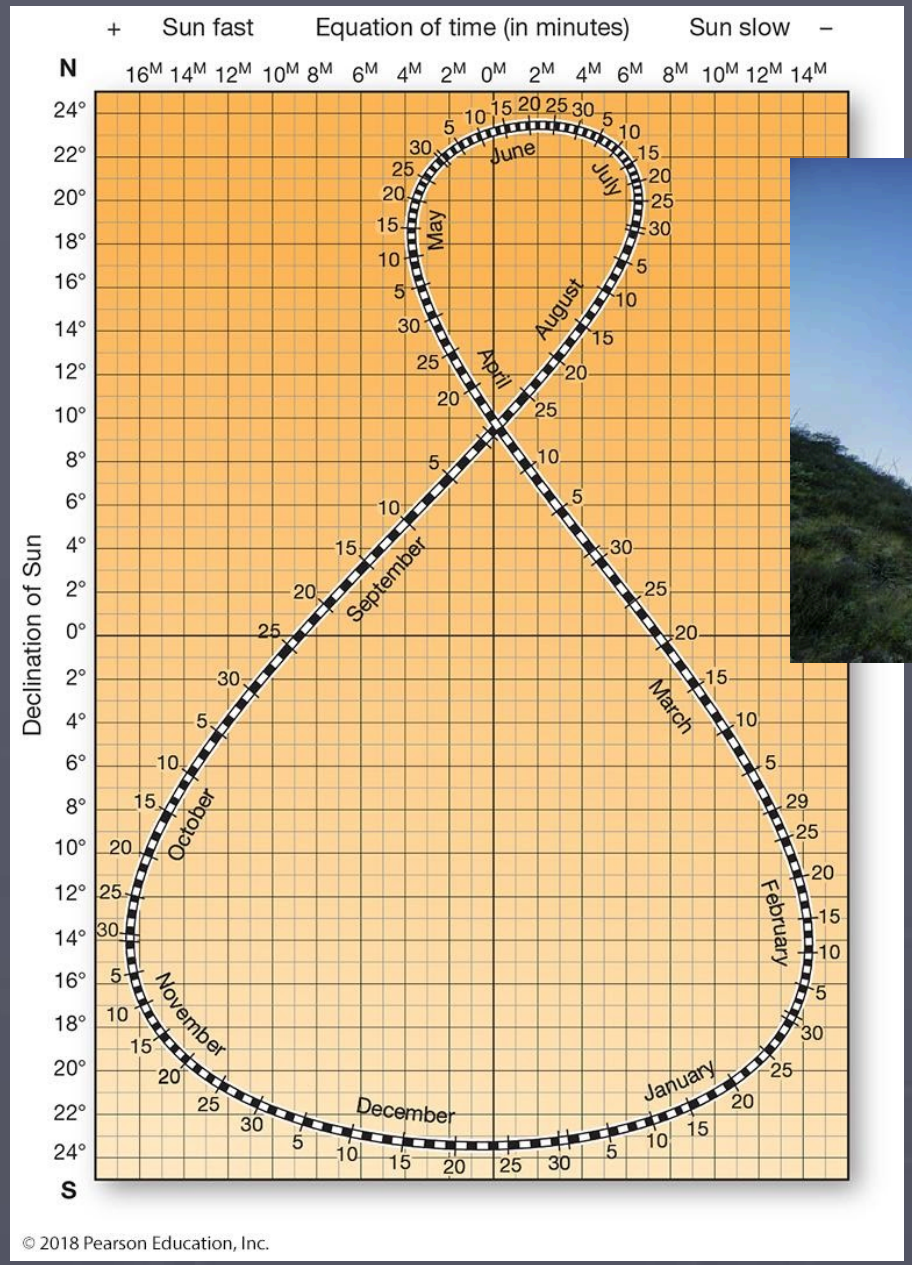
The Sun's Daily Path

- Sphericity
  - Different latitudes receive different amounts of energy on the same day.
- As Earth moves around the Sun the impact of the tilt becomes more pronounced
  - At Winter Solstice the Sun's zenith is at its most Southerly point leading to the shortest day of the year
  - At the Summer Solstice the Sun's zenith is the most northerly leading to the longest day of the year

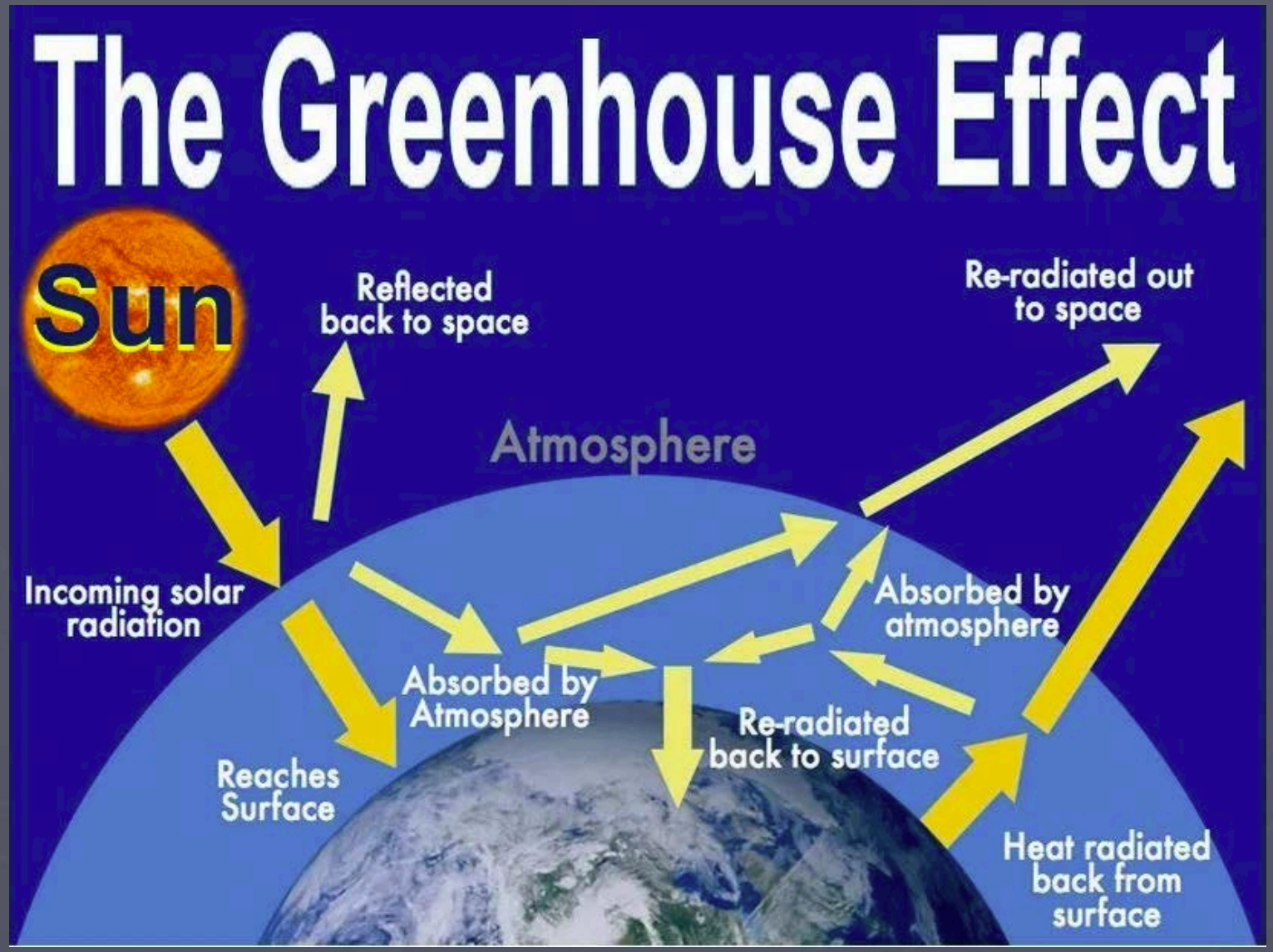


The Analemma

- Variation in the sun's position throughout the course of the year from a fixed point at the same solar time

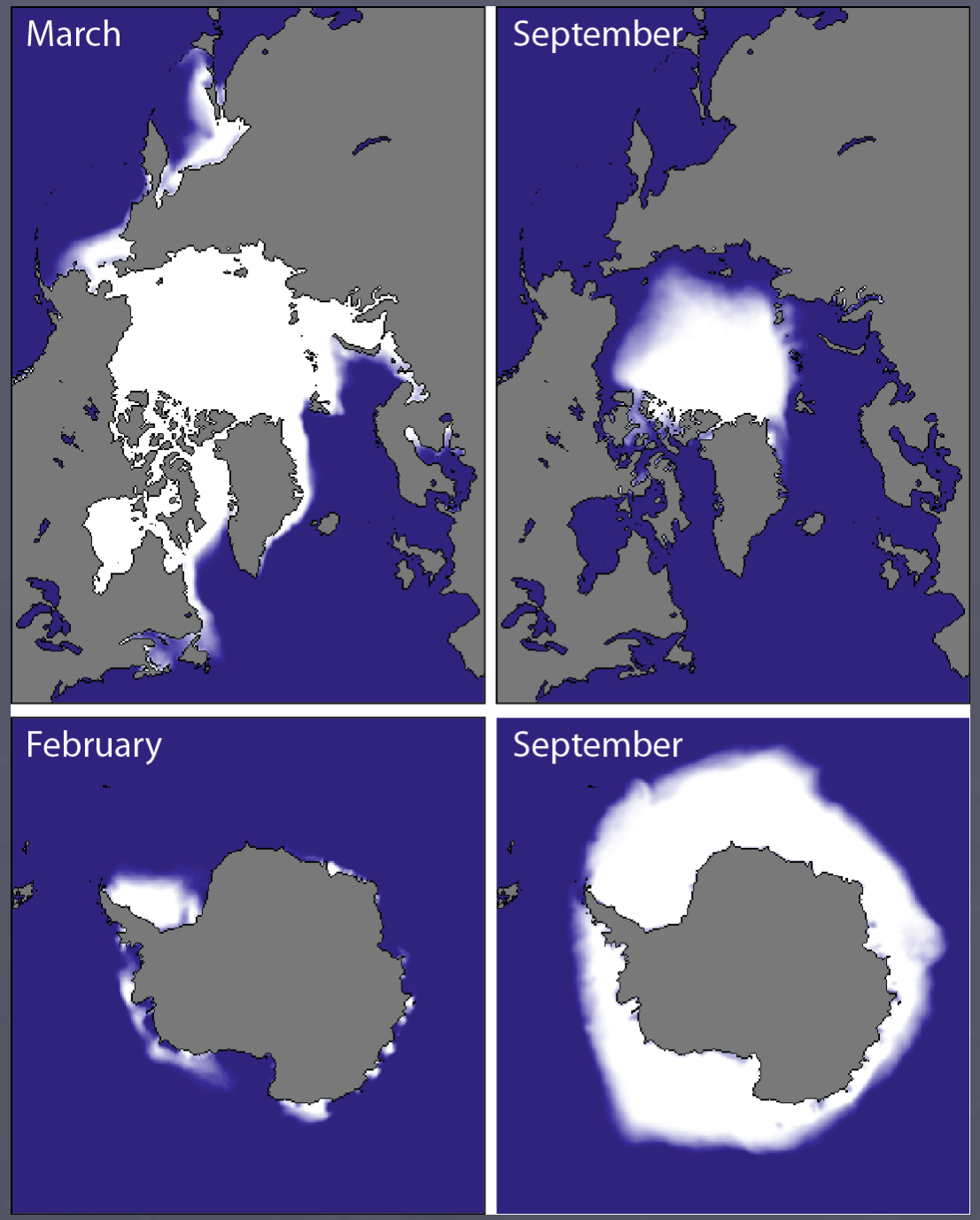


Why does this all matter? Ex. Greenhouse Effect



Why does this all matter?

Ex. Sun's Influence on Polar Ice Caps



Why does this all matter?
Ex. Species-Energy Theory