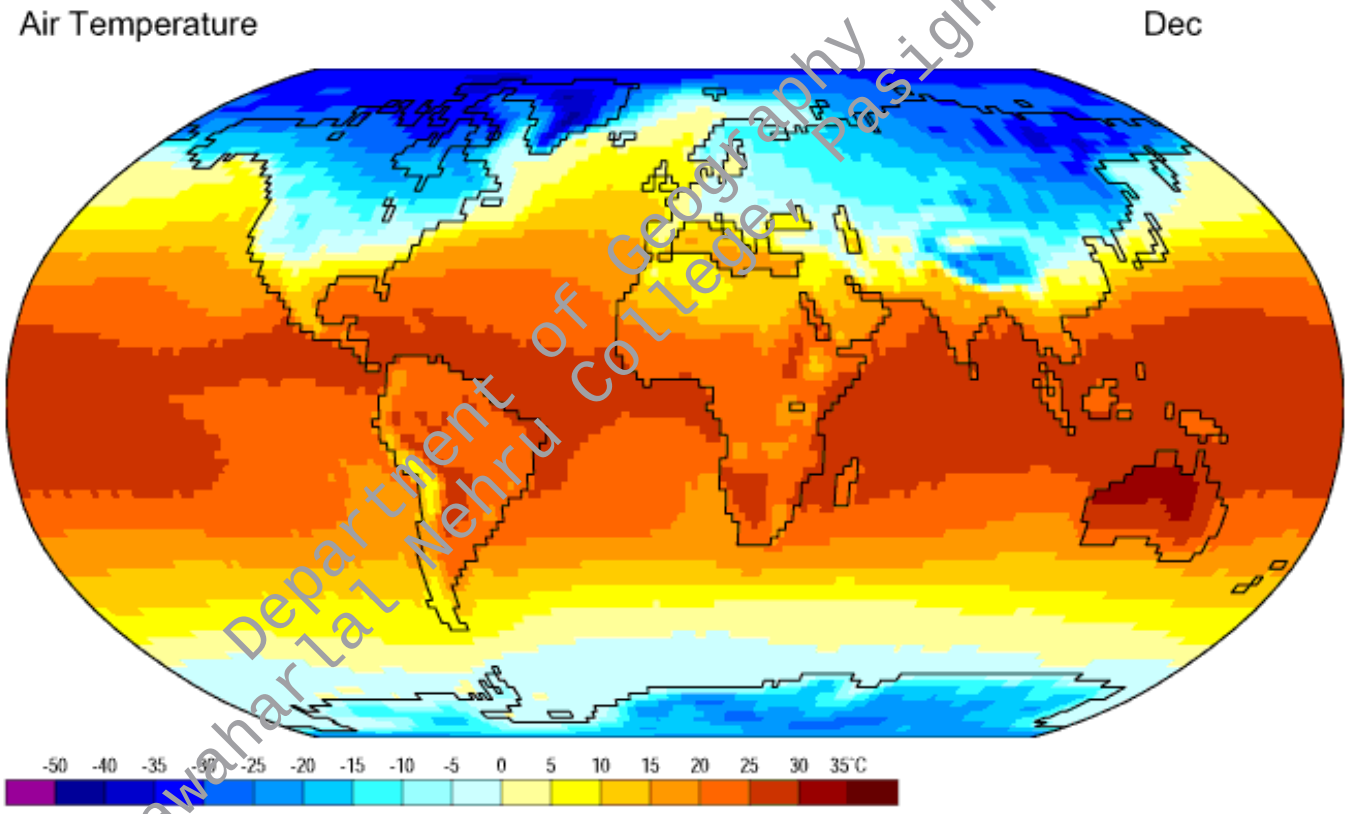
Atmospheric Temperature

DRKKMISHRA



The Dynamic Atmosphere

- The Earth's atmosphere is a sensitive and dynamic system.
- Natural and Human influences greatly influence and can control atmospheric processes.
- The atmosphere can be analyzed at a local (regional) scale and global scale.
- Temperature varies due to several factors including location and the influence of the Sun.

Heat and Temperature

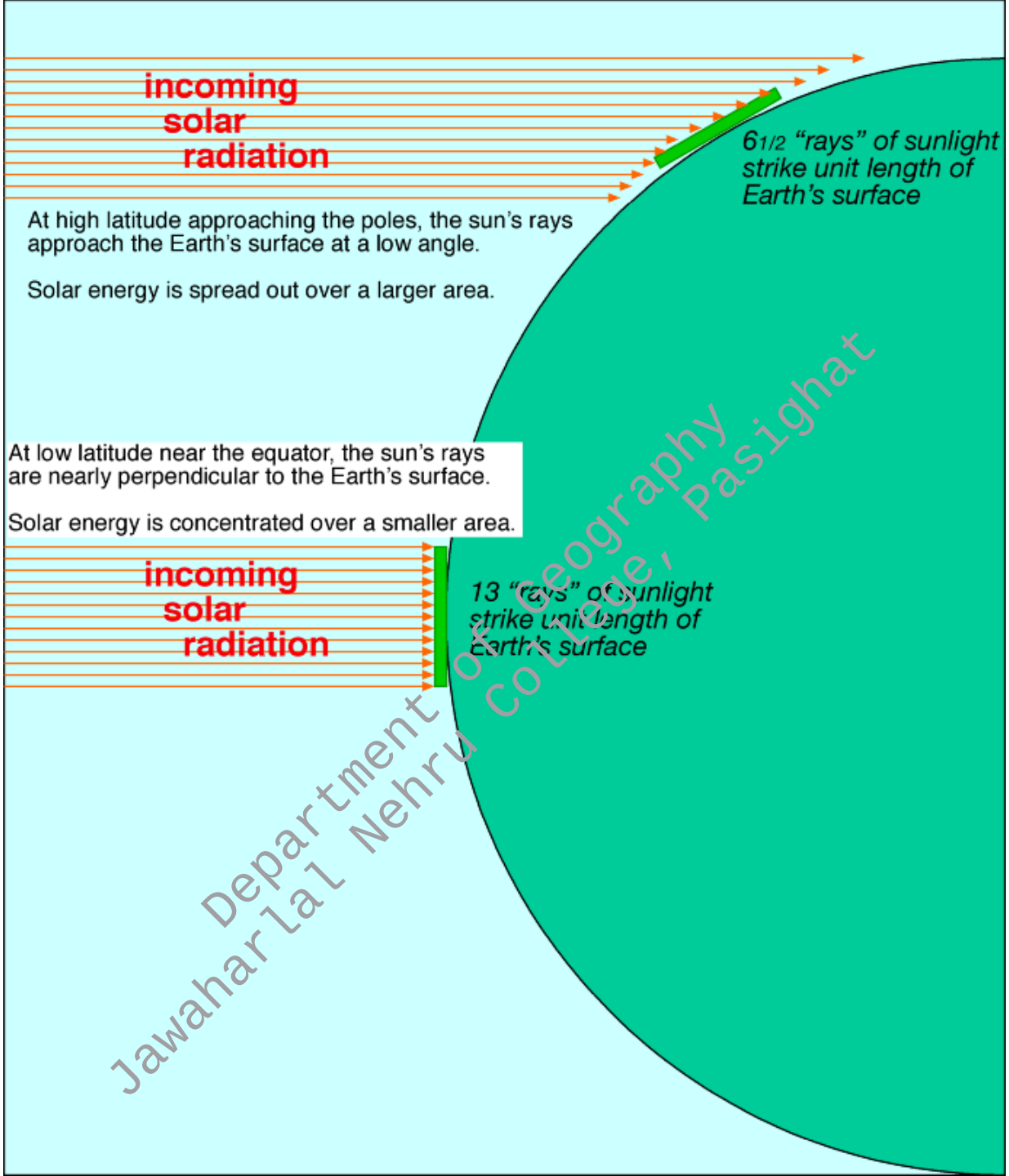
- Temperature is a measure of the average kinetic energy (motion) of individual molecules of matter.
- Heat is a form of energy that flows from one system or object to another because the two are at different temperatures.
  - Temperature and heat are related because changes in temperature are caused by gain or loss of heat energy.

Earth – Atmosphere Energy System

- Earth's atmosphere and surface are driven by the sun's radiant energy.
- This solar energy is unevenly distributed by latitude.
- The Earth-Atmosphere Energy System includes incoming shortwave radiation (UV light) and outgoing longwave radiation (thermal infrared).

Insolation & Sub-Solar Point

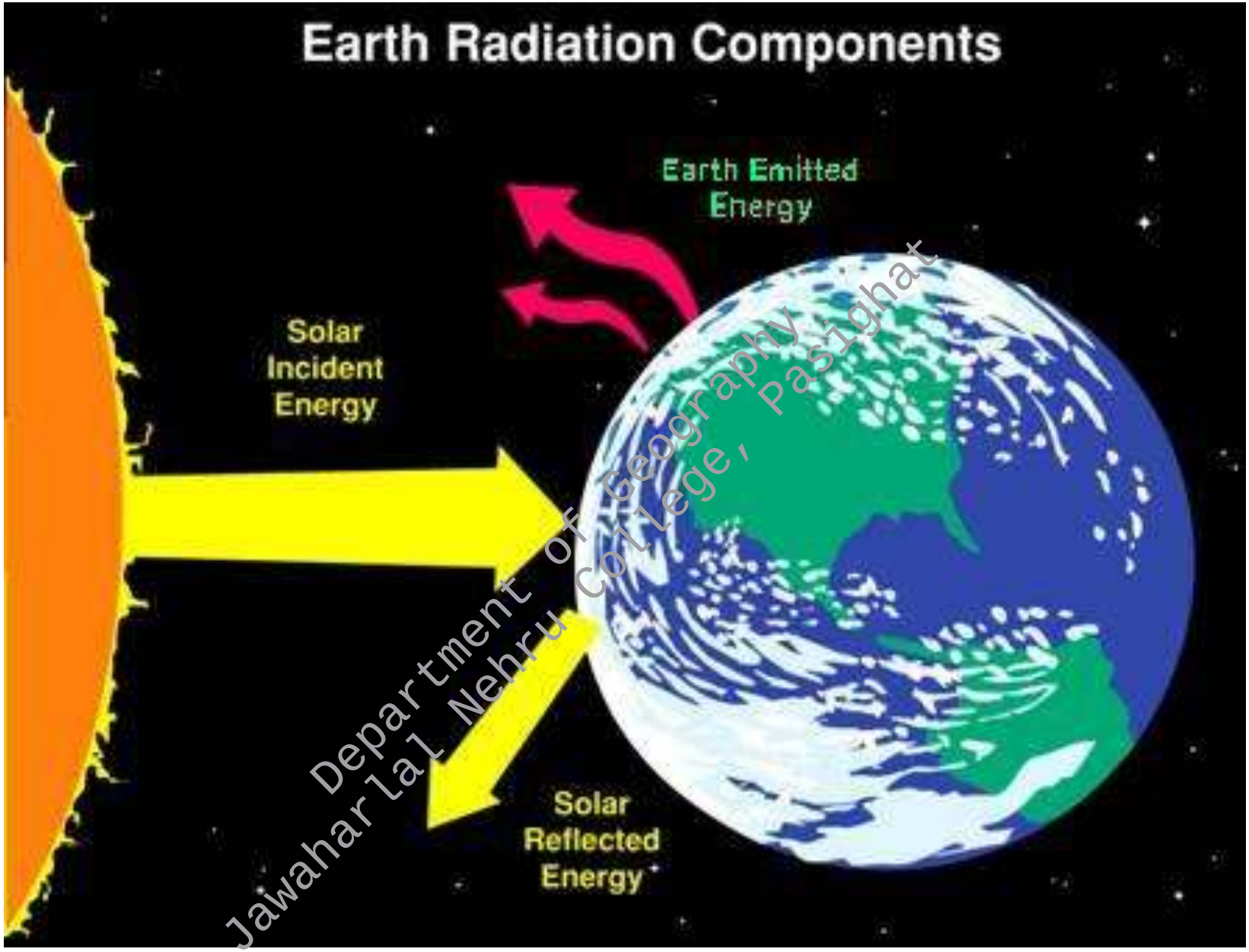
- Insolation (Intercepted Solar Radiation) is solar radiation that arrives at the atmosphere and surface.
- Insolation intensity decreases as one moves away from the Sub-solar point.
- The Sub-solar Point receives maximum insolation as sun rays are perpendicular to the surface. It migrates annually between the Tropic of Cancer and the Tropic of Capricorn (between 23.5° N and 23.5° S).

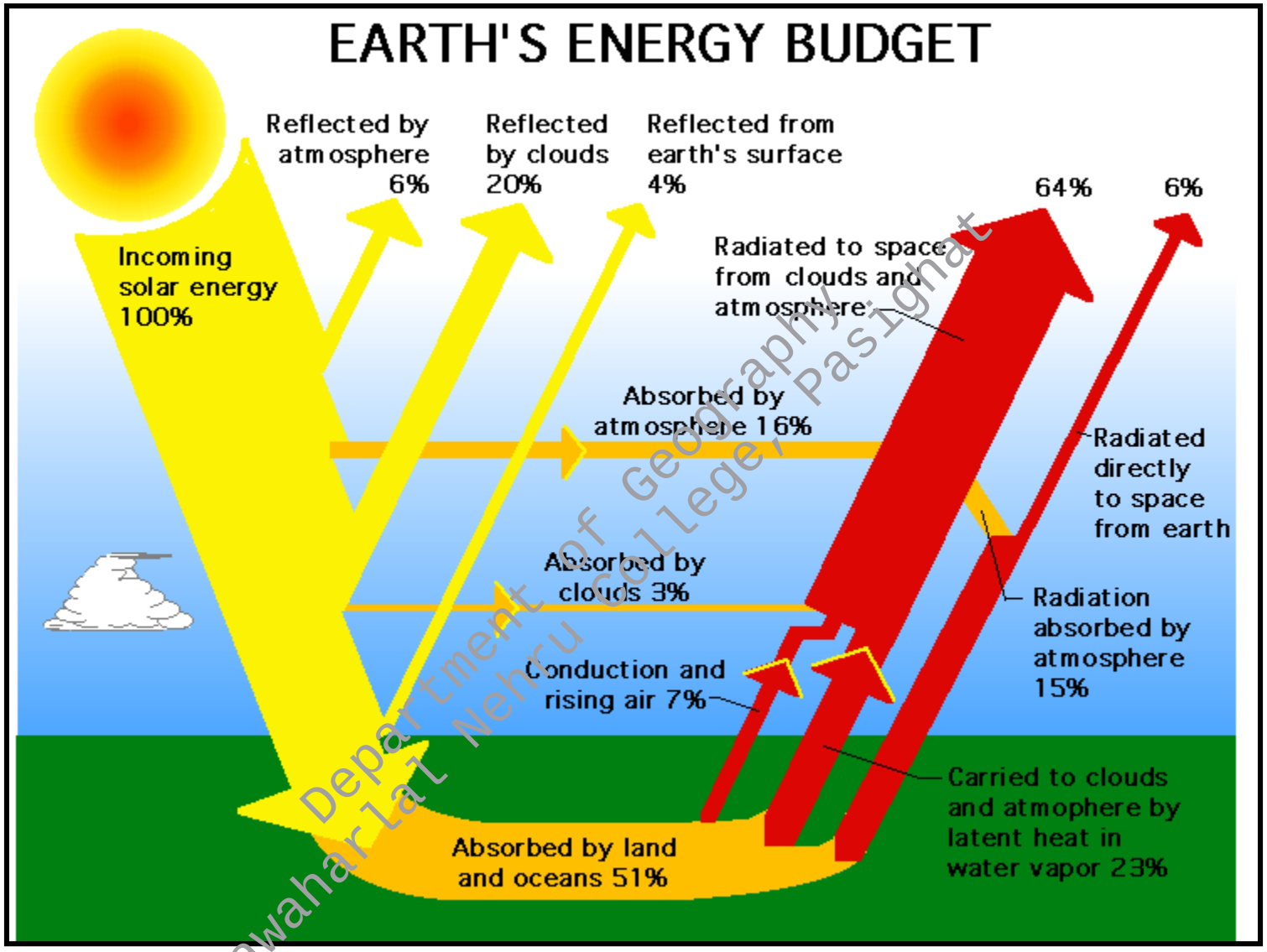


Radiant (Heat) Energy

- The **Sun's light** is composed of electromagnetic waves that include a spectrum of radiant energy at different wavelengths.
  - Objects radiate energy with spectra related to their surface temperature.
  - The Sun is very hot (6000°C) and emits shorter wavelengths. The Earth is a cooler radiating body and emits longer wavelengths.
- Incoming radiant (sun) energy (shortwave) can be:
  - Absorbed at ozone layer and Earth's land and oceans
  - Reflected back to space (clouds, meteoric dust, earth's surface)

  redirected by gas and dust in the atmosphere, resulting a directional change of the light's movement (Scattering).

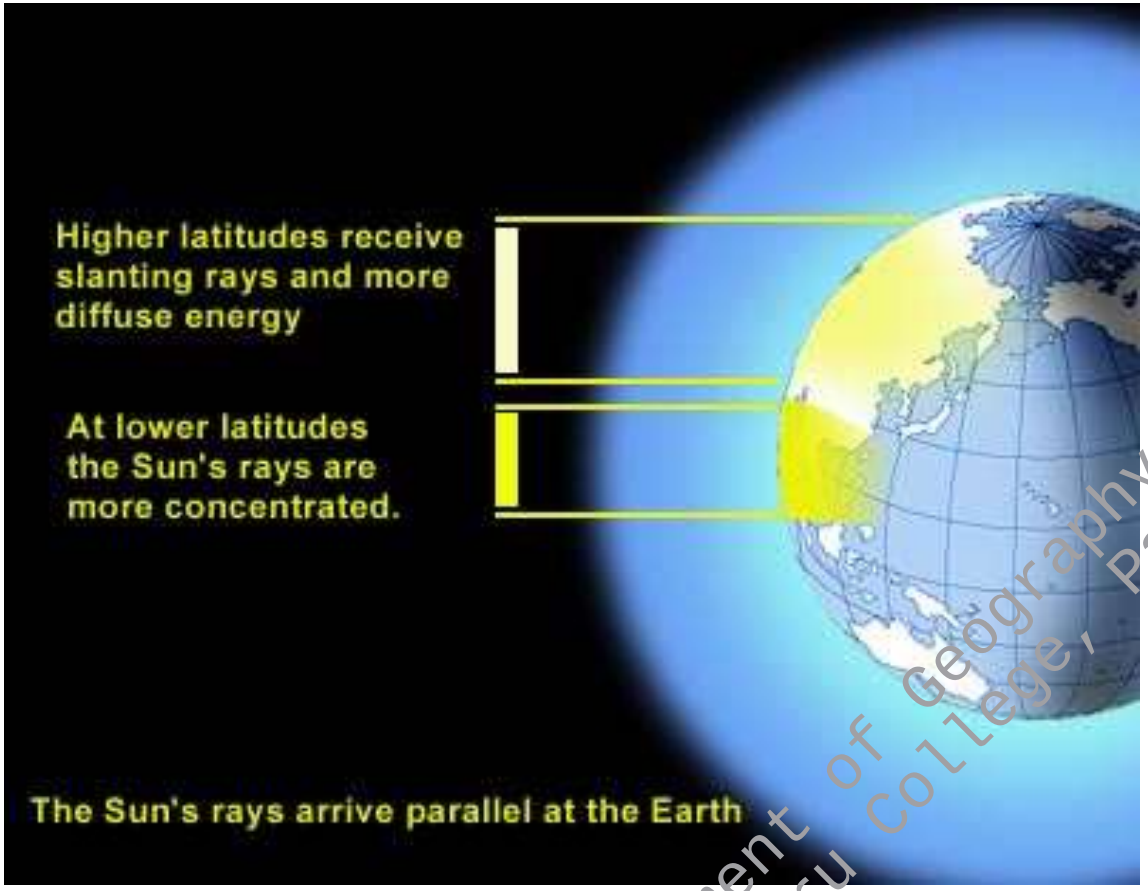


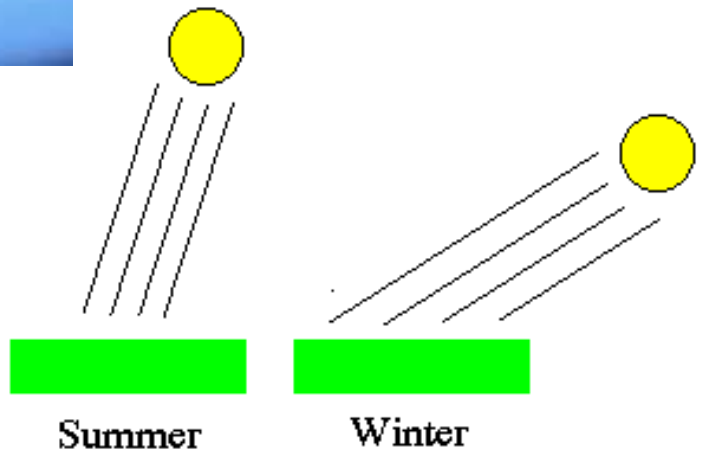


Factor # 1: Latitude

- The angel of the sun's rays at each latitude increases as one moves towards the equator.
  - Lower latitudes receive more concentrated energy from a more direct solar beam.
  - Higher latitudes receive slanting (oblique) rays and more diffused energy.

- As a result, differences in insolation and heating are present.





Factor #2: Altitude

- The Troposphere extends from the Earth's surface to 18km.
  - Within the Troposphere, temperatures decrease with increasing altitude above Earth's surface.
  - Temperatures decrease at an average of 6.4°C per kilometer. (*Normal Lapse Rate*).
- Worldwide, mountainous areas experience lower temperatures than do regions nearer sea level, even at similar latitudes.

Altitude…

- At higher elevations:
  - average air temperatures are lower
  - nighttime cooling is greater
  - the temperature range between day and night is greater than at low elevations.

- The density of the atmosphere also diminishes with increasing altitude.
  - ability to absorb and radiate sensible heat is reduced

Factor # 3: Cloud Cover

- Approximately 50% of Earth is cloud covered at any given moment.
- Clouds lower daily maximum temperatures and raise nighttime maximum temperatures.
  - At night, clouds act as insulation and radiate longwave energy, preventing rapid energy loss.
  - Daytime, clouds reflect insolation.

Factor # 4: Land-Water Heating Differences

- Land and water surfaces absorb and store energy differently.
- Moderate temperature patterns are found at water bodies and extreme temperature patterns occur inland.

Why?

- Land heats and cools faster than water.
  - Light striking land is absorbed, heating the ground surface during the day and is rapidly lost at night.
  - Light striking the ocean penetrates the surface because of its transparency. Heat energy is distributed at a greater depth and volume allowing for the heat to be stored longer.
- Water requires far more energy to increase its temperature.
- Ocean currents allow warmer and cooler waters to mix allowing energy to be spread out even further.

Marine Effect & Continental Effect

- **Marine Effect (Maritime):** Areas next to oceans exhibit more moderate temperature characteristics.

- **Continental Effect:** Areas less affected by the ocean have a greater range between maximum and minimum temperatures, both daily and yearly.

Isotherm Maps

- Isotherm: is a isoline that connects points of equal temperature.
- Isotherm maps allows Geographers to study the spatial analysis of temperatures.