Temperature Variation on Earth

Goal: Explain our atmosphere's interaction with the Sun's radiation

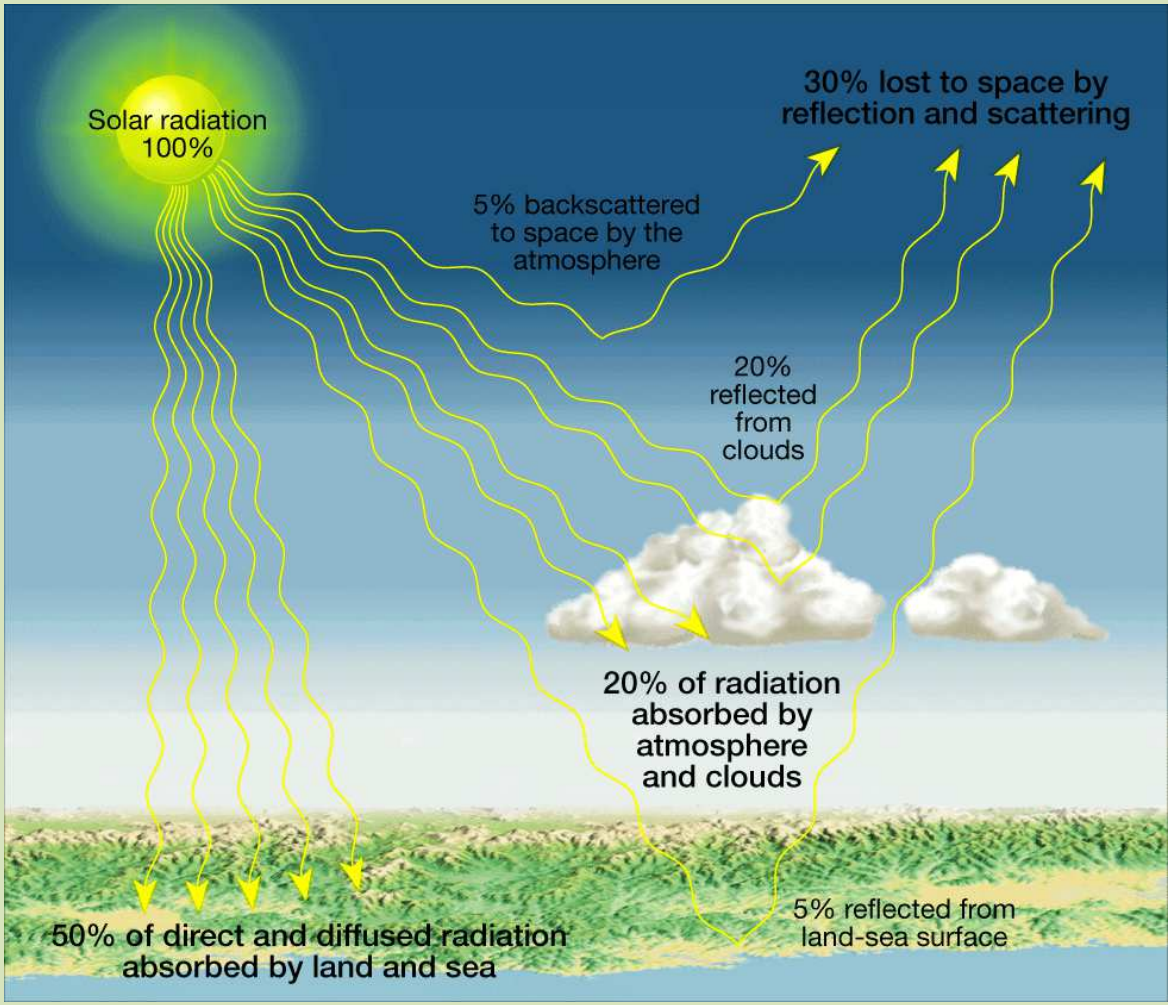
Review: What happens to Solar Radiation?

50%- absorbed by land & sea

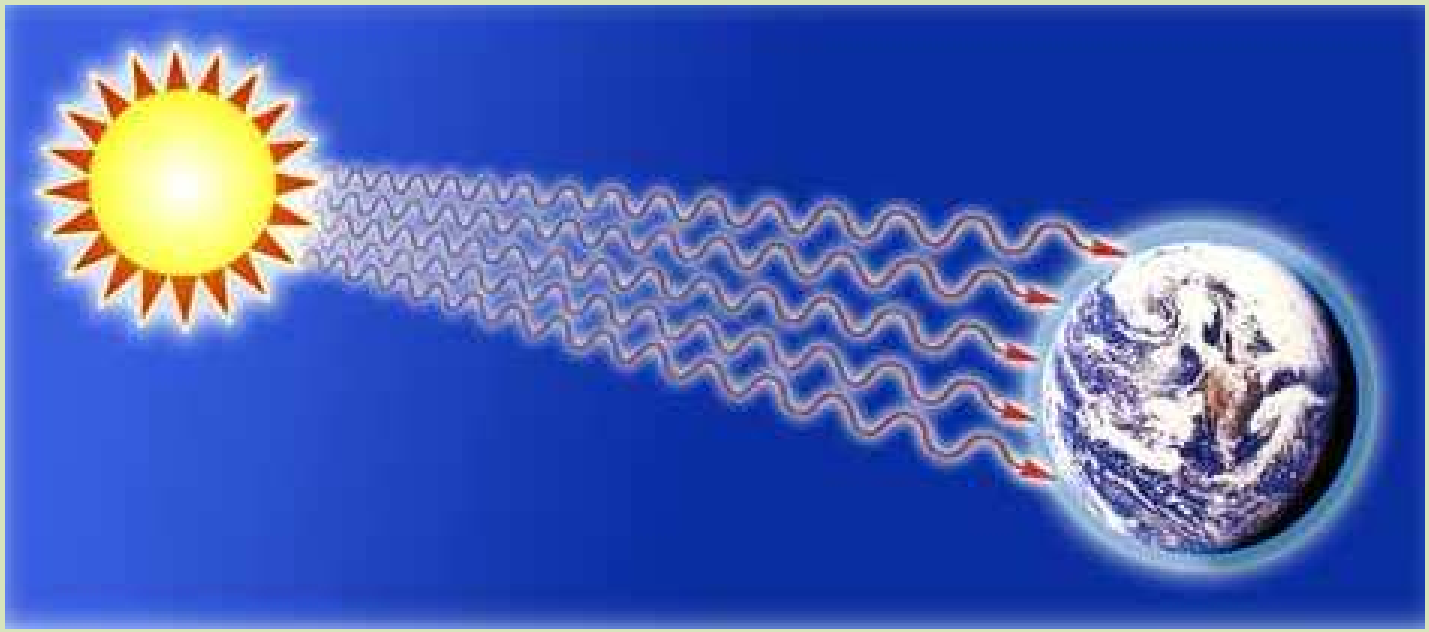
20%- absorbed by atmosphere and clouds

30%- lost to space by <u>reflection</u> and <u>scattering</u>

<u>reflection</u>
=20% from clouds
= 5% from surface
<u>scattered</u>
=5% from atmosphere



Solar radiation is **not** distributed equally on Earth.

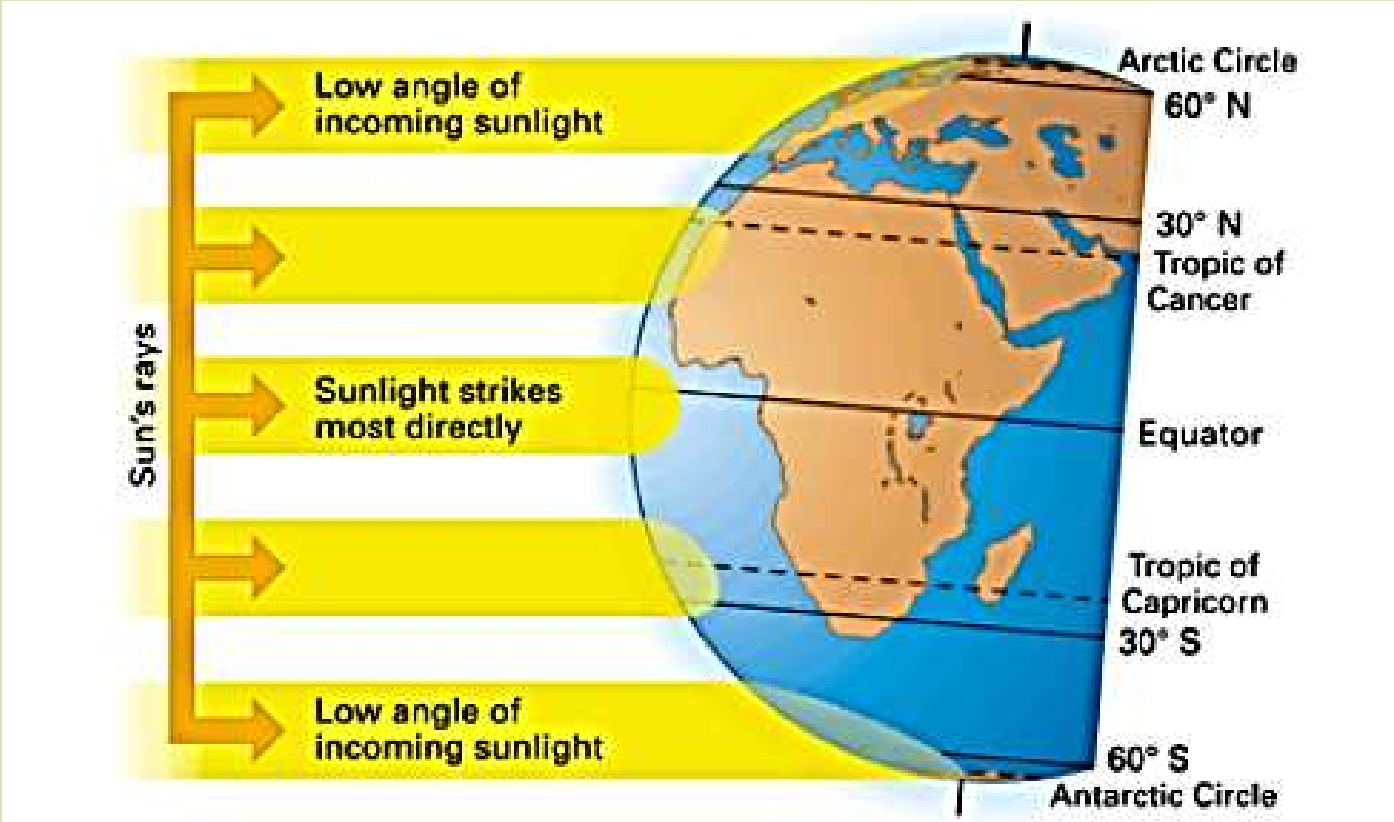


Why?: Earth's spherical shape causes an unequal distribution of sunlight and heat on Earth's surface.

Unequal Distribution of Heat from the Sun

Equator-The sun's rays strike Earth most directly near the equator = more energy

Poles- Near the poles, that same amount of solar energy is spread over a much larger area= less energy

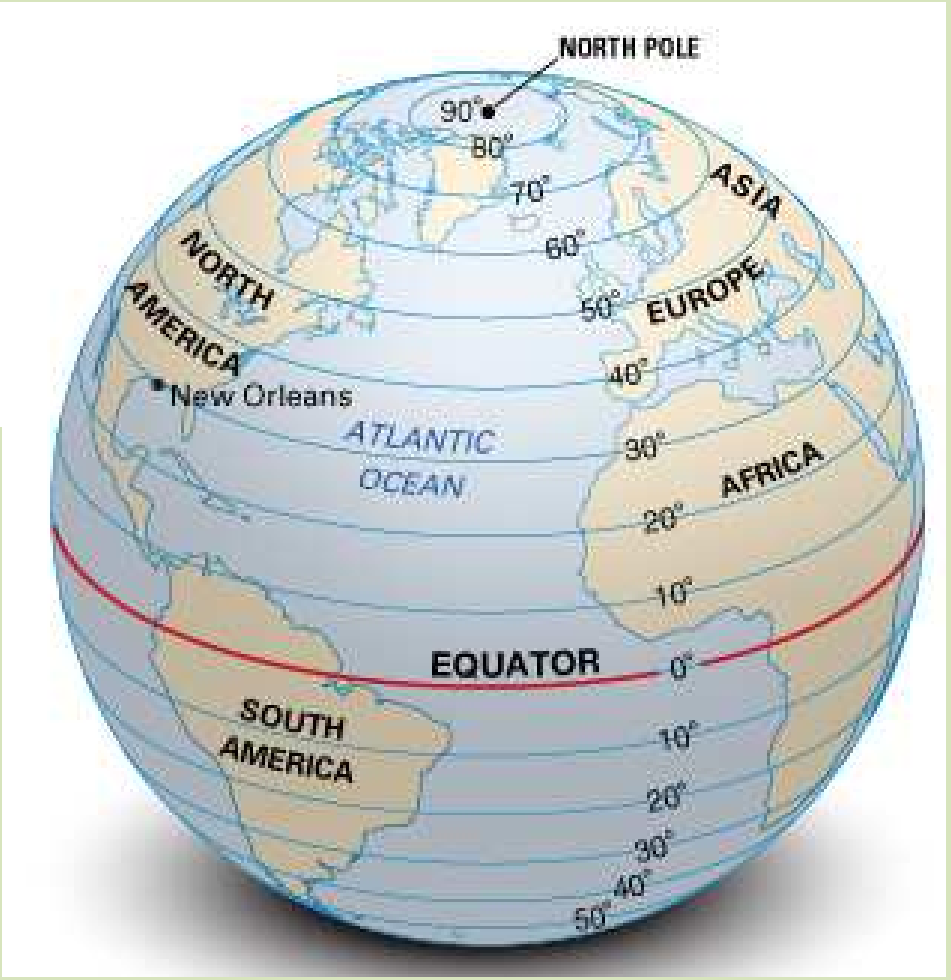


Latitudinal Temperature Differences

Unequal distribution results in latitudinal temperature differences.

LINES OF LATITUDE

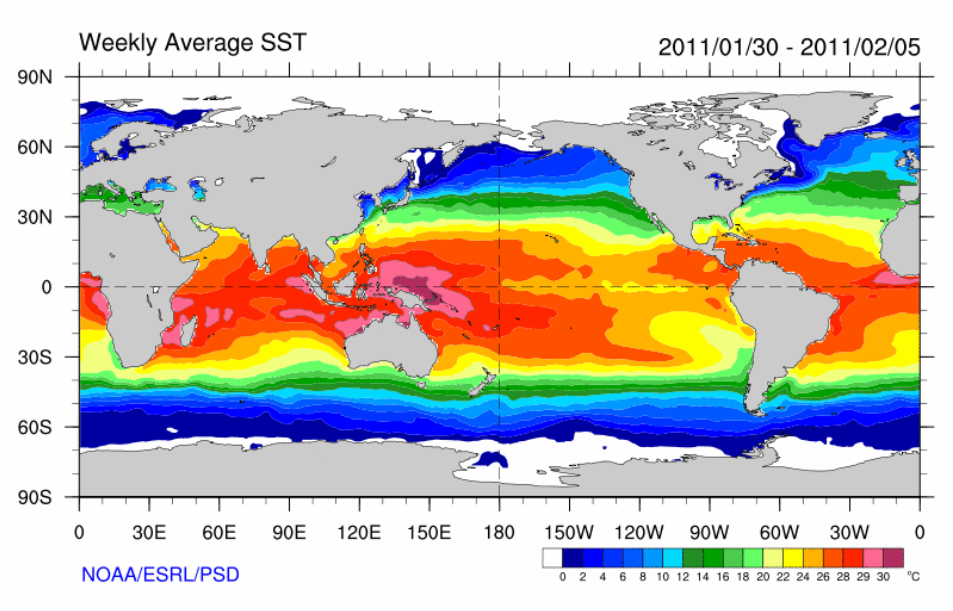
- Are known as parallels.
- Run in an east-west direction.
- Measure distance north or south from the Equator.
- Are parallel to one another and never meet.

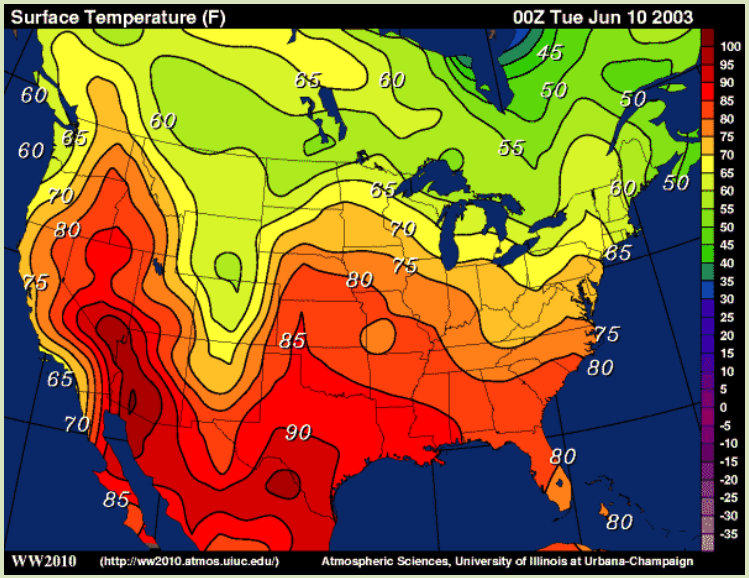


Mapping Thermal Energy in the Atmosphere

Isotherms are lines on a weather map that connect points where the temperature is the same.

- Isotherms generally trend east and west and show a decrease in temperatures as **latitude changes** from the tropics toward the poles.





What other factors influence temperature differences on Earth?

- There are four main factors that cause differences in temperature on Earth:

    1. Altitude
    2. Heating of land vs. water (Surface Characteristics)
    3. Geographic Position
    4. Cloud Cover

1.Temperatures vary because of ***Altitude***

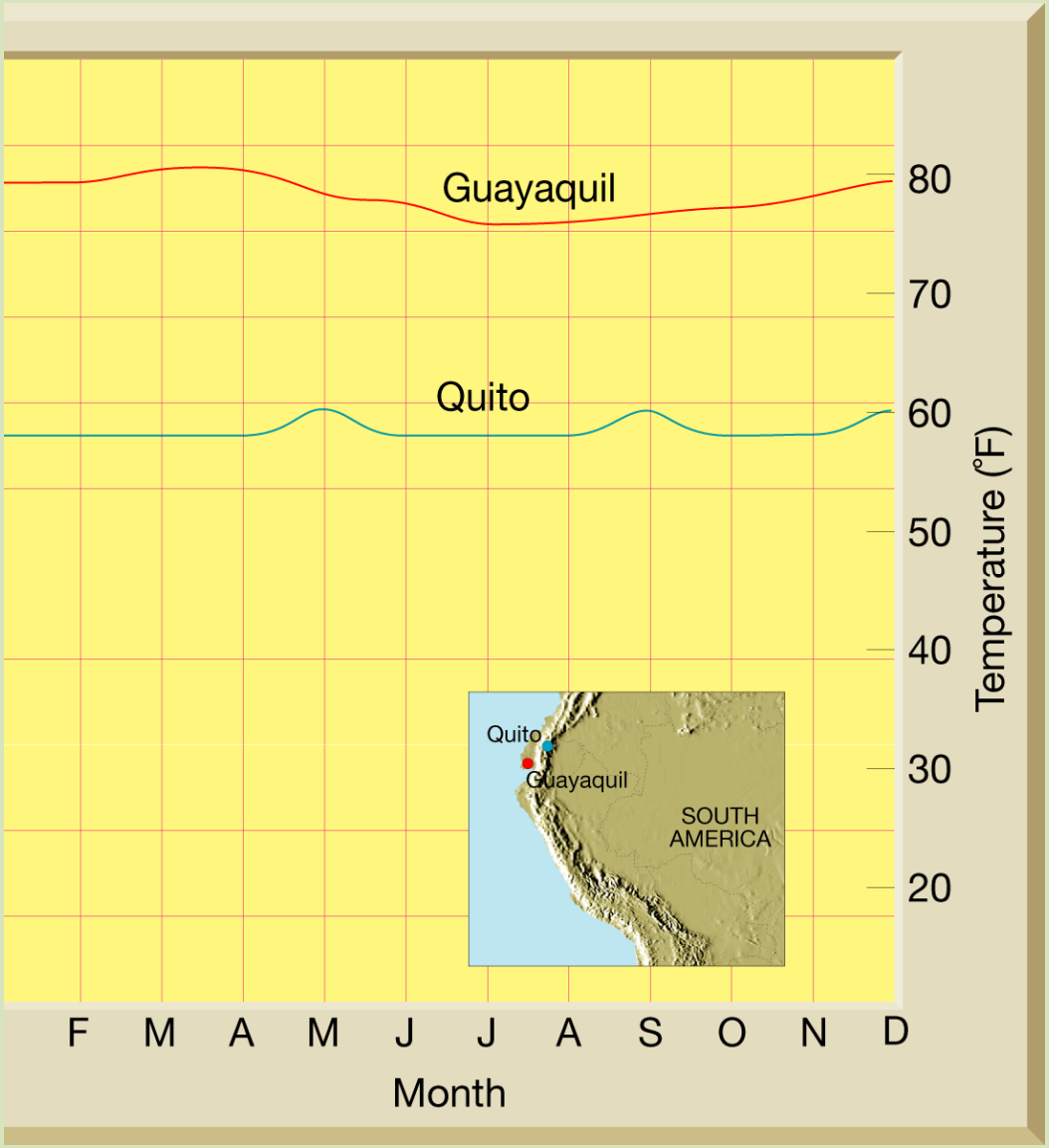
*Altitude is the distance measured above ground or sea

As altitude increases in the troposphere temperature decreases.

Mean Monthly Temperatures for Guayaquil and Quito in Ecuador, South America

Ex: Altitude

Q: Based on temperatures in the graph to the right, which city is located at a higher altitude?



2.Temperatures vary because of ***surface characteristics***

NOTE: **Surface temperatures control air temperatures!**

Land Surface vs. Water Surface

-Land and water absorb the sun's radiation differently

-Water has the ability to absorb *and* store more radiation then land

HOWEVER, land heats more rapidly and to higher temperatures than water.

Land also cools more rapidly and to lower temperatures than water.

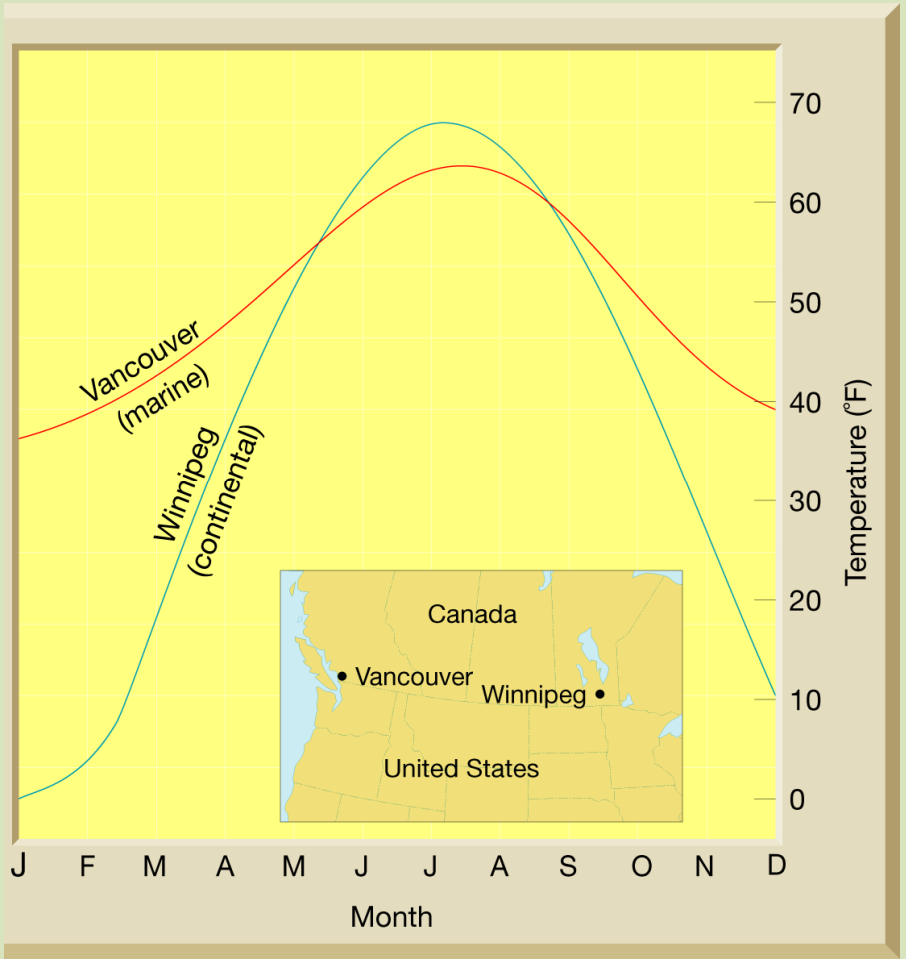
Land vs. Water- Vancouver and Winnipeg

Look at the graph below of Vancouver, British Columbia and Winnipeg, Manitoba.

-Vancouver is located along the Pacific (marine) coast near water.

-Winnipeg is surrounded by land and far from the influence of water

-Both cities are close to the same line of latitude



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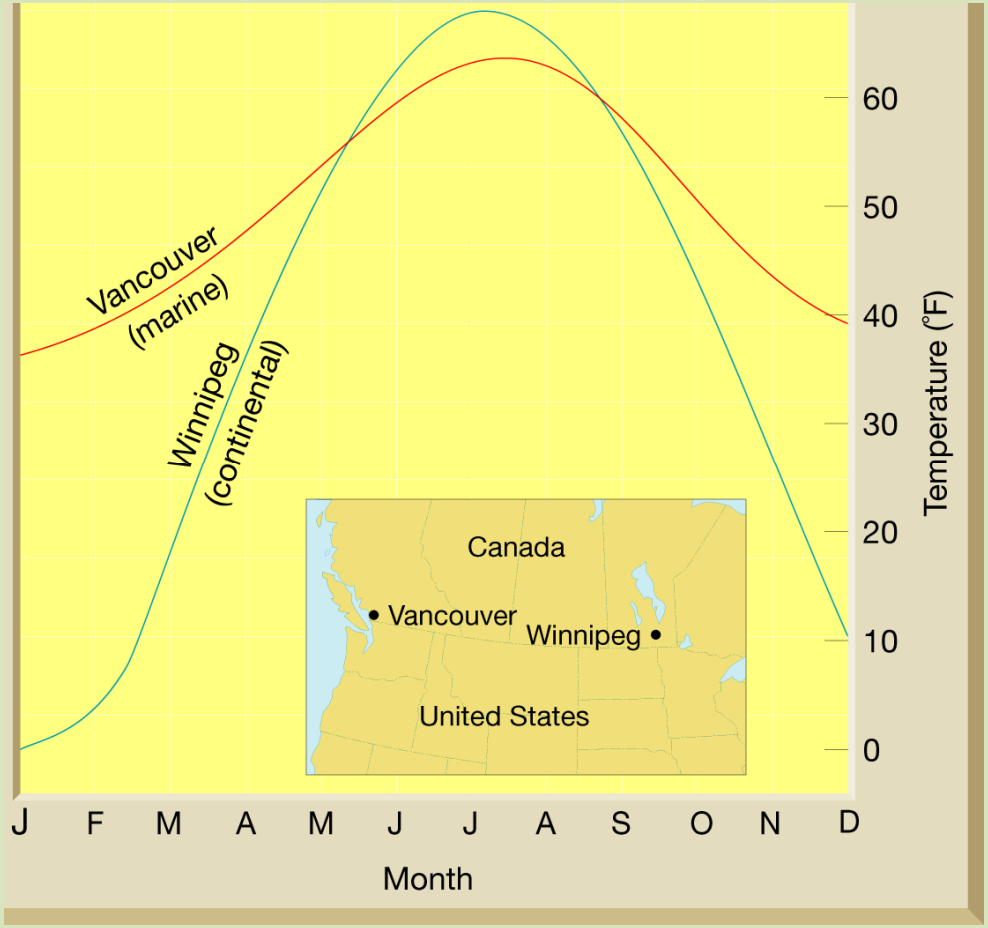
Land vs. Water - Similar latitude means that both cities will experience similar lengths of daylight and incoming radiation. **HOWEVER:**

Winnipeg has much greater temperatures than Vancouver.

Vancouver's temperatures are controlled by the Pacific Ocean and Winnipeg's are not!

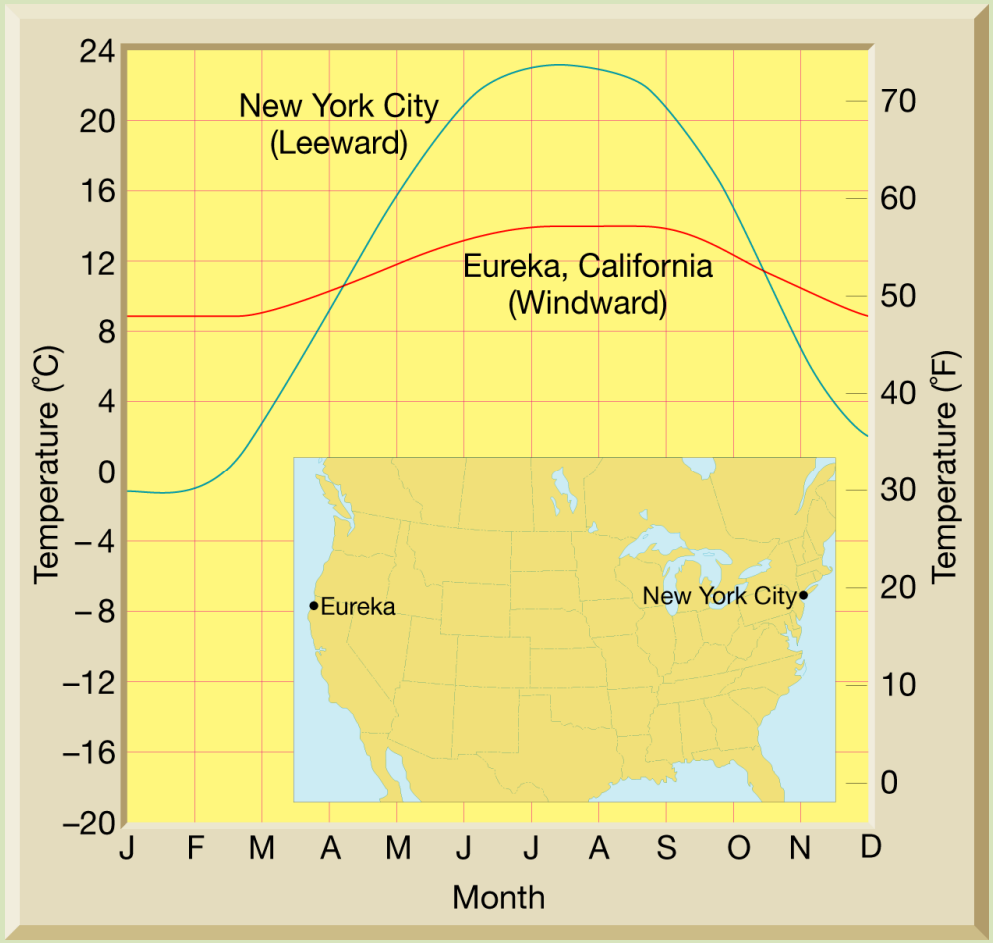


3.Temperatures vary because of *geographic position:*

FACT: In the Northern Hemisphere major winds move to the right

Ex 1: Coastal vs. Coastal Position (Leeward vs. Windward) Eureka, CA and New York City, NY

Ex: GEOGRAPHIC POSITION

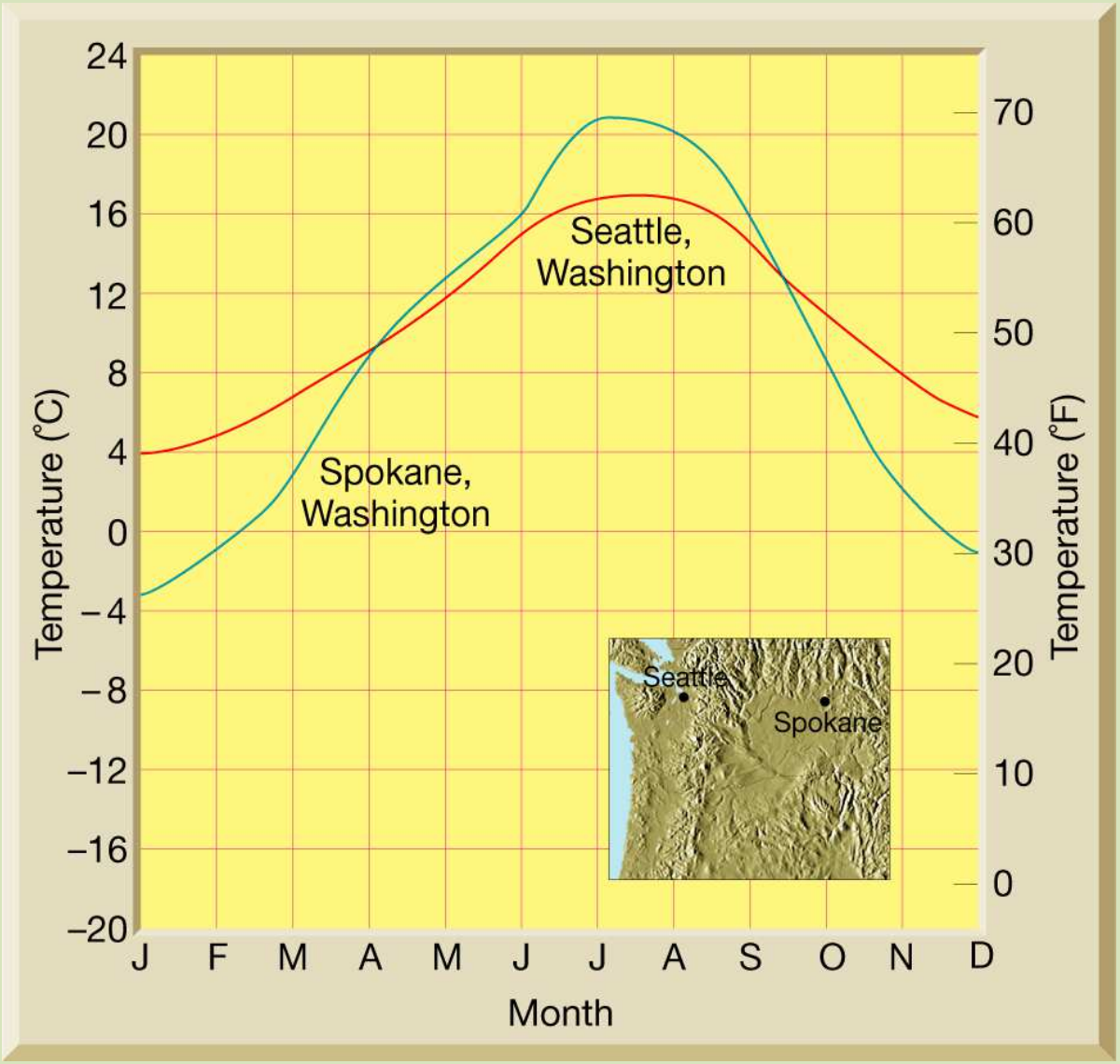


1) Coastal Positions

A coastal location like Eureka, CA where **prevailing** winds blow from the ocean toward the shore (**windward)**will experience a significant difference in temperatures than a coastal location like New York City where the winds blow from the land toward the ocean (**leeward**).

Ex 2: Continental vs. Coastal Position

Ex: **GEOGRAPHIC Position**



2) **Coastal vs. Continental Position:**

- Mountains can act as wind barriers and block wind from the ocean.

- Even though Spokane, WA is close to Seattle, WA the Cascade Mountain range separates both cities.

- Seattle is closer to the ocean and therefore will have more of a marine temperature influence.

- Spokane however is influenced by surrounding land surface temperatures instead of the ocean.

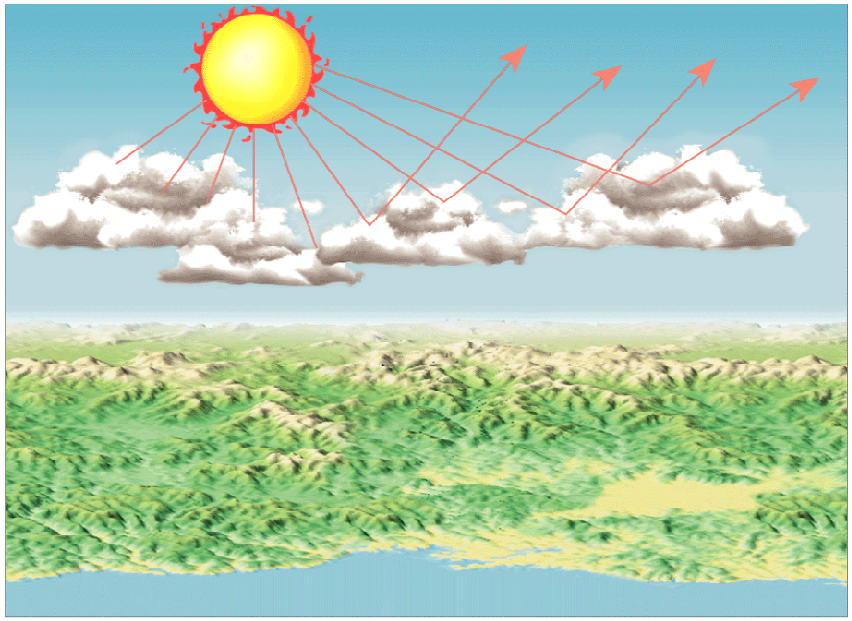
4. Temperatures vary because of *cloud cover* (albedo effect):

- **Albedo** is the fraction of total radiation that is reflected by any surface such as a cloud.

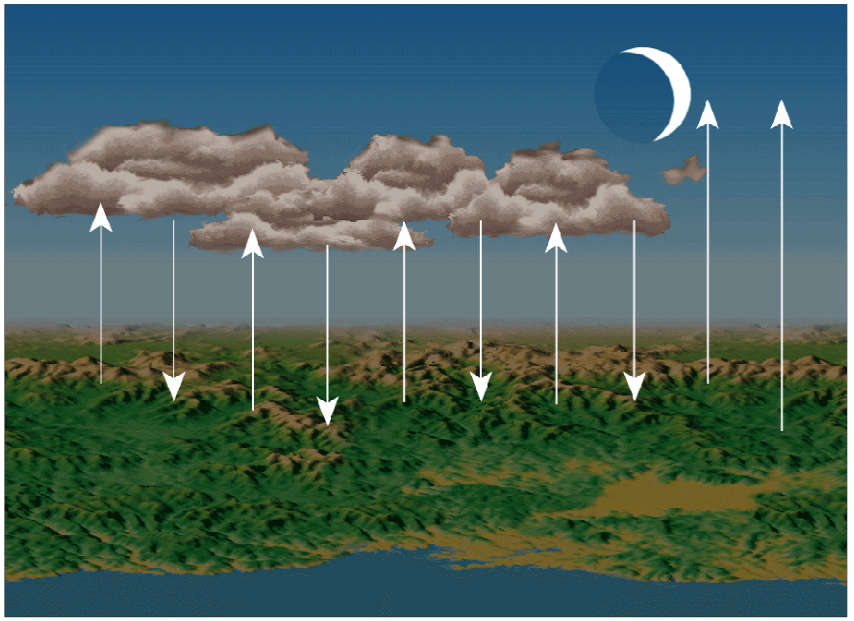
- **Cloud Cover**-Many clouds have a high albedo and therefore reflect back to space a significant portion of the sunlight that strikes them.

Temperatures vary because of how:

Clouds Reflect and Absorb Radiation



Reflect radiation from Sun



Absorb radiation that was absorbed by land

COMING UP NEXT:

WATER IN OUR ATMOSPHERE