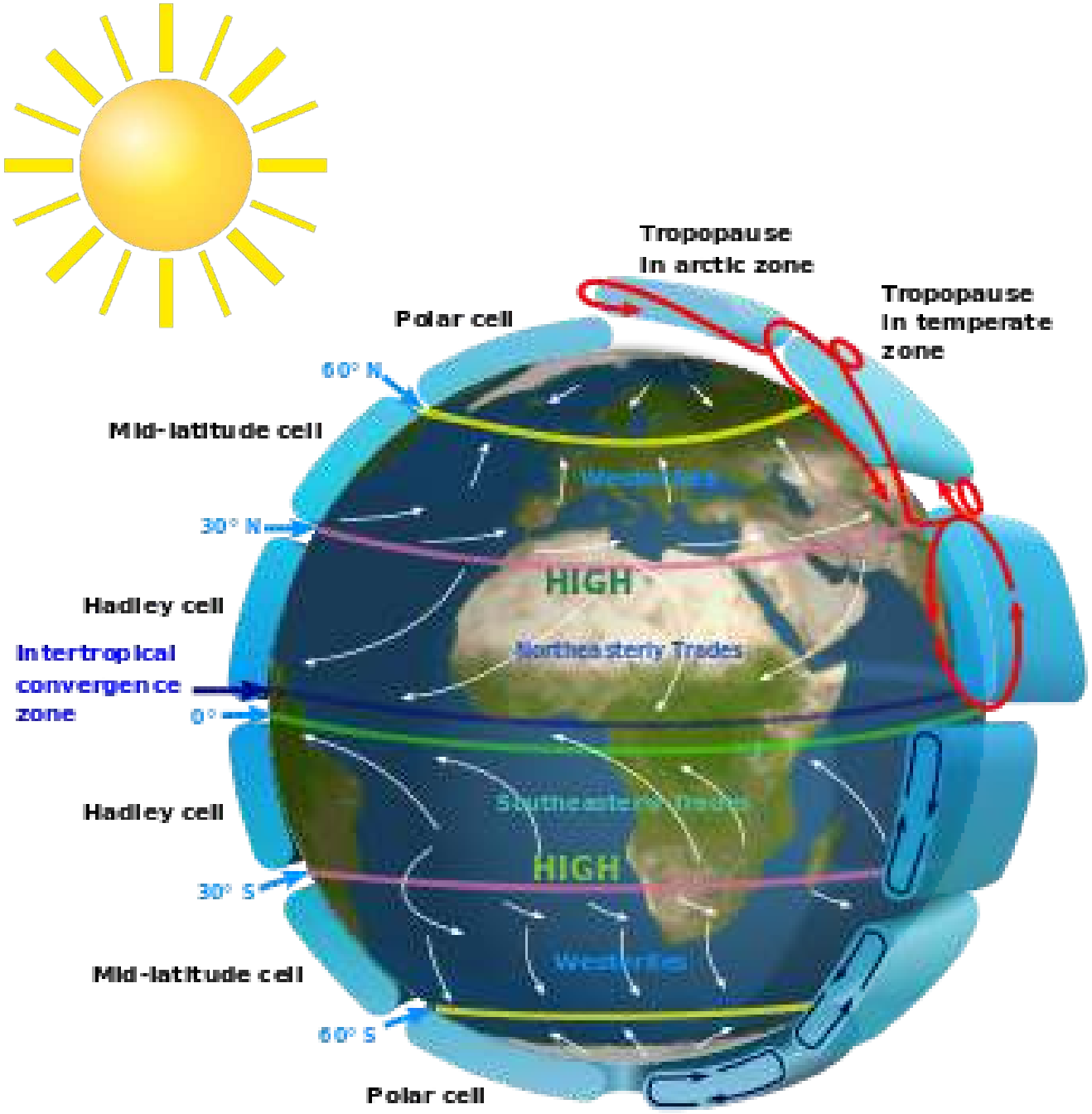
Energy Transfer in the Environment & Air Movement



Energy Transfer in the Atmosphere

Earth's energy is
provided by the SUN.

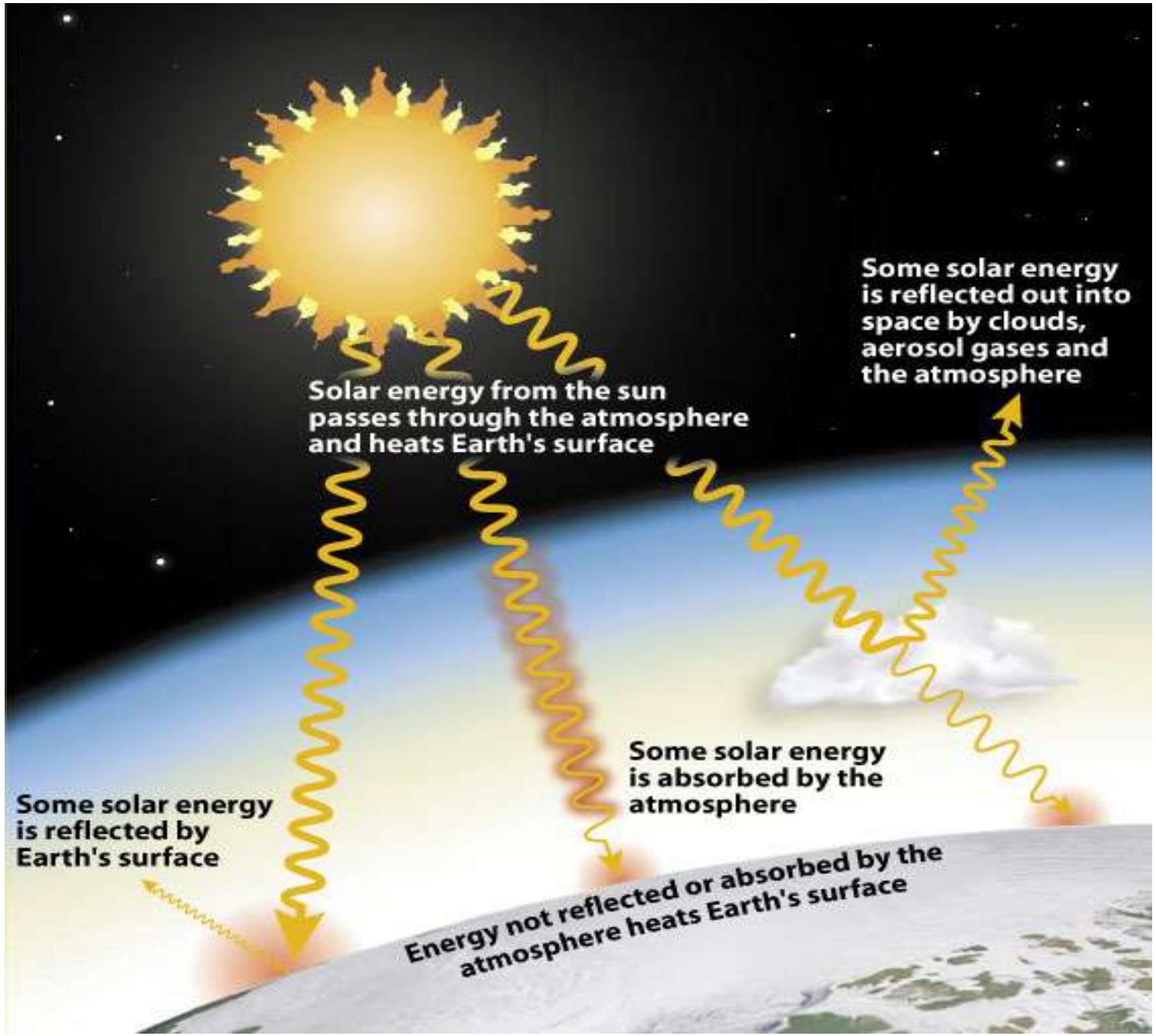
Energy is important to us because it...

Drives winds and ocean currents.

Allows plants to grow to produce food.

When Earth receives energy from the Sun, what three things may happen to that energy???

1. Reflected back into space.
2. Absorbed by the atmosphere.
3. Absorbed by the land and water.


Some solar energy is reflected out into space by clouds, aerosol gases and the atmosphere
Solar energy from the sun passes through the atmosphere and heats Earth's surface
Some solar energy is absorbed by the atmosphere
Some solar energy is reflected by Earth's surface
Energy not reflected or absorbed by the atmosphere heats Earth's surface

Does land or water absorb the Sun's energy faster???

Think about a sunny day at the beach ...

Land… Why?

- **Because it takes more energy to warm up a body of water than it does to warm up an equal area of land.**

Think about it…when you walk out onto the sand during the day, it is HOT, so we sometimes RUNNNNNNNN to the cooler water!

Figure 2--Conduction, Convection, and Radiation

Conduction

Energy is transferred by direct contact.

Convection

Energy is transferred by the mass motion of molecules.

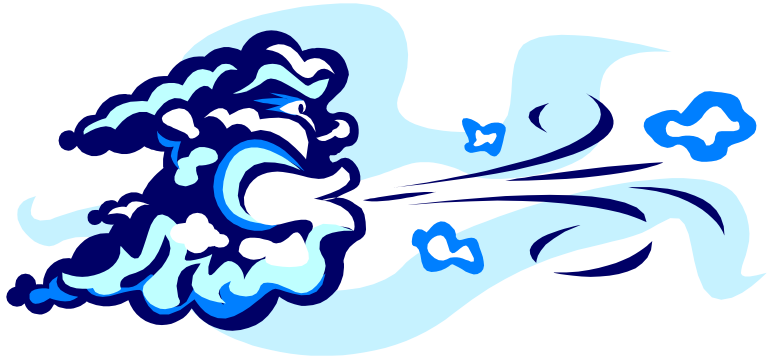
Radiation

Energy is transferred by electromagnetic radiation.

Why can life exist here on Earth only?

Answer: Because the atmosphere holds just the right amount of the Sun's energy!!


Air Movement



Wind

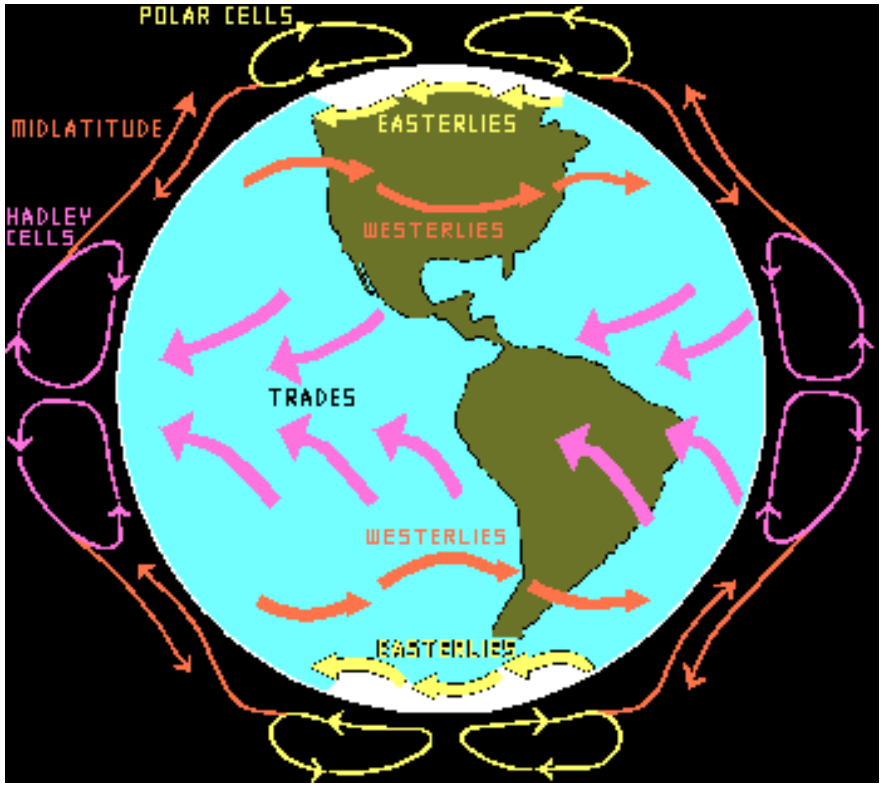
The uneven heating of the Earth's surface by the Sun causes some areas to be warmer than others...

...Remember that warmer air expands, becoming less dense than cold air... causing air pressure to be lowered where the air is heated & warm air rises.

So... what is wind???

Wind is…

the movement of air from an area of higher pressure to an area of lower pressure!



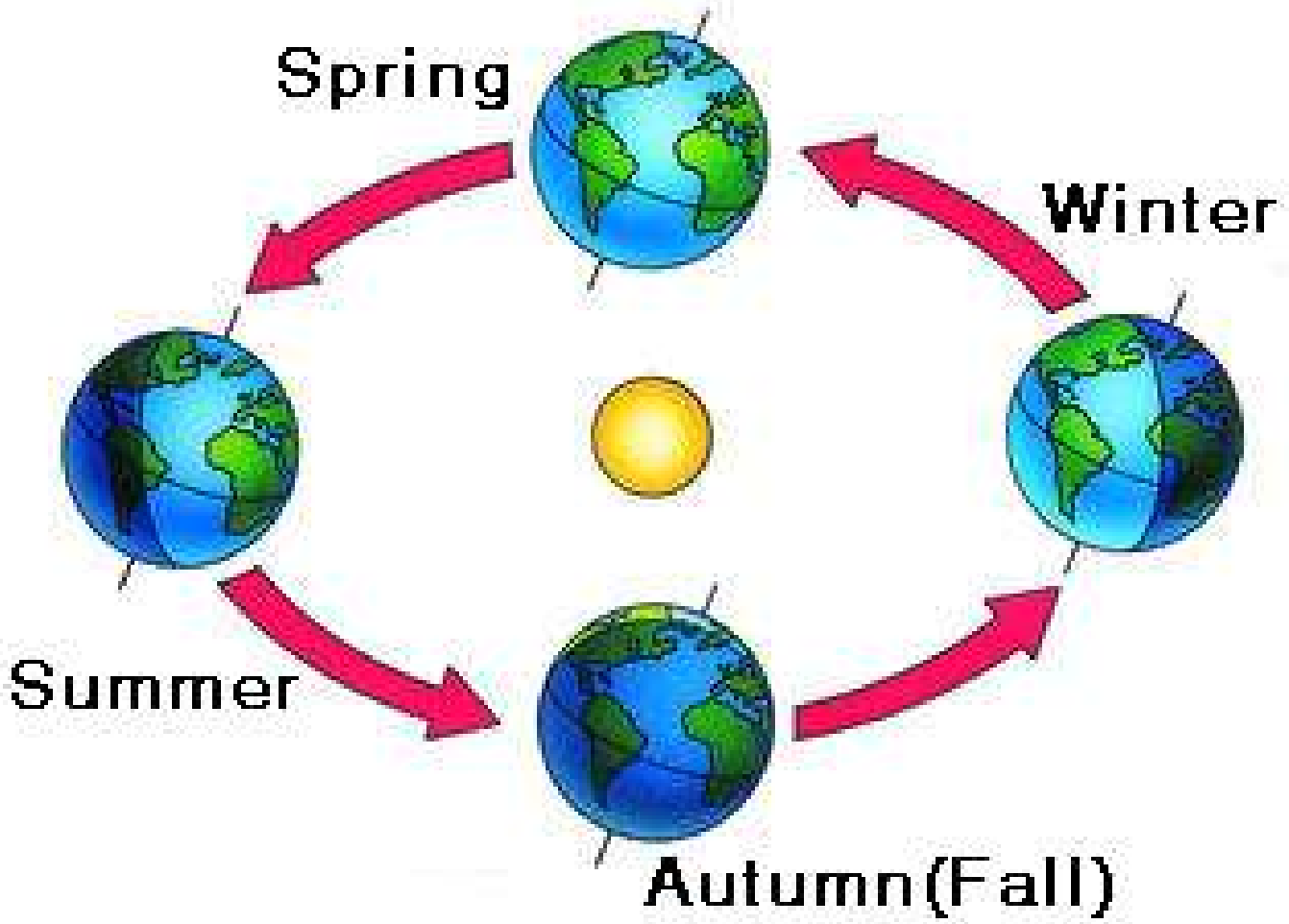
Do different areas of Earth receive different amounts of radiation from the Sun?

How?

Where?

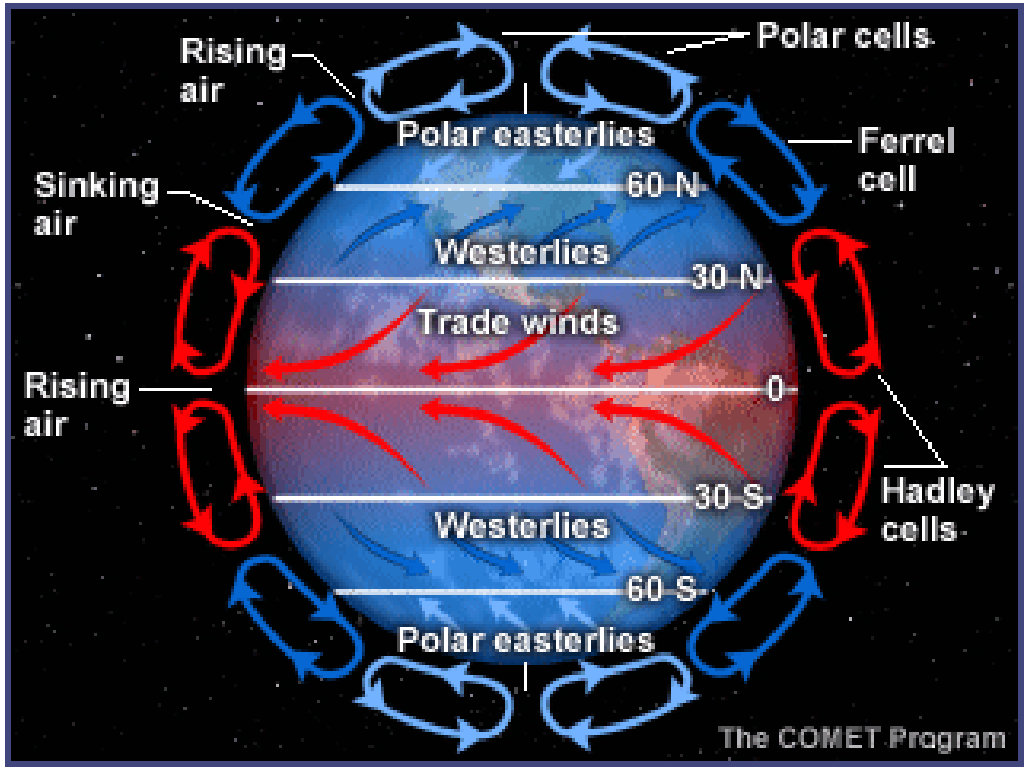
When?

Explain!



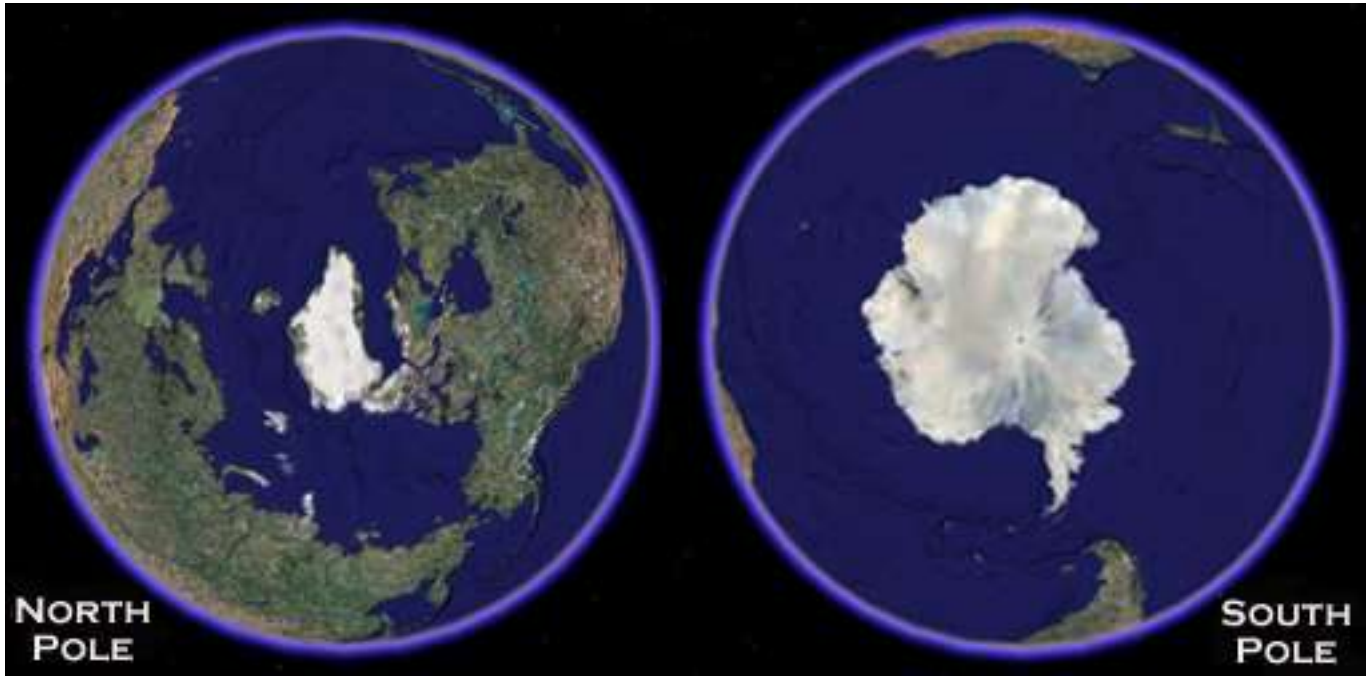
Which portion of the Earth receives the most radiation from the Sun?

Answer: The Equator receives more <u>radiation</u> than areas to the <u>North and South</u>.



The heated air at the equator is less dense, so it is displaced by denser, colder air sinking, which creates convection currents in the atmosphere.

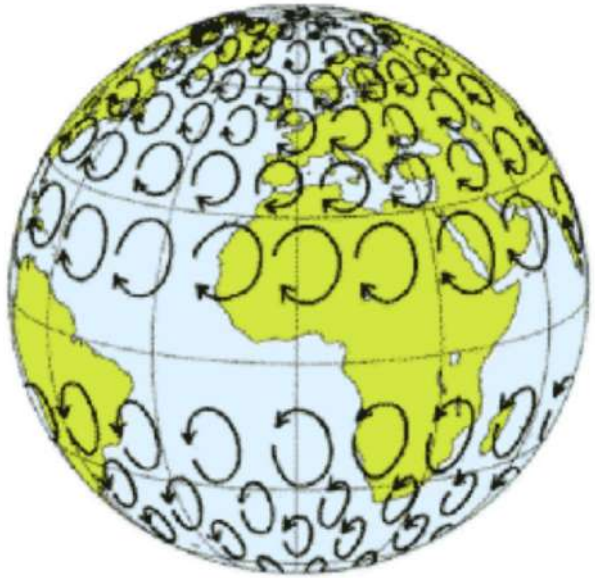
The cold, denser air coming from the poles, receives less radiation from the Sun, making the air at the poles much cooler. This results in the dense, high-pressure air sinking and moving along Earth's surface.

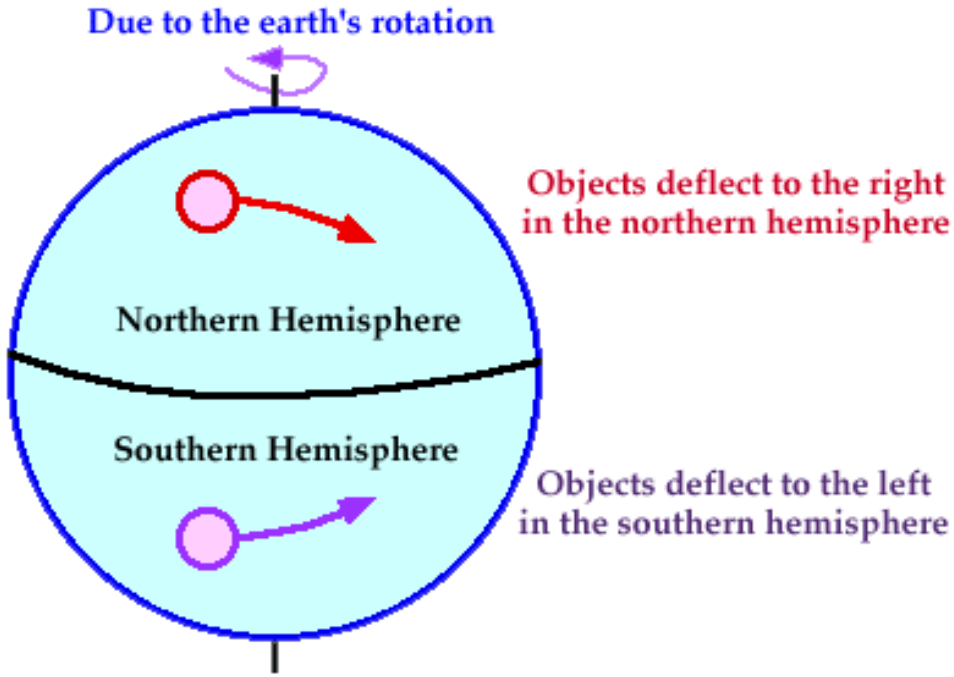


Note: Dense air sinking as less-dense air rises does not explain everything about wind... it is only one factor in forming wind!

The Coriolis Effect:

When the **rotation** of Earth causes moving air & water to appear to turn **clockwise (to the right)** North of the equator and **to the left (counterclockwise)** South of the equator.



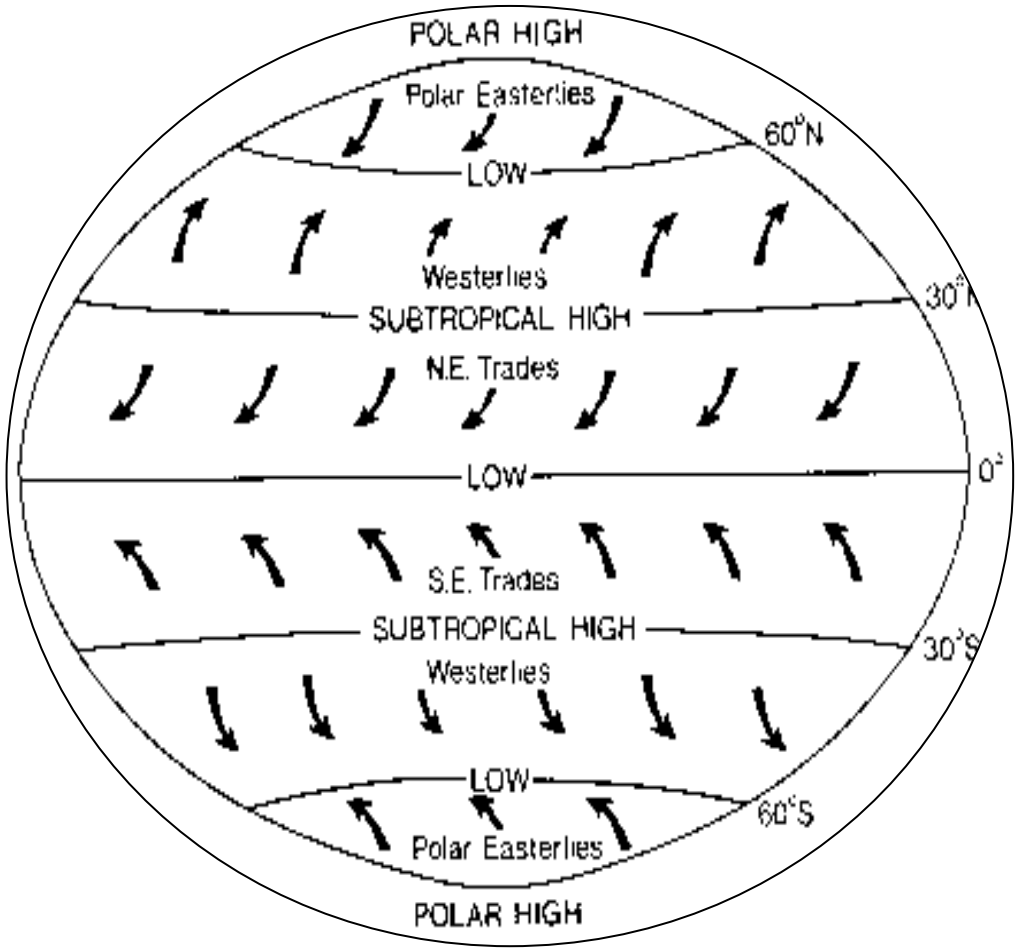


Global Winds

Global Winds

These winds blow all around the globe & are based on temps!

1. Trade Winds
2. Prevailing Westerlies
3. Polar Easterlies



Trade Winds:

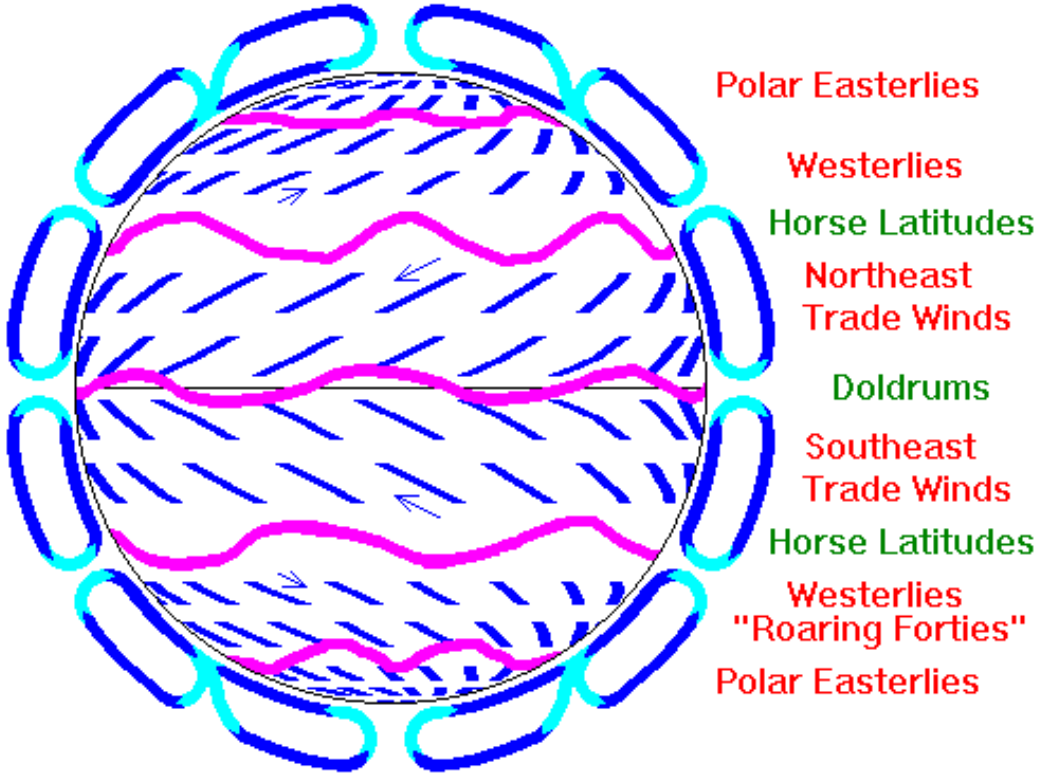
- Also called Tropical Winds (warm!) near the equator
- Used by sailors to establish early trade routes

Prevailing Westerlies:

- Located between the polar & trade winds
- Responsible for the movement of weather across North America

Polar Easterlies:

- Found near the poles (cold!)

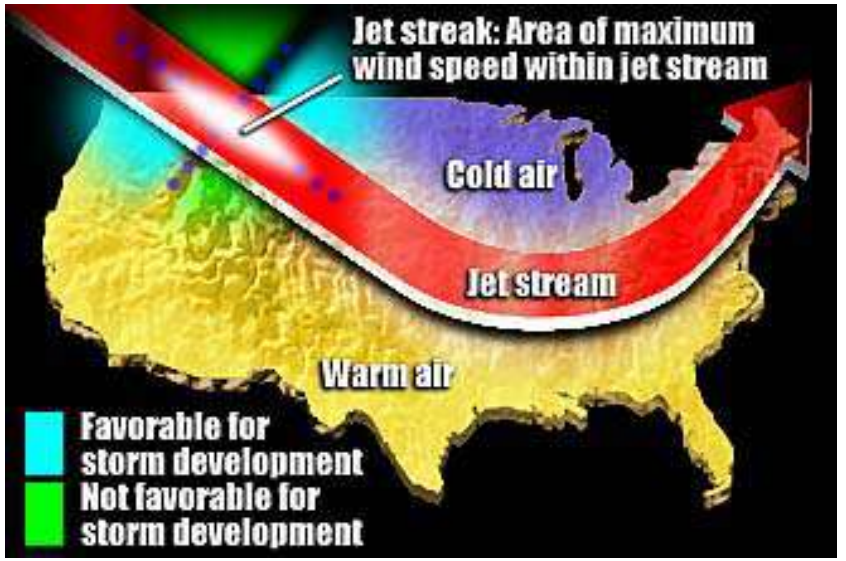


* Remember: the equator is the line of symmetry, so the winds to the North mirror the winds to the South, just like temps do.

Winds in the Upper Troposphere

Narrow belts of strong winds, called Jet Streams, blow near the top of the troposphere.

Polar jet streams form at the boundary of cold, dry polar air to the north and warmer, more moist tropical air to the south.



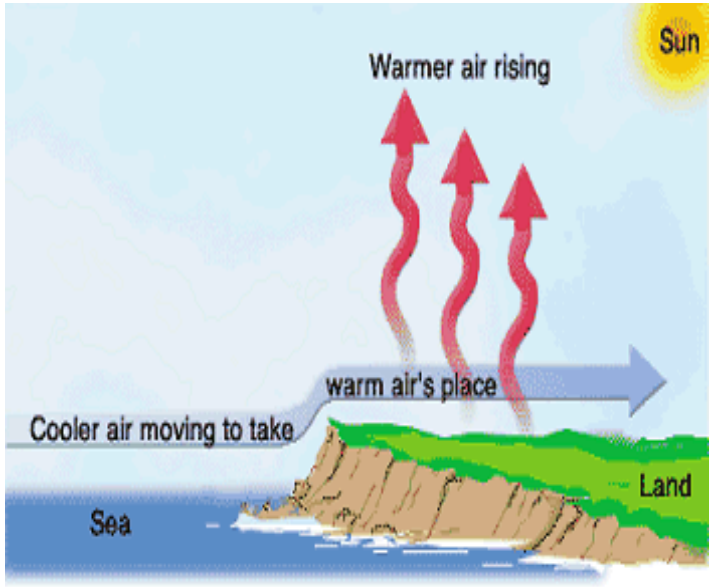
The **Jet Stream**...

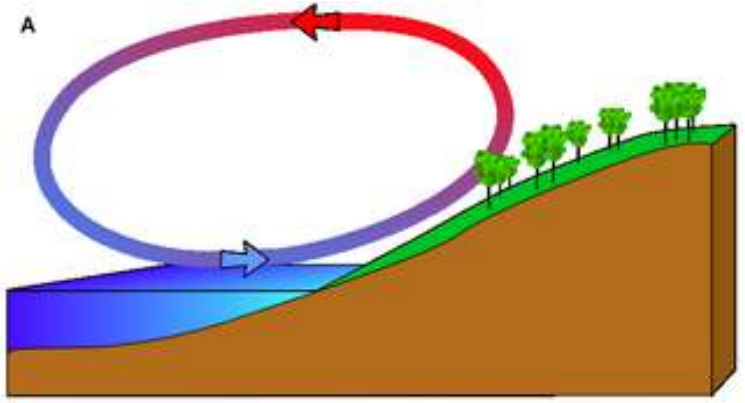
- Moves faster winter because the difference between the cold air and warm air is greater!
- Moves storms across the U.S.
- Pilots flying west → east save time & fuel.

Local Wind Systems

Local Wind: Sea Breeze

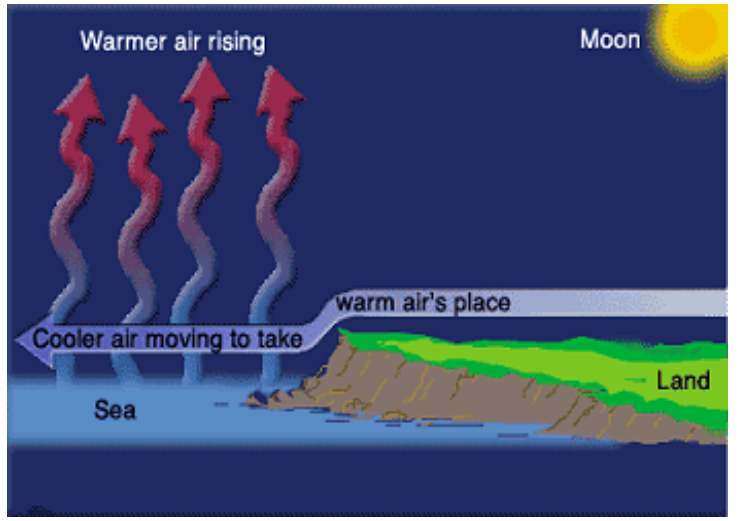
- The movement of air toward the land from the water (sea).
- Created during the day because solar radiation warms the land more than the water.
- Air over the land is heated by conduction.
- Heated air is less dense & has lower pressure.
- Cooler, denser air over the water has higher pressure & flows toward the warmer, less dense air.
- Results in a convection current that blows wind from the sea toward land.

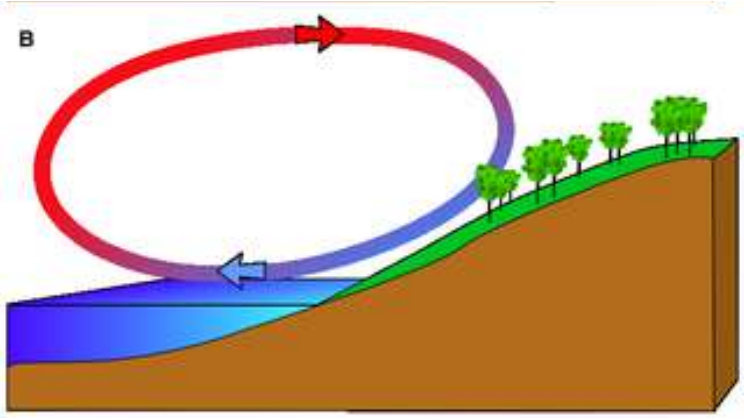




Local Wind: Land Breeze

- The movement of air toward the water from the land.
- Created at night because the land cools much more rapidly than the ocean water.
- Cooler, denser air above the land moves over the water, as the warm air over the water rises.
- Resulting in a convection current that blows wind from the sea toward land.





Types of Precipitation