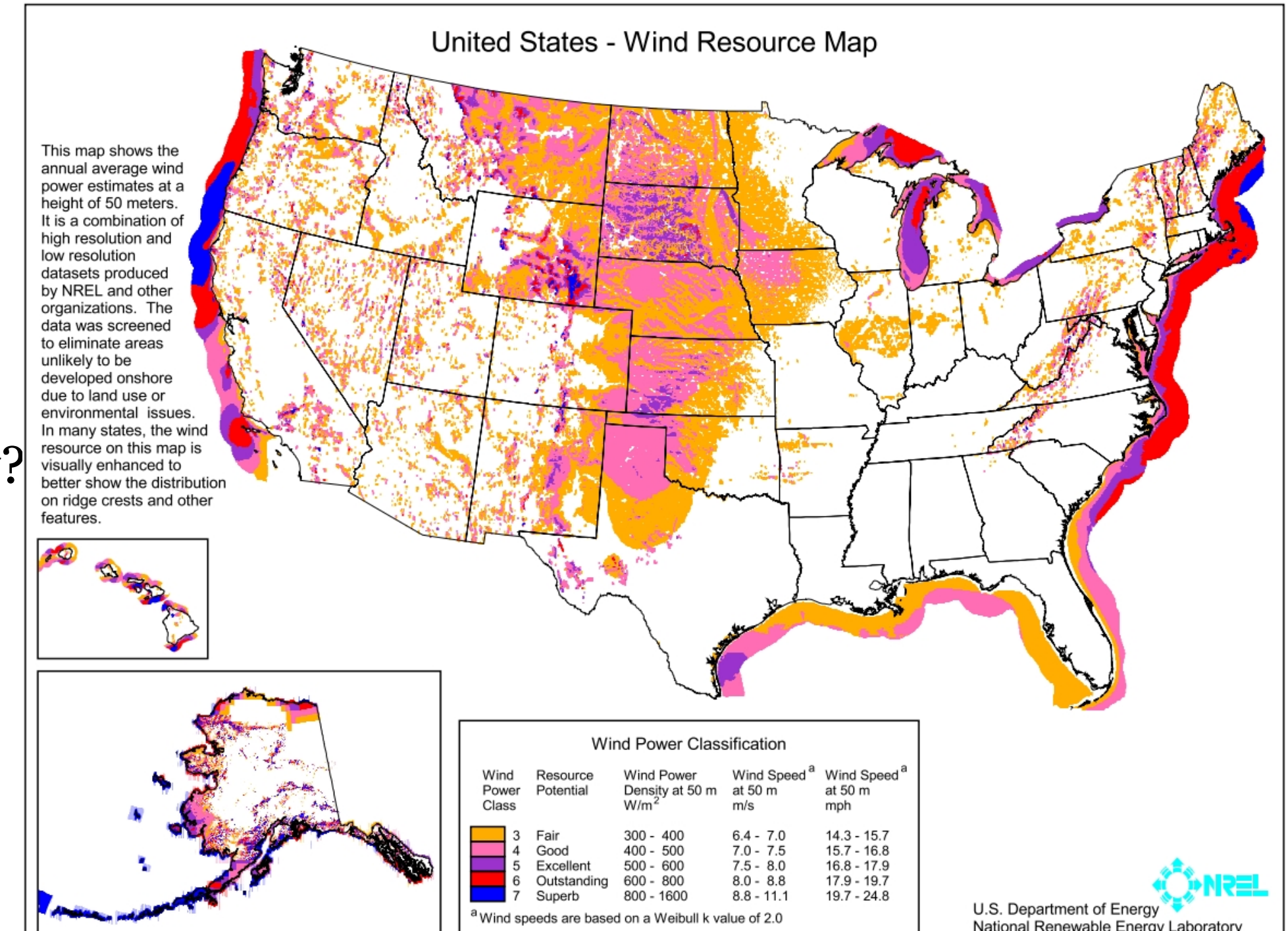
Air Currents (12.3)

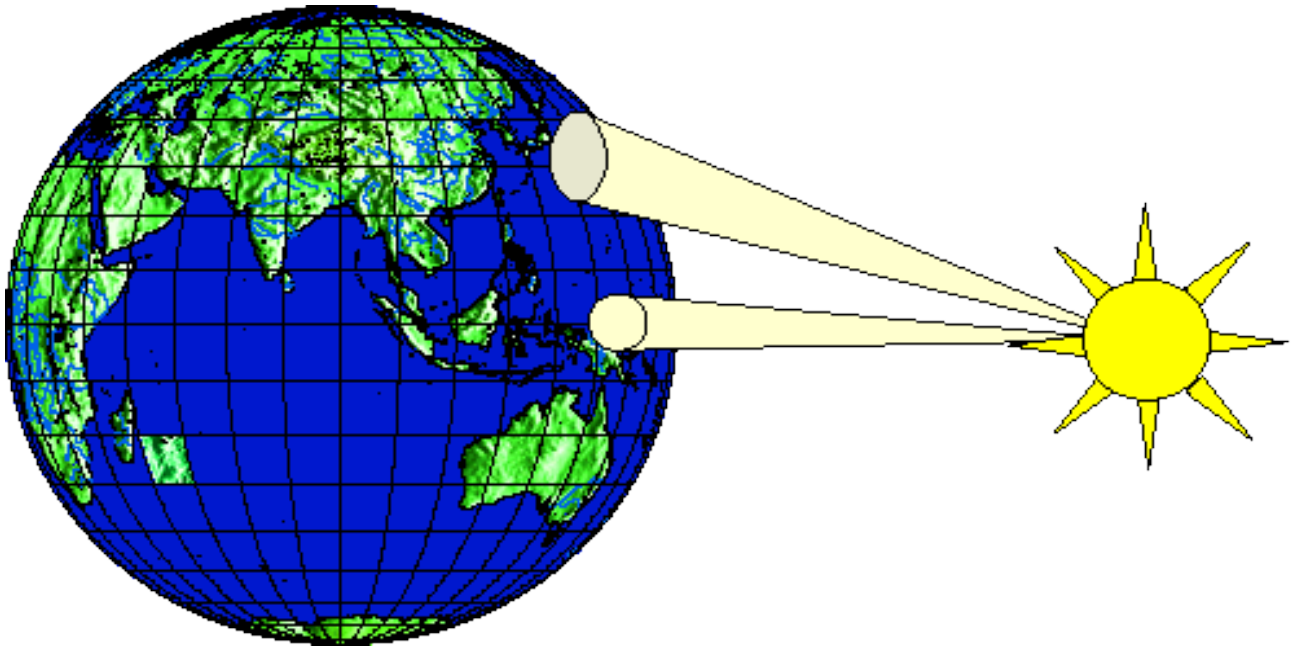
How does air push these blades?

Is Vernon Hills a good location for wind energy?



Sun's Energy

- The Sun's energy warms Earth. However, the same amount of energy does not reach all of Earth's surface.
- The amount of energy an area receives depends largely on the Sun's angle.



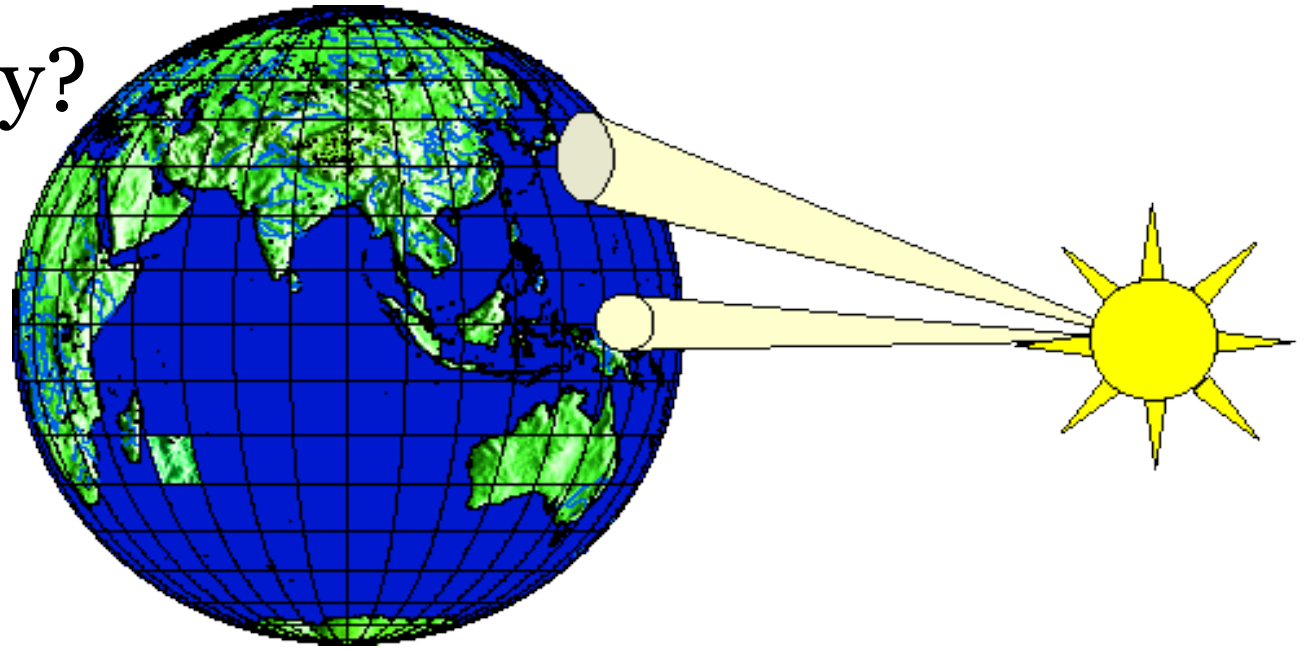
Sun's Energy

- Which area of the Earth receives the most solar energy (heat)?

_____

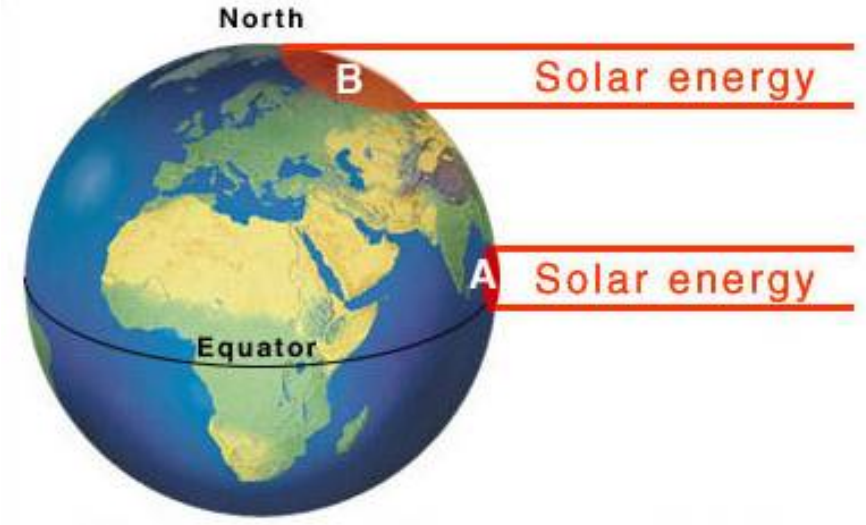
- Which area of the Earth receives the least solar energy?

_____



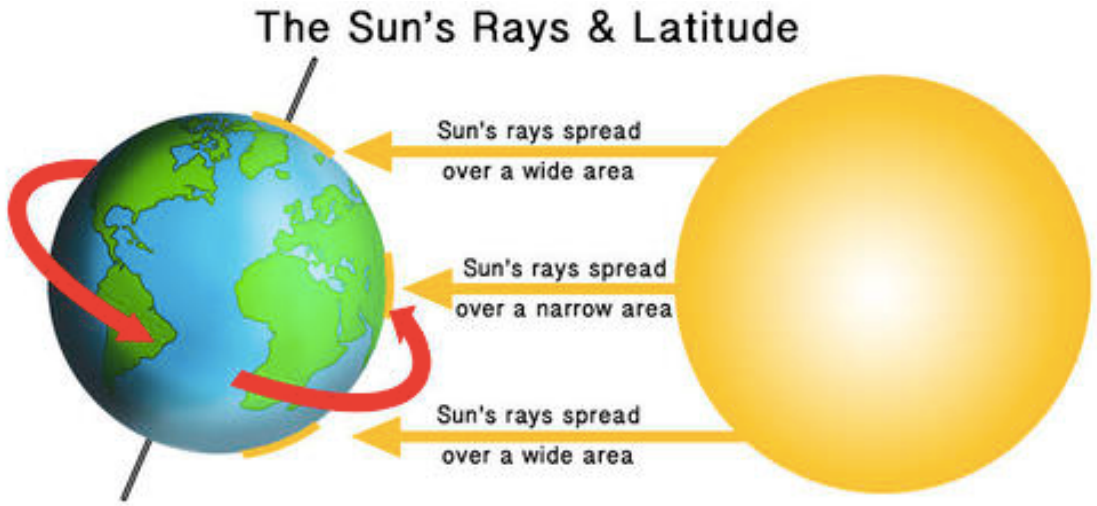
Unequal Heating of Earth's Surface

- Latitudes near the equator (tropics)-sunlight strikes Earth's surface at a nearly 90 degree angle year round
  - More sunlight per unit of surface area
  - Land, water, air at the equator are always warm



Unequal Heating of Earth's Surface

- Latitudes near the North and South Pole-sunlight strikes Earth's surface at a low angle
  - Now, sunlight is spread over a larger surface area than the tropics
  - As a result, poles receive very little energy per unit of surface area and are cooler

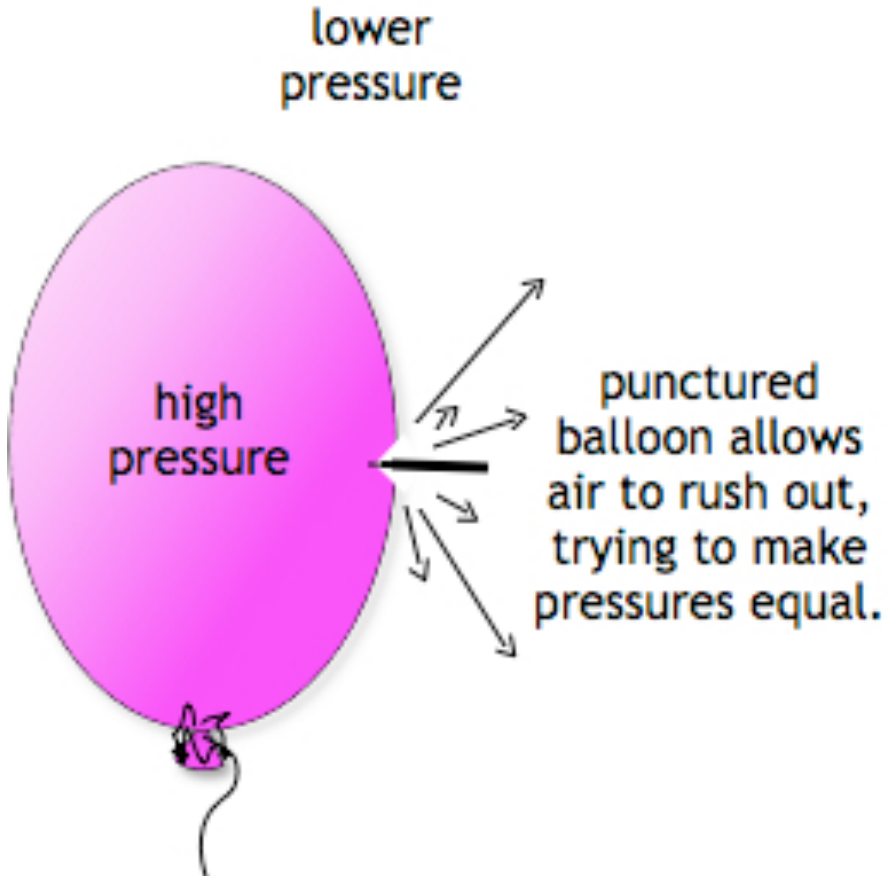


Wind

- Wind= movement of air from areas of high pressure (H) to areas of low pressure (L)
- High pressure= colder areas, air is more dense and sinks, which increases pressure
- Low pressure= warm areas (tropics), air is less dense and rises, which lowers pressure

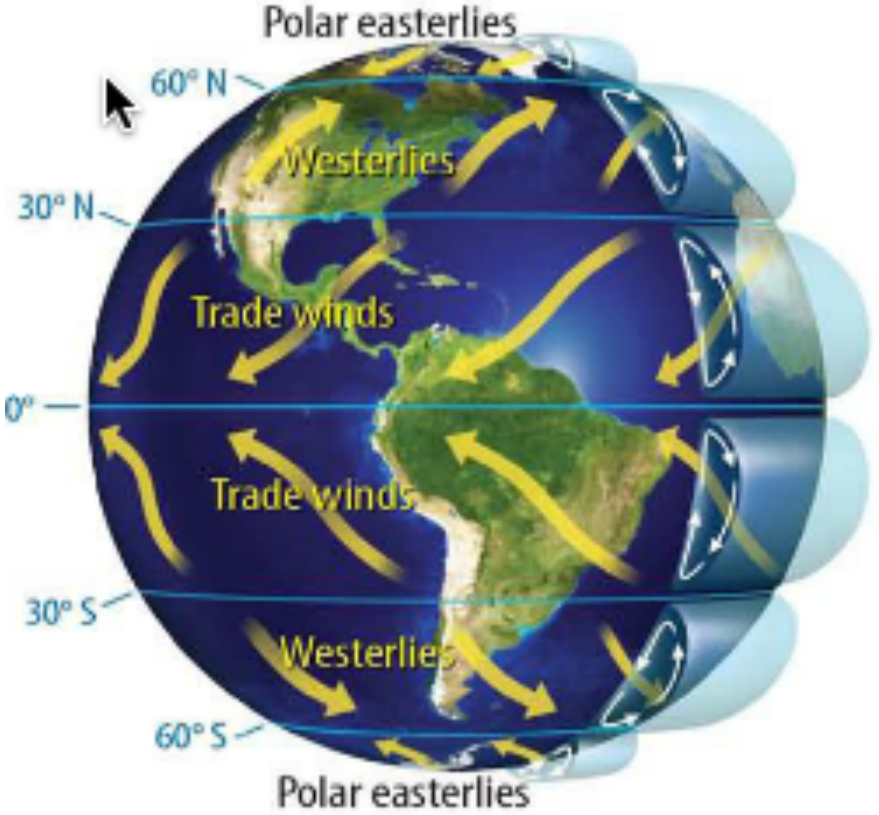
Wind

• ***<u>Example</u>: When you blow up a balloon, you increase the air pressure inside the balloon. When you let go of the end, the air rushes out of the balloon***



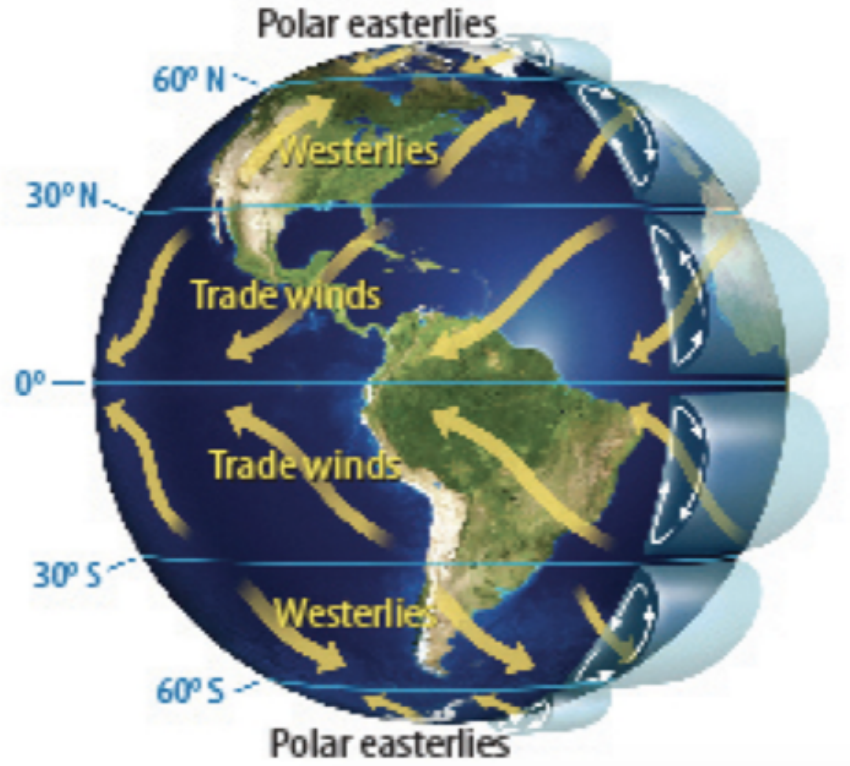
Global Wind Belts

- The uneven heating of the Earth creating differences in air pressure and the earth's spin creates **global winds**.
- At the **poles**: indirect solar energy; cold temps; high pressure
  - air sinks and moves towards the equator.
- At the **equator**: direct solar energy; warm temps; low pressure
  - air rises and moves towards the poles.



Global Wind Belts

- The atmosphere tries to send the cold air toward the equator at the surface and send warm air northward toward the pole at higher levels.
- Unfortunately, the spin of the earth prevents this from being a direct route, and the flow in the atmosphere breaks into three zones between the equator and each pole.



The Coriolis Effect

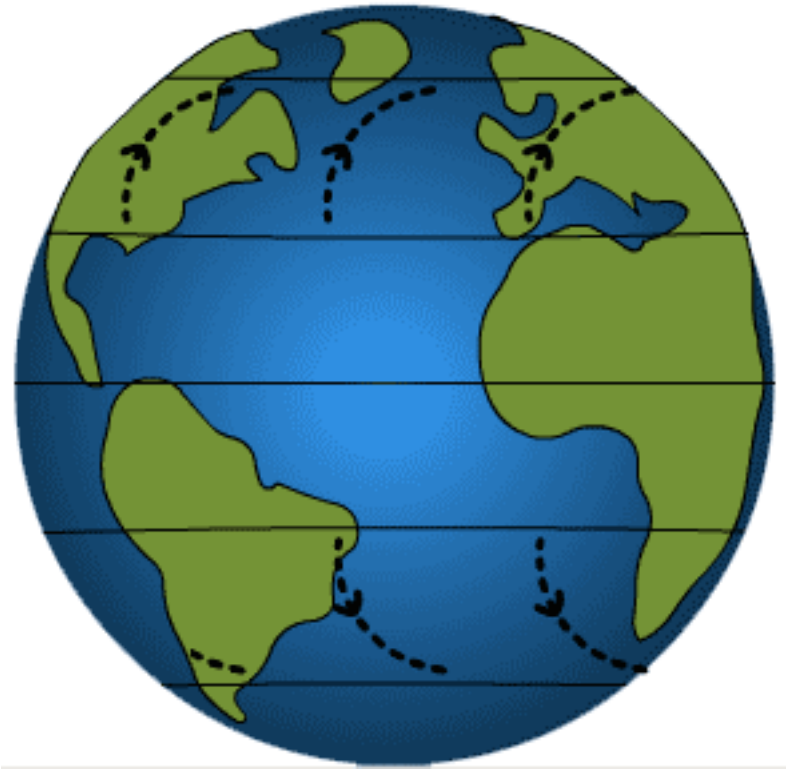
- makes things (like air, water, planes) traveling long distances around the Earth appear to move at a curve as opposed to a straight line.
- influences wind direction around the world
  - in the Northern Hemisphere it curves winds to the right
  - in the Southern Hemisphere it curves them left.

Prevailing Winds

- Trade winds
  - winds that flow from East to West
  - 30N→30S

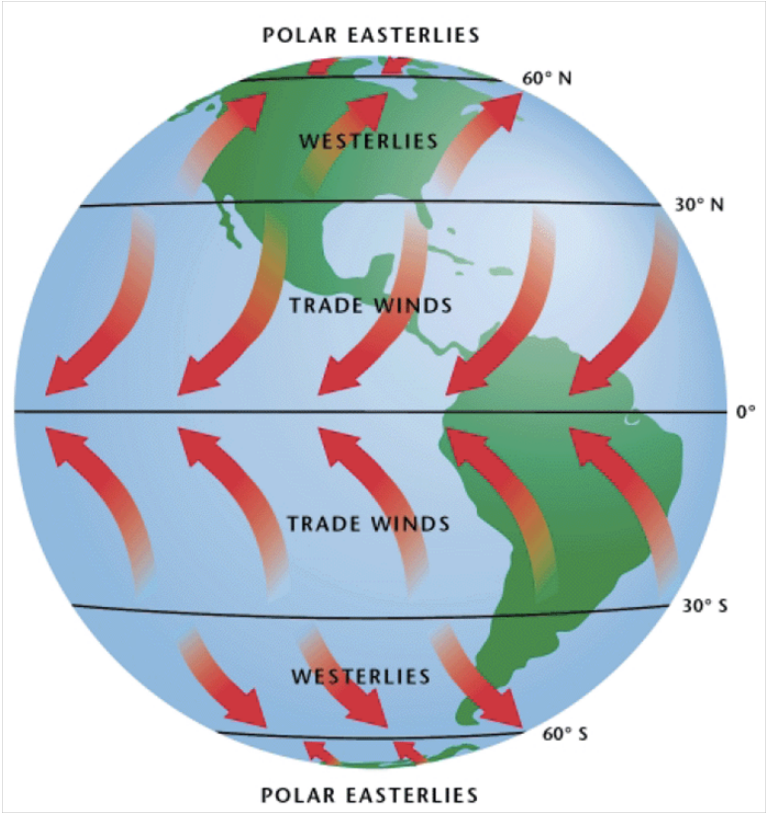
Prevailing Winds

- Prevailing westerlies-winds that flow from West to East
  - 30N→60N
  - 30S→60S



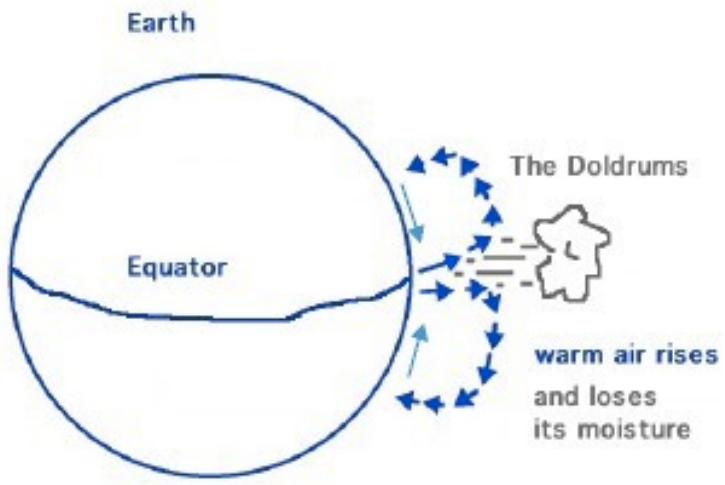
Prevailing Winds

- Polar easterlies
  - cold winds that blow from East to West
  - near the North and South Pole



Prevailing Winds

- Doldrums
  - 30 N/30 S
  - air cools and sinks and creates high pressure
  - light and calm winds
  - sailboats without engines can become trapped here

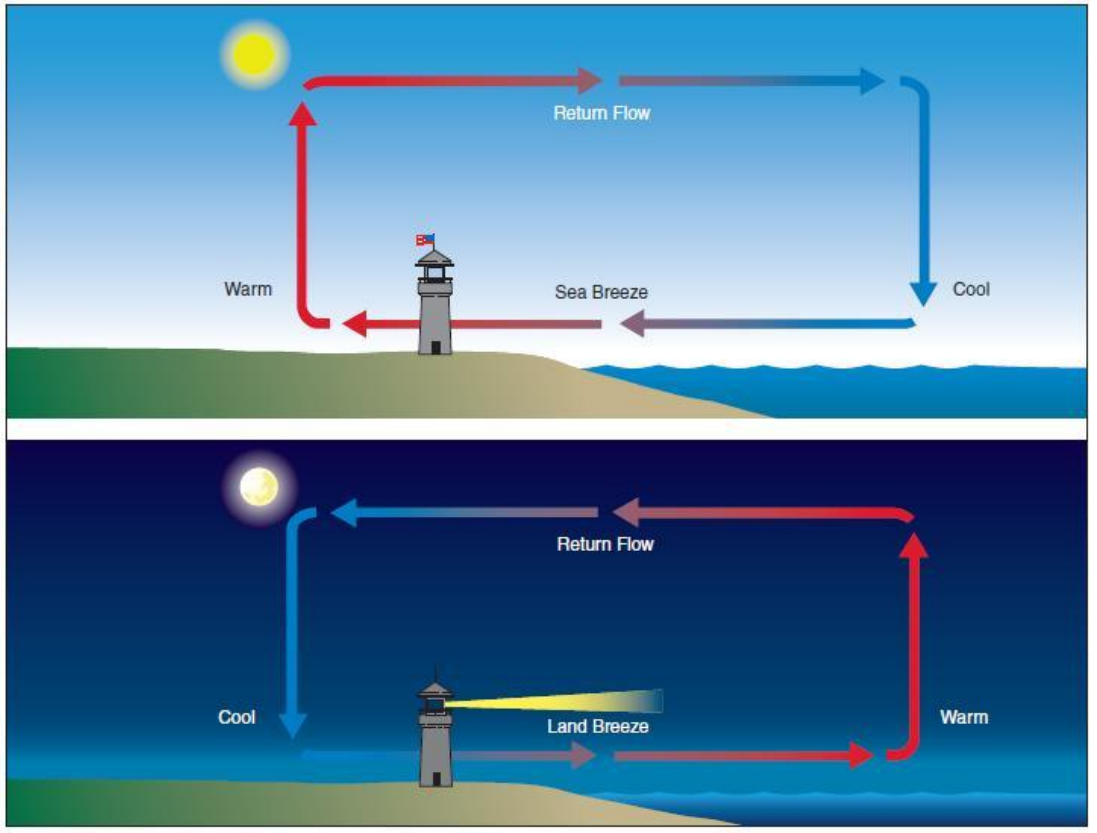


Jet Streams

- near the top of troposphere
- narrow band of high winds that usually separate cold and warm air.
- can reach speeds of 300km/hour and can be very unpredictable
- an airplane can travel much faster, and save fuel, by getting “sucked up” in the jet stream; this can also cause a bumpy flight, because the jet stream is sometimes unpredictable and can cause sudden movement, even when the weather looks calm and clear.

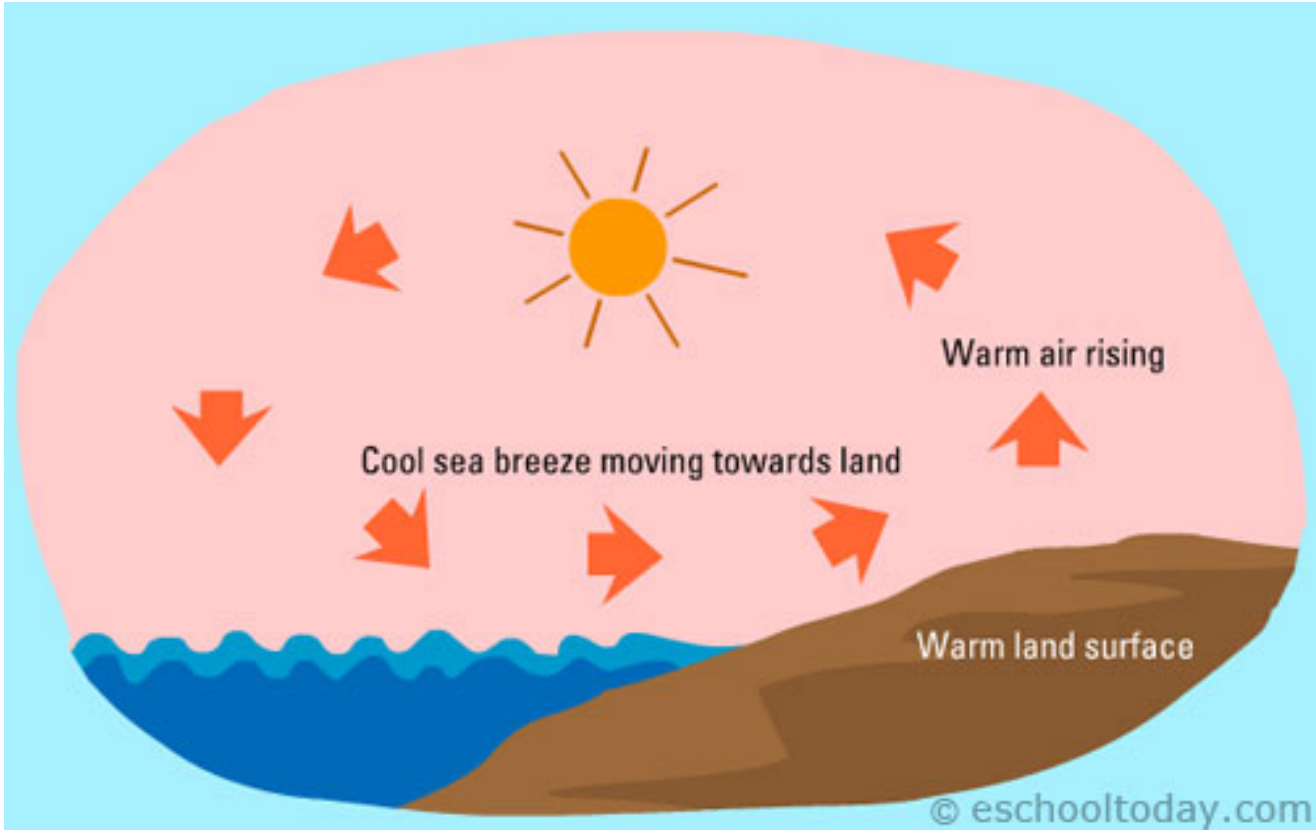
Local Winds

- occur along coastal areas or areas with adjacent large water bodies.
- water and land have different heating abilities.
  - water takes a bit more time to warm up and is able to retain the heat longer than land does



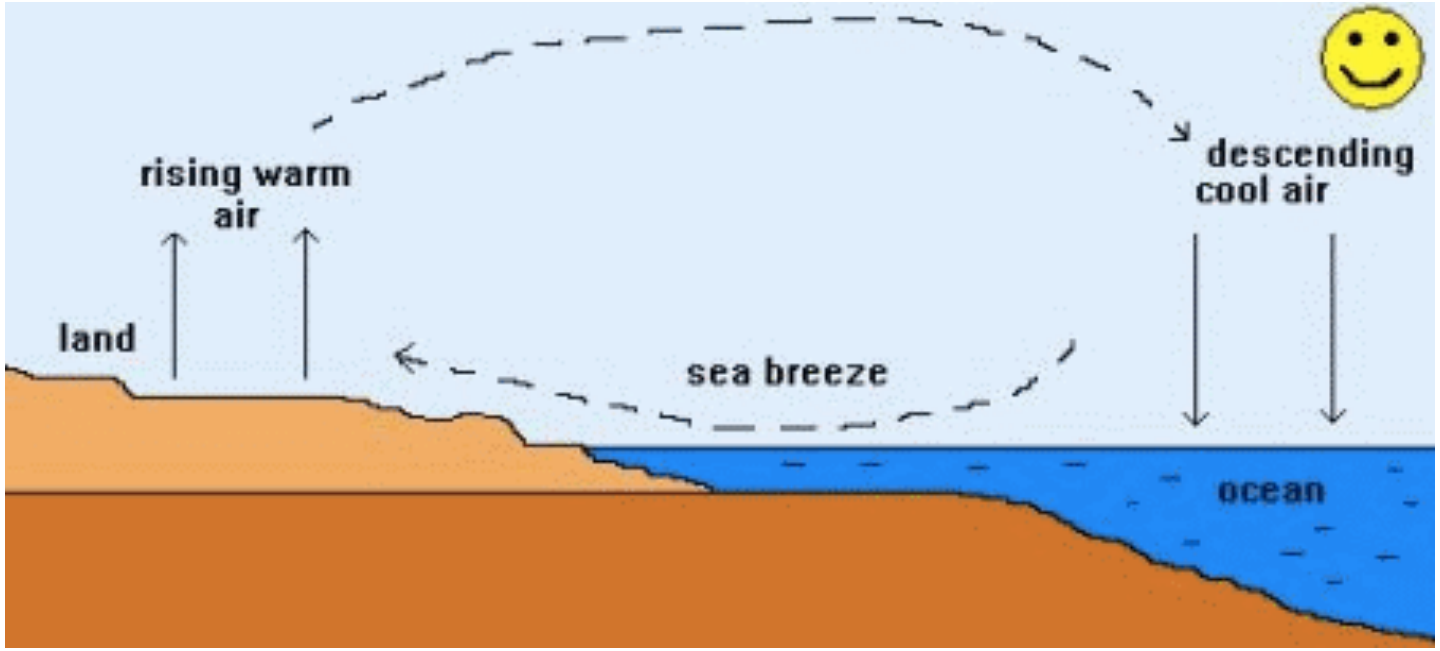
Sea Breeze

- In the day, when the sun is up, the land heats up very quickly and the air above it warms up a lot more than the air over the water. The warm air over the land is less dense and begins to rise.
- Low pressure is created.

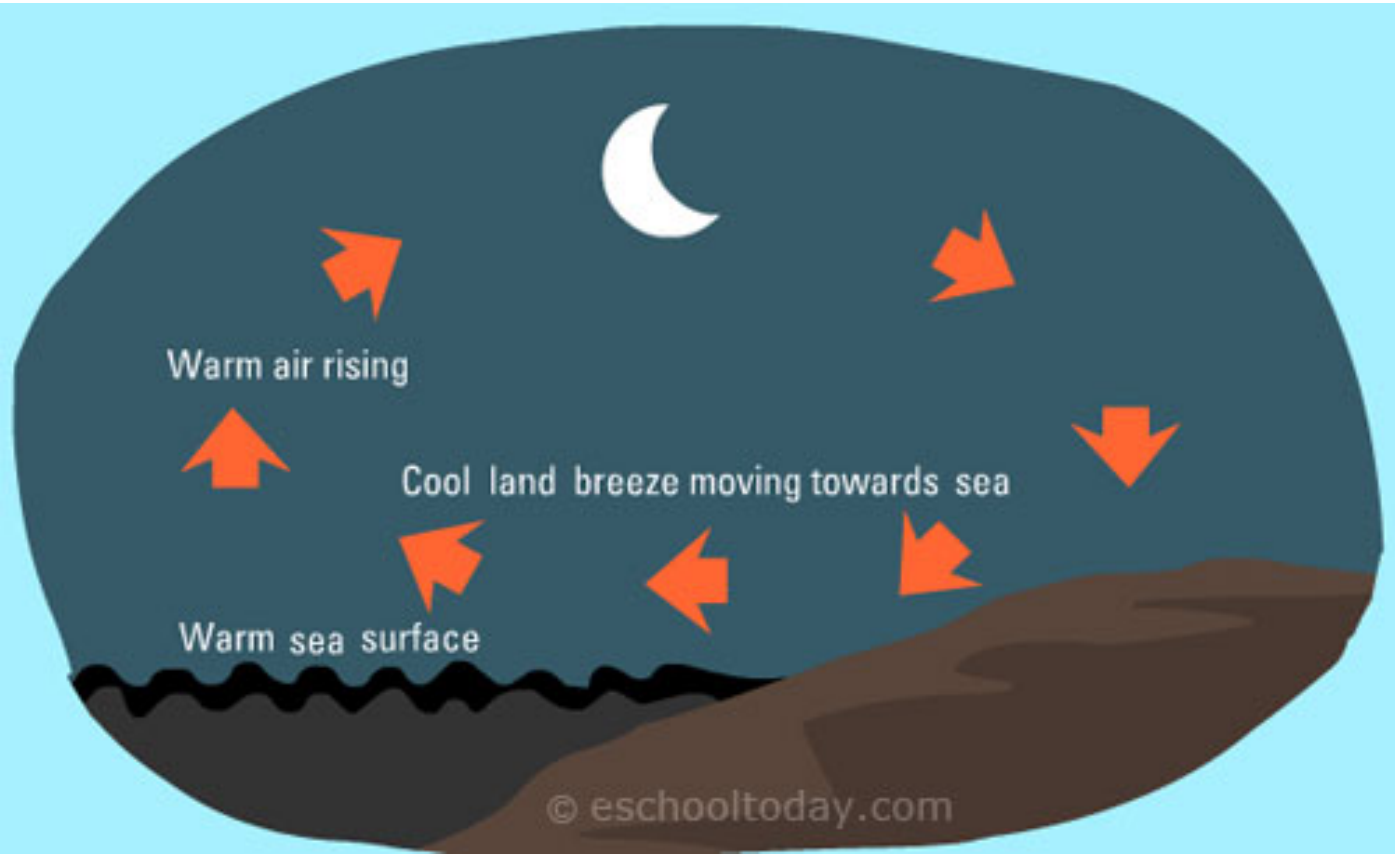


Sea Breeze

- The air pressure over the water is higher with cold dense air, which moves to occupy the space created over the land. The cool air (wind) that moves from sea onto land is called a sea breeze.



Land Breeze



In the night, the reverse happens.

- The land quickly loses its' heat whiles the water retains its' warmth. This means the air over the water is warmer, less dense and begins to rise.
- Low pressure is created over the water.

Land Breeze

- Cold and dense air over the land begins to move to the water surface to replace the warmer rising air. The cool breeze from the land toward the water is called a land breeze