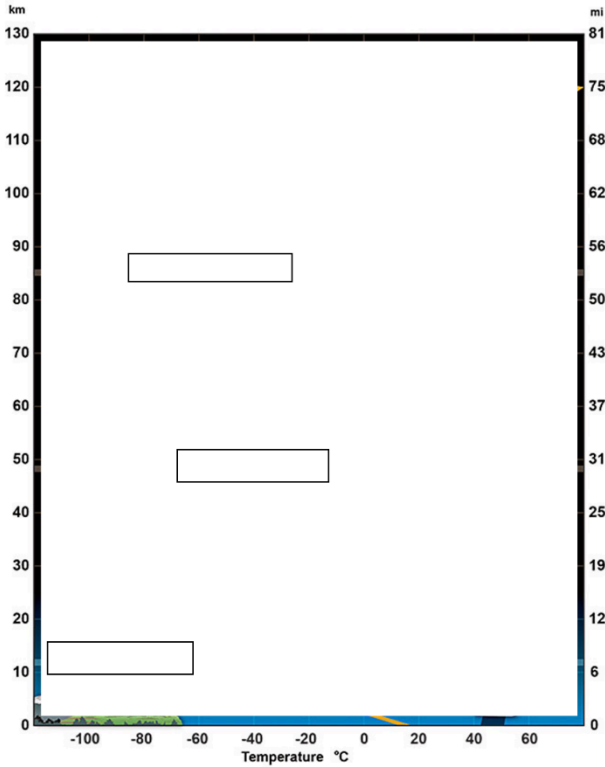


Earth's Atmosphere, Climate, and Weather

Atmospheric Layers

- If you were to travel from the ground to space, you would pass through ___ distinct layers, each with their own unique properties
- They are characterized mainly by _____

Exosphere (space)



_____ **osphere:** Not many _____. Where _____ orbit and the _____ can be found

_____ **osphere:** The _____ of the layers. Most meteorites _____ in this layer because it is the first layer (from space) to have atmospheric _____. These gases cause _____ with a fast-flying object → _____

_____ **osphere:** Where the "good" _____ (____) is that protects us from _____ and _____ radiation. There is _____ weather here!

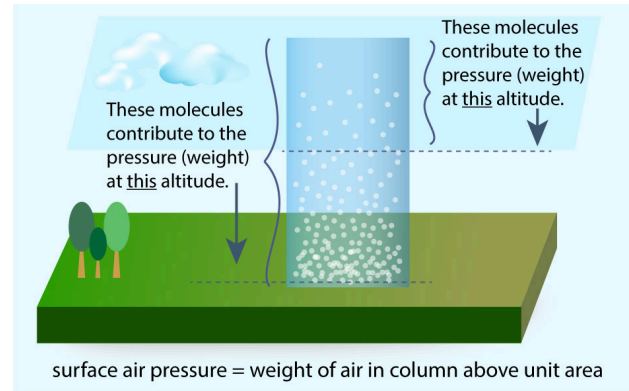
_____ **osphere:** First _____ km (about as high as Mt. Everest). Where airplanes fly and _____ occurs.

Weather & Climate

- Weather: the _____-term changes of a given area
 - o Occurs in the troposphere
- Climate: the _____-term average weather of a given area

Earth's Atmosphere

- The atmosphere (troposphere) is _____% _____ and _____% _____
 - o These proportions _____ fluctuate
- "Air" is not empty and has more weight/density with increasing gravity (at _____ level)
- So, the higher in altitude you go:
 - o The _____ the temperature
 - o The _____ the pressure

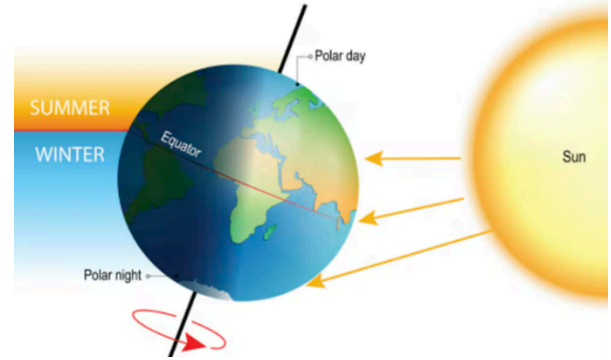


6 Factors Contribute to Climate & Weather

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1. Earth's Tilt and Orbit Around the Sun

- The Earth's axis of rotation is tilted _____ degrees from the vertical axis.
- It takes 365 days to orbit the sun
 - Part of Earth tilted towards sun will experience _____ because sun's rays are more _____
 - Part of Earth tilted away from sun will experience _____ because sun's rays hitting area at an _____

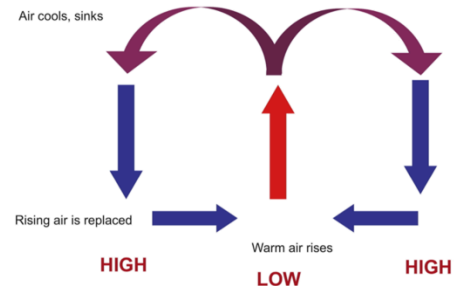


- The seasons are NOT caused by the Earth spinning on its axis (that is what causes day/night) OR Earth's distance from the sun. It is the _____ at which the sun's rays hit the Earth.

2. Unequal Heating of the Earth

- The _____ receives direct and almost constant sunlight year-round
 - Causes relatively _____ and _____ climates at the equator (_____)
- As you move towards the poles, the sun's rays hit the Earth at an ever-increasing angle, causing temperatures to _____ with _____
- The tilt of the Earth means that the Northern and Southern hemispheres receive direct rays for part of the year (summer) and visa-versa (winter)

Hadley Circulation Cell



3. Atmospheric Convection Currents

- How does the sun's radiation cause global winds?

- Air is warmed by the radiation of the sun and becomes _____ dense with the lower pressure (lighter), so it _____
- As air cools, it cannot hold onto moisture as easily and so it _____ (lots of rain at equator!)
- At high altitudes, the air cools as the gasses expand and are moved by the warm air that continues to rise
- Cool air falls to ground and warms as it gets closer to the ground
- It flows back to the point of origin due to pressure systems (_____ to _____)

- Causes large-scale air convection currents called _____

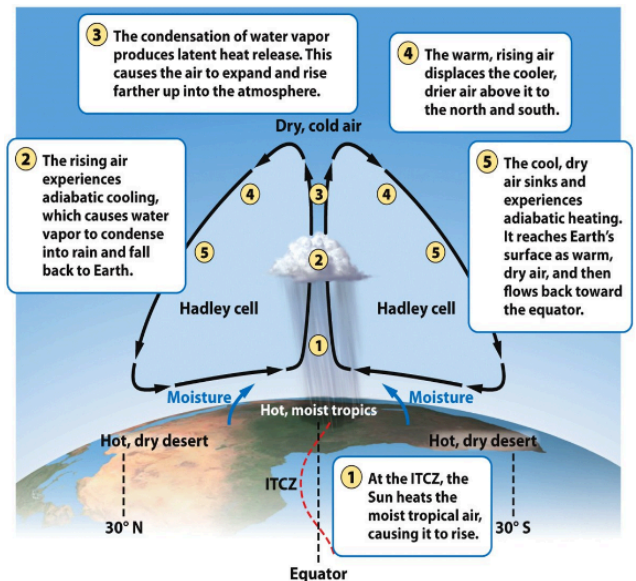


Figure 4.6 Environmental Science © 2012 W.H. Freeman and Company

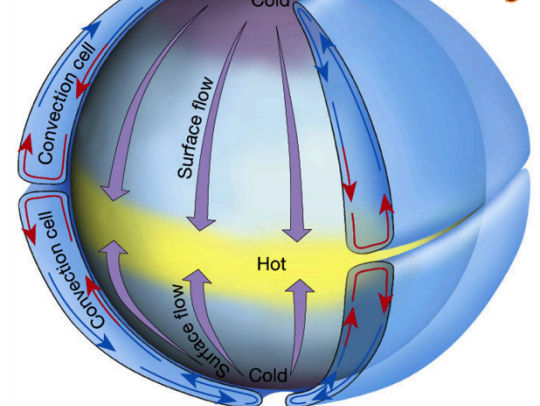
What If...

- If the earth didn't _____, there would only be _____ atmospheric convection cells
- Hot air at the equator would rise, travel to the poles, sink, and travel back to the equator as vertical surface winds
- But the Earth spins once every 24 hours...

4. Earth's Rotation

- The Earth spins _____ in the Northern hemisphere and _____ in the Southern hemisphere (try it!)

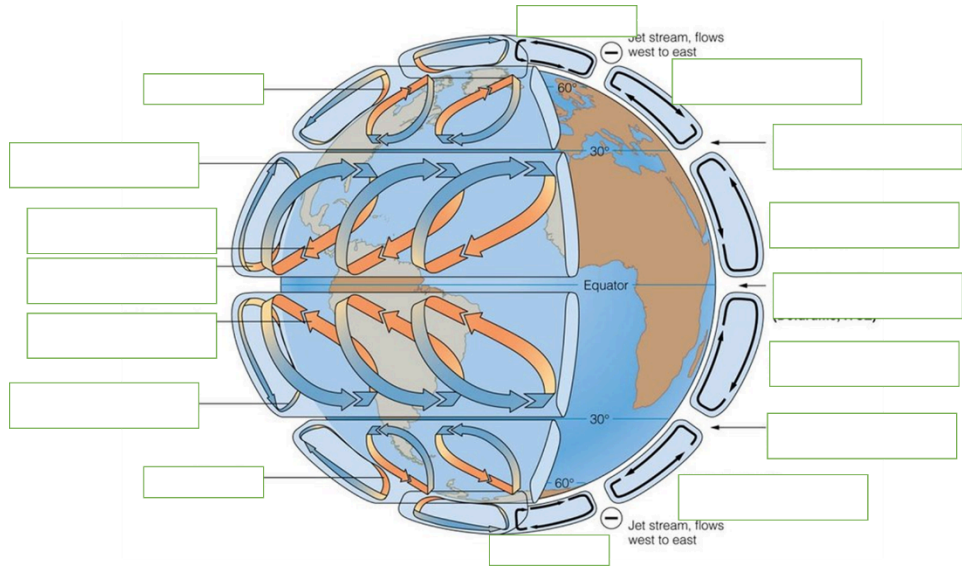
Theoretical...Not Reality



- _____ The rotation of the Earth causes objects (wind, water) to be deflected to the _____ in the Northern hemisphere and to the _____ in the Southern hemisphere

Global Winds

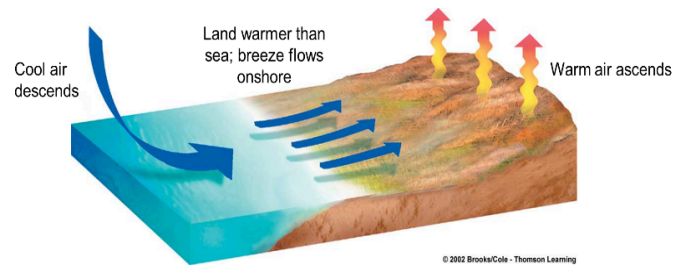
- Because of unequal heating of the earth and the Coriolis effect (caused by Earth's rotation), there are _____ convection cells that form
 - o 2 _____ Cells (_____)
 - o 2 _____ Cells (_____)
 - o 2 _____ Cells (_____)



5. Oceans: driven by _____!

A. Winds near bodies of water

- Small-scale winds/breezes caused by the difference in the _____ of heating between the land and the water
 - o Sea-Breeze: In the morning, the land heats up _____ than the ocean, leaving colder air over the ocean.
 - Cold air is _____, therefore, higher _____
 - The breeze will blow from the _____ (_____ pressure) to the _____ (_____ pressure)

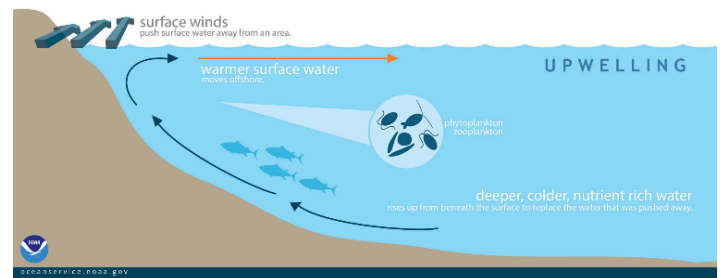
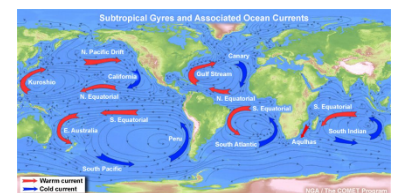


B. Ocean _____

- _____ massive circular current systems caused by the rotation of Earth and global wind patterns (Coriolis effect)
- Impact temp, salinity, nutrient distribution globally

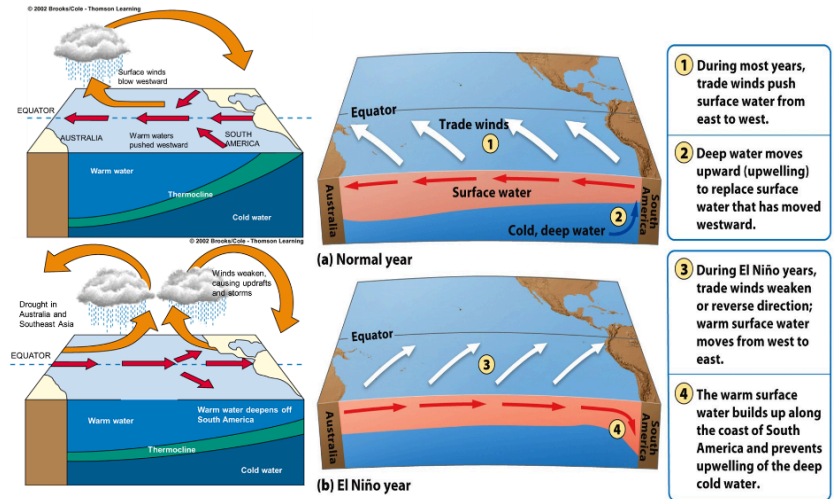
C. _____: upward movement of ocean water, driven by winds

- Winds push water away from coast and displaced surface water is replaced with _____ ocean water
- Deep water is _____ and _____-rich due to _____ that occurs in the _____ zone
- _____ can use these nutrients to produce new food energy, which supports _____ in the ocean
- Take place along _____ coasts of some continents
- Changes in upwelling can greatly affect the local climates and weather patterns
 - o El Nino and La Nina are due to changes in the winds/upwelling off the coast of _____
 - o _____ Every year is either an El Nino or a La Nina, although their strength can change



El Nino

- Some years, tropical _____ winds _____ down or even _____ direction
- Instead of warm waters moving AWAY from the coast and upwelling occurring to displace the lost water... warm water is pushed _____ the coast and _____ upwelling occurs
- Effects of El Nino
 - o Upwelling will not occur
 - Nutrients from deep ocean do not reach surface, leading to



- 1 During most years, trade winds push surface water from east to west.
- 2 Deep water moves upward (upwelling) to replace surface water that has moved westward.
- 3 During El Niño years, trade winds weaken or reverse direction; warm surface water moves from west to east.
- 4 The warm surface water builds up along the coast of South America and prevents upwelling of the deep cold water.

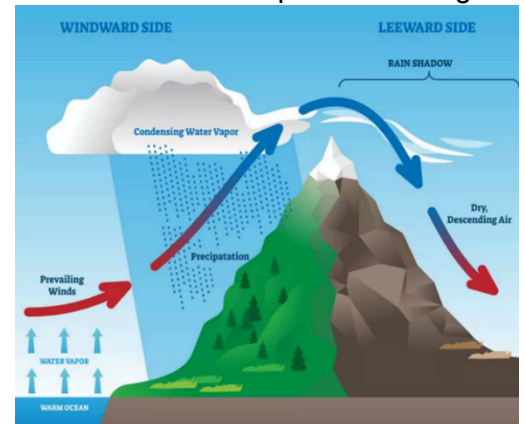
- _____ loss from fishing
- o Weather
 - Very _____ in South America that can cause destructive _____
 - _____ weather in Australia can cause _____

La Nina

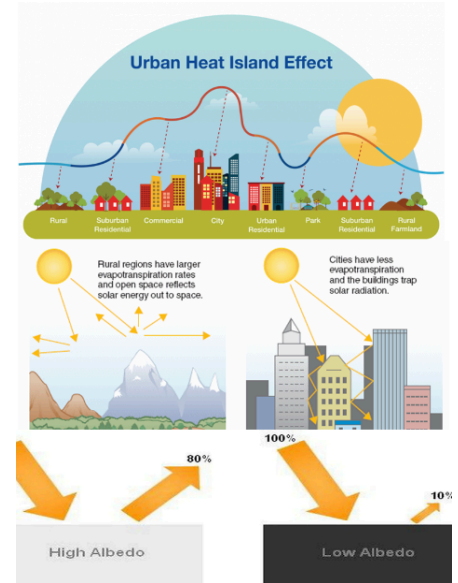
- Think of La Nina as either an enhancement of the natural tropical trade winds (E → W) or the _____ of an El Nino... So _____ tropical trade winds blowing from east to west
- Effect of La Nina
 - o _____ upwelling will occur than usual, leading to a biodiverse food web and plentiful fishing
 - o Weather: _____ in South America and _____ in Australia

6. Microclimates

- The climate of a localized area that is different from the general climate surrounding it
- Microclimates can be created by abiotic or biotic factors such as animals or humans
- Usually, some abiotic factor changes the characteristics of an area, such as light penetration, topography, water, albedo
- Ex. ponds, caves, city blocks, valleys, dams, etc.
- A. _____
 - o A measure of how much _____ is in the air
 - o Water has a _____: it resists changing _____
 - The more humid a place is, the _____ the temperature will _____ between day and night
 - o Caused by:
 - Temperature: _____ air holds onto moisture more than cold air
 - Proximity to water: Water evaporates and enters atmosphere
 - _____: water transpires from the leaves of plants and enters the atmosphere
 - o The most humid places on Earth are at the equator and along the coasts
- B. Elevation and Mountains
 - o Elevated terrain acts as a lifting mechanism for air
 - o Warm, moist air (usually coming from the ocean) sweeps over the land and climbs the mountain
 - o Air cools as it rises and cannot hold onto moisture as easily → rains



- o _____ **Effect:** the leeward side of a mountain having _____ conditions due to the cooling/precipitation that occurred on the windward side. The descending dry air warms as it reaches the ground.
- C. _____
- Example of a _____ microclimate
 - o Metro area where temp is _____ in city vs outside (most notable at night)
- Caused by:
 - o Buildings _____ cooler air
 - o _____ heat
 - o Little _____ reduces transpiration (cooling effect)
 - o Using _____ surfaces like asphalt (low albedo)
 - **Albedo:** the percentage of incoming sunlight that is _____ from a surface.
 - A _____ surface has a _____ albedo than a black surface.
 - Asphalt absorbs heat during the day and releases it at night
- **Solutions to Urban Island Heat**
 - o Use strategic building so that wind passes through city
 - o Place factories on _____ of city
 - o Use _____ colored building materials that have a higher albedo
 - o Increase _____ like green roofs and parks
 - o Use less _____ in general energy conserving appliances, _____



Albedo Effect Activity

Data for Temperature

<u>Surface</u>	<u>Temperature</u>	<u>Shade of Surface</u>
Cement Sidewalk Sunny	_____°F	Light Medium Dark
Cement Sidewalk Shade	_____°F	Light Medium Dark
Blacktop Sunny	_____°F	Light Medium Dark
Blacktop Shade	_____°F	Light Medium Dark
Brick Sunny	_____°F	Light Medium Dark
Brick Shade	_____°F	Light Medium Dark
Grassy area Sunny	_____°F	Light Medium Dark
Grassy area Shade	_____°F	Light Medium Dark
Dirt Sunny	_____°F	Light Medium Dark
Dirt Shade	_____°F	Light Medium Dark
White Car Sunny	_____°F	Light Medium Dark
White/Light Car Shade	_____°F	Light Medium Dark
Black Car Sunny	_____°F	Light Medium Dark
Black Car Shade	_____°F	Light Medium Dark
Interior of Dark car	_____°F	Light Medium Dark
Interior of light car	_____°F	Light Medium Dark

Analysis Questions:

1. Compare the overall pattern you see between the sunny areas and the shade areas.
2. What relationship do you see overall between the temperatures and the shades of surface?
3. What could account for the difference in temperature between the blacktop and the cement?
4. Based on your observations, what color shirt would you choose to wear on a cold winter day? Explain.
5. Based on your observations, what color car should you purchase in Texas?
6. Many urban areas are planting gardens and grass plots on the roofs of large buildings. Based on your observations, why would they do this?
7. Usually, the temperature of the grass is lower than the temperature of the white cement. Considering the fact that grass is darker, why is this? *(this is a really sciency answer- don't guess, you might want to do some research)*

Weekend Update – Atmosphere Project

“Weekend Update” is a popular skit on SNL. It is essentially a satirical news program that comments on and parodies current events. You will be presenting your own “Weekend Update” that helps review the content of this unit. You will have to make a video to submit (*either one full shot or piece together small clips*).

You may recruit other “actors” to participate in your weekend update, or you can act like different people (*dress differently and maybe even talking differently*). You must decide what actor will have what topic. There is no right or wrong answer; you can mix and match however you decide. All dialogue should accurately explain the topics in this unit. The use of props is highly encouraged to convey the information. Don’t be afraid to redo the video or record small clips and piece together.

- Actor 1:** News anchor who guides the flow of the entire skit
- Actor 2:** Special guest expert that likes to use strange **props** to demonstrate information
- Actor 3:** Person being interviewed (*maybe make them ignorant/dumb or a know-it-all*)
- Actor 4:** Meteorologist
- Actor 5:** News reporter “on the ground” during weather phenomenon

This is a very open-ended project. Your goals should be to learn, explain concepts, and have FUN! You can choose from the set of skits listed below:

Skit #	Plate Tectonics	Human Impact	Human Impact Solution	Weather	Weather Phenomenon
1	Hot Spots	Impermeable Concrete	Choice is yours	In the city	Decide based on other topics
2	Convergent Plate Boundary	Cattle Ranching	Choice is yours	Place at 30 degrees latitude	Decide based on other topics
3	Divergent Plate Boundary - continental	Fertilizer Running Off	Choice is yours	El Nino	Decide based on other topics
4	Hotspot	Till	Choice is yours	La Nina	Decide based on other topics
5	Transform Plate Boundary	Over-irrigation	Choice is yours	Place at the equator	Decide based on other topics
6	Pretend Planet with no tectonic plates	Monoculture	Choice is yours	Pretend planet w/ no tilt or spin	Decide based on other topics
7	Convergent Plate Boundary	Mountaintop removal miner OR Logging employee	Choice is yours	Place on the leeward side of the mountain	Decide based on other topics

Need Inspiration?

This project is so fun and so different! Watch this video to get some ideas for your skit:

<https://www.youtube.com/watch?v=kUuLalcK46M>

(*Best TV News Bloopers of The Decade*)