

Climate

Well our last major topic in the Geography part of Global Awareness is climate. Understanding climates will require us to know a lot of science terms and vocabulary. So why is this topic in Geography and not in Science class? Beats me, but I'm glad I get to teach it because it's cool.

First of all climate and weather are similar but they're not the same. Well what's the difference?

Weather: condition of the air at any one time. Weather is what's it like outside at a specific moment in time.

Climate: **how warm** and **how wet** a place is. Climate is weather over a long period of time.

Different places on earth can have very different climates. For instance northern Alaska can certainly have some pleasant days, but, overall, the climate there is dramatically different than it is here in Pennsylvania. Also the climate of Florida is very different than that of Titusville. Well why is this. Why are Alaska's and Florida's and Titusville's climates so different?

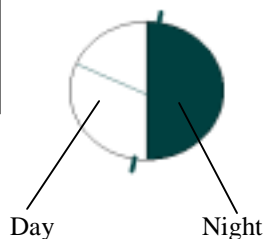
I. The movement of the earth

In order to understand climate we need to know a few basics about the earth. Basically you need to know that the earth is out of control, hurtling through space in a maniacal game of cosmic pinball.

First the earth gets its light and heat from that blazing star in the sky that we call the sun. At 93 million miles the sun is really far away. So far in fact that it takes light from the sun about 8 minutes to get to the earth. The heat and light we get from the sun is called **radiation**. Below are some other important terms.



Rotation: movement of the earth on its axis causing day and night. Rotates every 24 hours at a speed of about 1,000 miles per hour.



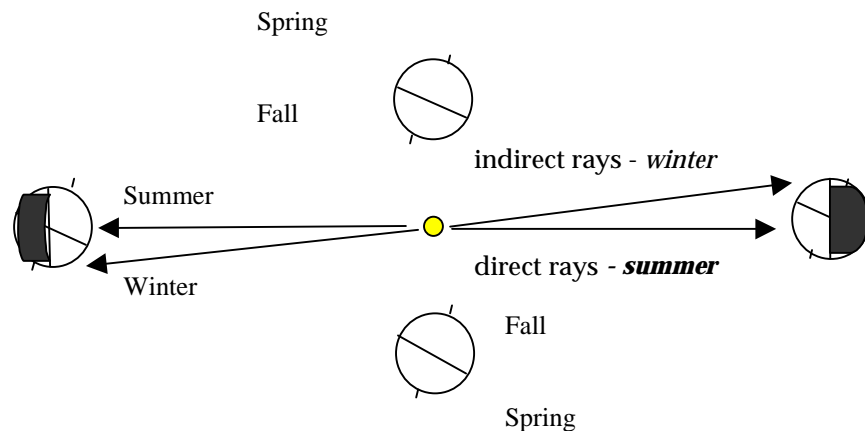
Axis: imaginary line the earth spins upon.

Revolution: movement of the earth around the sun in its orbit. Moving through space at about 18.6 miles per second. Takes 365 and 1/4 days. That 1/4 day is why every four years we have a leap year.

II. What causes climate?

Alright so the earth is moving through space revolving and rotating. Well the fact that the earth is on the move combined with our planet's tilt causes our seasons. The most important factor on climate and the one thing you better learn is that the earth is tilted and that this is the reason for the seasons.

23 1/2° Tilt – the earth is tilted on its axis causing the amount of direct sunlight to change on different parts of the earth.



The tilt and the movement of the earth causes different parts of the earth to get different amounts of direct sunlight. Direct sunlight makes us warm while indirect sunlight tends to reflect more off our atmosphere and it doesn't provide us with as much warmth. In the picture above, when the northern hemisphere is leaning towards the sun we get direct sunlight and thus its summer. But when 6 months pass and our hemisphere is leaning away from the sun that is our winter. But notice when the northern hemisphere is leaning away from the sun the southern hemisphere is leaning towards the sun. So our winter is their summer. But when it's summer here it is winter in the southern hemisphere. Weird.

What about spring and fall? If you look at the picture above, during those seasons neither hemisphere is leaning into the sun and thus we have those in between seasons – Spring and Fall.

The tilt also causes our days to get longer in summer and shorter in winter. This gets more extreme the closer you get to the poles. At the north and south pole in fact they get six weeks of sunlight and six weeks of darkness. I mean the sun doesn't set for six weeks in summer and it doesn't rise for six weeks in winter. Even though the sun doesn't set for six weeks it still doesn't get very warm because its still indirect rays.

We mark our shortest and longest days with something we call the solstice. The days that are have exactly 12 hour days and 12 hour nights we call equinoxes and they mark our seasons.

Solstice: shortest and longest days of the year.

June 21, 22 – summer solstice

December 20, 21 – winter solstice

Equinox – length of day and night is equal all around the world.

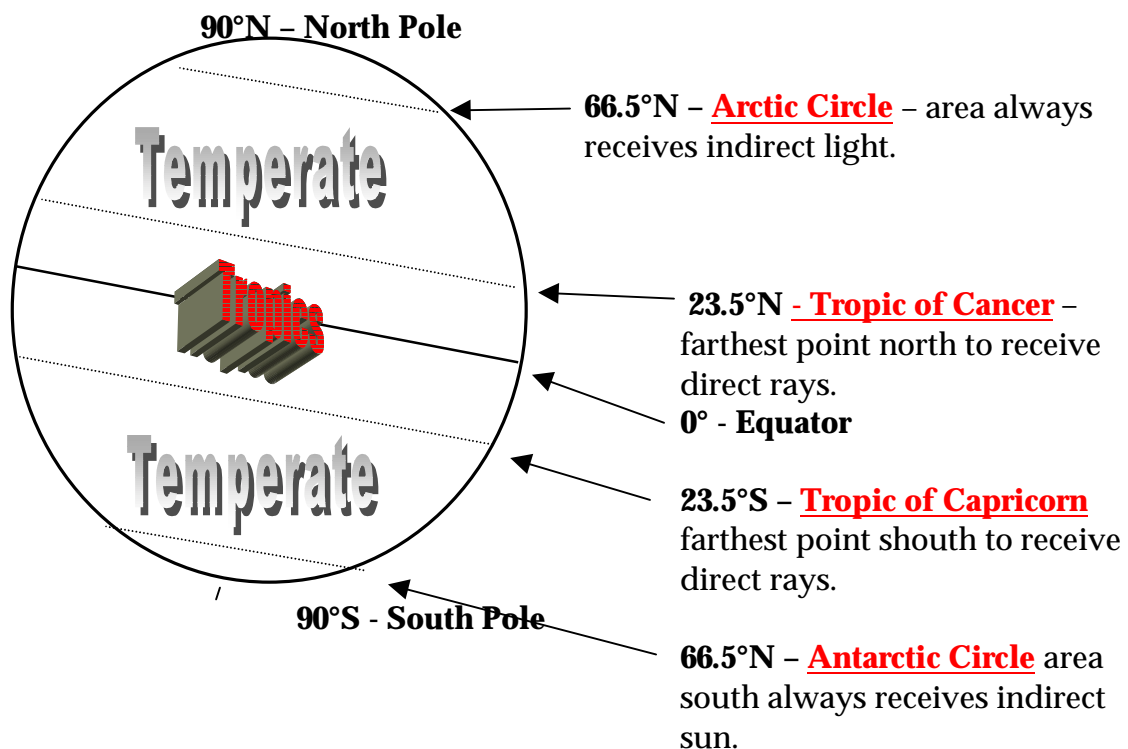
March 22, 23 – vernal equinox

September 22, 23 – autumnal equinox

So the tilt of our planet is super important. Why is the earth tilted? Well not all planets are and some have even more severe tilts. Probably early in our planet's history it suffered a massive collision. So massive that it knocked off a piece of the earth and it became the moon. Want to know more about this? Ask Mr. Reynolds. Well back to our planet.

III. Climatic Regions

Because of the tilt different areas receive different amounts of sunlight at different times during the year. However it's always cold at the poles because they always receive indirect sunlight, while it's always hot in the tropics because they always receive direct sunlight. Where we live we are hot and cold depending on the season. The three major climatic regions on earth are summarized below and they are polar, tropic and temperate. We've made named special latitude lines to help mark off these different zones.



Polar Region – 66.5° - 90° Area always receives indirect sunlight. Seasons of light and darkness. Because it's so cold there is little evaporation so polar areas are very dry.

Tropics – 23.5°S – 23.5°N Area always receives direct sunlight. Wet and dry seasons if any. Because it's so warm there is massive evaporation making this area usually very wet.

Temperate – 23.5° - 66.5° Area receives direct sunlight for part of the year and indirect sunlight for part of the year. The four seasons – summer, spring, winter, fall.

IV. Hydrologic Cycle

Alright now remember climate is how warm and how wet. Generally we've explained how warm a place is going to be. That all depends on its latitude and whether or not it's getting direct or indirect rays from the sun. Now we've got to discover how wet a place will be and why. For that we have to discuss something you should remember from sixth grade science.

Hydrologic Cycle – process of water moving from ocean to air to land and back to ocean.

1. **Evaporation**: process by which water turns into a gas and becomes water vapor – see this in steam. The rate this happens depends on the temperature. Thus the warmer it is the more evaporation.
2. **Transpiration**: process by which plants give off water vapor through their pores.
3. **Condensation**: as water vapor rises in the atmosphere, it cools, and it starts to change back from a gas to a liquid. You see this happening on your bathroom mirror after a shower, in clouds, in fog, and in your breath when it's cold outside.
4. **Precipitation**: enough droplets condense and gather together, become heavy and fall as either rain, sleet, snow or hail.

The water gathers on the ground, goes into our lakes, streams and oceans and the process repeats itself as it has done for billions of years.

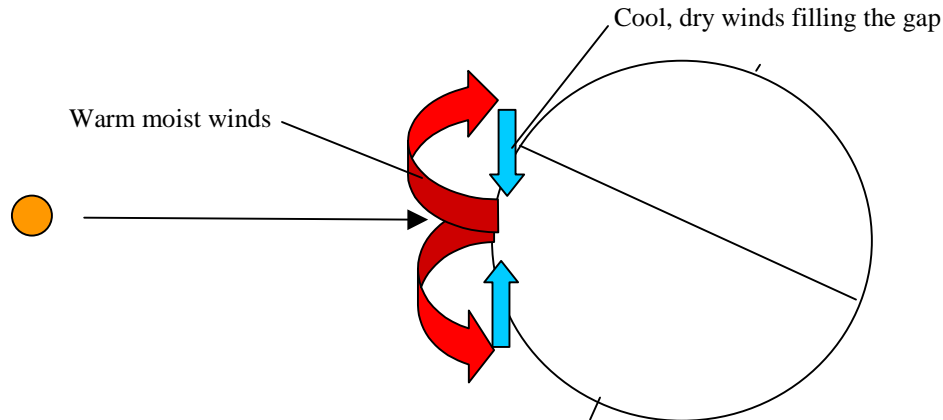
V. Winds

All right so what goes up must come down. So an area that is hot like the tropics will have lots of evaporation and thus will probably be wet. While an area like the poles which have little evaporation would be dry. Generally this is true but there are a few more factors. One of them is wind which moves evaporated water elsewhere to fall thousands of miles from the ocean it originally came from.

Winds: moving air. Distributes warm and cold air and moisture.

Why do winds work?

Winds work because the earth doesn't heat evenly. Air at the tropics is much warmer than air at the poles. The key is that hot air rises. While the hot air is rising cooler air has to fill the gap left by that hot air rising. This movement of air is wind. Because the earth is always being heated by the sun's direct rays at the tropics that air is always rising and air is constantly moving in to replace it. Thus the earth has its own air circulation system that never stops.



Because the winds in the picture above are constantly in motion there are winds that are almost always there. These winds are called prevailing winds.

Prevailing winds – winds that blow almost constantly from the same direction. The winds that blow over Titusville are usually out of the southwest. Because they are from the west they are called the Westerlies. Winds are named for the direction they come from.

In the tropics however you will find some areas in which the wind comes from one direction for part of the year and another for the other part. This changing of wind direction usually causes wet and dry seasons. Winds that change direction seasonally are called.

Monsoons – winds that change direction seasonally. The best example of this is in India. During India's dry season they have a cool, dry northern wind that blows over them. But come summer that wind shifts and comes out of the south giving them torrential rainfall. How much rain? Well Titusville gets around 40 inches of rain per year. India during the three month wet season gets 447 inches of rain or about 37 feet of rain.

VI. Ocean currents

Very similar to winds and pushed by them are

Ocean currents: water in motion pushed by prevailing winds. They also distribute heat, cold and moisture.

Riding the winds and ocean currents Christopher Columbus sailed to America and back to Spain. One of the important currents that he sailed on is known as

Gulf Stream: warm tropical ocean current that warms western Europe.

Much of Europe is farther north than Titusville but Europe is usually warmer than Titusville in winter. That's because the Gulf Stream is constantly bringing warm, warm air into Europe all year round. For instance London, England is about at 51°N latitude. That's 10 degrees farther north than Titusville. However London's average January temperature is about 40°. Titusville in January is in the 20's. Hey that's just not fair!

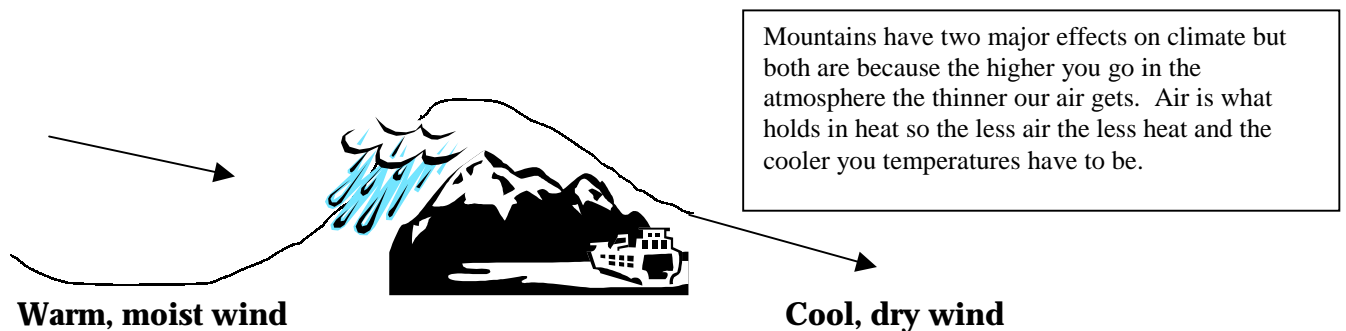
Another important current and the cause of a great mystery is the

Humboldt current: cold, Antarctic current that cools the entire Pacific Ocean.

The Humboldt runs directly into the central Pacific right at the tropics cooling off that warm, tropical water. The mystery is that every seven to ten years the Humboldt current weakens for no apparent reason and the Pacific gets warmer. Even more concerning is that about once every century the Humboldt disappears completely. It always comes back but where does it go. When the Humboldt disappears we call this

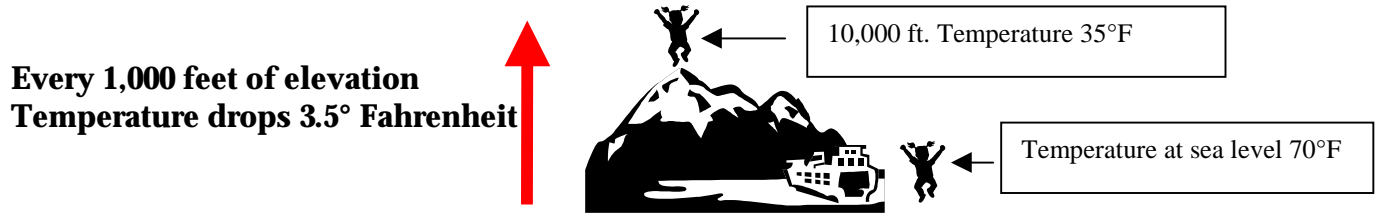
El Nino: "The Child" When the Humboldt weakens or disappears heating up the entire Pacific and causing havoc with the world's weather. The Pacific is half of the planet Earth. If half of the earth is warmer than you have a lot more evaporation and if you have a lot more evaporation you are going to have lots and lots more precipitation.

VII. The effect of elevation and mountains.



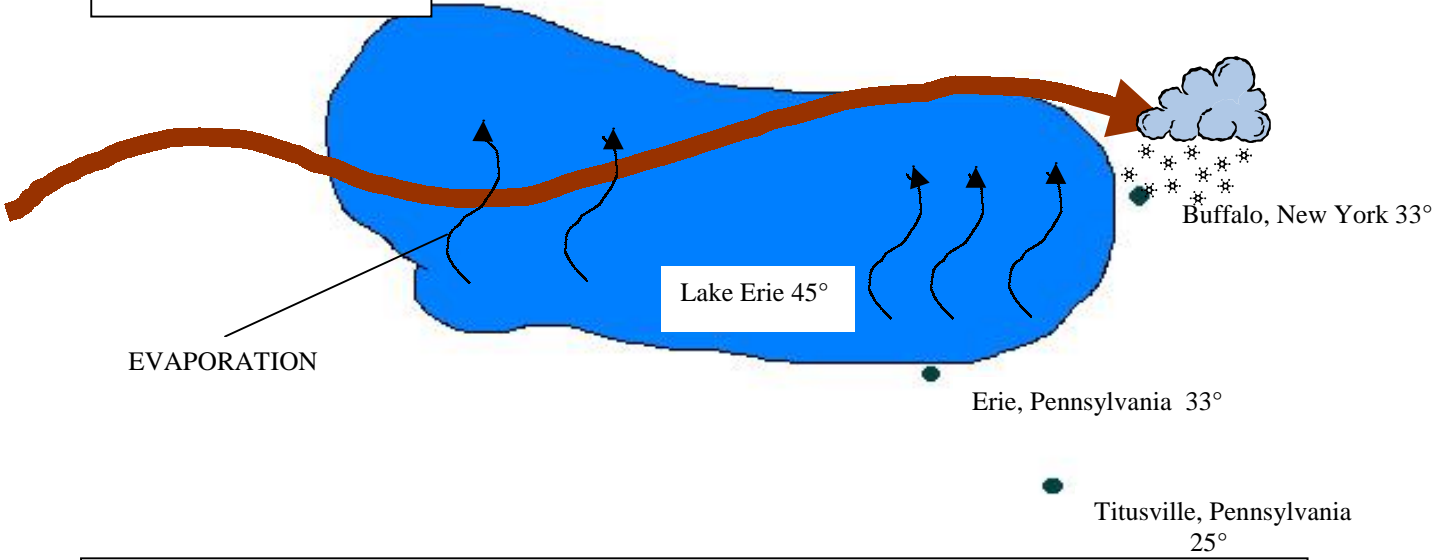
Windward slope: side of a mountain that faces the wind. Usually wet.

Leeward slope: side of a mountain that faces away from the wind. Usually dry.



VIII. Lake effect

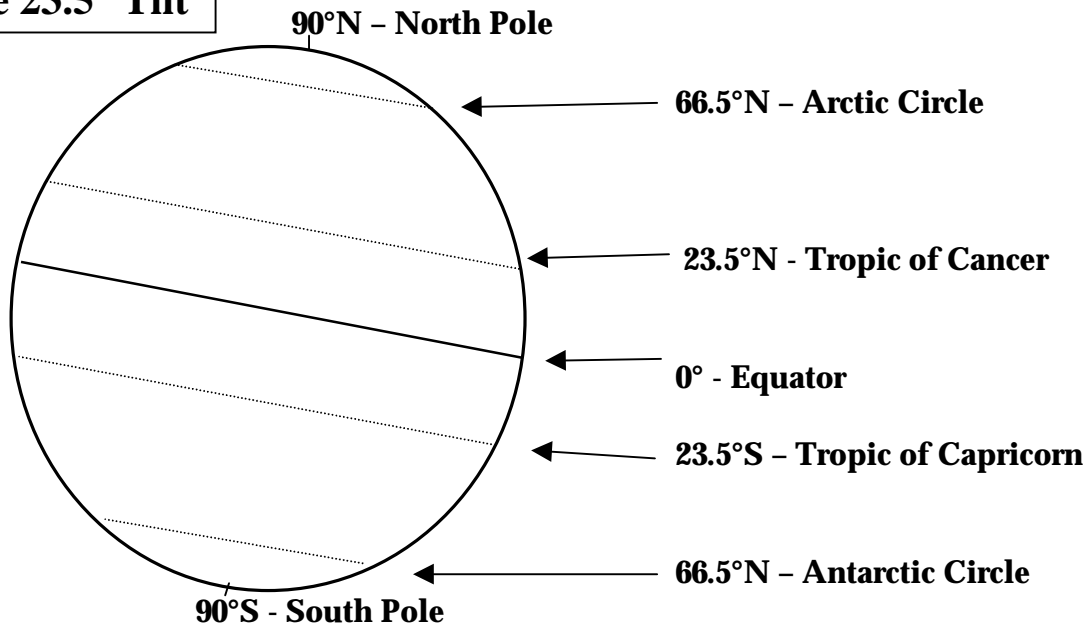
4. Lake effects



What is lake effect? Lake effect is the effect that large inland bodies of water have on the climate of land areas surrounding them. Lakes stay warm in winter and cool in summer. Because they are so large, cities by them also stay warmer in winter and cooler in summer. Therefore in my picture above Titusville is a chilly 25° F while Erie is 33°F. Wow, that's eight degrees warmer. All because the water temperature of Lake Erie is still 45°F. In summer Titusville might be 85°F, but Erie would only be 78°F because the lake temperature would still be 65°F. So living by a lake makes your weather a little nicer. There is one catch to this however. Because lakes are evaporating through much of the winter they put a lot of moisture into the cold winter air. That moisture condenses and becomes precipitation as snow very quickly. Where does all that snow fall? Why right on Buffalo and Erie. They may get warmer winter temperatures, but they pay for it with heavy, heavy snowfalls.

Climate Clues

1. The 23.5° Tilt



Polar Region – 66.5° - 90° Area always receives indirect sunlight. Seasons of light and darkness. Because it's so cold there is little evaporation so polar areas are very dry.

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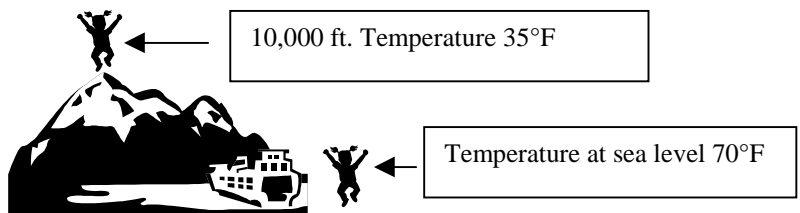
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2. Effect of Mountains

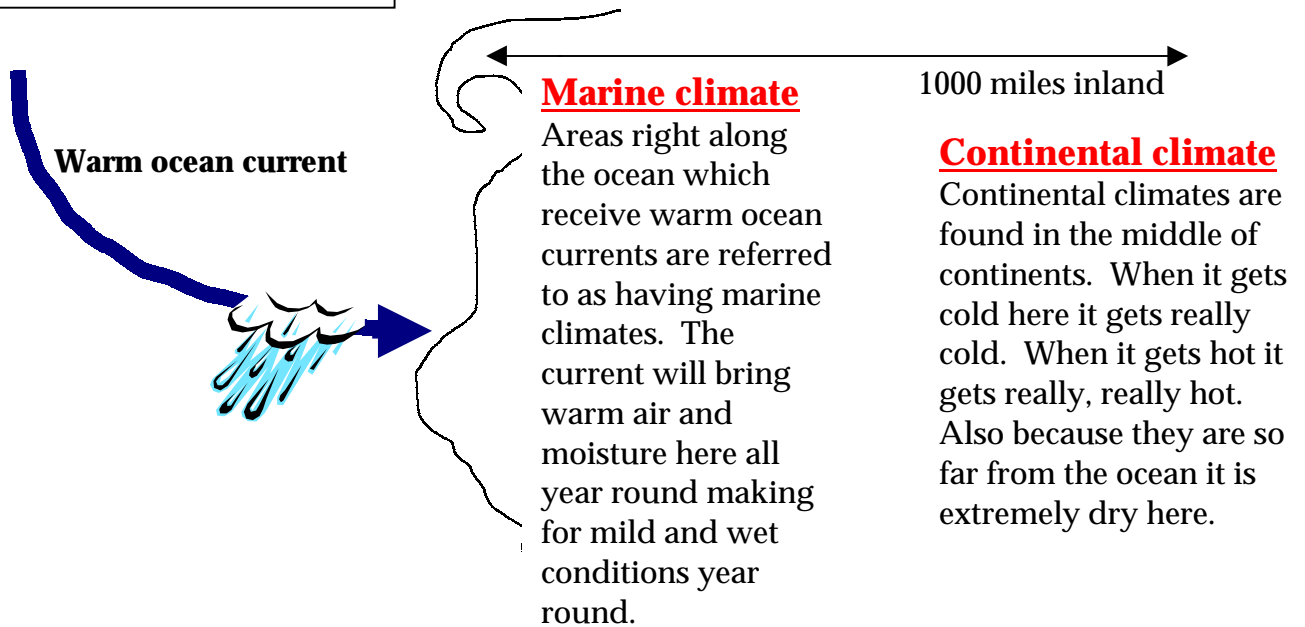


Mountains have two major effects on climate but both are because the higher you go in the atmosphere the thinner our gets. Air is what holds in heat so the less air the less heat and the cooler you temperatures have to be.

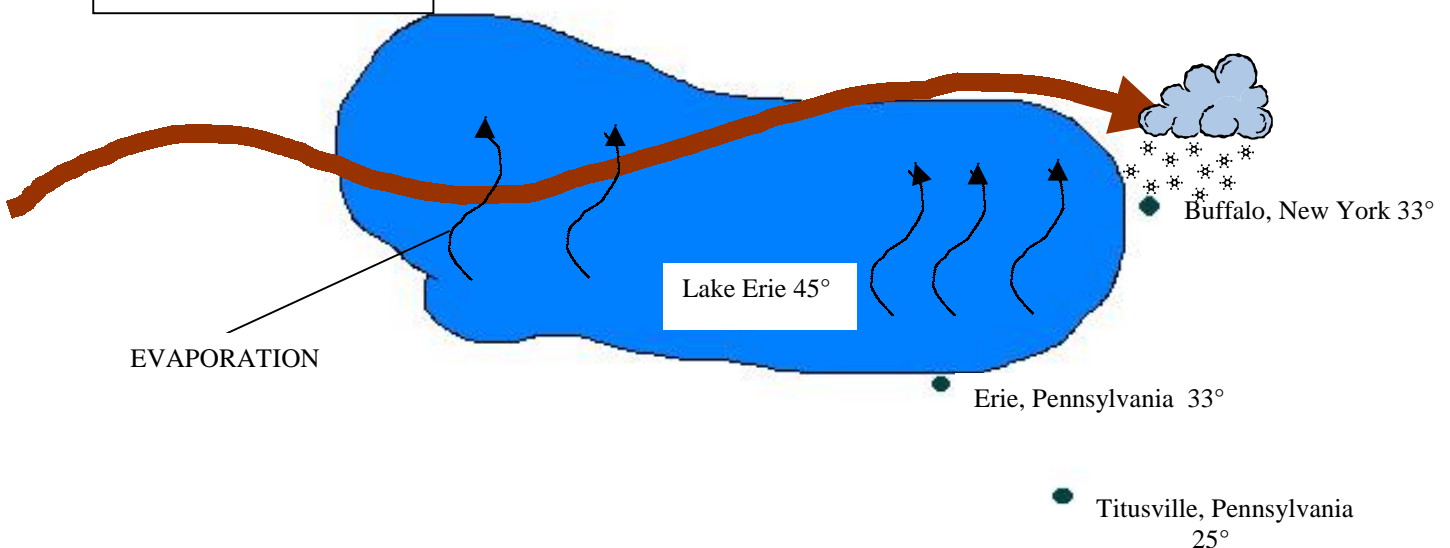
Every 1,000 feet of elevation
Temperature drops 3.5° Fahrenheit



3. Ocean Currents



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