

Climate Change Due to Natural Processes



Essential Standard 2.6

Analyze patterns of global climate change over time.

Learning Objective 2.6.2

Explain changes in global climate due to natural processes.

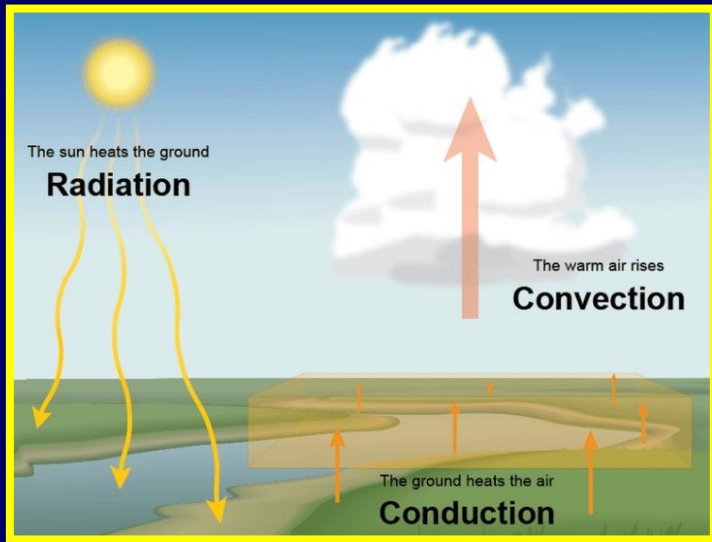
I Can Statements

At the end of this lesson, you should be able to say, with confidence:

- I can explain how periodic ice ages on Earth have occurred over time.
- I can explain what occurs during El Nino years and the effect it has across the globe.
- I can explain how sunspot and volcanic activity can affect global climate.
- I can explain what the greenhouse effect is and how it affects temperatures on Earth.

Heat Transfer

Heat is transferred through radiation from the Sun in the form of electromagnetic waves.

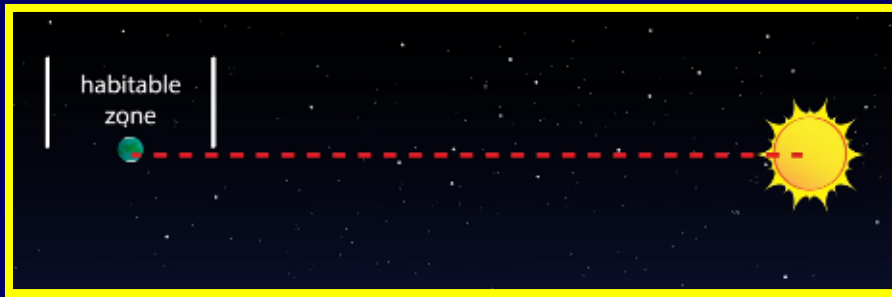


Once the sunlight heats the ground, it is transferred through the ground and into the air through conduction.

The warm air above the ground rises through convection, warming the air.

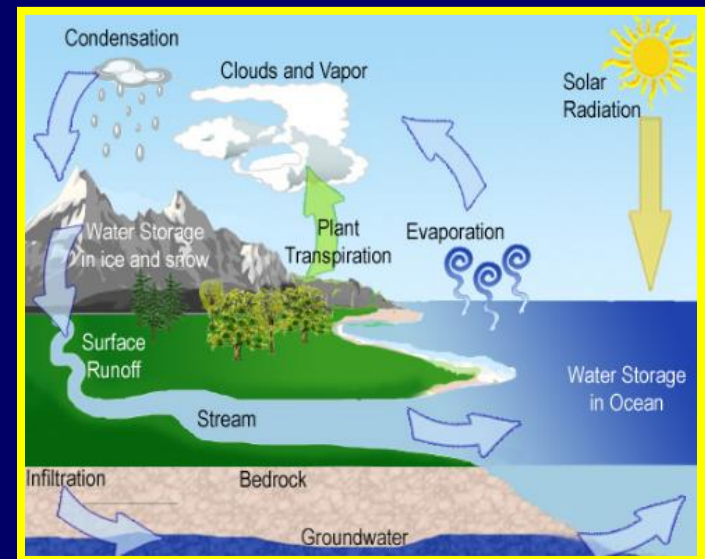
Earth's Global Temperature

The global temperature on Earth is partially due to its position in relation to the Sun.



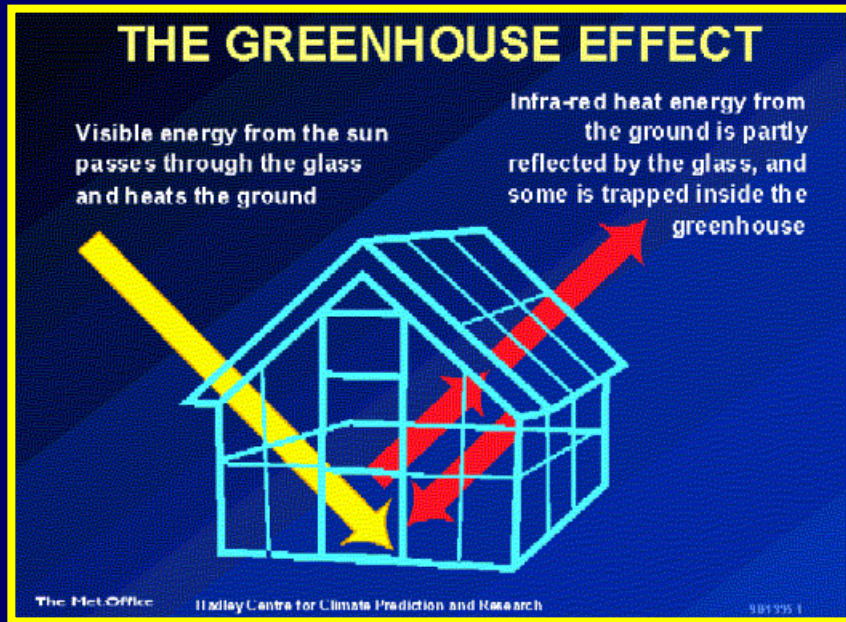
Earth is located in what is called the habitable zone.

In this zone, the global temperature allows for water to exist in all three states and be recycled in order to support life.



Greenhouse Effect

Earth's global temperature is also due to what is called the Greenhouse Effect.



A Greenhouse, made of glass, allows light waves through that then heat objects inside the greenhouse.

Heated objects emit infrared or heat waves, that cannot pass through glass are trapped, thus warming the greenhouse.

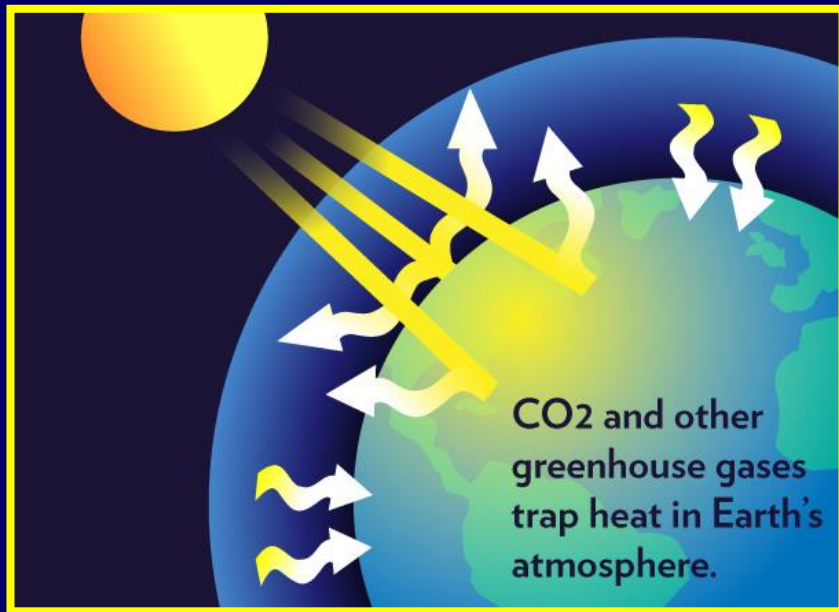
Greenhouse Effect

The same effect takes place inside cars that sit in the Sun during the summer.



Greenhouse Effect

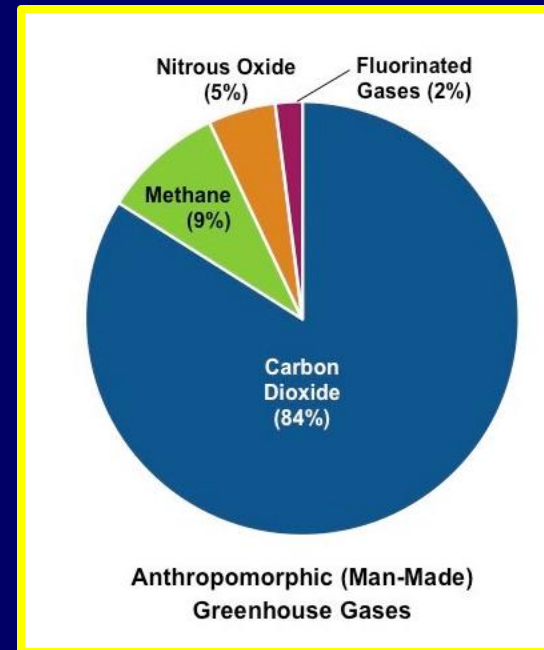
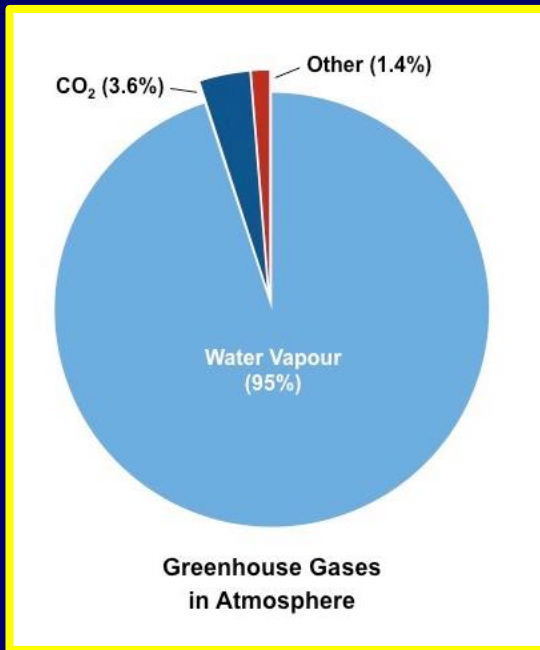
When sunlight enters Earth's atmosphere, some is reflected back out to space.



The rest becomes infrared radiation and are trapped by the greenhouse gases in the atmosphere, resulting in a warming of Earth.

Greenhouse Effect

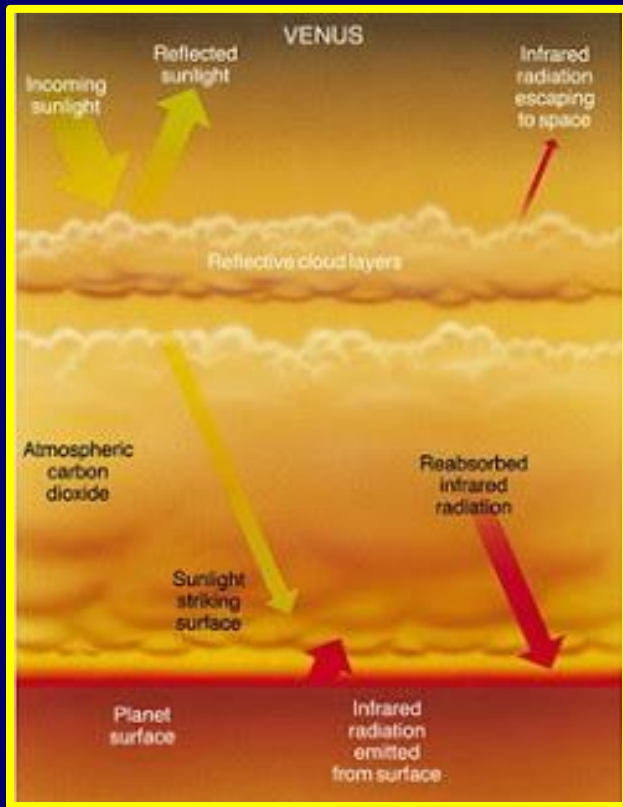
The two most important greenhouse gases are water vapor and carbon dioxide.



Other greenhouse gases include methane, nitrous oxides, and chlorofluorocarbons.

Runaway Greenhouse Effect

Too much carbon dioxide can result in a runaway greenhouse effect.

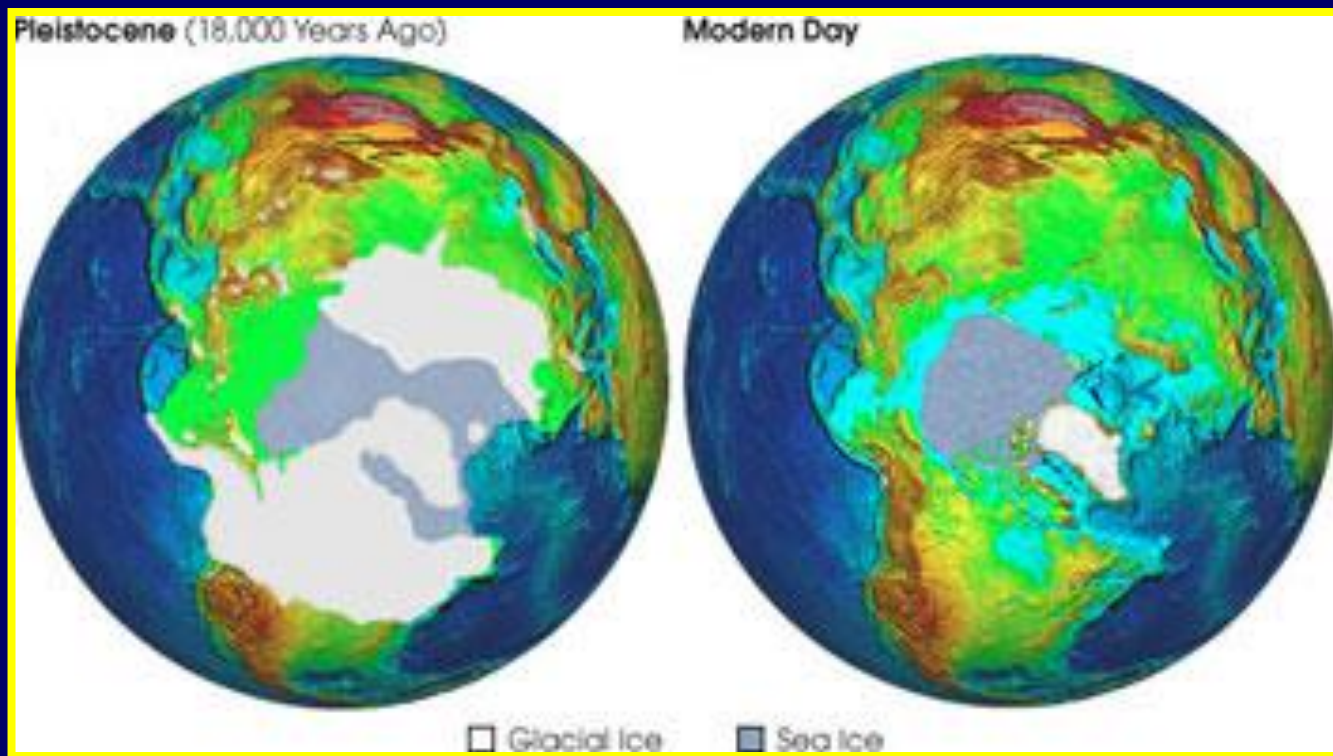


Venus, in which 96% of the atmosphere is made up of carbon dioxide.

The temperature on Venus can reach as high as 972 °F, hot enough to melt lead.

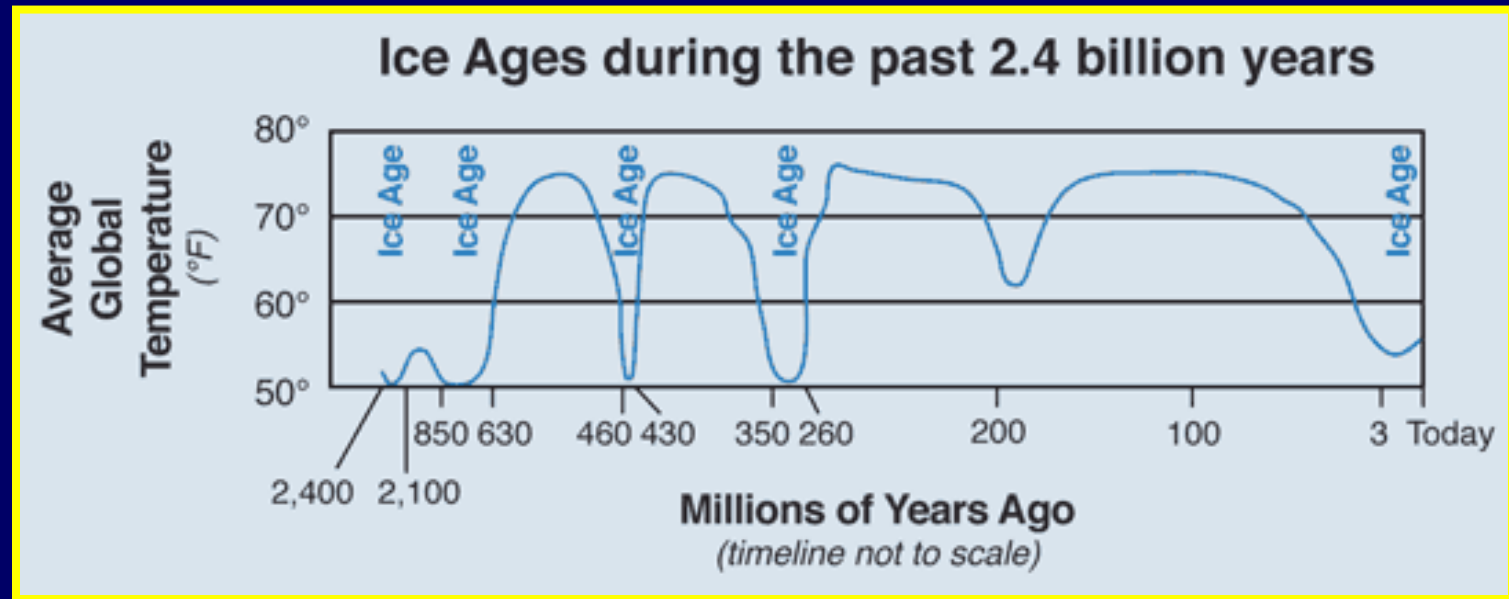
Natural Causes of Climatic Changes

Throughout Earth's history, studies show that climates have always been and currently are in a constant state of change.



Ice Ages

Over the past 2.5 billions years, several ice ages have occurred.



During periods of extensive glacier coverage, called ice ages, global temperatures have decreased by 5°C.

Cause of Ice Ages

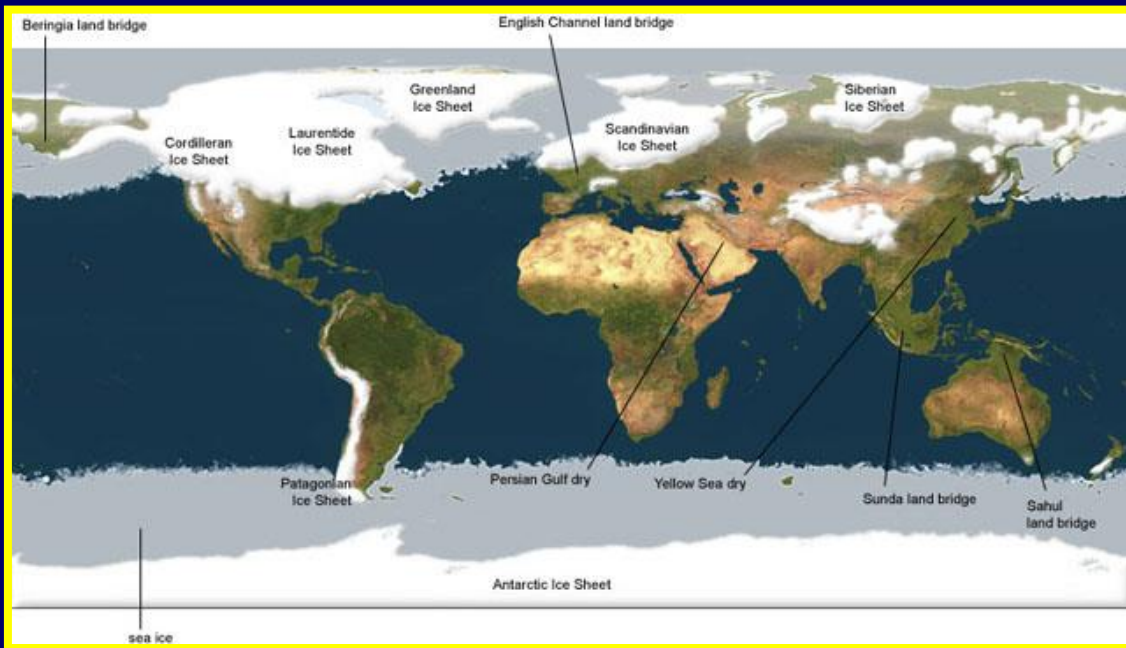
Plate tectonics plays a role because the location of continents affect global circulation of ocean currents that help balance heat around the globe.



The last ice age occurred right after plate tectonics helped to form the land bridge between North America and South America, resulting in shifting ocean currents.

Last Glacial Retreat

The most recent large glacial retreat occurred about 10,000 years ago.

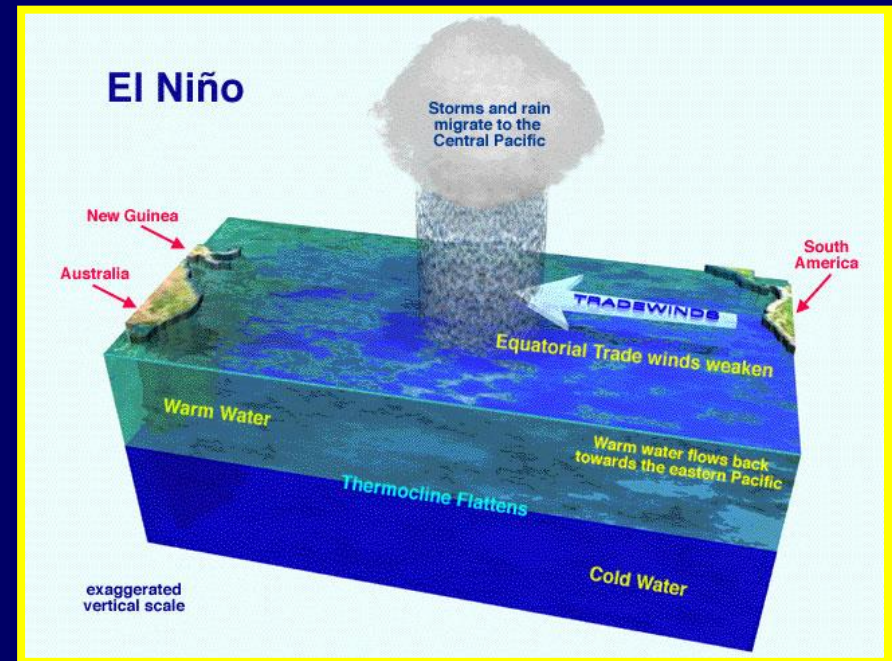
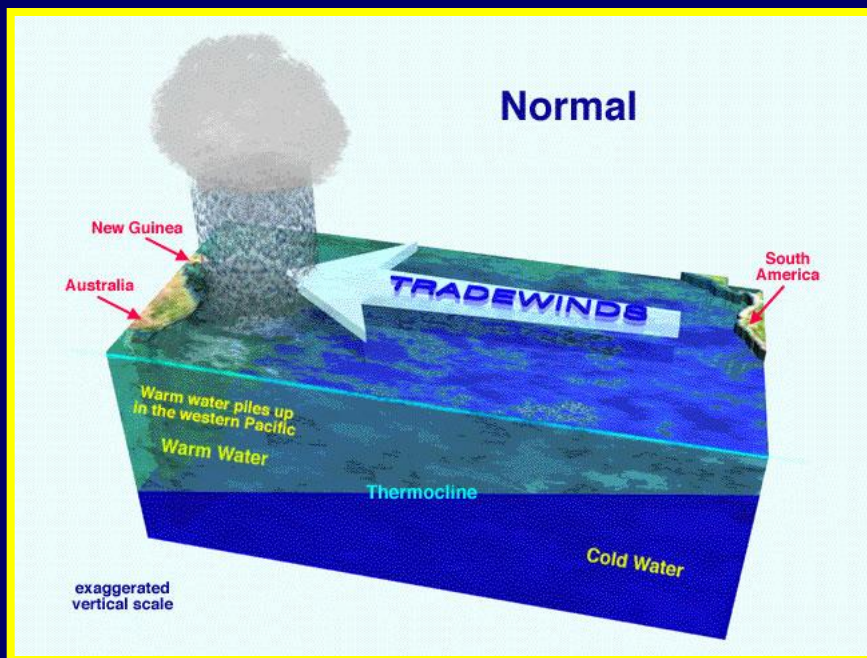


Glaciers used to cover large portions of North America, Europe, and Asia.

The Great Lakes and Niagara Falls were formed as these glaciers retreated.

El Nino

El Nino is a change in wind patterns and surface currents that occurs in the Pacific Ocean and affects weather patterns around the globe.



Normal Conditions

Normally, the Trade Winds push warm surface water from South America towards Indonesia and Australia.



The warm water generates warm, moist air and creates tropical rainforests in Indonesia and Australia.

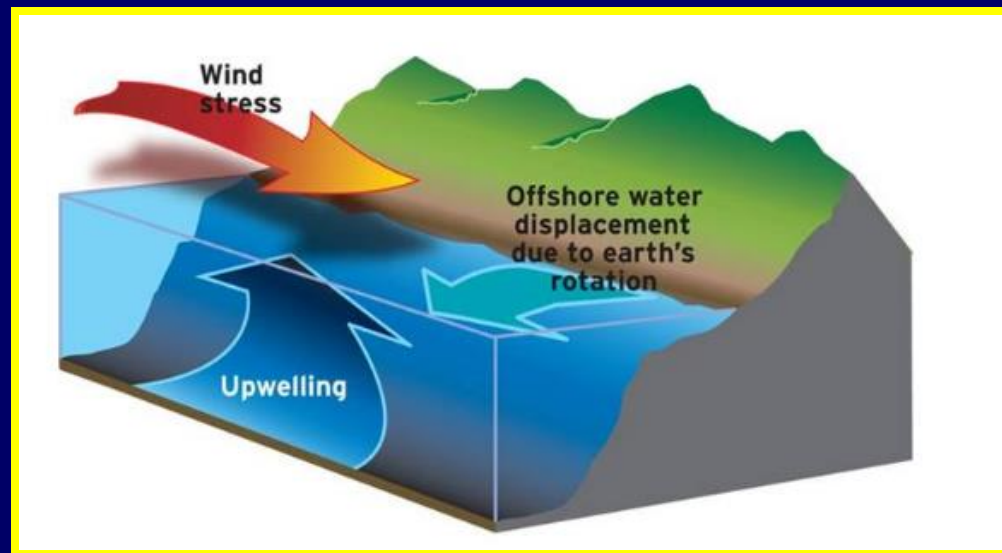
Normal Conditions

As the Trade Winds blow towards the west, they push warm surface water towards the west and causes it to pile up along the western part of the Pacific Ocean.



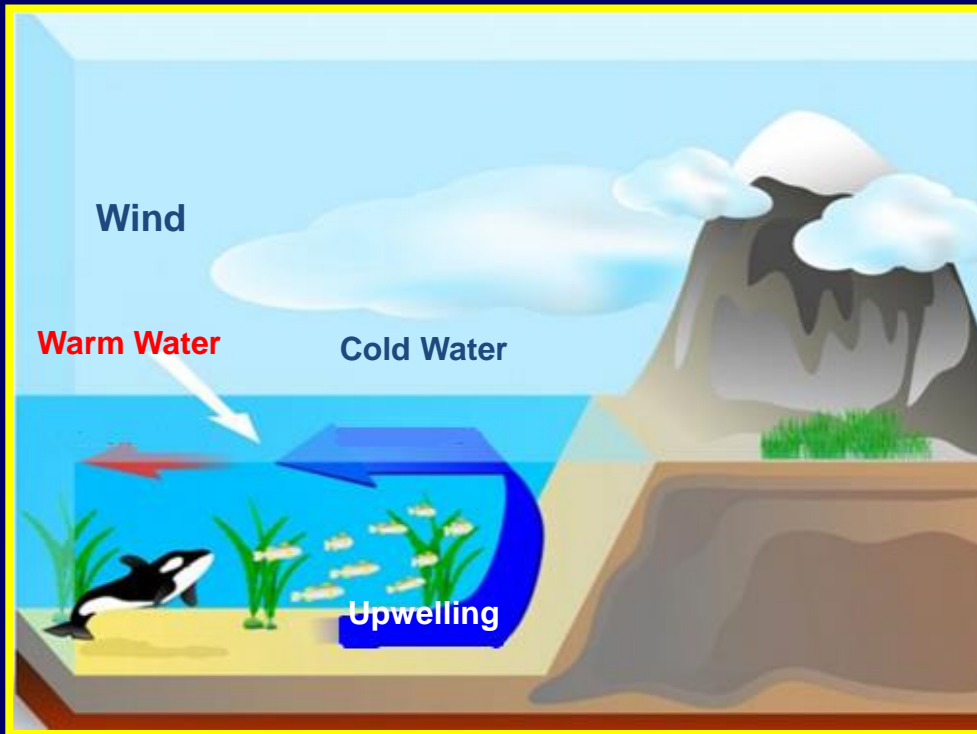
Normal Conditions

As the warm surface currents are pushed westward, cold water current from deeper down in the ocean, rises up to the surface to replace them in a process called upwelling.



Normal Conditions

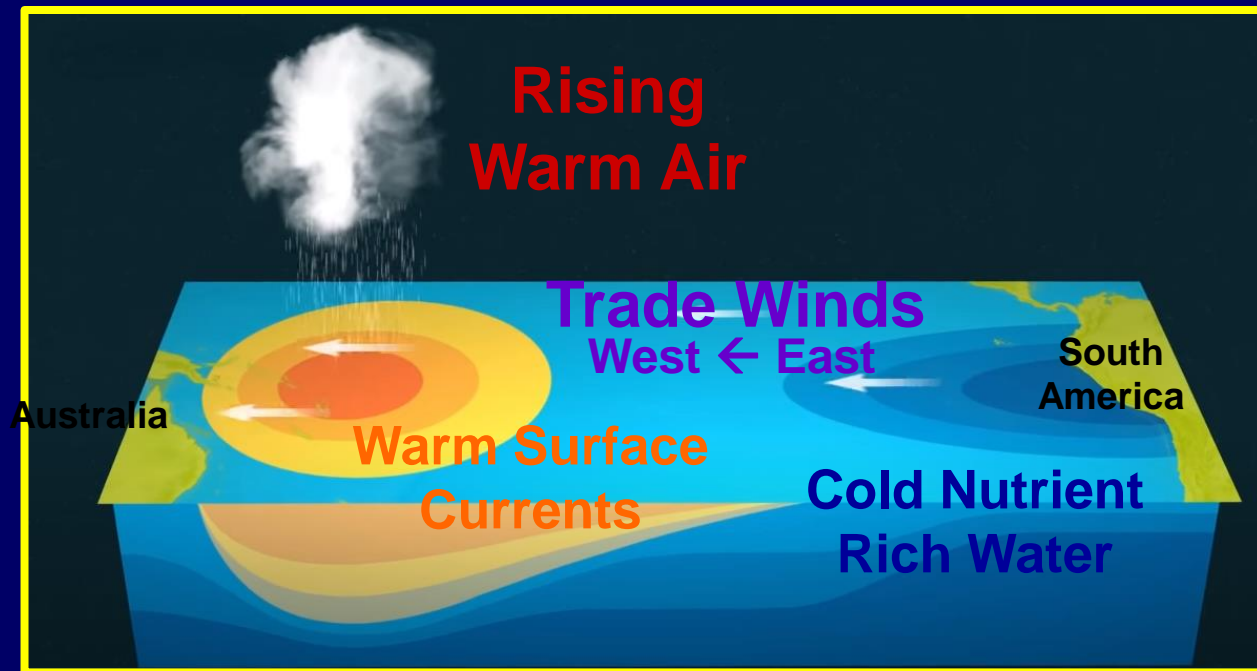
As animals eat or excrete waste, the left over materials floats down to the bottom of the ocean, making the deep ocean currents very nutrient rich.



The cool, nutrient rich water that rises to the surface, during upwelling, supports very diverse, abundant fish populations off the coast of South America.

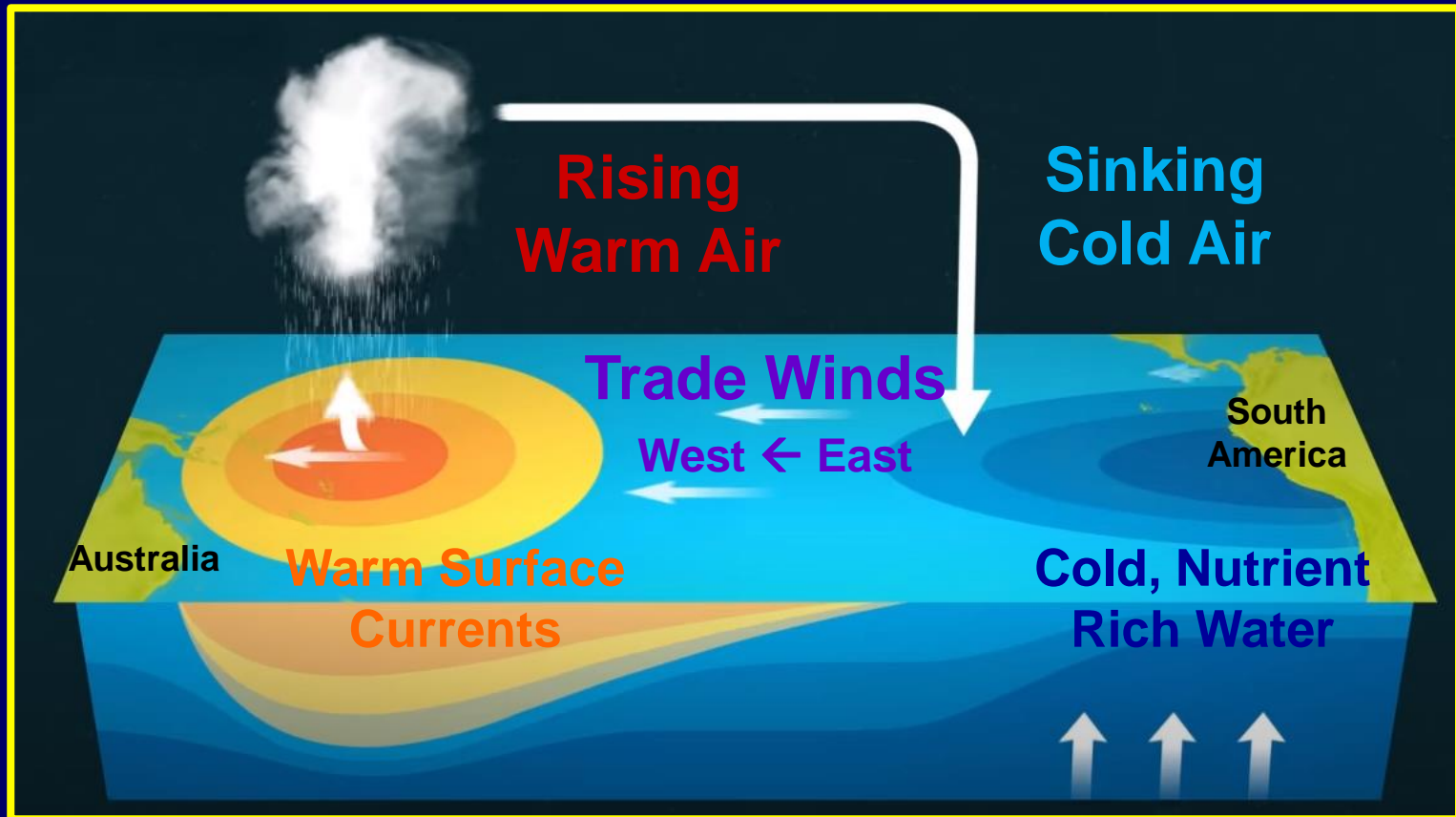
Normal Conditions

On the western side of the Pacific, the warm surface currents causes water to evaporate, collect in clouds, and precipitate, creating an area of abundant rain.



Normal Conditions

On the eastern side of the Pacific, cold, dry air sinks, completing a consistent convection cell over the Pacific Ocean.



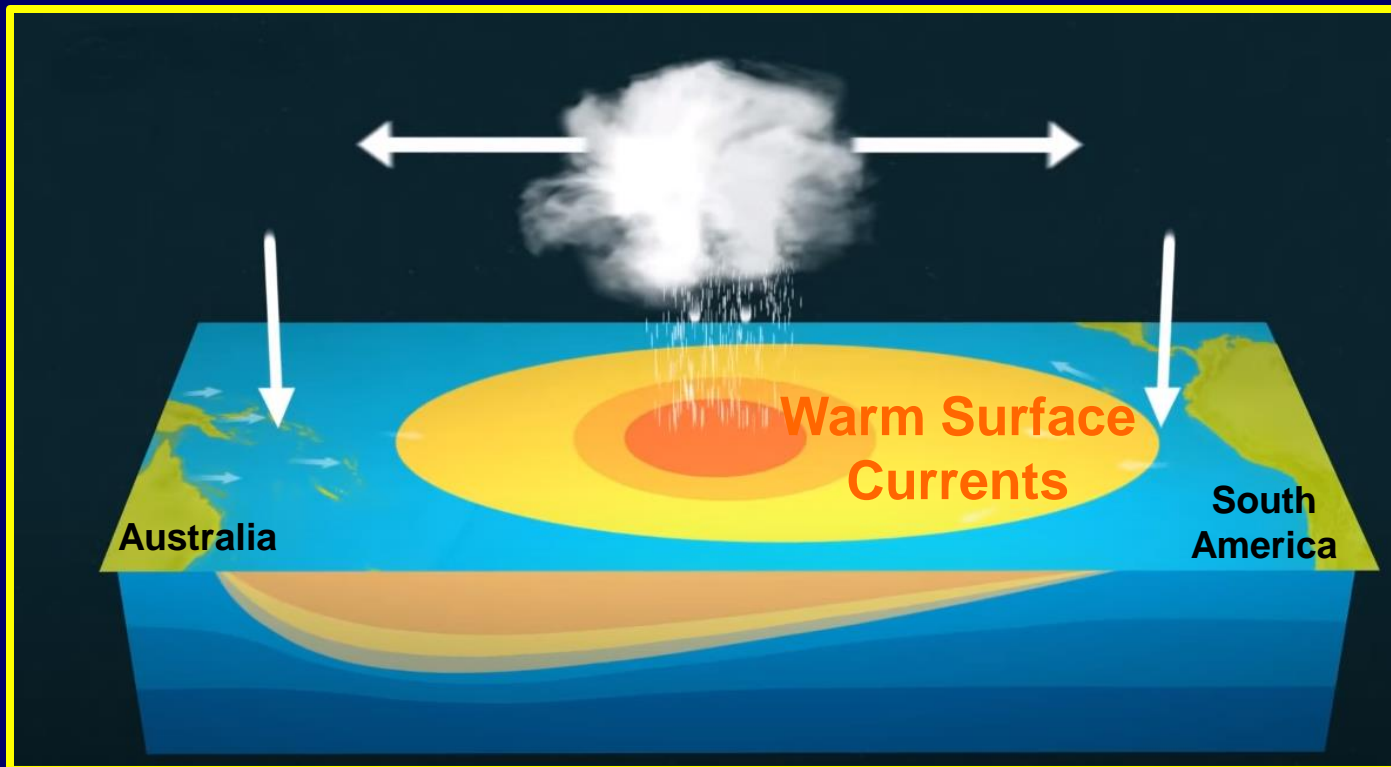
El Nino

During El Nino, the strength of the Trade Winds weaken, more the warm surface water remains on the eastern side and less cold water from deep in the ocean rises to the surface.



El Nino

As the area with the warmest surface currents shifts towards the east, so does the associated rising warm air and rain which results in changes in temperature and rainfall on both sides of the Pacific Ocean.



El Nino

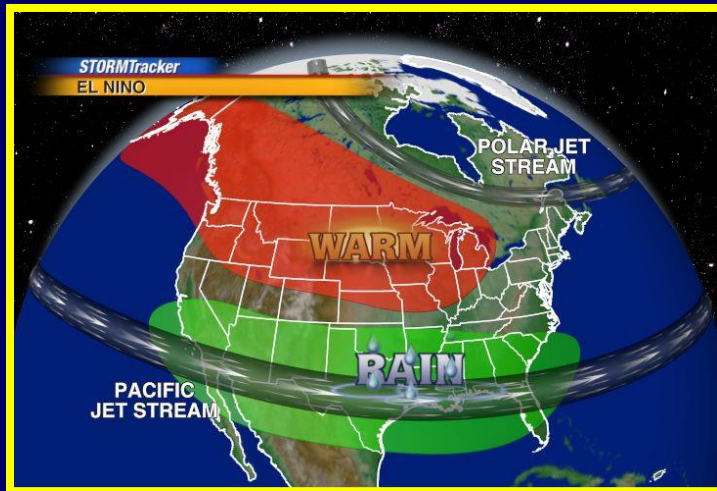
Not only does upwelling off the coast of South America stop, but the warm surface waters create lots of rain and flooding all along the coast of South America.



At the same time, Australia and Indonesia experience drought conditions and wildfires.

El Nino

The increased moisture in South America pumps large amounts of heat and moisture into the upper atmosphere, which causes the Pacific Jet Stream to shift further south.

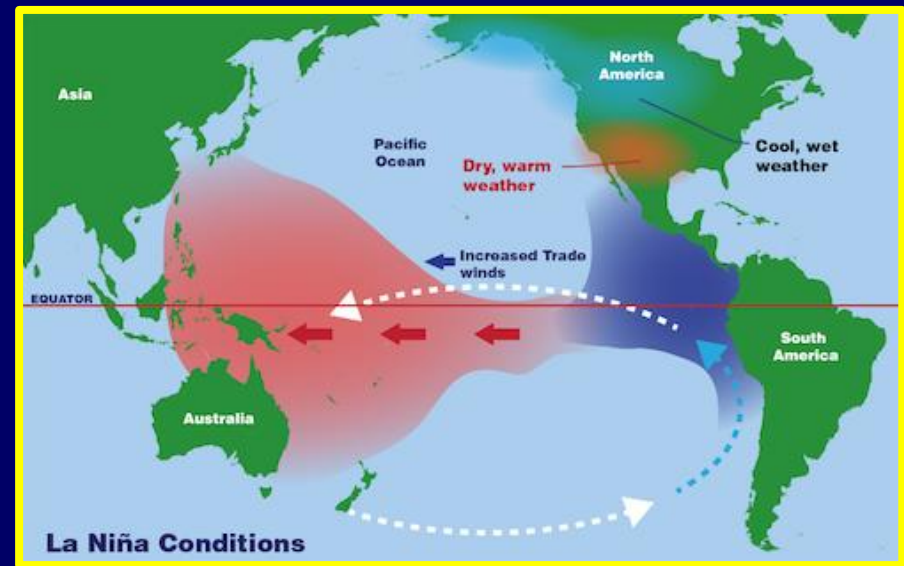
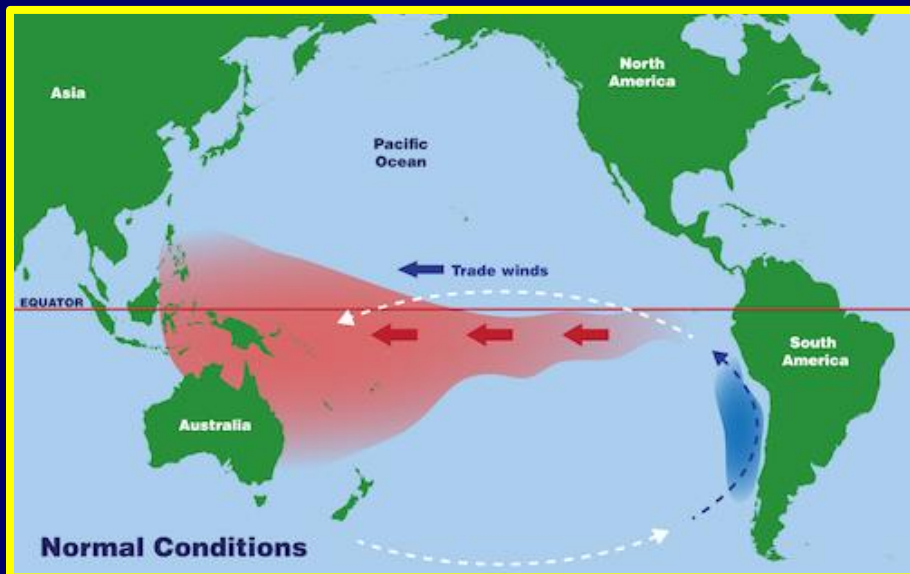


The lowered jet stream results in violent storms in California and the Gulf Coast.

A positive effect of El Niño is that the lower jet stream prevents hurricanes from forming in the Atlantic Ocean.

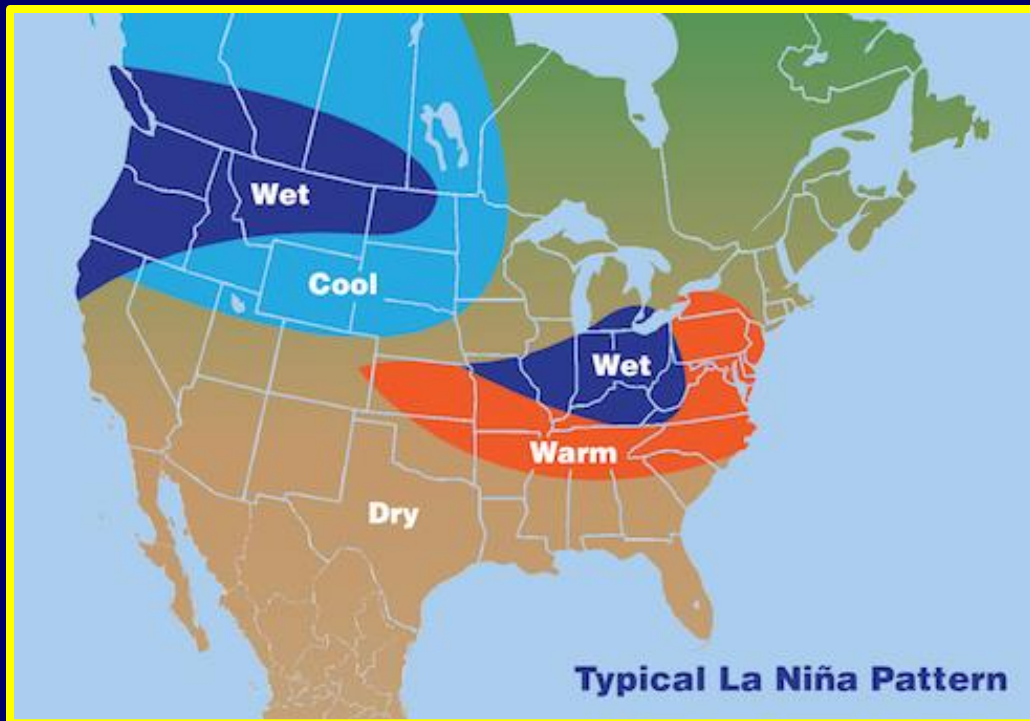
La Nina

La Nina is the cool phase of the ENSO climate and occurs when the trade winds are stronger than normal resulting in cooler ocean temperatures on the western side of the Pacific ocean.



La Nina

The cooler ocean temperatures result in less cloud formation and drier conditions on the west coast of the United States.

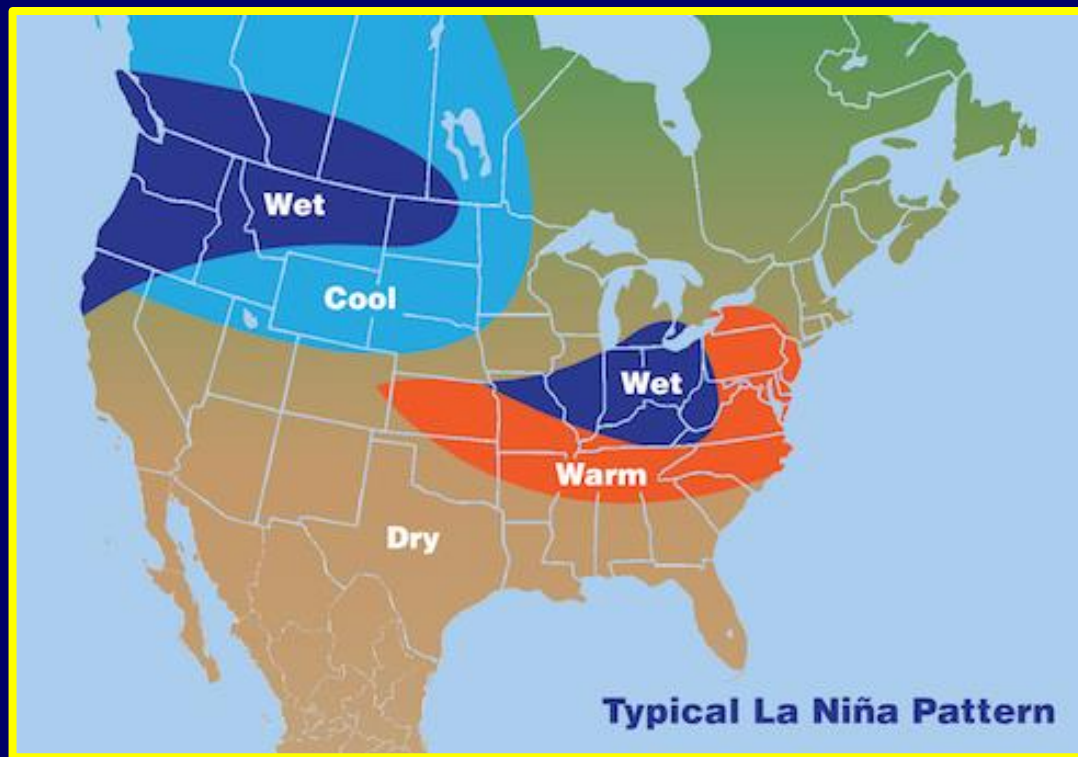


Drought

Wildfires

La Nina

On the east coast of the U.S., the weather is warmer than normal and result in more frequent hurricanes.



The End

