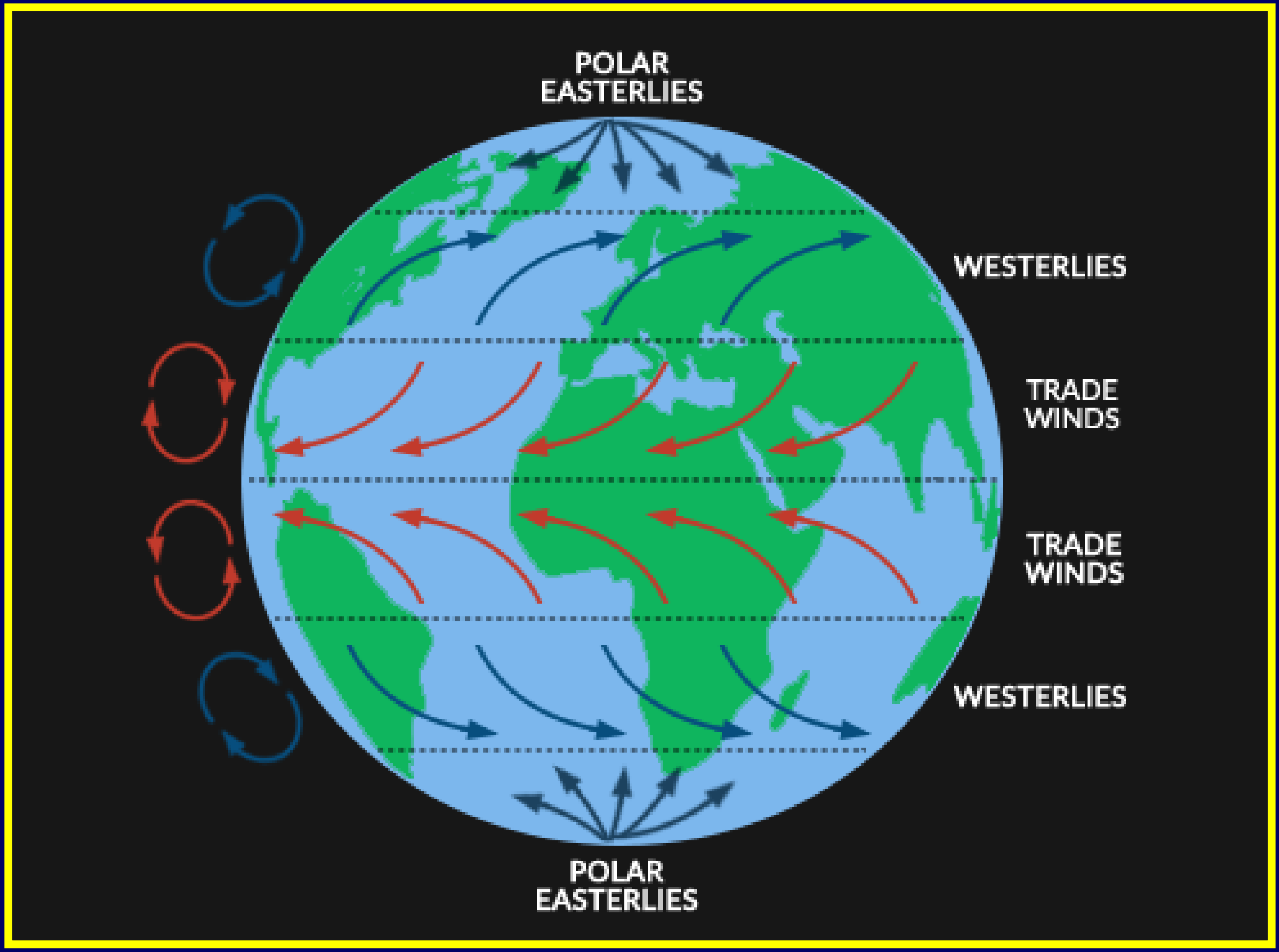
Global Wind Systems



Essential Standard 2.5

Understand the structure of and processes within our atmosphere.

Learning Objective 2.5.2

Explain the formation of typical air masses and the weather systems that result from air mass interactions.

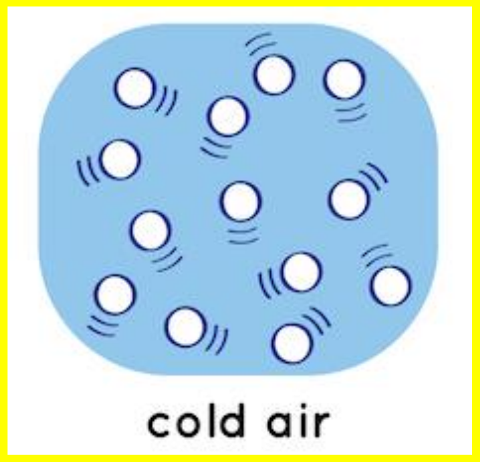
I Can Statements

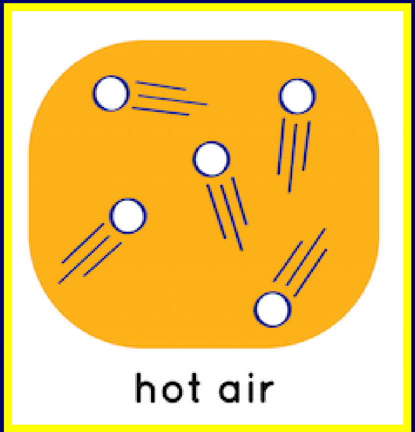
At the end of this lesson, you should be able to say, with confidence:

- I can list and explain what creates the three major global convections cells.
- I can describe each of the major global wind systems and list some of their characteristics.
- I can explain what jet streams are and how they affect Earth’s weather

Convection Cell

When air is cooled the molecules condense, making the air more dense, which causes the air to sink.

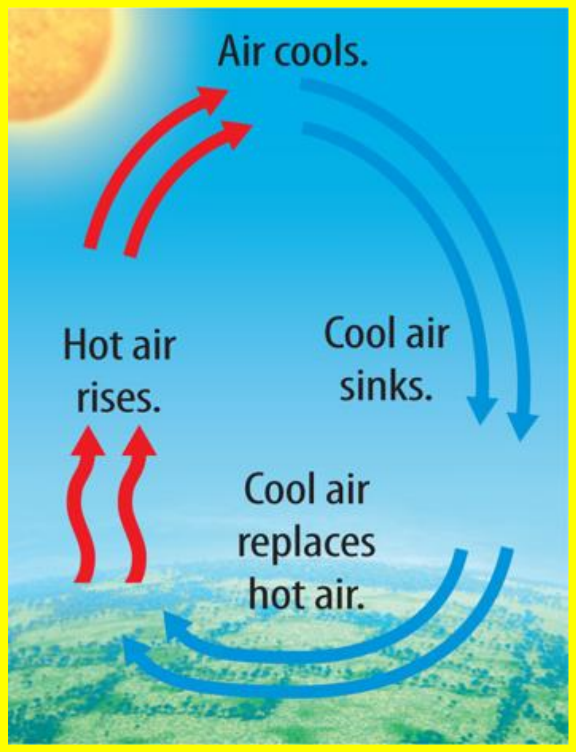




When air is heated the molecules spread out, making the air less dense, which causes the air to rise.

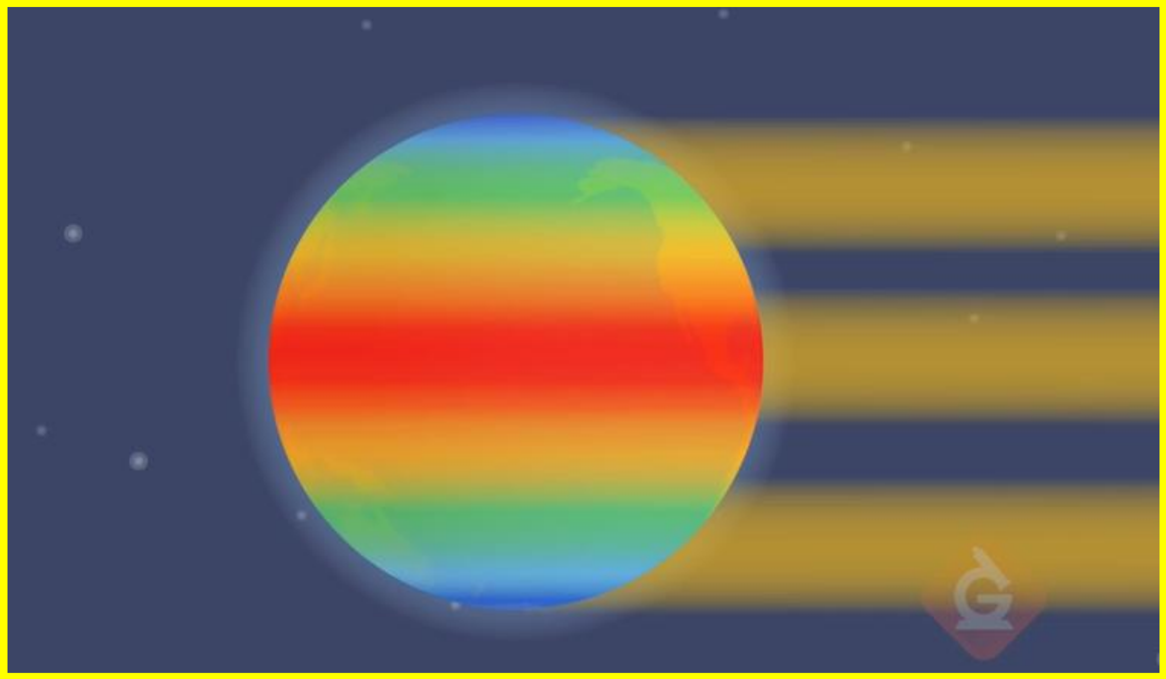
Convection Cell

The rising and sinking of air creates a convection cell.



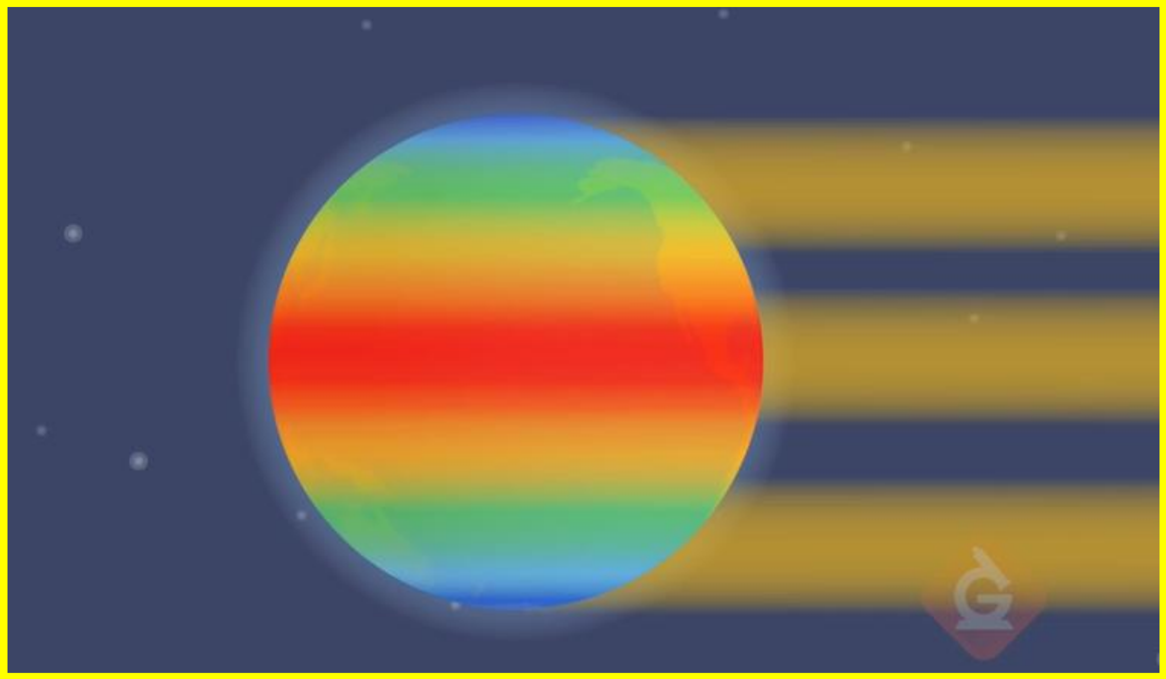
Equator

Because the Earth is curved, the equator gets more direct sunlight and experiences warm temperatures.



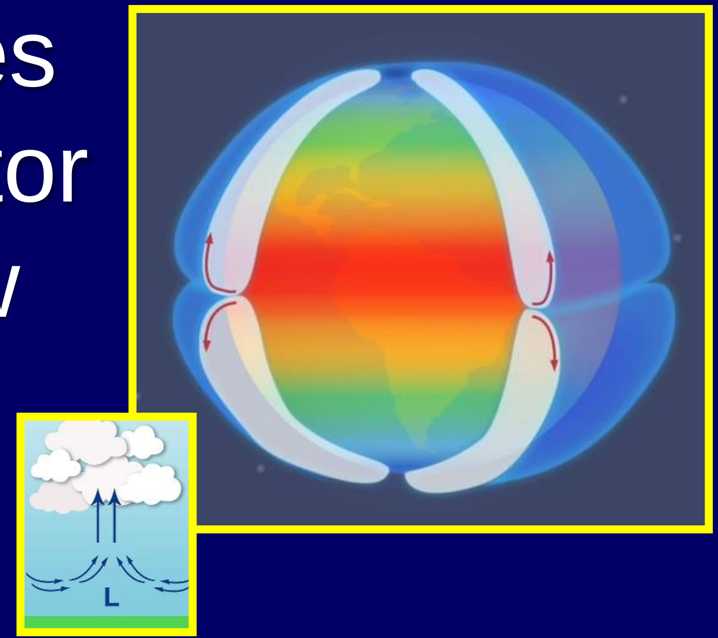
North and South Poles

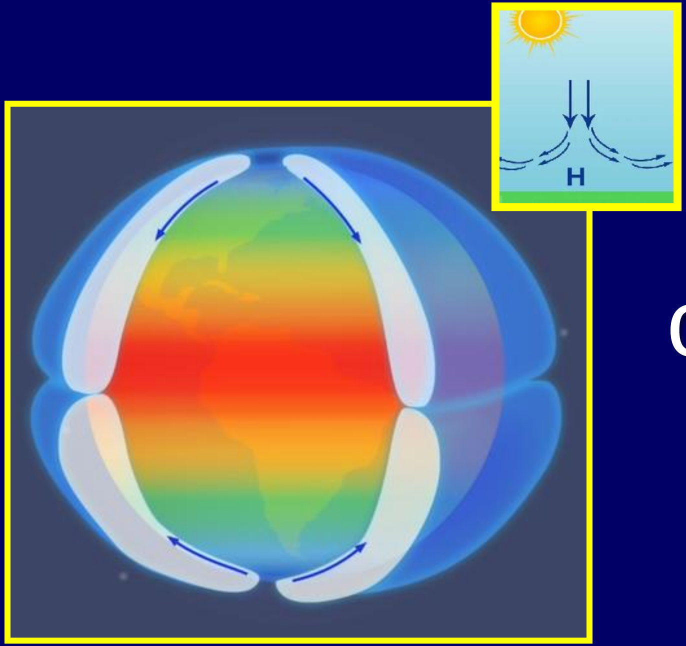
The north and south poles experience only indirect sunlight, so they experience cooler temperatures.



Rising & Sinking Air

The warmer temperatures cause the air at the equator to rise, resulting in a low pressure system.

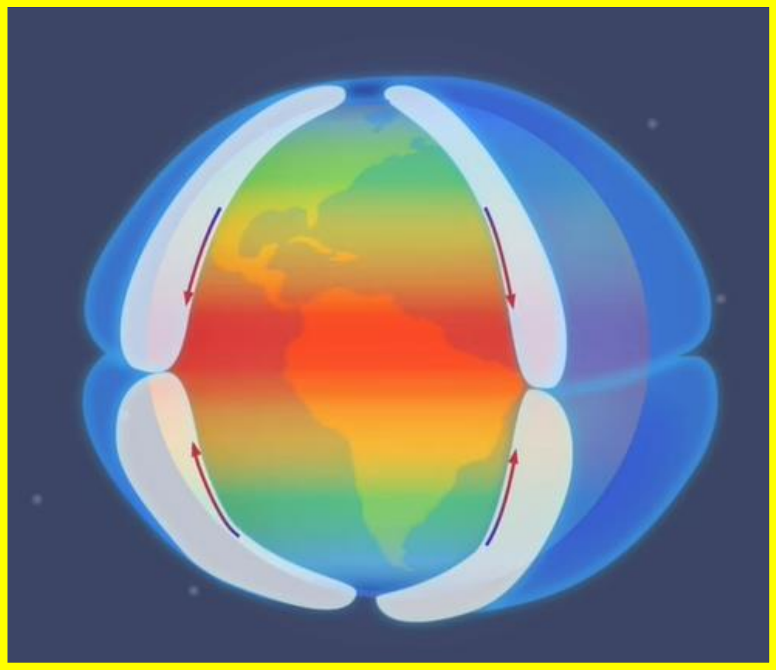




The cooler temperatures cause the air, at the poles, to sink, resulting in a high pressure system.

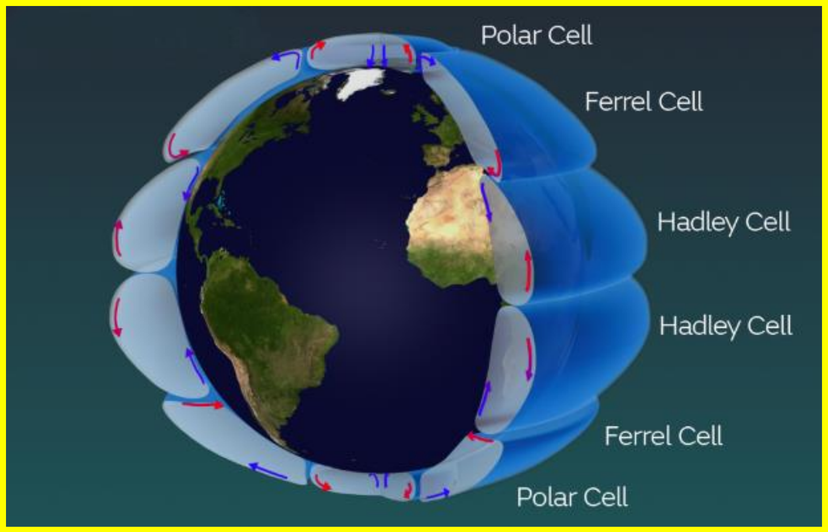
Global Convection Cells

The rising air at the equator and the sinking air at the poles causes air to circulate and create a global convection cell, along with global high and low pressure systems.



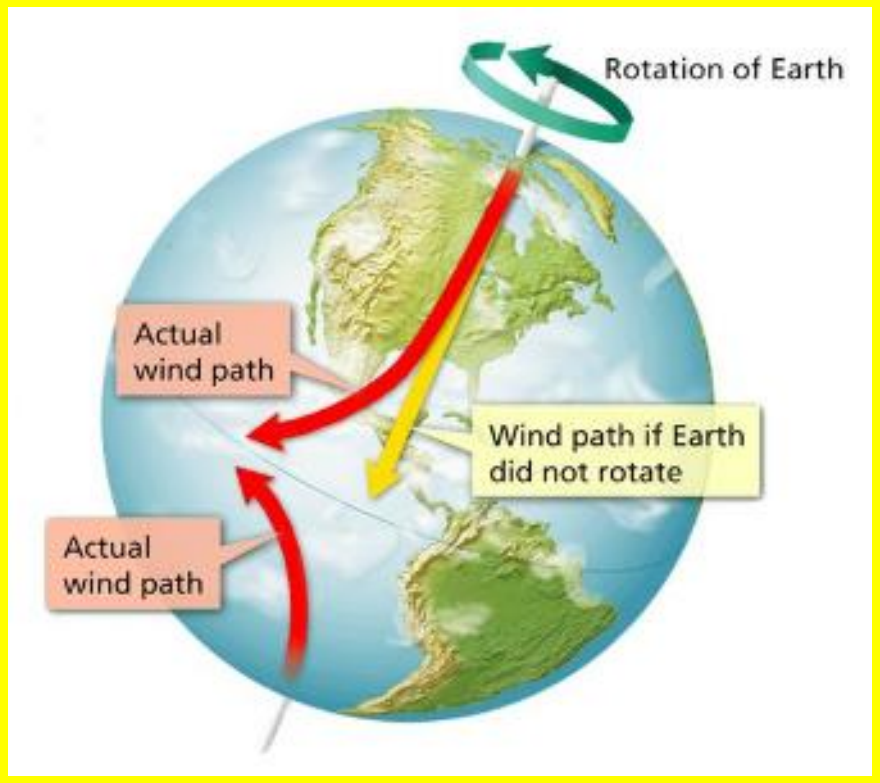
Global Convection Cells

Because the rising air doesn't have to travel all the way from the equator to the pole, before it cools, there are actually a series of three global convection cells in each hemisphere.



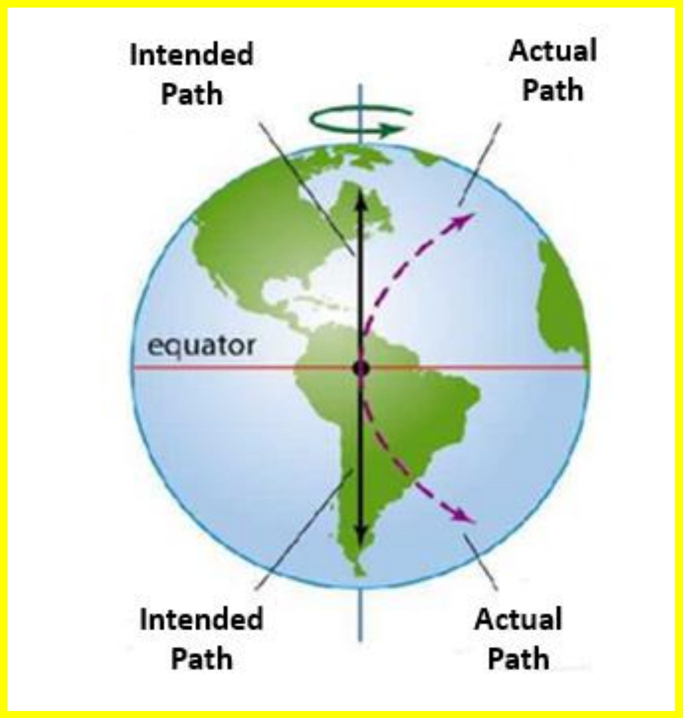
Coriolis Effect

As Earth rotates, the winds develop a curved path in what is called the Coriolis Effect.

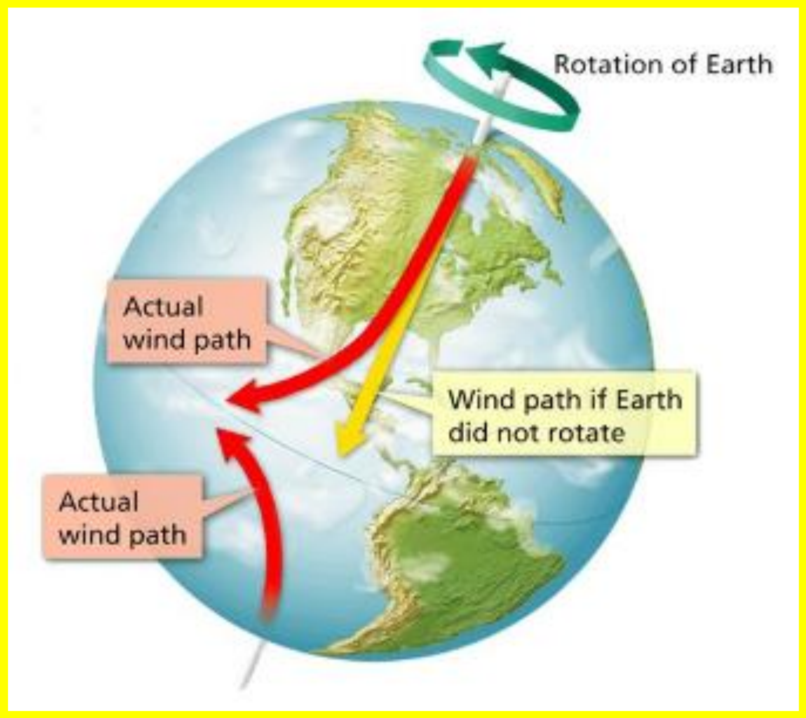


Coriolis Effect

In the northern hemisphere, the winds always curve to the right, when they are traveling from the equator or from the poles.



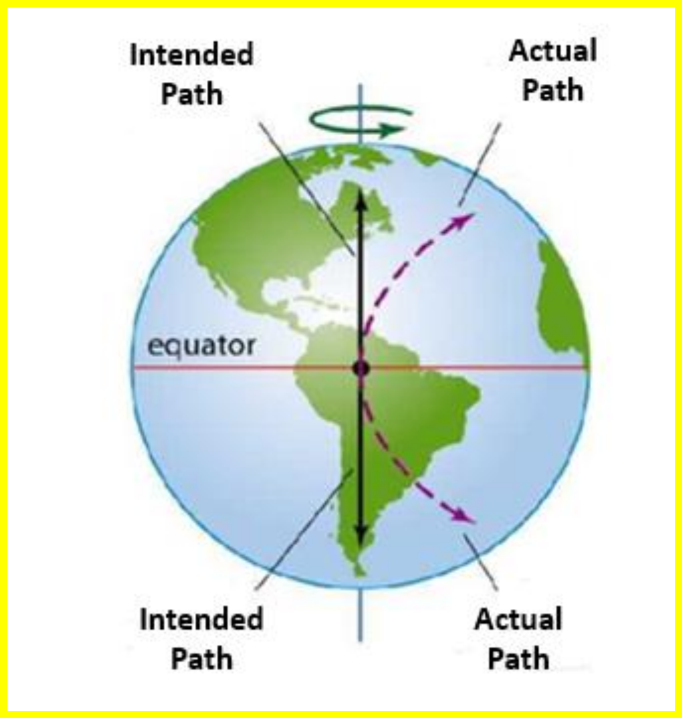
Equator to Poles



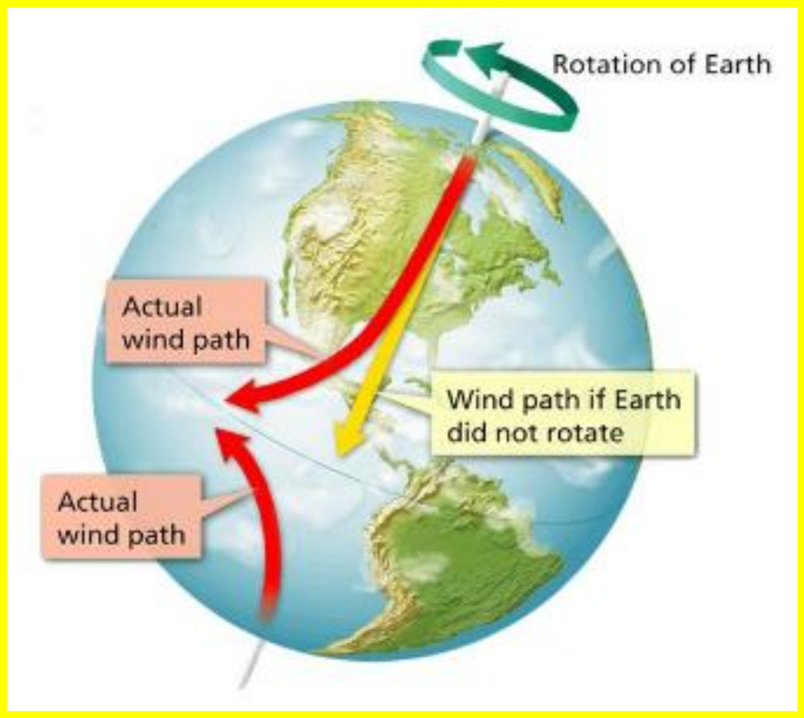
Poles to Equator

Coriolis Effect

In the southern hemisphere, the winds always curve to the left, when they are traveling from the equator or from the poles.



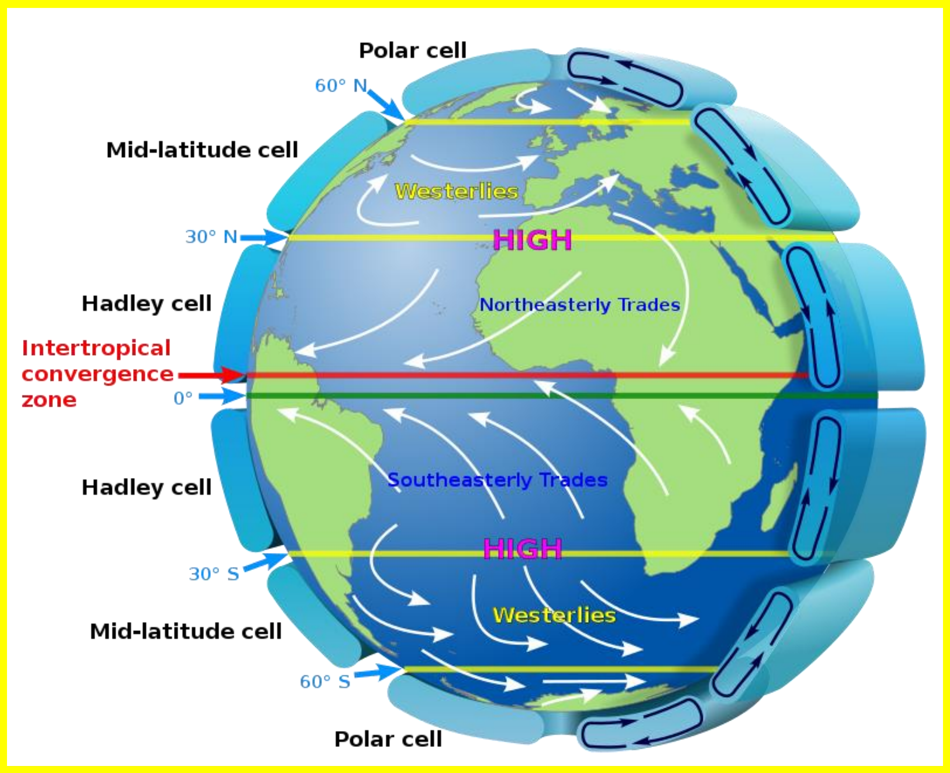
Equator to Poles



Poles to Equator

Global Wind Systems

This Coriolis Effect combines with the global convection cells to form distinct global wind systems.



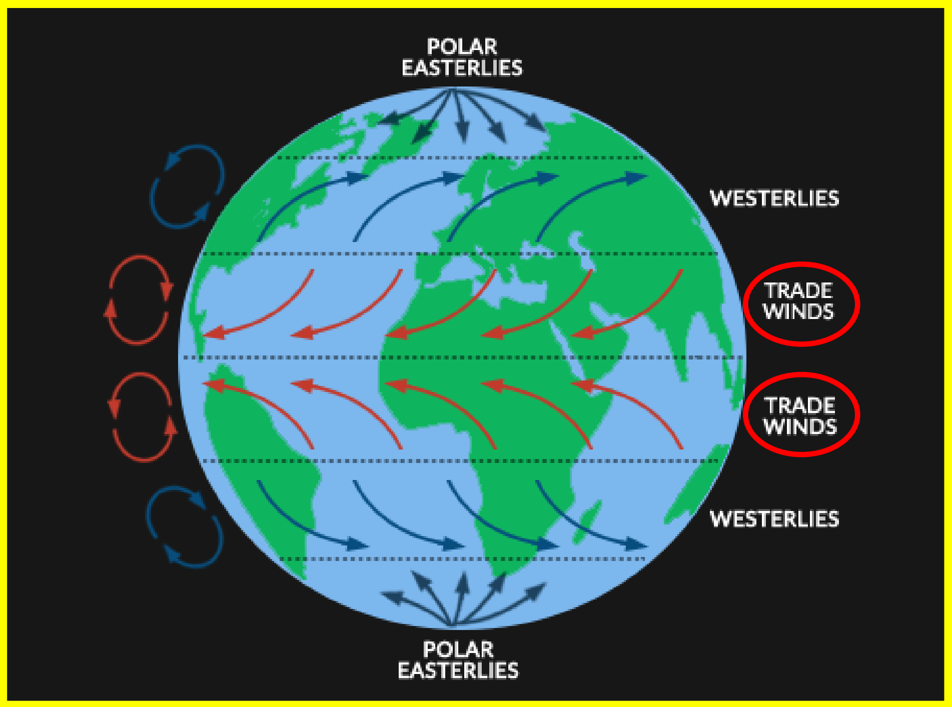
<u>Polar Cell</u>
Poles – 60º Latitude
Polar Easterly Winds

<u>Ferrel Cell</u>
60º – 30º Latitudes
Prevailing Westerlies

<u>Hadley Cell</u>
Equator – 30º Latitude
Trade Winds

Trade Winds

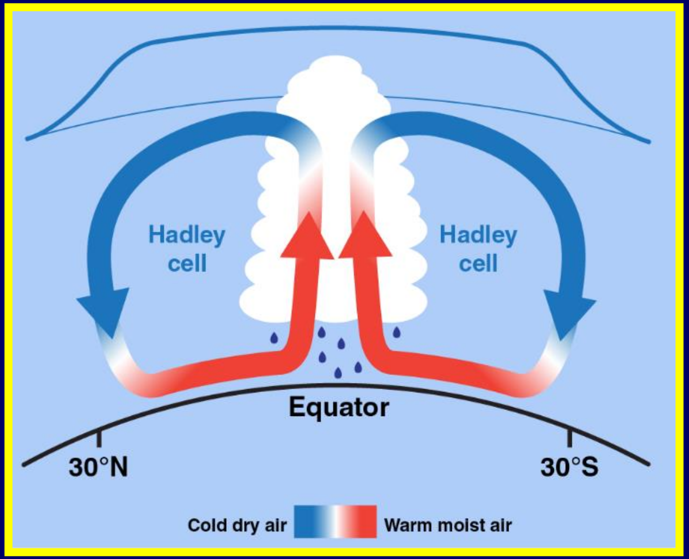
The trade winds blow from the high pressure system at 30^0 north and south latitude towards the equator, in a westerly direction.

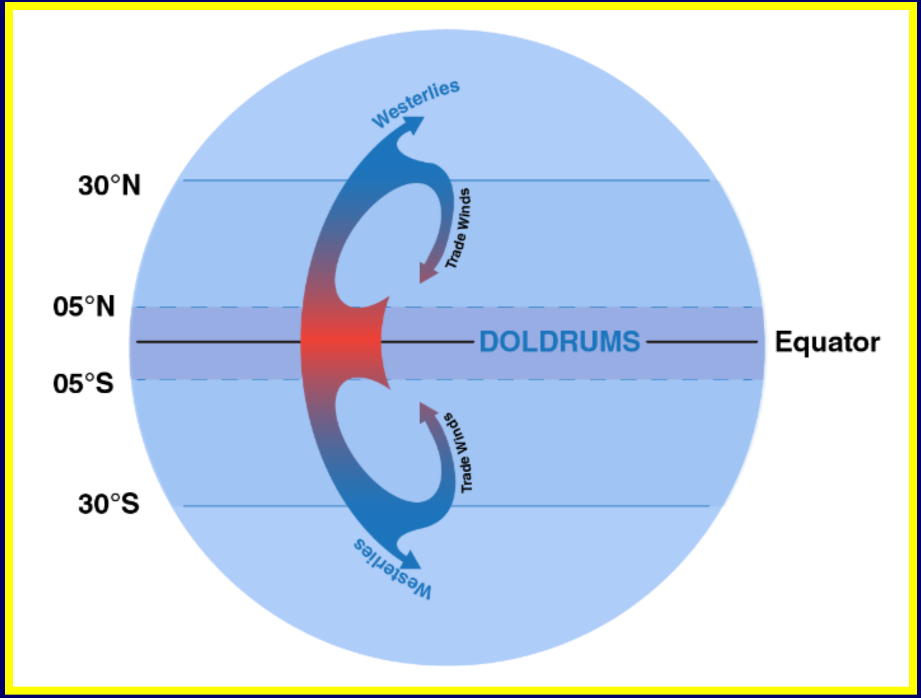


Because these winds were so reliable, sailing ships that were engaged in trade used them to travel.

Doldrums

Near the equator, the warm rises.

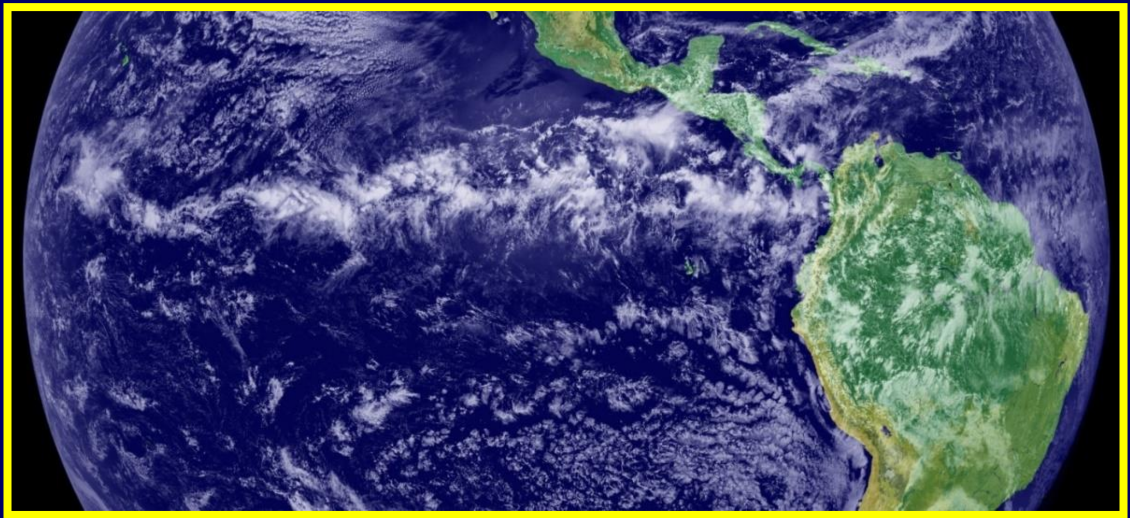


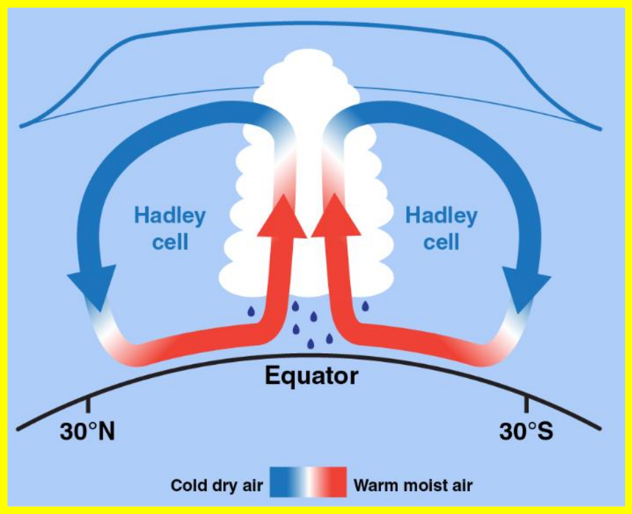


Because the air direction is upward, there is a not a lot of surface wind, so sailors called this region the doldrums.

Warm, Moist Rising Air

Along the equator, it is mostly ocean with only a small amount of air mass.

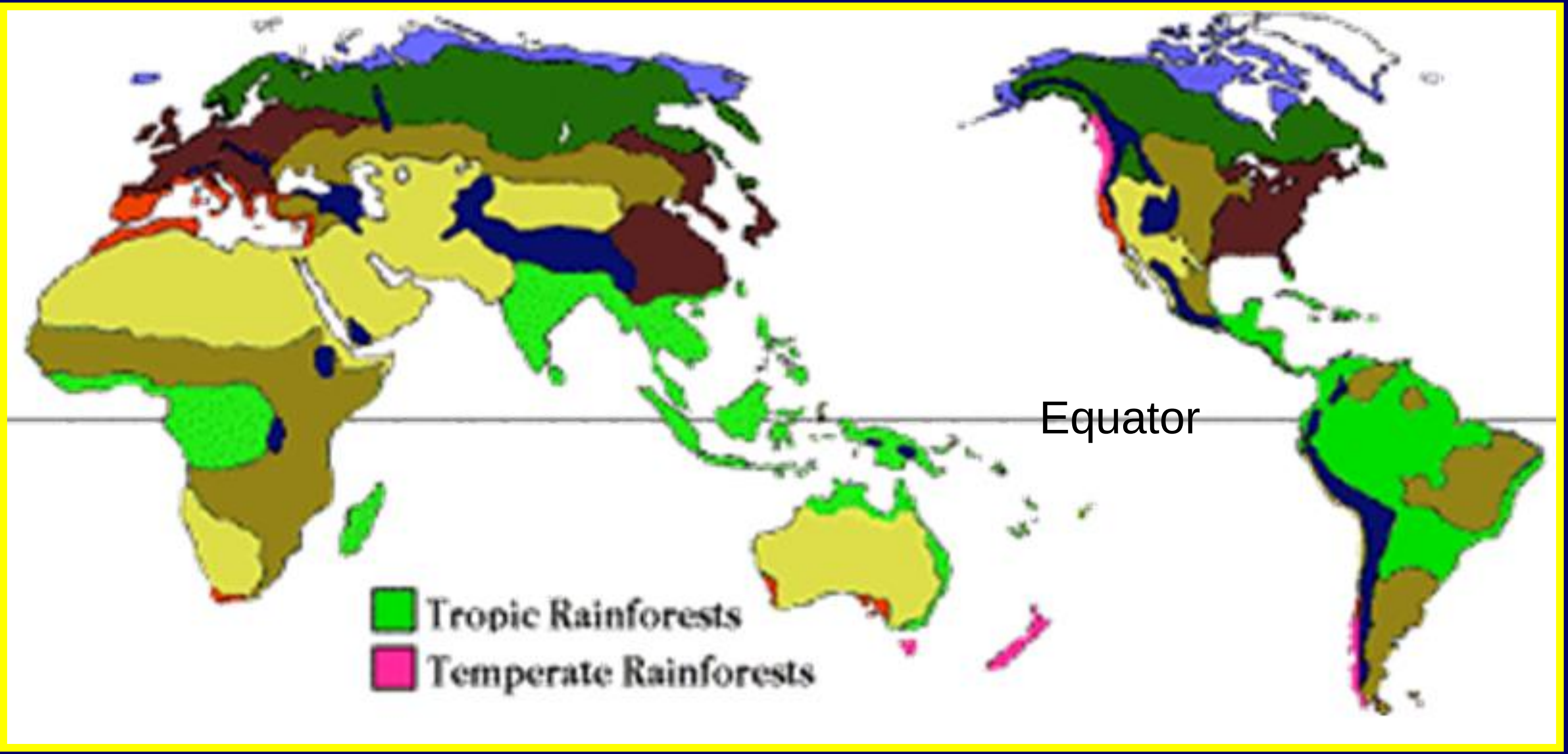




As the warm moist air rises and begins moving toward the poles, it cools and condenses and results in a high amount of precipitation.

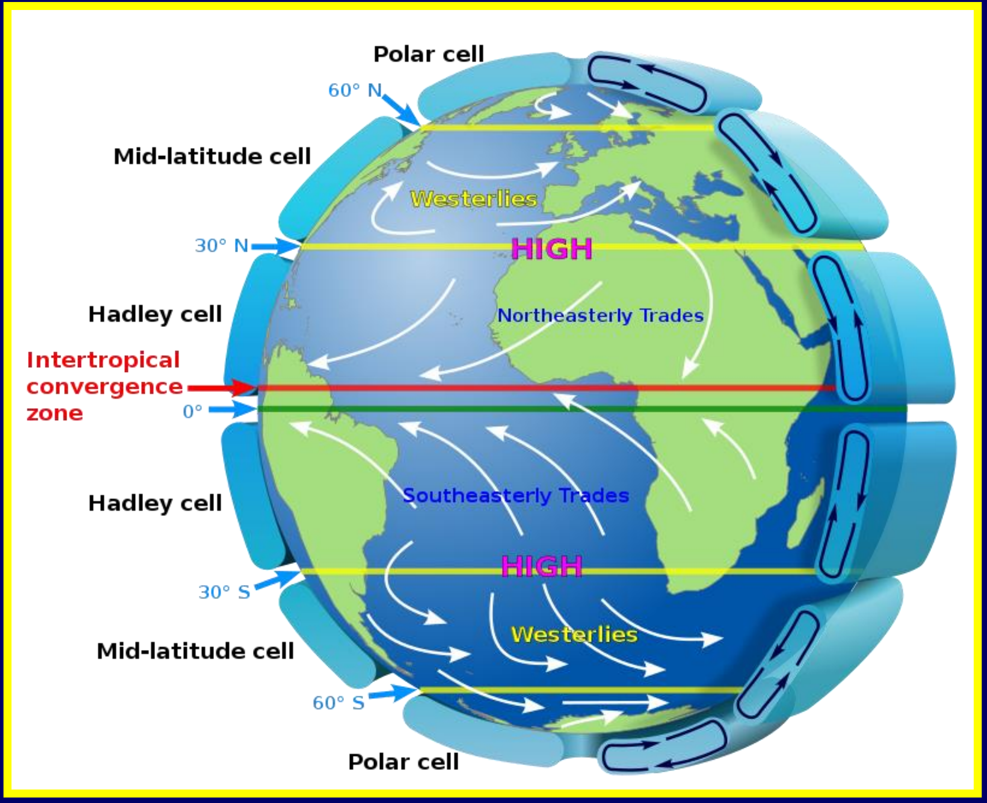
Tropical Rainforests

The high amounts of precipitation is responsible for all of the world's tropical rainforests which are located within this region or between 0º latitude and 30º latitude.



Horse Latitudes

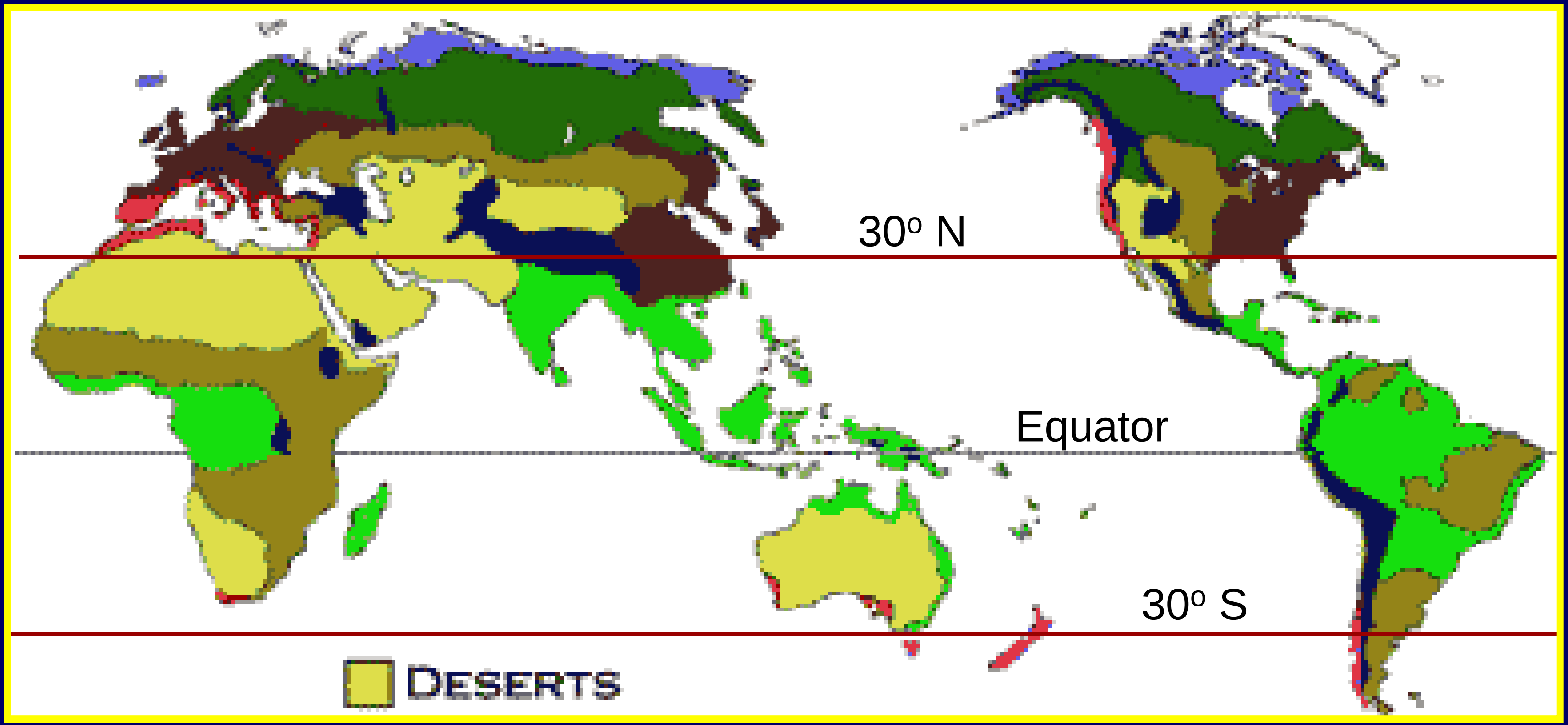
At around 30^0 latitude, the now dry, cool air sinks to create an area of high pressure.



High pressure regions are associated with calm, dry winds, and sunny skies.

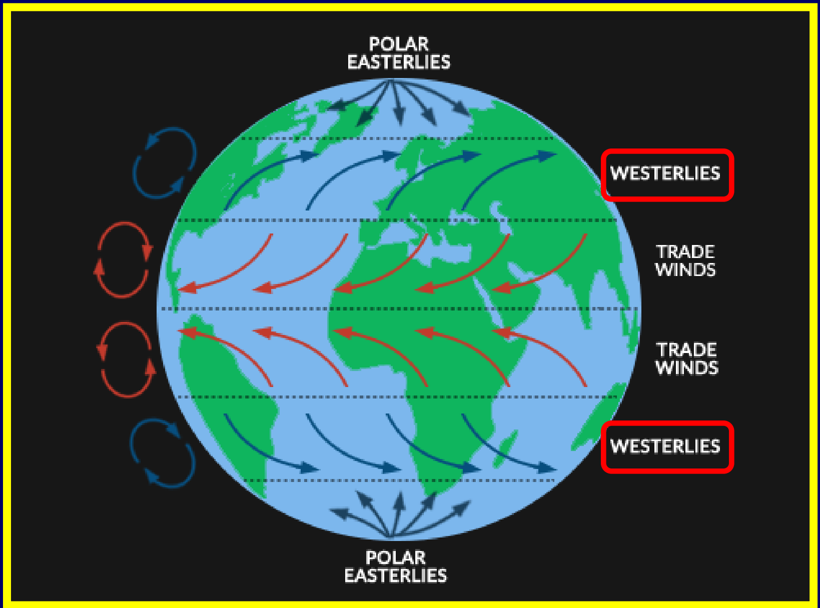
Deserts

The cool, sinking dry air at 30º is responsible for most of the world's deserts.



Westerlies

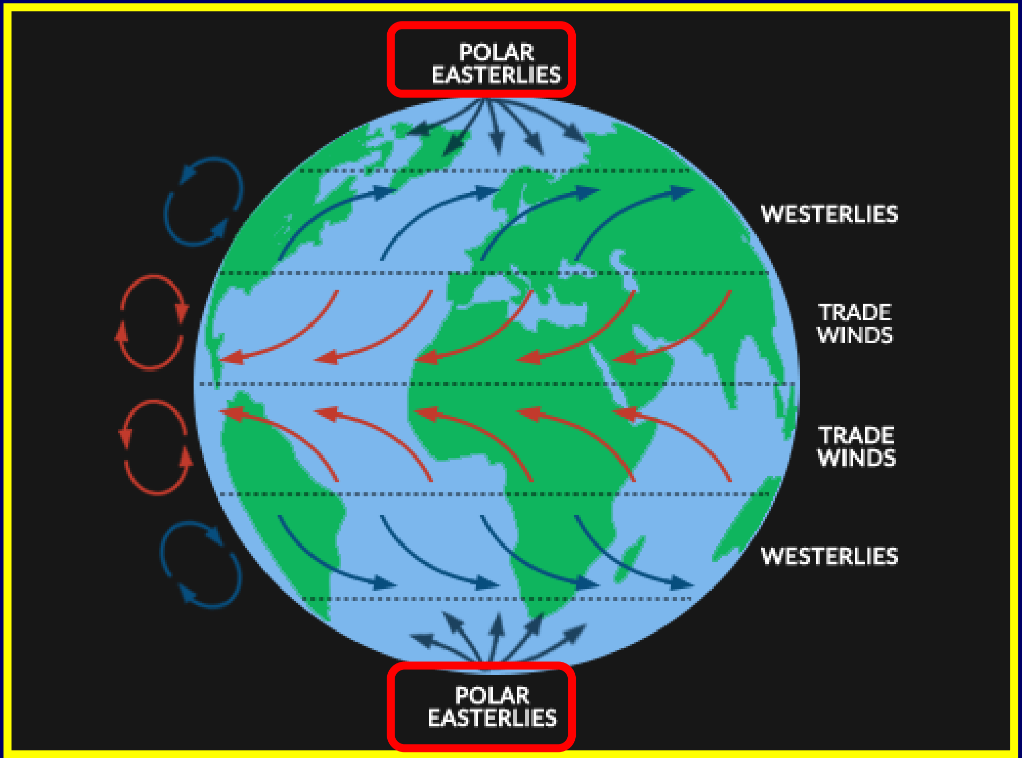
The westerlies that are found between 30º and 60º are called the prevailing westerlies in the United States.



That's why our storms usually come from the southwest.

Polar Easterlies

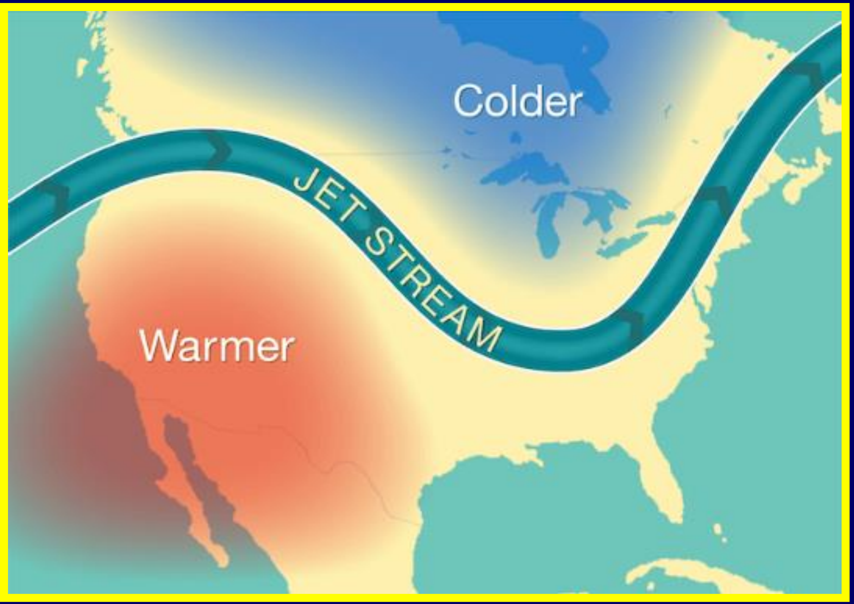
The polar easterlies blow from the poles to about 60^0 latitude.



Between 60^0 latitude and both poles, there is a lot of precipitation in the form of snow, which is where Antarctica and Siberia are located.

Jet Streams

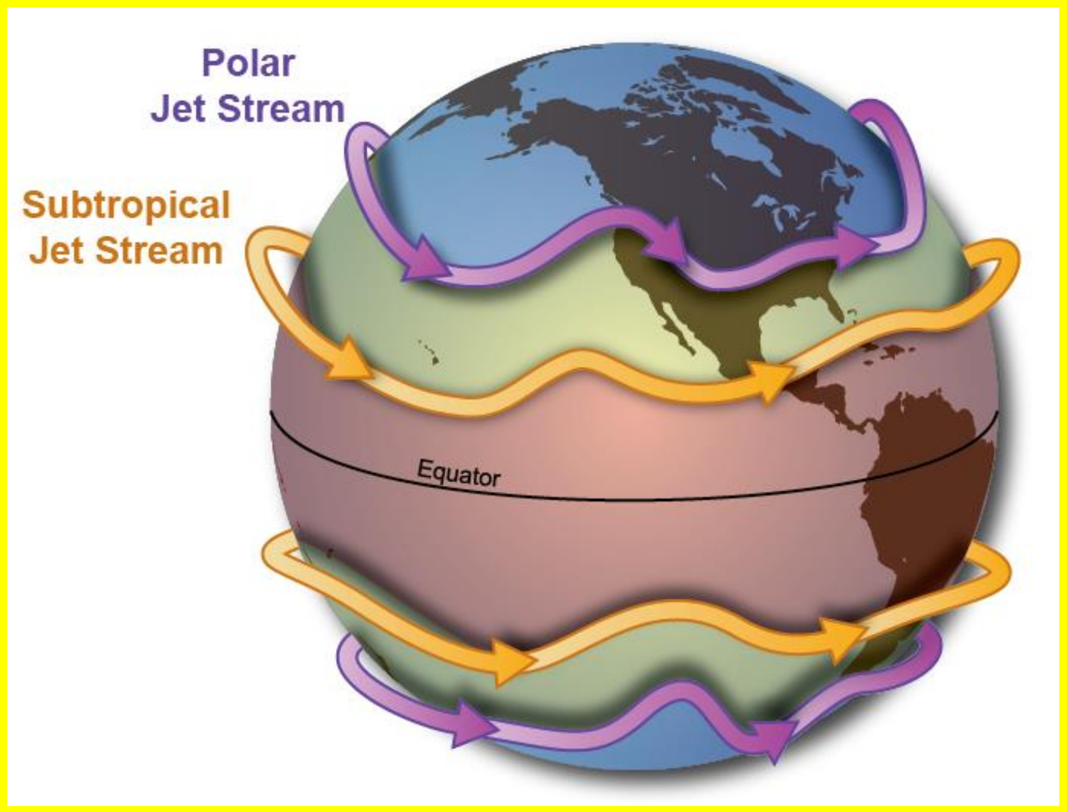
High in the atmosphere, differences in the temperature of air masses dominates air flow.



When a warm air mass meets a cold air mass, at the top of the troposphere, narrow bands of fast moving winds are created called jet streams.

Four Global Jet Streams

Earth has four major jet streams.



All four jet streams travel from west to east.

Speed of Jet Streams

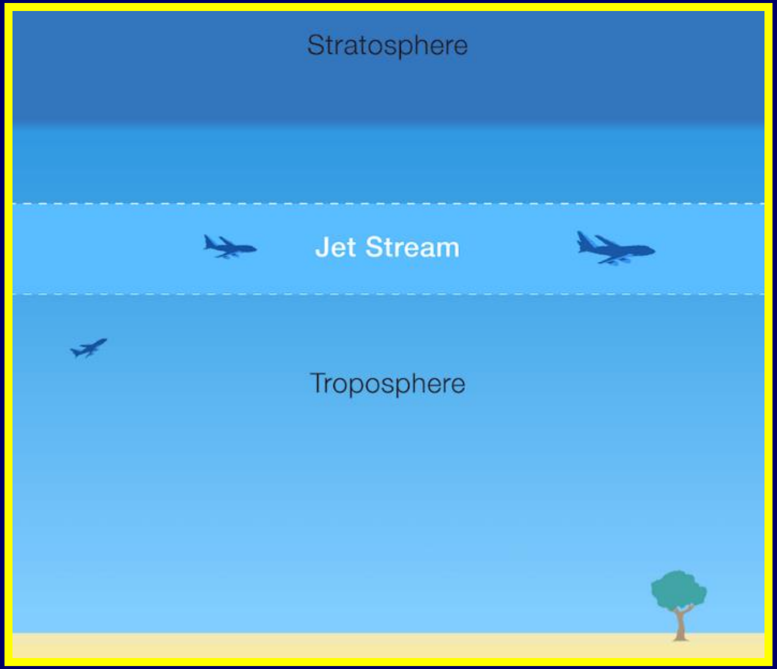
The speed of air jet streams can reach 110 mph to 250 mph, especially in the winter when the difference in temperature between air masses increases.

Summer Months

Winter Months

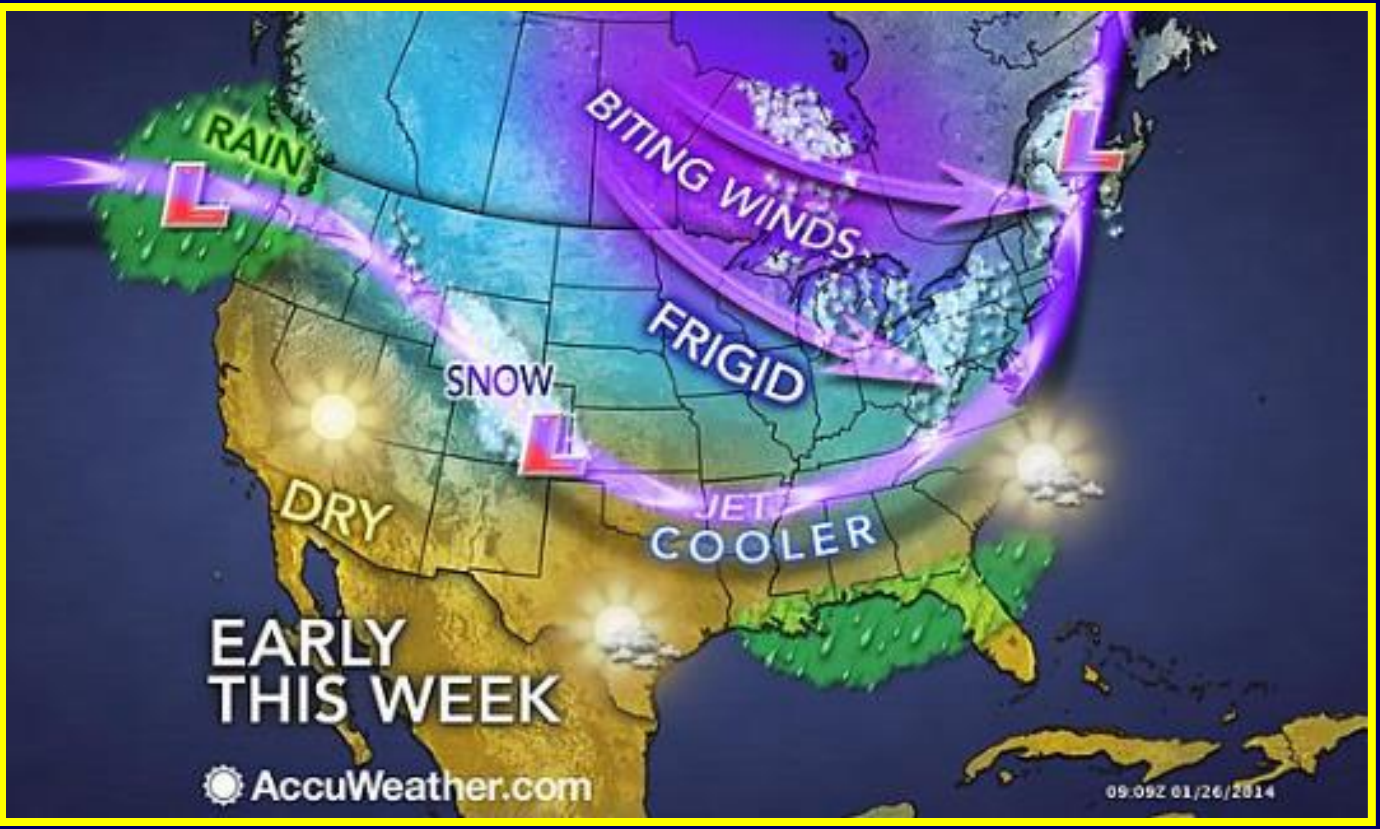
Airplanes

When airplanes are traveling in the same direction as the jet streams, they will fly in the jet stream to boost their speed and reduce their air travel times.



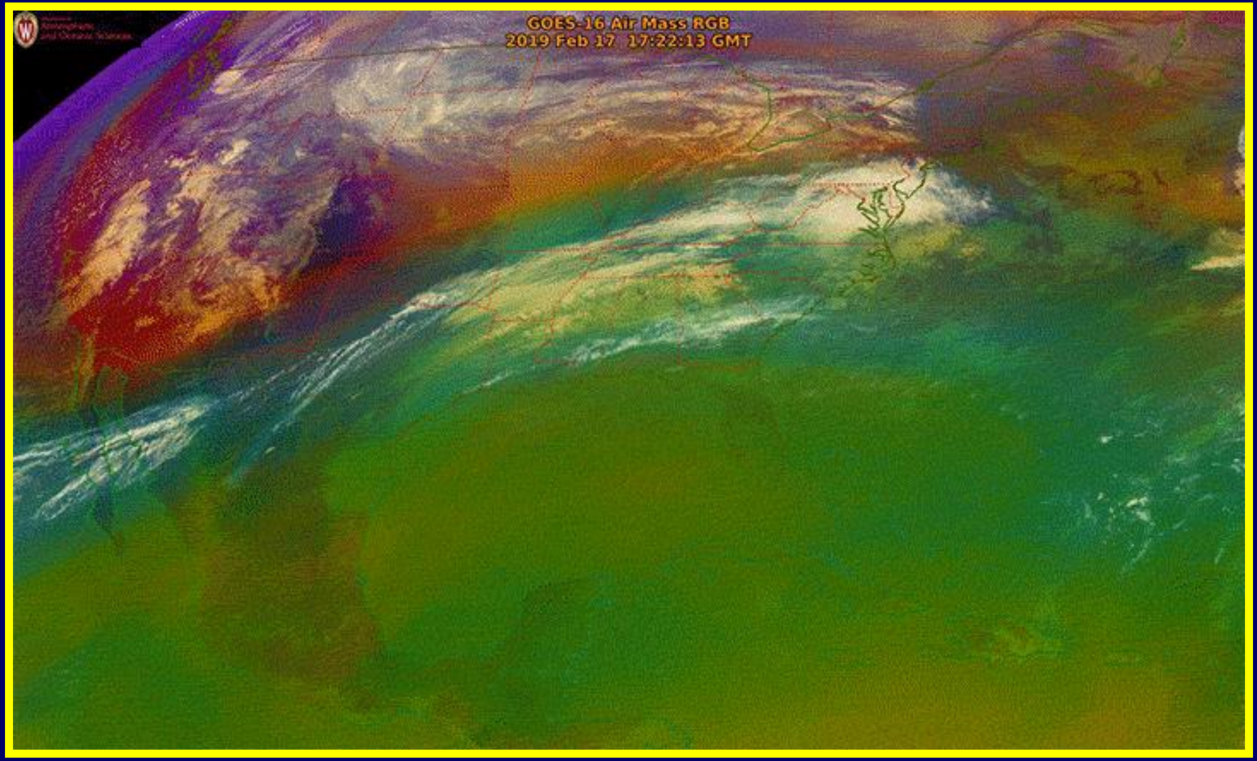
Jet Streams and Weather

In the winter, the polar jet stream often dips southward, causing most of the United States to experience extremely cold temperatures, cold rain, or snow storms.



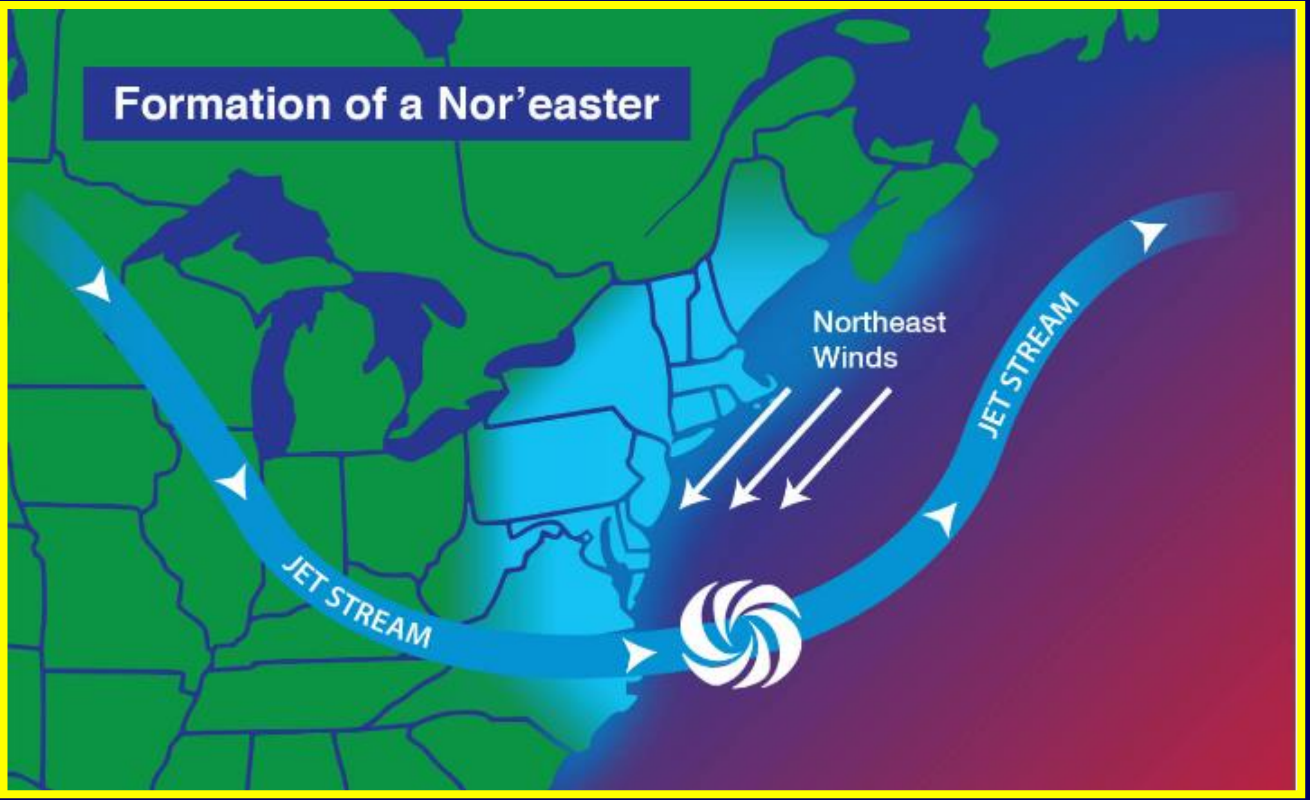
Jet Streams and Weather

In this video from the green area is warm, moist tropical air, while the orange and red areas are cold, dry polar air. The moving band of air between the two is the polar jet stream.



Nor'Easter

When the jet stream dips over the Atlantic Ocean, warm, moist air is forced upwards, where it cools and condenses into large winter storm clouds.



Nor'Easter

The storms that develop are called Nor'easters.

The End