

5.E.1 Weather Patterns and Phenomena Notes

Introduction to Weather

Weather is the combination of sunlight, wind, snow or rain, and temperatures in a particular region (area) at a particular time. People measure these conditions to describe and record the weather. Over time, people can notice patterns in weather conditions. Weather is always changing – from day to day and in seasonal patterns (spring, summer, fall and winter) throughout the year.

Weather Patterns on Earth

An imaginary line, called the **equator**, divides Earth into the **Northern Hemisphere** and the **Southern Hemisphere**. Areas near the North Pole the equator usually have warm temperatures.

Northern Hemisphere

Lines of **latitude** on a map or globe indicate how far North or how far South an area is located from the equator. The **equator** **Southern Hemisphere** South Pole **North Pole** and **South Pole** are furthest away from the equator so these areas usually have cold temperatures.

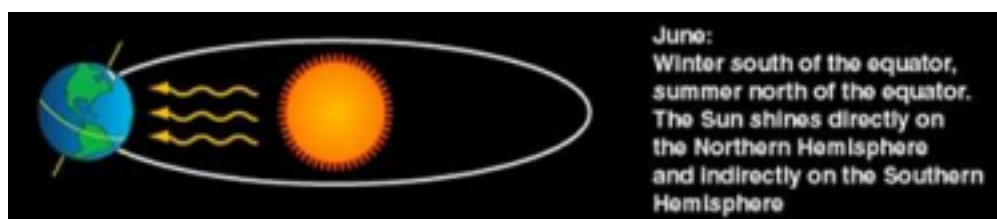


The United States is located in the mid-latitude region (area) of the Northern Hemisphere. That means the United States is located between the equator and the North Pole. The location of the United States results in seasonal patterns of weather.

Seasonal Weather Patterns

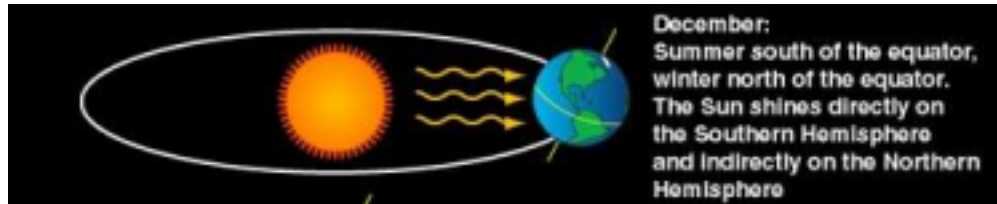
Earth is tilted on its **axis** as it revolves (**orbits**) around the Sun. Earth's tilt results in the areas near the equator receiving the most direct sunlight throughout the year. This is why areas near the equator usually have warm temperatures throughout the year. Earth's tilt results in the poles (areas furthest from the equator) receiving the most indirect sunlight. This is why areas near the North and South poles usually have cold temperatures throughout the year.

During part of Earth's orbit around the Sun, Earth's tilt causes the Northern Hemisphere to receive more direct sunlight than the Southern Hemisphere. This is why the Northern Hemisphere experiences the seasonal weather pattern of *summer*. When it is summer in the Northern Hemisphere, the Southern Hemisphere experiences the seasonal weather pattern of *winter*.



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During another part of Earth's orbit around the Sun, Earth's tilt causes the Northern Hemisphere to receive less direct sunlight than the Southern Hemisphere. This is why the Northern Hemisphere experiences the seasonal weather pattern of *winter*. When it is winter in the Northern Hemisphere, the Southern Hemisphere experiences the seasonal weather pattern of *summer*.



The chart below will help you remember that locations in the Northern and Southern Hemispheres experience *opposite* seasonal weather patterns. Remember, the seasons are a pattern because they are predictable and follow a particular order based on Earth's orbit around the Sun. (Notice how fall always follows summer and spring always follows winter.)

Seasonal Weather Pattern in the Northern Hemisphere	<i>spring</i>	<i>summer</i>	<i>fall</i>	<i>winter</i>
Seasonal Weather Pattern in the Southern Hemisphere	<i>fall</i>	<i>winter</i>	<i>spring</i>	<i>summer</i>

Weather Instruments

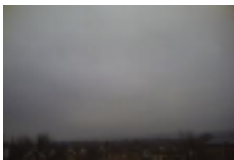
Meteorologists are scientists who study weather patterns. They observe and measure conditions in the atmosphere. The **atmosphere** is a mixture of gases (air) that surrounds the Earth. Once observations and measurements are collected, meteorologists analyze and interpret the data to make sense of it. Meteorologists are very good at noticing patterns in weather data and they use this information to **predict**, or forecast, upcoming weather events.

Weather Instrument Name	Picture	What it Measures
thermometer		temperature – the measurement of how hot or cold something is
rain gauge		precipitation – water that falls to the ground in the form of rain or snow

wind vane		wind direction – the direction (North, South, East, West) from which the wind is blowing
windsock		wind direction – the direction (North, South, East, West) from which the wind is blowing
anemometer		wind speed – how fast the air is moving
barometer		air pressure – the weight of air molecules pressing down on the Earth

Clouds

Meteorologists also observe the sky to determine the type of clouds that may be present. The three main cloud types are **cirrus**, **cumulus** and **stratus**. Each type of cloud can be associated with predictable patterns of weather.

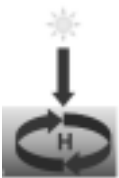
Cloud Type	Picture	Description	Predictable Weather Pattern
cirrus		white, thin, wispy (look feathery)	present in fair weather conditions; predict weather conditions will change soon
cumulus		white, puffy with flat bottoms (look like cotton balls)	predict fair weather conditions
stratus		gray, low (look like a blanket covering the sky)	predict rain when it is warm or snow when it is cold

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Air Masses and Fronts

An **air mass** is a body of air with the same temperature, humidity (the amount of moisture in the air), and air pressure.

Air mass	Description	Picture	Predictable Weather Patterns	Weather Map Symbols
high pressure system	sinking air		clear, dry, fair “ H appy Weather”	H
low pressure system	rising air		wet, precipitation, cloudy “ L ousy Weather”	L

When two different air masses meet, a borderline forms between the air masses. The difference in air pressure between the two air masses produces wind, or moving air. Air always moves from areas of **H**igh pressure to areas of **L**ow pressure. The larger the difference in air pressure, the faster the wind blows!

The borderline between two air masses is called a **front**. Predictable weather patterns can be associated with fronts.

Front	Description	Picture	Predictable Weather Patterns	Weather Map Symbols
cold front	leading edge of a cooler air mass, where colder air replaces warm air		a line of showers or thunderstorms form near the approaching front, then cooler temperatures behind the front	
warm front	leading edge of a warm air mass, where warmer air replaces cool air		heavy rain and an increase in temperatures	

On a weather map, the triangles on a cold front and the half circles on the warm front point in the direction the air mass is moving.

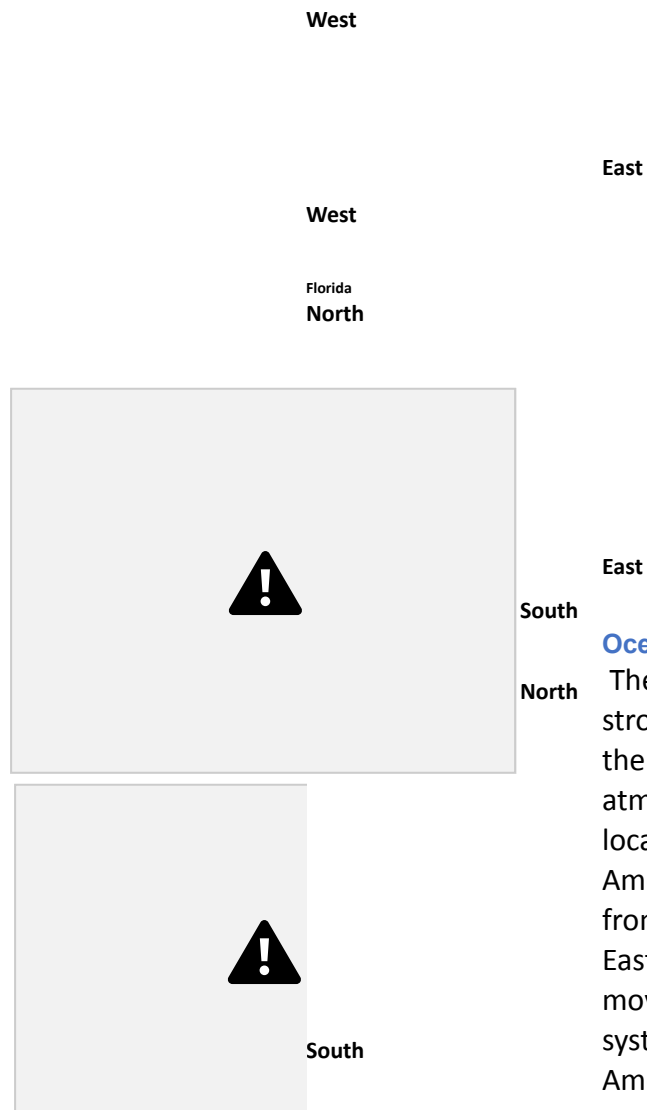
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Global Weather Patterns Impact Local Weather Conditions

Global weather patterns impact local weather conditions in measurable terms such as temperature, wind direction, wind speed, and precipitation.

Global weather patterns include air and water currents that have a powerful influence on

weather conditions in the atmosphere. A **current** is a continuous movement of water or air in the same direction.



East pattern.
Depending on global conditions, the jet stream can change location by shifting to the North or shifting to the South.

East

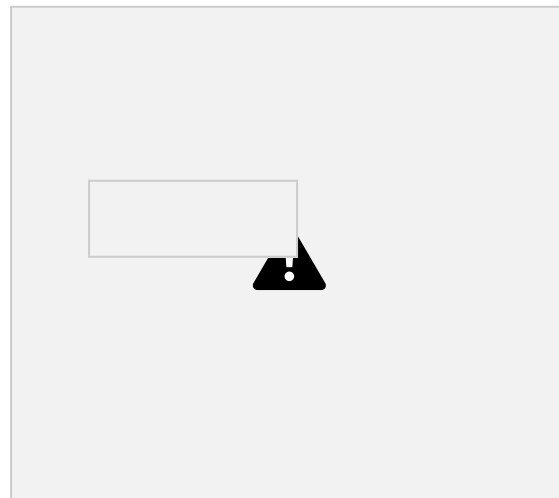
Ocean

The **jet stream** is a strong air current in the upper atmosphere. It is located over North America and flows from the West to the East. This flow helps move weather systems across North America in a West to

The **Gulf stream** is a strong, warm surface current in the North Atlantic Ocean. It moves from south of Florida up the eastern seaboard and then across the Atlantic. It moderates (or influences) weather by warming the air and land along the eastern seaboard during the cooler months.

Hurricanes, El Niño, and La Niña, are global weather patterns, too.

Hurricanes are major storms with very strong winds. They form over warm ocean water and are caused by global weather patterns. Hurricanes occur especially in the western parts of the Atlantic Ocean.



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El Niño is a water current or oscillation of unusually **warm** water temperatures in the Pacific Ocean. It causes many changes in weather conditions in other places, such as a lot of rain in areas that are usually dry.

La Niña is a water current or oscillation of unusually **cooler** water temperatures in the Pacific Ocean. It causes many changes in weather conditions in other places, such as winter temperatures that are warmer than normal in the Southeast region of the United States. The Northwest region of the United States will have winter temperatures that are cooler than

normal.

Both **El Niño** and **La Niña** oscillations impact the climates of North and South America for long periods of time.

Reflect on Your Learning

Learning about weather patterns and phenomena help us understand global weather and climate. Weather impacts our lives every single day! Knowing about the weather helps us decide if we should wear a jacket or heavy coat and whether we might need an umbrella or sunglasses. Knowing about the weather helps us decide if it's a good day for outdoor activities or if we should choose an indoor activity.

- What is something new that you learned about weather and weather patterns? •
- What questions do you still have about weather and weather patterns? •
- How can you learn more about weather and weather patterns?