

# Clouds, Wind, and Storms

*A Science A-Z Earth Series*

*Word Count: 1,437*



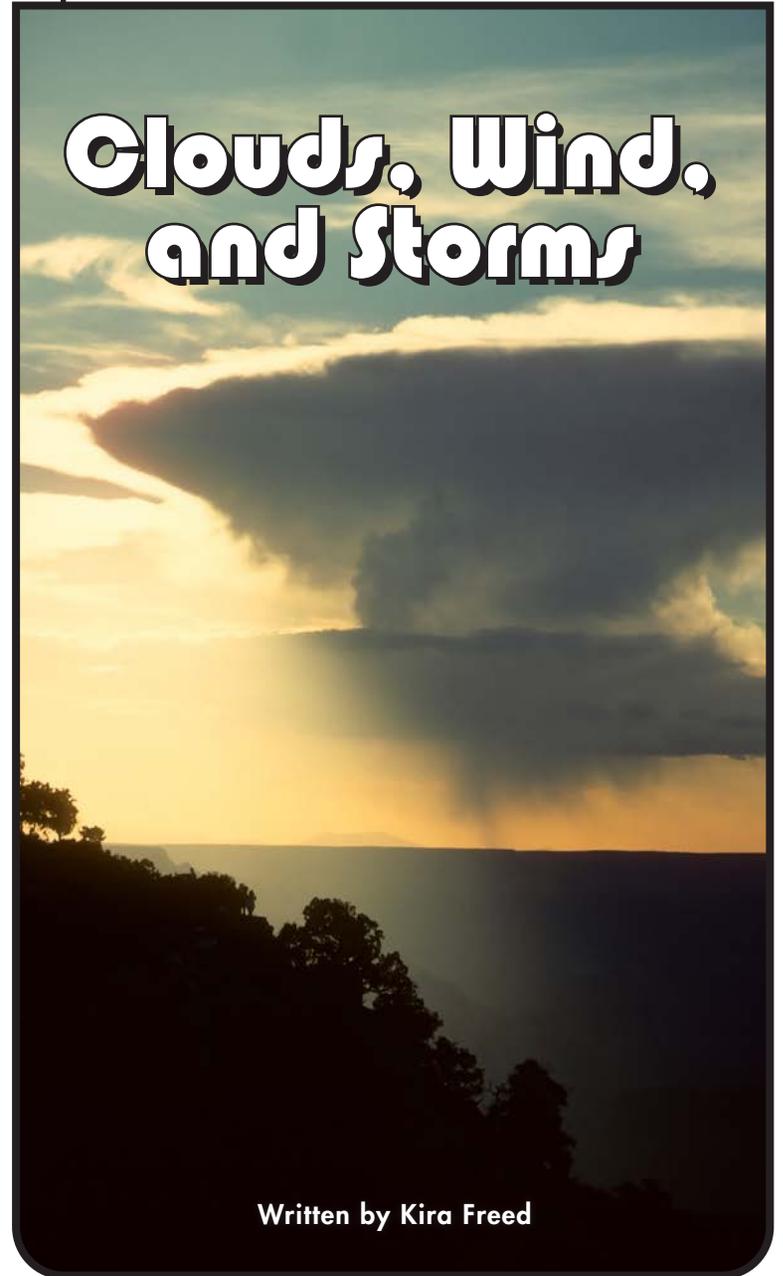
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# Clouds, Wind, and Storms



Written by Kira Freed

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## KEY ELEMENTS USED IN THIS BOOK

**The Big Idea:** Everywhere on Earth, all the time, some type of weather is occurring. Air masses mix to create clouds, wind, and precipitation. It may be clear one day but cloudy the next. It can be snowing in one place while it is warm and sunny elsewhere. Experts are now able to better predict the weather in advance, giving us information we need to plan our activities. We often select activities, clothing, and a place to live based upon weather. Understanding the weather can also prepare us to take precautions that will keep us safe in the event of severe weather.

**Key words:** air pressure, atmosphere, blizzard, cirrus, cloud, condense, cumulus, evaporate, forecast, front, gas, hail, humid, hurricane, lightning, liquid, moisture, precipitation, rain, sleet, snow, solid, stratus, temperature, thermometer, thunderstorm, tornado, water vapor, wind

**Key comprehension skill:** Main idea and details

*Other suitable comprehension skills:* Compare and contrast; classify information; cause and effect; identify facts; elements of a genre; interpret graphs, charts, and diagrams

**Key reading strategy:** Using a glossary and boldfaced words

*Other suitable reading strategies:* Connect to prior knowledge; ask and answer questions; summarize; visualize; using a table of contents and headings

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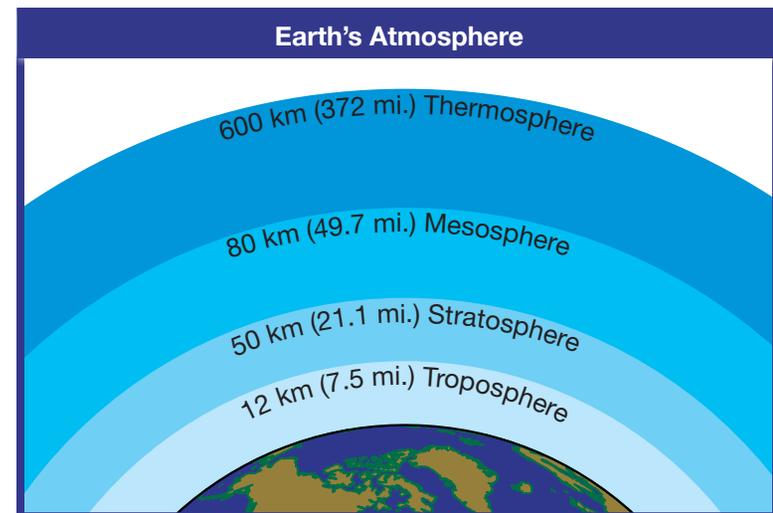
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## Introduction

Somewhere on Earth, almost every type of weather is happening right now. Some places have light, puffy clouds. Heavy rain or snow is falling in other places. Did you ever wonder what causes all these types of weather?

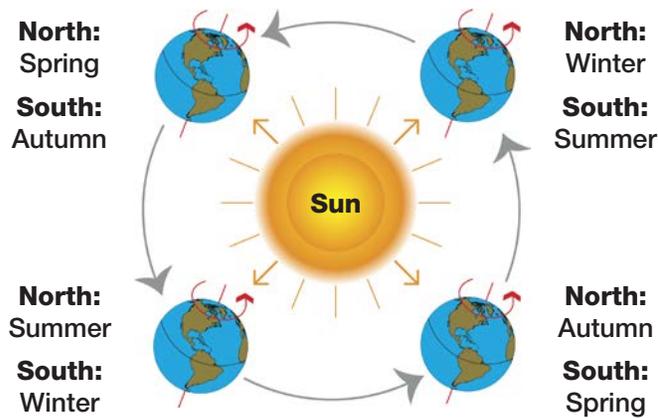
Our planet is surrounded by a layer of air called the **atmosphere**. The atmosphere is made of masses of air that are constantly moving and mixing. Warm air masses mix with cold air masses. Dry air masses mix with wet air masses. The mixing of air masses causes **wind, clouds, precipitation, and storms**.



Earth's atmosphere extends 600 kilometers (372 mi.) above the ground. Most weather happens in the lowest 12 kilometers.

Weather happens near Earth's surface. The Sun's energy warms Earth's surface, which warms the air above it. But not all surfaces are heated equally.

The parts of Earth closer to the equator get more heat than polar regions. Darker surfaces absorb more energy than lighter surfaces. Also, Earth's tilt makes parts of Earth get more sunlight than other parts during different seasons. When air that has received more heat from Earth's surface mixes with air that has received less energy, the result is weather. Weather is determined by the amount of wind, clouds, and precipitation.

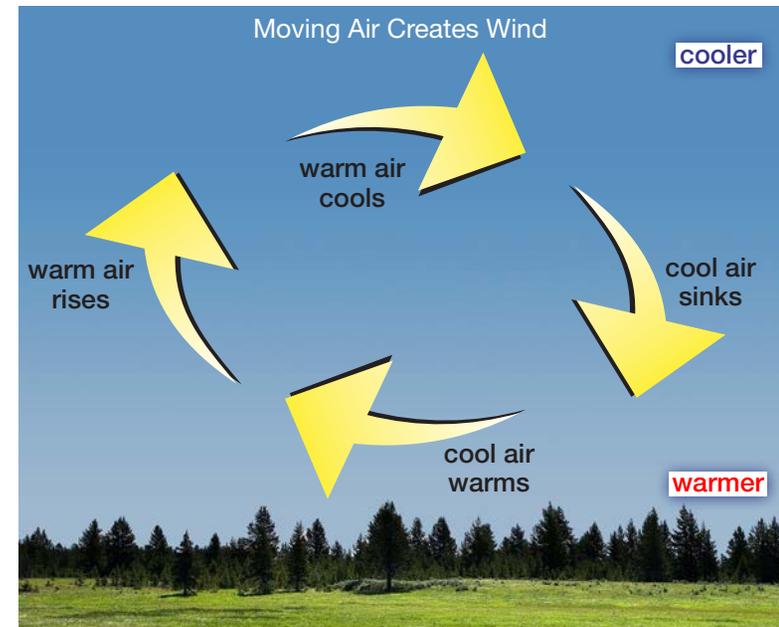


The northern half of Earth is tilted toward the Sun in June, July, and August, which creates summer. The southern half is tilted toward the Sun in December, January, and February. While North Americans and Europeans are enjoying summer, it's winter in Australia.

## Wind

Wind is simply air on the move. We can't see it, but we can feel it. And we can see its effects on plants, flags, wind chimes, and other things.

As air near Earth's surface gets warmed by its heat, the air gets lighter. The colder air, which is heavier, pushes down on it, squeezing it upward. As the warm air rises, it cools. As the cold air gets closer to the ground, it warms. Air is always moving, warming, and cooling, which makes wind.



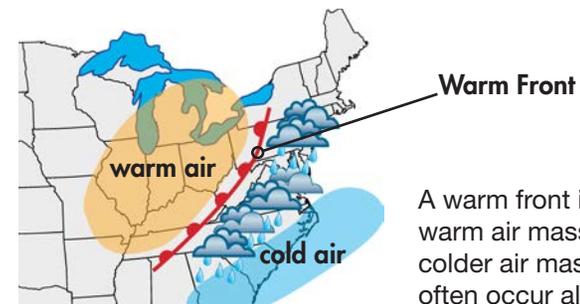


Chicago gets its nickname—the Windy City—from the breezes that blow off Lake Michigan.

Think about the city of Chicago, which is on Lake Michigan. When the Sun is shining, the air over land heats up more than the air over water. As warm air over the city rises, cooler air over the lake moves toward the land to replace the rising warm air. The movement of air creates a breeze from the lake to the land. This is called a *sea breeze*.

Why is wind strong sometimes and just a light breeze at other times? Wind is stronger when the difference in temperature between the warm air mass and the cool air mass is great. When this happens, the cold air “chases” the warm air faster.

Changes in weather are created when air masses of different temperatures meet each other. The line where a warm air mass and a cold air mass meet is called a **front**. Changes in weather tend to happen along a front. Have you ever noticed the lines on a weather map? Those lines show the location of fronts.



A warm front is where a warm air mass meets a colder air mass. Storms often occur along a front.

## MEASURING THE WIND

We measure the wind with an instrument called an *anemometer*. People measure the wind for many reasons.

- Information about wind speeds helps scientists predict the weather.
- Airplane pilots cannot take off or land if the wind is blowing too hard.
- Ship captains require safe wind speeds to enter harbors.
- Machines called *wind turbines* convert fast-moving wind into electricity. In some locations, the wind is too calm to use wind turbines.



Wind turbine



Water (liquid)

Ice (solid)

Water vapor (gas)

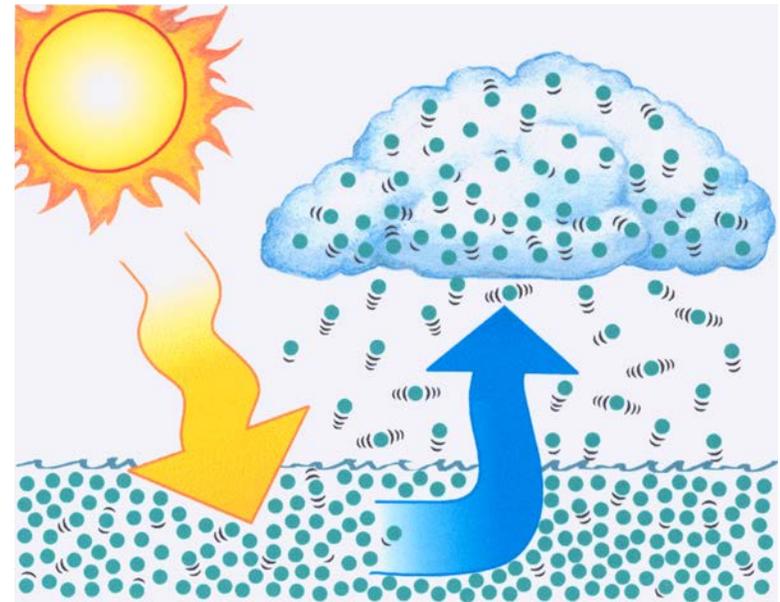
## Clouds

Clouds are made up of billions of tiny drops of water and tiny pieces of ice. The water drops and ice pieces float in the air because they are so small and weigh so little.

To understand how clouds form, let's first learn about the different forms water can take. When we think about water, we usually think about its liquid form. Water can also take the form of a solid, which is ice. And it can also be a gas, which is called **water vapor**.

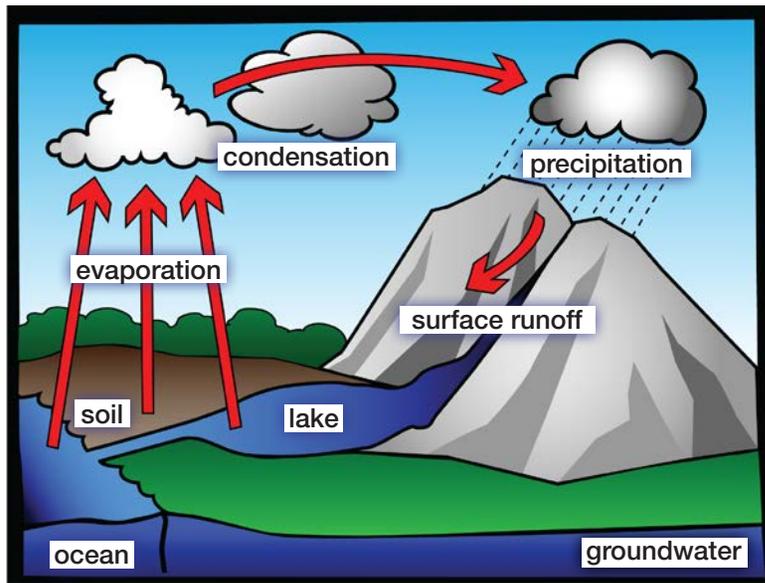
Earth's water is always changing form. If water gets very cold, it freezes and becomes ice. If it gets warm again, the ice melts and returns to its liquid form. Water also changes from a liquid to a gas and back again. Without these changes, clouds could not form.

Let's take a look at one important way that water changes. When the Sun shines on an ocean or another body of water, it causes some of the water to **evaporate**. During this process, some of the liquid changes to water vapor, an invisible gas. The water vapor rises in the air.

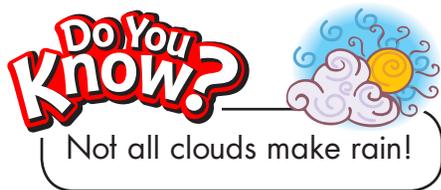


The Sun's energy makes water evaporate into the air. This warm, wet air rises, cools, and forms clouds.

The Water Cycle



As the water vapor rises, it becomes cooler. Cool air doesn't hold as much water vapor as warm air. Some of the water vapor **condenses**, or turns back into liquid water, when it hits tiny bits of dust. When enough of these drops of water gather together, they form a cloud.



You've probably noticed many types of clouds in the sky. The

type of cloud depends on how high it is and how much water vapor is in the air.

Cloud Type (Height in Sky)	Description	Forecasting
<b>Cirrus</b> (High) 	thin, wispy; made of ice crystals	usually mean fair, pleasant weather; usually indicate that the weather will change within 24 hours
<b>Cirrostratus</b> (High) 	thin, sheetlike; cover the whole sky	usually come 12-24 hours before a storm (either rain or snow)
<b>Altostratus</b> (Middle) 	gray or blue-gray; made of both ice crystals and water droplets; usually cover whole sky	usually form in front of storms (either rain or snow)
<b>Alto cumulus</b> (Middle) 	puffy and gray; form in groups; made of water droplets	come before a thunderstorm

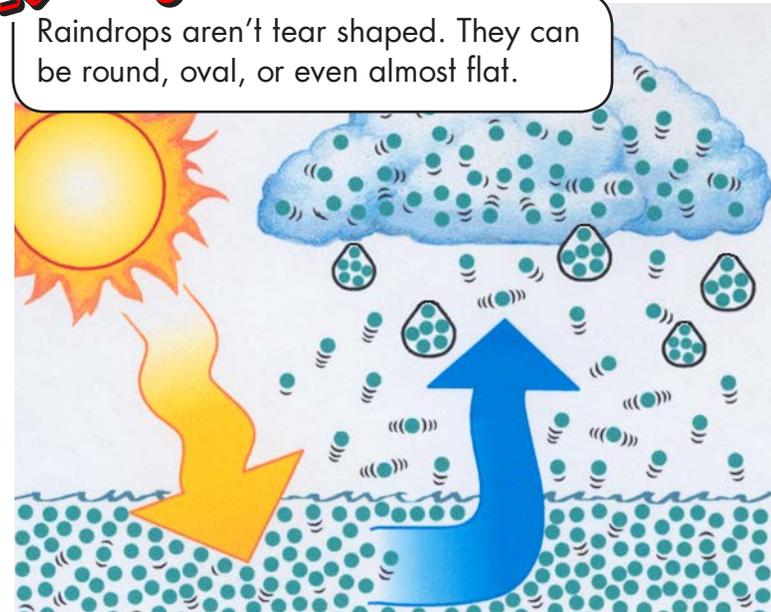
Cloud Type (Height in Sky)	Description	Forecasting
<b>Stratus</b> (Low)	 solid gray; usually cover whole sky	often create light mist or drizzle
<b>Stratocumulus</b> (Low)		
<b>Nimbostratus</b> (Low)	 dark gray blanket of clouds	light to moderate steady rain or snow
<b>Cumulus</b> (Several Heights)		
<b>Cumulonimbus</b> (Several Heights)	 top of towering cumulus cloud that gets flattened by high wind	thunderstorm clouds; can produce heavy rain, hail, snow, lightning, and sometimes tornadoes

## Precipitation

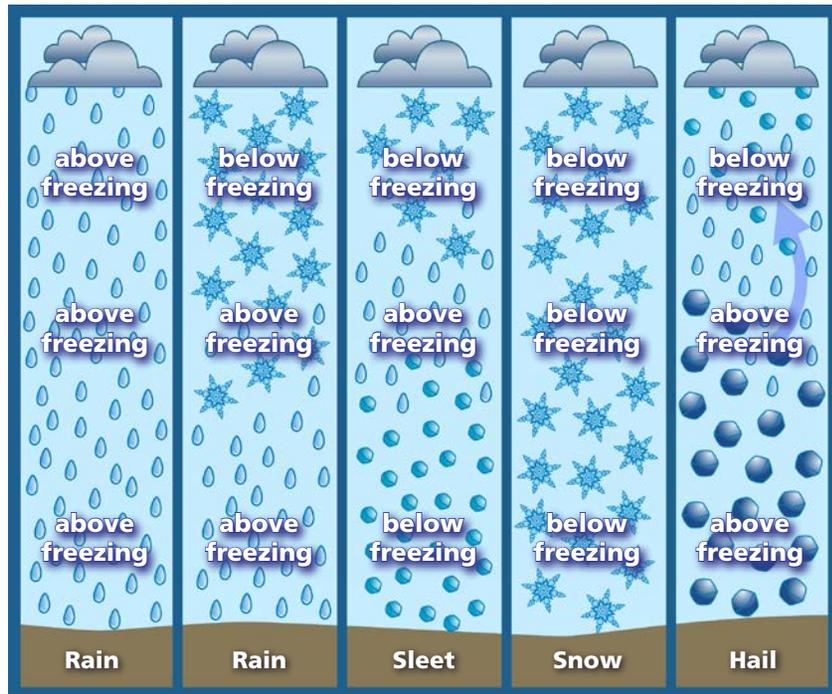
We learned earlier that the **moisture** in a cloud can be water, ice, or both. As a cloud holds more and more tiny drops of water or pieces of ice and the temperature gets colder, the water droplets and the pieces of ice begin to join. They get bigger and bigger until they become too large and heavy to stay in the cloud. They fall to the ground as rain, snow, hail, or sleet. These are all types of precipitation.



Raindrops aren't tear shaped. They can be round, oval, or even almost flat.



As water droplets in the cloud cool and condense, they form precipitation.



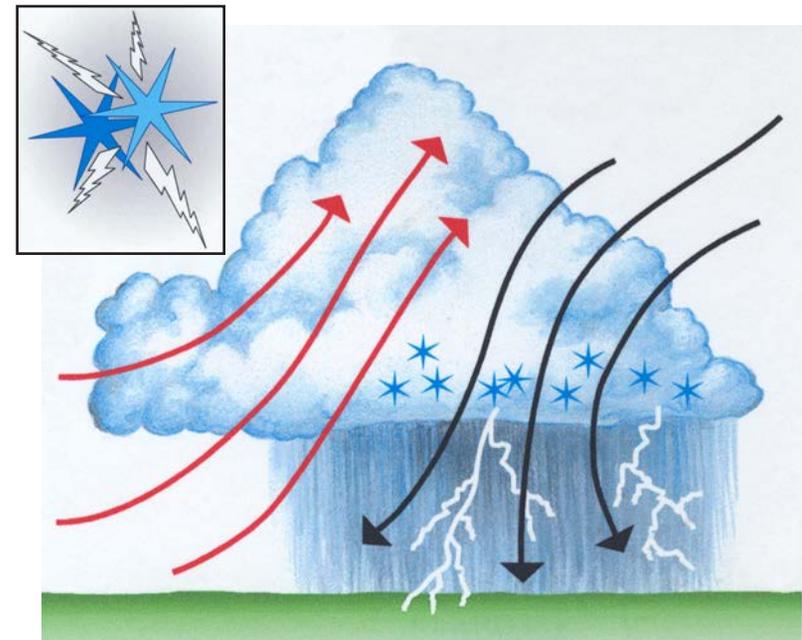
Key: Snow ❄️ Ice ⬤ Rain 💧 Hail ⬤ Updraft ↻

The temperature of the air determines the form of precipitation that falls. Sometimes the air between the cloud and the ground is warm. Then the precipitation falls as rain. If rain freezes on the way to the ground, it becomes sleet. At other times, the air in the cloud is very cold. So is the air between the cloud and the ground. In this case, the precipitation falls as snow. Hail forms when ice gets blown up inside a cloud over and over, getting bigger until it falls.

## Storms

Storms are extreme weather. Many types of storms occur on Earth. As you read about storms on the next pages, think about how different air masses move and mix to produce them.

**Thunderstorms** are the most common type of storm. They usually occur when air that is warm and full of moisture collides with cold, dry air. They are caused when warm, moist air rises quickly to form towering clouds.



Warm, moist air rises when it hits cold, dry air. Ice crystals bump into each other, causing lightning.

## THUNDERSTORM SAFETY

Lightning is extremely dangerous. Follow these tips to be safe.

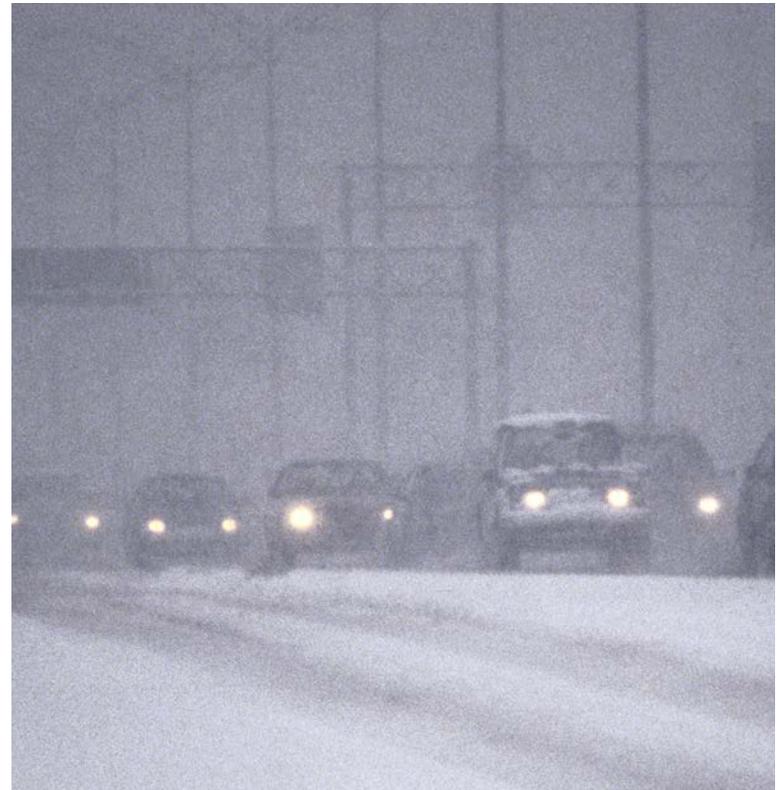
- Look for shelter, such as a building or a car. Never stand under a tree. Lightning often strikes the tallest thing around.
- If you are outside and cannot find shelter, crouch down with your head as low as possible. **Never** lie down on the ground because lightning spreads out through the ground after it strikes.
- Stay out of water during a thunderstorm and avoid touching metal. Water and metal are both good conductors of electricity.
- Do not use land-line telephones or electrical appliances.



Inside a thunderstorm cloud, many tiny pieces of ice bump into each other. All that movement creates static electricity. After a while, the cloud fills up with electricity and releases it as a burst of **lightning**. Lightning can go from one cloud to another cloud. It can also go between the cloud and the ground.

Lightning makes thunder. Lightning heats the air around it. The hot air expands very quickly, which creates a strong wave of air. When the wave reaches your ears, you hear it as thunder.

The fiercest winter storm, a **blizzard**, has heavy snowfall and high winds. Blizzards can dump several feet of snow in a few hours. The wind that accompanies the storm whips around and piles the snow into huge snowdrifts. Heavy snow can collapse buildings, block roads, and bury cars and trucks. High winds can knock out electrical power.



Driving is extremely dangerous during a blizzard, especially on freeways, where traffic moves faster.

## Do You Know?

Weather scientists use wind direction and wind speed to predict the path of a hurricane. But hurricanes can change course at the last minute. So the National Weather Service issues a hurricane warning only 12 to 18 hours before it reaches land.



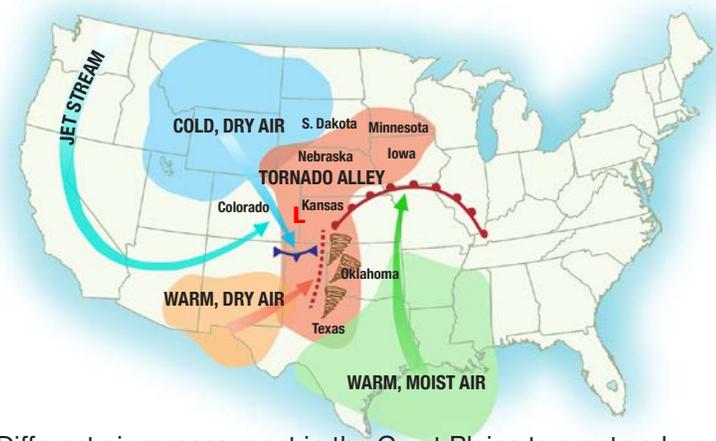
This shot of Hurricane Ivan (2004) was taken by a weather satellite.

During warm months, large masses of warm, moist air form over warmer parts of the oceans. They begin to swirl around when cooler air moves in to replace the rising warm air. When this happens, huge storms called **hurricanes** begin to form. As the spinning air continues to move over warm water, the hurricane gets stronger.

Hurricanes can cause terrible destruction from high winds and flooding. Hurricanes are measured by the strength of their winds and the amount of damage they cause.

**Tornadoes**, another type of extreme weather, have the strongest winds on Earth. Tornadoes form when air masses with extreme temperature differences collide. Warm, moist air rises very quickly when this happens. Then a strong current of cold air rushes in to replace the rising warm air. It moves in so fast that it begins to rotate. This rotating wind causes a funnel cloud to form.

Tornadoes rarely last more than one-half hour, but they can do great damage during that time. They can flatten buildings, pick up cars and trucks, and tear out trees by the roots. Like hurricanes, tornadoes are measured by the strength of their winds and the amount of damage they cause.



Different air masses meet in the Great Plains to create a large number of tornadoes. This region is nicknamed Tornado Alley.

## TORNADO SAFETY

Follow these safety tips during a tornado.

- Go to a basement, if possible. Otherwise, go to a closet or bathroom. Crouch down under a heavy piece of furniture or climb inside the bathtub. Cover your head with your arms.
- Cars and mobile homes can get lifted and moved by a tornado. You are safer outside. Lie down in a ditch or a depression in the ground.
- Stay away from doors and windows.



Tornadoes can form anywhere in the world where warm, moist air masses meet cold air masses. But most tornadoes occur in the United States.

Tornadoes are most common in the middle of the United States. Hot, dry air blows east from the Rocky Mountains. Warm, humid air moves north from the Gulf of Mexico. Cold, dry air blowing south from Canada bumps into these warm air masses. These conditions are perfect for the formation of tornadoes.

## Conclusion

Scientists know a great deal about how air masses move and mix together. They have many tools for studying wind, clouds, precipitation, and storms. They use these tools to predict the weather and try to keep people safe. But weather predictions are not always accurate. Nature is full of surprises! Still, we can all keep watching for clues and enjoy the many types of weather in our world.



anemometer

wind sock

satellite

### WEATHER INSTRUMENTS

These are some tools that help scientists predict the weather.

- Thermometers measure temperature.
- Anemometers measure wind speed.
- Weather vanes and wind socks measure wind direction.
- Barometers measure air pressure, which indicates fair or stormy weather.
- Radar detects precipitation.
- Airplanes take photographs of clouds.
- Satellites observe Earth's weather from space.

## Glossary

<b>atmosphere</b>	a layer of gases surrounding a planet, star, or moon (p. 4)
<b>blizzard</b>	a severe snowstorm with cold temperatures, high winds, and heavy snows (p. 18)
<b>clouds</b>	visible groups of water or ice particles in the atmosphere from which rain and other precipitation can fall (p. 4)
<b>condenses</b>	changes from a gaseous to a liquid state (p. 11)
<b>evaporate</b>	to change from a liquid to a gaseous state (p. 10)
<b>front</b>	the line where two air masses meet (p. 8)
<b>hurricanes</b>	strong, spinning rainstorms with high winds that start over an ocean (p. 19)
<b>lightning</b>	a flash in the sky made when electricity passes from one cloud to another or between a cloud and the ground (p. 17)

<b>moisture</b>	a small amount of water (p. 14)
<b>precipitation</b>	water that falls from clouds in the form of rain, snow, sleet, or hail (p. 4)
<b>thunderstorms</b>	storms with thunder, lightning, heavy precipitation, and sometimes hail (p. 16)
<b>tornadoes</b>	fast-spinning, funnel-shaped columns of air that touch Earth's surface (p. 20)
<b>water vapor</b>	the gaseous state of water (p. 9)
<b>wind</b>	moving air (p. 4)

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