



Weather Window Activity Kit



Watch step by step video assembly instructions. Scan to view.



www.nature-watch.com/clouds



To the Instructor: You will notice that this manual is written as if it were to be read by young learners. We have done this intentionally to provide specific language and examples that can be used in lessons taught by those unfamiliar with this topic. Feel free to use our language or simply pull out the facts and use your own.

Special Note! In this activity, participants will have the opportunity to look to the clouds and learn how to predict weather. It is critical that instructors tell participants that they must never look directly at the sun when using their Weather Window. Adult supervision is recommended for all of these activities.

AN INTRODUCTION TO WEATHER AND CLOUDS

Weather is the term that is used to describe the many different phenomena that can occur in Earth's **atmosphere** (the mixture of gases that surround the Earth). A **gas** is a substance that can expand in all directions, unlike a solid (a book or a car for example) that cannot change form. We call the mixture of gasses around earth "**air**," which is composed of oxygen, nitrogen, carbon dioxide, and water vapor (water in the form of gas, rather than liquid). And what do we call the portion of the atmosphere that we can see above us? The **sky**! The science of studying the atmosphere and its phenomena, particularly weather and weather forecasting, is called **meteorology** (me-tee-o-ROL-o-gee). Today, you'll get to become a meteorologist yourself!

So many different elements of the weather are affected by clouds—temperature, rain, snow, thunder, lightning, and more—which is why clouds are very useful tools in telling us about the weather. Water vapor in the air has the biggest effect on the weather we see since it is the reason that clouds form. Air can only hold a certain amount of water vapor until it becomes "saturated." Warm air can hold more water vapor than cold air. The amount of water vapor that air can hold is called **humidity**.

As saturated air (or very humid air) cools, some water vapor turns in to small water droplets (or ice crystals if the air is very cold). (This process is called condensation, which is the opposite of evaporation.) A **cloud** is a group of billions of water droplets or ice crystals. The temperature at which water vapor condenses into water droplets is called the **dew point**. The dew point is very high in warm climates like those areas near the equator and

much lower in cooler climates near the north and south poles. So, clouds form at different temperatures and under different conditions all over the world.

Different clouds bring different types of weather...

Temperature: You probably know that when the sun shines, the air gets warm and when there are lots of clouds blocking the sun, the air gets cooler. However, the opposite happens at night—a layer of clouds covering the sky acts as a blanket to keep the warm air inside the atmosphere. When there are no clouds in the night sky, the warm air escapes and temperatures around us drop.

Precipitation (pree-sip-i-TAY-shun) is the term for water that falls from the clouds. As water droplets move around inside clouds, they bump into each other and form bigger drops. After about one million droplets combine into one drop, that drop is too big to stay in the cloud any more so it will fall down to Earth.

- **Rain** is when liquid water falls.
- **Snow** is when frozen water in the form of ice crystals fall. Sometimes snowflakes grow larger as they bump into other snowflakes on the way down. If the air near the ground is warmer than it was inside the cloud, the snowflake can melt into a raindrop.
- If the temperature is colder near the ground than it was inside the cloud, a raindrop can freeze as it falls, causing an **ice storm** or **sleet**.
- During severe rainstorms caused by cumulonimbus clouds (you'll learn more about these soon), drops can freeze and

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INTRODUCTION TO WEATHER AND CLOUDS - CONT.

then be bounced around inside the cloud by updrafts (upward moving air) and downdrafts (downward moving air). As the frozen drop bounces around, it collects more frozen water and grows bigger. When it is too big for the updrafts to lift up anymore, it will fall to the ground as a **hailstone**. Some hailstones are small, while some can grow big like golf balls.

- Rain or snow may evaporate from liquid back into water vapor before hitting the ground. When this happens, streaks of **virga** clouds hang in the air.

Thunder and lighting are produced in cumulonimbus clouds (covered more thoroughly on the next page). Cumulonimbus clouds are very tall clouds that usually bring rain. The top of a cumulonimbus cloud has a positive electrical charge, while the bottom has a negative charge.

- Positive and negative electrical charges are attracted to each other, so as the charge between the top and bottom grows and grows, a **lightning** spark jumps between the two points. Most lighting occurs inside clouds, but if the surface of the earth has a positive charge, then the lightning may jump

from the bottom of the cloud to the ground.

- Lightning bolts are so hot (hotter than the sun!) that the heat they generate causes the air to explode. We hear the explosion as **thunder**. Since light travels faster than sound, you will always see lightning before you hear thunder.

Severe Weather

- **Tornadoes:** Sometimes the updrafts and downdrafts inside cumulonimbus clouds can start to rotate. When rapidly twisting winds and water droplets spin out from the bottom of a cloud, a tornado is formed. A tornado looks like a funnel and can uproot trees and destroy buildings if it touches the ground. A funnel that touches down on an ocean or lake is called a **waterspout**.
- **Hurricanes** (also known as typhoons or cyclones) occur when many cumulonimbus clouds form together and begin to spin. Hurricanes are fueled by moist, warm rising air, which is why they usually form over tropical waters and lose their strength over land. They can produce heavy rain, very strong winds, tornadoes, and high waves.

HOW TO MAKE YOUR WEATHER WINDOW

Materials:

- Weather Window frame
- Craft stick
- Scissors (you provide)
- Cloud artwork photos
- Glue
- Copies of the Cloud Naming section of the photos or the Cloud Key on the back of this manual

Instructions:

1. Carefully cut out cloud pictures from the two photos.
2. One at a time, glue the pictures on to the frame in the positions shown below. Notice that high clouds are at the top and low clouds are on the bottom.
3. If desired, copy, cut, and glue the "cloud key" from the back of this manual to the back of your frame. Or, you may use the "name" and "cloud naming" sections included with the photos on the back of the frame.
4. Glue the craft stick on the bottom of the back side of the frame.
5. Your Weather Window is ready to use!

How to use your Weather Window:

- Go outside and frame a cloud in the center of your Weather Window.
- Use the cloud pictures and your knowledge of different types of clouds and weather to determine what type of cloud you are looking at.
- Once you know what type of cloud you've identified, you can predict the weather it may bring.



TYPES OF CLOUDS



Cirrus (*abbreviation: Ci*)

Elevation: High (above 18,000 feet)

Name: "Cirrus" means wisp.

Appearance: Cirrus clouds are high clouds formed from ice crystals. They usually appear in thin, wispy strands.

Weather: Cirrus clouds usually indicate a change in weather—they may appear before a new "front" (the boundary between two air masses, often one is warm and the other is cold) passes through or after a thunderstorm.

Cirrostratus (*Cs*)

Elevation: High (above 18,000 feet)

Name: "Cirrus" means wisp and "stratus" means spread out.

Appearance: Cirrostratus clouds are seen when cirrus clouds spread out extensively across the sky, forming the appearance of a sheet of cirrus clouds. They often take on the appearance of a thin veil across the sky. They will sometimes cause the appearance of a halo around the sun.

Weather: The appearance of cirrostratus clouds indicates that precipitation will likely follow in the next 12 hours.

Cirrocumulus (*Cc*)

Elevation: High (above 18,000 feet)

Name: "Cirrus" means wisp and "cumulus" means heap or accumulation.

Appearance: Cirrocumulus clouds are formed when cirrus or cirrostratus clouds are warmed from below, which causes them to form fluffy-looking, billowy heaps like other clouds in the cumulus family. Cirrocumulus clouds usually appear as many little cloudlets across the sky.

Weather: Cirrocumulus clouds often indicate that precipitation will come or that a new front is coming through. They also make for excellent sunsets.

Alto cumulus (*Ac*)

Elevation: Medium (6,000 to 20,000 feet)

Name: "Alto" refers to mid-level clouds and "cumulus" means heap or accumulation.

Appearance: Alto cumulus clouds are white or gray billowy masses that appear in patches or groups. Each individual element of an alto cumulus group is larger than those of cirrocumulus yet smaller than those of stratocumulus.

Weather: Alto cumulus clouds may be seen before the arrival of cooler temperatures. Or, their appearance during a warm summer day can indicate that thunderstorms are coming.

Altostratus (*As*)

Elevation: Medium (6,000 to 20,000 feet)

Name: "Alto" refers to mid-level clouds and "stratus" means spread out.

Appearance: Altostratus clouds appear as a layer spread out across the middle of the sky. They are usually lighter in color than nimbostratus clouds and darker than cirrostratus.

Weather: Altostratus clouds signal a change in weather since they form when an incoming front causes an air mass to condense and rise. They can bring precipitation to wide-spread areas.

Cumulus (*Cu*)

Elevation: Low (below 6,000 feet)

Name: "Cumulus" means heap or accumulation.

Appearance: Cumulus clouds form when warm air rises off the ground, giving them their fluffy appearance.

Weather: Cumulus clouds are often called "fair weather clouds" since they form in fairly clear skies and indicate pleasant weather conditions.

Stratocumulus (*Sc*)

Elevation: Low (below 6,000 feet)

Name: "Stratus" means spread out and "cumulus" means heap or accumulation.

Appearance: Stratocumulus clouds are usually seen as large, rounded masses in dark groups or lines. The individual masses that compose stratocumulus clouds appear much larger than altocumulus clouds.

Weather: Stratocumulus clouds may bring drizzle, light rain or snow, but they are usually seen before or after more severe weather such as a storm or gusty winds.

Stratus (*St*)

Elevation: Low (below 6,000 feet)

Name: "Stratus" means spread out.

Appearance: Stratus clouds appear as horizontal layers that blanket the sky in a gray layer. Rather than appearing as many smaller clouds (like stratocumulus), stratus clouds are seen as one large sheet.

Weather: Stratus clouds do not usually bring precipitation, but if they form low enough, they become known as "fog" and can bring drizzle or mist.

Nimbostratus (*Ns*)

Elevation: Low (below 8,000 feet)

Name: "Nimbus" refers to rain and "stratus" means spread out.

Appearance: Nimbostratus clouds do not consistently take on one particular form. One thing that all nimbostratus clouds have in common is that they will be gray and spread out to completely block the sun.

Weather: Nimbostratus clouds usually bring precipitation.

Cumulonimbus (*Cb*)

Elevation: Vertical (Ground to 50,000 feet)

Name: "Cumulus" means heap or accumulation and "nimbus" refers to rain.

Appearance: Cumulonimbus clouds are usually tall and dense, and may form from smaller cumulus clouds. They appear flat on the bottom, with fluffy cumulus-looking sides, and flat "anvil" tops caused by winds in the upper atmosphere that essentially cut off the top of the cloud. Cumulonimbus clouds grow vertically because of updrafts inside them.

Weather: Cumulonimbus clouds usually appear along front lines and almost always bring precipitation. Because vertical winds cause the cloud to grow vertically and gravity causes water droplets to fall down, there is a lot of motion inside a cumulonimbus cloud, which leads to violent storms as well as static charges associated with lightning and thunder.

CLOUD KEY



Keep this page as a reference or cut out the key below and glue it on to the back of your weather window. To cut to size, simply cut on the dotted lines.

<p><u>Cirrocumulus</u> <i>Appearance:</i> High clouds, many fluffy cloudlets across the sky <i>Weather:</i> Precipitation may come</p>	<p><u>Cirrus</u> <i>Appearance:</i> High clouds, thin, wispy strands <i>Weather:</i> Arrival of a new front, change in weather conditions</p>	<p><u>Cirrostratus</u> <i>Appearance:</i> High clouds, a sheet of wispy clouds across the sky <i>Weather:</i> Precipitation within 12 hours</p>	<p>Weather Window made by:</p> <p>© 2018 Nature-Watch (800) 228-5816 www.nature-watch.com</p>	
<p><u>Alto cumulus</u> <i>Appearance:</i> Mid-level clouds, groups of white or gray billowy masses <i>Weather:</i> Arrival of cooler temperatures; could indicate rain during the summer</p>				
<p><u>Altostratus</u> <i>Appearance:</i> Mid-level clouds, sheet of gray clouds spread across the sky <i>Weather:</i> Arrival of a new front, change in weather conditions</p>			<p><u>Cumulonimbus</u> <i>Appearance:</i> Vertical clouds, tall and dense with a flat bottom and fluffy sides <i>Weather:</i> Almost always bring precipitation, they appear along front lines so they usually signal a change in the weather, can bring thunder and lightning</p>	
<p><u>Cumulus</u> <i>Appearance:</i> Low clouds, fluffy heaps <i>Weather:</i> "Fair weather" clouds bring clear skies</p>	<p><u>Stratocumulus</u> <i>Appearance:</i> Low clouds, large rounded masses in groups/lines <i>Weather:</i> Light rain before severe weather</p>	<p><u>Stratus</u> <i>(Glue bottom center of frame)</i> <i>Appearance:</i> Low clouds, gray layer blanketing sky <i>Weather:</i> No rain, fog if formed near ground</p>		<p><u>Nimbostratus</u> <i>Appearance:</i> Low clouds, gray clouds that block the sun <i>Weather:</i> Will bring precipitation</p>

WEATHER ACTIVITIES

- Lightning and Thunder.** Next time you're in a thunderstorm, see how far away you are from the center of the storm. When you see lightning, begin counting. The sound of thunder takes about five seconds to travel one mile. So, if it takes 30 seconds between when you see lightning and when you hear the thunder, you'll know that the storm is about six miles away (30 seconds / 5 seconds per mile = 6 miles).
- Make a cloud!** You'll need a jar, some hot water, a small strainer, some ice cubes and an adult's help. Pour one inch of water in the jar and close the lid. (Be sure your hot water is not too hot or it can crack the glass jar.) Soon the air in the jar will contain lots of water vapor because the hot water will begin to evaporate. Take the lid off and rest the strainer on the mouth of the jar. Fill the strainer with ice cubes—they'll cause the temperature in the jar to drop. As the air in the jar cools, it will become more saturated as the water vapor condenses into droplets. A miniature cloud will form inside the jar.
- Keep a cloud journal.** What types of clouds are most common in your area? Keep a journal with the type of clouds you see each day and the type of weather they bring. Is there a pattern?