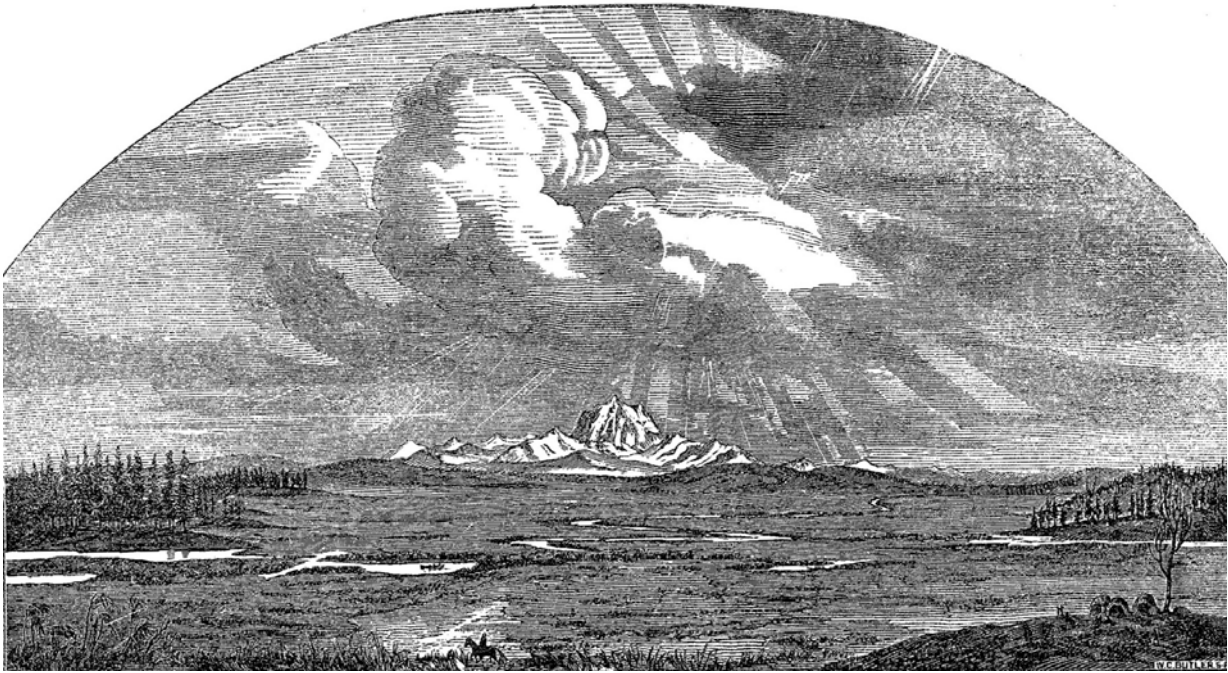


Weather and Climate



*"A sky without clouds is a meadow without flowers, a sea without sails."
—Henry David Thoreau*

Introduction

We talk about the weather every day. "How about this weather?" "Hot enough for you?" "Can you believe this rain?" We listen to weather forecasts to determine what we will and won't wear and do. Hurricanes, tornadoes, blizzards, droughts, and floods can wreak havoc on our lives and environment. No wonder we're so interested in the weather!

But what causes the weather? Why does it rain, and what is fog? What happens when people get too hot or too cold? These are questions you can answer in a weather and climate program. Most children don't realize that we affect the weather. In the conclusion of your program, you can show how deforestation, global warming, and the thinning ozone layer affect the weather around the world, while focusing on what we can do to keep the weather systems intact.

Interesting Weather Facts

- Insects fly low to the ground before a rainstorm because their wings are heavier than normal with dampness from increased humidity.
- The reason it smells different right before a rainstorm is because there is less air pressure around us. It presses less heavily on the ground. Smells have a chance to rise higher. What you smell is grass, flowers, and decaying vegetation.
- Spiders live on the snow and ice of Mount Everest, the highest mountain in the world. They were blown there by the wind. What do they eat? Live insects also blown there!
- An average thundercloud holds about six trillion raindrops.
- Mighty winds pick up dusty soil from the Sahara Desert in Africa and blow it all the way across the Atlantic Ocean. The soil drops as far away as Florida, the Caribbean, and the Amazon rainforest, and may help fertilize the soil there!
- There are approximately 2000 thunderstorms raging around the world every second of the day.
- In 1937, a tornado lifted a train engine, turned it around, and set it back down on nearby tracks, facing in the other direction!
- Swirling winds can pick up animals and drop them far from home. Cities in California have been showered with crabs, shrimp, and salamanders!
- Racetrack Playa is a place in California where the racing contestants are rocks! Wind makes rocks slide along the smooth surface of a desert "dry lake" bed when the ground is wet or frozen!



Sample Program: Weather and Climate

I. Introduction

Introduce yourself to the group.
Introduce the Junior Ranger Program.

II. Focus

Ask the Junior Rangers to look at what they are wearing and what the other kids are wearing. Why did they choose to wear that outfit today? (Keep asking for responses until someone says, "because of the weather.")

III. Objectives

Today we are going to discuss weather. Weather includes everything from a breeze to a tornado, from a raindrop to a thunderstorm. By the end of this program, you will have learned just how much everything on earth is affected by the weather, and how some kinds of weather phenomena occur.

IV. Inquiry/Discussion

A. Weather and Safety

Junior Ranger Program Handbook: Weather and Climate

1. We have to pay attention to weather. If animals, including humans, get too cold or too hot, they can get very sick and some can even die.
2. What is it called when people become too cold, either from being exposed to cold water or weather for long periods of time or from not wearing appropriate clothing in cold or windy weather?
Hypothermia (hypo = low, thermia = temperature)
3. How does your body try to keep itself from getting too cold?
Your muscles move to create heat (shivering).
4. If people exercise too much or hike without drinking enough water they can overheat and get heat exhaustion, heat cramps, or heat stroke. What is this condition called?
Hyperthermia (hyper = high, thermia = temperature).
5. How does your body try to keep cool?
You perspire (sweat).
6. Let's say you look out in the morning before your hike, and it is sunny and warm, but the weatherman says it is going to rain. What should you do?
 - a. Bring several layers of clothing (T-shirt, sweatshirt, windbreaker.)
Bring a hat, sunscreen, and plenty of water to drink. If it stays warm, you can tie the extra clothing around your waist. If it rains, you will still be comfortable and warm.
7. How do most animals keep cool?
 - a. They pant, shed their coats, reduce their activity, or hide in the shade/shelter.

B. Nature's Temperature Regulation

As sunlight is not distributed evenly on the earth, the temperature in other places may not be the same as it is here right now. Differences in pressure and temperature cause air masses to circulate.

1. What is this movement of air called?
Wind
2. Do you feel air moving right now?
3. Where is the air going?
4. How fast is it moving?
5. Have the children close their eyes and "feel" the wind. Have them listen to the grass or trees to find out where the wind is coming from.
6. Compare their "gut" responses to real observations based on the "Determination of Wind Speed" chart in Appendix B.

C. Clouds

1. Name some types of weather that you can see.
Sunshine, wind (blowing things), clouds, fog, snow, rain, sleet, hail
2. Are there any clouds in the sky?
3. What are clouds made of?
Clusters of minute droplets of water or ice crystals
4. Form a circle with the children lying on their backs, heads to the center (without heads touching).
5. What types of clouds are there today?
6. Clouds are forms of condensation. How does condensation occur?

7. If all clouds contain water, why don't all clouds rain?
(Have the group sit back up, but remain in the circle)
 8. What is a type of cloud with its base at or near the ground?
Fog
Fog and clouds are made of the same stuff—fog is just closer to the ground.
- D. Lightning
1. The shock you get on a rainy day when you touch a metal object is very close to what lightning is—only at a different intensity.
 2. Can you remember what type of cloud would create a thunderstorm?
Cumulonimbus
 3. Let's make our own thunderstorm!
Activity: The Rain Circle Game (see activity section below)
- E. Climate
1. What is climate?
Generalized weather patterns
 2. Name a place that has a dry climate.
Africa, Australia, the desert, Texas, New Mexico
 3. Name a place that has a wet climate.
Hawaii, tropical rainforest
 4. Within the overall climate there are also smaller climates.
Activity: The 100-Inch Microclimate (see activity section below)
- V. Application/Conclusion
- A. Discuss the importance of weather in our lives.
Droughts, floods, etc.
 - B. Do people affect the weather?
Yes: deforestation, greenhouse effect, ozone depletion (see Ecology Information.)
 - C. What can we do about it?
 - D. Announce time and topic of the next Junior Ranger program.
 - E. Stamp logbooks.

Activities

The 100-Inch Microclimate

Number of Children: One or more

Environment: Large natural area

Equipment needed: None

Purpose of Activity: To understand the variety of climates and which animals and plants are adapted for climate

Activity:

1. Give each student approximately 100 square inches of area to investigate. Try to give each person a different climate (e.g. in the moist shade, by a stream, under a tree, on the trail, etc.).
2. Have the Junior Rangers sit for a minute and feel the way the sun hits them. Is there wind? Is it warm or cool? Have them look for plants and animals. What do they look like? Do the plants look like they want more or less sun (look at leaf structure). Have the children touch the soil. Is it moist? Is the soil warm or cool? Then gather in a circle and discuss the climate types you all have found.

Adapted from "Tom Thumb's Jungle." Green Box. Office of Environmental Education, Humboldt County Schools, Eureka, CA.

Rain Circle

Number of Children: Three or more

Environment: Anywhere

Equipment needed: None

Purpose of Activity: To investigate the sounds of a rainstorm

Activity:

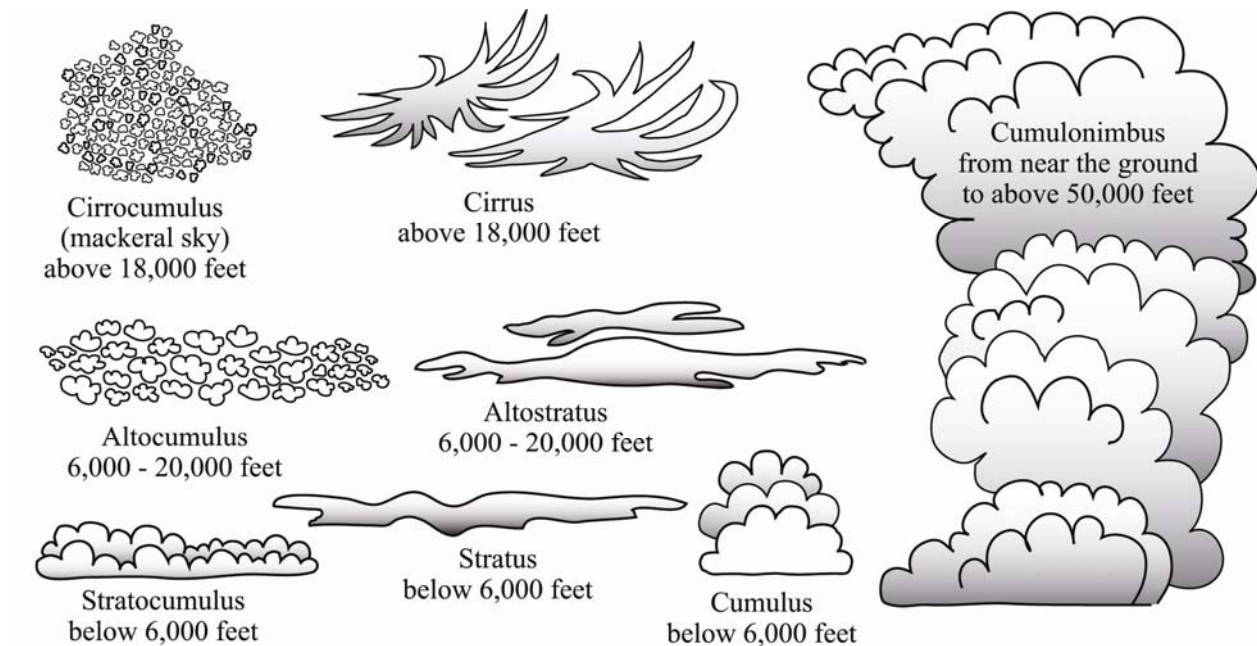
1. While the children are sitting in a circle facing the center, ask them to close their eyes, pausing for a moment or two of quiet while each child gets ready to repeat the sound the person on his or her right will be making.
2. With all eyes closed, the leader begins the rainstorm by rubbing her palms together, back and forth. The person to her left joins in and then the person to his left, and then the next person, and so on around the circle until everyone is rubbing palms and can hear the drizzling rain building in intensity.
3. When the leader hears the drizzle sound being made by the person on her right, she starts snapping her fingers. One by one around the circle, finger snapping replaces palm rubbing and the sprinkling rain turns into a steady patter. When the snapping action has been picked up by everyone, the leader switches to hand clapping, and all follow in turn. A hard rain is falling now.
4. The storm builds into a downpour as the leader begins slapping her thighs. Then the skies open and thunder crashes as the next round has everyone stomping their feet.
5. And then the storm subsides, just as it grew - foot stomping, thigh slapping, hand clapping, finger snapping, and back to palm rubbing. (If someone is having trouble hearing the changes, his neighbor can alert him with a gentle nudge each time he switches from one action to the next.)
6. For the last round, the leader stops rubbing her palms and takes the hand of the person on her left, as each person does in turn around the circle until there's silence once again. When everyone opens his eyes, perhaps the sun will have appeared.

From The New Games Book. New Games Foundation. The Headlands press Inc., 1976.

Background Information: Weather and Climate

Clouds

Clouds are forms of condensation best described as clusters of minute droplets of water or ice crystals. They are identified and grouped according to three basic classifications: their form and appearance, their composition, and their height above the surface.



Despite their seemingly endless shapes, clouds can come under two very broad classifications with regard to appearance or form. They are either stratus type (stratiform) or cumulus type (cumuliform). The stratus cloud is sheetlike, fibrous, layer-like. Think of the word "straight," and visualize layers or sheets. Cumulus is a type of cloud that has piled up, or accumulated in appearance. It has a rolled, cottony, or cauliflower appearance.

There are three heights of clouds in the atmosphere: high, middle, and low. The high clouds include cirrus, cirrocumulus, and cirrostratus. Cirrus clouds are often isolated, detached, fibrous filaments of cloud. They are generally delicate, thin, and wispy in appearance, sometimes in feathery plume shapes or tufted streaks. They produce no precipitation.

Cirrocumulus clouds are usually arranged in small ripples, layers, patches, or tiny-appearing globular forms without shading. They produce no precipitation.

Cirrostratus clouds are veil-like, fibrous sheets of cloud, often with a shredded appearance. They usually cover large portions of the sky.

Middle clouds include altocumulus and altostratus. They are usually composed of water droplets, though sometimes upper portions contain ice crystals. Altocumulus clouds may appear as small, isolated, globular patches, parallel bands, or in flattened, slightly rolled masses. Altocumulus clouds sometimes produce light rain or snow. Altostratus clouds appear fibrous, and shredded. They are generally grey in color and can produce fairly steady light rain or snow.

The low clouds include nimbostratus, cumulus, stratocumulus, and stratus. Nimbostratus clouds are low, thick, dark grey masses of clouds, often threatening in appearance. Their bases are usually ragged and wet looking. This cloud produces steady rain or snow.

Stratus clouds often resemble a light fog lifted a few hundred feet off of the ground. Stratus clouds are not very thick and usually dissipate quickly under the sun's heat.

Cumulus clouds, also known as fair weather clouds, are usually flat on the bottom with rounded, cauliflower-like tops. These low puffy clouds are often seen in the late morning or early afternoon.

Cumulonimbus clouds are hugely developed vertically and have a dark, menacing appearance. They are often called thunderheads and generally produce heavy showers of rain and snow, sometimes hail, and frequent thunderstorm activity.

Condensation

Warm air can hold more water than cold air. If air cools to a certain temperature (called the dew point), then water is forced out of the air. In order to condense, each water droplet needs a bit of dust, smoke, or salt to hold on to. It takes about one million of these droplets to form one raindrop. The little droplets stay in the air until enough of them clump together to form a raindrop.

There are two ways these rain droplets bind together:

1. If the cloud is below the freezing temperature, the droplets can freeze together until they are heavy enough to fall out of the cloud. On their way to the earth's surface, the ice may melt and become a raindrop; or,
2. Droplets in the cloud can bump into each other and combine. After they've bumped into enough other droplets to form a raindrop, they will fall from the cloud as rain.

Fog

Fog is defined as a cloud with its base at or near the surface of the earth. Physically, there is no difference between a cloud and fog. Fog can be formed in several ways:

- Under clear skies, rapid cooling of the ground and air at night can cause water vapor to condense into fog. This is radiation, or tule (winter), fog. In the morning, when it gets warm enough to evaporate the water droplets, the fog disappears.
- When warm, moist air blows over a colder surface, it becomes chilled and the moisture/vapor in the air condenses. Moist marine air passing over cold coastal waters gives rise to the persistent fog bank found along the seashore in summer.
- Fog can also be formed when humid air rises up a gradually sloping hill or mountain.
- When cool air moves over warm water, enough water may evaporate from the water surface to produce saturation. As the rising water vapor meets the cold air, it immediately recondenses and rises with the air being warmed from below. Often it has a steaming appearance and is called steam fog. This type of fog is sometimes seen on lake surfaces on chilly mornings.

Lightning

Lightning is caused by the attraction of unlike electrical charges within a thundercloud, or between the cloud and the earth. The earth normally has a negative charge (a surplus of electrons as compared to the atmosphere.) The lower part of the cloud has positive zones surrounded by negative zones. When electrical pressure becomes high enough, charges between parts of cloud or between cloud and Earth are released by lightning. Sixty-five percent of all discharges are within the cloud or between clouds. A single lightning discharge is incredibly powerful—up to 30 million volts. The sudden tremendous heat from lightning causes the compression or shock waves we call thunder.

Lightning Safety

Lightning tends to hit the highest places. Never stand under a lone tree in an open field or fix your television antenna during a lightning storm. Stay away from boats and water during storms. You will always be safe inside your car or a steel-framed building. Airplanes have often been struck by lightning, but occupants are seldom harmed. If you are in a safe place, remain there for 30 minutes after the last observed thunder or lightning.

Wind

Air flows from areas of high pressure to areas of low pressure. You have experienced this when you open a vacuum-packed can of coffee or tennis balls. The sucking sound you hear is caused by air rushing from the higher pressure outside to the lower pressure inside the can. So wind comes from pressure differences. The greater the pressure difference, the stronger the wind.

Our coastal winds are largely a result of the global circulation pattern (prevailing westerlies).

Suggested Resources: Weather and Climate

Anderson, Bette R. *Weather in the West*. Palo Alto, CA: American West Publishing Co., 1975. This book explores Western American weather—its curious, distinctive aspects, its shaping of major climatic regimes, and its influence on human life and history.

Bailey, Harry P. *Weather of Southern California*. California Natural History Guides: 17. Berkeley: University of California Press, 1966. This little book does a nice job of introducing readers to the many fascinations of Southern California's climate.

Greenler, Robert. *Rainbows, Halos, and Glories*. Cambridge, NY: Cambridge University Press, 1980. This book explains the physical origins of the many optical effects found in the sky and advises how to look for them.

Keen, Richard A. *Skywatch West: The Complete Weather Guide*. Golden, CO: Fulcrum, Inc., 2004. This source covers much of the same material as Anderson's *Weather in the West* (cited above), but is more current.

Lehr, Paul E., R. Will Burnett, and Herbert S. Zim. *Weather*. New York: Golden Press, 1975. This pocket-sized "Golden Guide" provides a basic overview of meteorological science. Contains many colorful and useful illustrations.

Williams, Jack. *The Weather Book: an Easy-to-Understand Guide to the USA's Weather*. New York: Vintage Books, 1992. An outstanding introduction to meteorology, this book contains many colorful diagrams, maps, and other graphics.

Other Sources of Information

National Oceanic and Atmospheric Administration. "National Weather Service." www.nws.noaa.gov.

National Aeronautics and Space Administration. "Earth Observatory."
earthobservatory.nasa.gov.

INSERT *DIRECTED ACTIVITIES* TAB HERE

