The World of Weather Folklore

Weather is something that humans have always strived to understand, predict, and even control. Before they understood how to use science to study the world, people invented gods and spirits and stories to explain the rhythms and events of nature. Let us respectfully remember some of these stories and realize how far science has taken us in truly appreciating our world.

You can find the approximate location of the country or continent where each story originated using the coordinates in parentheses, which refer to the world map on Panel 5.

Lightning Folklore

Africa (M-P, 4-7)—People hit by lightning were thought by many ancient Africans to have incurred the anger of the gods. Lightning bolts were considered bolts of justice.

Nigeria (N, 5)—The Yorubas are said to have believed that lightning was a storm spirit who carried powerful magic. That spirit scolded them with fiery bolts of light shot from his mouth. He was believed to punish people for their wrongdoings by destroying things on the ground or by hitting someone with his bolts of light.

England (M, 2)—St. Elmo was the patron saint of sailors. English sailors in the nineteenth century called the apparent lightning they saw in the rigging of the ship "the body of the saint." It was considered a good omen by mariners.

Sweden (O, 2)—Lightning, as well as thunder, was part of the legend of Thor, the god of thunder in long-ago Sweden. Children were told that lightning is only sparks from Thor's hammer as they fly through the air, and the thunder was Thor riding his chariot across the sky.

Multiple cloud-to-ground and cloud-to-cloud lightning strokes during a thunderstorm. Photo by C. Clark. Credit: NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory

Lightning Science

Lightning bolts between cloud and ground ("bolts of justice" in African lore) start with electrons (negatively charged particles) zig-zagging downward from the cloud, drawing a streamer of positively charged ions up from the ground. When they meet, an intense wave of positive charge travels upward at about 96,000 kilometers (about 60,000 miles) per second! This process may repeat several times in less than half a second, making the lightning seem to flicker. Lightning also produces more ozone in the atmosphere and provides the "fresh and clean" smell sometimes noticed after a thunderstorm.

Some unusual forms of lightning are bead lightning, ball lightning, and St. Elmo's Fire. Bead lightning is composed of a string of luminous balls similar to a chain of beads. Ball lightning is a rare form that measures from one-half inch to six feet in diameter and is white, red, yellow, or blue. St. Elmo's Fire, named for the patron saint of sailors, is a static glow or visible electrical discharge from a pointed object, like the mast of a ship or the wing of an airplane during an electrical storm.

Thunder Folklore

Kenya (P, 5)—The god of thunder, Mkunga Mburu, is believed by some to travel the heavens on a huge black bull with a spear in each hand, ready to hurl them at the clouds to make the loud noises.

Europe (M-P, 2-3)—In medieval times, many people believed that thunderstorms were evil spirits. Church bells were rung so the sound would chase away the evil thunder. Often people used a variety of rituals to save themselves during thunderstorms. They would hide scissors, cover every mirror, lie down on feather beds, and stay away from wet dogs and horses.

Thunder Science

Thunderstorms start in cumulonimbus clouds, called thunderheads. Warm, humid air rises from the ground. As it cools in the atmosphere, it condenses into water droplets, forming a cloud. When the droplets or ice crystals (if cold enough) grow big enough, they fall, dragging down the air, forming downdrafts. Updrafts and downdrafts in the cloud make for a very violent storm, spawning lightning. The noise of thunder is caused by cooling, contracting air masses slamming together after being instantly heated to searing temperatures along a lightning stroke.

Rain Folklore

India (S, 4)—In ancient India, it was said that a dragon stood guard over the clouds to hoard the rain and prevent it from falling to Earth, causing dry

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spells. The people cheered for the storm god to lure the dragon away from the cloud, allowing rain to fall.

Peru (H, 6)—Native people in Peru once believed that the rainfall during the growing season of October to May can be predicted from the brightness of stars in the Pleiades constellation in June. The brighter the stars, the more abundant the rains.

England (M, 2)—People in early England recited charms to make the rain stop. "Raine, raine, goe to Spain; faire weather come againe." You may have chanted another version of this charm: "Rain, rain, go away; come again another day." Such charms were thought to be more powerful if recited while staring at a rainbow.

Rain Science

Water recycles from Earth's surface to the atmosphere and back again in a process called the hydrologic cycle, or water cycle. Water gets from Earth's surface into the air through the processes of evaporation (transferred from rivers, lakes, and oceans) or transpiration (transferred from plants). And it gets back to Earth by the process of precipitation. Water vapor in the air rises and cools, condenses into water droplets, and collects to form clouds. Rain develops when cloud droplets become too heavy to stay in the cloud and fall to Earth. The total amount of water on Earth doesn't change, so we need to take good care of it!

A rainbow is a fairly accurate sign that rain is ending, because it appears when the sun starts to shine through the clouds. That may explain why people believed that the charm worked when you stared at the colorful arches in the sky.

Rainbow Folklore

Southeast Africa (P, 7)—Many of the ancient Zulus thought of rainbows as snakes that drank from pools of water on the ground. According to legend, a rainbow would inhabit whatever pool it was drinking from and devour anyone who happened to be bathing there.

Turbulent clouds in Norman, Oklahoma. Credit: NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory

Burma (T, 4)—One sect, the Karens, once considered rainbows to be dangerous demonic spirits that devoured the souls of humans and caused sudden or violent deaths. They thought that such activity made the rainbow thirsty enough to appear in the sky and dip down to Earth to drink water.

Polynesia (C, 7)—There was a belief among ancient Polynesians that a rainbow was a ladder that their heroes climbed to reach heaven.

Greece (O, 3)—The folklore of ancient Greece taught that Iris, wife of the god Zephyrus, caused rainbows. Iris was a messenger between mortals and the gods. She ran back and forth, dressed in shimmering multicolored robes. The word "iridescence" comes from Iris's robes.

North Carolina USA (H, 3)—An old proverb says that a house that is overarched by a rainbow will soon experience a disaster or if you walk through the end of the rainbow, your family will experience a disaster within a year.

Rainbow Science

Rainbows are byproducts of rain. Raindrops act as tiny prisms when lit by the Sun, bending light and separating it into its different colors. A rainbow's arch, made up of long colorful streamers, appears to dip down from the sky to meet Earth's surface. To see a rainbow, you must be standing with the Sun behind you, looking at rain falling in another part of the sky. A rainbow may mean the rain is nearly over, since the Sun must be peeping through the clouds to make the rainbow appear. Made up of long, colorful streamers, a rainbow may look similar to Iris's robes, as in the Greek myth.

Snow and Cold Weather Folklore

Japan (X, 3)—In ancient times, it was believed that a spirit called Snow Woman caused men traveling in snowstorms to sleep, ultimately causing their deaths.

Finland (N, 2)—In the lore of ancient Finland, Snow is an ancient king who has three daughters: Thin Snow, Thick Snow, and Snow Storm.

Germany (N, 3) —It was commonly believed in old times that Old Mother Frost caused snow by shaking the feathers from her bed. These feathers would then fall to Earth as snow.

Snow and Cold Weather Science

In northern Finland, the average yearly precipitation is only 600 millimeters (about 23.5 inches), half of it rain and half of it snow. Snow forms in clouds with temperatures below freezing. A tiny droplet of water freezes into a six-sided ice crystal. Then as more water vapor condenses onto it, it begins to grow six branches with arms. When the crystals get large and heavy enough, they fall. Sometimes they begin to melt as they fall through warmer air, and the water acts like glue, holding the crystals together in large clumps. Perhaps similar to a pile of feathers from the bed of Old Mother Frost, fresh, uncompacted snow typically is 90-95 percent trapped air.

Rather than meeting up with Snow Woman, people who are exposed to very cold conditions can develop hypothermia, with their body temperature dropping several degrees below normal. They often

lose their ability to think clearly and may remove clothing, get sleepy, and lie down in the snow to rest, never to wake up.

Frost Folklore

Australia (V-X, 6-7)—An aboriginal myth says that frost comes from the seven stars of the Pleiades, also called the Seven Sisters. The sisters once lived on Earth but were so cold they sparkled with icicles. They flew up into the sky and once each year they pull off their icicles and hurl them down to Earth.

Norway (N, 2)—Josti, son of Kari, the fierce god of the winds, blew frost on the Earth when he was angry.

Russia (P-Z, 1-3)—The Mordvins set out bowls of porridge for the Frost Man so their crops would be protected.

Nevada USA (E, 3)—In the language of the Shoshone Indians, the word for rime frost "pogonip," meant "white death."

Frost Science

Frost is an accumulation of ice crystals on cold surfaces. When the air cools at night, water vapor condenses out of the air, coating surfaces with water. The temperature at which this happens is called the dew point. If the temperature drops below freezing (32º F or 0º C), this condensed water freezes, making frost. If the dew point is below freezing, water vapor in the air may change directly to ice without going through the liquid state first.

Rime frost forms when fog or low clouds that are heavy with very cooled droplets of water come in contact with an object and freeze there. As the wind blows, the rime frost builds up, sometimes into needlelike formations that may stick straight out. The stronger the wind and larger the supercooled droplets, the larger the rime formations. Some rime formations more than three feet long have been recorded on high mountain tops.

Wind Folklore

Ethiopia (Q, 5)—Many tribesmen believed evil spirits dwelt in whirlwinds, so they would chase the wind with knives.

Europe (M-P, 2-3)—Magicians of Northern Europe are said to have captured the winds in bags and tied them with ropes. They attempt to control the winds by the tightness of the ropes, the number of knots, and the way the bag was tied. With this power, a magician could cause great destructive winds or he could take the winds away.

Greece (O, 3)—The folklore of ancient Greece taught that the god Aeolus caused the wind. Aeolus kept the wind locked in an enormous whistling cavern. When he played his harp, a gentle breeze ruffled the trees. When he blew his conch shell, great storms devastated the land and whipped up the ocean waves.

Canada (C-I, 2-3)—Long ago, people told of a wind eagle that lived on a bald mountain top. The wind eagle caused the wind by flapping its wings. The harder its wings flap, the stronger and more abundant the wind. If there was too much wind, Gluskabi, a powerful being in Abenaki Indian lore, climbed to the top of the mountain and tied the wings of the wind eagle to its body. When the weather was too hot because there was no wind, Gluskabi again climbed the mountain to cut the eagle's bonds.

Caribbean (H, 4)—In this region, a hurricane was considered an evil spirit, or the god of all evil, who would send terrifying winds to punish people when he was angered.

Wind Science

The wind is caused by a complex collection of forces. Warming and cooling of the air causes changes in density, or pressure. Air tends to move from areas of high pressure to areas of low pressure. Even very small differences in pressure from one area to another can cause very strong winds. Friction from obstacles such as trees, mountains, and buildings affects wind, slowing it down, or creating updrafts, bottlenecks, and so on. Also, Earth's rotation creates what is called the Coriolis effect, causing winds north of the equator to tend to curve to the right and winds south of the equator to curve to the left.

Wind-driven waves threaten to inundate homes in Miami, Florida, in September 1945. Photo taken by the American Red Cross.

Hurricanes (also called cyclones or typhoons) usually start over warm, tropical oceans. Thunderstorms rise high into the air, causing the atmospheric pressure to drop. As trade winds in the area begin spiraling, warm moist winds in the center are drawn upward by low pressure. If the spiraling wind reaches 74 miles per hour, the storm is called a hurricane. The GOES environmental satellites see hurricanes developing and help weather forecasters make very accurate predictions and warnings about their strength and direction and speed.

Cloud Folklore

Nebraska USA (F, 3)—According to Skidi Pawnee Indian lore, clouds are clothing for the gods of heaven. The sky god wears a cloud garment. When he spreads his arms, the clouds, or "garments," stretch across the entire sky.

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New Mexico USA (F, 4)—Tradition among the Zuni Indians tells of a monster called Cloud Eater. He was as tall as a mountain peak and had an enormous appetite for clouds, thus causing drought. Down through the years the Zuni Indians have hunted for this monster far and wide to destroy him and bring rain, but no one discovered where Cloud Eater lived.

Towering cumulonimbus cloud with anvil top. Photo by Herbert Campbell. Credit: NOAA Central Library/National Weather Service

Cloud Science

Clouds are named by how they look and how high or how low they appear in our atmosphere. The sky god of the Skidi Pawnee Indians was probably "wearing" stratus or stratocumulus clouds since these clouds are generally layered or broad and flat, taking up much of the sky. Some other cloud names are cumulonimbus, cirrostratus, cirrus, cirrocumulus, altostratus, altocumulus, and cumulus.

The GOES environmental satellites, from their geostationary orbits above the equator, maintain constant watch over the clouds, how much moisture they contain, where they are heading, and how fast.

Sun Folklore

Egypt (P, 4)—Ancient Egyptians, boating on the Nile, believed that the Sun sailed across the sky in a shallow boat.

Polynesia (C, 7)—According to Polynesian folklore, the Sun used to race across the sky each day, giving barely any light. People didn't have much time to finish their chores before darkness came. The half-god, half-man Maui became annoyed and snared the Sun in an enormous net made from braided coconut fiber. He threatened to cut off the Sun's legs if it refused to slow down. Being terrified, the Sun agreed and to this day has kept its promise to move slowly across the sky.

North Carolina USA (H, 3)—The ancestors of modern Cherokee Indians believed that spiders spun their webs in the shape of a circular, rayed sun because Grandmother Spider stole a piece of the Sun from a greedy band of people hoarding the Sun's light on the other side of the world.

Sun Science

Our Sun is an ordinary star, a gigantic ball of burning gas so hot that atoms are being fused together to make new elements.

While the Sun may seem to be sailing across the sky, it is we who are moving on Earth's surface as Earth rotates on its axis and orbits the Sun. One rotation takes 23 hours 56 minutes, or one day, and one orbit takes 365.26 days, or one calendar year.

The Earth's rotation creates almost equal periods of light and darkness. The Sun shines on the side of Earth that is turned towards it, causing day time. At the same time, the side of Earth that is turned away from the Sun is in darkness.

Moon Folklore

China (S-V, 3-4)—Round buns filled with spicy bean paste, called "mooncakes," are eaten in celebration of the moon's birthday, on the eighth day of the eighth month of the Chinese calendar.

India (S, 4)—People in long-ago India saw a silhouette of a hare on the moon. According to tradition, it got there when Indra, the all-knowing god of the sky, overheard a rabbit declare that he would sacrifice himself so a beggar could eat. Declaring that such selflessness would not go unrewarded, Indra etched the outline of a rabbit, also called a "hare," on the moon.

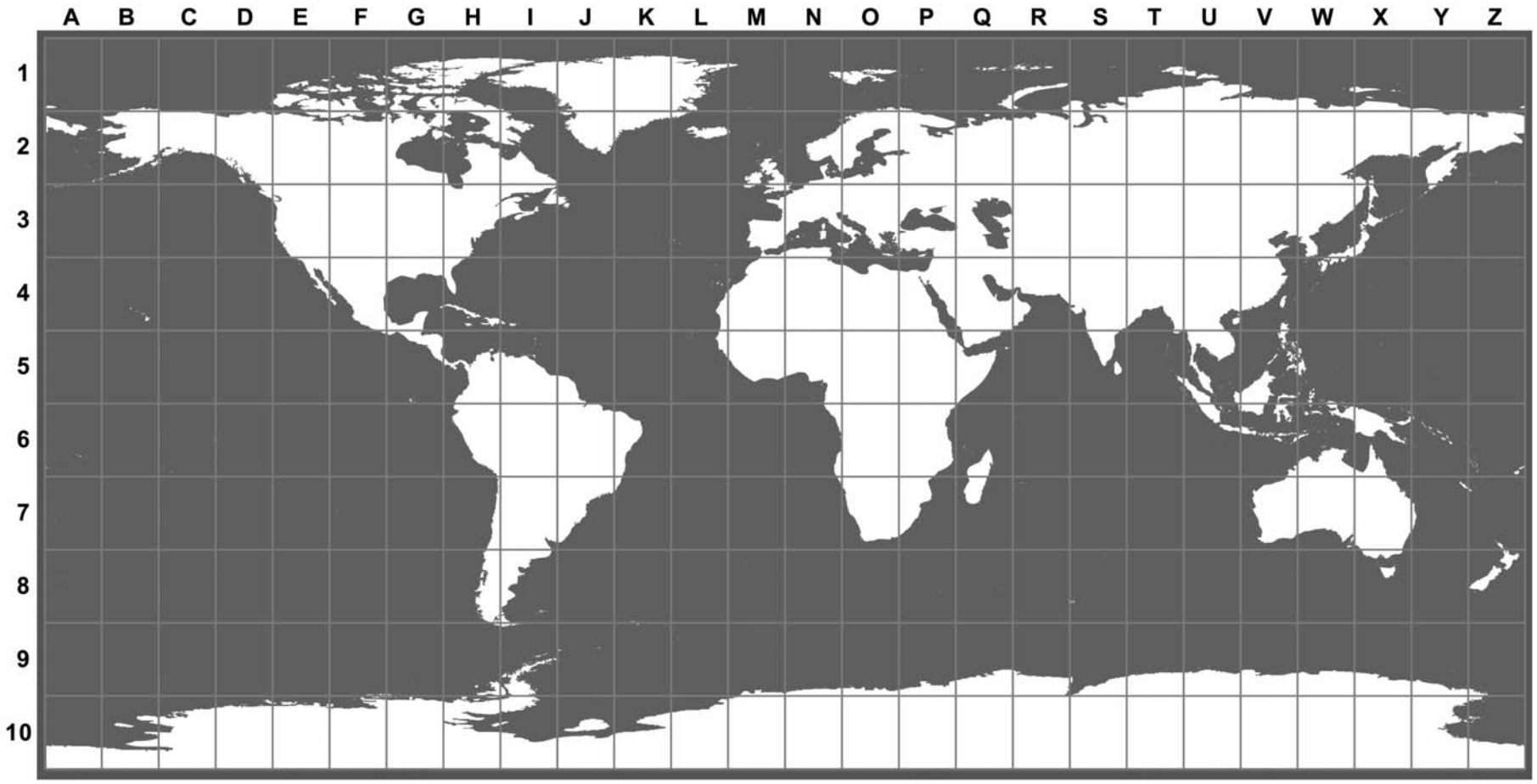
Turkey (P, 3)—In olden days, some Turkish people tried to capture the moon when it "fell" into bodies of water or into a well filled with water. They believed the moon had fallen out of the sky when they saw its reflection in the water.

New Guinea (X, 6)—It is said that in olden times, there was a woman who had power to make fire. Wanting to learn her secret, two children sneaked into her hut when she went out. When they lifted the lid of one of her pots, they released the moon that was trapped inside. It began floating away. The children tried to grab it, but it was too slippery and floated up into the sky. This is how the moon got its markings.

Moon Science

The Chinese calendar is partly based on the phases of the Moon. The Moon gives off no light of its own, but instead reflects sunlight. As the Moon orbits Earth each 27.3 days, its position relative to the Sun and Earth changes. For example, when Earth is between the Sun and the Moon, we see the full sunlit side of the Moon (a full Moon). When the Moon is between the Sun and Earth, we do not see the sunlit side of the Moon at all (a new Moon). So, the shape of the Moon appears to change from day to day (or night to night), depending on Earth's position relative to the sunlit side of the Moon.

When we look at the Moon from Earth, we see dark and light regions. The dark regions are mostly flat and are called maria (Latin for seas). They are covered with a dark-colored rock similar to the basalts from volcanoes here on Earth. The light regions are heavily cratered highlands, and are cov-



Use the grid coordinates on this world map to locate the places where the different folk tales originated.

ered with light-colored rock called anorthosite. The surface of the highlands is older than the surface of the maria.

The Moon is the source of the strongest of the three gravitational forces that create ocean tides here on Earth. The other two are the Sun and Earth's own rotation. The Moon's gravity creates a high tide every 12 hours and 25 minutes. Low tide occurs midway between each of these two high tides. These tides are highest and lowest just after the Moon is full and after its new phase. When the Sun and Moon are on the same side of the Earth (new Moon) or the opposite side (full Moon), their bulges add together to make larger tides called "spring tides," which happens about twice a month. When the Sun and Moon are 90 degrees apart (first quarter or last quarter Moon), the bulges interfere and cancel each other creating the unusually small "neap tides."

Weather Forecasting Folklore

Italy (O, 3)—In ancient times, the Etruscan soothsayers from Northern Italy were considered divine weather watchers. They were said to have foretold disaster or good fortune from slight changes of the wind direction, claps of thunder, or bolts of lightning.

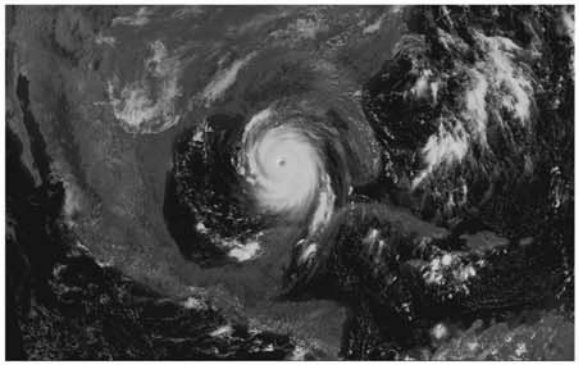
New Mexico USA (F, 4)—There is an ancient rain-predicting proverb among the Zuni Indians that says, "If the moon's face is red, of water she speaks."

Germany (N, 3) and Pennsylvania USA (H, 3)—Medieval Germans often relied on the shadow of a badger to tell them whether or not spring was on its way. If the badger saw his shadow on a particular day, then more winter was in store. If the badger didn't see his shadow, then spring

would come soon. German immigrants brought this tradition to the United States. It is celebrated every February 2nd in Punxsutawney, Pennsylvania, as Groundhog Day.

Weather Forecasting Science

Meteorologists (weather scientists) are getting better and better at "foretelling" what the weather will do in the next hours and days. Technology makes a great deal of difference. Observers such as the GOES environmental satellites, along with a vast network of weather monitoring instruments on the ground, plus instantaneous communication and computers to process all this information, all help scientists put together the big picture and predict what will happen next.



Hurricane Katrina in the Gulf of Mexico, as seen by GOES on August 29, 2005. Credit: GOES-12, NASA, NOAA

As for using the appearance of the Moon to predict rain, the Moon appears red because of dust being pushed ahead of a low pressure front bringing in moisture. So the Zuni Indians of New Mexico were right on!

And, as for how much longer winter will last, technically, the beginning of spring in the Northern Hemisphere is the spring equinox. This is one of two dates when Earth's axis of rotation is tilted neither toward nor away from the Sun. Day and night are nearly equal. The vernal (spring) equinox falls on March 21, and the autumnal (fall) equinox on September 21. Of course, in some areas far north of the equator, spring may still seem a long way off on March 21.

Day and Night Folklore

Arizona USA (E, 3)—Tsohanoai is the name of the Sun god for those practicing traditional Navajo ways. Every day, he crosses the sky, carrying the Sun on his back. At night, the Sun rests by hanging on a peg in Tsohanoai's house.

Georgia USA (H, 4)—According to the Creek Indians, the beginning of the world was a time when "animals could talk" and had the power of day and night. Daytime animals used all their magic to keep the Sun in the sky. Nighttime animals used all their magic to make darkness fall. This caused trouble between the two groups. Finally, they met and discussed the problem. At first they argued. Then, noticing the raccoon's striped tail, they decided to divide the times of light and dark into equal parts, resulting in "day" and "night."

Day and Night Science

Earth's rotation once every 23 hours 56 minutes makes the Sun appear from Earth's surface to be crossing the sky. The Sun shines on the side of the Earth turned towards it, causing day time. At the same time, the side of Earth turned away from the Sun is in darkness.

Seasons Folklore

Slovakia (O, 3)—According to Slovakian folklore, the twelve months of the year are twelve bearded men sitting around a roaring fire, the Sun.

Ireland (M, 2)—The Old Woman of the Gloom was considered an evil spirit who gathered sticks on St. Briget's Day for a fire to dry herself. If St. Briget's Day was wet, the Old Woman could not venture out until she made sure there was a dry spring for her own comfort. If St. Briget's Day was dry, a wet spring would follow, so then she would gather enough fuel to warm her through the wet months.

Rome (N, 3)—Ancient Romans believed that Sirius, the Dog Star, caused the very hot temperatures in July and August because Sirius is the brightest summer star. From this belief came the phrase still used today, "Dog days of summer."

Scotland (M, 2)—The Blue Hag was believed to have lived in the Scottish highlands in a cave. In her cave, she tried to keep the Summer Maiden captive, in an effort to prevent the summer from arriving.

Seasons Science

Earth is tilted on its axis of rotation as it makes its annual trip around the Sun, and it is always tilted in the same direction. Thus, sometimes it is the North Pole tilting toward the Sun (as in June) and sometimes it is the South Pole tilting toward the Sun (as in December). Thus, we have seasons. It is summer in June in the Northern Hemisphere because the Sun's rays are hitting that part of Earth more directly than at any other point in Earth's orbit—or, in other words, more directly than at any other time of the year. It is winter in December in the Northern Hemisphere, because that is when it is the South Pole's turn to be tilted toward the Sun.

In early days, St Briget's Day was celebrated in mid-winter, on February 1. Technically, the beginning of spring in the Northern Hemisphere is the vernal (spring) equinox. This is one of two dates when Earth's axis of rotation is tilted neither toward nor away from the Sun. Day and night are nearly equal. The spring equinox falls on March 21 and the autumnal (fall) equinox on September 21.

A region's climate is determined by its latitude (how far it is from the equator), along with air circulation, ocean currents, and local geography. Scotland is far from the equator. So, in Scotland, sunlight hits at a slant and spreads over a large area. When the North Pole is tilted toward the Sun around June through August, Scotland gets the most direct sunlight of the year, so that's when it is summer in Scotland (when the "Blue Hag sets the Summer Maiden free").

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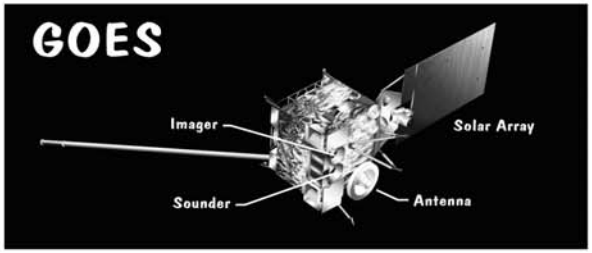
Improving Life Down Here From Up There



Satellites are important tools for today's weather forecaster. Satellites in orbit high above Earth provide images and other data about the atmosphere that enable meteorologists (who study short-term weather) and climatologists (who study long-term climate change) to do their jobs. It is the job of the National Oceanic and Atmospheric Administration (NOAA) to build and launch (with NASA's help), and to operate two different types of weather and environmental satellites.

One type of satellite is called a GOES (for Geostationary Operational Environmental Satellite). The other type is called a POES (for Polar-orbiting Operational Environmental Satellite). The GOES and POES work together, each carrying a different set of instruments to collect different types of data and from different points of view.

These satellites have other instruments as well that enable them to monitor space weather, pollution levels, and animal migration patterns. They also play an important role in the global search and rescue network of satellites and relay stations on the ground.

Geostationary Operational Environmental Satellites (GOES)

A geostationary orbit is one in which a satellite is always in the same position with respect to the rotating Earth. This orbit allows GOES to hover continuously over one position on Earth's surface. As a result, GOES keep watch for atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hail storms, and hurricanes.

The latest GOES carry an imager, a sounder, and a collection of other instruments to monitor the space environment.

The imager continuously observes Earth's surface, oceans, cloud cover, cloud temperature and height, surface temperature, and water vapor. It monitors the development of severe storms, such as hurricanes.

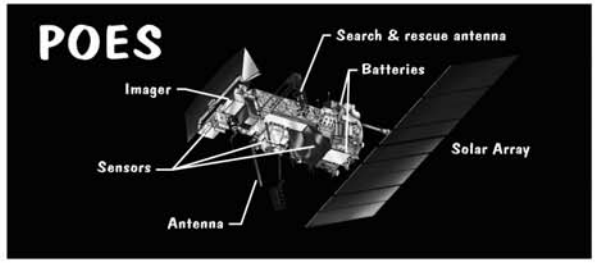
The sounder gathers data about the atmosphere in three dimensions by receiving signals in various wavelengths that are emitted from different levels of the atmosphere. From this information, meteorologists develop vertical profiles of atmospheric temperature and moisture, surface and cloud-top temperatures, and ozone distributions.

The Space Environment Monitor includes instruments that monitor solar flares and storms that can affect electric power grids, communications satellites, radio communications, signals from Global Positioning System (GPS) satellites, and the safely of astronauts in orbit.

The Solar X-ray Imager on GOES observes the Sun's x-ray emissions and provides early detection and location of flares, which also affect space weather near Earth.

Polar-orbiting Operational Environmental Satellites (POES)

NOAA uses two satellites whose orbits pass nearly over the North and South Poles, so that every part of Earth is observed at least twice every 12 hours. POES' data is used primarily for long-range weather forecasting, contributing to forecasts that provide early warning, thus helping to minimize effects of catastrophic weather events.



The latest POES, called NOAA-18, carries an imager, two types of sounders, Space Environment Monitor, plus data processing and storage instruments.

Search and Rescue

Both the GOES and POES also have instruments to support the Search and Rescue Satellite-Aided Tracking System, COPAS-SARSAT. This international program transmits to ground stations the location of emergency beacons from ships, aircraft, and individuals in distress around the world. The program, in place since 1982, has saved over 18,500 lives.

Tracking Animal Migration Patterns

A good way to learn about animals is to track them from space. Scientists pick individual animals and fit them with lightweight, comfortable radio transmitters. Signals from the transmitters are received by special instruments on the POES as they pass overhead, then relayed to a ground station, and sent on to NASA's Goddard Space Flight Center, which sends the information to interested scientists, wherever they might be. Tracking migrating animals using satellites may help us figure out how to make their journey as safe as possible and help them survive.

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How to Play the GOES POES Wild World of Weather Adventure Game

Object:

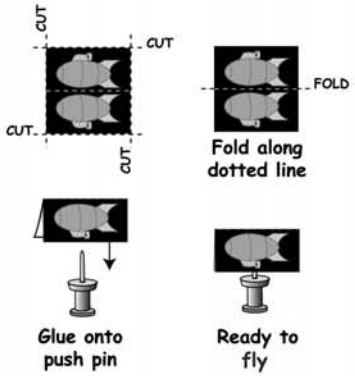
Be the first to pilot your Weather Airship from San Francisco, California, USA, all the way around the world and back across the USA to Miami, Florida, while earning at least **35** Adventure Chips.

Preparing to play:

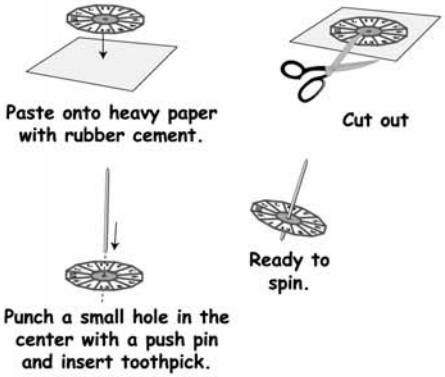
Game Board: Your playing field is a world map, showing the route (and a few detours) your airship must travel.

Question Cards: The Question Cards you need to play the game are printed on separate sheets. Carefully cut the cards apart. Separate the Question Cards into three separate piles, one for each level of difficulty—Easy, Medium, and Hard. Shuffle each pile of cards and put them face down in three piles reachable by all players.

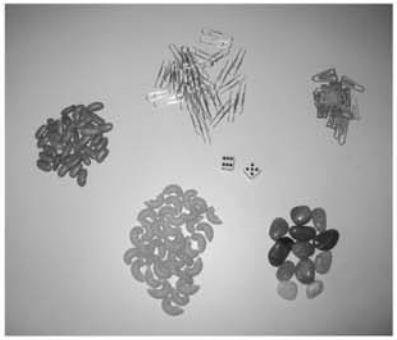
Playing Pieces: Carefully cut out the Weather Airship playing pieces. They are made to be folded in half and glued to a push pin so they will stand up.



Spinner: Before cutting around the outside of the spinner, glue the spinner piece onto heavy paper or card stock (like a piece of file folder). Then cut out the spinner, being sure to make a straight cut on each of its 12 sides. Precisely in the center of the spinner, insert a wooden toothpick and slide the spinner about half-way down. (*Note:* Instead of the spinner, you can use two six-sided dice.)



Equipment: For "Adventure Chips" (the currency of the game) you may use small pebbles, beans, colored bits of paper, paper clips, or any other small objects. You will need about 70 of them for two players, 140 for four players. Place the "chips" in a small bowl to the side of the board. OR, use paper and pencil to keep track of "Adventure Chip" earnings and expenditures.



How to play:

- Each player picks a Weather Airship playing piece and places it near the *START* point at San Francisco.
- Each player, in turn, spins the spinner (or throws the dice) to see who goes first. Highest number goes first, then play proceeds to that player's left.
- When it's your turn, **spin the spinner** and **move ahead** the number of steps indicated.
- If you land on a YELLOW step, you must answer a question from a Question Card that will be read by the opponent to your right. You must first **choose a level of difficulty** for your question. The harder the question, the more Adventure Chips you can earn for a correct answer or lose for an incorrect answer.

2 Chips if right, lose 1 if wrong

4 Chips if right, lose 2 if wrong

6 Chips if right, lose 3 if wrong

- Your opponent then picks the top Question Card from the Easy, Medium, or Hard pile and reads you the question. (The correct answer is in bold type on the card.)

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Answer the question. If you are correct, you receive either 2, 4, or 6 Adventure Chips, depending on the difficulty level.

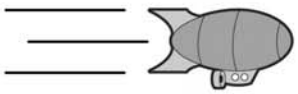
If your answer is incorrect, you must pay back half the number of Adventure Chips you would have won if correct. If you don't have any Adventure Chips, you don't have to pay.

Whether correct or incorrect, your turn is over.

The used Question Card should be placed face up on a "discard pile" beside the unused pile. When all cards in a stack have been used, shuffle the discard pile and place the stack face down on the board.

- If you land on a RED space, you have an adventure! All red spaces have a number with a description at the bottom of the game board. Find this description, read your adventure out loud, and follow the instructions. You will either gain or lose Adventure Chips or spaces. If the adventure moves you forward or backward to another yellow space, do not answer another question. Your turn is over.
- BLUE circles are decision points.
- If you land on a BLUE circle, spin again. If you get an ODD number, take the detour (smaller yellow circles) and jump as many spaces as the spinner shows. If you get an EVEN number, stick to the main route and jump as many spaces as the spinner shows. In either case, take a question if you land on a YELLOW space, or follow the instructions on a RED space.

At the end of a detour route, rejoin the main route and keep moving forward.



Other instructions:

- It is OK for two or more players to occupy the same space.
- If you are within a few steps of reaching the *FINISH* point, you do not need to spin the exact number to land on the *FINISH* point. If you land directly on the *FINISH* point without enough chips to win, treat it as a yellow circle and answer a question.
- If you are the first to reach the *FINISH* and have at least 35 Adventure Chips, congratulations! The game is over and you win!
- If you reach the *FINISH* but do not have at least 35 Adventure Chips, keep going. You will be caught up in the trade winds and sent west along the equator again to earn some more Adventure Chips. When you have earned 35 Adventure Chips, you have won!

  You do not have to pass FINISH again.

Keeping Score:

One player has the job of "Banker," paying out Adventure Chips that players earn and collecting Adventure Chips that players lose. (If paper and pencil are being used to keep track of Adventure Chips, one player has the job of writing down Adventure Chips earned and lost for all players.) Players who have no chips do not have to pay for incorrect answers or unfortunate adventures requiring payment of chips.

Rule Options:

To make the game **go faster** for younger players who will likely favor the Easy questions, reduce the number of Adventure Chips required to win. For example, try 25 Adventure Chips instead of 35.

To make the game **more challenging**, for incorrect answers, player must give back the following quantities of Adventure Chips:

Wrong answer to Easy question, give back 6 chips.

Wrong answer to Medium question, give back 4 chips.

Wrong answer to Hard question, give back 2 chips.

For a two-player game, to make the game **more competitive**, if a player answers a question incorrectly, instead of giving back the above number of chips to the "bank," the player must give them to the other player. That is

Wrong answer to Easy question, give other player 6 chips.

Wrong answer to Medium question, give other player 4 chips.

Wrong answer to Hard question, give other player 2 chips.

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