



## JPL/NASA Earth Science Patch

Most Girl Scouts know that JPL builds rovers and NASA sends astronauts into space. Did you know that NASA and JPL also keep an eye on our home planet, Earth? Understanding Earth from the viewpoint of space helps us to understand and connect to our changing world.

### Key Messages:

NASA monitors the vital signs of Earth from (the perspective of) space to help you understand the future of your planet.

NASA monitors the vital signs of Earth from (the perspective of) space to help connect you to your changing world.

NASA monitors the vital signs of Earth from (the perspective of) space to help connect you to your global community.

**To earn this patch, please complete the following number of items from each section:**

	Discover	Connect	Take Action
<b>Daisy</b>	1	1	1
<b>Brownie</b>	2	1	1
<b>Junior</b>	2	2	1
<b>Cadette</b>	2	2	2
<b>Senior</b>	3	2	2
<b>Ambassador</b>	3	3	2

*\* Requires adult supervision.*

## **DISCOVER**

1. **MEASURING AIR TEMPERATURE:** Using an outdoor thermometer, take the air temperature (about 3 feet above the ground) every morning and evening at approximately the same time for 10 consecutive days. Take multiple temperature readings in the shade, in the sunshine, your front yard, your back yard, above concrete, above grass, above snow or ice and above melted ice. Write down the temperatures in each location and the weather conditions as you recorded the temperatures. Report your findings to your troop.

2. **UNDERSTANDING TEMPERATURE DIFFERENCES** – You will need to use a newspaper, an online weather website, or the weather report from the news on TV for this activity. Pick two cities in the United States which are at similar latitudes – one along the coast and one inland, for example Denver, Colorado and Baltimore, Maryland are both at 39° north latitude. Record the high and low temperatures in each city for 10 consecutive days. Write a short summary of the temperature differences.

A list of latitudes of major U.S. cities can be found at:  
<http://www.artscipub.com/info/latlonofmajorcities.asp>

\*3. **HEAT CAPACITY OF THE OCEAN:** Watch the “Oceans of Climate Change” video (less than 4 minutes) and use the instructions that were demonstrated to recreate the experiment. You will need an adult or a troop leader to help you with this activity. During your own experiment, record the time it took for each balloon to pop. What do you think is causing the difference?

<http://climate.nasa.gov/imagesVideo/climateReel/index.cfm> Oceans of Climate Change is the 7<sup>th</sup> video link from the top of the page.

4. **NASA/JPL TAKES THE EARTH'S VITAL SIGNS:** Visit the Eyes on the Earth website. Choose 5 NASA satellites that are currently monitoring our planet, Earth. Which satellites look at the ocean? Land? Atmosphere? Which satellite is the smallest? Which is the largest? (Please note that this website interface does not work on iPads).

Eyes on the Earth: <http://climate.nasa.gov/Eyes/>

5. **EARTHQUAKES:** Take a look at the most current earthquakes which have happened around the world at:

<http://earthquake.usgs.gov/earthquakes/recenteqsww/>.

*\* Requires adult supervision.*

Where do you see the most earthquakes? Why do you think this is the case?

For clues, check out the Ring of Fire at the following website:

<http://www.weatherwizkids.com/weather-volcano.htm>

6. SEA LEVEL RISE: Find two clear plastic cups. With a permanent marker label one cup sea ice and the other cup land ice. Fill each cup with water. Add a large ice cube to the cup labeled sea ice. Mark the water level with a permanent marker. Place a piece of cheesecloth (you can substitute with aluminum foil or plastic wrap with small holes poked into it) on the top of the cup labeled land ice. Secure the cheesecloth, foil or plastic wrap with a rubber band around the top of the cup. Place a large ice cube on top of the cheesecloth, foil or plastic wrap. Once the ice melts, mark the water level with permanent marker. Which cup had the largest amount of increase in the water level? Why?

For more information visit the following website:

<http://www.calacademy.org/teachers/resources/lessons/global-climate-change-and-sea-level-rise/>

Land ice, such as glaciers and ice sheets found on Greenland and Antarctica, raises sea level as it melts. This happens because, when ice on land melts, it adds water into the ocean that was not there before.

Sea ice, such as ice shelves and icebergs, do not raise sea level. According to Archimedes' principle, a floating object displaces an amount of water equal to its weight. Therefore, when floating ice melts, there is very little change in sea level.

7. OCEANOGRAPHY: Take the quiz and become a certified Junior Oceanographer at: <http://sealevel.jpl.nasa.gov/education/stuffforkids/junioroceanographer/>

\*8. EL NINO: What is the El Nino effect? To learn more about this condition in the Pacific Ocean and how it affects weather all over the world, recreate your own El Nino at: <http://sealevel.jpl.nasa.gov/files/archive/make-your-own-el-nino.html>

or

<http://spaceplace.nasa.gov/el-nino/>

9. CLOUDS: Make a cloud mobile by following the instructions at: <http://spaceplace.nasa.gov/cloud-mobile2/>. What is your favorite type of cloud? Are they high up in the atmosphere or close to the ground?

## **CONNECT**

*\* Requires adult supervision.*

1. EL NINO: Does your troop like to make costumes, build props and perform for your friends and parents? If so, why not trying organizing a play and performing a troop El Nino skit: <http://sealevel.jpl.nasa.gov/files/archive/el-nino-skit.html>

2. WATER CYCLE: How does the global water cycle work? Take a look at The Water Cycle interactive website at:

[http://www.epa.gov/ogwdw/kids/flash/flash\\_watercycle.html](http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html)

Draw your own pictures or cut out pictures from a newspaper or magazine to make your own poster that demonstrates the water cycle.

3. WATER USE: Have you ever wonder how much water you use in your shower or bathtub? Visit the following website to find out. Track how much water you use for an entire week. Can you use less water? If so, how many gallons of water did you conserve? <http://pbskids.org/zoom/activities/sci/showerestimation.html>.

4. SEASONS: Season team activity (see attached sheet)

5. CLIMATE CHANGE: Visit the Climate website ([www.climate.nasa.gov](http://www.climate.nasa.gov)). Take a look at the evidence and key indicators pages.

<http://climate.nasa.gov/evidence/>

<http://climate.nasa.gov/keyIndicators/>

Make notes of 5 key forms of evidence that the Earth's climate is changing. Why are these important to you? Can you explain the evidence to your friends, family and troop?

6. GREEN CAREERS: A green career can be any type of job that provides education, products and/or services that use renewable energy resources, reduce pollution, conserve energy and natural resources and either clean up or reuse waste. Learn about a few types of green careers at:

<http://climate.nasa.gov/kids/greenCareers/index.cfm>

Pick one career that sounds interesting to you and learn more about it. Tell your troop what you like about that career.

7. COMPARING PLANETS: Compare the planets of Mars and Earth. Are they the same or different? Find 3 ways they are the same as one another and 3 differences (hint: size, weather, mass, ice caps, land, oceans, volcanoes, length of year, length of day).

<http://muse.jpl.nasa.gov/library/Earth.and.Mars.pdf>

8. Read the book *All the Way to the Ocean* by Joel Harper, Freedom Three Publishing, 2006 (ISBN-10: 0971425418 ISBN-13: 978-0971425415).

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Take the plastic vs. glass quiz at:

<http://www.funnelbrain.com/quizViewer.php?quizID=4604> (this may require help from an adult)

## **TAKE ACTION**

1. Call your local water district and find out where your water comes from. Draw a map of where your water comes from and share it with your troop. Discuss three ways in which you can conserve water at home with your troop.

2. Work with your family to put together an earthquake supply kit. These kits can also be helpful during other types of emergencies, such as a hurricane, snowstorm, flood, ice storm, power outage, etc. A list of items can be found at:

<http://www.earthquakecountry.info/roots/step3.html>

<http://www.kidzworld.com/article/25506-earthquake-how-to-make-an-emergency-supply-kit>

<http://www.sfgate.com/cgi-bin/article.cgi?f=/earthquakes/archive/ready.dtl&ao=all>

3. Create an earthquake preparedness plan. These types of plans can also be used during other types of emergencies, such as a hurricane, snowstorm, ice storm, flood, power outage, etc. Information can be found at:

<http://www.earthquakecountry.info/roots/step2.html>

4. Find a map of the city you live in. Look at the street map immediately surrounding where your house is located. Using the key on the map, use a ruler to mark the streets or landmarks that are one mile from your house. Make these marks in each of the four directions, north, east, south and west. Using these marks, draw a circle with your house in the center. Pledge to walk to locations within this circle rather than drive.

5. Organize a bike pool, walk pool, or carpool to school. Visit the following website for ideas on how to coordinate these activities with others.

<https://www.carpooltoschool.com/Home.aspx>

*\* Requires adult supervision.*

6. Grow a vegetable garden at home or plant one at school. How does it help the environment to eat fruits and vegetables that are grown locally? Check out the following website for hints:

[http://www.homeandgardensite.com/ChildrensSite/vegetable\\_garden.htm](http://www.homeandgardensite.com/ChildrensSite/vegetable_garden.htm)

7. Visit a local museum, science center, nature center or arrange a tour for your troop to visit the Jet Propulsion Laboratory (JPL). Report back to your family, troop, or school class what you learned about our planet earth.

8. Create a presentation (poster, video, radio show, play, art project, PowerPoint, newsletter) about what you learned from the Earth Science Patch. Share it with your troop, class, family, and friends.

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# Seasons of the Year



In many parts of the world, the climate changes regularly throughout the year. These changes — spring, summer, autumn, and winter — are called seasons. They happen because of the way the Earth is tilted on its axis — an imaginary line between the North and South Poles. As the Earth slowly circles the Sun once every year, different parts of the Earth are closer to the Sun. This affects the amount of light and heat they receive. Look at the diagram on the opposite page to see how this works.



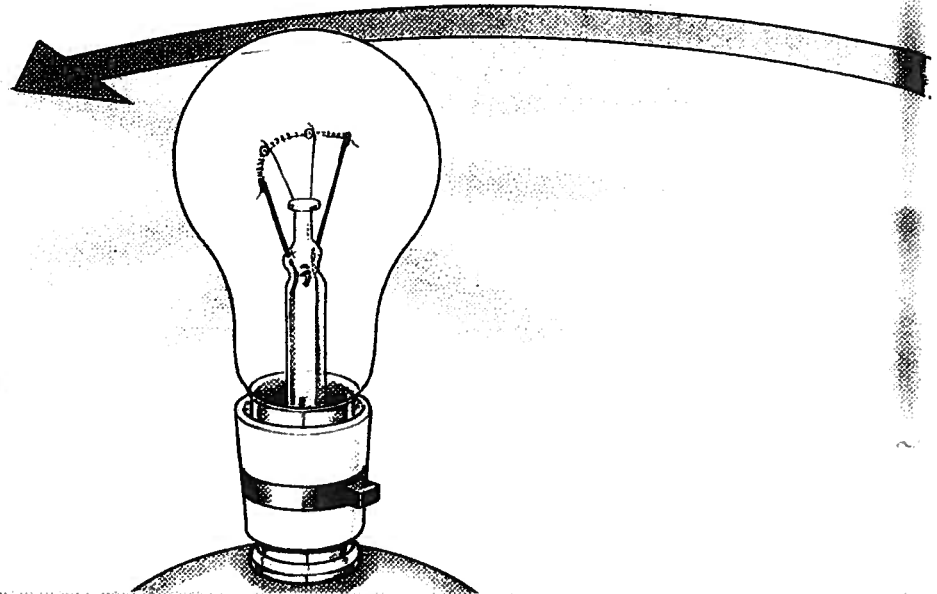
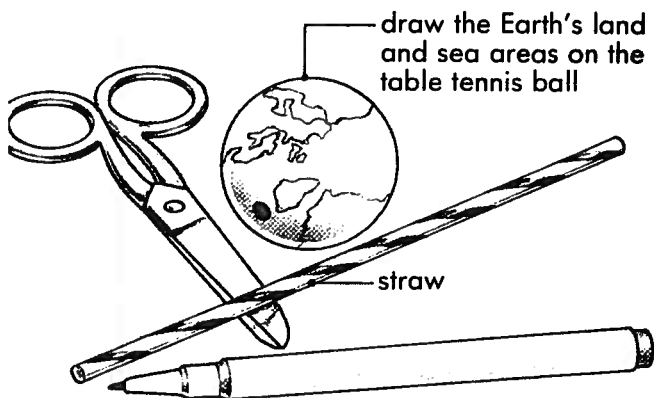
## Winter Sleep

Some animals like this dormouse hibernate, or sleep, through the cold winter months. They live off stores of fat in their bodies until the spring.

## Do it yourself

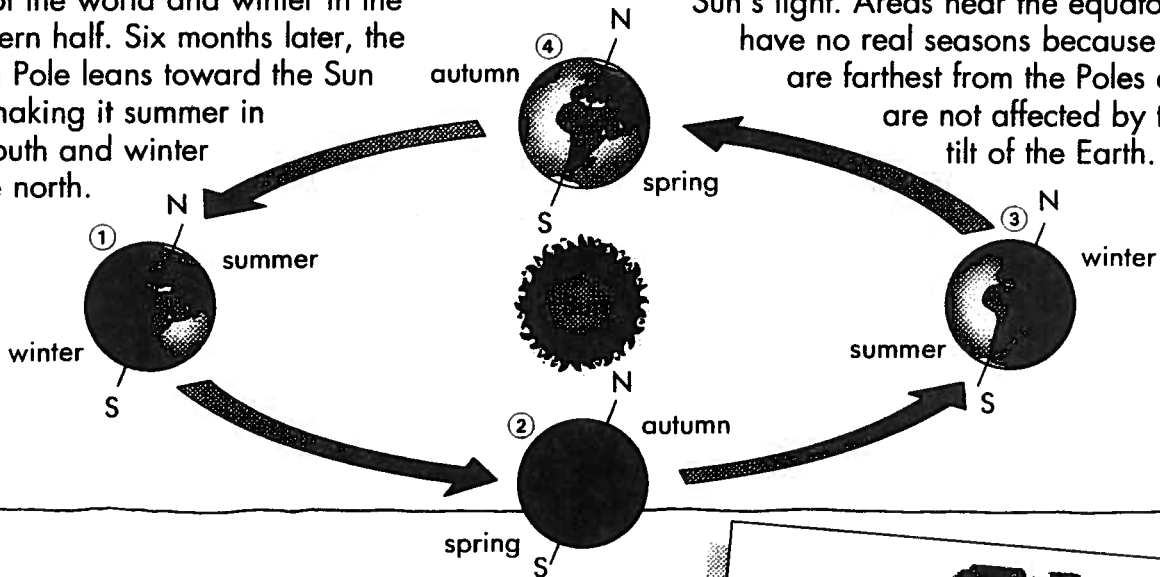
**Make a model to see how the seasons work. You will need a table tennis ball, a straw, scissors, glue, colored pens, and a table lamp.**

1. Cut the straw in half. Glue one half to the top of the ball and the other to the bottom. This is the Earth's axis.
2. Ask an adult to take the shade off a table lamp and switch on the lamp for you.
3. Walk slowly around the lamp, tilting your "Earth" at an angle and keeping it turned toward the lamp. See how the lamp lights up your Earth.



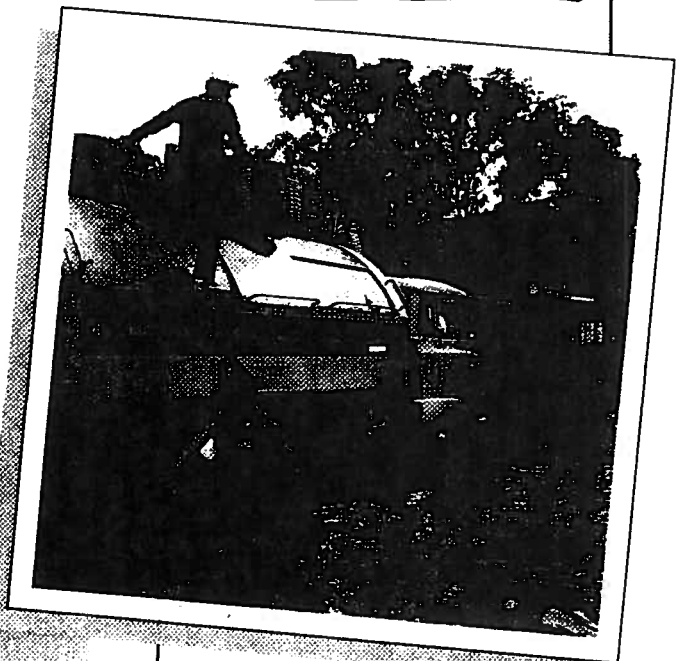
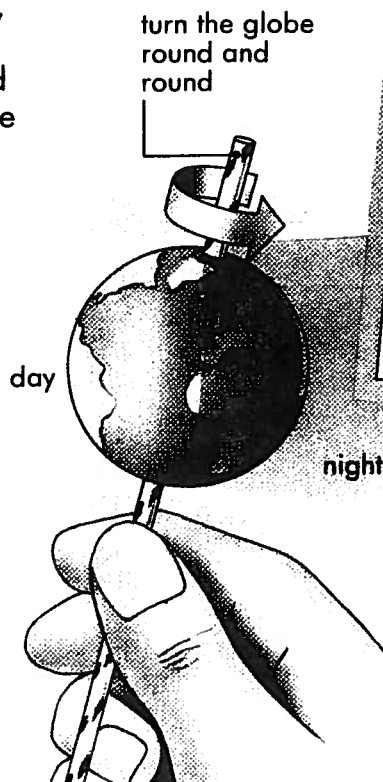
## How Seasons Work

When the North Pole is tilted toward the Sun (1), it is summer in the northern half of the world and winter in the southern half. Six months later, the South Pole leans toward the Sun (3), making it summer in the south and winter in the north.



During spring and autumn (2 and 4), the northern and southern parts of the Earth have more equal shares of the Sun's light. Areas near the equator have no real seasons because they are farthest from the Poles and are not affected by the tilt of the Earth.

4. The Earth also spins on its axis once every 24 hours, giving us night and day. Try to turn your globe round and round at the same time to see how this works.



Some tropical countries have a yearly rainy season called the monsoon. It may rain for days at a time and there can be severe floods.