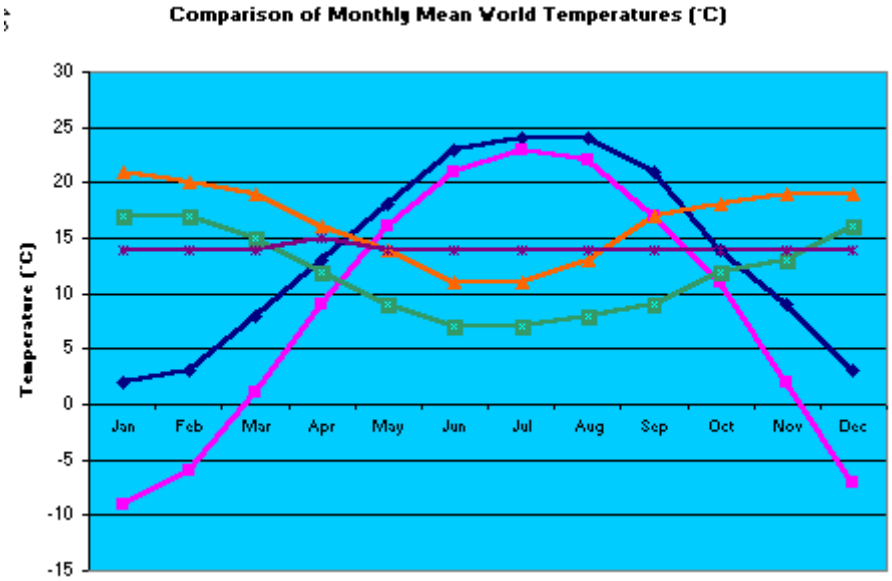
Exploring Weather Patterns Around the World

Activity Overview

In this activity, students download climatic data from various world locations available on the Weather Channel website and then manipulate and analyze data in a spreadsheet. Through the analysis of graphs created in the spreadsheet, students can observe patterns in the world's climate and try to identify the primary factors involved in these patterns.



Advantages of Technology

Rather than reading about climate patterns in a textbook, students can use real temperature data downloaded from the Internet, importing it to a spreadsheet in order to discover and make inferences about climate patterns. After the data is imported into the spreadsheet and formatted appropriately, students can easily create graphs that help them visualize temperature differences around the world and infer the reasons behind these temperature differences.

Educational Standards

Virginia Earth Science Standards of Learning addressed in this lesson include:

Earth Science.1 The student will plan and conduct investigations in which

- Technologies, including computers, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;
- Scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted.

Earth Science.13 The student will investigate and understand that energy transfer between the sun, Earth, and the Earth's atmosphere drives weather and climate on Earth. Key concepts include observation and collection of weather data.

Materials

Technology:

- Computer with compatible spreadsheet program (Microsoft Excel, Appleworks, etc.)
- Access to the Internet (www.weather.com)

Other Supplies:

- *Optional:* World map

Procedure

NOTE TO TEACHERS:
These procedures are written to show you how you might use these technologies to teach science concepts. Suggested questions, approaches, and expected answers are all provided. Therefore, these activity descriptions should be used as a guide for your instructional planning, rather than as a step-by-step activity guide for students.

Getting Started

If you were in Melbourne, Australia, today, what clothes would you be wearing? Why?

What do you think the weather is like in Johannesburg, South Africa, today?

What about London, England?

Kyoto, Japan?

As students answer these questions, it may helpful for them to look at the world map available from World Atlas web site (http://www.sitesatlas.com/Atlas/PhysAtlas/physatlas.htm)

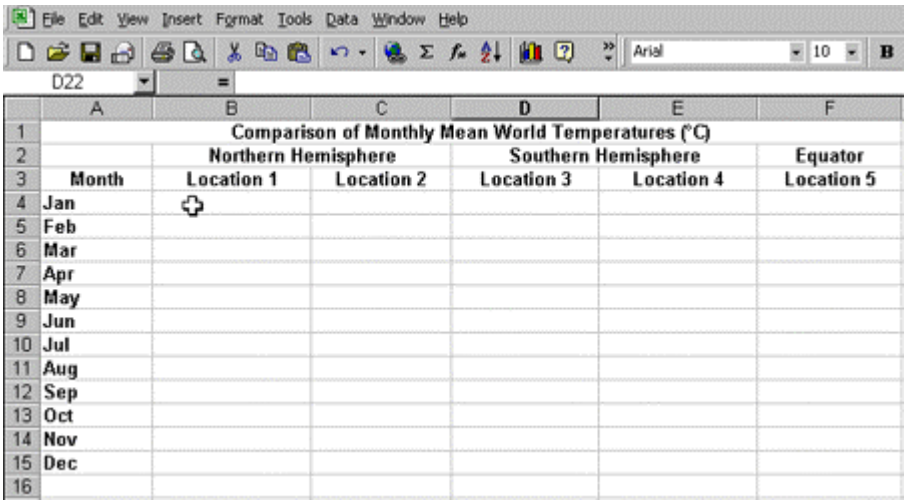
Although it's interesting to look at temperatures around the world for any given day, it's even more important to recognize the underlying climatic trends when trying to understand these differences. The abundance of climatic data available on the Internet makes investigating these trends both easier and more relevant to students.

The Research Question

How do temperature patterns differ for difference locations around the world?

To begin your investigation, look at a world map and select two cities from the northern hemisphere, two cities from the southern hemisphere, and one city along the equator. One of these cities can be the city nearest you.

Now, set up a data table in a spreadsheet (our examples use Microsoft Excel). The first column should list the months of the year. Then make a column for each city.



	A	B	C	D	E	F
1	Comparison of Monthly Mean World Temperatures (°C)					
2		Northern Hemisphere		Southern Hemisphere		Equator
3	Month	Location 1	Location 2	Location 3	Location 4	Location 5
4	Jan					
5	Feb					
6	Mar					
7	Apr					
8	May					
9	Jun					
10	Jul					
11	Aug					
12	Sep					
13	Oct					
14	Nov					
15	Dec					
16						

Gathering Data

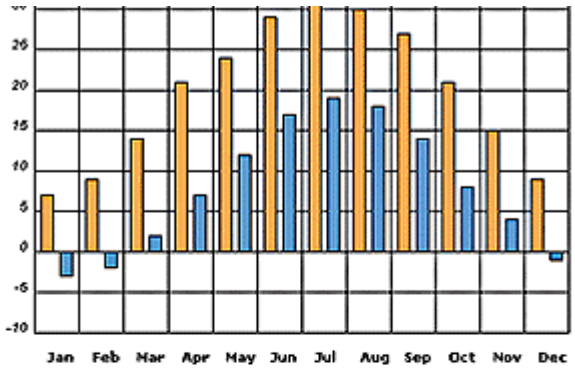
Go to http://www.weather.com/common/home/climatology.html and type in the first city you have selected. Find the Monthly average temperatures for that city.

The example shown here displays the monthly average high and low temperatures for Charlottesville, Virginia.

You have the choice of displaying either English units or metric units for temperature.

As you can see from the screen capture, the Weather Channel website provides a bar graph of average high and low temperatures for each month. One option is to print out this graph for each city you have selected to investigate and place them side by side for comparison.

However, each of these graphs shows more data than you need, and the website doesn't allow much freedom for making the graphs less complicated.



Month	Avg. High	Avg. Low	Mean	Avg. Precip.	Record High	Record Low
Jan	7°C	-3°C	2°C	9.4 mm	26°C (1950)	-23°C (1994)
Feb	9°C	-2°C	4°C	8.4 mm	27°C (1985)	-17°C (1996)
Mar	14°C	2°C	8°C	10.3 mm	33°C (1998)	-12°C (1996)
Apr	21°C	7°C	14°C	8.5 mm	35°C (1960)	-6°C (1950)
May	24°C	12°C	18°C	12.3 mm	36°C (1996)	1°C (1966)
Jun	29°C	17°C	23°C	11.3 mm	38°C (1994)	4°C (1967)
Jul	31°C	19°C	25°C	12.5 mm	40°C (1953)	9°C (1988)
Aug	30°C	18°C	24°C	10.5 mm	41°C (1999)	7°C (1986)
Sep	27°C	14°C	21°C	12.3 mm	42°C (1954)	2°C (1974)
Oct	21°C	8°C	14°C	10.7 mm	36°C (1954)	-3°C (1972)
Nov	15°C	4°C	9°C	9.5 mm	31°C (1950)	-12°C (1950)
Dec	9°C	-1°C	4°C	8.3 mm	28°C (1998)	-19°C (1983)

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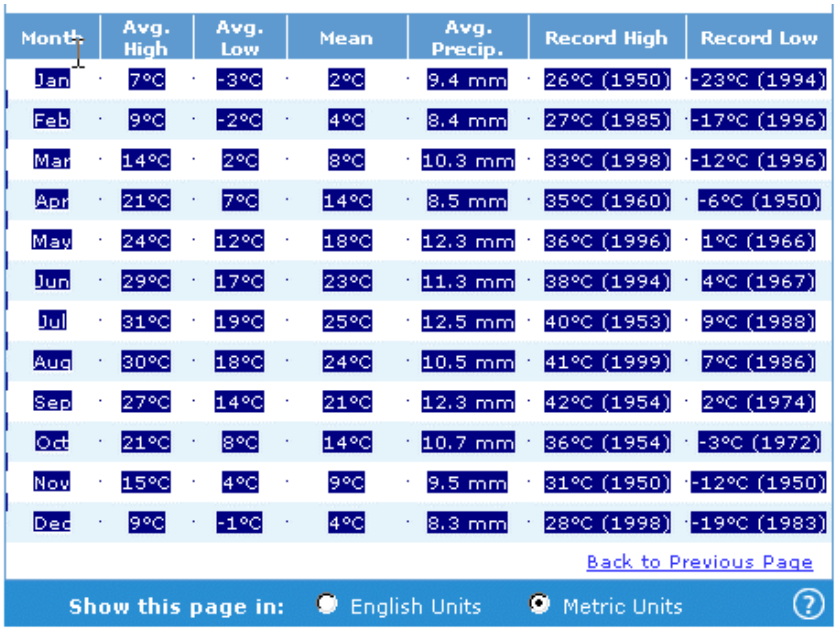
Show this page in: English Units Metric Units

Formatting Your Data

Copy and paste the Mean temperature row from each geographic location into an Excel spreadsheet.

If you are unable to select only the "Mean" column from the table, select the entire table, then copy and paste it temporarily into Sheet 2 of your Excel Workbook.



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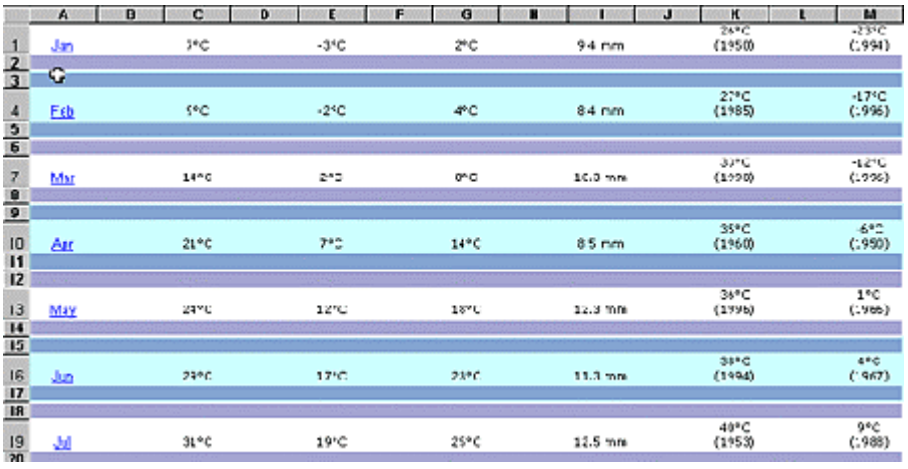
Because the format of the website is different from the format of the spreadsheet, you will like need to "clean up" some of the data. In our case "cleaning up" will involve the following:

1. Deleting extra rows.
2. Copying the "Mean" column to our comparison chart on Sheet 1.
3. Removing extraneous characters from the data set.

To delete extra rows, hold down the Control button on your keyboard and highlight all extra rows within the table. After all the rows are highlighted, click **Edit**, **Delete**, then **Entire Row.**



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Jan		7°C		-3°C		2°C		9.4 mm		26°C (1950)		-23°C (1994)
2													
3													
4	Feb		9°C		-2°C		4°C		8.4 mm		27°C (1985)		-17°C (1996)
5													
6													
7	Mar		14°C		2°C		8°C		10.3 mm		33°C (1998)		-12°C (1996)
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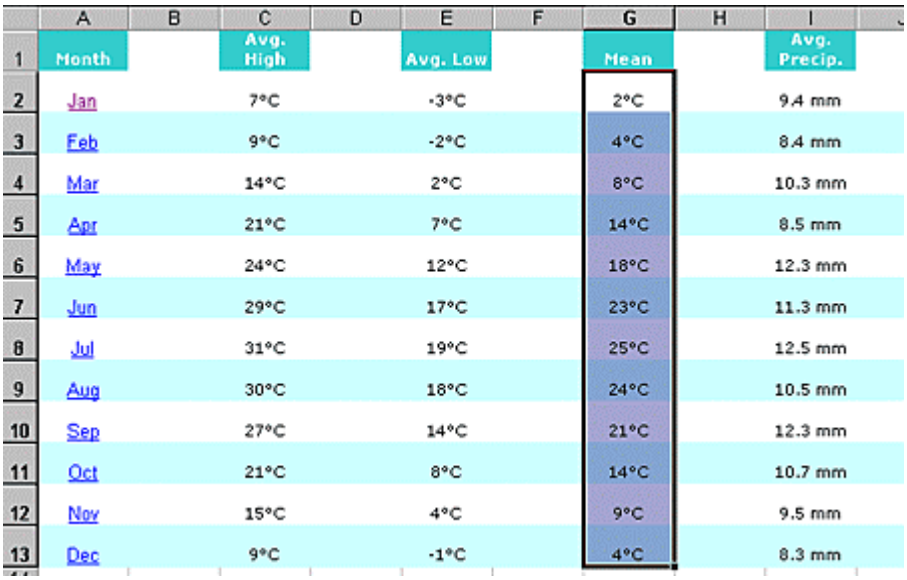
11													
12													
13	May		24°C		12°C		18°C		12.3 mm		36°C (1996)		1°C (1966)
14													
15													
16	Jun		29°C		17°C		23°C		11.3 mm		38°C (1994)		4°C (1967)
17													
18													
19	Jul		31°C		19°C		25°C		12.5 mm		40°C (1953)		9°C (1988)
20													

Now you can copy the data from the Mean row and paste it in the proper column of the comparison chart in Sheet 1.



	A	B	C	D	E	F	G	H	I
1	Month		Avg. High		Avg. Low		Mean		Avg. Precip.
2	Jan		7°C		-3°C		2°C		9.4 mm
3	Feb		9°C		-2°C		4°C		8.4 mm
4	Mar		14°C		2°C		8°C		10.3 mm
5	Apr		21°C		7°C		14°C		8.5 mm
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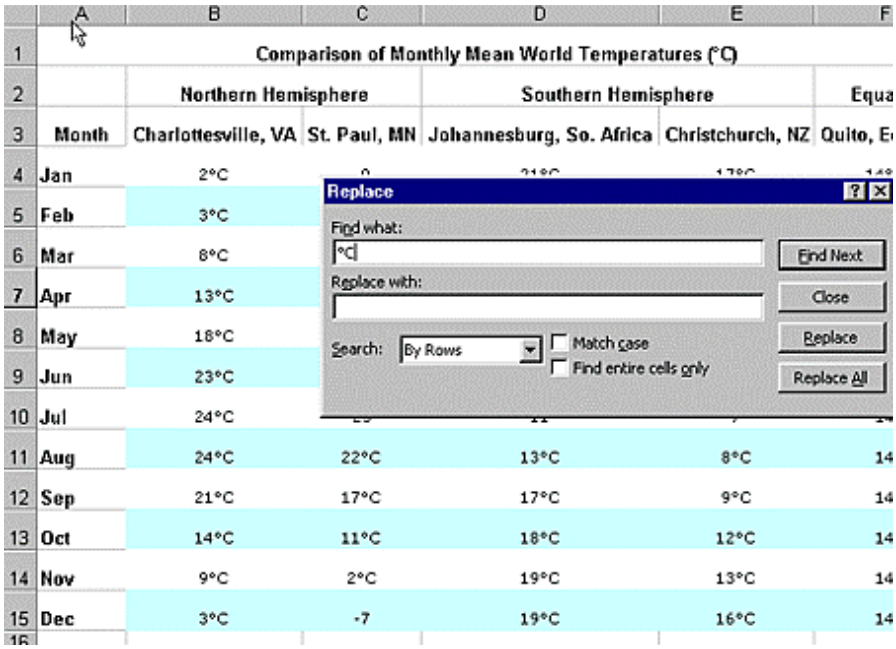
8	Jul		31°C		19°C		25°C		12.5 mm
9	Aug		30°C		18°C		24°C		10.5 mm
10	Sep		27°C		14°C		21°C		12.3 mm
11	Oct		21°C		8°C		14°C		10.7 mm
12	Nov		15°C		4°C		9°C		9.5 mm
13	Dec		9°C		-1°C		4°C		8.3 mm

Repeat this process for all five cities. You may use additional "Sheets" in the Workbook for temporarily placing the entire data table for each city.

Once all the Mean data are placed in Sheet 1, you will need to complete at least one additional formatting task. All extraneous characters, such as "°F" (or "°C") must be removed in order for the spreadsheet program to identify the points as numbers and not text.



Since the degree symbol "°" is not a symbol found in Excel, you will have to copy and paste the symbol from one of the active cells in which it is found. First, copy it, then click on **Edit**, **Replace**, in the toolbar, and paste it into the "Find what:" window beside the "F" or "C." Leave the **Replace** box empty. After selecting **Replace All**, the extraneous characters will disappear from all the data. If you skip this step, you will not be able to graph the data in Excel.

Graphing Your Data

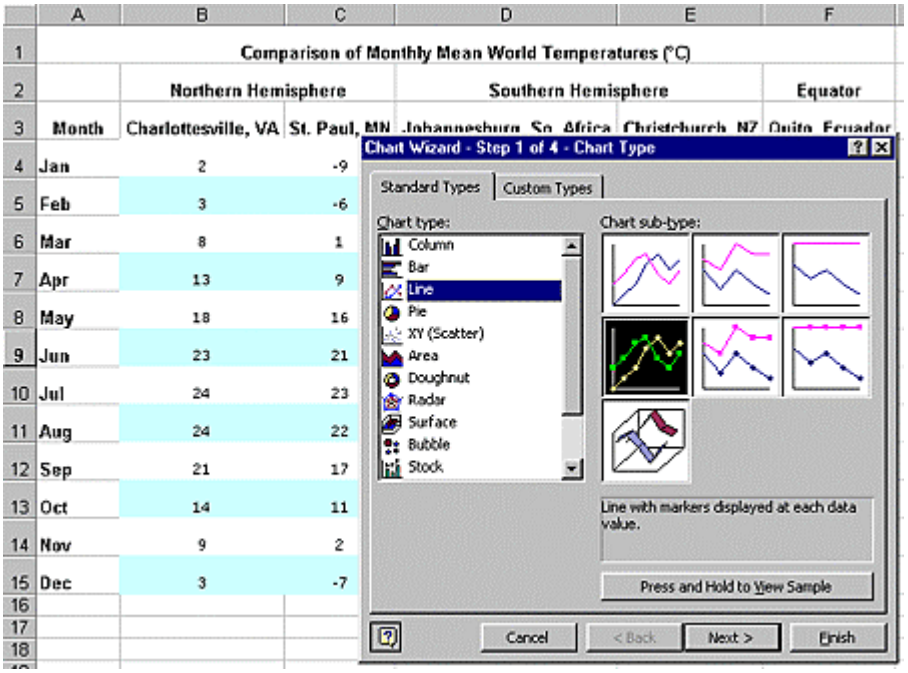
Now look at your comparison chart of the mean monthly temperature data for the five cities.

Can you identify any trends just from looking over the data?

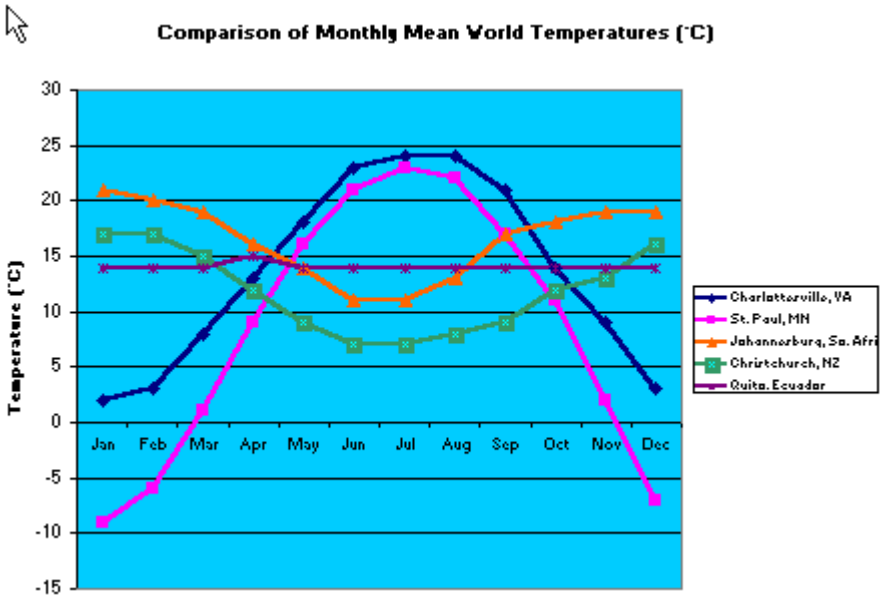
Most likely, you will find it difficult to identify a trend from the data chart. Fortunately, you will find that a graph of these data make the trend much more obvious, and the spreadsheet eliminates the tedium of making graphs by hand.

To graph the data, highlight the month and temperature columns for each city and then click on the graphing icon in the Excel menu.

For best results, select one of the line graphs (we chose the "line with markers displayed at each data value"). Follow the directions in the graphing wizard to name the table and label the Y-axis (be sure to include units). The X-axis will already be labeled with month headings.



In the last box of the Graph Wizard, select "As new sheet" to view the graph on a full page.



Now look for patterns in the graph. Find the high and low temperatures for each location.

Do all five locations experience low and high temperatures at the same time of year?

In which months does summer occur in the northern hemisphere locations?

In which months does summer occur in the southern hemisphere locations?

Why do you think the northern and southern hemispheres have opposing seasons?

What do you notice about temperatures in the equatorial zone throughout the year? How would you explain this?

Which latitudes experience the highest amount of fluctuation? Why do you think this happens?

NOTE: Websites can and often do change from time to time. If the data is now presented differently in the website, the step-by-step instructions for downloading the data and formatting it in the spreadsheet may no longer apply. However, the overall activity plan should not be affected:

- Copy the data from the website.
- Revise formatting to make the data fit in the spreadsheet.
- Create a graph from the data.

Completing these steps will help familiarize students with important skills in handling and analyzing data in a spreadsheet.

Modifications:

This activity can be modified to include other climatic data such as precipitation data for students to graph and study to recognize patterns in periods of rainfall over the year. Additionally, students can analyze historical climatic data to draw conclusions about El Niño or global warming.

Assessment Strategies

A variety of assessment strategies can be implemented in this activity. Informal student assessment should be included throughout the lesson to check for student understanding. Additionally, other assessment techniques may include the following:

- Give the students a printout of a graph depicting temperature data from several unidentified locations from around the world (not discussed in the lesson) accompanied by a list of cities and their longitude and latitude. Have your students write a short paragraph linking weather patterns to specific cities. Make certain that they justify their matches by describing how each city's geographic location explains the weather pattern they matched it to.

Resources

The Earth

http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Seasons.shtml
Enchanted Leaning Online offers an illustration and detailed information the relationship between Earth's axis and the seasons on Earth.

Motion of Earth around the Sun

http://staff.science.nus.edu.sg/~aslaksen/sun_fixed/sun_fixed.html
This java applet illustrates the motion of Earth around the Sun. The simulation is designed to show Earth's location during the months of the year.

National Data Buoy Center: Science Education- What Causes the Seasons?

http://www.ndbc.noaa.gov/educate/seasons.shtml
The National Data Buoy Center illustrates how the Earth's axial tilt causes changes in our seasons.

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