Data Science Learning:

Effects of Solar Eclipse on Earth Temperatures

NASA Office of STEM Engagement Next Gen STEM

EDUCATOR NOTES

Learning Objectives

Students will:

- Learn what causes a solar eclipse and its effects on the atmosphere
- Sort through a raw dataset and organize it into useful information
- Use graphical tools to visualize and analyze data to answer specific questions

Investigation Overview

In this data analysis activity, students will sort through a raw dataset of temperatures collected from various reporting sites during the total solar eclipse over the United States on August 21, 2017. Students will learn to sort and filter raw data to meet specific criteria, and then use their new dataset to graph temperatures over time for a single reporting site during the eclipse. Finally, students will analyze their graphs to answer specific questions about the 2017 solar eclipse, compare them with known quantities, and share/compare their results with their peers.

Safety

- There are no safety concerns associated with this activity
- NASA's number one priority for eclipse viewing is safety. If you plan to use this activity in conjunction with viewing an actual solar eclipse, never view, or allow students to view, the Sun without approved solar viewing glasses. Additional eclipse safety information can be found at **https://science.nasa.gov/eclipses/safety/**.

Investigation Preparation

To prepare for this activity, read and become familiar with the background information contained in the "Background Information" and the "Curriculum Connection" sections of this activity. After becoming familiar with the steps to complete this activity, included in the "Introduce the Investigation" and "Facilitate the Investigation" sections, it is recommended for the educator to test the dataset outlined in the bullet points below, to ensure the activity proceeds smoothly with students.

- Download the **raw eclipse dataset**. Download the first dataset, including the air temperature data from the 14 states that experienced a total solar eclipse. The Excel (XLSX) version of the file seems to be the most compatible with popular spreadsheet applications.

GRADES 6-8

Suggested Pacing

90 to 120 minutes

Materials

- Internet-connected computers or other devices with spreadsheet applications
- Copy of the Student Handout for each group
- Pencils
- Optional: Paper for creating graphs

Datasets

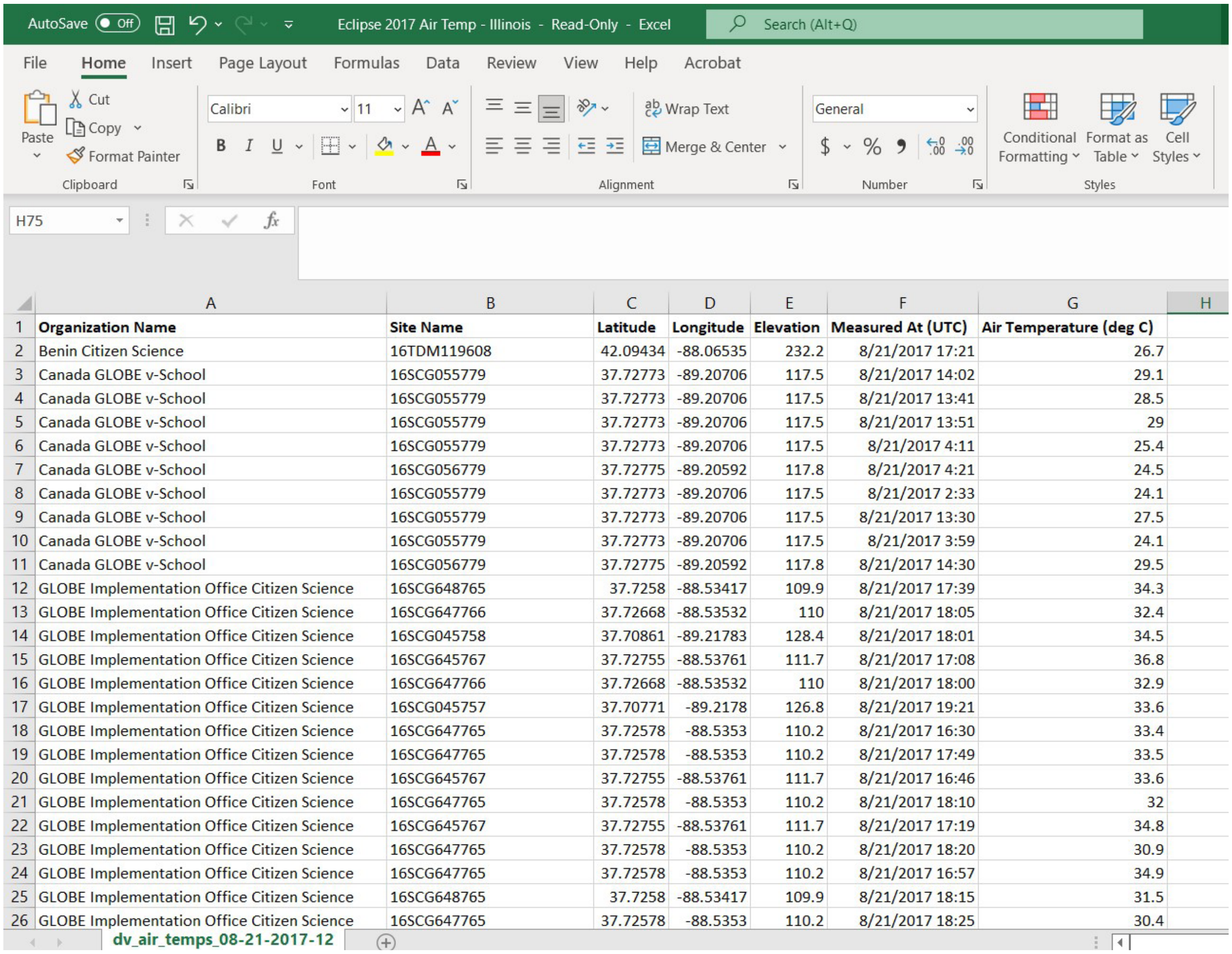
- **Raw dataset**
- **2017 Eclipse Path and Timeline Map**

National STEM Standards

- MS-ESS1-1
- MS-ESS1-3
- CCSS.Math.Content.8.SP.A.1

Sun's corona visible during a total solar eclipse

Ensure that the datasets for each of the 14 states will open and are visible in your spreadsheet application. See image below.



	A	B	C	D	E	F	G
1	Organization Name	Site Name	Latitude	Longitude	Elevation	Measured At (UTC)	Air Temperature (deg C)
2	Benin Citizen Science	16TDM119608	42.09434	-88.06535	232.2	8/21/2017 17:21	26.7
3	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 14:02	29.1
4	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 13:41	28.5
5	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 13:51	29
6	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 4:11	25.4
7	Canada GLOBE v-School	16SCG056779	37.72775	-89.20592	117.8	8/21/2017 4:21	24.5
8	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 2:33	24.1
9	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 13:30	27.5
10	Canada GLOBE v-School	16SCG055779	37.72773	-89.20706	117.5	8/21/2017 3:59	24.1
11	Canada GLOBE v-School	16SCG056779	37.72775	-89.20592	117.8	8/21/2017 14:30	29.5
12	GLOBE Implementation Office Citizen Science	16SCG648765	37.7258	-88.53417	109.9	8/21/2017 17:39	34.3
13	GLOBE Implementation Office Citizen Science	16SCG647766	37.72668	-88.53532	110	8/21/2017 18:05	32.4
14	GLOBE Implementation Office Citizen Science	16SCG045758	37.70861	-89.21783	128.4	8/21/2017 18:01	34.5
15	GLOBE Implementation Office Citizen Science	16SCG645767	37.72755	-88.53761	111.7	8/21/2017 17:08	36.8
16	GLOBE Implementation Office Citizen Science	16SCG647766	37.72668	-88.53532	110	8/21/2017 18:00	32.9
17	GLOBE Implementation Office Citizen Science	16SCG045757	37.70771	-89.2178	126.8	8/21/2017 19:21	33.6
18	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 16:30	33.4
19	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 17:49	33.5
20	GLOBE Implementation Office Citizen Science	16SCG645767	37.72755	-88.53761	111.7	8/21/2017 16:46	33.6
21	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 18:10	32
22	GLOBE Implementation Office Citizen Science	16SCG645767	37.72755	-88.53761	111.7	8/21/2017 17:19	34.8
23	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 18:20	30.9
24	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 16:57	34.9
25	GLOBE Implementation Office Citizen Science	16SCG648765	37.7258	-88.53417	109.9	8/21/2017 18:15	31.5
26	GLOBE Implementation Office Citizen Science	16SCG647765	37.72578	-88.5353	110.2	8/21/2017 18:25	30.4

Sample dataset provided by GLOBE showing data collected by reporting sites.

Review the table below which provides a description of the data contained in each column of the spreadsheets. This will help students understand the data reported from each site.

Included Columns	Description
Organization name	The organization who reported the data. If there isn't a name, the default name will be, "United States of America Citizen Science." Multiple organizations could have the same name.
Site name	Reporting stations are assigned a unique code. All data reported with the same site name code will be from the same reporting station and exact geographical location.
Latitude	Coordinates used to find the geographical location of the reporting site.
Longitude	Coordinates used to find the geographical location of the reporting site.
Elevation	Elevation of the reporting site in meters.
Measured at (UTC)	The date and time the air temperature was recorded by the reporting site in Coordinated Universal Time (UTC). The map gives time in UTC and the four time zones of the contiguous states.
Air temperature (deg C)	The air temperature in degrees Celsius recorded by the reporting site at the given time.

- Teach students to sort the data alphabetically. This is usually done by right-clicking at the top of a column, selecting "Sort," then selecting "Sort A to Z" within the drop-down menu
- Use the coordinates of a reporting station to find its geographic location on a map and estimate its distance from the path of totality located on another map
- Isolate all the rows of data from a single reporting station by either copying and pasting those rows into a separate spreadsheet or by deleting unwanted rows
- Have students graph the time vs. temperature of their chosen reporting station. Students can do this manually with pencil and paper or by generating it automatically from within the spreadsheet application. There are several online tutorials to guide students through automatically creating graphs from spreadsheet data. Students may need to delete all data except the time from the Measured At (UTC) column for the spreadsheet application to properly generate the graph.

Introduce the Investigation

Share the "Background Information" section located at the beginning of the "Student Handout" section of this activity with your students.

Discuss the events within the solar system that cause a solar eclipse.

Discuss how a solar eclipse impacts the locations in the path of totality on Earth. Ask students what it will look and/or feel like. Will it affect any other senses?

Ask your students how they think local temperatures may be affected by a total solar eclipse. Why? Have them formulate a hypothesis statement: "I believe local temperatures will __________ during a total solar eclipse, because _________."

Discuss citizen science as referenced in the Curriculum Connection section of this activity. Inform students that this activity uses raw datasets collected from various volunteers across 14 states as part of a citizen science project conducted by GLOBE (Global Learning and Observations to benefit the Environment Program) that occurred during the total solar eclipse which crossed the United States on August 21, 2017. GLOBE is a NASA-sponsored, worldwide program that brings together, students, teachers, scientists, and citizens to promote science and learning about the environment. Your student's objective is to determine whether the data supports the hypothesis that local temperatures are affected during a total solar eclipse. To do this, students must analyze data from various reporting stations, organize the data in a meaningful order, such as grouping each station's reports together, to identify a suitable reporting station, and graph the reported temperatures of that station during the time of the total solar eclipse.

The student's first objective is to identify a suitable reporting station. For the purposes of this activity, a suitable reporting station meets the following criteria:

- Must be from a single reporting station and not data combined from multiple reporting stations
- Must be within the solar eclipse's path of totality (within 50-60 miles of the centerline of the eclipse path)
- Must have reported an adequate number of temperature readings (about 50-100 readings)
- Reported temperatures must have taken place over a period of at least two hours to show the temperature before, during, and after totality

Question	Possible Answers
Why must temperatures from only one reporting station be used?	• A variety of factors can cause temperatures to vary from location to location, even only a few miles away. Using only a single reporting station helps to ensure that variations in temperature were caused only by the eclipse. • Different reporting stations may use different instruments, calibrated differently, resulting in different temperature readings. • It is always beneficial to limit the number of variables in any scientific study or experiment.
Why are you looking for reporting stations close to the centerline of the path of totality?	• If a total solar eclipse causes the temperature to drop due to the lack of sunlight, reporting stations just outside the path of totality may not experience a significant drop in temperature. • The closer you are to the centerline of the path of totality, the longer the total eclipse will last. This may increase the eclipse's effects on the temperature at these locations.
Why is it important to find a reporting station with many temperature recordings over a long period of time (at least two to three hours)?	• Only a few temperature recordings may not be enough to analyze and understand how the temperature reacted to the eclipse. • If the temperature recordings were too close together, or just during the time of totality, it would be difficult to see the effect on the temperature over the entire eclipse.

Facilitate the Investigation

Part One: Organizing Data

1. Discuss the following questions with your students:

2. After arranging students into groups, guide them through downloading the raw dataset. The raw dataset includes 14 different spreadsheets, one for each state within the path of the totality. Have each group choose one of the 14 states and open the corresponding spreadsheet. Discuss with students the meaning of each column and row as outlined in the preparation section above.

3. Instruct students to automatically sort the data by the reporting station's Site Name. Tips on how to do this are included in the preparation section above. Remind students the Site Name is a unique code given to each reporting station. The Organization Name is the name chosen by each reporting station. However, if no name was chosen by the reporting station, the name "United States of America Citizen Science" was assigned to the reporting station by default. Several reporting stations have this default name, making it difficult to identify individual reporting stations if the data is sorted by Organization Name.

4. After the students sort their dataset by Site Name, have them scroll through the data to identify reporting stations with 50 to 100 temperature reports. If students cannot identify a single reporting station with 50 to 100 temperature reports, they may need to choose a different spreadsheet from one of the other states.

5. Have students use the coordinates for a selected reporting station and find its location using an online map-searching website. Then, compare the reporting station's location to the path of totality on the 2017 solar eclipse path map. Students can zoom in and out on the map to easily find the location of their chosen reporting station and see if it lies within the path of totality. Additionally, students can use the map's scale to estimate the distance between their chosen reporting station and the path of totality. If the reporting station lies farther than 50-60 miles from the centerline of the path of totality, the reporting station may not have experienced a total solar eclipse and the temperature change experienced at that reporting station during the eclipse may not be as dramatic as those closer to the centerline of totality. Advise students to select a different reporting station if their reporting station lies too far beyond the centerline of the path of totality.

6. Once students select a suitable reporting station, they will need to isolate all the reports from that station to analyze. Instruct students to either copy and paste all rows and columns of data reported by their specific reporting station and place them into a separate spreadsheet, or to highlight and delete all rows and columns of data reported by other reporting stations on the spreadsheet. Once this is complete, students should have a clean, organized dataset of temperature reports from only their chosen reporting station.

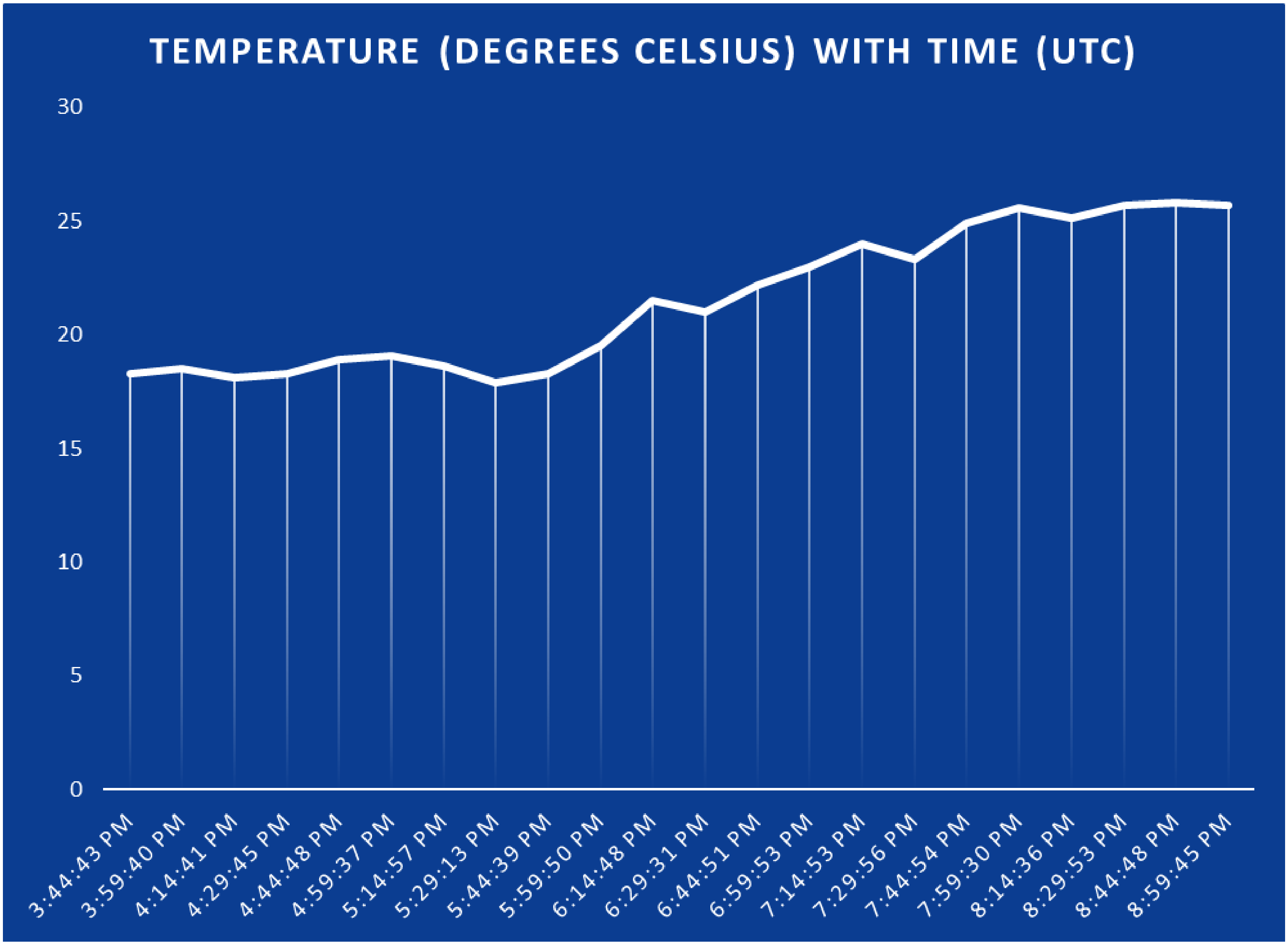
Part Two: Visualizing and Analyzing Data

1. Students now have a table of reported temperatures at specific times from their reporting stations during the 2017 eclipse. They can graph this data to show the change of temperature visually over the entire solar eclipse at their reporting station. Have the students either create these graphs manually or generate them automatically using their spreadsheet application. Students may have to delete the date so only the time is shown within the Measured AT (UTC) column for their spreadsheet application to generate a graph properly. Having more than one value in each cell may cause issues for some applications.

	A	B	C	D	E	F	G	H
1	Organization Name	Site Name	Latitude	Longitude	Elevation	Measured At (UTC)	Air Temperature (deg C)	
2	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	12:14:49 AM	27	
3	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	12:29:31 AM	28.1	
4	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	12:44:50 AM	27.5	
5	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	12:59:35 AM	27.2	
6	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	1:14:19 AM	27	
7	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	1:29:43 AM	26.8	
8	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	1:44:33 AM	26.5	
9	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	1:59:14 AM	25.9	
10	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	2:14:34 AM	25.8	
11	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	2:29:49 AM	25.2	
12	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	2:44:43 AM	25	
13	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	2:59:39 AM	24.6	
14	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	3:14:26 AM	24	
15	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	3:29:28 AM	23.5	
16	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	3:44:25 AM	23	
17	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	3:59:19 AM	22.6	
18	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	4:14:43 AM	22.1	
19	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	4:29:53 AM	21.8	
20	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	4:44:53 AM	21.7	
21	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	4:59:52 AM	21.6	
22	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	5:14:37 AM	21.4	
23	Lourdes Public Charter School	School Site:ATM-02	44.7225	-122.6898	188.3	5:29:24 AM	21	

Sample data set showing the date removed reporting times.

2. Once the graphs have been created, students should be able to see a trend in the temperatures of their reporting stations. Ideally, the temperature should steadily drop as the solar eclipse progresses, with the sharpest drop during the minutes of totality. Then, during the second half of the eclipse, as the Sun begins to reappear, temperatures should rise back to where they were before the eclipse. However, this may not be the case with every reporting station. Several factors can affect the reported temperatures, such as local weather conditions of the reporting station, the reporting station's distance from the centerline of the eclipse, or the accuracy of the recording instruments. Discuss these factors and how recorded and reported data doesn't always follow the expected result for an experiment.



Sample of graphed temperature data

3. Have students analyze their graph, predict the time of totality to the closest five minutes, and record their predictions on the student handout. Ideally, the time of totality will be just before the temperature reaches its lowest point. Then, have students look again at the location of their reporting station on the 2017 solar eclipse map. The green lines running perpendicular to the path of totality on the map correspond to the times of totality at the top of the map.

Map of the path of totality and times of occurrence of the of the total solar eclipse over North America on August 21, 2017.

Zoomed in image of solar eclipse map that shows green lines corresponding to times of totality along eclipse path.

4. Have students determine how close their predicted time of totality was to the time depicted on the map and record the actual time, as well as the difference, on the student handout.

5. Have students analyze their graphs to depict the maximum temperature decrease at their reporting station during a window of one hour before and one hour after totality. Have students record this temperature difference on the student handout.

Part Three: Sharing and Discussing Findings

1. Indicate that additional analysis can be completed from the datasets if students share their findings and compile their data together. Create a common chart on the board for each group to write the following information about their reporting site:
   - Site Name
   - Estimated distance from the centerline of totality
   - Elevation
   - Maximum temperature change

   You may also consider having all groups mark the location of their reporting station on a common map of the path of totality of the 2017 solar eclipse, so that the class as a whole can visualize the reporting station locations and relative distances to the path of totality.

2. Have the students analyze the distance from the centerline of totality compared with the maximum temperature change for all the reporting stations. Can they find any correlations? Discuss the correlations, if any, and how these relate to the hypothesis that a solar eclipse has a temporary effect on local temperatures, as well as how proximity to the centerline of totality affects the degree to which the temperature is affected.

3. Have students analyze the elevation of the reporting stations compared with the total temperature changes for those stations. Ask again, is there any correlation? What is the correlation, and what could be the potential cause?
   - Potential Answer: Higher elevations have thinner air and hold less heat energy making them more susceptible to changes in temperature due to sudden decreases in sunlight.

4. Ask students the following question:
   - What seems to be the larger factor in determining the amount of temperature change a reporting station experienced: elevation, distance from the centerline of totality, or is there an inability to tell from the data?

5. Have students reflect on the following:
   - How is the accuracy of the data you started with related to your end results?
   - What are some challenges associated with data analysis that can occur with inaccurate data?

6. Ask students the following question:
   - What addition questions to you have about eclipses and their impact on temperatures?

CURRICULUM CONNECTION

NASA Citizen Science

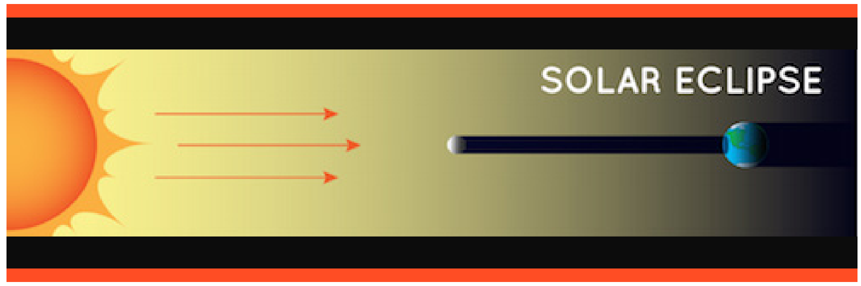
Everyday members of the public collected the data for this activity during the August 21, 2017 solar eclipse. They reported this data to the GLOBE Program, a NASA-sponsored organization with many citizen science opportunities. Sometimes, NASA needs help from volunteers to assist in all kinds of observation and data analysis projects. These projects can be anything from tracking items in our solar system, studying images from space, or even reporting observations of one-time events, like the 2017 solar eclipse. NASA is constantly analyzing and collecting data, but also needs help collecting more. If you are interested in opportunities where you can contribute to collecting NASA data, check out NASA's citizen science website at **https://science.nasa.gov/citizen-science/**.

Additional Resources

- NASA Solar Eclipse website: **https://science.nasa.gov/eclipses/**
- NASA 2017 solar eclipse path of totality video: **https://svs.gsfc.nasa.gov/4515/**
- Detailed maps of 2017 eclipse path over each state: **https://eclipse2017.nasa.gov/eclipse-maps**

Background Information

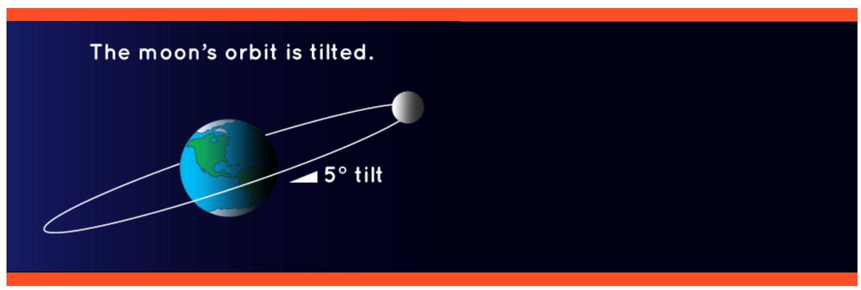
What is a Total Solar Eclipse?



A total solar eclipse is a rare phenomenon during which the Sun, Moon, and Earth align in such a way that the Moon travels directly between the Sun and Earth, covering the Sun from view, and casting a narrow shadow that travels across the surface of Earth known as the path of totality. Even though the Sun is four hundred times larger than the Moon, it is also four hundred times farther away from Earth. This unique coincidence is why the Moon and Sun appear to be the same size in our sky.

If you are in the path of totality during a solar eclipse, the Moon will completely obstruct your view of the Sun, and for a few minutes, it will become nearly completely dark. The only remaining visible part of the Sun will be the relatively cooler outer atmosphere which glows with a dim, white light around the Moon. This circular halo is known as the Corona and is only visible to those directly in the path of totality during a solar eclipse.

Why Doesn't a Solar Eclipse Happen Every Month?



A solar eclipse can only occur during the new moon phase of the lunar cycle. During this phase, the far side of the Moon is illuminated by the Sun, and the near side is completely in shadow, making the Moon nearly invisible to us on Earth. As it travels unnoticed across the daylight sky, the Moon passes the Sun, usually above or below where we observe it in the sky. This is because the Moon's orbit around Earth is tilted 5° from Earth's orbit around the Sun, meaning the path of the Moon and Sun are usually not aligned in the sky. Occasionally, however, their paths do cross, causing a solar eclipse.

Effects of a Solar Eclipse

Along the path of totality, during the total solar eclipse on August 21st, 2017, the Sun was blotted out by the Moon, and a 360° sunset glowed from every direction. Nocturnal animals like crickets began their night-time activities while stars could be seen in the middle of the day. Even for those outside the path of totality, extra-sharp shadows were cast by the partially eclipsed Sun, and projections of the crescent shaped Sun could be cast through holes.

Incoming solar radiation warms the surface of Earth, increasing the temperature during the day and causing a cooler temperature at night. During a solar eclipse, the Moon blocks this incoming solar radiation, preventing it from reaching Earth's surface. This localized decrease in solar radiation, could also affect the local temperatures during a solar eclipse. The purpose of this activity is to analyze data measured during the 2017 solar eclipse and determine if such effects on the local temperatures occurred.

YOUR INVESTIGATION

In this activity, you will work in groups to analyze raw temperature data collected during the August 21, 2017 total solar eclipse to determine what effects a total solar eclipse can have on local temperatures. Volunteer organizations collected the data for this activity as part of a citizen science project. This is raw, unorganized data, and you will be tasked to sort and organize it to find a suitable reporting station meeting certain criteria. The reporting stations are organized by state and there is no single correct reporting station. You may need to search multiple states' data sets to find a reporting station that provides adequate data for this activity.

A suitable reporting station meets the following criteria:

- Must be from a single reporting station and not data combined from multiple reporting stations
- Must be within the solar eclipse's path of totality (within 50-60 miles of the centerline of the eclipse path)
- Must have reported an adequate number of temperature readings (about 50-100 readings)
- Reported temperatures must have taken place over a period of at least two hours to show the temperatures before, during, and after totality

Part One: Organizing Data

1. Think of possible answers to the following questions as your teacher leads a discussion with your class:
   - Why must temperatures from only one reporting station be used?
   - Why are you looking for reporting stations close to the centerline of the path of totality?
   - Why is it important to find a reporting station with many temperature recordings over a long period of time?
2. Your teacher will give you instructions on downloading the raw dataset. This will include 14 different spreadsheets, one for each of the states within the path of the totality. Choose one of the 14 states and open the spreadsheet. You should see several rows of data in seven columns. Each row represents a single time and temperature report from a reporting station. Your teacher will discuss the meaning of the data in each column.
3. Your group's first task in organizing the raw data into a usable dataset is to sort the data. This makes it easier to decide what data is useful and what you can eliminate. Since you have already decided to only use data from a single reporting station, first sort the data so all the reports are grouped by reporting station. Your teacher will give you instructions on using your spreadsheet program to automatically sort the data by reporting Site Name.
4. After sorting by Site Name, scroll through the spreadsheet and look for individual reporting stations with about 50 to 100 temperature reports. If you have difficulty finding a station with enough temperature reports, you may need to choose a different spreadsheet from one of the other states.
5. Once you have found a reporting station with a suitable number of temperature reports, you will need to check to ensure the station was within, or very close to, the path of totality. Follow your teacher's instructions and use your selected reporting station's coordinates to find its location on an online map searching website. Then, compare the station's location to the **2017 solar eclipse's path of totality map**. Use the scale of the map to estimate the distance between your chosen reporting station and the path of totality. If the station lies beyond 50-60 miles from the path of totality, it may not have experienced a total solar eclipse, and the temperature change may not be as dramatic as stations closer to the centerline of totality. Your teacher may instruct you to find a different reporting station within or very close to the path of totality. After determining your reporting station was close enough to the centerline of the path of totality, record its estimated distance from the centerline in your handout.

CAREER CORNER

Carolyn Ng, Educations Specialist in the Heliophysics Science Division and member of the NASA Heliophysics Education Team (NASA HEAT)

Carolyn Ng is an Education Specialist and team member of the NASA Heliophysics Education Activation Team (NASA HEAT) at the NASA Goddard Space Flight Center in Greenbelt, Maryland. She supports heliophysics data inventory as well as curating and developing educational resources for learners of all ages, including supporting NASA in its solar eclipse coordination efforts. NASA employs educators to help students learn STEM concepts using NASA missions and research, just like this activity. To learn more about NASA HEAT and heliophysics, follow the link below.

NASA HEAT
NASA HELIOPHYSICS EDUCATION ACTIVATION TEAM

Learn more: **NASA HEAT**

6. After you find a suitable reporting station, you must eliminate all the other lines of data from other reporting stations to gain a clean, organized dataset of temperature reports from your chosen station. Follow your teacher's instructions to isolate the data from your selected reporting station.

Part Two: Visualizing and Analyzing Data

1. Congratulations! Now that you have a table of reported temperatures at specific times from your chosen reporting station, you can graph this data to create a visualization of the change of temperature during the solar eclipse at your reporting station. Follow your teacher's instructions on how to use your dataset to create the graph.

2. Once your graph has been created, you should be able to see a trend in the temperatures at your reporting station. Your teacher will lead a discussion with the class during which you can report any trends you see. Check to see if other groups saw a similar trend and discuss different factors that may cause recorded and reported data to differ from the expected result of an observation or experiment.

3. Analyze your graph and its temperature changes to predict the time of totality for your reporting station to the closest five minutes and record your predictions on the student handout. Then, look again at your chosen reporting station's location on the **2017 solar eclipse maps**. The green lines running perpendicular to the path of totality on the map lead to the times of totality at the top of the map. Use the green line closest to your reporting station and follow it to the top of the map to determine your location's actual time of totality. Record the actual time in the table below.

4. What was the difference between your predicted time and your reporting station's actual time of totality?

5. Now, analyze your graph to determine the maximum temperature change during the eclipse at your reporting station (highest reported temperature minus lowest reported temperature). Record this temperature difference in your student handout.

Recording Data	
Reporting site name	
Estimated distance from centerline of totality	
Predicted time of totality	
Actual time of totality	
Maximum change in temperature for reporting station	

Part Three: Sharing and Discussing Findings

1. Now that you have analyzed the data from your reporting station and have come to some conclusions, you can share your data with other groups and see what additional information can be obtained by compiling some of your data together. Have the following data from your student handout ready to share:
   - Site Name
   - Estimated distance from the centerline of totality
   - Elevation (located in the dataset)
   - Maximum temperature change

2. After all groups have added their data to the chart, analyze the distances from the centerline of totality compared to the maximum temperature changes for all the reporting stations. Do you see any correlations? Discuss the correlations, if any, and how it relates to how a solar eclipse temporarily affects local temperatures, as well as how proximity to the centerline of totality affects the degree to which the local temperature is affected.

3. Next, analyze the elevation of the reporting stations compared to the maximum temperature changes for those reporting stations. Once again, determine if there is any correlation? What is the correlation, and what could be the potential cause?

4. What seems to be the larger factor in determining the amount of temperature change at a reporting station: elevation, distance from the centerline of totality, or inability to tell from the data?

5. Reflect on your process of sorting and analyzing your data. How is the accuracy of the data you started with related to your end results? What are some challenges associated with data analysis that can occur with inaccurate data?

6. What additional questions do you have about eclipses and their impact on temperatures?

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