

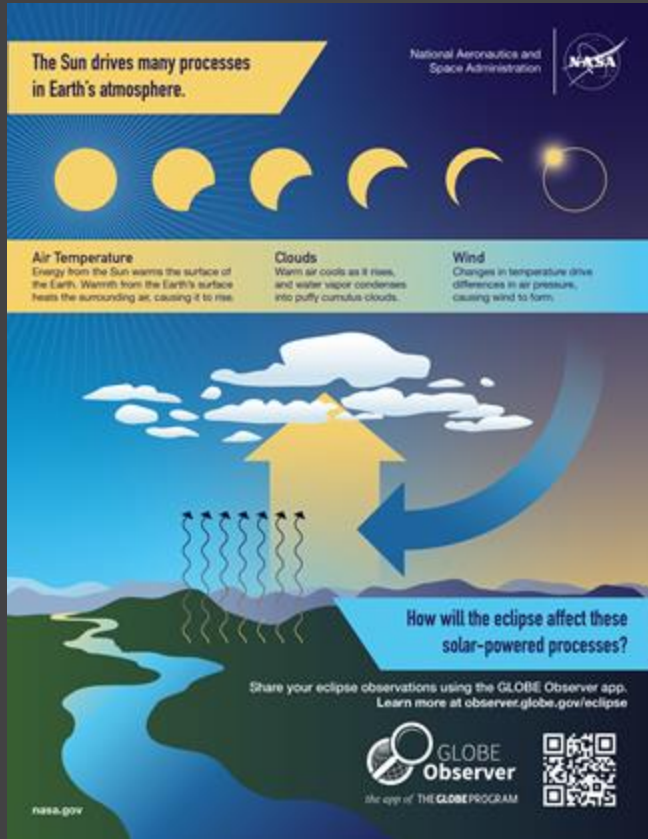
GLOBE Eclipse poster, available in the [Resource Library](#).

# GLOBE Eclipse: Preparing for 2023 & 2024

## Introduction & Safety



# The Earth Science Angle: Study eclipses as a volunteer observer with GLOBE



Energy from the Sun warms our planet, and changes in sunlight can also cause changes in temperature, clouds, and wind. What happens when the Sun is blocked by the Moon during an eclipse? How will the eclipse affect these solar-powered processes?

Diagram from the front side of a one-page document outlining the changes that might be observed during a solar eclipse, which is available on the [GLOBE Observer Eclipse website](https://observer.globe.gov/eclipse).

# Using the GLOBE Eclipse tool, volunteer scientists are able to:

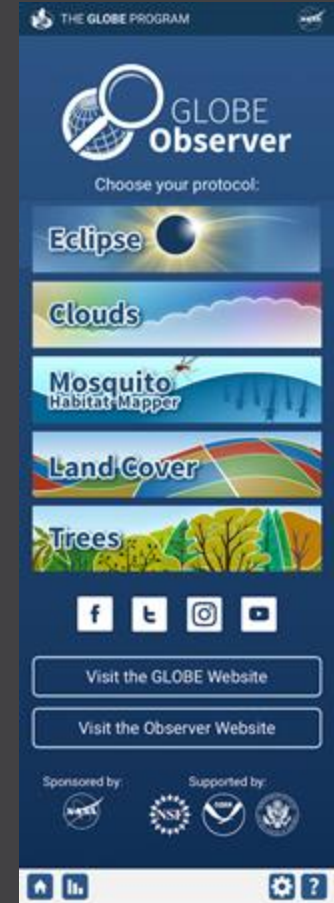
- Observe how the eclipse changes atmospheric conditions near you by reporting on clouds and air temperature



Taking clouds observations using the Clouds tool is always available in the GLOBE Observer app, and is incorporated into the observation prompts for the Eclipse tool. Credit: GLOBE Clouds Team, NASA LaRC



Above: A simple thermometer that can be used to take air temperature measurements. Credit: GLOBE  
Right: An example of what the home screen of the GLOBE Observer app will look like when the Eclipse tool is available. Credits: GLOBE



- Report surface conditions (photograph and describe the landscape) that may have an impact on differences in the atmospheric effects in varying locations



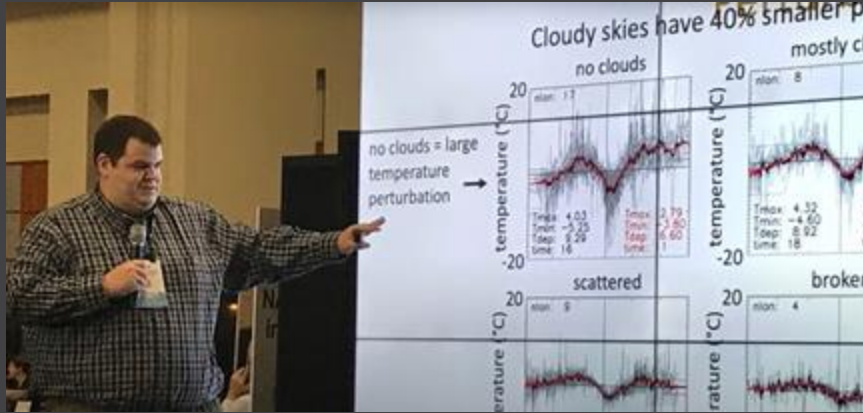
A participant using the GLOBE Observer app Land Cover tool to take photos of the surrounding landscape. Credit: GLOBE



A screenshot from the GLOBE Visualization System, <https://vis.globe.gov>, showing images of land cover taken around the United States. Credit: GLOBE

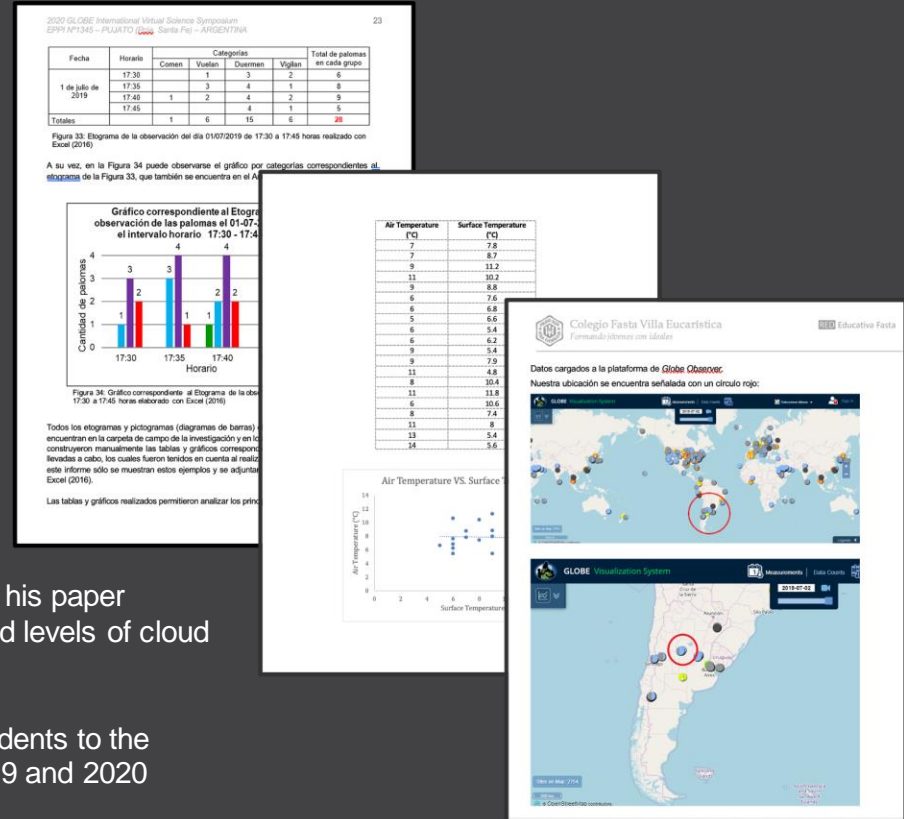


- Contribute to a citizen science database used by scientists and students to study the effects of eclipses on the atmosphere



Left: Dr. Brant Dodson (NASA Langley Research Center) presents his paper comparing the citizen science temperature data at different reported levels of cloud cover, [doi.org/10.1175/JAMC-D-18-0297.1](https://doi.org/10.1175/JAMC-D-18-0297.1)

Right: Pages from several of the research reports submitted by students to the GLOBE International Virtual Science Symposia after the 2017, 2019 and 2020 eclipses, [observer.globe.gov/eclipses#studentresearch](https://observer.globe.gov/eclipses#studentresearch)



- Provide comparison data even if not on the path of maximum eclipse

Eclipse shadow location  
is an estimation.

[View data animation](#)

Air Temperature (°C)



August 21, 2017 Eclipse  
Air Temperature Measurements



# Eye Safety During an Annular Eclipse



A solar eclipse watcher in Argentina in December 2020.  
Credit: Marta Kingsland

The Sun is never completely blocked by the Moon during an annular solar eclipse. Therefore, during an annular eclipse, it is never safe to look directly at the Sun without specialized eye protection designed for solar viewing.



A crowd uses handheld solar viewers and solar eclipse glasses to safely view a solar eclipse. Credit: National Park Service



View the eclipse  
with special solar  
viewing glasses



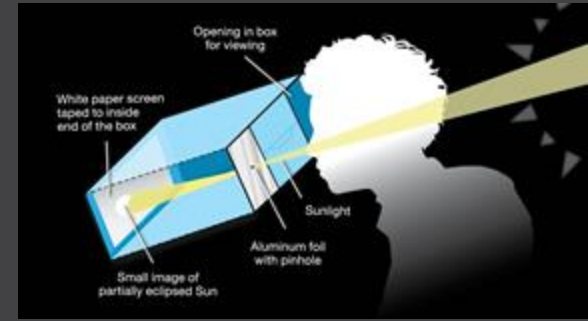
Regular sunglasses  
are not safe to view  
the eclipse



# Indirect viewing methods

If you don't have eclipse glasses or a handheld solar viewer, you can use an indirect viewing method, which does not involve looking directly at the Sun. For example, a pinhole projector or a colander or other object with circular holes. The GLOBE Eclipse cards also have a place where a hole can be punched to serve as an indirect viewer.

Read more on  
[NASA's Eclipse Safety page.](#)



You can make your own eclipse projector using a cardboard box, a white sheet of paper, tape, scissors, and aluminum foil. Credit: NASA



Left: A GLOBE Eclipse card used to project the Sun onto the ground. Credit: GLOBE Above: The circular holes of a colander project crescent shapes onto the ground during the partial phases of a solar eclipse. Credit: Joy Ng



# GLOBE Eclipse: Preparing for 2023 & 2024

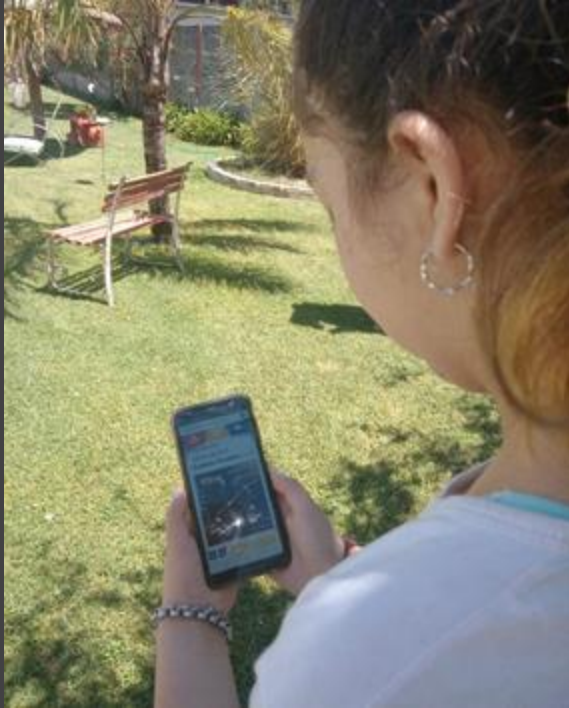
## App Basics



Materials laid out and ready to observe the eclipse in December 2020: the Eclipse tool in the app, solar viewing glasses, and a thermometer. Credit: Marta Kingsland



# Using the GLOBE Eclipse tool



Observer using the GLOBE Eclipse tool during the total eclipse in Argentina on 14 Dec 2020. Credit: Marta Kingsland



The app screen showing the countdown to the next observation, as well as an (optional) paper data sheet. Credit: Pablo Cecchi

Settings ✕

Please confirm your thermometer type:

Type of Thermometer: ▼

C F

Measurement Alarm: On

---

Location:  
39.0009, -76.9146

---

Do a Land Cover observation to characterize your location (include your thermometer in the down photo).

Land Cover

# Using the App: Configuration

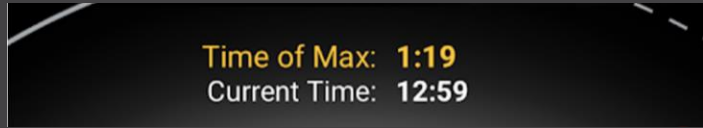
- Set the type of thermometer to be used (liquid filled, digital, weather station, other)
- Choose Celsius or Fahrenheit to display the temperature in the app (all data is stored in Celsius in the GLOBE database)
- Activate reminders for taking measurements
- Current location (automatically set)
- Take a Land Cover observation to tell us about the landscape where the observations are being collected



Example thermometers. Credit: GLOBE  
NOTE: A weather app does not count as "other" - you should have a separate physical thermometer.



# Using the App: Data Collection Screen



Top portion shows the time of maximum eclipse based on the current location



Buttons navigate to safety/intro pages, configuration/ settings (see previous slide), and a listing of the already collected data, respectively





# Using the App: Entering Temperature Data

Next Observation:  
9 mins 18 secs

Enter Data Now:

Display shows a countdown to the time for the next observation, or “Enter Data Now” when it’s time to collect another air temperature measurement. Tapping “Enter Data Now” brings up a selection menu for temperature values (right).



















# Using the App: Review/Edit Data



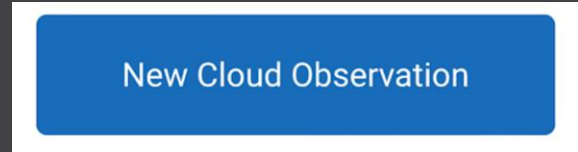
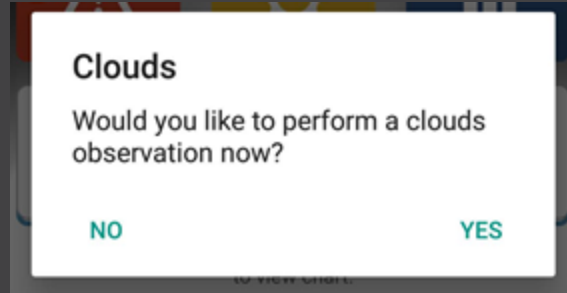
The graph icon goes to a listing of previously collected air temperature data, with options to edit or delete data points if needed.

The screenshot shows the Data screen in the Eclipse app. It has a title bar 'Data' with a close button (X). Below the title bar is a section titled 'Air Temperature Observations'. The table lists observations with time, temperature, and edit/delete options.

Air Temperature Observations		
11:57 am	27.5° C	 
12:07 pm	27.3° C	 
12:17 pm	27.2° C	 
12:27 pm	27.2° C	 
12:37 pm	27.1° C	 
12:42 pm	27.0° C	 
12:48 pm	26.8° C	 
12:53 pm	26.6° C	 



# Using the App: Clouds Data



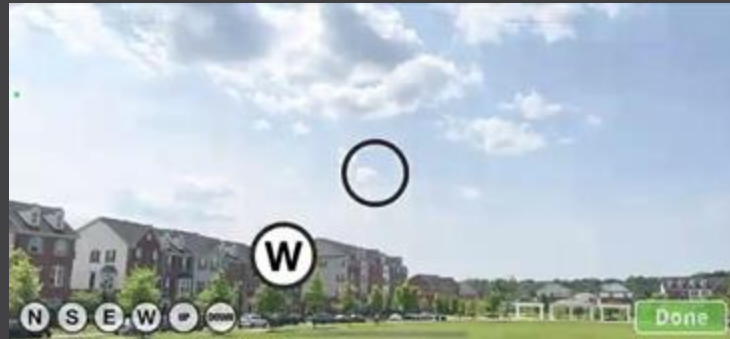
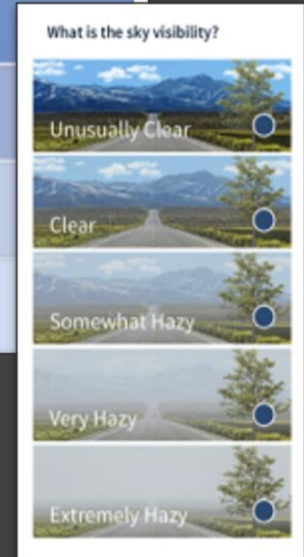
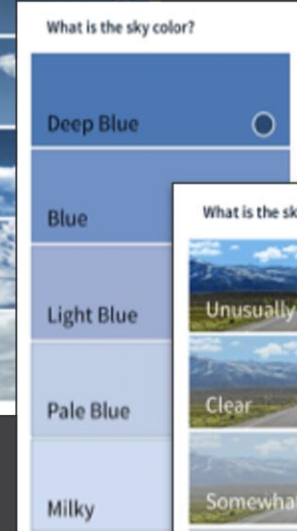
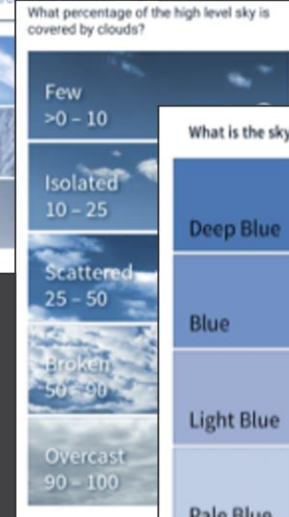
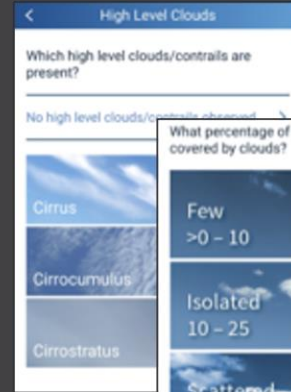
Periodically, the app will also pop up a reminder to take an observation of clouds, although users are also encouraged to take an observation at any time if they notice something changing in the cloud conditions (New Cloud Observation button).

# Taking a Clouds Observation



Steps to observe:

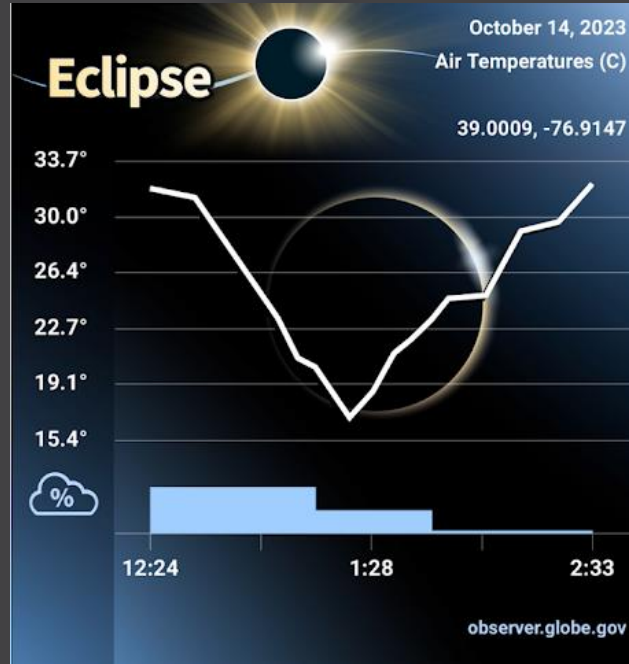
- Overall cloud cover
- Sky conditions
- Cloud types, cloud cover, and opacity by height
- Take photos



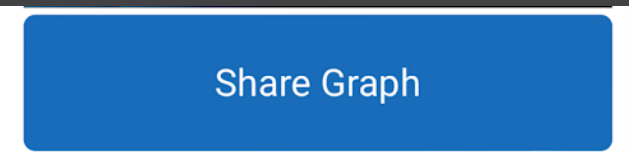





# Using the App: Graphing the Data



The graph will update as new data points are added, both for air temperature and overall cloud coverage.



The "Share Graph" button allows easy sharing to social media.



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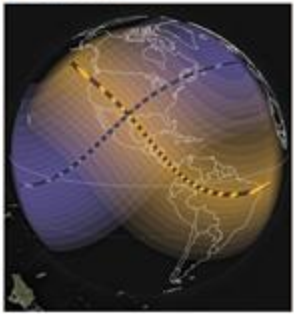
## What is GLOBE Eclipse?



GLOBE Eclipse is a temporary tool in the GO app that will help you document air temperature and clouds during an eclipse. The tool is not visible in the app on a regular basis, but is only opened up when a solar eclipse is happening somewhere in the world. The Eclipse tool will prompt you to take air temperature measurements using a meteorological thermometer, as well as taking regular observations of sky conditions using the Clouds tool. For more details about equipment needed, how to take observations, and frequently asked questions, visit the [Taking Observations](#) page. Our [Resource Library](#) includes additional activities, references and videos.


*Image source: GLOBE School Colegio Fasta Villa Eucarística in Argentina, taken during the July 2019 eclipse.*

On 14 October 2023, an annular eclipse ☾ will take place in North, Central and South America. The path of maximum eclipse will be across parts of the United States, Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panama, Columbia and Brazil (the path from upper left to lower right with yellow circles in the diagram below). A partial annular eclipse will be visible in Canada, and other parts of Central and South America. This map of the 2023 eclipse ☾ shows the percentage of obscuration for any location.



Learn More

Find more details, including activity guides and extended opportunities for data collection, on the Eclipse page of the GLOBE Observer website, [observer.globe.gov/eclipse](https://observer.globe.gov/eclipse)



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## Eclipse Resource Library

[Salta a recursos en español](#)




**Annular Eclipse Fact Sheet - 14 October 2023**

On 14 October, 2023, an annular solar eclipse will cross North, Central, and South America. Visible in parts of the United States, Mexico, and many countries in South and Central America, millions of people in the Western Hemisphere can experience this eclipse. This fact sheet, available to download in color and grayscale, provides information about eclipses and how to watch this one safely.

[PDF File - English](#)

[Archivo PDF - Español](#)



**Exploring the Solar System: Solar Eclipse**

"Exploring the Solar System: Solar Eclipse" is a hands-on activity demonstrating how the particular alignment of the Sun, Earth, and Moon can cause an eclipse. Visitors investigate the positions of these objects to create shadows and learn about solar eclipses. This activity was designed specifically in advance of the total solar eclipse that will traverse the continental United States in August, 2017, but can be used anytime. Las actividades también están disponibles en español.




**GLOBE Eclipse Pinhole Postcard**

Dual-language (English and Spanish) postcard about observing the eclipse with GLOBE Observer, with a space in the middle that can be punched out to use as a pinhole projector. The text reads: "Energy from the Sun warms our planet, and changes in temperature lead to the formation of clouds and wind. What happens when the Sun is blocked by the Moon? Download the GLOBE Observer app to share your observations during the eclipse. Never look directly at the Sun! Project the eclipse onto a nearby surface using the hole in this card."


# Additional Resources

The Eclipse Resource Library has a number of useful resources aimed at individual observers, and we will add more as they are developed.


También hay una sección de recursos en español.



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Citizen scientists contributed over 80,000 air temperature measurements and nearly 20,000 clouds observations during the 2017 solar eclipse across North America, as well as hundreds of additional observations during the 2019 and 2020 eclipses in South America. The Eclipse tool will next be active in the GLOBE Observer app for the annular eclipse in October 2023. In the meantime, you can analyze eclipse data with your participants or start preparing for an upcoming solar eclipse.

### Analyze Eclipse Data

Did your museum or library host a big event for the 2017 eclipse? Invite your participants back to take a look at the observations collected by citizen scientists. [Learn more about accessing and analyzing eclipse data.](#)


### Upcoming Eclipses

**14 October 2023 - Annular Eclipse across North, Central and South America**  
**8 April 2024 - Total Solar Eclipse across North America**

For more information about how to take observations, visit the [GLOBE Eclipse landing page](#).

### Eclipse Facilitator Resources

For more resources geared toward individual observers, visit the [Eclipse Resource Library](#) (incluyendo recursos sobre eclipses en español).




#### GLOBE Eclipse Presentation: Introduction, Safety & App Basics

A presentation giving an introduction to GLOBE Eclipse: the Earth science angle on eclipses and why to study them with citizen science observations, eclipse viewing safety tips, how to use the GLOBE Eclipse tool in the app, and some supplemental observing tips.

[PDF file \(1.4 MB\)](#)

[PPTX file with embedded videos \(42 MB\)](#)

[Google Slides deck \(will require making a copy\)](#)



[Learn more about the upcoming annular eclipse on the NASA Eclipse page.](#)

# Lead a Program

The Eclipse Toolkit for Informal Educators has resources specifically for facilitators, and more are coming.





Download the app from the Apple App Store or Google Play.



Get the latest information as the eclipses approach by following us on social media:

- [facebook.com/TheGLOBEProgram](https://facebook.com/TheGLOBEProgram)
- [twitter.com/GLOBEProgram](https://twitter.com/GLOBEProgram)
- [instagram.com/globeprogram](https://instagram.com/globeprogram)

Contact the GLOBE Observer team with any questions.



Making notes during the December 2020 eclipse in Argentina. Credit: Ana Prieto

# GLOBE Eclipse: Preparing for 2023 & 2024 Supplemental Observation Tips



# Air Temperature Tips: Timing

- Ideally, take a measurement at least every ten minutes for two hours before and after maximum eclipse
- If you can, increase that to every five minutes for the half hour before and after totality or the maximum eclipse at your location.

Stop taking measurements during the maximum eclipse/totality to enjoy the experience!



Image of the solar corona taken in Argentina on 14 December 2020. Credit: Science Club Huechulafquen, Junín de los Andes, Argentina

- If you want the full temperature curve to appear in your graph, make sure you keep taking observations after the point of maximum eclipse.

# Air Temperature Tips: Choosing a Thermometer

- Make sure you have a separate thermometer of some sort, whether digital or liquid-filled. Don't rely on a weather app on your phone, as that could be pulling data from a weather station some distance away.



Example thermometers. Credit: GLOBE

- GLOBE has a [list of equipment suppliers for North America](#), but many available thermometers are acceptable. Look for one with with an accuracy of  $\pm 0.5^{\circ}\text{C}$  (and  $0.5^{\circ}\text{C}$  divisions for liquid filled models).



# Air Temperature Tips: Accuracy of Measurements

- Using an instrument box is ideal, but if that isn't possible, make measurements in the shade (even your own shadow will help)



A mounted instrument box being checked by GLOBE students.  
Credit: GLOBE



Examples of taking the current temperature in the shade: Holding a simple liquid-filled thermometer in your shadow (left) or propping up a digital thermometer in a tree (right). Credit: GLOBE



# Air Temperature Tips: Thermometer Calibration

For maximum accuracy, check the calibration of your thermometer.

- Prepare a mixture of fresh water and crushed ice with more ice than water in a container.
- Put the thermometer in the ice-water bath and let sit for about 10 minutes.
- Read the thermometer. If it reads between  $-0.5^{\circ}\text{C}$  and  $+0.5^{\circ}\text{C}$ , the thermometer is fine.



Testing the calibration of a liquid filled thermometer and a digital thermometer at the same time. Credit: GLOBE

# Clouds Observations for the Eclipse

- Make observations about every 15-30 minutes, more often if you wish, especially any time you notice something changing.
- If you are also measuring air temperature, the eclipse tool will remind you with notifications to make your measurements about every third air temperature measurement.
- Feel free to add narrative comments to your photos about anything interesting you see happening.



Taking a Clouds observation with a mobile device. Credit: Lindsey Weaver



Students from Colegio Fasta Villa Eucarística, Córdoba, Argentina observing the July 2019 eclipse. Credit: Pablo Cecchi

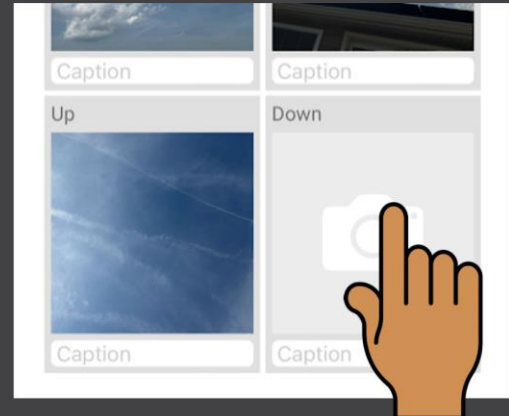
# Basic Wind Observations

- A simple rod and a ribbon (a wind stick) can be a way to visually estimate if the wind is increasing or decreasing, or changing direction
- Include your stick in the down photo of any clouds observations you take to document the changes during the period of the eclipse.



Images of a wind stick showing progressively stronger wind from left to right.  
Credit: AREN Project

Tip: Using the manual photo option for your down photo may make it easier to capture the wind stick fully.





# Land Cover Observations

- We ask you do to a Land Cover observation as part of the initial setup when you open the Eclipse tool to help with research questions that may look at the effect of different types of surface cover on temperature changes during the eclipse.
- As part of that site setup, please include your thermometer in one of your photos, which will allow us to confirm the type you are using for air temperature measurements.



A photo from a land cover observation.  
Credit: GLOBE



A person taking a land cover observation.  
Credit: GLOBE



A digital thermometer included in the down photo of a land cover observation.  
Credit GLOBE


# General Notes

- You should download the app and set up your account ahead of time, but you don't need to have wifi or cellular signal to collect data (can collect and send later).
- Cloud and land cover observations are always available in the GLOBE Observer app, so you can practice those types of observations ahead of time. For basic app users, air temperature will become available closer to each eclipse.



# Qualitative Observations

- In addition to adding narrative comments to the photo captions in a Clouds observation, or to the field notes in a Land Cover observation, we also have a paper Solar Eclipse Journal page available in the [Eclipse Resource Library](#) on the GLOBE Observer website.
- This can serve as an organizer for your thoughts or simply inspiration for creating your own style of eclipse journal page.


National Aeronautics and Space Administration 

## Solar Eclipse Journal

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Location: \_\_\_\_\_

What does the Sun look like? These circles represent the Sun. Shade in how much of the Sun is covered by the moon at different times.

Max Cover:  %



Start Time:  Max Time:  End Time:

What is going on around you? Describe or draw other things you notice at different times during the eclipse. What are birds or other animals doing? What is the weather like (clouds, temperature, wind)?

At Start	Around Max	At End
<div></div>	<div></div>	<div></div>

Share cloud and air temperature data with NASA during the eclipse with the GLOBE Observer app. [Learn More: observer.globe.gov](#)

**Safety First:** It is never safe to look directly at the Sun. The only safe way to look at the Sun is through special-purpose solar filters, such as "eclipse glasses" or hand-held solar viewers.

[www.nasa.gov](http://www.nasa.gov)

