

# Cloud Quest

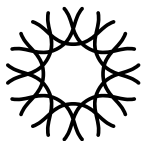
Activity Leader Guidebook



*This guidebook belongs to: \_\_\_\_\_*

*GLOBE Observer username: \_\_\_\_\_*

*GLOBE Observer password: **Jellyfish123***



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# WHAT IS SCIENCE ACTION CLUB?

[Science Action Club](#) (SAC) is a nationwide STEM program for middle school youth in out-of-school time. We provide afterschool staff with in-depth training, teaching kits, and best practices for informal STEM education. Our goal is to get middle school youth outside, connected to nature, and contributing to citizen science research.

## What is Citizen Science?

Citizen science is a global movement in which scientists and the general public collaborate to answer some of the most pressing questions about our planet. Many big scientific questions require more data than one single scientist, or even a team of scientists, could collect. In SAC, youth will collaborate with NASA and contribute to the GLOBE database of observations. Through citizen science, anyone can learn the process of science and make valuable contributions.

## What is GLOBE Observer?

[GLOBE Observer](#) is an international network of scientists and students working together to study how clouds affect Earth's environment. By observing the sky from the ground and reporting what you see, citizen scientists like you can help NASA researchers track changes in sky and cloud conditions to support Earth science research. Clouds affect weather and climate by controlling the flow of energy through Earth's atmosphere. Since clouds can change rapidly, scientists need frequent observations from citizen scientists to better understand cloud cover over Earth's surface.

## School-day Standards

The activities in this guidebook support the Next Generation Science Standards (NGSS).

## No Experience Necessary!

Just like citizen science, this guidebook is designed to be accessible to everyone, even those with little-to-no science background. Each activity plan includes step-by-step instructions and techniques for engaging youth in fun science exploration. The focus is on curiosity, investigation, and community. Through these experiences, youth and activity leaders learn and discover together.

## Educator Portal

Visit [sacportal.calacademy.org](http://sacportal.calacademy.org) to access the *Cloud Quest* training, flyers, forms, guides, and other helpful resources.



























A NASA CloudSat satellite

# SUGGESTED PROGRAM TIMELINE

Responsibility	Description	Due Date
Complete the online training	This required online training is interactive, fun, and will help you succeed as an activity leader. Use the SAC guidebook and teaching kit to follow along as you learn.	Before the first club meeting session
Identify an outdoor location	You are responsible for finding an outdoor space where youth can look for clouds. Ideally, the space should be within a five-minute walk of your club. Ask your program supervisor for support, if needed.	Before the first club meeting session
Secure technology equipment	In order to participate in citizen science, your club will need at least one mobile device and a working internet connection. A projector and speakers are also highly recommended. Check with your supervisor to make sure you have access to digital technology during SAC time.	Before the first club meeting session
Recruit youth	SAC is more fun when the club is full. Use the <a href="#">SAC Youth Flyer</a> to recruit 15 to 20 youth.	Before the first club meeting session
Connect with families	Once youth are enrolled, send home the <a href="#">SAC Letter to Families</a> . Download and edit the template to fit your audience and include your own details.	Once youth are enrolled
Lead Science Action Club activities	There are 12 <i>Cloud Quest</i> activities. To prepare for each activity in advance: <ul style="list-style-type: none"> <li>• Read activity instructions in the guidebook.</li> <li>• Gather the materials needed.</li> <li>• Revisit the online training, if necessary.</li> </ul>	Before you lead each SAC activity
Submit citizen science observations	Citizen science is an essential part of Science Action Club. Remember to submit your club's observations to GLOBE Observer regularly. If you need help navigating GLOBE Observer, check out the <a href="#">Sky Survey video guide</a> .	During Activities 4-12
Record and share feedback	In your guidebook, jot down any highlights, challenges, or notes to remember for next time. Then, send your attendance and feedback to SAC so we can continue to improve and grow the program. You can do this using the hyperlinks or QR codes in the guidebook.	After completing each activity
Celebrate!	Invite your supervisor and/or families to stop by your last SAC session and celebrate with your club. Remember to sign SAC certificates of success.	

# ACTIVITY SUMMARIES

Title	Activity Mission	Not Recommended	
Activity 1: Get to Know a Cloud	Design and build a model cloud.		
Activity 2: Build a Satellite	Design and build a model satellite.		
Activity 3: Ground Truthing	Ground truth your surroundings.		
Activity 4: A Closer Look at the Sky	Hone your cloud observation skills.		
Activity 5: Connect to NASA	Collect data about clouds to help NASA conduct Earth science research.		
Activity 6: Rocket Science	Build and launch a model rocket.		
Activity 7: Drain to Rain	Trace a drop of water through the water cycle.		
Activity 8: Measure the Wind	Test the wind speed.		
Activity 9: Erupt a Volcano	Build and erupt a volcano.		
Activity 10: Fly a Kite	Design and build a kite that can fly.		
Activity 11: Green Design	Design an eco-friendly building.		
Activity 12: Cloud Conclusions	Summarize the data from your sky surveys.		



# KIT MATERIALS

## A

1	<i>Altitude Axis</i>
10	<i>Build an Anemometer</i> handouts
4 sets	<i>Cloud Cover Categories</i> cards
10	<i>Cloud Cover</i> grids
4 sets	<i>Cloud Cover</i> photos
2 sets	<i>Cloud Identification</i> cards
1	<i>Cloud Quiz Show</i> scorecard
2 packs	color construction paper
5 sets	<i>Design a Satellite</i> cards
5	<i>Design a Satellite</i> handouts
20	<i>Drain to Rain</i> maps
1 set	<i>Drain to Rain</i> signs
1 set	<i>Drain to Rain</i> stations
4 sets	<i>Fly a Kite</i> instructions
10 sheets	gray construction paper
10 sheets	gray tissue paper
1 set	<i>Green Building Challenge</i> cards
20 sheets	kite paper
20	SAC certificates
20	SAC stickers
1 set	<i>SatCom Relay</i> images
10	<i>Sky Color</i> strips
5	<i>Sky Survey</i> charts
50	<i>Sky Survey</i> stickers
20	<i>Which Cloud Am I?</i> grids
10 sheets	white construction paper
10 sheets	white tissue paper

## B

5	graduated cylinders
4	hole punchers
2 packs	markers
5	scissors

## C

1	blindfold
100	cotton balls
40	effervescent tablets
20 sheets	foil
5	glue sticks
40	pipe cleaners
100	popsicle sticks
40	skewers
50	straws (narrow)
10	straws (wide)
2 spools	string
10	tape
11	t-pins

## D

1 bag	baking soda
55	cups
1 box	food coloring
10	plastic vials

## Loose Items

20	<i>Cloud Quest</i> buttons
1	<i>Cloud Quest</i> guidebook
1 bottle	dish soap
20	SAC notebooks
20	SAC pencils
1 bottle	vinegar

# HOW TO USE THIS GUIDEBOOK

## 1: GET TO KNOW A CLOUD

Share each activity's mission statement with youth.

Before your club meets, check the preparation section for a list of things to prepare.

The introduction gives an overview of the activity's goals and purpose.

Before your club meets, check the blue box for the supplies you need.

"A" indicates materials found in Bag A of the kit.

Some activities require additional materials that are not included in the kit.

Time estimates and location suggestions are provided for each part of the activity.

Encourage youth to continue learning with family and friends in their community.

Scan the QR code to access videos and other digital content. In the digital guidebook, you can also click the hyperlink.

Studying clouds helps NASA scientists better understand Earth's weather and climate systems. In this activity, youth learn the names and basic features of different cloud types.

**Your mission today is to design and build a model cloud.**

### Preparation

- Load videos: GLOBE Observer Cloud Science and Why Are There Different Types of Clouds?
- Distribute SAC notebooks as youth enter the room. Encourage youth to decorate their notebook cover while waiting for the club session to begin.

### Why Take on This Mission? 5 min. | inside

NASA needs you! Starting today, you will build the scientific skills you need to report cloud observations to NASA, helping professional scientists learn how clouds affect climate on Earth. Over the coming weeks, you will become expert citizen scientists. Through games and experiments, you will investigate the sky and learn to ground truth satellite images. Each day, you will get a new mission to help focus your adventure. Your mission today is to design and build a model cloud.

Watch GLOBE Observer Cloud Science (3 min.) to learn more about your mission as a NASA citizen scientist.

### Eye of the Storm 20 min. | inside or outside

The goal of this game is to make a storm of sounds and pay attention to small changes in the beat. Like scientists, all players have to closely observe what is going on.

1. Form a circle with the group. Choose one person who will be the Guesser. The Guesser either steps outside the room or is blindfolded.
2. Choose another person to be the Motion Leader. Make sure the Guesser doesn't know who the Motion Leader is.
3. Have everyone around the circle start with clapping. Place the Guesser at the middle of the circle, or eye of the storm. If the Guesser was blindfolded, take the blindfold off.
4. The Motion Leader's job is to start new motions (snapping, tapping the ground, stomping, etc.) for the group to copy without the Guesser noticing; the Guesser's goal is to identify the Motion Leader in three guesses or less.
5. If the Motion Leader is caught, he or she becomes the next Guesser. If not, he or she can choose the next Guesser. Play for ten minutes.

### Construct a Cloud 35 min. | inside

What is a cloud? Clouds are made up of tiny water droplets and small particles floating in the air, such as dust and sea salt. As air cools, water vapor (water in the gas state) condenses into liquid water droplets that grab onto the floating particles. When

2. Activity 1: Get to Know a Cloud | [www.calacademy.org/sac](http://www.calacademy.org/sac)

### Kit Materials

#### A

- Altitude Axis
- Cloud Identification cards
- gray construction paper
- SAC stickers
- white construction paper

#### B

- markers

#### C

- cotton balls
- glue sticks

### Loose Items

- SAC notebooks



GLOBE Observer  
Cloud Science



they form a visible cloud. Depending on factors like temperature, altitude, and moisture,

is? (2 min.) to learn more about the clouds you see in the sky.

in different weather conditions?

NASA scientists:

id Identification card to each pair.

id: work together to read the description of the cloud and describe what your cloud looks like in your own words. You can record your ideas in your notebooks.

3. Create your own version of the cloud on your card using construction paper, cotton balls, glue, and markers.

Hang the Altitude Axis on the board or wall. Ask each group to introduce their cloud to the club and then hang their cloud at the appropriate height next to the Altitude Axis.

Share out: What similarities do you notice about the shapes and colors of clouds at different altitudes?

**Explore More:** Watch The Making of a Cloud (3 min.) and talk about where else you have noticed condensation.

**Call to Action:** Start a cloud journal to sketch the clouds you notice in the sky. Note important details such as the date, time, location, and type of cloud. See how quickly you can become an expert!

### Attendance & Feedback:

Let us know.



Why Are There  
Different Types  
of Clouds?



Explore More:  
The Making of a  
Cloud



How did it go?  
Let us know!



# 1: GET TO KNOW A CLOUD



Cirrus and cumulus clouds

**Studying clouds helps NASA scientists better understand Earth's weather and climate systems. In this activity, youth learn the names and basic features of different cloud types.**

***Your mission today is to design and build a model cloud.***

#### **Preparation**


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- Distribute SAC notebooks as youth enter the room. Encourage youth to decorate their notebook cover while waiting for the club session to begin.

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Watch [GLOBE Observer Cloud Science](#) (3 min.) to learn more about your mission as a NASA citizen scientist.

**Eye of the Storm** 20 min. | inside or outside 

The goal of this game is to make a storm of sounds and pay attention to small changes in the beat. Like scientists, all players have to closely observe what is going on.

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**Construct a Cloud** 35 min. | inside 



What is a cloud? **Clouds** are made up of tiny water droplets and small particles floating in the air, such as dust and sea salt. As air cools, water vapor (water in the gas state) condenses into liquid water droplets that grab onto the floating particles. When

#### **Kit Materials**

##### **A**

- [Altitude Axis](#)
- [Cloud Identification cards](#)
- gray construction paper
- SAC stickers
- white construction paper

##### **B**

- markers

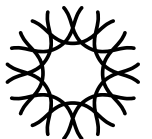
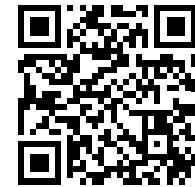
##### **C**

- cotton balls
- glue sticks

#### **Loose Items**

- SAC notebooks

[GLOBE Observer  
Cloud Science](#)





large amounts of these droplets join together, they form a visible cloud. Depending on factors like temperature, altitude, and moisture, different kinds of clouds can form.

Watch [Why are There Different Types of Clouds?](#) (2 min.) to learn more about the clouds you see in the sky.

Share out: What kinds of clouds have you seen in different weather conditions?

You are going to become cloud experts to help NASA scientists:

1. Break into pairs and distribute one *Cloud Identification* card to each pair.
2. Each pair will focus on one type of cloud: work together to read the description of the cloud and describe what your cloud looks like in your own words. You can record your ideas in your notebooks.
3. Create your own version of the cloud on your card using construction paper, cotton balls, glue, and markers.

Hang the *Altitude Axis* on the board or wall. Ask each group to introduce their cloud to the club and then hang their cloud at the appropriate height next to the *Altitude Axis*.

Share out: What similarities do you notice about the shapes and colors of clouds at different altitudes?

Explore More:  

Watch [The Making of a Cloud](#) (3 min.) and talk about where else you have noticed condensation.

Call to Action:  

Start a cloud journal to sketch the clouds you notice in the sky. Note important details such as the date, time, location, and type of cloud. See how quickly you can become an expert!

[Why are There Different Types of Clouds?](#)



[Explore More: The Making of a Cloud](#)



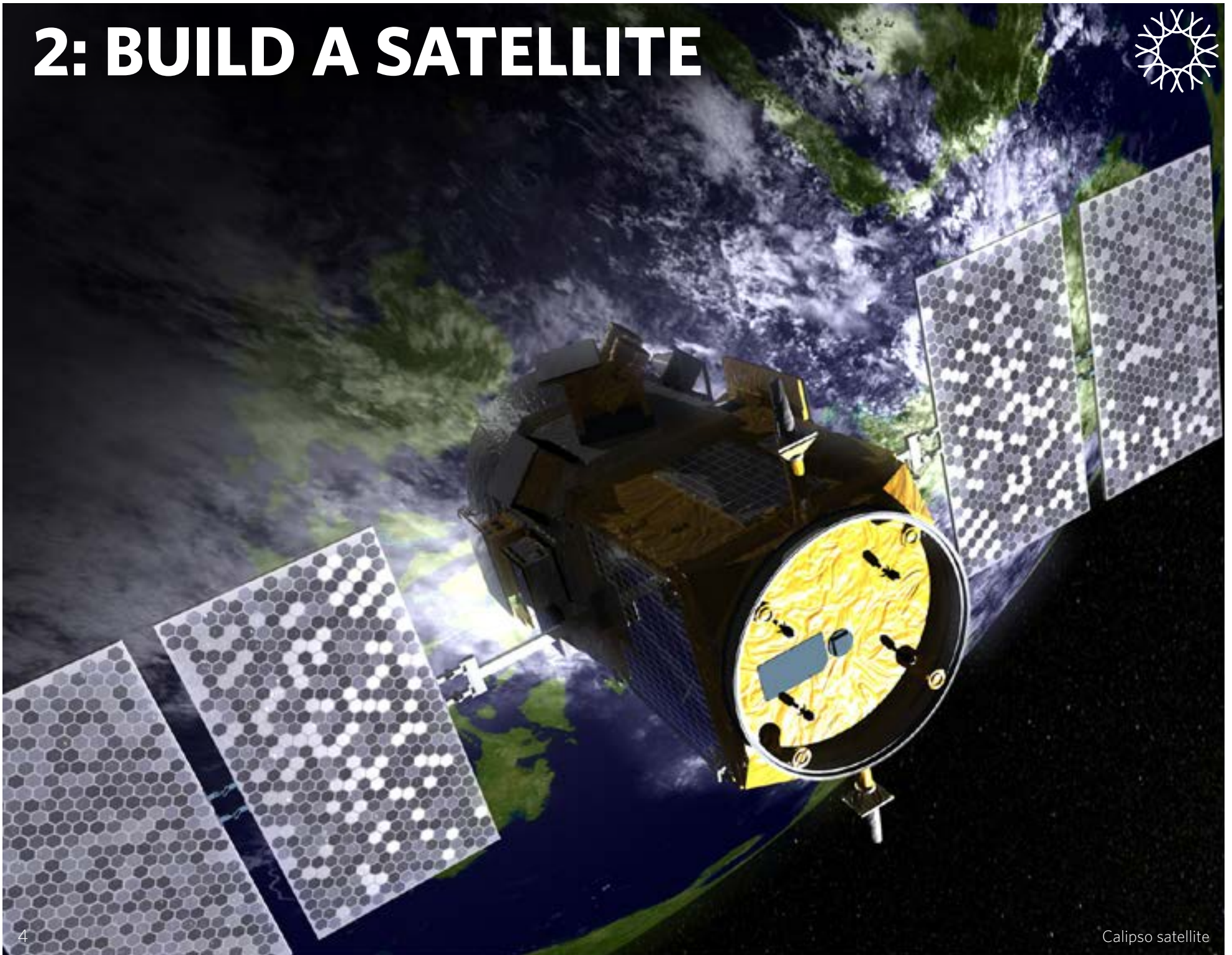
**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

[How did it go? Let us know!](#)





# 2: BUILD A SATELLITE



**NASA has more than a dozen scientific satellites in orbit around Earth. In this activity, youth play a game to learn how satellites send and receive data, then design and build their own satellite models.**

***Your mission today is to design and build a model satellite.***

### Preparation

- Collect recyclable materials.

**Satellite Communication (SatCom) Relay** 25 min. | inside or outside



What do you think of when you hear the word satellite? What do satellites do? Share some ideas with a friend.

A **satellite** is anything that orbits another object (for example, the Moon is a satellite of Earth). People build satellites to observe Earth and send signals. You most likely use satellites in some way every day, perhaps through television or a map app on your phone.

When a satellite collects data, like photos of objects from space, that information gets translated several times on its way back to Earth—from a photo to computer code to radio signal, and then the same in reverse.

This game simulates that experience, as teams compete to relay information correctly from a satellite's camera to a computer on Earth. This is not a race. The goal is for the final image to match the original *SatCom Relay* photo most closely. The team with the most accurate image at the end wins.

To begin, create five stations at least 20 steps apart from each other. Then, place the four *SatCom Relay* images face down in Station 1 and place markers and paper in Stations 2, 4, and 5. Only players—not materials—can move between stations.

- Form teams of four players and assign each player a number (1-4).
- In Station 1—the satellite's camera—Player 1 must look at the *SatCom Relay* image, memorize it, and travel to Station 2 to write a description of it. Make sure no other players see the original image.
- In Station 2—the satellite's computer encoder—Player 2 must memorize the written description, travel to Station 3, and repeat the description to Player 3. Make sure only Player 3 hears the description.
- In Station 3—the radio transponder—Player 3 will listen to the description and travel to Station 4 to record it in writing.

### Set up summary:

Station 1: Four *SatCom Relay* images, face down.

Station 2: Paper and markers (one set per team).

Station 3: No materials, but station must be out of earshot.

Station 4: Paper and markers (one set per team).

Station 5: Paper and markers (one set per team).

### Kit Materials

#### A

- construction paper
- [Design a Satellite cards](#)
- [Design a Satellite handouts](#)
- [SatCom Relay images](#)

#### B

- markers

#### C

- foil
- pipe cleaners
- popsicle sticks
- tape

### Loose Items

- SAC notebooks

### Materials Not Included

- recyclable materials



5. In Station 4—the radio receiver—Player 4 will read the written description and travel to Station 5 to draw the final image.
6. Station 5 is the computer on Earth. Compare the final image to the original *SatCom Relay* image.

### Design a Satellite 25 min. | inside

The goal of this activity is to build a model satellite out of a limited set of supplies.

1. Form five or fewer groups and distribute the *Design a Satellite* cards. These are five satellites that collect data about Earth's atmosphere, land, ocean, and energy: Terra, Aqua, Suomi NPP, Calipso, and CloudSat.
2. Look at the cards and talk with your group: What parts do satellites need in order to be able to stay in space for long periods of time? To gather information? To send that information back to Earth?
3. Pass out the *Design a Satellite* handouts, pipe cleaners, popsicle sticks, foil, and recycled materials. Your challenge is to design and build a model satellite that includes the components listed on the handout and at least one moving part.

### Label and Share Your Satellites 10 min. | inside

1. Put a piece of paper under your satellite. Draw arrows to label the different components on your satellites and describe what they do.
  - What is each component? Why did you decide to place it where it is? How does it move?
  - How will the satellite's camera and communication device stay pointed toward the Earth as it orbits?
2. Share your satellites with the rest of the club.

### Explore More:

Watch [Wanna Launch a Satellite? You Can!](#) (3 min.) to learn how to launch your own satellite into space!

### Call to Action:

Human-made satellites can look like stars moving slowly across the sky. With your friends and family, head outside at night and see if you can spot a satellite orbiting overhead. For more information check out [How to Observe Satellites](#) (5 min.).

**Attendance & Feedback:** How many youth attended? How did it go?  
Record notes here, then click or scan the link to let us know.

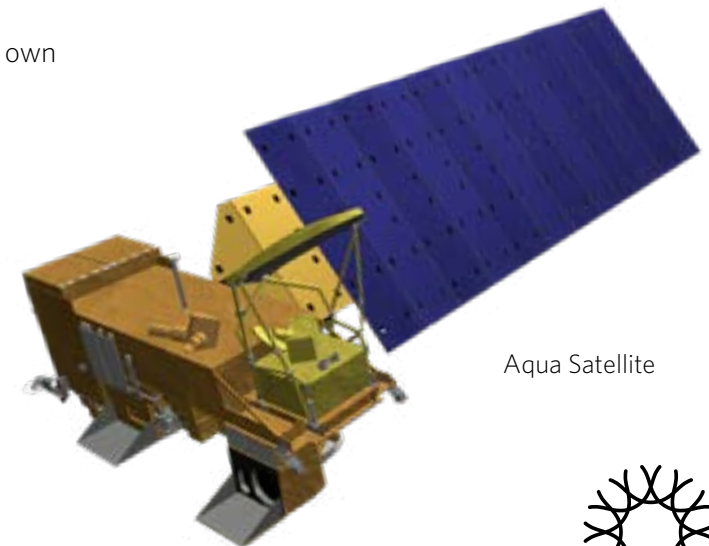
Explore More:  
[Wanna Launch  
a Satellite? You  
Can!](#)



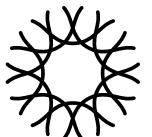
Call to Action:  
[How to Observe  
Satellites](#)



How did it go?  
[Let us know!](#)



Aqua Satellite



# 3: GROUND TRUTHING



Satellite view of clouds and snow

**Computers can be trained to find patterns, but they often miss important details that humans would easily notice. In this activity, youth learn how to verify satellite images by making observations from Earth's surface—a process called ground truthing.**

***Your mission today is to ground truth your surroundings.***

### Preparation

- Load video: [NASA Landsat's Orbit](#).
- Draw a picture of your living room as it would look from above, but don't label anything.
- Print or copy the satellite image of your site.

### Room from Above 25 min. | inside



Imagine a satellite's point-of-view by creating a map of a room in your home or school as it would look from above.

1. Look at the example drawing of a living room from the view of a satellite floating on the ceiling. Point out two or three items in the drawing (sofa, chair, tv, etc.).
2. Use construction paper and markers to draw a picture of your own living room from above.
  - What shape is your room? Where are doors and windows?
  - What would the furniture look like from above (for example, a lamp might just look like a circle)?
3. When you are finished, swap your picture with a partner and try to guess what each item is on their map.
  - Was it easy to recognize what everything was? What would help you?
  - Would it be useful to have people on the ground telling you what they saw? Why or why not?



### Kit Materials

A

- color construction paper

B

- markers

### Loose Items

- SAC notebooks

### Materials Not Included

- satellite image of your site (one copy per pair)

### Ground Truthing 35 min. | outside

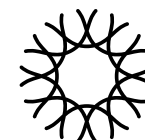


**Ground truthing** is when data is collected at ground level to check measurements made by scientific instruments such as planes and satellites. At times, this data can be collected by hand.

Watch [NASA Landsat's Orbit](#) (1 min.) to see how satellites collect data in strips around Earth.

In SAC, you are part of a team that takes ground truth measurements to check the NASA CERES satellites. Ground truthing

[NASA Landsat's Orbit](#)





is important because people on the ground can see differences the satellite might miss, like distinguishing between snow, smoke, and clouds. Ground truthing is done by scientists in remote locations, by the National Weather Service over long periods of time, and by citizen scientists.

Share out: Why do you think ground truthing is important?

Your challenge today is to find as many differences as you can between a satellite image and your own observations on the ground.

Analyze the satellite view:

1. Divide into pairs and give each pair a satellite view image of your site.
  - Do you recognize any buildings or areas?
  - Is there anything you don't recognize?
  - Can you see where SAC meets?
2. When satellites collect data, sensors "decide" what the image is of (for example, ocean vs. land). Label what you recognize on your site map. This may include buildings, roads, trees, parking lots, sports fields, cars, etc.

Check from the ground:

1. Grab a pencil or marker and go outside to the location shown in your site's satellite image.
2. Explore the area and mark any differences between the satellite image and reality on your site map.
3. Decide if differences are errors by the satellite (object should have been visible from above) or were caused by the satellite's limitations (object was underneath something so the view was obstructed). Also consider when the satellite image was taken.

Share out: What sort of things did the satellite see best? Which things were hardest to record?

Explore More:  

Watch [Best of "Earth as Art"](#) (4 min.) to see more satellite images taken from space.

Call to Action:  

Practice your ground truthing skills by examining maps of your favorite places. Enter any location into [Google Maps](#) and switch to Satellite view. Compare the satellite images you see to your own experience on the ground. If you find any errors, you can send Google your feedback.

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

Explore More:  
[Best of "Earth as Art"](#)



Call to Action:  
[Google Maps](#)



How did it go?  
[Let us know!](#)



# 4: A CLOSER LOOK AT THE SKY





In addition to cloud shape, texture, and altitude, scientists study other features to learn how clouds influence climate. In this activity, youth measure cloud cover and identify sky color, two important steps in the Sky Survey protocol.



***Your mission today is to hone your cloud observation skills.***

#### Preparation

- Hang the *Altitude Axis* at a height where everyone can reach the top.
- Load video: [Why So Many Cloud Types?](#)

#### Cloud Investigation 5 min. | inside

In order to report your observations to NASA, you will become an expert on different types of clouds and the altitudes where they are found. With a partner, take turns describing clouds you have seen recently. What shapes or texture did you notice? Did they seem low or high?

Watch [Why So Many Cloud Types?](#) (4 min.) to learn more about the many types of clouds that form in the sky.

#### Pin the Cloud on the Sky 20 min. | inside

Your challenge is to place your cloud at its correct altitude on the *Altitude Axis*, but you will do it blindfolded!

1. Set up the *Altitude Axis* on a wall or board and pass out one *Cloud Identification* card to each person.
2. Study the cloud on your card.
3. Divide into pairs. Turn to your partner and tell them about your cloud using your own words.
4. Distribute *Sky Survey* charts (one per pair). Find your cloud on the chart and note its altitude.
5. In your pair, choose one person to be the guesser and one person to be the spinner.
6. In turns, each pair will stand next to the *Altitude Axis*. The guesser tells everyone about their cloud and places a piece of tape on the back of their card. The spinner ties the blindfold onto the guesser and gently spins them around a few times. The guesser will try to stick their cloud at the correct altitude.
7. Switch roles and repeat step 6.

The rest of the club can shout out helping hints to make sure that the cloud ends up in the right spot. Take turns until everyone has a cloud on the board.

Share out: Why are clouds found at different altitudes?

#### Cloud Cover 25 min. | inside

Knowing how much of the sky is covered by clouds is as important to ground truthing and climate study as what kinds of clouds

#### Kit Materials

##### A

- [Altitude Axis](#)
- [Cloud Cover Categories cards](#)
- [Cloud Cover grids](#)
- [Cloud Cover photos](#)
- [Cloud Identification cards](#)
- [Sky Color strips](#)
- [Sky Survey charts](#)

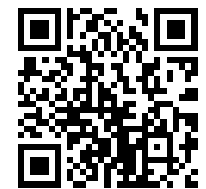
##### C

- blindfold
- tape

#### Loose Items

- SAC notebooks

[Why So Many Cloud Types?](#)



are visible. In this game, you will estimate what percentage of the sky is covered by clouds using a transparent grid.

1. Divide into four groups. Give each group a set of *Cloud Cover Categories* cards, *Cloud Cover* photos, and two *Cloud Cover* grids.
2. Hold a grid over a photo and count how many boxes are full of clouds. If a box is partially full, estimate to the nearest percent. Thin clouds do count, but blue sky in between does not.
3. Each box is 5% of the photo. Calculate cloud cover by multiplying the number of boxes you counted by five.
4. Spread out the *Cloud Cover Categories* cards (Clear, Isolated, Scattered, etc.) and sort all of the photos into the correct categories. When you think you are done, step back and shout, "Done!"
5. If you misidentified cards, rearrange them and explain your thinking to your teammates. If you got all of your images right, compare estimates with another group.

When a group shouts, "Done!", check their answers using the diagram on the next page. If they have images in the wrong categories, tell them how many they need to change, but not which ones they need to change.

Share out: What made it easier or more challenging to determine the cloud coverage? Were some types of clouds easier to categorize than others? If so, why?

Explore More:  
[Why Do Clouds Stay Up?](#)



**Sky Color** 10 min. | outside



In addition to making observations about clouds, it's also important to look at what is behind them. We can learn more about the condition of our sky by determining its color. For example, a pale blue or milky sky tends to have a large number of particles in it.

1. Estimate today's sky color by using the *Sky Color* strips (one per pair). Hold the strips up next to the sky, looking up at a 45° angle, and try to decide which color matches best. Hint: squinting can make it easier.
2. Collect the *Sky Color* strips for later use. You can record today's observations in your notebooks.

Explore More:



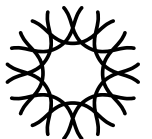
Watch [Why Do Clouds Stay Up?](#) (6 min.) to learn more about how clouds float above Earth's surface.

Call to Action:



Challenge your friends and family to figure out cloud coverage and altitude. Notice if the clouds look the same or different at home. Remember to add these notes to your cloud journal.

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.



## Cloud Cover answer key

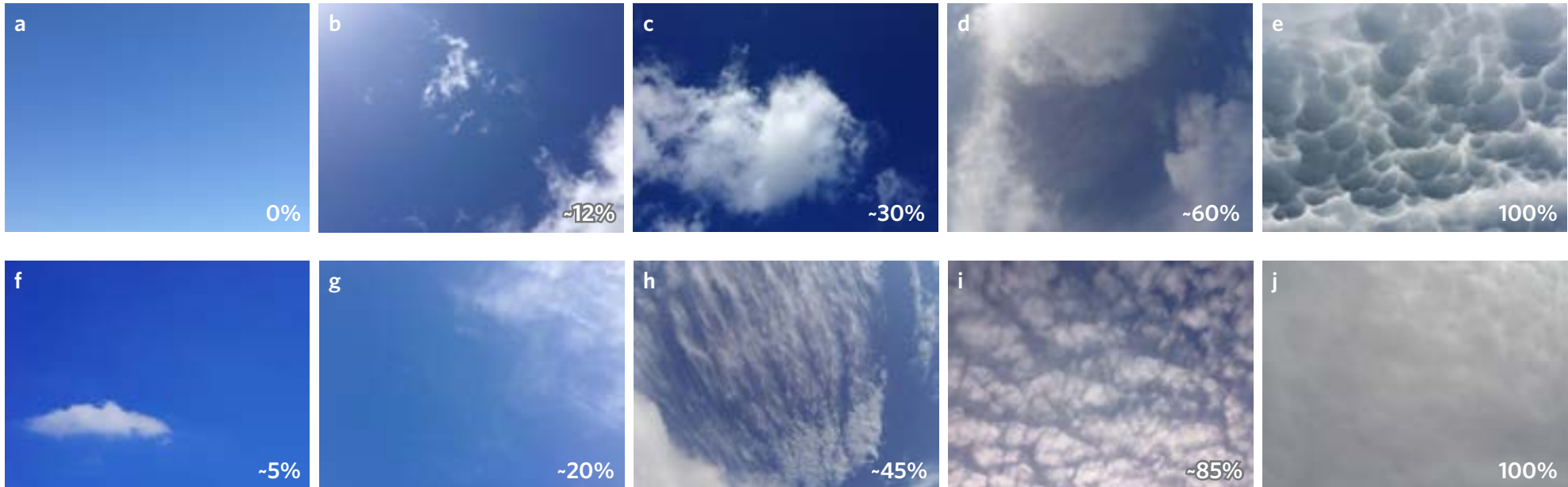
Clear <10%

Isolated 10-25%

Scattered 25-50%

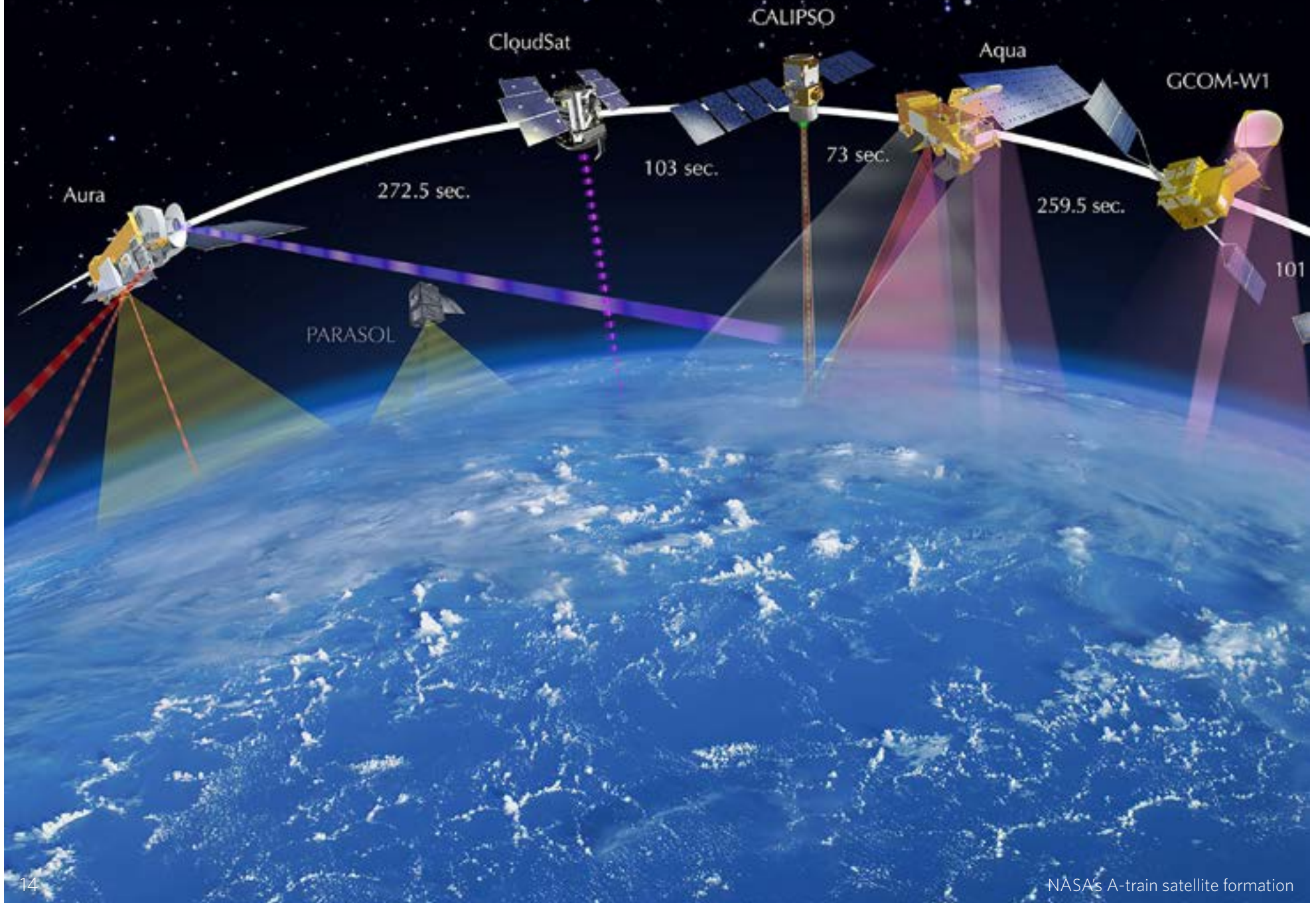
Broken 50-90%

Overcast >90%





# 5: CONNECT TO NASA



**Sky Survey observations help NASA researchers study Earth's weather and climate. In this activity, youth practice their cloud identification skills, conduct their first Sky Survey observation, and submit their findings to NASA.**



***Your mission today is to collect data about clouds to help NASA conduct Earth science research.***

### Preparation

- Load videos: [Cloud Names](#) and [How to Do a Sky Survey](#).
- Download the [GLOBE Observer Data Entry app](#) on your digital device and sign into your club's account.

### Cloud Quiz Show 15 min. | inside

Learning cloud names takes practice. Knowing the meaning of those names can offer clues about how clouds look. For example, **cirrus** clouds are wispy and **stratus** clouds form in layers, so when you hear the name **cirrostratus**, you can expect to see a wispy layer of clouds. In this game show, teams will compete to identify cloud names.

Start by watching [Cloud Names](#) (1 min.). As you watch, practice saying the name of each cloud out loud. See the sidebar for a full list of names. Now you are ready to play.

1. Choose one player to be the scorekeeper. Give her or him the *Cloud Quiz Show* scorecard.
2. Divide into teams of four to five players.
3. To begin, say, "Name a cloud that begins with..." and insert one of the starting sounds. See sidebar for the list of five starting sounds.
4. Team members must huddle to choose a cloud name that begins with that sound. The first team to raise their hands and make a buzzer sound gets a chance to respond.
5. Identify that team and say, "And the cloud is..."
6. The team then calls out the name in unison.
7. The scorekeeper checks if the name is correct and keeps score.

Award two points for the first correct answer. If the first answer is incorrect, or if there are additional correct cloud names, the team to the left gets a turn to respond. Each additional correct answer is worth one point.

#### Names of Clouds

- |                        |                         |
|------------------------|-------------------------|
| » <b>Alto</b> cumulus  | » <b>Cumulo</b> nimbus  |
| » <b>Alto</b> stratus  | » <b>Cumulus</b>        |
| » <b>Cirro</b> cumulus | » <b>Nimbo</b> stratus  |
| » <b>Cirro</b> stratus | » <b>Strato</b> cumulus |
| » <b>Cirrus</b>        | » <b>Stratus</b>        |

#### Starting sounds

- |                  |                  |
|------------------|------------------|
| » <b>Alto</b> -  | » <b>Nimbo</b> - |
| » <b>Cirr</b> -  | » <b>Strat</b> - |
| » <b>Cumul</b> - |                  |

### Kit Materials

#### A

- [Cloud Cover grids](#)
- [Cloud Identification cards](#)
- [Cloud Quiz Show scorecard](#)
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)
- [Which Cloud Am I? grids](#)

#### Loose Items

- SAC notebooks

#### Materials Not Included

- 10 folders

#### [Cloud Names](#)





Teams take turns responding until all valid clouds are named. Repeat steps 3-7 for each of the five starting sounds.

Play for six minutes or complete all five rounds.

**Bonus round:** Each team has 30 seconds to write down as many cloud names as possible. The team with the most correct cloud names gets five bonus points. Spelling is not important.



Share out: Why do you think scientists have multiple names for clouds? What strategies did you use to help you remember clouds names?

**Which Cloud Am I?** 20 min. | inside 

In this game, one person will use clues to figure out which *Cloud Identification* card their partner is holding.

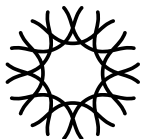
1. Create teams of two. Determine who will guess and who will respond first. The Guesser needs a *Which Cloud am I?* grid and the Responder needs one *Cloud Identification* card.
2. Responders use a folder to hide the *Cloud Identification* card from the Guesser.
3. All of the clouds are on the grid, so Guessers ask yes or no questions to determine which one their partner has. Focus on characteristics of the cloud itself rather than other parts of the picture.
4. Once a card is guessed, switch roles and pick a new *Cloud Identification* card. Use details when describing color, shape, texture, or position in the sky.

Share out: Which clouds look the most similar to you? How can you tell them apart?

**Sky Survey** 25 min. | outside  

Through GLOBE Observer, citizen scientists like you help NASA understand how clouds affect weather and climate. By observing the sky and reporting what you see, you can help confirm or clarify valuable data from NASA satellite photos. Watch [How to Do a Sky Survey](#) to learn how it works.

1. Form teams of four. Each team needs the following *Sky Survey* tools:
  - *Cloud Cover* grid
  - *Sky Color* strip
  - *Sky Survey* chart
  - *Sky Survey* sticker (this goes in the recorder's notebook)
2. Record the location, time, and date on the *Sky Survey* sticker. Then, head outside to observe the sky.
3. Review the *Sky Survey* sticker together as a club. There are three basic sky conditions:



- No Clouds: The sky is completely clear.
  - Some Clouds: Clouds are visible.
  - Obscured: Clouds can't be seen in more than one-quarter of the sky because of heavy rain, snow, or fog.
4. You will use the *Cloud Cover* grid to estimate cloud cover (few, isolated, scattered, broken, or overcast) for the entire sky.
  5. Observing cloud cover at different altitudes takes practice. While clouds might all seem to be the same distance away, some are closer to Earth's surface and others are high in the sky. The closer ones might block our view of higher ones. Only on a relatively clear day can we estimate cloud cover for low, middle, and high altitudes all at once.
  6. To estimate cloud cover, first, identify clouds at each level of the sky. Then, use the *Cloud Cover* grid to estimate how much of the sky is full of clouds at each level. Each team will be responsible for a different direction—north, south, east, and west—so we can collect more accurate observations of the entire sky.
  7. Now you are ready to do your first *Sky Survey*. You have 10 minutes to observe the sky and record observations in the *Sky Survey* sticker.
  8. Discuss your observations as a club. We will submit only one report for the entire club each time we meet. Ask a youth to hold the mobile device and walk everyone through the [GLOBE Observer data entry](#) process.

[GLOBE Observer Data Entry App](#)



Congratulations! You have completed your first *Sky Survey* as a NASA citizen scientist.

Share out: What did you find challenging about observing the sky? What strategies would you recommend for next time?

Explore More:  

How do clouds affect climate? Watch [Cloudy Forecast](#) (1 min.) to learn how NASA is studying clouds and Earth's climate.

Call to Action:  

Teach your friends the names of different clouds and help them identify clouds in your neighborhood.

Explore More:  
[Cloudy Forecast](#)



**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

How did it go?  
[Let us know!](#)



# 6: ROCKET SCIENCE





**In order to send satellites into space, NASA uses powerful rockets that can escape Earth's gravity. In this activity, youth design, prototype, and test their own rockets.**

***Your mission today is to build and launch a model rocket.***

### Preparation



- Load video: [On a Rocket Launch to Space](#).
- Find a flat open space to launch the rockets.
- Make a model rocket and practice launching it.

**Sky Survey** 20 min. | outside  

During today's *Sky Survey*, pay special attention to **contrails**, which are trails of water vapor and smoke left behind by planes or rockets. Form teams and gather your *Sky Survey* tools to begin.

1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: Why do you think contrails are straight and long? How do you think contrails are created? What else would you like to know about these unique clouds?

**Build a Rocket** 25 min. | inside  

What do you picture when you hear the word *rocket*? For example, how is it shaped? Where is it? What is it doing?

Watch [On a Rocket Launch to Space](#) (4 min.) to ride along as a rocket reaches an altitude of nearly 400,000 feet and returns to Earth.

Share out: What parts of the rocket did you notice?

NASA's rockets are launched by setting off engines that powerfully push air straight down toward the ground. This pushes the rocket up, shooting it into the sky. Working in pairs, you will design and build a rocket to launch in an outdoor area.

1. The body will be made of a rolled up piece of construction paper. In groups of two or three, decorate the visible part of the body before taping it into a tube.
2. Use tape to securely attach the rocket body to the plastic vial. The open end of the plastic vial should face down.
3. Attach any fins or other additions that you design and create to help your rocket fly.

### Kit Materials

#### A

- [Cloud Cover grids](#)
- color construction paper
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

#### B

- markers

#### C

- effervescent tablets
- plastic vials
- tape

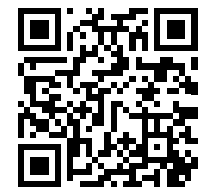
### Loose Items

- SAC notebooks

### Materials Not Included

- large bottle of tap water

[On a Rocket Launch to Space](#)



4. Practice closing the vial quickly and placing it firmly on the ground. This can be tricky, so practice several times.

#### **Launch Your Rockets** 15 min. | outside

1. Head outside to your chosen rocket launch spot.
2. Hold the rocket upside down and fill the plastic vial about halfway with water.
3. These next steps need to be done quickly, since the reaction will start right away. Place one fuel tablet into the vial and quickly place the lid on securely. Place the rocket on a level surface with the lid touching the ground. Step at least five feet away from the rockets—they may not fly straight up!

Pause to modify your rockets: What did you notice about how your rocket flies? What do you want to try to change?

1. Experiment with your rocket to see if you can change how it flies. Think about using more or less water, making the rocket lighter, adjusting the fins or shape of the cone, etc.
2. Use two or three more fuel tablets to test your ideas.

Share out: What worked well? What can you conclude about how these rockets fly?

Explore More:  

Watch [How Do We Launch Satellites Into Space?](#) (2 min.) to learn more about how satellites are launched.

Call to Action:  

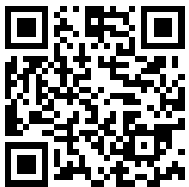
Can we reuse rockets? In April 2016, [SpaceX](#) successfully landed the first reusable rocket back on Earth. How else can we make space exploration more sustainable?

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

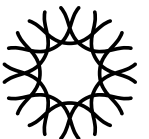
Explore More:  
[How Do We Launch Satellites Into Space?](#)



Call to Action:  
[SpaceX](#)



How did it go?  
[Let us know!](#)





# 7: DRAIN TO RAIN



**Water covers most of the Earth's surface and moves around the planet through a process called the water cycle. In this activity, youth explore how water changes states, and how water molecules travel.**

***Your mission today is to trace a drop of water through the water cycle.***

### Preparation

- Load video: [The Water Cycle](#).
- Fold the *Drain to Rain* signs.

**Sky Survey** 20 min. | outside



During today's *Sky Survey*, notice if the air around you feels dry or wet and look for cloud types that could signal rain. Form teams and gather your *Sky Survey* tools to begin.

1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: How do you think clouds and weather are related? Which clouds are you likely to see on warm, humid days? What about cold, dry days?

**Ice Cube Challenge** 10 min. | inside or outside



The Earth is a closed system. This means that all of the water on Earth stays on Earth. The water does not go off into space. Instead, it moves around from place to place, changing from liquid to gas or ice and back to liquid again.

Your goal is to convert as much ice into water as you can before time runs out.

1. Form teams of three or four. Give each team a bowl and two ice cubes.
2. Ice cannot be put into mouths. Otherwise, you can use any methods that you can think of to melt the ice into water.
3. You will have four minutes to fill up your container with as much water as possible. Remove any remaining ice from the container once time is called.
4. Measure how much water each team finished with in the graduated cylinders.

Share out: What tactics did you try? What helped your ice to change to liquid water most quickly? Were you able to see evidence of water in all three forms: solid, liquid, and gas?

### Kit Materials

#### A

- [Cloud Cover grids](#)
- [Drain to Rain maps](#)
- [Drain to Rain signs](#)
- [Drain to Rain stations](#)
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

#### B

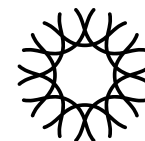
- graduated cylinders

### Loose Items

- SAC notebooks

### Materials Not Included

- 5 bowls
- 10 ice cubes



## Drain to Rain 25 min. | inside or outside



Water is everywhere! In fact, Earth could be mapped in sections called **watersheds**, or an area of land where all water flows to the same place. We can easily see water in rivers or snow, but it is also stored in the ground, frozen as ice, and even in the air we breathe. Remember, water and ice molecules in the air collect around dust particles to form clouds.

With a partner, spend one minute making a list of as many places as you can think of where water can be found. Can you come up with a place that nobody else can think of?

Watch [The Water Cycle](#) (6 min.) to see how water flows on, in, and above the Earth.

Imagine you are a water molecule. Your mission is to make your way through every water location in the system, mapping your journey as you go. Set up nine stations with the matching *Drain to Rain* signs and *Drain to Rain* station at each.

1. Each player gets a *Drain to Rain* map.
2. You can start at any water location you want. Not all stations are connected, so refer to the card at each station to choose where to go next.
3. As you move from one station to the next, draw and number a line on your map showing your path.
4. Strategize paths to take to get to all of the stations.

Share out: Which places did you end up going the most? How many lines did you draw? What was surprising about where the water went?

## Let's Make a Toast 5 min. | inside



Give everyone a small cup of water (or pretend!). Our bodies are about 60% water. Talk about how far the water we drink has traveled and the experiences it may have had along the way. Ask for youth volunteers to make toasts to water. Drink up!

## Explore More:



Check out how satellites help us save water by watching [Recharging Aquifers](#) (3 min.).

## Call to Action:



Find out where your city's water comes from and where it goes. Check your city's public utilities website.

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

### [The Water Cycle](#)



### Explore More:

[Recharging Aquifers](#)



### How did it go?

[Let us know!](#)



# 8: MEASURE THE WIND







**We can't see wind, but we can see and feel its effects. In this activity, youth explore the power of wind, and build an anemometer to measure wind speed.**

***Your mission today is to test the wind speed.***

### Preparation


- Build an anemometer as an example.

**Sky Survey** 20 min. | outside  

During today's *Sky Survey*, pay special attention to wind conditions and how clouds move. Form teams and gather your *Sky Survey* tools to begin.

1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: How do you think wind affects clouds? How might the wind affect other weather conditions?

**Wind Power** 15 min. | inside or outside 

Wind is one of the most powerful forces on Earth. It moves clouds, creates waves, and shapes mountains. Changes in wind speed and direction can have different effects on the environment. For example, short, strong gusts move objects differently than sustained, gentle breezes.

In this game, your goal is to work with your team to keep a piece of tissue afloat for as long as possible using only your breath.

1. Form teams of four to six. Each team starts with two narrow straws, two wide straws and a piece of tissue paper. It's ok if some players don't have straws, they can blow on the tissue directly.
2. When you hear the signal to start, drop the tissue paper from above and try to keep it afloat for as long as possible. Keep trying for 30 seconds.
3. Gather with your team. You will have one minute to come up with a strategy to keep the tissue up longer. You can change the combination of straws or get rid of them altogether. You can also modify the tissue, change the arrangement of people or the way that you blow on the tissue, or try any other ideas you have. Try again for 30 seconds.
4. Gather your team and discuss what you have discovered so far. You will have one minute to change your strategy based on your findings and test it out. Continue this process for up to five minutes.

Share out: What strategy worked best? How did you know which parts of your strategy worked? What would you try next time if you could do this again?

### Kit Materials

#### A

- [Build an Anemometer handout](#)
- [Cloud Cover grids](#)
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

#### B

- hole punchers
- markers

#### C

- narrow straws
- t-pins
- tape
- wide straws

#### D

- paper cups

### Loose Items

- SAC notebooks

### Build an Anemometer 25 min. | inside or outside



Scientists use many instruments to measure the weather: thermometers to measure temperature, barometers to measure atmospheric pressure, and rain gauges to measure rainfall, to name a few. An **anemometer** (an-eh-mom-eh-ter) is a device that measures wind speed by spinning at different rates when there is more or less wind.

Build an anemometer to test the wind speed around you.

1. Form pairs. Each pair needs a *Build an Anemometer* handout.
2. Work through the steps on the instructions side of the handout to build your anemometer.
3. Go outside to test the anemometers. You will use the table on the back of the *Build an Anemometer* handout to determine the wind speed based on how quickly the anemometer spins.
  - If there isn't any wind, that is still a result. Then, you can also measure the speed of your breath or a fan.

Explore More:  
[Wind Power](#)



Share out: When or why would it be useful to know the wind speed? Tell a partner, or record a list of ideas in your notebook. (List could include weather forecasting, sailing, flying, construction, plant growth, etc.)

Explore More:



Watch [Wind Power](#) (3 min.) to learn how we can harness wind power.

Call to Action:

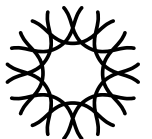


Take your anemometer home to show your friends or family how it works. Try attaching it to a spot where it could measure the wind, like outside a window or on your roof.

How did it go?  
[Let us know!](#)



**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.



# 9: ERUPT A VOLCANO





Steam plume from Mount Gharat on Gaua Island in the South Pacific.

**Volcano eruptions spew particles of gas, dust, and ash into the air. These particles can influence the way clouds form, which can in turn affect rainfall and winds. In this activity, youth explore the mechanics of volcanic eruptions, then test and tweak their own model volcanoes.**

***Your mission today is to build and erupt a volcano.***

### Preparation

- Load video: [Volcanoes 101](#).
- Collect small plastic bottles from your site or home recycling.

**Sky Survey** 20 min. | outside  

During today's Sky Survey, pay special attention to the surrounding natural environment. Form teams and gather your Sky Survey tools to begin.



1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: What nature did you observe? How do you think clouds affect your natural environment?

**Lava Flow** 15 min. | outside

The goal of this game is to avoid being swallowed by lava (similar to Sharks and Minnows).

1. Define the boundaries of the Lava Field and line up along one edge.
2. Choose two people to be the Lava. They will begin in the center of the field and try to tag the others.
3. When the Lava call out "Eruption!" the others run to the opposite side of the field and try to avoid being tagged. Anyone caught by the Lava becomes a Lava Tube and freezes in place. Lava Tubes cannot move, but can reach out and tag from where they stand.
4. Play another round. This time, look out for both Lava and Lava Tubes.
5. Play several rounds until only two people remain untagged. They win!

**Erupt a Volcano** 25 min. | inside or outside  

What comes to mind when you think of volcanoes? Inside Earth are layers of solid and melted rock. Volcanoes erupt when enough pressure builds to push gases or some of the melted rock, called **magma**, through the Earth's surface. Some volcanoes release long steam plumes that can be seen from space.

Watch [Volcanoes 101](#) (3 min.) to learn what causes volcanoes to form and erupt.

### Kit Materials

#### A

- [Cloud Cover grids](#)
- color construction paper
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

#### B

- scissors

#### C

- tape

#### D

- baking soda
- food coloring

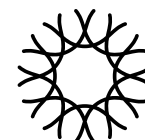
### Loose Items

- dish soap
- SAC notebooks
- vinegar

### Materials Not Included

- gallon of water
- small plastic bottles

[Volcanoes 101](#)





1. Divide into teams of three or four. Each group will need a bottle, two sheets of paper, tape, markers, and scissors.
2. Fold the sheets of paper into cones around the bottle and cut the corners off. The point of the cone should fit tightly around the opening of the bottle.
3. Measure out a small amount of water and twice as much vinegar in the plastic bottle. Add three to five drops of food dye and one small squeeze of dish soap. Swirl everything together gently.
4. When everyone is ready, set the first volcano on the ground near a drain or on a large tray.
5. To erupt a volcano, add baking soda to the bottle. Set it down quickly and stand back.
6. The next team can choose to add the same amount of baking soda, more baking soda, or less baking soda to change the rate of eruption.

Share out: If you were to erupt volcanoes again, what would you do differently? How do you think a volcano could influence the weather?

Explore More:  

Watch [How Do Volcanoes Change Clouds?](#) (2 min.) to learn about the connections between active volcanoes and clouds.

Call to Action:  

When volcanoes erupt, they release large amounts of carbon dioxide into the atmosphere. Carbon dioxide is one of the leading greenhouse gases responsible for global warming. However, human activities release a lot more carbon dioxide than volcanoes. Use the [Carbon Footprint Calculator](#) to figure out how much carbon dioxide your household releases every year. Can you think about ways in which you might reduce the amount of carbon dioxide you release?

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.



#### Tips for erupting volcanoes:

- Avoid spills by carrying a large container of water out with you, or teams may fill their bottles individually before going outside.
- Make a funnel out of paper to pour the baking soda into the bottle more easily.
- Ask youth to help you carry the materials outside. Youth helping out will develop a stronger sense of connection to the club.

#### Explore More:

[How do Volcanoes Change Clouds?](#)



#### Call to Action:

[Footprint Calculator](#)



#### How did it go?

[Let us know!](#)



# 10: FLY A KITE





Some kites are used to send weather instruments into the atmosphere. A kite's shape and size determines how it flies. In this activity, youth investigate flying styles, then design and test their own kites.



***Your mission today is to design and build a kite that can fly.***

#### Preparation



- Create at least one kite as a model.

**Sky Survey** 20 min. | outside  

During today's Sky Survey, keep an eye out for birds, airplanes, or other flying objects. Form teams and gather your Sky Survey tools to begin.

1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: What objects or animals did you spot flying through clouds? What do you think it feels like to be inside a cloud?

**Wind, Kite, Flight** 10 min. | outside  



A kite flies by balancing lift from the wind (pushing the kite up) and the tension from the string (pulling the kite down).

Whenever these two forces are in balance, the kite flies.

In this game, one person will shout one of three commands for the rest of the group to act out:

1. Wind: everyone walks around as if blown by the wind. (individual activity)
2. Kite: find a partner and form a diamond-shaped kite with your arms. (groups of two)
3. Flight: find two other players; two will form a diamond-shaped kite and the third player will act as wind under the kite. (groups of three)

Anyone who can't form the shape of the command is out. The last three players to form the Flight shape win!

**Fly a Kite** 30 min. | inside or outside  

Kites can be designed in many shapes and sizes, depending on their use: for entertainment, carrying messages, measuring distances, investigating weather, observing the sky, transporting objects—and people!—or carrying out scientific experiments.

Your goal is to design and build a kite with the ability to fly. Most kites will not fly on the first try so you will need to test, revise, and try again.

#### Kit Materials

##### A

- [Cloud Cover grids](#)
- [Fly a Kite instructions](#)
- kite paper
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

##### B

- markers
- scissors

##### C

- skewers
- string
- tape

#### Loose Items

- SAC notebooks

Explore More:  
[NASA Launches Super-Pressure Balloon](#)



1. With a partner, explore and examine the three different kite designs. Choose one kite design or create your own. Think about what features you want your kite to have.
2. Use the kite paper to create a **prototype**, or model to test, and try to fly it.
3. Consider how you can improve how you launch or how you fly your kite. Make small changes and try again.
  - If the kite is spinning around, it might need a tail to balance it.
  - If the kite won't fly, it may be too heavy.

Share out: What changes helped? Did you see any modifications on other kites that could help yours?

Explore More:  

Watch [NASA Launches Super-Pressure Balloon](#) (2min.) to see how NASA uses high-flying devices to study Earth.

Call to Action:  

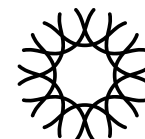
Watch [Float Beijing](#) (2 min.) to learn more about how citizen scientists in China are using kites to measure air pollution. Can you think of other ways in which kites could be used for citizen science?

Call to Action:  
[Float Beijing](#)



Attendance & Feedback: How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

How did it go?  
[Let us know!](#)





# 11: GREEN DESIGN





The California Academy of Sciences' solar panels, living roof, and efficient heating and cooling make it a green building.

**A green building aims to eliminate the negative impacts, and create positive impacts, on our climate and natural environment. In this activity, youth design and build an eco-friendly residential building.**

***Your mission today is to design an eco-friendly building.***

### Preparation



- Load video: [What is green building?](#)
- Gather any remaining craft supplies from your kit.
- Buy edible supplies. (If food is not an option, you can use craft supplies.)
- Collect an assortment of recyclable materials from around your site or home.

**Sky Survey** 20 min. | outside  

During today's *Sky Survey*, pay special attention to the surrounding buildings and other human-made parts of the environment. Form teams and gather your *Sky Survey* tools to begin.

1. Observe the sky and record your cloud observations in your notebook.
2. Discuss your observations and decide as a club what to report to NASA.
3. Submit your club's report using the GLOBE Observer app.

Share out: How might clouds affect the buildings and structures in your environment?

**Green Building Challenge** 40 min. | inside  

Watch [What is green building?](#) (1 min.) to learn about sustainable building design.

Your challenge is to design an eco-friendly residential building and construct a model using edible or reusable materials.

1. Visit [Green Solutions](#) and explore the website as a club.
2. Brainstorm what it means for a building to be green or eco-friendly. Research and discuss:
  - Renewable energy technologies, such as solar panels, hydroelectricity, and wind turbines.
  - Sustainable building materials, such as bamboo and adobe.
  - Beneficial landscaping, like a living roof or vegetable garden.
  - Water conservation methods, such as harvesting rainwater or installing a graywater system.
3. Form teams of four. Each team needs one *Green Building Challenge* card.
4. Design an eco-friendly building according to your *Green Building Challenge* card. Use edible or

### Kit Materials

A

- [Cloud Cover grids](#)
- [Green Building Challenge cards](#)
- [Sky Color strips](#)
- [Sky Survey charts](#)
- [Sky Survey stickers](#)

C

- glue sticks
- tape

### Loose Items

- SAC notebooks

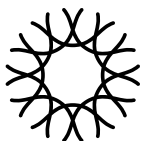
### Materials Not Included

- recyclable materials such as cardboard boxes and plastic bottles
- food items such as whip cream, nut butter or frosting, graham crackers, pretzel sticks, fruit, and other green or brown snacks.

[What is green building?](#)



[Green Solutions](#)





reusable materials to construct a model of your building. Make sure to include at least one moving part. Be creative in your designs. Think about how you can turn your challenge into an advantage.

Share out: When everyone has finished building, have an open house. Invite youth to gather around each building while the youth briefly describe their models and explain their choices.

Explore More:  

Watch how architects and engineers are building smarter in [Waste Water Recycling](#) (2 min.).

Call to Action:  

Visit the [World Green Building Council](#) to learn more about green design strategies. Choose one building you are familiar with, such as your school or home, and identify what you can do to make it greener. Discuss your ideas with others who use that building, and see if you can implement any changes.

**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.

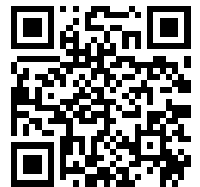
Explore More:

[Waste Water Recycling](#)



Call to Action:

[World Green Building Council](#)



How did it go?

[Let us know!](#)



# 12: CLOUD CONCLUSIONS







Scientists review their data to look for patterns and make discoveries about the natural world. In this final activity, youth analyze their Sky Survey results and create a poster of their favorite cloud. This is also the time to celebrate their accomplishments as citizen scientists.




**Your mission today is to summarize the data from your sky surveys.**

### Preparation

- Fill out a certificate for each youth.
- Plan a fun celebration for completing Science Action Club.

**Replay** 15 min. | outside  

Vote to play your favorite clouds game; choose from: Activity 1: *Eye of the Storm*, Activity 2: *Satellite Communication Relay*, Activity 5: *Cloud Quiz Show*, Activity 8: *Wind Power*, Activity 9: *Lava Flow*, or Activity 10: *Wind, Kite, Flight*.

**Cloud Conclusions** 30 min. | inside or outside  

You have successfully learned how to identify clouds and record sky conditions to help NASA scientists study Earth's climate. Now you are ready to review your observations, make sense of what you found, and share your results with the local community.

Part I. Review your records.

1. Review the sky conditions you recorded in your notebook for each *Sky Survey*.
2. Open the Globe Observer app and select **See My Data** to review your club's observations.
3. Use your findings to answer the following questions as a club:
  - How many times did you do a *Sky Survey*?
  - What types of clouds did you see?
  - How many of the days were sunny? Cloudy? Rainy or snowy?
  - Which clouds did you see on rainy or snowy days? Which clouds did you see on dry days?

Part II. Create a cloud atlas.

1. Working alone or in small groups, choose one cloud that you saw during your *Sky Surveys*.
2. Create a cloud atlas for your chosen cloud. A **cloud atlas** is a guide that includes information such as:
  - Images of the cloud.
  - Descriptions of shape, height, and characteristics.
  - Descriptions of accompanying weather, such as rain, heat, or cold.
  - How often the cloud was observed during the *Sky Surveys*.

### Kit Materials

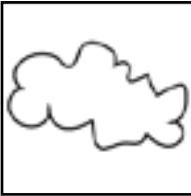
A

- [SAC certificates](#)

### Loose Items

- *Cloud Quest* buttons
- SAC notebooks

### Cloud Atlas



Cloud name:

Shape:

Altitude:

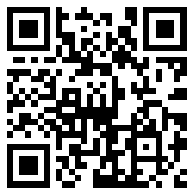
# of observations:

Characteristics:



Weather:

**Explore More:**

[Climate Kids:](#)  
[Eyes of Earth](#)



Share out: Present your cloud atlas to the rest of the club. Which cloud did you choose and why? Talk about some of the information you included in the cloud atlas.

**SAC Ceremony** 15 min. | inside or outside  

Congratulations! You have proven your skills as a NASA citizen scientist, and you have earned your certificate of success, as well as a *Clouds* button. Hold a ceremony to honor your achievements. Then, take home your notebook and use it to continue your explorations.

**Explore More:**  

Continue exploring clouds and climate with NASA by visiting the [Climate Kids: Eyes on Earth](#) website.

**Call to Action:**  

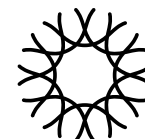
Introduce your family and friends to the GLOBE Observer project. Encourage them to download the app and start contributing to citizen science!

**How did it go?**

[Let us know!](#)



**Attendance & Feedback:** How many youth attended? How did it go? Record notes here, then click or scan the link to let us know.



# CONNECT TO THE ACADEMY



California Academy of Sciences offers several ways to stay connected:



## [Flipside Science](#)

These video-based units, designed for middle school educators and students, address food, water, and energy systems, environmental solutions, and design-thinking skills.



## [Science Films for the Classroom](#)

These award-winning planetarium dome shows have been reformatted for educational use as stand-alone films or as a series of short, modular clips.



## [Science Video Vault](#)

A collection of high-quality short-length videos to help your students visualize data and scientific and natural phenomena.



## [bioGraphic for Educators](#)

This multimedia magazine powered by the Academy includes immersive infographics, data visualizations, and videos.



## [Educator Tab](#)

This is the entry point to all of the educator resources offered by the California Academy of Sciences.



## [Distance Learning](#)

Distance Learning brings Academy experts, animals, collections, and exhibits to youth the world over, via the internet.



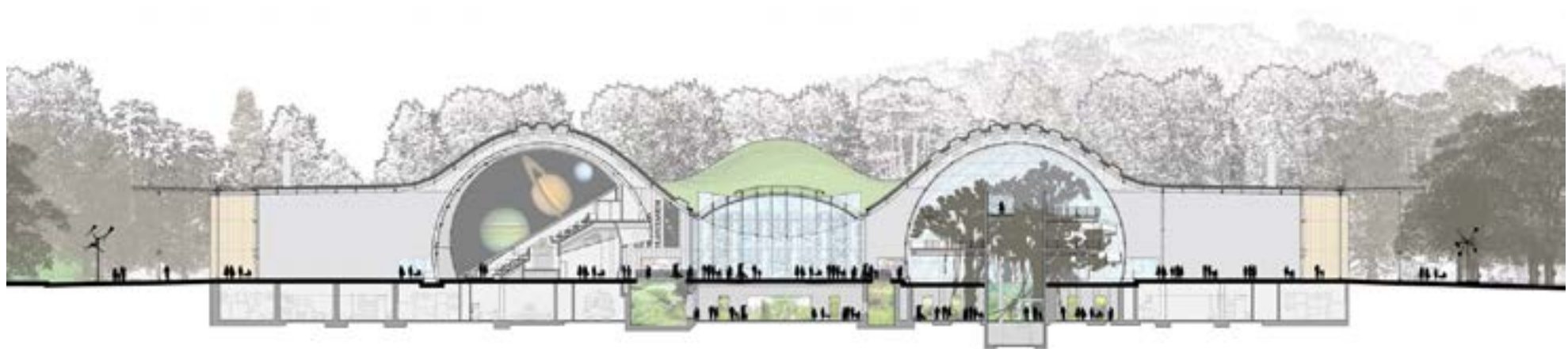
## [Citizen Science Projects](#)

Learn how the Academy connects with community volunteers to explore and protect biodiversity in California.



## [Citizen Science Toolkit](#)

This toolkit is designed to help educators integrate citizen science projects into classroom curricula or afterschool programming.



# NGSS CONNECTIONS

The Next Generation Science Standards (NGSS) offer a new vision for K-12 science education. Released for states' adoption in 2013, and designed with decades of research on best practices for teaching and learning science, the NGSS offer an opportunity to move science education into the 21st century.

The activities in *Cloud Quest* support youth engagement in some aspects of the three dimensions of the NGSS. Specifically the Science and Engineering Practices (SEPs) are used as strategies for making sense of content that connects to the Crosscutting Concepts (CCCs) and the Disciplinary Core Ideas (DCIs).

## Science and Engineering Practices (SEPs)

### Analyzing and Interpreting Data

*Activities 1 - 12*

- Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
- Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.
- Analyze and interpret data to determine similarities and differences in findings.

### Developing and Using Models

*Activities 2, 3, 6, 7, 10, 11*

- Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.

### Designing Solutions

*Activities 2, 6, 10, 11*

- Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process, or system.

## Disciplinary Core Ideas (DCIs)

### ESS2.C: The Roles of Water in Earth's Surface Processes

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.

### ESS2.D: Weather and Climate

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

### ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of test results, in order to improve it.

## Crosscutting Concepts (CCCs)

### Patterns

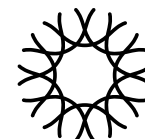
*Activities 4, 12*

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
- Patterns can be used to identify cause and effect relationships.
- Graphs, charts, and images can be used to identify patterns in data.

### Structure and Function

*Activities 2, 10, 11*

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.





# REFERENCES



## Photos

Unless otherwise stated, all images were created by NASA, California Academy of Sciences staff members, or released to the public domain without copyright. Other satellite images were obtained from Google Earth.



Laptop by raihanil from the Noun Project



social distancing by Made x Made from the Noun Project

# WEB LINKS

<b>1: Get to Know a Cloud</b>	Attendance and Feedback	<a href="https://sciclub.link/clouds-feedback">sciclub.link/clouds-feedback</a>
	GLOBE Observer Cloud Science	<a href="https://sciclub.link/globemission">sciclub.link/globemission</a>
	Why Are There Different Types Of Clouds?	<a href="https://sciclub.link/cloudtypes">sciclub.link/cloudtypes</a>
	The Making of a Cloud	<a href="https://sciclub.link/cloudmaking">sciclub.link/cloudmaking</a>
<b>2: Build a Satellite</b>	Want to Launch a Satellite? You can!	<a href="https://sciclub.link/cloudsa2em">sciclub.link/cloudsa2em</a>
	How to Observe Satellites	<a href="https://sciclub.link/cloudsa2cta">sciclub.link/cloudsa2cta</a>
<b>3: Ground Truthing</b>	Landsat's Orbit	<a href="https://sciclub.link/nasaSAT">sciclub.link/nasaSAT</a>
	Best of "Earth As Art"	<a href="https://sciclub.link/cloudsa3em">sciclub.link/cloudsa3em</a>
	Google Maps	<a href="https://sciclub.link/cloudsa3cta">sciclub.link/cloudsa3cta</a>
<b>4: A Closer Look at the Sky</b>	Why So Many Cloud Types?	<a href="https://sciclub.link/cloudtypes2">sciclub.link/cloudtypes2</a>
	Why Do Clouds Stay Up?	<a href="https://sciclub.link/cloudsa4em">sciclub.link/cloudsa4em</a>
	Cloud Names	<a href="https://sciclub.link/cloudnames">sciclub.link/cloudnames</a>
<b>5: Connect to NASA</b>	How to Do a Sky Survey	<a href="https://sciclub.link/skysurvey">sciclub.link/skysurvey</a>
	GLOBE Observer	<a href="https://sciclub.link/globeobserver">sciclub.link/globeobserver</a>
	Cloudy Forecast	<a href="https://sciclub.link/cloudsa5em">sciclub.link/cloudsa5em</a>
<b>6: Rocket Science</b>	On a Rocket Launch to Space	<a href="https://sciclub.link/rocketlaunch">sciclub.link/rocketlaunch</a>
	How Do We Launch Satellites Into Space?	<a href="https://sciclub.link/cloudsa6em">sciclub.link/cloudsa6em</a>
	SpaceX	<a href="https://sciclub.link/cloudsa6cta">sciclub.link/cloudsa6cta</a>
<b>7: Drain to Rain</b>	The Water Cycle	<a href="https://sciclub.link/watercycle">sciclub.link/watercycle</a>
	Recharging Aquifers	<a href="https://sciclub.link/cloudsa7em">sciclub.link/cloudsa7em</a>
<b>8: Measure the Wind</b>	Wind Power	<a href="https://sciclub.link/cloudsa8em">sciclub.link/cloudsa8em</a>
<b>9: Erupt a Volcano</b>	Volcanoes 101	<a href="https://sciclub.link/volcanoes101">sciclub.link/volcanoes101</a>
	How Do Active Volcanoes Change Clouds?	<a href="https://sciclub.link/cloudsa9em">sciclub.link/cloudsa9em</a>
	Carbon Footprint Calculator	<a href="https://sciclub.link/cloudsa9cta">sciclub.link/cloudsa9cta</a>
<b>10: Fly a Kite</b>	NASA Launches Super-Pressure Balloon	<a href="https://sciclub.link/cloudsa10em">sciclub.link/cloudsa10em</a>
	Float Beijing	<a href="https://sciclub.link/cloudsa10cta">sciclub.link/cloudsa10cta</a>
<b>11: Green Design</b>	What is green building?	<a href="https://sciclub.link/greenbuild">sciclub.link/greenbuild</a>
	Green Solutions	<a href="https://sciclub.link/greensolutions">sciclub.link/greensolutions</a>
	Waste Water Recycling	<a href="https://sciclub.link/cloudsa11em">sciclub.link/cloudsa11em</a>
	World Green Building Council	<a href="https://sciclub.link/cloudsa11cta">sciclub.link/cloudsa11cta</a>
<b>12: Cloud Conclusions</b>	Climate Kids: Eyes on Earth	<a href="https://sciclub.link/cloudsa12em">sciclub.link/cloudsa12em</a>

# GLOSSARY

<b>altitude</b>	the height of an object or point in relation to sea level or ground level
<b>alto-</b>	prefix for mid-level clouds
<b>anemometers</b>	an instrument for measuring the speed of the wind, or of any current of gas
<b>atmosphere</b>	the envelope of gases surrounding the earth or another planet
<b>cirro-</b>	prefix for high-level clouds
<b>cirrus</b>	cloud forming wispy filamentous tufted streaks (“mare’s tails”) at high altitude
<b>citizen science</b>	the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists
<b>cloud</b>	a visible mass of condensed water vapor floating in the atmosphere, typically high above the ground
<b>condensation</b>	the conversion of a vapor or gas to a liquid
<b>contrail</b>	a trail of condensed water from an aircraft or rocket at high altitude, seen as a white streak against the sky
<b>cumulus</b>	a cloud forming rounded masses heaped on each other above a flat base at fairly low altitude
<b>evaporation</b>	the process of a substance in a liquid state changing to a gaseous state due to an increase in temperature and/or pressure
<b>ground truthing</b>	manual collection of data that enables calibration of remote-sensing data, and aids in the interpretation and analysis of what is being sensed
<b>lava</b>	hot molten or semifluid rock erupted from a volcano or fissure, or solid rock resulting from cooling of this

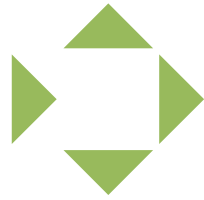
<b>magma</b>	hot fluid or semifluid material below or within the earth's crust from which lava and other igneous rock is formed by cooling
<b>meteorology</b>	the branch of science concerned with the processes and phenomena of the atmosphere, especially as a means of forecasting the weather
<b>nimbo-</b>	prefix for clouds that bring precipitation, such as rain and snow
<b>-nimbus</b>	postfix for clouds that bring precipitation, such as rain and snow
<b>orbit</b>	the curved path of a celestial object or spacecraft around a star, planet, or moon, especially a periodic elliptical revolution
<b>precipitation</b>	rain, snow, sleet, or hail that falls to the ground
<b>prototype</b>	a first, typical or preliminary model of something, especially a machine, from which other forms are developed or copied
<b>rocket</b>	a cylindrical projectile that can be propelled to a great height or distance by the combustion of its contents
<b>satellite</b>	a celestial body orbiting the earth or another planet; or an artificial body placed in orbit around the earth or moon or another planet in order to collect information or for communication
<b>solar panel</b>	a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating
<b>stratus</b>	cloud forming a continuous horizontal gray sheet, often with rain or snow
<b>sustainability</b>	able to be maintained at a certain rate or level
<b>volcano</b>	a mountain or hill, typically conical, having a crater or vent through which lava, rock fragments, hot vapor, and gas are being or have been erupted from the earth's crust
<b>watershed</b>	an area or ridge of land that separates waters flowing to different rivers, basins, or seas



# NOTES



The Science Action Club program is generously supported by

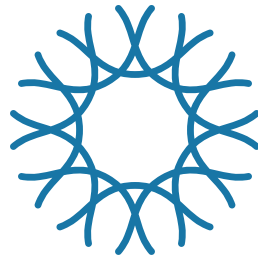


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