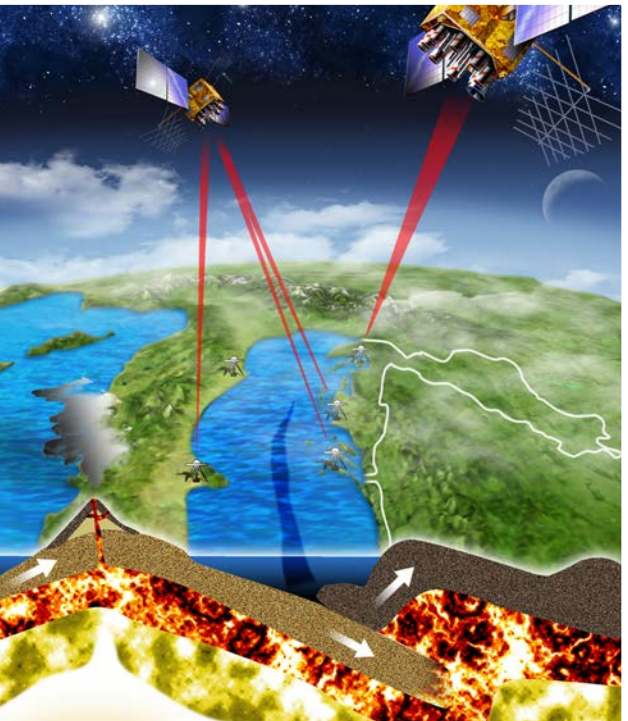



Geoscience Innovating for Earth and People

Innovations in the geosciences allow us to study the Earth in new ways. Emerging technologies and updated methods of collecting data help monitor phenomena such as natural hazards, climate change, and the overall health of ecosystems. Understanding these processes and continuing to innovate techniques for studying the Earth help people to live more sustainably.

Innovations have led to changes in geoscience-related careers over the past few decades, requiring new skills, especially those related to technologies that allow for faster and more accurate data collection, analysis, and sharing. That's why Earth Science Week 2023 is celebrating the theme "Geoscience Innovating for Earth and People." This year's theme emphasizes the essential role new technologies and techniques being used in the geosciences play in helping people make decisions that support communities while maintaining and strengthening the planet's ability to support thriving life.

This year's celebration also relates innovations in the geosciences to sustainability initiatives by focusing attention on the United Nations' 17 Sustainable Development Goals (SDGs, **https://sdgs.un.org/**). Each SDG outlines how issues such as energy, climate change, the environment, natural hazards, agriculture, industry, and economic opportunity would be addressed in a sustainable world. Aligning educational activities to the SDGs connects student learning to real-world problems as well as potential solutions for them. The activities in this calendar are tagged with the SDGs to which they relate as well as relevant Next Generation Science Standards (NGSS).

You can help promote understanding of the vital role that innovations in the geosciences play in informing, maintaining, and strengthening sustainability. This calendar features a variety of activities that highlight Earth science concepts and related innovations. These activities can be conducted in the classroom, at home, or in any other places where people gather — to explore the theme "Geoscience Innovating for Earth and People" during Earth Science Week and all year long!

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Earth Science Week Is for You

Taia Saurer

Litzia Galvan

Evelyn MacMichael

Eva Nichter

Kendra Schirckel

Earth Science Week 2022 Photography and Visual Arts Contest entries by listed artists.

This year, you're invited to join the millions of participants in all 50 states and many nations worldwide who are celebrating Earth Science Week. This exciting event has grown steadily in momentum and participation since the American Geosciences Institute facilitated the first Earth Science Week in 1998.

Every year, people in schools, workplaces, civic centers, and elsewhere celebrate Earth Science Week to help build public understanding and appreciation of the Earth sciences. Earth Science Week serves the geoscience community by:

- giving students new opportunities to discover the Earth sciences,
- highlighting the contributions made by the geosciences to society,
- publicizing the message that Earth science is all around us,
- encouraging responsible stewardship of the planet through an understanding of Earth processes,
- providing a forum where geoscientists can share their knowledge and enthusiasm about the Earth and how it works, and
- making learning about Earth science fun!

Formal and informal educators, students, parents, geoscientists, and interested citizens can all play a leading role in Earth Science Week. Start with a visit to the Earth Science Week website (**www.earthsciweek.org**). Let us know how you are planning to celebrate! Send us an email at **info@earthsciweek.org**. Celebrate Earth Science Week: October 8–14, 2023!

EARTH SCIENCE WEEK

How can you get involved? Explore the Earth Science Week website to find a host of tools designed to make planning and attending events easy, fun, and rewarding! We have many resources to help you work with local geoscience professionals to engage young people and others in events that help them consider their role in Earth science, innovation, and sustainability.

You'll also find links to educational materials and activities, many of which are also available in the 2023 Earth Science Week toolkit.

The website also includes a link to subscribe to our electronic newsletter so you can stay up-to-date on the latest developments and upcoming activities!

www.earthsciweek.org

LEARNING ACTIVITY:

From Trash to Terrarium

GRADES 3–7

MATERIALS

- Two matching bottles with straight sides (1 L recommended)
- Thick yarn, rope, or string
- Scissors (Adult supervision required)
- Small plants or seeds
- Soil
- Rocks (optional)

Figure 1.
Credit: Alexandria Gillen/NOAA. Modified by L. Mossa

Source: National Oceanic and Atmospheric Administration.
Adapted with permission.

Our ocean is filled with items that don't belong there. Huge amounts of plastics, metals, rubber, paper, textiles, abandoned fishing gear, and much more enter the ocean every day, making marine debris one of the most widespread pollution problems facing the ocean and waterways.

The problem of marine debris affects everyone, no matter where they live. Marine debris comes from human activity on land and at sea. Even debris that starts on land can enter waterways, where it is then further spread by water movements and currents. Marine debris can cause a lot of problems for ecosystems, wildlife, and our economy.

The NOAA Marine Debris Program leads national and international efforts to research, prevent, and reduce the impacts of marine debris. One way you can help reduce marine debris is by reducing the amount of trash you create! This activity reuses materials that might otherwise be thrown away.

PROCEDURE

1. Cut a piece of yarn that is approximately the same length as the height of the bottles.
2. With adult supervision, cut each bottle into two pieces each. Cut Bottle A about 2/3 of the way from the top and Bottle B about 2/3 of the way from the bottom (Figure 1). Recycle the bottom of Bottle A.
3. With adult supervision, cut a hole in Bottle A's cap large enough to push the strand of yarn through the hole. Put the cap with the yarn onto Bottle A. Adjust the yarn so it comes about halfway into Bottle A.
4. Fill the bottom of Bottle B halfway with water (and rocks, if available).
5. Nest Bottle A upside-down into Bottle B with the yarn hanging into the water. You may need to add more water if the yarn does not reach.
6. Fill Bottle A halfway with soil. Add plants and/or seeds to the soil.
7. Secure the top of Bottle B onto the up-turned opening of Bottle A. Now you have made your terrarium (Figure 2). If it isn't fitting, try cutting a small slit in the wide end and wiggling it on (this may take some adjusting!).
8. Watch your plant grow! The string will pull water from below into the soil, while the top will trap humidity to create suitable conditions for your plant.

FURTHER STEPS

1. Use egg cartons as seed-starting nurseries. You can use plastic bags or domed plastic lids from drinks to increase the humidity inside the terrarium.
2. Repurpose t-shirts or socks as plant ties in an outdoor garden. They're soft and stretchy to support your tomatoes, peas, and other leggy climbers while they grow.

Figure 2.
Credit: Alexandria Gillen/NOAA

3. Reuse food scraps like green onions, carrot tops, celery stems, avocado pits or other plant parts that would otherwise be food waste by planting them in your terrarium.
4. Research a common type of trash found in marine debris. How does it affect the animals living in that waterway? Design and test out ways to reuse this item rather than throwing it away.

ADDITIONAL RESOURCES

Learn more about marine debris at **https://marinedebris.noaa.gov/** and explore all of NOAA's educational resources at **www.noaa.gov/education**.

NGSS CONNECTIONS

SEP: Planning and Carrying Out Investigations
DCI: ESS2.A: Earth's Materials and Systems; ESS3.A: Natural Resources
CCC: Cause and Effect

SDG CONNECTIONS

12: Responsible Consumption and Production
14: Life Below Water

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
National Water Quality Month		1	2	3	4	5
6	7	8	9	10	11 Mountain Day	12
13	14	15	16	17	18	19
20	21 **Aug. 21–22, 2023:** **Geoscience Event:** 6th International Conference on Environmental Sustainability and Climate Change, Philadelphia, Pennsylvania	22	23	24	25	26
27 **Aug. 27-Sept. 1, 2023:** **Geoscience Event:** IMAGE 2023, American Association of Petroleum Geologists and Society of Exploration Geophysicists, Houston, Texas	28	29	30 National Beach Day	31		

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LEARNING ACTIVITY:

What Do Mineralogists Do?

GRADES 6–8

MATERIALS

- Computer with Internet access
- Pen or pencil
- Paper

Close-up photo of a crystalline rock.
Credit: Brand X Pictures/David Wasserman

Source: Mineralogical Society of America.
Adapted with permission.

Minerals are the naturally occurring solid materials that make up rocks and sands and are found in soil. You are probably aware of everyday minerals like halite (sodium chloride — table salt), graphite ("lead" in pencils), quartz (main mineral in beach sand), and others. As of this writing, there are 5,663 known minerals, and new ones are still being discovered. You can learn about minerals online in the Handbook of Mineralogy (**https://handbookofmineralogy.org/**). Geoscientists who study minerals for a living are called mineralogists. Having an in-depth knowledge of minerals opens many doors to more careers than you might imagine. In this activity, you will explore some of these exciting careers and see if these might be part of your future!

PROCEDURE

1. You might find it helpful to work with a friend for this activity. Brainstorm the kinds of jobs or activities that you think mineralogists might do in their work. Write down your ideas. Which of these jobs sound interesting to you? Why?
2. The Mineralogical Society of America (MSA) has a collection of videos from people with backgrounds in mineralogy. All of these people talk about what they do for a living and how minerals are important to their work. You can find these videos on MSA's YouTube Channel at **https://bit.ly/MSA_YouTube**.
3. Choose and watch three videos that look interesting to you. As you watch, make notes about how minerals play an important part in these jobs.
   a. What knowledge and skills did these people need to do their jobs? Were the activities they describe as part of their job on your original list?
   b. How do their jobs help people to know more about minerals?
   c. How did they prepare for their careers?
   d. What do they find rewarding about their jobs?
4. Which of these jobs could you imagine yourself doing in the future? Why is that? How do their jobs help society? Think about these questions and add your answers to the notes you made about the careers. Discuss your thoughts with a partner.

FURTHER STEPS

The United Nations developed 17 Sustainable Development Goals (SDGs) to address the biggest challenges faced by the world today (**https://sdgs.un.org/**). Explore these goals and describe how the mineralogy jobs you learned about can help achieve at least one of these goals.

Gemologist examining samples under a microscope.
Credit: Alamy

NGSS CONNECTIONS

SEP: Obtaining, Evaluating, and Communicating Information
DCI: ESS2.A: Earth's Materials and Systems
CCC: Science Addresses Questions About the Natural and Material World

SDG CONNECTIONS

4: Quality Education
8: Decent Work and Economic Growth
12: Responsible Consumption and Production

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 **Did You Know?** The First Instrumental Tsunami Warning System Was Established in Sendai, Japan, 1941	2
3	4 **Federal Holiday:** Labor Day	5	6 **Protect Your Groundwater Day**	7	8	9 **Sept. 9–10, 2023:** **Geoscience Event:** 40th NABG Annual Technical Conference, National Association of Black Geoscientists, Virtual
10	11 **Patriot Day**	12	13	14	15 **Rosh Hashanah Begins** (Sundown)	16 **Sept. 16–19, 2023:** **Geoscience Event:** AIPG 60th Anniversary National Conference, American Institute of Professional Geologists, Covington, Kentucky **International Day for the Preservation of the Ozone Layer**
17 **Rosh Hashanah Ends**	18 **World Cleanup Day** **World Water Monitoring Day**	19 **Sept. 19–24, 2023:** **Geoscience Event:** 66th AEG Annual Meeting, Association of Environmental & Engineering Geologists, Portland, Oregon	20	21 **Zero Emissions Day**	22 **World Car-Free Day**	23 **Sept. 23-Oct. 1, 2023:** **Geoscience Event:** Flagstaff Festival of Science, "The Mammoth World of Science," Flagstaff, Arizona **Autumnal Equinox** **Geoheritage Day**
24 **World Rivers Day** **Yom Kippur Begins** (Sundown)	25 **Yom Kippur Ends**	26 **World Environmental Health Day**	27	28 **International Day for the Universal Access to Information**	29	30

LEARNING ACTIVITY:

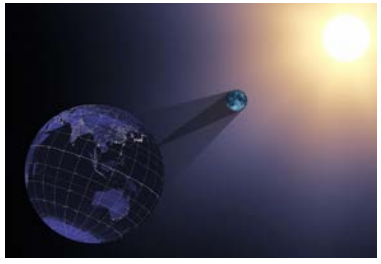
How Does a Solar Eclipse Affect Air Temperature?

GRADES 6–8

MATERIALS

- Phone, tablet, or computer with internet access

Safety Note: ***Remember to never look directly at the Sun without proper safety equipment.***



Simplified solar eclipse model.
Credit: NASA's Goddard Space Flight Center

Source: National Aeronautics and Space Administration.
Adapted with permission.

Most everyone has experienced the cool relief provided by shadows and clouds on a hot day. You may have even done experiments that measure the difference in air temperature between areas with direct sunlight and areas shaded by trees or other objects. How would a solar eclipse affect air temperature?

PROCEDURE

1 Go to the My NASA Data website to complete the full lesson, "How does a Solar Eclipse Affect Air Temperature?" **https://go.nasa.gov/42MdTXg**.

2 View the *Solar Eclipse Visualization* image again. This diagram is not to scale. It is designed to emphasize the umbra and penumbra. Point out the umbra and penumbra in the image. Remember that light from the Sun shines equally in all directions, but this image focuses on sunlight that hits Earth to highlight an eclipse event.

3 Watch *The GLOBE Air Temperature with Eclipse Shadow 2017* visualization which shows how the Moon's shadow affected air temperature in the continental United States during the total solar eclipse of August 21, 2017. The air temperature data presented in this animation were collected by citizen scientists using the GLOBE Program.

a. In the visualization, the Moon's shadow first hits the west coast of the continental US at approximately 17:00 UTC (Coordinated Universal Time, which equates to 10:00 AM Pacific Standard Time). At approximately what time of day does the shadow reach the East Coast? How would the time of day affect the data?

b. The innermost (smallest) circle represents where a total solar eclipse was witnessed (umbra). The lighter outer circles represent the penumbra shadow. Viewers in this shadow experienced a partial solar eclipse. Viewers in the medium-sized circle would have seen the Sun obscured by 90%. Viewers in the outermost (largest) circle (also the penumbra) would have seen the Sun obscured by 50%. Outside the concentric circles viewers would experience a partial solar eclipse, but with an even smaller percentage of the Sun obscured. Do locations experiencing the total solar eclipse experience greater temperature variations than locations experiencing a partial solar eclipse? What is your evidence?

ANALYSIS

1 Answer the analysis questions on the lesson site to interpret the data from the animation.

2 Consider the atmospheric temperature change that occurs during an eclipse. Is it:

a. Short-term or long-term?
- How do you know?
- Describe another factor that could affect temperature change for this time range.

b. Regional or global?
- How do you know?
- Describe another factor that could affect temperature change over a similar area.

ADDITIONAL RESOURCES

For Earth Systems Science learning activities, visit My NASA Data at **https://mynasadata.larc.nasa.gov/**.

NGSS CONNECTIONS

SEP: Developing and Using Models
DCI: ESS1.B: Earth and the Solar System
CCC: Cause and Effect

SDG CONNECTIONS

15: Life on Land

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 **Oct. 1–4, 2023:** **Geoscience Event:** GRC Annual Meeting & Expo, Geothermal Rising, Reno, Nevada	**2**	**3** **Did You Know?** The First Rocket to Reach Space Launched from Peenemünde an Island Off the Coast of Germany, 1942	**4** **Did You Know?** Sputnik 1 Became the First Artificial Satellite to Orbit Earth, 1957 **Oct. 4–10, 2023:** **World Space Week**	**5** **World Teachers' Day**	**6**	**7**
8 **Oct. 8–14, 2023:** **Earth Science Week** **International EarthCache Day**	**9** **Federal Holiday:** Indigenous Peoples' Day **Minerals Day**	**10** **No Child Left Inside Day** **Earth Observation Day**	**11** **National Fossil Day**	**12** **Geoscience for Everyone Day**	**13** **Geologic Map Day**	**14** **Annular Solar Eclipse** **Earth Science Week Contest Due Date**
15 **Oct. 15–18, 2023:** **Geoscience Event:** GSA Annual Conference, GSA Connects 2023, Geological Society of America, Pittsburgh, Pennsylvania **Oct. 15–21, 2023:** **National Chemistry Week**	**16** **Oct. 16–18, 2023:** **Geoscience Event:** SPE ATCE, Annual Technical Conference and Exhibition, Society of Petroleum Engineers, San Antonio, Texas	**17**	**18**	**19** **Oct. 19–21, 2023:** **Geoscience Event:** AISES National Conference, American Indian Science and Engineering Society, Spokane, Washington **Great ShakeOut Earthquake Drill 10:19 AM local time.** Learn more at ShakeOut.org	**20**	**21** **International Archaeology Day**
22	**23**	**24** **International Day of ClimateAction**	**25** **Sustainability Day** **Oct. 25–28, 2023:** **Geoscience Event:** NSTA National Conference on Science Education, National Science Teaching Association, Kansas City, Missouri	**26** **Oct. 26–28, 2023:** **Geoscience Event:** SACNAS National Diversity in STEM Conference, Society for Advancement of Chicanos/ Hispanics and Native Americans in Science, Portland, Oregon	**27**	**28**
29 **Oct. 29-Nov. 1, 2023:** **Geoscience Event:** ASA-CSSA-SSSA International Annual Meeting, St. Louis, Missouri	**30**	**31** **Halloween**				

Earth Science Week

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October 2023

NOVEMBER 2023

LEARNING ACTIVITY:

Design and Build a Water Filtration System

GRADES 4–12

MATERIALS

- 2 L plastic bottle
- Scissors
- Water with coffee grounds or soil (unfiltered water)
- Large cup
- Natural filter materials: soil, gravel, sand, dried grass, or others
- Other filter materials. Consider:
  - Paper products
  - Pet care materials
  - Hardware store materials
  - Unneeded clothing or packaging materials

If you have an idea, test it out!

USGS science for a changing world

Source: United States Geological Survey.
Adapted with permission.

Access to clean drinking water is necessary for human health. But how do we get clean water? What happens to our water between its source and our faucet? What parts of the environment might act as a water filter? How can humans filter water to make it cleaner? This activity will allow you to investigate the ability of materials to filter particles from water.

PROCEDURE

1. Carefully cut the bottom off the 2 L bottle and remove the cap. Place the bottle upside down into the mouth of a large cup.
2. Layer filter materials inside the overturned bottle.
3. Run tap water through the filter a few times to wash away any particles on the filter material. Empty the cup after each rinse.
4. Evaluate your unfiltered water. What does it look like? Is there a color? Do you see anything in the water? Does it have a smell? What materials might be easy to filter out of water? What might be difficult to filter out?
5. How might each material in your filter help clean the unfiltered water?
6. Pour your unfiltered water into the overturned bottle with the filter material. It may take some time for water to move through the filter material.
7. Make observations of the filtered water collected in the cup.

Safety Note: ***Do not consume the water filtered during this experiment.***

8. Make changes or build a new filter by repeating steps 2–6 using different materials.
9. Communicate your findings to others with a talk, poster, or short report.

ANALYSIS

1. How does each sample of filtered water compare to the unfiltered water? Why do you think that is the case?
2. How does each filtered sample compare to each other? Which filter was most effective? Overall, which worked better as a filter- natural or manmade materials? Describe how you know.
3. Choose a filter that you consider to be ineffective. How could the filter be changed to improve its function? If possible, test your suggestions.
4. Research where your drinking water comes from and how it is filtered before it gets to your faucet. If you filter your water at home, research what types of contaminants your filter can remove from drinking water.

FURTHER STEPS

1. Even if run through a filter, the water sample you used is likely not safe to drink because it has not been purified. What else may be in the water that you cannot see? Research ways that contaminants that are too small to see can be removed from water.
2. Quantitatively evaluate your water by measuring the pH or electrical conductivity (EC). Cleaner water will have a pH near 7.0 (the pH of pure water) and a lower EC (a poorer conductor).

Patapsco River, Hollofield, MD.
Credit: USGS, Public Domain

ADDITIONAL RESOURCES

USGS Drinking Water and Source Water Resources

NGSS CONNECTIONS

SEP: Planning and Carrying Out Investigations
DCI: ESS3.A: Natural Resources
CCC: Cause and Effect

SDG CONNECTIONS

3: Good Health and Well-Being
6: Clean Water and Sanitation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2 **International Day Against Violence and Bullying at School, Including Cyberbullying** **Did You Know?** The Yujialiang Coal Mine Becomes the First Unmanned Mine, China, 2022	3	4
5 **Daylight Saving Time Ends**	6	7	8 **National STEM/STEAM Day**	9	10 **World Science Day for Peace and Development** **Federal Holiday:** Observation of Veterans Day	11
12 **Observation of Diwali**	13 **Nov. 13–17, 2023: Geography Awareness Week**	14	15 **America Recycles Day** **GIS Day (Geographic Information Systems) Day**	16	17 **National Take a Hike Day**	18 **International Day of LGBTQIA+ People in STEM**
19 **National Camp Day**	20	21	22	23 **Federal Holiday:** Thanksgiving	24	25
26	27	28	29	30 **Nov. 30-Dec. 12, 2023: Geoscience Event:** 2023 United Nations Climate Change Conference (COP27), United Arab Emirates		

LEARNING ACTIVITY:

Virtual Fieldtrip to the Whaleback Anticline

GRADES 8–12

MATERIALS
- Computer with Internet access

Many geoscientists study Earth's features, which typically requires going out into the field. The Whaleback Anticline, located near Shamokin, Pennsylvania, is a unique and well-studied geologic formation. This site is located on privately owned land, making it difficult to access. Technologies, such as drones and other unmanned aircraft, have been used to take pictures and collect other data of the site, making it accessible online.

Screenshot from the Whaleback Anticline Game.
Credit: Max Needle
Source: **https://bit.ly/Whaleback_Game**

PROCEDURE

1. Go to: **https://bit.ly/WhalebackGeology** to read a brief description of the geology of the Whaleback Anticline.
2. Go to the Virtual Field Geology site: **https://bit.ly/Virtual_Geology**.
   a. Read the quick start guide to learn about the game's controls.
   b. Open the tutorial.
3. Open the game by going to **https://bit.ly/Whaleback_Game** and clicking on "Field Adventure".
   a. Watch each segment of the tutorial and try out each tool being demonstrated.
   b. Note: To change perspective, right-click the mouse to change direction. If using a touch screen, use two fingers but only move one.
4. Choose one tool and use it to collect data.
5. Organize your data into a table.

ANALYSIS

1. Describe what your data reveals about the Whaleback Anticline. How could someone use this data to describe or interpret the feature?
2. What other data would you want to collect from the Whaleback Anticline site? Explain your thinking.
3. Search "Whaleback Anticline" using Google Earth.
   a. What information can you get by looking at the site on Google Earth that you cannot get on the virtual fieldtrip site?
4. The model of Whaleback Anticline was created with *structure-from-motion* technology. Research the technology to summarize its use.
5. What is one benefit of virtual field trips? What is one drawback?
6. Choose an area near you that could be used for a virtual field trip.
   a. Why did you choose this site?
   b. What geologic feature(s) would you highlight in the virtual fieldtrip and why?
7. The Whaleback Anticline has been named a *geoheritage site*. Read about Pennsylvania's geoheritage sites at **https://bit.ly/Geoheritage_Sites_Pennsylvania**.
   a. Describe why the Whaleback Anticline is a geoheritage site.
   b. Research your state to discover geoheritage sites near you.

ADDITIONAL RESOURCES

Arizona State University virtual fieldtrips: **https://vft.asu.edu/**
Science Education Resource Center: **https://bit.ly/Virtual_Geoscience_Trips**

NGSS CONNECTIONS

SEP: Developing and Using Models; Analyzing and Interpreting Data
DCI: ESS1.C: The History of Planet Earth
CCC: Scale, Proportion, and Quantity; Systems and System Models

SDG CONNECTIONS

4: Quality Education
9: Industry, Innovation, and Infrastructure

ADVANCING EARTH AND SPACE SCIENCES

Source: American Geophysical Union.
Developed by Lindsay Mossa, AGI.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Universal Human Rights Month					1	2
3 **International Day of Persons with Disabilities**	4 **Did You Know?** John Snow Presented Maps Tracking London's Cholera Epidemic, Pioneering the Field of Epidemiology, 1854	5 **World Soil Day** **Dec. 5–7, 2023: Groundwater Week, Las Vegas, Nevada**	6	7 **Hanukkah Begins** (Sundown) **Pearl Harbor Remembrance Day**	8	9
10 **International Animal Rights Day**	11 **International Mountain Day** **Dec. 11–15, 2023: Geoscience Event:** AGU Fall Meeting, American Geophysical Union, San Francisco, California	12	13	14	15 **Hanukkah Ends**	16
17	18	19	20	21 **Winter Solstice**	22	23
24 **New Year's Eve**	25 **Federal Holiday:** Christmas	26 **Kwanzaa Begins**	27	28	29	30
31						

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LEARNING ACTIVITY:

A Cool Roof

Varied roof colors and structures affect the heating and cooling needs of each home.
Credit: Michael Tuszynski
Source: Pexels

GRADES 6–8

MATERIALS

- A bright, sunny day (or a heat lamp)
- Black construction paper
- White construction paper
- Thermometers (2)
- Clock or timer
- Graph paper
- Aluminum foil (optional)

According to the U.S. Energy Information Administration, approximately 79% of the energy used in the United States comes from burning fossil fuels (i.e., coal, petroleum, and natural gas). Because fossil fuels are nonrenewable, it is important that we conserve them, otherwise they will become more expensive, and we might eventually run out of them. (**https://bit.ly/EIA_Energy**)

Think about all the things that use energy in your home (air conditioners, heaters, refrigerators, lights, TVs, etc.). Brainstorm simple actions you can take to reduce energy use (conserve energy). During warmer months, keeping buildings cool with air conditioning can use a lot of energy. Let's explore how simple innovations, such as the color of a building, particularly its roof, might affect air conditioning needs and energy consumption.

PROCEDURE

PART 1

1. Visit the U.S. Environmental Protection Agency (EPA) website (**https://bit.ly/EPA_ClimateChangeIndicators**) and look at *Figure 1: Heating and Cooling Degree Days in the Contiguous 48 States, 1895–2020*. The red line represents "cooling degree days", which is a measure of the amount of time that the weather was warm enough to run fans and air conditioners.
    a. What pattern do you notice in "cooling degree days" over the last 100 years? Over the last 30 years?
    b. What might cause this pattern?
    c. What does this pattern suggest about the usage of air conditioning?
    d. How can we reduce the need for air conditioning and thus reduce energy consumption?

PART 2

1. Fold a piece of black construction paper around one thermometer and white construction paper around another thermometer. Fold the paper so you can slide the thermometer out to read the temperature.
2. Place these a few feet apart in a sunny area or under a heat lamp (be sure the two setups are about the same distance from the lamp).
3. Write down the initial temperature on both thermometers and predict what you think will happen to the temperature on each.
4. Record the temperatures from each thermometer every 5 minutes, for at least 30 minutes or until the temperature on both thermometers stops changing.
5. On graph paper, draw a double line graph of temperature vs. time. Be sure to include a title, key, and labels on the x and y axes.

ANALYSIS

1. Which color construction paper had the largest increase in temperature? Why do you think this happened?
    a. Predict how the results would differ from a thermometer wrapped in aluminum foil.
    b. If possible, test your prediction.
2. Many roofs are dark in color. How might changing roofs to a lighter color affect energy costs when it comes to using air conditioning? What about when using heat in colder months?
3. What else might be done to homes to reduce energy usage? What potential problems might be caused by such changes?

ADDITIONAL RESOURCES

For more lessons from GSA, visit **www.geosociety.org/k-12**

NGSS CONNECTIONS

SEP: Analyzing and Interpreting Data; Constructing Explanations and Designing Solutions
DCI: ESS2.A: Earth's Materials and Systems
CCC: Energy and Matter; Cause and Effect

SDG CONNECTIONS

7: Affordable and Clean Energy
9: Industry, Innovation, and Infrastructure

THE GEOLOGICAL SOCIETY OF AMERICA®

Source: Geological Society of America.
Adapted with permission.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
International Creativity Month **Hawai'i Volcano Awareness Month**	1 **Kwanzaa Ends** **New Year's Day** **Did You Know?** The Sustainable Development Goals are Adopted by World Leaders at the UN Summit, 2016	2 **Federal Holiday:** Observation of New Year's Day	3	4	5	6
7	8	9	10	11	12 **Ed C. Roy Jr. Award for Excellence in K-8 Earth Science Teaching Applications Due**	13
14	15 **Federal Holiday:** Martin Luther King Jr. Day	16	17	18	19	20
21	22	23 **Did You Know?** Greenhouse Gases Observing Satellite (GOSAT), The First Spacecraft to Monitor Atmospheric Carbon Dioxide and Methane is Launched, Japan, 2009	24 **International Day of Education**	25	26	27
28 **Jan. 28-Feb. 1, 2024:** **Geoscience Event:** AMS Annual Meeting, American Meteorological Society, Baltimore, Maryland **International Reducing CO_2 Emissions Day**	29	30	31			

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January 2024

LEARNING ACTIVITY:

Safe as a Mine

GRADES 6–12

MATERIALS

- Paper and pencil or device on which to take notes
- Internet access

Figure 1: Quarry.
Credit: Society for Mining, Metallurgy & Exploration (SME)

SME FOUNDATION
MEC
MINERALS EDUCATION COALITION

Source: Minerals Education Coalition.
Adapted with permission.

Safety is always the top priority in modern mining. It is important to every person working in the industry — most importantly to ensure everyone's health, but also to prevent lost productivity and costly equipment damage. Safety in the mining industry is crucial to our society since minerals obtained from mining are required for everything we use such as buildings and roads, computers, and phones, and everything we do, from farming to medicine to green energy generation. In this exercise, students will learn about the Personal Protection Equipment (PPE) used in mining as well as innovations to make a safe industry even safer.

PROCEDURE

1. List some potential hazards of working in surface mines or quarries (Figure 1). Include the hazards of being outside, in addition to those of mining operations and activities.
2. List potential hazards in an underground mine (Figure 2). Think about the underground environment as well as the challenges of using equipment underground. Be sure to think about modern mining practices, conducted with modern communication, construction, lighting, sensors, and machines that dig and haul underground.
3. Visit **https://mineralseducationcoalition.org/esw/** to view a diagram showing Mining PPE. In addition to what is shown, Mining PPE also includes hearing and fall protection. Research the different types of mining PPE and some of the features that are important in each type of safety equipment. For example, boots may need a steel toe, protective material, non-slip tread, etc. Go back through the lists you created and indicate which safety equipment could help protect against specific hazards and how.
4. PPE is an important part of reducing risk, but technology is also important. Watch the "Mining 2.0 Progress and Innovation in the Industry" video [20:51] or, optionally, the "micro-learning" version [3:31], both found at **https://media.smenet.org/jobs-of-tomorrow-series**, looking for technological innovations that improve safety.

Figure 2: Underground miners in PPE.
Credit: S. Chundra, Creative Commons 4.0
Source: **https://commons.wikimedia.org/wiki/File:Underground_Mining_team.jpg**

ANALYSIS

1. Think about modern technology that you have used or would like to use. How could it be used to make mining safer?
2. How can the operation of vehicles from a distance (remote control) increase the safety of a mining operation?
3. What kind of safety hazards in mining can you detect with a drone?
4. What hazards would be associated with mining in space, Earth's oceans or in landfills? What PPE would be required for these types of mining operations?

ADDITIONAL RESOURCES

Go to **https://MineralsEducationCoalition.org/esw** for more "Jobs of Tomorrow"-related activities, video links, and information about mining-related careers and safety.

NGSS CONNECTIONS

SEP: Asking Questions and Defining Problems
DCI: ESS2.A: Earth's Materials; ESS3.B: Natural Resources
CCC: Influence of Science, Engineering, and Technology on Society and the Natural World

SDG CONNECTIONS

8: Decent Work and Economic Growth
9: Industry, Innovation, and Infrastructure

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2 Groundhog Day World Wetlands Day	3
4 **Did You Know?** The American Journal of Science Published Bertram Boltwood's Paper on His Discovery of Absolute Dating Using Radioactive Isotopes, 1907	5	6	7	8	9	10
11 **International Day of Women and Girls in Science**	12	13	14 Valentine's Day	15	16 National Innovation Day	17
18 **Feb. 18–23, 2024:** **Geoscience Event:** Ocean Sciences Meeting, virtual and in-person, United Nationals Decade of Ocean Science for Sustainable Development, New Orleans, Louisiana **Feb. 18–24, 2024:** **National Engineers Week**	19 **Federal Holiday:** Presidents' Day	20	21	22	23	24
25 **Did You Know?** The First Computerized Geographic Information System (GIS) was Invented by Roger Tomlinson, 1969	26 **Feb. 26-Mar. 2, 2024:** **National Invasive Species Awareness Week**	27	28	29		

LEARNING ACTIVITY:

Mapping from Different Perspectives

GRADES 5–8

MATERIALS

- Large table, preferably rectangular
- 10 small objects
- Paper, unlined
- Pencil
- Stepladder or stool (requires supervision)
- Clipboard (optional)
- Ruler (optional)

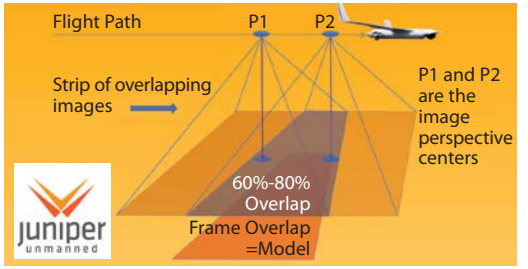
Maps can be used for many purposes, such as exploring new areas and tracking changes in Earth's features. Maps are also made in different ways. Traditionally, maps have been made from the ground-level. It is now becoming more common for maps to be made from images taken by satellites and drones. In this activity, you will make maps from different perspectives and analyze how those views can reveal different features.

PROCEDURE

1. Without looking, have a partner place 10 objects on a table.
2. Kneel at the edge of the table so it is at eye level (you can just see the surface of the table).
3. On a blank sheet of paper, draw a map of the tabletop, showing the location of each object. Repeat this procedure from new perspectives:
   a. at a different spot along the edge of the table,
   b. standing,
   c. standing on a stepladder (step down from the ladder while drawing).
4. Label the 4 maps you created with the perspective the viewer was at when it was made.
   a. Compare these maps and discuss differences and similarities with your partner.
   b. Choose the map that is most accurate.
5. Have an adult help you make a map of the table using a scale. You will need to:
   a. Cut the paper so its length and width in centimeters (cm) matches the table's length and width in decimeters (dm). Each cm of the paper would represent one dm of table length).
   b. Measure the distance of each object from the sides of the table and/or each other and use your scale to draw them on the map.
6. Watch AGI's introductory video on the use of drones (unmanned aerial systems, UAS) to take geoscience data, including pictures that can be used to make maps: **https://bit.ly/ESW-2023**.
7. Use Google Maps or Google Earth to view your school from both the ground and aerial views. Make observations of each view.

ANALYSIS

1. From which perspective was it most difficult to map the objects on the table? From which perspective was it easiest? Explain why.
2. When you look at your school from the ground, what are some things you can see that you cannot see from the aerial view? What are some things you can see from the aerial view that you cannot see from the ground?
   a. If you could only look from the ground, how could you make a map of the area around your school?
   b. If you were to map your schoolgrounds, would you use one perspective or multiple? Explain your answer.
3. Describe two benefits of using drones to make maps.



Drones take pictures along their flight path. The images are overlapped to create detailed maps of the landscape.

Credit: Modified from Juniper Unmanned
Source: Juniper Unmanned Inc, Menke, E., & Cozart, J. (n.d.). Data Acquisition - Week 10 Lecture [Slide show].

FURTHER STEPS

Use Google Maps or Google Earth to view other areas, such as the Grand Canyon. Click the "street view" icon (person) to see how much area has been photographed at ground view (the area that turns blue). Why do you think the entire area has not been photographed from the ground?

NGSS CONNECTIONS

SEP: Obtaining, Evaluating, and Communicating Information; Developing and Using Models
DCI: ESS2.B: Plate Tectonics and Large-Scale System Interactions
CCC: Patterns; Scale, Proportion, and Quantity

SDG CONNECTIONS

4: Quality Education
9: Industry, Innovation, and Infrastructure

AAPG
Advancing the World of Petroleum Geosciences™

Source: American Association of Petroleum Geologists.
Developed by Lindsay Mossa, AGI.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3 World Wildlife Day	4 World Engineering Day for Sustainable Development	5	6 World Energy Efficiency Day Mar. 6–12, 2024: National Groundwater Awareness Week	7	8 International Women's Day	9
10 Daylight Saving Time Begins	11 **Did You Know?** The First Use of an Unmanned Aircraft to Collect Data From a Volcanic Plume in Costa Rica, NASA, 2013 **Did You Know?** The First Use of Aerial Photography to Construct an Orthomosaic Map, 1915	12 National Plant a Flower Day	13	14	15	16
17 St. Patrick's Day	18 Global Recycling Day National Biodiesel Day	19 Vernal Equinox	20 Mar. 20–23, 2024: **Geoscience Event:** NSTA National Conference on Science Education, National Science Teaching Association, Denver, Colorado	21 International Day of Forests	22 World Water Day	23 World Meteorological Day
24 International Transgender Day of Visibility	25	26	27	28	29	30
31						

APRIL 2024

LEARNING ACTIVITY:

The Soil Science of Sports Fields

Credit: ©Adobestock

GRADES 5–8

MATERIALS

- Two large plastic cups
- Paper coffee filters
- Drill (or something to poke holes, may require supervision)
- Stopwatch
- Two 0.5-liter pitchers filled with water
- Measuring cup
- Two medium bowls
- Dry playground sand
- Dry soil from your area

Procedure step 2
Credit: Chase Straw

Soil Science Society of America

Source: Soil Science Society of America.

Developed by Chase Straw and Melanie Szulczewski for SSSA.

Soil plays a pivotal role in natural turfgrass sports fields. Native (natural) soils are common on community fields, while engineered (amended) soils are often used on baseball/softball infields and professional fields. Soil types vary in their water holding capacities and infiltration rates. For example, clayey soils have smaller particle sizes with less pore space than sandy soils giving clayey soils a higher water holding capacity. Slower water infiltration through clayey soils could cause game cancellations during heavy rainfalls due to water pooling on the field.

A goal for field managers is optimal soil moisture conditions for turfgrass growth while ensuring safety and playability. Soil moisture sensors can measure the relative amount of water in soil to help with irrigation scheduling. In this activity, you will compare the infiltration and water-holding capacities of two soils to determine which would be best to use on a sports field.

PROCEDURE

1. Drill three small holes in the bottom of each plastic cup.
2. Fill one coffee filter with dry sand and one with dry locally sourced soil.
3. Place each coffee filter in the bottom of one of the cups. Add soil until the soil is 1-inch from the top of the cup.
4. Hold each cup just above the bowls.

Procedure step 5
Credit: Chase Straw

5. Have two people pour water at about the same rate from the pitchers into the cups for 3 minutes. Pour slowly so the cups do not overflow. Water should go through the sand and soil and into the bowls.
6. Continue pouring until the water is gone or time is up. Measure the amount of water caught for each soil type.

ANALYSIS

1. Which soil type had the higher water holding capacity? How do you know?
2. In what scenarios would it be desirable for sports fields to have a high water infiltration rate? What about a higher water holding capacity?
3. How would higher water infiltration rates affect sports field management decisions, such as irrigation and fertilization?
4. How would water infiltration rate and water holding capacity affect the growth of crops on a farm? Why might the choices made for a sports field be different from those on a farm?

FURTHER STEPS

If you have access to a baseball field, try this experiment after several days of no rain:

1. Saturate an area of the infield (about a 5 x 5 ft square). Wet the soil just enough to be noticeably different from the dry area.
2. Bounce a baseball on both the wet soil and the dry soil, then walk on each area. Were there any differences in ball bounce on the wet versus dry soil? Did they feel different when walking on them? Which would you prefer running on and why? What are possible implications of an infield soil being very wet or dry during a game (in terms of ball roll and bounce)?

ADDITIONAL RESOURCES

- Sports Field Root Zone Constructions: **https://bit.ly/Rootzones**
- Video of baseball infield construction and maintenance: **https://bit.ly/Baseball_Infield**
- IYS June Video "Soils Support Recreation": **https://bit.ly/Soil_Support**
- Water Movement in Soils video: **https://bit.ly/Water_In_Soil**
- Additional soil lessons: **www.soils4teachers.org/esw**

NGSS CONNECTIONS

SEP: Asking Questions and Defining Problems
DCI: ESS2.A: Earth's Materials and Systems
CCC: Systems and Systems Models

SDG CONNECTIONS

11: Sustainable Cities and Communities
15: Life on Land

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
National Garden Month	1	2	3 **National Find a Rainbow Day**	4	5	6
7 **Did You Know?** The Expedition of the Oceanic Drilling Vessel, *CUSS I*, Resulted in the First Core Samples of Oceanic Crust Ever Taken, 1961	8 **Total Solar Eclipse**	9 **Apr. 9–10, 2024: Eid-al-Fitr** (sundown to sundown)	10	11	12 **Did You Know?** The First Manned Spaceflight, Kazakhstan, 1961	13
14 **National Gardening Day**	15	16 **Apr. 16–20, 2024:** **Geoscience Event:** AAG Annual Meeting, American Association of Geographers, Honolulu, Hawaii	17	18	19	20 **Apr. 20–28, 2024:** **National Park Week**
21 **World Creativity and Innovation Day**	22 **Earth Day**	23	24	25 **Did You Know?** Bell Labs Announces the Invention of the First Solar Panel Capable of Powering Electronic Devices, 1954 **Apr. 25–29, 2024:** **Geoscience Event:** National Science Bowl, U.S. Department of Energy Office of Science, Washington D.C.	26 **Arbor Day** **National Richter Scale Day**	27
28	29 **Passover Ends**	30				

LEARNING ACTIVITY:

Using Soundscapes to Analyze Environments

GRADES 6–8

MATERIALS

- Computer with internet access
- Access to a safe outdoor space

Earth's Spheres.
Credit: Martin Ruzek, Universities Space Research Association (USRA)
Source: **https://serc.carleton.edu/download/images/180954/earths_spheres.jpg**

Source: National Park Service.
Developed by Lindsay Mossa, AGI.

If you were to make observations of your local environment, what types of data would you collect? Have you ever considered the sounds of the environment to be an important factor? Consider what information sounds can provide about the condition of an environment. Many ecologists study specific environments using their natural combination of sounds, called a **soundscape**. This innovative technique allows scientists to use more types of evidence to describe an environment and study how it may change over time.

PROCEDURE

1. With your eyes closed, listen to the video at: **https://bit.ly/NPS_Soundscape**.
   a. Count how many different sounds you hear.
   b. What types of environments do you think are shown in the video?
2. The diagram to the left shows Earth's systems, which are also called *spheres*. List some examples of sounds you heard from the video that come from each sphere. If any sphere is not represented, think of other environments where this sphere might be heard.
3. Open a window or go outdoors. What sounds do you notice?
4. Make a data table to record your observations. Sit or lie still for 5–10 minutes and record the sounds you hear.
5. If possible, repeat step 4 at a different time of day.

ANALYSIS

1. Compare the sounds in your area to those in the video from step 1. Which environment shown in the video sounds most like your area? What are some differences in the sounds?
   a. Do you think the human-made sounds interfered with your ability to hear natural sounds?
   b. What effect do you think human-made sounds could have on animal populations?
   c. Human-made noise is sometimes referred to as *noise pollution*. Why do you think this is?
2. Describe a sound that is made by the interaction of two or more of Earth's spheres. What information could this sound give you about the environment?
3. What information can you learn about an environment by listening to and studying its soundscape?
4. Describe a scenario in which you would expect an environment's soundscape to change.
   a. In this scenario, which of Earth's spheres:
      - is responsible for the change in the environment?
      - would contribute more or less to the environment's soundscape after the change?

FURTHER STEPS

Go to **https://bit.ly/Soundscape_Storymap** and learn more about Lewis and Clark National Historical Park by exploring soundscapes. If you were to make a soundscape StoryMap of your area, what sound clips would you include and why?

ADDITIONAL RESOURCES

Exploring National Parks with Soundscapes:
https://findyourpark.com/about/news/parktracks

NGSS CONNECTIONS

SEP: Obtaining, Evaluating, and Communicating Information; Engaging in Argument from Evidence
DCI: ESS2.A: Earth's Materials and System; PS4.A: Wave Properties
CCC: Patterns; Energy and Matter; Interdependence of Science, Engineering, and Technology

SDG CONNECTIONS

15: Life on Land

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
National Inventors Month			1 **Did You Know?** Jack Ball's Long Range Seismic Team Becomes the First to Produce a 3D Seismic Image of Underground Structures, 1964	2	3 **National Space Day**	4 **Wildfire Community Preparedness Day**
5 **Cinco De Mayo** **May 5–10, 2024: Geoscience Event:** AbSciCon, NASA and the American Geophysical Union, Providence, Rhode Island	6	7 **National Teachers' Day**	8	9	10 **National Public Gardens Day**	11
12 **Mother's Day**	13	14	15	16	17 **Endangered Species Day**	18 **International Museum Day**
19	20	21	22 **World Biodiversity Day**	23	24 **May 24–25, 2024: Geoscience Event:** Science Olympiad National Tournament, Science Olympiad Foundation Hosted by Michigan State University	25
26	27 **Federal Holiday:** Memorial Day	28	29 **Learn About Composting Day**	30	31	

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May 2024

LEARNING ACTIVITY:

Mitigating the Effects of Landslides

GRADES 3–7

MATERIALS

- Plastic bin or foil pan (recommended about 15 in. long and 5 in. deep)
- Soil
- Craft sticks
- Tape or glue
- 3 small plastic or waxed paper cups
- Spray bottle filled with water
- Foil
- Ruler (optional)
- Timer (optional)
- Plastic aquarium plants (optional)

Landslides occur when the soil or rocks on a hill or mountain are loose or unstable and fall down the slope. Landslides are a natural hazard and greatly affect people who live on or near unstable land. Common triggers of landslides include heavy rains and earthquakes, which occur in many places around the world. Mitigation strategies are developed and built by people to prevent or reduce the effects of landslides.

Landslide in South India state Kerala, circa August 2018.
Credit: Thomas Oommen

PROCEDURE

1. Use soil to build a hill that is half the height and length of the bin.
2. The 3 cups will model houses built on a hill. Place one model house at the top of the hill, one in the middle, and one at the bottom.
3. To simulate rain, you will use the spray bottle to mist water onto the soil next to the house at the top of the hill.
   a. Before starting, consider what data to collect. Make a data table to organize your measurements and/or observations.
   b. Hold the spray bottle about 3 inches from the soil as you spray the water.
   c. Stop spraying once a landslide occurs. Record data and observations.
4. Clean out the bin and set it up again using dry soil.
5. Use craft sticks (or plastic plants, if available) to build structures that you think will help prevent landslides or that will mitigate their effects on the houses.
6. Collect the same data on your new model as you did on the original model.

ANALYSIS

1. Compare the data between the original model and the model with mitigation strategies. If your strategy was successful, why do you think so? If it was not successful, what might you change so it works better?
2. What other materials could you use to build a successful mitigation strategy? Explain your choices. If possible, test out this new strategy.
3. Discuss the changes made to the model with other students. What was the most effective strategy for preventing or reducing the effects of landslides? How can you tell?
4. Do you think the strategies that were tested would work in the real world? Why or why not? What other factors might you have to think about?
5. Go to **https://bit.ly/GWB_Projects** to see a map of projects being done by Geoscientists *without* Borders®.
   a. In what countries are projects being done to address landslides?
   b. Many of these projects do not involve mitigation but help to install early warning systems for landslides. What is a benefit of installing an early warning system versus a mitigation strategy?

FURTHER STEPS

Repeat the procedure using sand or gravel instead of soil. Compare your results to those when you used soil. How does the type of land affect landslides? How does it affect your mitigation strategies?

ADDITIONAL RESOURCES

To find out more about projects from the Society of Exploration Geophysicists and Geoscientists *without* Borders, go to: **https://seg.org/gwb**

NGSS CONNECTIONS

SEP: Developing and Using Models; Constructing Explanations and Designing Solutions
DCI: Natural Hazards; Developing Possible Solutions
CCC: Cause and Effect; Structure and Function

SDG CONNECTIONS

9: Industry, Innovation, and Infrastructure
11: Sustainable Cities and Communities
15: Life on Land

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SOCIETY OF EXPLORATION GEOPHYSICISTS
Founding Supporter SLB

Source: Society of Exploration Geophysicists.
Developed by Lindsay Mossa, AGI.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
National Great Outdoors Month						1 World Reef Awareness Day National Trails Day
2	3	4	5 World Environment Day	6 World Green Roof Day National Caves and Karst Day	7	8 World Oceans Day
9	10	11	12	13	14 Flag Day	15
16 Father's Day	17 Eid al-Adha World Day to Combat Desertification and Drought	18	19 Federal Holiday: Juneteenth	20 Summer Solstice National Dump the Pump Day	21	22 World Rainforest Day
23 June 23–28, 2024: Geoscience Event: Frontiers in Hydrology Meeting, St. Paul, Minnesota International Asteroid Day National Meteor Watch Day	24 30 National Upcycling Day	25	26	27	28	29 Armed Forces Day

LEARNING ACTIVITY:

Simulating a Hurricane to Assess Hazard Risk

GRADES 6–12

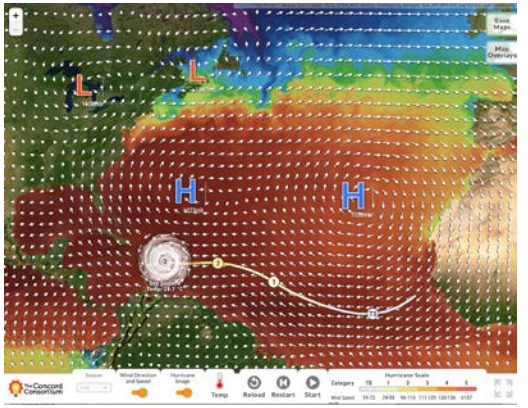
MATERIALS

- Computer with Internet access

Geoscientists use simulations based on computational models to help them predict the risks and impacts of natural hazards to people and infrastructure. Hurricanes are a major natural hazard and can have devastating effects. Simulations can help us better understand how hurricanes form and move. In this activity, you will change factors such as temperature and the position of high- and low-pressure systems to investigate their effects on hurricane trajectory and intensity.

PROCEDURE

1. Read an article and watch a video about how hurricanes form at **https://scijinks.gov/hurricane/**.
2. Launch the Hurricane Explorer simulation at **https://hurricane.concord.org/**. Turn on the **Hurricane Image** and click **Start**. Take a screenshot after each time you change conditions and run the simulation. Paste these into a document to keep a record of your changes and their effects.
3. Observe the storm's path and how its category changes over time once it becomes a hurricane.
4. Switch the Base Map to a **Street Map**. Where does the hurricane make landfall? Zoom in on Jacksonville, Florida.
5. Turn the **Storm Surge Overlay** on and off to see what structures and roads are affected. What parts of Jacksonville experience the highest storm surge?
6. Sea surface temperature changes as seasons change. Click **Reload** and change the season to **Winter**. How does the path of the storm compare to its path to **Fall**? Investigate **Spring** and **Summer**. In which season did the storm fizzle out just after leaving Africa?
7. **Reload** the simulation then click and drag the low- and high- pressure systems (**L**s and **H**s) to new positions. Notice how wind direction (arrows) and speed change with different positions of the Ls and Hs. Run the simulation several times, moving the Ls and Hs to new locations to investigate how the path of the storm changes.
8. On August 25, 2017, Hurricane Harvey made landfall near Corpus Christi, Texas as a Category 4 hurricane. It caused approximately $125 billion in damage, affecting over 200,000 homes. Learn more about this storm at **www.weather.gov/crp/hurricane_harvey**.
9. **Reload** the simulation and set the Base Map to **Street** and the Overlay to **Storm Surge**. Change other factors until you simulate the conditions leading to a hurricane forming in the Gulf of Mexico and making landfall near Corpus Christi, Texas.
10. Switch to the **Precipitation Overlay** to examine changes in rainfall along the storm's path.



Screenshot from the Hurricane Explorer simulation.
Credit: McAuliffe, creative commons

11. Consider storm surge effects. If a storm were to take the path you created, what cities and structures would be most at risk?

ANALYSIS

1. Summarize what factors cause a hurricane to strengthen and use evidence from the simulation to support your summary.
2. Read the article, "A Force of Nature: Hurricanes in a Changing Climate," **https://go.nasa.gov/44RkAIz**. Simulations are innovative technologies that enable geoscientists to model current and future conditions affecting the trajectory and intensity of hurricanes. What do global climate models predict about hurricanes in the future?

NGSS CONNECTIONS

SEP: Developing and Using Models
DCI: ESS3.B: Natural Hazards; ESS3.D: Global Climate Change
CCC: Patterns; Cause and Effect

SDG CONNECTIONS

11: Sustainable Cities and Communities
13: Climate Action

Source: Earth Science Information Partners.

Based on materials from The Concord Consortium at **https://learn.concord.org/earth**. Supported by the National Science Foundation (NSF) under Grant No. DRL-1812362. Developed by the ESIP Education Committee which promotes the use of Earth science data in education and offers 15 minute "Out2Lunch" webinars (**https://wiki.esipfed.org/Education/Out2Lunch**) highlighting Earth Science tools and resources for educators.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Plastic Free July	1	2	3	4 **Federal Holiday:** Independence Day	5	6
7	8	9	10	11	12	13 **International Rock Day**
14	15	16	17	18 **World Listening Day**	19	20
21 **Did You Know?** Neil Armstrong and Buzz Aldrin Become the First Men to Walk on the Moon as Part of the Apollo 11 Mission, 1969	22	23 **Did You Know?** The Satellite Landsat 1 was Launched to Capture the First Images and Temperature Readings from Space, 1972	24	25	26	27
28 **Parents' Day**	29 **Rain Day**	30 **International Friendship Day**	31			

WHAT IS EARTH SCIENCE WEEK?

The American Geosciences Institute has organized this annual international event since 1998 to help people better understand and appreciate the Earth sciences and to encourage responsible stewardship of the planet. Earth Science Week takes place October 8-14, 2023, celebrating the theme "Geoscience Innovating for Earth and People"

Visit the Earth Science Week website — **www.earthsciweek.org** — to learn more about how you can become involved, events and opportunities in your community, the monthly Earth Science Week newsletter, highlights of past Earth Science Weeks, and how you can order an Earth Science Week Toolkit.

You are invited to help keep the spirit of Earth Science Week alive all year long by posting this calendar in your classroom, office, or home. Whoever you are and wherever you go, you can celebrate Earth science!

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Association of American State Geologists
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Geological Society of America
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International Association for Geoscience Diversity
International Association of Hydrogeologists/U.S. National Chapter
International Medical Geology Association
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Mineralogical Society of Great Britain and Ireland
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National Speleological Society
North American Commission on Stratigraphic Nomenclature
Paleontological Research Institution
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Seismological Society of America
SEPM (Society for Sedimentary Geology)
Society for Mining, Metallurgy & Exploration
Society of Economic Geologists
Society of Exploration Geophysicists
Society of Independent Professional Earth Scientists
Society of Mineral Museum Professionals
Society of Vertebrate Paleontology
Soil Science Society of America
United States Permafrost Association

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AGU ADVANCING EARTH AND SPACE SCIENCE

NATIONAL PARK SERVICE

SME Society for Mining, Metallurgy & Exploration

THE GEOLOGICAL SOCIETY OF AMERICA®

AAPG FOUNDATION

CLEAN Committed to Climate and Energy Education

AMS American Meteorological Society

SEG SOCIETY OF EXPLORATION GEOPHYSICISTS

EARTH SCIENCE WEEK
October 8–14, 2023

FUTURE DATES
October 13–19, 2024
October 12–18, 2025
October 11–17, 2026

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