



Tested & Approved STEM Activities

Earth Science Programming

Teacher's Guide

Collaborate with us!

- Send students home with flyers or link to the library from your classroom website.
- Plan an event with us, or encourage students to volunteer!

Please contact _____ at _____ to discuss
how we can work together to increase the community's STEM engagement!

Classroom Connections

There are a variety of websites with Earth science activities for different grade levels:

- **Earth Science Week Classroom Activities:** www.earthsciweek.org/classroom-activities
- **Aquarius Hands-On Activities:** aquarius.umaine.edu/cgi/ed_activities.htm
- **NASA Climate Kids: Teach About Climate Change:** climatekids.nasa.gov/menu/teach/
- **NOAA Education Resources:** www.education.noaa.gov/
- **National Weather Service Education:** www.weather.gov/owlie/
- **National Geographic Science Activities:** education.nationalgeographic.com/activity/science/index/
- **Lunar and Planetary Institute Educator Resources:** www.lpi.usra.edu/education/resources/

Younger elementary students (K-2)

These students make connections to:

- Physical science investigations: invite the students to study water—how we use it, its physical properties (solid, liquid, gas), and its effects on weathering.
- Weather investigations: what is the weather like each day? Measure the precipitation and temperature and observe and record clouds daily, and create a class weather wall to plot the data.
- Your class or school garden: what types of plants grow where you live? How much sunlight do they need, how warm do they need to be, and how much water do they need?
- Your class and school activities that positively affect the environment: recycling, planting gardens or trees, carpooling, walking or riding bicycles to school, etc.



Credit: Chiara Mattiolo, USAG Livorno

Older elementary students (grades 3-5)

These students can research the community's historical weather patterns. Make connections to:

- The water cycle: what are the different forms that water takes, and how does the water cycle transport water from one location to another?
- Water as a resource: where is most water located? What is the source of fresh water globally, and in your community? What are the water needs of your community (population, agriculture, etc.)?
- Climate and weather: what are the differences? What type of climate does your region have? Consider having a class analysis of the weather patterns.
- Local impact: How your community is impacting the local environment? Which activities are negatively impacting the environment? Which are altering the existing ecosystems? Which are benefiting the environment?



Middle school students (grades 6-8)

These students can work with the library to conduct community programs. Make connections to:

- Environmental change: Create a photo-wall of the local changes to your environment
- Systems: how are the hydrosphere and cryosphere related? How do they affect the atmosphere? How does the biosphere affect these systems?
- Ongoing research: invite students to study further and submit questions to a scientist, such as a meteorologist at your local National Weather Service office (www.weather.gov).
- Precipitation: how does it influence erosion and deposition in your region? How does it affect your local ecosystem?
- Climate: what role do the oceans, atmosphere, and topography play in climate?



Credit: Ashley Spratt/USFWS

Connections to Science Standards

The concepts and activities within the *STAR_Net* Earth science exhibits and library programming resources connect to a variety of the Next Generation Science Standards.

Disciplinary Core Ideas

- **ESS2.A Earth materials and systems:**
3-5: Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around.
- **ESS2.C The roles of water in Earth's surface processes:**
K-2: Water is found in many types of places and in different forms on Earth.
- **ESS2.D Weather and climate:**
K-2: Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time. People record weather patterns over time.
3-5: Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed.
- **ESS3.C Human impacts on Earth systems:**
K-2: Things people do can affect the environment but they can make choices to reduce their impacts.
3-5: Societal activities have had major effects on the land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments.
- **ESS3.D Global climate change:**
6-8: Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.

Science and Engineering Practices

- Developing and using models
- Analyzing and interpreting data
- Constructing explanations (for science) and designing solutions (for engineering)
- Obtaining, evaluating, and communicating information

Crosscutting Concepts

- **Patterns.** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- **Cause and effect:** Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- **Stability and change.** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Student Research

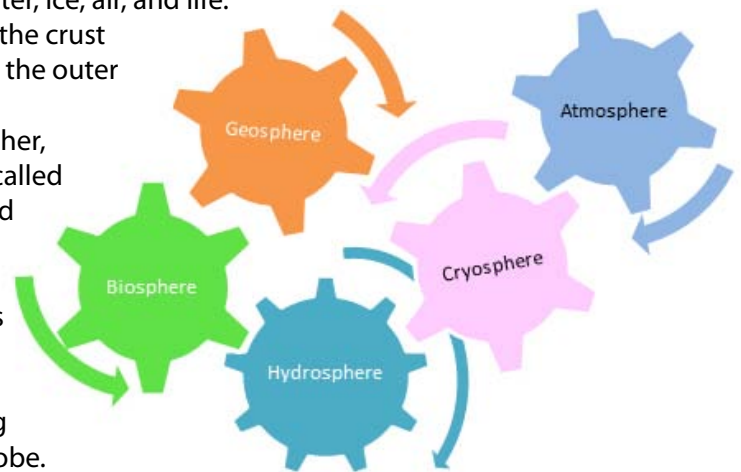
Middle school and high school student may conduct their own research or science fair projects using online Earth science data, such as:

- **Earth Observatory:** earthobservatory.nasa.gov/GlobalMaps
Invite exploration of Earth's climate system -- the atmosphere, ocean, land, and vegetation -- through current satellite data. Students compare systems, analyze data & make predictions about changes in Earth's systems.
- **S'COOL Data:** science-edu.larc.nasa.gov/SCOOOL/usedata.html
Upload S'COOL cloud observations around the world and compare the data to satellite imagery.
- **NASA Earth Observations:** neo.sci.gsfc.nasa.gov/Search.html
Use this site to manipulate a variety of atmospheric data sets on aerosols, carbon monoxide, clouds, rainfall, and more! Compare two sets of data over time.
- **Community Collaborative Rain, Hail & Snow Network (CoCoRaHS):** www.cocorahs.org
Collaborate with others to measure and map precipitation from your registered location.

Key Earth Science Concepts

We belong to a complex system of interacting rock, water, ice, air, and life.

- **Rock** makes up the solid part of the Earth, including the crust and mantle and inner core, and liquid rock makes up the outer core. Together, these are the **geosphere**.
- **Water** can be found in all of its states on Earth. Together, Earth's surface waters and water vapor in the air are called the **hydrosphere**. Water moves through its states and across the globe through the "water cycle."
- **Ice** exists as precipitation, snow and ice on and in the ground, and ice covering polar seas. The portions of Earth where water is frozen are the **cryosphere**.
- **Air** is an invisible shroud around the Earth (the **atmosphere**), and places a crucial role in distributing the Sun's warmth and circulating water across the globe.
- **Life** on the Earth is collectively referred to as the **biosphere**. The features of a region determine what types of life can thrive there and in what abundance. Many life forms, from bacteria to humans, have the ability to alter their surroundings.



Oceans, air, and life have an influence on our regional environment, including the climate and the ecosystem.

- What type of climate do you have in your region?
- How does the geography influence your region's climate?
- How have the ecosystems in your region changed?

Humans are making changes to the global environment.

- How has your region's environment changed?
- In what ways do people affect the local environment? The global environment?
- What changes can people make to improve the global and local environment?



A product of the Science-Technology Activities and Resources for Libraries (STAR_Net) program. Visit our website at www.starnetlibraries.org for more information on our educational programs. Developed by the Lunar and Planetary Institute/Universities Space Research Association November 2016



This material is based upon work supported by the National Science Foundation under Grant No. DRL-1421427. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.