



Section 2: Education



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This Country Coordinator Implementation Guide has been developed as a resource guide to assist GLOBE Country Coordinators in the operations and implementation of The GLOBE Program in their countries. Section 2: Education contains:

1. GLOBE Education Resources
 - a. Teachers Guide
 - b. Learning Activities
 - c. Elementary GLOBE
2. Research and Resources
3. International Virtual Science Symposium (IVSS)

1. GLOBE Education Resources

Teachers Guide

The set of GLOBE measurements reflects the Program's commitment to provide the education community with a rich suite of protocols that meet their various curriculum needs while also providing scientifically useful environmental data. The student data can be used to address local needs and interests, contribute to the global study of the Earth system, and support student research projects. All schools are encouraged to participate in any or all of the wide range of GLOBE environmental measurements that fit their research needs. Such broad participation results in a comprehensive dataset which is more useful scientifically and educationally because the different measurements complement one another and provides a more complete characterization of the local environment. However, schools do not need to collect data in all of these areas but rather focus on the measurements that can most easily fit into either their curriculum, their local environmental concerns, or in the local or regional projects in which they are participating.

[The GLOBE Teacher's Guide](#) is a collection of scientific background information, data-collection protocols, and learning activities categorized by Earth sphere: Atmosphere, Biosphere, Hydrosphere and Pedosphere (Soil). It also contains specifications for the instruments required to take environmental measurements.

GLOBE Science Protocols

Earth is a complex, dynamic system we do not yet fully understand. Our planet is changing on all time and space scales, and we hope to engage students in exploring Earth systems locally, regionally, and globally, to contribute to understanding Earth system interactions. We need to understand the Earth's spheres as a single connected system. GLOBE protocols fall within four [spheres](#), and GLOBE Protocol Bundles have been assembled to understand how they together form an interconnected system ([Earth as a System](#)).

1. **Atmosphere:** Explore different aspects of our planet’s weather and climate
 - Students monitor atmospheric conditions every day. All measurements may be taken at a site adjacent to the school. Many measurements are taken within one hour of local solar noon, although some measurements may be taken at other times throughout the day. Instruments that measure daily high, low, and current temperatures, and amounts of precipitation are installed at this site. Other instruments are brought to the site as needed while some instruments are used in the classroom.
2. **Biosphere:** Explore cycles of plant life
 - Students assess the land cover of a 15 km by 15 km area (their GLOBE Study Site) centered on their school. Ultimately, they track changes to land cover over time by comparing satellite imagery acquired in different years.
3. **Hydrosphere:** Explore water properties including impacts on animal life (mosquitos and macroinvertebrates)
 - For all protocols except freshwater macroinvertebrates, students take weekly measurements of surface water properties at a near-by water body (river, stream, bay, ocean, lake, pond, etc.) that serves as their hydrology study site. Students may also collect data about the types and abundances of freshwater macroinvertebrates, marine invertebrates and mosquitoes.
4. **Pedosphere (Soil):** Explore the physical and chemical properties of soil
 - Students measure soil moisture and temperature at a study site near their school. Students characterize the top meter of soil at this and other sample sites, use an infiltrometer to measure the rate at which water soaks into the soil and a frost tube that provides climate information about frozen soils.
5. **Earth as a System:** Understanding how the Atmosphere, Biosphere, Hydrosphere, and Pedosphere together form an interconnected system with many interactions. Figuring how each sphere interacts with one another allows us to make more accurate predictions within each individual sphere.
 - Students explore complex Earth phenomena by using protocol bundles which incorporate protocols from across all four spheres in order to understand how the Earth operates as a system: Agriculture Bundle, Air Quality Bundle, ENSO Protocol Bundle, Mosquito Protocol Bundle, Ocean Bundle, Rivers and Lakes Protocol Bundle, Soil Bundle, Urban Protocol Bundle, Water Cycle Bundle, Water Quality Bundle, and Weather Bundle.

Learning Activities

In the [Teacher's Guide](#), teachers can access [GLOBE Learning Activities](#) to help students learn more about GLOBE protocols and instruments. GLOBE Learning Activities are a great, action-oriented way for students to approach scientific concepts. Teachers can use them to complement lesson plans or modify them to fit within their time, resources, or learning objectives. GLOBE has developed several learning activities that support and enhance student observation activities in the four spheres and Earth as a System.

Atmosphere

In this sphere, there are activities on: Aerosols, Air Temperature, Barometric Pressure, Clouds, Precipitation, Relative Humidity, Surface Temperature, Water Vapor, and Wind.

Biosphere

In this sphere, there are activities on: Arctic Bird Migration, Biometry, Carbon Cycle, Green-Up / Green-Down, Land Cover Classification, Phenological Gardens, and Seaweed Reproductive Phenology.

Hydrosphere

In this sphere, there are activities on Alkalinity, Conductivity, Dissolved Oxygen, Freshwater Macroinvertebrates, Nitrates, pH, Salinity, Water Temperature, and Water Transparency.

Pedosphere (Soil)

In this sphere, there are activities on Bulk Density, Soil Characterization, Soil Fertility, Soil Infiltration, Soil Moisture, Soil Particles, and Soil pH.

Earth as a System

Includes activities on global connections, regional connections, and local connections, as well as seasonal changes (phenology).

Elementary GLOBE

Elementary GLOBE's books and modules introduce students in grades K–4 to the various aspects of Earth system science. Using a storybook approach, the modules utilize a science-based, fictional narrative to engage students in the scientific method. The modules also challenge them to extend their lessons into the natural world through observation and measurement of their surrounding environment.

Each module of Elementary GLOBE includes:

- A science-based, fictional storybook in which kids explore an aspect of the Earth system using their scientific skills.
- Three learning activities that further explore the lesson content and help students develop sound science and engineering approaches to complex problems.
- A glossary and teacher's notes that provide educators with the necessary background information to further assist their students with each module.

The Teacher Implementation Guide

The Implementation Guide includes:

- An overview of Elementary GLOBE
- The connections the curriculum makes to literacy and other areas of the elementary curriculum
- The usage of science journals

- Scientific inquiry in the elementary curriculum
- Standards alignment

Translated Versions

GLOBE strives to provide translations of our materials in the official U. N. languages. Currently, our resources are available in:

- [Arabic](#)
- [French](#)
- [German](#)
- [Norwegian](#)
- [Spanish](#)

To download a translated version, click on the corresponding language:

[العربية](#) | [Français](#) | [Deutsch](#) | [Norsk](#) | [Español](#)

Not all storybooks and activities have been translated into every language. If you'd like to add your language to this list, contact globehelp@ucar.edu for more information about translation approval.

Modules

Air Quality – “What’s Up in the Atmosphere?”

Students will investigate why aerosols and other types of air pollution affect the color of the sky. They’ll also learn how to describe the sky color and the underlying conditions in the atmosphere. [Visit the Air Quality Module.](#)

Climate – “What in the World is Happening to our Climate?”

Students will learn about regional climate variations and how climate change is affecting our world. Then, they will brainstorm ways to solve climate change. [Visit the Climate Module.](#)

Clouds – “Do You Know That Clouds Have Names?”

Students will explore how different types of clouds can be described via analogy. As they start understanding how to observe clouds, they will create models of the different cloud types and contrails. [Visit the Clouds Module.](#)

Earth System – “All About Earth”

Students will examine how water, air, soil, and living creatures interact within the Earth system. They will also learn the importance of each role to the planet’s ecology. [Visit the Earth System Module.](#)

Seasons – “The Mystery of the Missing Hummingbirds”

Students will discover how hummingbirds deal with seasonal changes. To broaden their scope, they will use science journals to describe the changes in their own local environment as it cycles through the different seasons. [Visit the Seasons Module.](#)

Soils—“The Scoop on Soils”

Students will investigate why different locations have different soil characteristics. They will also learn how to describe the matter found within the soil and explain why it is so important to plants and animals. [Visit the Soils Module.](#)

Water—“Discoveries at Willow Creek”

Students will learn how to describe a creek by making observations, taking measurements, and investigating its macroinvertebrates. To accomplish this, they will be introduced to measurement tools like rulers and magnifying glasses. [Visit the Water Module.](#)

2. Research and Resources

Research

GLOBE has a long history of sharing impact and science findings through peer-reviewed publications. The peer-review process ensures that published articles represent the best scholarship currently available. Each article that is submitted to a peer-reviewed journal is sent to other scholars in the same field in order to get their opinion on the quality of research, the relevance to the field, and its appropriateness for inclusion in the journal.

The first publication, which explored the idea of the program, was published in 1993, before GLOBE’s official beginning. Since then, the use of GLOBE data has been published in many peer-reviewed journals and as scholarly works, such as theses and dissertations. Reading through these publications can provide important background for classroom projects, as well as methods for using GLOBE in the classroom. The links on the [GLOBE Publications webpage](#) provides a bibliography based on the year of many of these publications, or you can search the database for a specific paper or conference proceeding.

GLOBE also has a history of students doing their own research, through different GLOBE symposia. You can search through all student reports on the [Student Research page](#) on the GLOBE Website.

Resources

Teaching resources: In addition to the Teacher’s Guide, GLOBE provides a number of resources to help teachers to engage their students in a collaborative approach to scientific exploration of Earth.

Student resources: GLOBE provides students the opportunity to participate in the scientific research process and provides details on the [nine steps in the scientific process](#), the [GLOBEScience Process](#), a [research report format](#), and **data exploration learning activities**. Other resources available to enhance a student’s GLOBE experience include: [STEM Career Speakers](#), [Games](#) and [GLOBE Student Blog](#).

Higher education resources: Resources are available for university faculty for using GLOBE for pre-service teachers and other undergraduate students.

Resources for training and implementation activities

Countries have the flexibility to organize training workshops to meet their own requirements for GLOBE. Country Coordinators (CCs) and staff of trainers need to continue to work with teachers after their initial training in order to present other protocols and/or activities that support their educational objectives. Following are resources that support CCs' teacher training and GLOBE implementation activities.

Teacher training: To enter GLOBE data, teachers must complete necessary protocol training. Teachers attend GLOBE workshops to receive person-to-person training that involves hands-on conduct of the protocols by the trainee. Training is delivered by GLOBE Trainers. Teachers can also complete required online [protocol eTraining](#) modules and assessment tests on the GLOBE Website as approved by their CCs. CCS increasingly have been employing a hybrid approach to teacher training, with teachers completing some eTraining modules prior to a training workshop and then completing additional modules after the completion of the workshop.

Trainer training: It is important to have GLOBE Trainers leading GLOBE workshops who are knowledgeable in the GLOBE program with a firm understanding of protocols, procedures, quality of data being collected and recorded, and who can guide teachers how to implement GLOBE in their educational setting. These GLOBE Trainers must be able to educate as well as support teachers to ensure GLOBE protocols are properly being conducted. Currently there are two certified types: GLOBE Trainers and GLOBE Mentor Trainers. The GLOBE Program has developed a [GLOBE Trainer Process](#) that provides opportunities for individuals worldwide to become GLOBE Trainers.

School implementation: Schools are expected to implement GLOBE protocols using instruments meeting GLOBE specifications and collect and report the data. The protocols and associated material science background information, learning activities, instrument specifications, and data entry forms and sheets, are included in the print (when available) and Web versions of the Teacher's Guide or in Supplements to the Guide.

Systems support: GLOBE maintains an archival database that serves as a repository for all data measurements (GLOBE Data Archive) and provides several methods for data entry as well as data visualization tools through the GLOBE Website.

Translated Materials: Many GLOBE materials have been translated into over 15 languages and can be found [here](#). GLOBE welcomes translations of GLOBE materials; CCS should contact globehelp@ucar.edu for more information about translation approval.

The GLOBE Program's app, GLOBE Observer (GO): The app enables users to make environmental observations that complement NASA satellite observations to help scientists studying Earth and the global environment. Citizen Scientists in countries that have joined GLOBE can [download and use the app to record data measurements for clouds, mosquitos, land cover, and trees](#). By using the app, they are joining the GLOBE community and contributing important scientific data to NASA and GLOBE, their local community, and students and scientists worldwide.

GLOBE International STEM Network (GISN): The [GLOBE International STEM Network \(GISN\)](#) is the bridge connecting the researchers of today with those of tomorrow. An international coalition of science, technology, engineering, and mathematics (STEM) professionals, members of the GISN work to promote Earth science and education in schools and classrooms. These professionals can act as student mentors for research projects, volunteer as judges for school and virtual science fairs, or serve in other educational capacities with students, teachers, and STEM professionals.

GISN members mentor students and teachers, present scientific ideas, and/or collaborate on scientific research. Each relationship between a STEM member and a GLOBE school is unique and is determined between them. This relationship can be established in different ways. Here are a few reasons why STEM professionals participate in GLOBE:

Mentor and Inspire: GISN member working with GLOBE have a strong desire to mentor and inspire young minds by interacting with the next generation.

Education and Community Outreach: The GLOBE Program offers an ideal means to partner science and education. The hands-on nature of GLOBE allows students to become involved in authentic scientific research. Since GLOBE relies on a network of partners to implement the program, it is possible to find partners eager to work with scientists' projects or to become partners themselves. These partnerships involve a variety of groups such as satellite missions, university departments, zoos, science centers, and museums.

Research Quality Data: All data are collected following scientifically valid protocols, and research scientists work to ensure the accuracy and consistency of all measurements. All data reporters have already undergone or will undergo protocol training.

Spatial and Temporal Coverage: GLOBE has a scientific database extending over 25 years with data in most Earth system science research areas that can be used to supplement standard research data. As of 2022, over 220 million environmental measurements have been collected by students around the world.

Field Campaigns: GLOBE students can collect data related to scientists' research expanding their observation network. GLOBE students are currently partnering with several NASA Earth science satellite missions and providing measurement data to the missions.

Contribute to Science Education: GLOBE students want to be a part of real world, cutting edge science that matters to them, their community and scientists. GISN members contribute to science education in a unique way that can have a lasting impression on student interest in science as well as scientific literacy.

International Reach: The international nature of GLOBE provides a unique opportunity for GISN members to add an international, or even global, component to their research.

Name Recognition: Established in 1994, GLOBE is an internationally recognized and respected program in the realm of science education.

3. [International Virtual Science Symposium \(IVSS\)](#)

The International Virtual Science Symposium (IVSS) provides students with the chance to share their research, discuss that research with their peers, earn virtual badges, and receive feedback from a team of STEM professionals. An annual, GLOBE-organized event, the IVSS is hosted entirely online and is open to students from around the world. Each event focuses on a new theme, fostering a wide variety of student-led research from year to year.

Students share their projects with the IVSS team by submitting them through the student report upload tool on the [Student Research Reports](#) page. If students are having trouble figuring out where to start with their research, they can check out walkthroughs that can help guide them through the [steps in the scientific process](#) and the [research report format](#).

Students can also browse firsthand accounts from GLOBE students on our [student blog page](#). They will discover how IVSS alumni navigated the submission process and learn more about the important lessons they learned along the way.

To see what students have worked on in the past, check out previous [GLOBE symposia](#). You can also [view our collection of IVSS statistics](#) to find out more about participating countries across the globe.

In addition to the IVSS, there are regional and local events that are held to encourage students to use GLOBE data in research on their local environment. For example, in the Near East and North Africa region, student competitions have been held during Earth Day events and Regional Meetings, Croatia organizes annual student competitions, and Student Research Symposia are held in the U.S.