



THE GLOBE PROGRAM



2015-2016 GLOBE Annual Review

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Major GLOBE Milestones

- **1994:** Earth Day, U.S. Government announces The GLOBE Program as a multiagency effort.
- **1995:** Earth Day, The GLOBE Program launches (with 11 protocols); 33 countries join the program.
- **1997:** U.S. hosts the first GLOBE Teacher Conference.
- **1998:** Finland hosts the first GLOBE Learning Expedition (GLE) in Helsinki.
- **2000:** USA hosts second GLE in Fayetteville, Arkansas.
- **2003:** GLOBE offers 53 protocols across the spheres: Atmosphere, Biosphere, Hydrosphere, and Pedosphere (Soil).
- **2003:** Croatia hosts third GLE held in Sibenik.
- **2004:** GLOBE receives the Goldman Sachs Award for being an “outstanding program that makes use of media/technology to educate students or teachers about other world regions and cultures, or international issues.”
- **2005:** Earth Day; GLOBE celebrates its 10th birthday, with 15,000 schools in 106 countries; GLOBE Alumni independently create their own organization.
- **2008:** South Africa hosts fourth GLE in Cape Town.
- **2009:** GLOBE established Regional Offices in Africa, Asia and the Pacific, Europe, Latin America and the Caribbean (LAC), and North Africa and the Near East (NENA) to support professional development workshops, capacity building, and regional sustainability efforts; measurements in GLOBE database reaches 20 million.
- **2011:** GLOBE launches concept of Student Research Campaigns, with first topic focused on climate.
- **2014:** Europe and Eurasia Region host first regional Student Aerosols Research Campaign; student research campaigns with NASA satellite missions Global Precipitation Measurement (GPM) and Soil Moisture Active Passive (SMAP) launch.
- **2014:** India hosts fifth GLE in New Delhi.
- **2015:** Earth Day, GLOBE celebrates its 20th birthday! GLOBE launches new mobile data entry app for schools, enhances the GLOBE website, and updates the Teacher’s Guide; offers 51 protocols; reaches 128 million measurements in the international database.
- **2016:** GLOBE provides online eTraining; hosts highly successful GLOBE International Virtual Science, six regional U.S. science fairs, and various student scientific campaigns; reaches 136 million measurements in the international database.

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Section I The GLOBE Program

A Message from Dr. Tony Murphy

Message from the Director, GLOBE Implementation Office



This year, as our 20th Anniversary Year draws to a close and an exciting third decade begins, I invite you to join me in **celebrating the GLOBE Community**. This is the community of people who influence, guide, and contribute to The GLOBE Program; and, while a long list, it points to wonderfully committed groups of people: our students, teachers, scientists and other STEM professionals; citizen scientists, our partners and country coordinators; our alumni groups, working groups, and U.S. partner forum; our sponsors and supporters. The broad range of experiences and perspectives, contributed by our culturally rich and linguistically diverse community, serves as a powerful resource and makes GLOBE unique in the landscape of STEM education.

The past year has shown tremendous growth in The GLOBE Program. We welcome three new GLOBE countries this year: Brazil, Mauritius, and Vietnam! Wonderful events have taken place in every region, including celebrations of GLOBE's 20th Anniversary and regional campaigns and expeditions. The overwhelming success of the 2016 GLOBE International Virtual Science Fair, the U.S. regional science fairs, and the 2016 Data Entry Challenge all point to an increase in student data and research worldwide. New technological developments, such as the mobile app and eTraining; new and revised protocols, including the timely Mosquito Larvae Protocol; a new Elementary GLOBE storybook and instructional unit on Aerosols; training intensives

worldwide; and continued collaborations with satellite missions, are all indicators of the growth and health of The GLOBE Program and the resilience of our worldwide community.

Communities grow stronger when citizens regularly and persistently act together, connect with one another, build trust, and begin to work together. The web of trusting relationships that grows from attending webinars, trainings, conferences, meetings and science fairs – the simple act of joining together to recognize and help one another – makes bigger joint ventures possible.

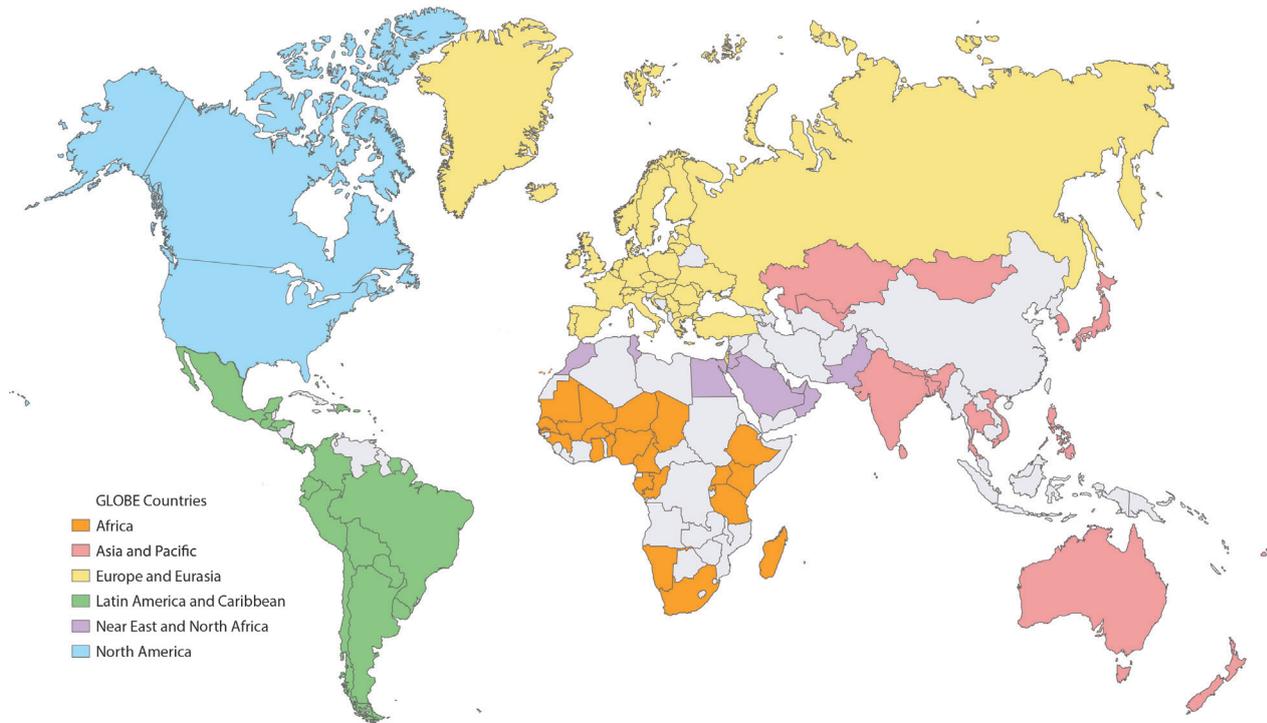
By engaging with others in the GLOBE community, we model – for our GLOBE students – the enormous importance of adopting a genuinely global perspective. Our world demands this global view. Our environmental issues are global and our interdependencies have never been more apparent. Students who learn to work collaboratively with classmates from various cultures are better prepared for the world they are in now – and the world they will face in the future. I think you will agree that GLOBE supports meaningful connections and bonds among individuals, creating a sense of community, respect for other cultures, and shared sense of responsibility about our planet.

The GLOBE community is the beating heart of The GLOBE Program and this is something that we celebrate at the 20th Annual Meeting and throughout the year ahead. I would like to thank our sponsors, National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF), along with our supporters at the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of State, for providing the foundation on which GLOBE was built and continues to thrive. Also, I would like to thank all of you for your hard work and dedication, your creativity, energy, and good humor. Every single individual in this enormously diverse and ever changing system has the power to serve as an invaluable resource for all others – students, teachers, partners, and the group as a whole. Our community is flourishing. Let's celebrate each other's accomplishments and this planet we call home!

Sincerely,

A handwritten signature in black ink, appearing to read "Tony Murphy". The signature is fluid and cursive, with a long horizontal stroke at the end.

Dr. Tony Murphy



About The GLOBE Program

The GLOBE Program (GLOBE) is an international science and education program that provides students and the public (worldwide) the opportunity to participate in data collection and the scientific process, and to contribute in a meaningful way to our understanding of the Earth system and the global environment.

GLOBE is jointly sponsored by the National Aeronautics and Space Administration (NASA, which is the lead Agency) and the National Science Foundation (NSF), with support from the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of State (DOS). The University Corporation for Atmospheric Research (UCAR) has hosted the GLOBE Implementation Office (GIO) in Boulder, Colorado, USA, as one of the UCAR Community Programs (UCP) since 2014.

GLOBE provides grade-level appropriate, interdisciplinary educational activities and scientific investigations that have been developed by the scientific community and validated by teachers. GLOBE connects students, teachers, scientists, and citizens from different parts of the world to conduct real, hands-on science within their local environment to enhance their awareness of – and their scientific contribution to – the global environment. In 2016, the program developed a new app called the GLOBE Observer that allows citizens in participating countries to enter data into the international database.

History of The GLOBE Program

Since its founding, The GLOBE Program has focused time and talent, determination and dedication, and passion and purpose on expanding the boundaries of science and education within the United States and around the world.

Announced by the U.S. Government on Earth Day in 1994, GLOBE launched its worldwide implementation on Earth Day in 1995. Today, the international GLOBE network has grown to include representatives from over 100 U.S. partners and 117 participating countries. Due to their efforts, there are tens of thousands of GLOBE-trained teachers representing schools around the world. GLOBE students have now contributed well over 130 million measurements to the GLOBE database for use in their inquiry-based science projects.

The GLOBE Program has developed an interconnected community of people of all ages, nationalities, belief systems, and resource levels that is ever-evolving and ever-dedicated to the idea that new questions lead to new answers, new scientific discoveries, and a deeper understanding of the world around us.

GLOBE Impacts around the World (as of 31 May 2016)

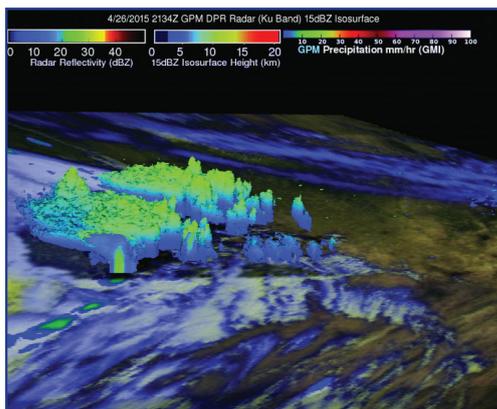
GLOBE has played a critical role in NASA’s commitment to scientific exploration and STEM education, with the goals of igniting the creative curiosity and scientific practicality of students (getting them outside with their eyes on the sky and their hands in the soil seeking answers to science-based questions), empowering educators and teachers (giving them professional tools and resources for everyday use in their classrooms), and inviting professional and citizen scientists to become more involved in the scientific process. The program also enhances international collaboration, and assists people around the world make a difference in understanding, and helping, with the critical environmental issues facing the planet.

All Regions						
Name	Schools	Teachers	Pre-Service	Students	Alumni	Citizen Scientists
Africa	768	486	44	8,717	21	9
Asia and Pacific	2,949	1,145	342	20,205	17	72
Europe and Eurasia	4,358	2,885	208	59,215	22	60
Latin America and Caribbean	958	1,010	506	15,443	22	29
Near East and North Africa	557	497	108	33,204	8	16
North America	19,635	18,536	2,320	404,403	15	177

NASA Missions and Field Campaigns

Observing, examining, and monitoring Earth’s ever-changing environment is one of the primary activities of The GLOBE Program. Students from all over the world have been involved in hands on data collection since 1995.

In order to increase the connections with Earth science scientists, collaborations were forged with NASA. The interactive relationship is based on the collection and analysis of data – where GLOBE students collect field data and NASA scientists use satellites to collect them. The data are combined to help validate and calibrate satellite instruments.



GPM 3-D Data Visualization



Students collect Soil Moisture Data as part of SMAP Protocol.

The collaboration provides an especially exciting and unique citizen science opportunity for students to engage in research campaigns related to two NASA Earth observing satellites – Global Precipitation Measurement (GPM) and Soil Moisture Active Passive (SMAP) – as well as the El Niño Field Campaign.

- **GPM** – Global Precipitation Measurements (GPM) Mission launched from the Tanegashima Space Center, Japan on 27 February 2014. GPM mission data will advance our understanding of water and energy cycles and extend the use of precipitation data to directly benefit society. Through participating in GPM events and contests, GLOBE students learn how satellite information can improve our knowledge of Earth.

Although the GPM Student Field Campaign is not currently active, students are encouraged to continue collecting precipitation data and reporting it to GLOBE. (In addition, precipitation is one of the protocols included with the currently running El Niño Field Campaign, which you might also find to be of interest and you can read about below.)

- **SMAP** – Soil Moisture Active Passive (SMAP) Field Campaign – In order to support the SMAP satellite mission, a 7-month-long (from October 2015 through April 2016) soil moisture measurement field campaign was launched. During this campaign, GLOBE students collected soil moisture data following the GLOBE SMAP Block Pattern Soil Moisture (Volumetric) Protocol and entered the data into the GLOBE science database. Now SMAP scientists and GLOBE students can view the student-collected data, through the GLOBE visualization tool, and compare them to the SMAP satellite data. SMAP is a component of the current El Niño Field Campaign.
- **El Niño Field Campaign** – In March 2016, the new GLOBE El Niño Field Campaign began! This campaign focuses on the current El Niño event affecting Earth. As part of the Campaign, which runs through September 2016, a suite of six GLOBE measurement protocols (including the GPM and SMAP protocols) are serving as ways to identify environmental changes affected by El Niño. GLOBE students can participate by choosing to collect data for at least two of the six protocols, which include: precipitation, air temperature (maximum/minimum), surface temperature, soil temperature, SMAP soil moisture, and biometry – canopy and ground cover.

Throughout the campaign, scientists regularly blog about how they study El Niño and teachers write about data collection with their students. In addition, there is information on the science of El Niño, how to participate in the campaign, analysis tools, numerous resources, and engaging discussions on the webpage.

The GLOBE Community: An Overview

The GLOBE Program functions like an ecosystem, with a network of interactions among its diverse members across varied geographic regions. The GLOBE Program is informed – first and foremost – by ongoing interactions with the scientists, teachers, and students who make up the worldwide GLOBE community. GLOBE’s commitment to collaboration with community members — listening to their suggestions and responding to their needs (and communicating with them in their primary languages, where possible) – is the key to lasting success.

GLOBE Working Groups – The purpose of the Working Groups (WG) is to enhance the role of GLOBE U.S. and Country Partners, as well as GLOBE scientists and teachers, in shaping the future of The GLOBE Program and supporting the development and implementation of GLOBE worldwide. The WGs are composed of eight members of the GLOBE community who serve on a rotating basis. An effort has been made to ensure that members of all of the six GLOBE regions are included in the groups to the fullest extent possible. The purpose and goals of the WGs include:

- **The Education WG** identifies or recommends ways to ensure the pedagogical merit of all aspects of GLOBE, including the Teacher’s Guide, educator professional development, training modules and certification processes, and the conduct and competition of student research projects.
- **The Evaluation WG** identifies or recommends ways to document the common elements of education evaluation that already exists in most learning environments carrying out GLOBE activities.
- **The Science WG** identifies or recommends ways to ensure the scientific validity of all aspects of GLOBE, including GLOBE measurement protocols and instrumentation, GLOBE student research campaigns, and the facilitation of international and in-country scientists to engage with GLOBE.
- **The Technology WG** identifies issues with, and opportunities for, the GLOBE Data Information System (DIS), and recommends ways to ensure the integrity and continuous improvement of the system.

U.S. Partner Forum – The purpose of the U.S. Partner Forum is to facilitate discussion of ways to enhance the contribution of GLOBE to the improvement of STEM education in the U.S. locally, regionally, and nationally. With the goal of encouraging collaboration and mutual support, the U.S. is divided into six geographic areas: Pacific, Midwest, Northeast and Mid-Atlantic, Northwest, Southeast, and Southwest. Each region has one representative on the U.S. Partner Forum. They work closely together to guide the future of GLOBE in the United States.

GLOBE at a Glance – 2015					
Region	Countries	Total Number of Schools	Change in Number of Schools from Previous Calendar Year	Total Cumulative Measurements	Measurements Entered in 2015
Africa	23	737	-08	1,319,128	3,093
Asia and Pacific	18	2,891	83	1,671,422	30,211
Europe and Eurasia	41	4,212	100	48,762,626	2,661,178
Latin America and Caribbean	20	872	75	1,219,776	31,030
Near East and North Africa	13	547	73	1,006,642	139,522
North America	2	19,449	357	85,656,130	3,074,334
TOTAL	117	28,708	680	139,635,724	5,939,368

GLOBE at a Glance

Thanks to the continuing efforts of the GLOBE community, there’s always more going on throughout the program than meets the eye. The table to the right shines a light on some of the critical results of the community’s ongoing efforts during the calendar year of 2015.



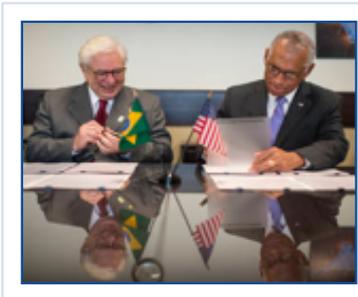
Section II GLOBE around the World

GLOBE's 20th Anniversary Celebrations Come to a Close

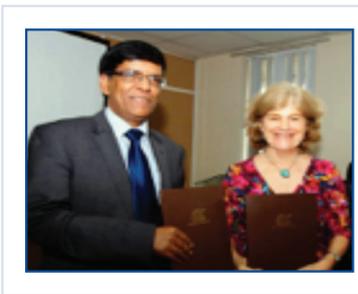
Numerous celebrations took place around the world to help acknowledge the 20th Anniversary of The GLOBE Program. Officially launched on Earth Day 2015, the international GLOBE network has grown to include representatives from 117 participating countries coordinating GLOBE activities that are integrated into their local and regional communities. GLOBE would like to thank everyone who has invested passion and purpose in supporting GLOBE's vision of fostering a worldwide community of students, teachers, and professional and citizen scientists working together to better understand, sustain, and improve Earth's environment at local, regional, and global scales.

GLOBE Welcomes Three New Countries

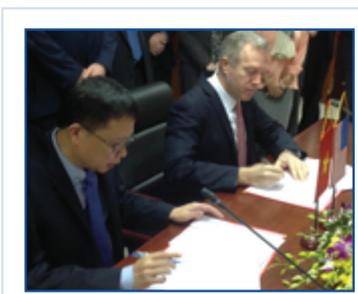
In 2015-2016, The GLOBE Program welcomed three new countries into the community! It is always an exciting adventure, and an honor, to welcome aboard the dedicated participation of new students, teachers, and scientists!



Brazil -- Brazilian Space Agency (AEB) President José Raimundo Braga Coelho (left) and NASA Administrator Charles Bolden signed an agreement on 30 June 2015 establishing Brazil as a GLOBE partnering country. The partnership is intended to further research into heliophysics and space weather and to enhance global climate study and educational opportunities.



Mauritius – On 05 October 2015, Acting Senior Chief Executive R.P. Ramlugun, Ministry of Education and Human Resources, Tertiary Education and Scientific Research of Mauritius, and U.S. Ambassador Shari Villarosa signed the agreement establishing Mauritius as a GLOBE partnering country.



Vietnam – Vietnam Academy of Science and Technology (VAST) President Chau Van Minh and United States Ambassador Ted Osius signed an agreement on 09 December 2015, in Hanoi, establishing Vietnam as GLOBE's newest partnering country.

Spotlights on the Regions

GLOBE around the World – Africa



Annual Regional Meeting:
05-07 October 2015
Location: Dar es Salaam, Tanzania

In October (05-07), the 2015 Africa Regional Meeting was held in Dar es Salaam, Tanzania. Participants from 10 countries (Madagascar, Cameroon, Nigeria, Benin, Tanzania, Kenya, Senegal, South Africa, and Uganda) attended the event.

The theme of the workshop was “Bringing out the Best in You” and focused on capacity building within the region. Professional Integral Coach Dr. Gilbert Dennis facilitated sessions in the meeting.

The objective of the meeting was to “work towards greater participation, cooperation, collaboration and innovation to strengthen the GLOBE program in the Africa region.”



Annual Regional Meeting:
29-31 March 2016
Location: Johannesburg, South Africa

In March (29-31), the 2016 Africa Regional Meeting was held in Johannesburg, South Africa. Participants from eight countries (Madagascar, Benin, Kenya, Mauritius, Senegal, South Africa, and Uganda) attended the event.

Dr. Gilbert Dennis again facilitated the capacity-building workshop, including:

- Effective Communication
- Constructive Feedback
- Formulation of WGs to Ensure Participation and to Serve the Region

The main objective of the meeting was to “continue working towards greater participation, cooperation, collaboration and innovation to strengthen the GLOBE program in the Africa region.”



Highlights from the Africa Region

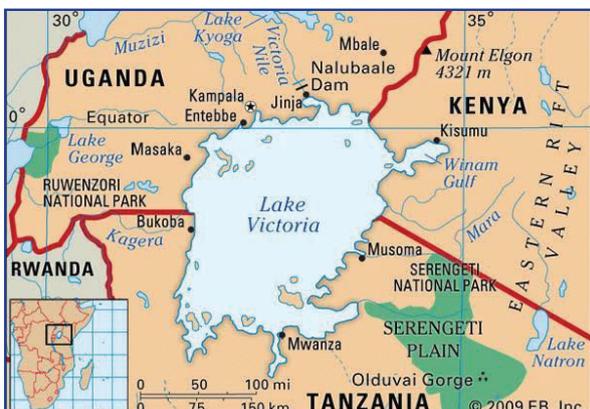
2015 Kilimanjaro Learning Expedition

In collaboration with Discovery Education, GLOBE set out on an expedition (from 24 September 2015 through 01 October 2015) to summit Mount Kilimanjaro in Tanzania in order to collect scientific data that would help evaluate the evolving ecosystem. Over 20 students and teachers from Oman participated in the expedition.



Teacher/Master Teacher Training Workshops

In April 2016, a teacher training workshop was held in Mauritius. This successful workshop was attended by 35 participants (31 from Mauritius and four from Madagascar).



Lake Victoria Expedition Project Launch

GLOBE Africa is developing a Lake Victoria Learning Expedition. The expedition will take place in September 2016. (It will be a biannual expedition alternating with the Kilimanjaro Learning Expedition.) Mark Brettigny and Charles Mwangi (Deputy Country Coordinator for Kenya) visited potential expedition sites, including the Kenya Lake System in the Great Rift Valley, a natural area of outstanding beauty having three inter-linked relatively shallow lakes (Lake Bogoria, Lake Nakuru and Lake Elementaita) and villages of the Masai Mara.

The expedition will visit sites in three Lake Victoria basin GLOBE countries: Tanzania, Kenya, and Uganda. GLOBE students from these countries will perform hydrology studies (specifically the Dissolved Oxygen, pH, Conductivity, Nitrates, Transparency and Temperature protocols).

Lake Victoria is Africa's largest lake, by area, covering more than 68,800 square kilometers. It is the second largest fresh water lake in the world, by surface area, after Lake Superior in North America. Lake Victoria is the lifeblood for the people of Tanzania, Kenya, and Uganda who rely on its waters for its huge fishing industry. However, water pollution, over-fishing, and ecological destruction (through invasive species) have many worried about its future. GLOBE students and citizen scientists in the region will be able to contribute scientifically through data collection and research on the Lake, which is sure to evolve during the course of the expeditions in years to come.

GLOBE around the World Asia and Pacific

Annual Regional Meeting:
14-16 January 2016
Location: Chaing Rai, Thailand



In January (14-16), the 2016 Asia and Pacific Meeting was held in Chaing Rai, Thailand. Participants from 14 countries (Japan, Taiwan, Republic of Korea, Mongolia, Marshall Island, Micronesia, Palau, Thailand, Philippines, Sri Lanka, Maldives, Vietnam, and India) attended the event.

Each GLOBE Country Coordinator presented a Country Report at the meeting. These reports included the status of GLOBE activities and future plans to strengthen GLOBE in their countries. A main topic of the meeting was a discussion centering on how the region will promote Citizen Science activities through GLOBE schools. Participants discussed how the region could promote the exchange of students and teachers within the region. Meeting participants also agreed to set up an Ocean Club in GLOBE Schools (most of the countries within the region are islands or have a vast coastline). The region will also develop a sustainability plan and engage in fundraising campaigns in order to support regional activities. In addition, the region will support and promote a GLOBE Science Olympiad. Increased data entry will be encouraged (with a goal of at least 100 data points being entered by each country before the next regional meeting). The countries will also promote activities to align GLOBE with Eco-Clubs. In addition, the translation of GLOBE material into the regional languages will be promoted.

Highlights from the Asia and Pacific Region

NASA Visits

The region hosted several successful visits by NASA officials: GLOBE Philippines hosted Dr. Ellen Stofan, NASA Scientist; GLOBE Thailand hosted NASA Administrator Charles Bolden; and GLOBE Taiwan hosted Dr. Jack Kaye, Associate Director, Research, Earth Science at NASA. The visits included trips to GLOBE schools, interaction with GLOBE teachers and students, and meetings with GLOBE County Coordinators and Government Points of Contact.

Train the Trainer Workshop

In January (18-22) 2016, a GLOBE Train-the-Trainer Workshop was held in Thailand at the Mae Fah Luang University in Chiang Rai (after the Regional Meeting). Fifty-seven participants from Thailand, Taiwan, Sri Lanka, and the United States participated in the training, which included both basic and advanced protocols.

Water Conservation Activities

GLOBE Sri Lanka organized activities about water conservation on 05 June 2016. UNESCO and the Ministry of Education in Sri Lanka sponsored the event. GLOBE students and teachers attended and actively participated. Officials from the UNESCO office in New Delhi, as well as RCO representatives and experts on water and education delivered lectures to the participants.



Teacher Training Workshops

In April (08-13) 2016, a teacher training workshop was held in Maldives. Six schools from Addu Island participated in the training program. The RCO provided the schools with limited GLOBE equipment, GLOBE manuals, and Cloud and Soil charts.

The GLOBE Citizens Conference

The GLOBE Citizens Conference was held in December 2015 at Bhubaneswar in India. Twenty-two participants from Thailand, 8 participants from Taiwan, and 16 participants from India attended the event. The students made presentations on their GLOBE research activities and participated in field visits to Chilika Lake (Ramsar Site) and cultural visits.

The GLOBE Science Olympiad

More than 7,500 students from GLOBE schools participated in the GLOBE Science Olympiad, which was held in India. The winners were given prizes (including laptops) at the Earth Day (22 April 2016) celebration. Two workshops designed to align GLOBE with ECO-Clubs were held. GLOBE teachers showed great interest in these activities, and decided to hold a two-day workshop in July/August – to which teachers and Eco-Club students will be invited.

Upcoming Events in 2016

- In September, GLOBE India will host the Ozone Science Festival in New Delhi.
- In October, GLOBE Thailand will host a conference in Bangkok.
- In November, GLOBE Republic of Korea will host a GLOBE science festival.
- In December, GLOBE Japan will host the 9th Annual GLOBE Conference in Tokyo.



GLOBE around the World Europe and Eurasia

Annual Regional Meeting:
23–27 November 2015
Location: Warsaw, Poland



In November (23-27), the 2015 Europe and Eurasia Regional Meeting was held in Warsaw, Poland. Thirty-seven participants from 21 countries (Belgium, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Netherlands, Norway, Poland, Russia, Switzerland, and Ukraine) attended the event.

A representative from the U.S. Embassy in Poland welcomed the group. Main topics discussed were: the 20th Anniversary of The GLOBE Program; regional campaigns for schools (Aerosols, GLOBE at My School Picture Contest); regional events (GLOBE Regional Learning Expedition in Estonia, GLOBE Games, the MASS Project (an EU funded science education project)); national campaigns for schools (SMAP in Croatia, Phenology Campaign in Ukraine, GLOBE Science Schools in Netherlands, Topic of the Year in Czech Republic); how to engage more schools in GLOBE activities; GLOBE Alumni; Citizen Science within GLOBE; and GLOBE website enhancements.

Highlights from the Europe and Eurasia Region

International Phenology Campaign

GLOBE Ukraine: 01 April–16 May 2016

During this campaign (which engages students in investigation of the vegetation cycles of wild cherry and Nanking cherry), more than 440 students from 60 schools observed budburst and flowering of cherry species and entered data into the GLOBE database. The campaign went international in 2016; students from any country were invited by GLOBE Ukraine to participate.





GLOBE Regional Learning Expedition (GRLE)

GLOBE Estonia: 03–06 August 2015

GLOBE Estonia hosted the GRLE 2015, which was a celebration of GLOBE’s 20th Anniversary. Over 180 participants (from Latvia, Lithuania, Ukraine, Finland, and Russia), Ambassador Jeffrey D. Levine of the United States Embassy in Tallinn (the capital of Estonia), and Jürgen Ligi (the Minister of Education and Science of the Republic of Estonia) attended the event. Participants investigated the lakes and forests surrounding the camp, collected data, and presented the results of their research projects. Among other presentations, NASA Outreach Specialist Brian Campbell introduced the new SMAP protocol.



Rivers in Spring GLOBE Italy

22 March 2016

For the Rivers in Spring event, approximately 3,000 students, teachers, and citizens came together on Mantova Lakes to carry out science projects and art-related activities – and to learn about the unique water ecosystem of Mincio River. More than 70 activities were carried out by the students of all ages (spanning elementary to high school) attending the event.

GLOBE Italy was represented at the event by three GLOBE schools: IISS della Bassa Friulana (a GLOBE school leader at the national level) in Cervignano del Friuli (Udine); IS Fermi High School; and IS Strozzi High School in Mantua. Students presented the GLOBE field measurement campaigns and ran workshops on Mantova Lake (water monitoring according to GLOBE protocols). They investigated water-soil interaction and also presented a case study on river resurgence and an operating model of ground water.

Aerosols in Europe Project

The GLOBE Community in Europe recently completed a two-year campaign (2014-2016) to learn more about aerosols and the atmosphere. Scientific support for this endeavor was provided by Bjørn Samset from Cicero (2015-2016) in Norway and Danielle deStaerke from CNES in France. GLOBE students across Europe focused on the atmosphere during the two month-long Intensive Observation Periods (IOPs), which took place from March 02 through May 08, 2015, and again from October 12, 2015 through November 08, 2015.

The campaign gained momentum at the first international workshop, which was held in the city of Nove Mesto (Czech Republic) in September (16-19) 2015. In all, 53 participants from 25 schools in six countries took part, under the guidance of scientists Marianne Lund and Bjørn Samset. This event was organized by Karl T. Hetland, Norway’s GLOBE Country Coordinator. (Hetland fosters “school twinning” as part of the aerosols campaign in Europe.)

2nd Educational Conference of the MASS Project

Poland: 25–27 November 2015

Since 2003, European GLOBE countries have worked together on the project “Motivate and Attract Students to Science” (MASS). As a joint event with the Regional Meeting, the MASS network organized a conference that gathered more than 70 participants from over 20 European countries. The event began with a keynote about citizen science from GIO Director Dr. Tony Murphy. The main goal of the event was to connect teachers, educators, trainers, and scientists by sharing best practices of science education with the use of modern tools and methodologies.

SMAP Campaign, Croatia

Schools from Croatia actively participated in the SMAP campaign, contributing substantial amounts of data to the GLOBE database. Country Coordinator Diana Garasic organized a teacher training workshop on soils that included measurements from the SMAP campaign. Students and teachers learned how to take samples and how to determine soil moisture. Because of their focused effort, four schools from Croatia were honored by NASA scientists for their contribution to the campaign.

2016 GLOBE at My School Calendar

The photo contest “GLOBE at My School” was held for the second time in 2015. Schools from six European countries captured their best moments with GLOBE (showing study sites and local environment). The jury of the Board of Europe and Eurasia Region selected the winners from more than 700 photos submitted. The calendar was distributed to schools across the region.



A sampling of winning photos from the GLOBE Europe and Eurasia 2016 Calendar Art Competition



GLOBE around the World Latin America and Caribbean

Annual Regional Meeting:
05-06 November 2015
Location: Paramaribo, Suriname



In November (04-07) 2015, the Latin America and Caribbean (LAC) Regional Meeting was held in Paramaribo, Suriname. Twenty-four participants from 11 countries (Argentina, Bahamas, Bermuda, Brazil, Costa Rica, Ecuador, Mexico, Panama, Suriname, Trinidad & Tobago, and Uruguay) attended the event. This included Ambassadors from The Netherlands, France, and Argentina, as well as officials from the Indian Embassy and the Ministry of Education and Foreign Affairs of Suriname. The main topic of discussion at the meeting was the retention of schools in The GLOBE Program. Other topics included data entry, navigating the website, and technical aspects of the infrastructure.



Highlights from the Latin America and Caribbean Region

NASA Administrator Charles Bolden Meets with GLOBE Students in Peru

In February 2016, 20 students (aged 12 and 13) and their GLOBE teachers from a Callao public secondary school, Institución Educativa Callao (I.E. Callao), received a visit from Charles Bolden, NASA Administrator. Administrator Bolden (who was on a brief stay in Lima to meet with heads of the Peruvian scientific community), made a special trip to Callao to speak with students participating in The GLOBE program.

Administrator Bolden commended the students on pursuing scientific exploration, and for integrating parents and families into academic and extracurricular activities – an enriching experience for students as well as the entire community. He urged the students to continue working hard, both in and out of the classroom, and to embrace challenges.



GLOBE Country Coordinator Monique Pool Named as a "CNN Hero 2015"

Monique Pool, GLOBE Suriname's Country Coordinator, was named as a "CNN Hero 2015." Monique founded the Green Heritage Fund Suriname in 2005 after agreeing to foster and rehabilitate an orphaned sloth from the local animal shelter. Monique focused on Suriname's need to

rescue, rehabilitate, and relocate all *Xenarthra* species of sloth due to deforestation and expansion of the capital city, Paramaribo.

Measuring Precipitation Competition

23 September 2015 – 10 December 2015

Teachers and students from five Primary and two Secondary schools participated in this contest, which took place across the spring season. Students learned about weather and climate and, for the first time, teachers were able to coordinate a number of

students measuring consistent and daily data at the same time. Participating schools included: 6th grade, School No. 81, Teacher Sandra Vega in Salto; 2nd and 4th grades, School No. 8, Teacher Silvana Furtado in Nuevo Berlín, Río Negro; 4th grade, School No. 10, Teacher Gustavo Dotta in Durazno; 5th grade, School No. 88, Teacher/Headmaster Darío Greni in Las Violetas, Canelones; and 2nd and 1st grades, Secondary School No. 1, Teacher Natalia Marichal in Pando, Canelones.



GLOBE in Suriname

15 November 2015

During this event, which was an "information market" about health and environment organized by the Brokopondol Youth Organisation, students took hydrology measurements at Brokopondo Lake, Brownsweg. They used the GLOBE Cloud Chart to observe cloud type and cover in the sky. During the event, students (ages 10 to 18) quickly learned how to use certain equipment (such as the Secchi Disk for water transparency, thermometers, and Cloud Chart).



GLOBE around the World Near East and North Africa

Annual Regional Meeting:

01–05 November 2015

Location: Jordan



In November (01-05), the 2015 Near East and North Africa (NENA) Regional Meeting was held in Jordan. Sixteen participants from six countries (Bahrain, Lebanon, Oman, Pakistan, Jordan, and Saudi Arabia) attended the event. This included six Country Coordinators (or their representatives), six teachers from the region, and the African Regional Office Coordinator. During the week, the group traveled to Wadi Araba and to the Dead Sea in order to take samples of the soil and to observe indigenous plant and animal species. Other activities included presentations about past and current achievements, future goals and plans, and website training.

Highlights from the Near East and North Africa Region

Morocco

The GLOBE Morocco Association participated in a scientific event organized on August 19, 2015 in Rabat. This event was part of an exhibition of the “Caravan of Science,” which was organized in partnership with the U.S. Embassy in Rabat and the Science Association in Morocco. The event, supported by the GLOBE NENA RCO, received a large number of visitors, from young students to seniors.

Saudi Arabia

In October 2015, in cooperation with the Environmental Association in Saudi Arabia, the Jeddah Festival GLOBE Program occurred. A “cloud” competition took place in March 2016. During this event, all GLOBE students in the country were invited to increase their knowledge of clouds by observing them and submitting their best photos and videos. The event was organized



in three stages: 1) the School Stage, where 1,428 students from 230 schools participated – and from which 700 were selected to advance to the next stage; 2) the Educational Department Stage, where judges narrowed the pool to 244 participants; and 3) the National Stage, where the best 30 entries (15 boys and 15 girls) were chosen. The winning entries were celebrated at a special event in Al-Liath City.

The Governor of Al-Liath, Mr. Muhammad Al-Qabaa, opened the competition exhibition. The opening also included remarks by other dignitaries and a video presentation by GIO Director Dr. Tony Murphy. The event included a tour of the exhibition (where the winners' videos and photos were displayed), visits to the National Aquaculture Group and Planetarium, and a cruise around the shores of Al-Liath.

The closing ceremony was held in the presence of the Governor of Al-Liath, Mr. Muhammad Al-Qabaa; Deputy Minister for Education, Dr. Haya Al-Awwad; Director General for Students' Activities, Mrs. Reem Abu Alhassan; and the Director of Education at Al-Laith, Mr. Marey Al-Barakati.

GLOBE Saudi Arabia participated in the First Workshop for Women and Children and Environment, organized by the Saudi Environmental Society (SENS) in Jeddah, 21-24 October 2015. Students and teachers from Al-Farouq Intermediate School, Prince Faisal Bin Fahad Intermediate School, the 61st Secondary Girls School and the 128 Intermediate Gifted Girls School attended the four-day workshop. Fifty five papers were presented on environmental education.



United Arab Emirates

In 2015/2016, the Minister of Education adopted the results of GLOBE scientific innovations and student cognitive development reports. The number of GLOBE schools has increased to 54 (as of May 2016). The Country Coordinator also conducted a website data entry training workshop for teachers.



Oman

In March (20-21) 2016, a GLOBE student science invention exhibit was held at the Jaber bin Zaid School in Muscat. This event promoted collaboration and discussion regarding international studies and The GLOBE Program. It was also a chance for GLOBE students to participate in a national science fair, and was designed to encourage more students and schools to join The GLOBE Program. Ten students, ten teachers, and six evaluation committee members attended the event.



In April (06-07), Oman hosted the fifth GLOBE Science Fair in Dakhliya City, Manh State. This event honors students, teachers, directors, and deans. It is part of the annual science competition. This year, 120 students, 40 teachers and supervisors, and 30 school directors attended the event. In addition to honoring the students who won the science research competition, the event promoted an exchange of information regarding The GLOBE Program in Oman.

On 24 April 2016, Oman sponsored a regional Environment Day exhibit. This event is a science event for GLOBE students – offering them the chance to increase their knowledge of scientific research and The GLOBE Program. The event, which involved experts from the Ministry of Environment and Climate Affairs, was attended by 17 students, 10 teachers, and 20 scientists and experts from the Ministry.



Bahrain

In April 2016, a GLOBE exhibition for Bahraini students was held. For the fourth year in a row, the exhibition included a competition for GLOBE science projects. Fifty-nine projects were submitted and the winners – selected by a panel of GLOBE staff and teachers – received a variety of prizes. Representatives from the Ministry of Education and from the Ministry of Environment attended the exhibition.

Jordan

A teacher training workshop was conducted, with the support of the GLOBE RCO. It was a special event for teachers and students from the Science and Technology Institution. A meeting with the staff from the American embassy in Jordan was held during the workshop. Sixteen teachers from 13 schools attended the training, where many of the GLOBE protocols were covered. In addition, trainings on data entry were successfully conducted. The Country Coordinator also directed a session on the importance of GLOBE in the country.

GLOBE around the World North America

Annual Regional Meeting:
28–30 March 2016
Location: Nashville, Tennessee
and
North American Regional Meeting/
U.S. Partner Forum Meeting



The U.S. Partner Forum met in Nashville, Tennessee, USA, on 28 March 2016; this was followed by the Train-the-Trainer (TTT) event on March 29th. The North American Regional Meeting (NARM) took place at the same location on March 30th. There were 12 participants for the U.S. Partner Forum; 40 participants for the TTT; and 50 for NARM.

The U.S. Partner Forum has representatives from the six U.S. regions as well as two at-large members. (A list of the current members can be found in the “Community” section of the GLOBE website.) During the meeting, various initiatives within the U.S. were discussed, including the regional science fairs and building capacity within the program in the country.

The TTT event focused on air quality in urban communities and the use of GIS (geographic information system). Discussion of the new GLOBE Elementary Aerosols publication and hands-on training with an aerosols instrument were key components of the event.

The NARM had one of the largest numbers of participants in recent years, a sign of increased engagement from the U.S. community. Topics included presentations and hands-on experience with the website; discussion of the new GLOBE Elementary Aerosols book and “Regional Best Practices;” and overviews of the NASA education funding that a number of partners were awarded. A NARM 2016 Committee was formed to develop the agenda for the meeting, which included a number of GLOBE partners, U.S. Partner Forum members, and GIO staff.

Highlights from the North America Region

GLOBE Teacher and Students Learn about NASA and STEM at Special Event

The White House Office of Science and Technology Policy hosted the 13 January State of Science, Technology, Engineering and Math Address, playing off the president’s State of the Union address. It included displays on tech topics as well as face time with a group of high-caliber experts. About 140 students from across the nation heard from STEM





standouts including Mark Davis, a former NBA player who now owns a solar energy company; former astronaut Alvin Drew; and Megan Smith, the nation's chief technology officer.

Stamford High school teacher Sue Dougherty was introduced to GLOBE through NASA's LEARN (Long-term Engagement in Authentic Research with NASA) Program which gives teachers the chance to do research and training with NASA scientists and share their knowledge with students. Dougherty traveled to NASA's Langley Research Center in Hampton, Virginia, to work with researcher Margaret Pippin. With guidance from Pippin, Dougherty conducted two projects between 2013 and 2015, one exploring a possible correlation between ozone concentration in the atmosphere and autism birth rates, the other on polar ice variability. All of the LEARN teachers were trained in the GLOBE program, which engages students and teachers around the world in collecting valid scientific data on Earth and our environment.

Into the Woods with GLOBE New York Metro

On 12 June 2015, 900 students from twenty-eight elementary schools across New York presented projects on the environment at the "Into the Woods Science and Arts Symposium" hosted by Queens College.

Into the Woods is a four-year professional development program that trains elementary school teachers to extend their classrooms outdoors into nature and to



enhance their students' environmental literacy through the use of GLOBE protocols and activities. This event allowed students and teachers to present their GLOBE inspired projects with other members of the community and also with the Queens College community. Into the Woods is funded by a grant from the National Oceanic and Atmospheric Administration (NOAA).

Ohio Students' GLOBE Research Abstracts Published in Peer-reviewed Ohio Journal of Science

The 125th Annual Meeting of the Ohio Academy of Science was held at Ohio University in Athens, Ohio on 16 April 2016. Akron students Mai See Lor (Akron Early College) and Suzanna Vang (Roswell Kent Middle School) presented their GLOBE Program research during the Poster Session. In addition, Mai, and Suzanna's research abstracts have been published in the peer-reviewed Ohio Journal of Science. This accomplishment means these students earned a Superior rating at each science fair including the State Science Day at The Ohio State University. The research focused on urban heat island effects, and asphalt's affect on soil temperature.

Section III

The GLOBE Program: Strategies and Outcomes – 2014-2016

Strategies and Outcomes: An Overview

Over the last two years, GLOBE has employed a number of strategies to deliver a set of outcomes that would rebuild, solidify, and expand the program’s foundation and community. Major outcomes of these strategies are visible this year and are outlined in this review.

The three strategies are to:

- Increase student data entry and student research;
- Facilitate an engaged community; and
- Provide efficient, effective, transparent management of the GLOBE Implementation Office and The GLOBE Program.

Outcomes are categorized under four main headings:

- Supporting the Worldwide GLOBE Community through Core Services
- Fostering Program Growth
- Enhancing Program Quality
- Advancing Mission and Vision through Internal Initiatives and External Collaborations

Some specific examples of these outcomes are described below.

Supporting the Worldwide GLOBE Community through Core Services

The GLOBE Program supports the worldwide GLOBE community through core services, including – but, of course, not limited to – the actions and activities described in this section.

A More User-Friendly Technology Infrastructure

In order to help ensure that The GLOBE Program is doing everything possible to assist community members on a daily basis, in addition to the help provided by the Community Support Team, new website tools and tips for the community have been created, and new apps have been developed.

New Website Tools and Tips for the Community

An exciting variety of new website tools and tips have been added for the GLOBE community, including those described below.

- **New “Tip of the Week” Feature** – In February of 2016, GLOBE created a new “Tip of the Week” feature. This feature is designed to offer tips and insights on implementation of the program by community members – and to ensure that this work is as efficient and effective as possible.
- **Translated Materials** – In order to better meet the needs of GLOBE’s international population, additional translated materials have been made available for the GLOBE community. This includes translated Data Entry forms, Spanish translation of the Visualization System and the Advanced Data Access Tool, and a “Translated Material” page with an aggregate of all translated materials on the website.



- **Advanced Data Access Tool** – The new Advanced Data Access Tool allows users to find and retrieve GLOBE data using different search parameters such as science protocol type, school, location, or date. Users can refine searches and then download data into a CSV file for detailed analysis. Additionally, a CSV summary file is available for each site.

- **International Virtual Science Fair Upload Tool** – In order to aid participants in the 2016 International Virtual Science Fair, a new research report upload tool was developed with specific components for the science fair. The new upload tool allows users to select desired virtual badges, to transfer a presentation, and included additional fields for information about the project and the participants.
- **Low-Bandwidth Site** – GLOBE community members in areas with low bandwidth now can load the GLOBE website (globe.gov) faster – as a result of the new GLOBE lite site. The low-bandwidth site has fewer images and features to allow for easier navigation, quicker access to the data entry forms, and overall use of the site.

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- **New Visualization Base Maps** – Users can now compare GLOBE data to different base layer maps in the Visualization System. Options include:
 - ✓ Map views of streets, physical geography, hybrid streets and physical geography, or a satellite image of the surface;
 - ✓ True color image showing clouds and a snapshot of the Earth at points in time;
 - ✓ Earth at night showing visible light at night;
 - ✓ Aerosol optical depth from Terra/MODIS;
 - ✓ Land surface temperature from Terra/MODIS;
 - ✓ Chlorophyll measurements from Terra/MODIS;
 - ✓ Daily precipitation estimates from Aqua/AIRS; and
 - ✓ Soil moisture from SMAP.

New Apps

In response to the need for new technology for data collection, GLOBE has developed a data entry app, which allows students to record measurements in the field and transmit them directly from their hand-held device whenever they have a Wi-Fi connection.

As GLOBE welcomes non-school based Citizen Scientists into the program, a new app called the GLOBE Observer will be launched in 2016. This new app will allow any person in a GLOBE country to enter data for specific science protocols. The push toward the use of hand-held devices for recording data isn't new, but it is new to GLOBE, where we continue to respond to user requests for new and agile tools to facilitate essential research about the environment.

New Learning Activities Using GLOBE Datasets

A new suite of GLOBE Learning Activities, GLOBE Data Explorations, which helps students explore GLOBE data as they build skills with analysis and interpretation of data, will soon be available to the community. The Learning Activities are adaptable for different levels of instruction – from upper elementary to high school learners. They are a way for students to start understanding what GLOBE data can tell them and how to test a hypothesis using these data. There are two groups of activities: one group for getting to know how to explore data, and another group for more in-depth explorations.

The activities also cover atmospheric science concepts and geography as well as identify practices and processes from *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. The nine activities were developed by the UCAR Center for Science Education, a GLOBE Partner, with input from science educators, GIO staff, and field tested by GLOBE teachers.



The GLOBE Annual Survey – A Snapshot of the 2015 Survey Responses

The Annual Partner Survey is one of GLOBE’s primary data-collection tools. As The GLOBE Program and its organizational structure continue to evolve, the need to collect data that reports on, and that is relevant to, the GLOBE community becomes more important. To that end, the Annual Partner Survey became community-wide and not focused on one specific audience, such as partners. Currently, the responses are being analyzed. It is anticipated that the summary results will be disseminated to the community soon!

The following provides a “snapshot” of responses to the 2015 Survey.

Technology/Website:

- ✓ Overall, Partners and Country Coordinators (CCs) found navigating the GLOBE website easy, with close to 50 percent of respondents indicating that navigating the GLOBE Teacher’s Guide was “very easy.”
- ✓ Overall, Partners/CCs were satisfied with their ability to interact and use various aspects of the GLOBE website and close to 50 percent were “extremely satisfied” with the information reported in News & Events.

Funding:

- ✓ Over one-third of respondents receive government funding (either direct award or contract/grant) for GLOBE management and operations, whereas one-quarter reported no funding available for GLOBE management and operations.

Communications:

- ✓ Close to one-third of the respondents reported that GLOBE’s e-Newsletter was their primary source for receiving information about GLOBE.
- ✓ Forty-one percent of Partners/CCs communicate with each other on a monthly basis.
- ✓ The primary mode of communication among GLOBE Partners/CCs is e-mail.

Education/Training:

- ✓ The majority (93 percent) of Partners/CCs work with public schools.
- ✓ Over 50 percent of GLOBE teachers responded that they prefer hybrid training (a mix of online and face-to-face), with most commenting that it offered the greatest flexibility for their schedules.
- ✓ Close to 50 percent of teacher respondents indicated that student interest in science and technology topics is the student outcome they would most like to be able to document.

GLOBE would like to thank all the community members who took the time to respond to the survey.

2015 Annual Meeting and Student Research Exhibition Highlights



The 19th GLOBE Annual Meeting and 3rd Student Research Exhibition took place in Los Angeles, California, USA, in July (20-24) 2015. As always, the purpose of the gathering was to engage the GLOBE community in an interactive, inclusive, and iterative process where participants could share concerns and contributions – and generate momentum for the implementation and expansion of The GLOBE Program.

Participants at the 2015 GLOBE Annual Meeting and Student Research Exhibition

REGIONS	Africa	Asia and Pacific	Europe and Eurasia	Latin America and Caribbean	Near East and North Africa	North America	Total
Representatives from Each Region	10	68	15	13	7	112	225
Teachers	1	23	2	2	1	14	43
Students		27	3	1	1	26	58
Other	9	18	10	10	5	72	124

The theme of the annual meeting was “Strengths of a GLOBE-al Community of Scientists.” There were 225 participants from 35 countries and 56 students from 7 countries. Students and teachers participated in the 1st Student Research Experience, which was successfully conducted by the Wrigley Center for Environmental Studies at Catalina Island off the coast of California. Students spent two days on a field experience and collected data using GLOBE protocols. The following day, they presented the data and personal reflections about the experience. This pilot was highly successful and, as a result, is being repeated at the 2016 Annual Meeting in Estes Park, Colorado.

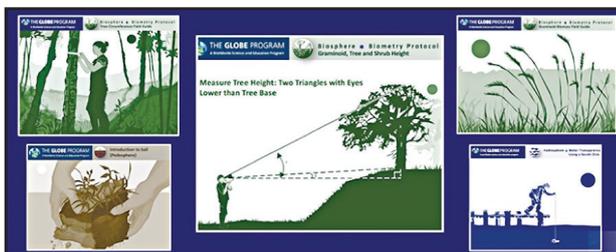


Fostering Program Growth

A second critical outcome is to foster overall program growth, including – but, of course, not limited to – the actions and activities described in this section.

GLOBE's eTraining System

A new eTraining system was launched on Earth Day 2016. Teachers no longer have to wait for a face-to-face workshop in order to get their students out collecting data using GLOBE science protocols.



There are currently 28 training slide sets, associated interactives, and certification quizzes available on the GLOBE website. Ultimately, the eTraining portal will serve to function as a community hub for teachers who cannot attend a face-to-face GLOBE training event and may also serve as a platform connecting teachers with training campaigns and providing them access to scientists and facilitated science learning experiences (short courses).

Beginning in 2017, GLOBE anticipates expansion of the eTraining program to include professional development pathways for teachers who want to be GLOBE Trainers, and for GLOBE Trainers who want to be Master Trainers. Educational products developed by individuals who are obtaining advanced certification will be vetted; some of these products will be used to populate the eTraining portal with supporting resources, providing a robust and inclusive introduction and/or review of GLOBE science protocols for GLOBE teachers around the world.

GLOBE Citizen Science

GLOBE students have been involved in data collection, partnering with scientists and satellite missions, and participating in scientific measurement campaigns, and have been doing the work of citizen scientists for more than two decades. GLOBE has become an early adopter of the view that the “general public” can benefit from engaging in the process of GLOBE’s investigations, too.

Launching in late August 2016, the GLOBE Observer app will eventually provide a suite of environmental investigations (such as cloud and mosquito identification) to all citizen scientists. The measurements entered by these citizen scientists are tagged differently than the school based data giving users the ability to discern their origin.

2016 GLOBE International Virtual Science Fair

In 2016, it was time for GLOBE students (K-12) to show the world what they are learning through the scientific, experiential, hands-on journey that is GLOBE! The 2016 GLOBE International Virtual Science Fair (IVSF) served as a showcase for this dedicated work. The IVSF took place online, and students from any GLOBE country were invited to participate (and there was no limit to the number of projects a school could submit).

This completely virtual science fair allowed GLOBE students to use the measurements from the database and to collaborate with scientists of the GLOBE International STEM Network (GISN) – and to apply their work to a real-world problem. GISN members from all six GLOBE regions volunteered to help mentor students and help score the submitted projects.

In order to encourage different grade levels, scoring rubrics and guidelines were developed for grades levels as follows: lower primary (K-2), upper primary (3-5), middle school (6-8), and high school (9-12). The rubrics are also merit-based to encourage a more positive environment (rather than having students competing against each other for a “First Place” winner) and there is no limit to the number of projects that can receive top scores.

Another new item for the 2016 IVSF was the introduction of scoring badges. Each student project received a “Student Research Badge.” Students also had the option to complete five other badges: Collaboration, Community Impact, Connections to a Scientist, Interscholastic Connection, and Engineering Solution.

On Earth Day 2016, four eligible projects (two from the U.S. and two international) were awarded with stipends to attend the 2016 GLOBE Annual Meeting in Estes Park, Colorado:

United States –

- St. Francis Xavier Catholic School (Gettysburg, Pennsylvania): The Effect of Land Use on Water Quality
- Roswell Kent Middle School (Akron, Ohio): How does Asphalt Affect Soil Temperature?

International –

- Princess Chulabhorn Nakornsrihammarat (Nakon, Srithammarat, Thailand): Seasons and Climatic Factors Affecting Dengue Cases in Muang Nakhon Si Thammarat, Thailand
- Prirodoslovna i graficka skola (Rijeka, Croatia): Determining the Presence of heavy metals in the air by using GLOBE science protocols for aerosols, conductivity and pH.

In all, 105 projects were submitted; 24 judges and 37 mentor scientists participated in the IVSF. (To read the reports, read about the judges who helped score the projects, or learn where the reports came from, visit: globe.gov/science-fair.)

The IVSF is a wonderful example of the work of the community: students showcasing their work, and members of the GISN mentoring and judging the work (which was greatly appreciated) and working with a U.S. GLOBE Partner, WestEd, to redesign aspects of the fair. This type of community effort makes the program stronger.

The 2017 International Virtual Science Fair has been launched; reports are due by 03 April 2017 and scoring and badges will be announced on 15 May 2017.



U.S. Regional Science Fairs

In 2016, with support from a grant from the National Science Foundation (NSF), students from across the United States had the opportunity to come together at one of six face-to-face regional science fairs to share the results of field investigations using GLOBE protocols.

Science Fair	Location	Date	Projects	Students	Partners	States
Northeast & Mid-Atlantic	NASA Goddard, Greenbelt, MD	10 – 11 March	12	30	8	7
Pacific	NASA Jet Propulsion Lab, Pasadena, CA	29-30 April	7	16	5	2
Southeast	Museum of Natural Science, Jackson, MS	5-6 May	6	20	4	3
Midwest	University of Toledo, Toledo, OH	13-14 May	23	37	4	3
Northwest	World Forestry Center, Portland, OR	20-21 May	8	20	4	3
Southwest	University of Texas – Tyler	20-21 May	11	36	2	2

Leading up to the science fairs, GLOBE teachers were able to attend live webinars (or view the archived version) that provided professional development on field investigations and enhancing scientific practices of the natural scientists in classrooms. The two-day regional science fairs included judging of science fair entries, keynote speakers, tours of local museums and science facilities, geocaching and GPS treasure hunts, team-building exercises, teacher workshops, and professional development opportunities for participants.

Committees within each of the six regions helped to organize these fairs and worked in conjunction with U.S. Partner Forum members and the U.S. Country Coordinator. At each of the fairs, students presented their GLOBE research projects, which were then evaluated for their effectiveness.

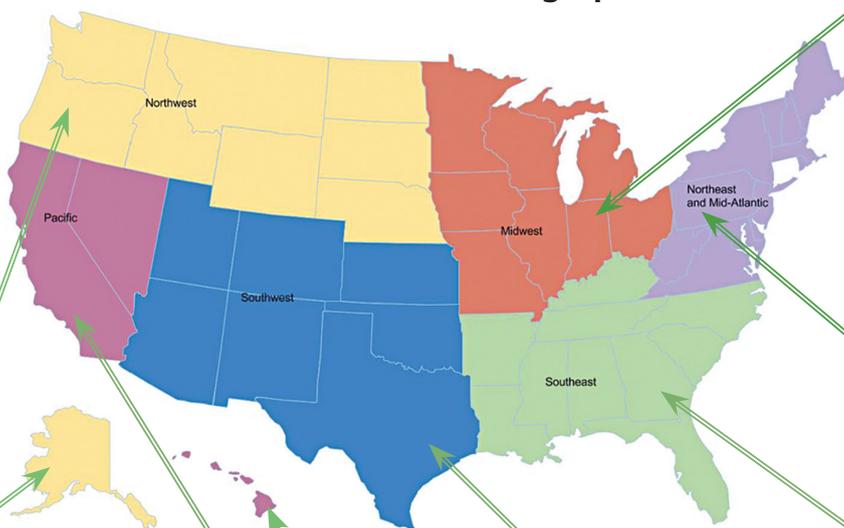
Each science fair began in the evening with activities where the students could get to know one another. At each fair, the opening was a regional choice. Examples included geocaching in the Midwest, building towers out of newspaper and tape in the Southeast, viewing the night sky with high-powered telescopes in the Northeast & Mid-Atlantic, or visiting museum displays (such as the World Forestry Center Discovery Center in the Northwest).

The next morning, students discussed their research with judges and each other. While the judges deliberated on the strengths and weaknesses of the various projects, students were given tours of NASA facilities (Pacific, Southwest, Northeast & Mid-Atlantic), or engaged in other student activities such as kite-flying with sensors (Midwest) or museum tours (Southeast), while teachers were offered professional development using probes, sensors or aerosol-measurement equipment. Some events included keynote speakers discussing their research (such as Dr. Mullica Jaroensutasinee on the topic of mosquitos, and Dr. Bill Patzert on the topic of El Niño). Each event ended with a closing ceremony and awards for middle school and high school projects.

Student participants of the Six U.S. Regional Science Fairs 2016



U.S. GLOBE Geographic Areas



Midwest - Toledo, Ohio



Northeast & Mid-Atlantic - NASA Goddard Space Flight Center, Greenbelt, Maryland



Northwest - Portland, Oregon



Southwest - Dallas, Texas



Southeast - Jackson, Mississippi



Pacific - NASA Jet Propulsion Laboratory
Pasadena, California



NASA-Funded GLOBE Partner Projects

In a 2015 funding competition, NASA selected a number of organizations across the U.S. to implement a new strategic approach to more effectively engage learners of all ages on NASA science education programs and activities. Three GLOBE-related projects were included in the selection. Dr. Elena Sparrow (University of Alaska, in Fairbanks), Dr. Kevin Czajkowski (University of Toledo in Ohio), and David Bydlowski (Wayne County Intermediate School District in Michigan), all long-standing GLOBE partners are the principal investigators of the projects. Each of the projects is funded for five years.

Dr. Sparrow's project, *STEM Integration of NASA and GLOBE*, will use citizen science, NASA satellite data and other assets, online course module technology, and integrated STEM problem solving skills to leverage the benefits of Earth system education, particularly in rural communities.

Dr. Czajkowski's project, *The Mission Earth*, proposes a systematic embedding of NASA assets with GLOBE assets into the curricula of K-12 schools, leveraging existing partnerships and networks and supported through state departments of education, as a systemic, effective, and sustainable approach to meeting NASA's science education objectives.

David Bydlowski's project, *The AEROKATS and ROVER Education Network (AREN)*, has as one of its goals to emphasize and strengthen the connection between NASA and GLOBE by highlighting concepts such as: the role and practice of remote sensing; in situ measurement techniques for calibration and validation; structured field operations; and advanced technologies. Many GLOBE protocols involve students collecting data through in situ field measurements but do not highlight remote sensing tools. With the exception of a select set of GLOBE field campaigns, the connection between remote sensing missions and GLOBE protocols is minimal. This project will strengthen this connection.

Enhancing Program Quality

A third critical outcome is to enhance overall program quality, including – but, of course, not limited to – the actions and activities described in this section.



Strengthening the GLOBE International STEM Network

In order to and more accurately reflect its mission and purpose, the GISN, which was the “GLOBE International Scientists’ Network” now stands for the “GLOBE International STEM Network.”

The GISN is an international network of STEM professionals who work with GLOBE students around the world conducting science. STEM professionals mentor students and teachers, present scientific ideas, and/or collaborate on scientific research. In 2016, the number of members in the GISN doubled, rising to 277 members (as of June).

GLOBE continues to work closely with GISN members. In 2015, GLOBE engaged in a number of events and activities in efforts to expand and enhance the GISN, including:

- Encouraging GISN members to present about GLOBE on a national level at science and education conferences;
- Developing ongoing opportunities for GISN to engage GLOBE community (including via the IVSF and the U.S. regional science fairs);
- Creating outreach materials to support GISN members in the making of their own videos (such as slide decks that demonstrate how to make a video, and talking points that show how to share science with GLOBE students and how to upload video to the website); and
- Creating a useable and searchable database for all community members (the goal is that the profiles can be viewed by other members and encourage connections and collaborations wherever possible).

The GISN is an invaluable part of The GLOBE Program. Keep checking the GLOBE website to see how GISN members can assist you – or how you can become involved with the GISN movement!

Regional Field Campaigns: The 2015 Surface Temperature Field Campaign

How does surface cover affect surface temperature? In December 2015 (over the course of the entire month), GLOBE Partner Dr. Kevin Czajkowski, Director of the Geographic Information Science and Applied Geographics Lab at the University of Toledo (Ohio, USA), hosted a Surface Temperature Field Campaign.

As always, the campaign is a great opportunity for schools around the world to work together as a community on a common research project. “The surface temperature field campaign may be even more interesting this year with the strong El Nino occurring currently in the Pacific Ocean,” said Czajkowski (who developed the surface temperature protocol for the campaign).

In order to discover just how surface cover affects its temperature, students set up research studies at their schools and investigated how surface temperature changes between schools. For the 2015 campaign, Czajkowski updated the community on the progress of the students in entering data through a regular blog. At the end of the campaign, he noted that 34 schools from around the world had entered data – for a total of 995 observations.

The data submitted by students is available on the GLOBE website and is used by researchers of all ages – from fourth graders to graduate students at universities.



Students taking surface temperature measurements



The Kilimanjaro Learning Expedition: Returning to the Roof of Africa

In collaboration with Discovery Education, GLOBE Africa set out on an expedition (from 24 September 2015 through 01 October 2015) to summit Mount Kilimanjaro in Tanzania in order to collect scientific data that would help evaluate the evolving ecosystem.

GIO Director, Dr. Tony Murphy, joined the expedition – an endeavor that has been recording data on vegetation, air and soil temperature, clouds, surface temperature, relative humidity, and several parameters of water (including pH, electrical conductivity and dissolved oxygen) since 2008. The data obtained using GLOBE science protocols were entered into the GLOBE database where students and scientists can access them for visualization, analysis, and further research. This information is being used to determine how the ecological biomes are shifting, how much the glaciers of Mt. Kilimanjaro are shrinking and why.

Revised and Updated Teacher's Guide

In 2015, GLOBE successfully launched the newest edition of the Teacher's Guide. Originally developed in 1995, the Teacher's Guide has always been a core component of the program – containing all of the information necessary for teachers to successfully implement GLOBE activities in their classrooms and schools. In addition to text updates, the new Teacher's Guide features:

- Linking throughout the guide for enhanced navigation, allowing users to immediately locate documents referred to within the guide;
- An enhanced search tool allowing the user to search by keyword, language, grade level, investigation area, document type, NGSS standards, and time requirement;
- Protocol-specific drop-down menus allowing users to select from data sheets, field guides, learning activities, science protocols, and supporting resources related to the specific protocol selected;
- An organization of the Teacher's Guide based on Earth's spheres;
- The replacement of data visualizations with those created from the new tools; and
- A single glossary that spans all of the investigation areas.

The GLOBE Program is pleased to offer this updated and enhanced edition of the Teacher's Guide to the GLOBE community. The new Teacher's Guide can now even more effectively serve as a core component of the GLOBE journey into inquiry-based science and education.

20 THE GLOBE PROGRAM

20th Anniversary · 1995 – 2015



THE GLOBE DATA ENTRY CHALLENGE

Advancing Mission & Vision through Internal Initiatives and External Collaborations

The fourth critical outcome is to advance the mission and vision through internal initiatives and external collaborations, including – but, of course, not limited to – the actions and activities described in this section.

Data Entry Challenges

The GLOBE Program offers those studying Earth sciences the ability to collect, submit and analyze data that can also potentially be used by scientists in Earth science research. The GLOBE Program is continuing to facilitate the expanded collection and use of GLOBE data; this is a core undertaking of GLOBE – and one that is being achieved by ensuring increased consistency in efforts to collect data. GLOBE is intensifying work with partners, and the overall GLOBE community, through training and by highlighting the schools whose teachers and students collectively observed and reported high-quality data.

During the most recent Data Entry Challenge, held in April (18-24) 2016, the community's extraordinary efforts added an incredible 208,000 measurements, from 79,000 data forms, to the GLOBE database in just one week!

These ongoing campaigns help students recognize the importance of going out in the field and making scientific observations and/or collecting samples to do analysis in the classroom – and how critical it is to actually report the findings to GLOBE so that scientists and other community members may benefit from them.

The GLOBE Program recognizes every student and every school that has participated in making the data count over the last twenty-one years – and will continue to recognize these efforts as the program moves forward. These extraordinary efforts are invaluable in helping GLOBE further promote the teaching and learning of science and scientific discovery.



GLOBE and SciGirls

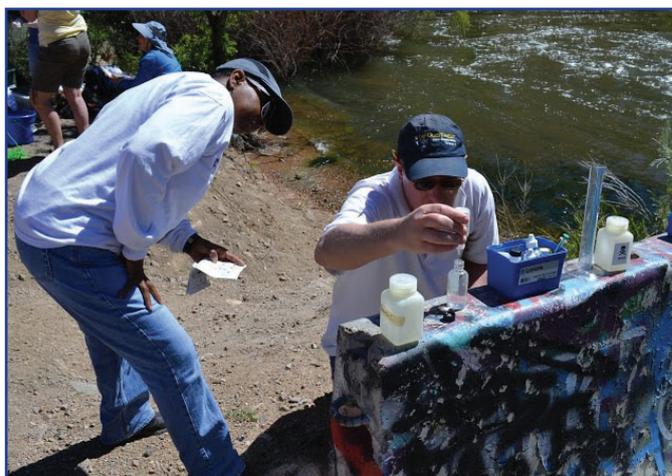
In the U.S., GLOBE continues its educational partnership with SciGirls, which is an NSF funded Twin Cities Public Television STEM education production. GLOBE has trained partners in SciGirls methodologies to help increase interest in STEM by girls and minorities

In 2016, The GLOBE Program was invited to help lead “SciGirls Reflect,” a two-day workshop for STEM educators from across the United States that discussed gender-equitable teaching strategies. GLOBE staff also assisted NASA Langley with SciGirls mentor trainings and the SciGirls partnership. Currently, GLOBE is being funded to pilot SciGirls activities for ten Latina girls in the Boulder, Colorado community. Once these activities are piloted, they will be available for the GLOBE community.

GLOBE, Peace Corps and USAID

Alongside NASA, GLOBE is working to enhance communications with Peace Corps and USAID headquarters; updating them on The GLOBE Program; discussing ways they can help promote GLOBE to their country organizations; and exploring other collaborative activities. GLOBE is seeking to develop potential new ways and activities to sustain and enhance the collaboration with Peace Corps and USAID.

NSF-Sponsored GLOBE Workshops on STEM Equity and Inclusive Practices



Photos of the workshop that took place in May 2016 in Sante Fe, New Mexico, with the goal of making GLOBE more accessible to diverse communities underrepresented in the STEM disciplines

In 2016, GLOBE conducted two five-day GLOBE Partnership Train-the-Trainer intensives in the U.S. (one in Charlotte, North Carolina in April; one in Santa Fe, New Mexico in May). The focus of these workshops was implementing GLOBE within highly diverse communities or within schools and informal learning programs that serve traditionally under-served and under-represented populations in the STEM disciplines, including women, minorities, and persons with disabilities.

Section IV

Focus on the Future

What Can the Community Expect?

Each year brings new strengths, initiatives, and enhancements to GLOBE. With a heightened focus on data collection, entry and analysis, as well as community engagement, GLOBE will continue to organize a number of events in the coming year. Based on the success of the data entry challenges, and thanks to the efforts of the community, the number of schools entering data has increased – along with the number of measurements. Currently, the Program has almost 140 million measurements in its global database, providing the community with access to all these data for research purposes. In this coming year, data entry challenges will again occur.

The number of student research submissions for the 2016 International Virtual Science Fair (IVSF) increased significantly, so another IVSF will be held in 2017. Your involvement in these research activities continues to strengthen the program and the community.

GLOBE's technological infrastructure hosts the global database and visualization tools, and encourages community interactions. This system will continue to undergo improvement and refinement, in order to make it more user-friendly and more powerful as an analysis tool and as a communications vehicle.

GLOBE, as one of the first large-scale school-based Citizen Science programs, is excited to include other audiences through the introduction of its new Citizen Science data entry app, the GLOBE Observer. The app allows anyone in GLOBE countries to enter cloud data. This new initiative encourages crowd-sourcing of measurements and will increase the amount of data available for students and scientists to analyze in their research. More GLOBE measurements will be added to this app in the coming years.

New learning activities based on GLOBE datasets are being launched this year. These have been developed and field-tested with GLOBE teachers from around the world. A new climate publication is being added to the Elementary GLOBE book set and should be available online in a few months.

Regions continue to add new or enhanced campaigns and/or expeditions to their activities. The Africa region will hold its first Lake Victoria Learning Expedition this year, while the Asia and Pacific region continues to solidify and expand the number of GLOBE student exchange programs. The Europe and Eurasia region will again host an aerosols and phenology campaign, while Latin America and Caribbean is focusing on a Green-Up/Green-Down campaign. The Near East and North Arica region continues to establish GLOBE camps in different countries, while the North America region will focus on strengthening student research opportunities.

All of these activities point to a renewed community with heightened engagement in the program. Thank you for all that you do for, and with, GLOBE helping us become a more vibrant community of learners.



Notes



Thanks to our GLOBE Partners around the world...

