

Brazil

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Organization and Number of Staff: Brazilian Space Agency/2

Funding by: Brazilian Space Agency

Cooperating Organizations/Individuals:

- Federal University of Maranhao
- Federal University of Rio Grande do Norte
- Inês Maria Mauad de Sousa Andrade, Volunteer Mentor Trainer
- Manuel Ricardo de Jesus Costa, Volunteer Trainer
- Municipal Secretary of Education of Umirim and Federal Institute of Education, Science; Technology of Ceará - Campus Umirim
- Municipal Secretary of Education of Belo Horizonte;
- Municipal Secretary of Alcântara
- Federal University of Paraná
- Federal Institute of Education, Science and Technology of Óbidos
- State Secretary of Education of Mato Grosso

GLOBE Schools: We have 292 Schools registered

GLOBE Protocol Areas: GLOBE Observe Protocol (Cloud, Mosquito, Tree and Land Cover)

Number of Schools Reporting Data over Past Year: 16 schools reported data for the period June 30, 2023 to July 1, 2024.



Program Implementation, International Cooperation in GLOBE Network, and Activities over Past Year (categorized by GLOBE Strategic Plan 2018-2023 Goals):

- Education

Our efforts were dedicated to promoting enriching workshops, events, and activities tailored to inspire and educate a diverse audience, including new students, educators, volunteers, and community members. These initiatives were carefully designed to encompass the realms of Science, Arts, Mathematics, Technology, and Engineering, all with a distinct focus on nurturing environmental awareness and a connection to our planet. To address the challenges faced by some educators in integrating the GLOBE program into their curriculum, we took a proactive approach by developing comprehensive educational materials. These resources were thoughtfully aligned with the Brazilian Common Curriculum Bases, providing educators across the nation with an accessible avenue to seamlessly incorporate the GLOBE Program into their teaching activities, fostering a harmonious blend of educational objectives and global environmental consciousness.

Besides the face-to-face activities, we promoted some trains in the AEB Escola Virtual, our online platform (<https://aebescolavirtual.aeb.gov.br/>, mentioned in the previous Highlight).

1. **Citizen Science GLOBE Observer Workshop**

Date: August 18, 2023 – October 18, 2023

Location: Online

Number of participants: 62

Number of certificated participants: 25

Participants came from the following countries: Brazil

A brief description: The classes were conducted 100% online, with theoretical classes held in the AEB Escola Virtual platform. The classes were recorded, so the students could do the course in their steps. Protocols, theoretical introductions, videos, and other educational materials are accessible to the trained even after the end of the course. The theme of the training was how to become a Citizen Scientist with the GLOBE Observer and the focus was on the protocols of Clouds, Land Cover, Trees, and Mosquito Habitat Mapper. In this virtual workshop, the average age of participants was 31.68, with the youngest being 14 years old and the oldest being 61 years old.

2. **GLOBE Citizen Scientist Workshop - Mosquito Habitat Mapper**

Date: February 07, 2024 – March 07, 2024

Location: Online

Number of participants: 74

Number of certificated participants: 25

Participants came from the following countries: Brazil

A brief description: Due to the large number of dengue cases in early 2024 in Brazil, the Brazilian Space Agency decided to conduct a workshop for citizen scientists focused on the mosquito protocol. The classes were conducted 100% online, with theoretical classes held in the AEB Escola Virtual platform. The classes were recorded, so the students could do the course in their steps. Protocols, theoretical introductions, videos, and other educational materials are accessible to the trained even after the end of the course.

3. **GLOBE Teacher Workshop - Mosquito Habitat Mapper**

Date: March 20, 2024 – April 05, 2024

Location: Online

Number of participants: 28

Number of certificated participants: 15

Participants came from the following countries: Brazil

A brief description: As the number of dengue cases continued to grow in the first half of 2024, especially in the state of Minas Gerais, the Secretary of Education of Belo Horizonte, capital of Minas Gerais, contacted us to offer a workshop on the mosquito protocol exclusively for teachers in Belo Horizonte. Thus, AEB offered the GLOBE teacher workshop on the mosquito protocol. The classes were conducted 100% online, with theoretical classes held in the AEB Escola Virtual platform. The



classes were recorded, so the students could do the course in their steps. Protocols, theoretical introductions, videos, and other educational materials are accessible to the trained even after the end of the course.

4. GLOBE Citizen Scientist - 1st Class/2024

Date: March 15, 2024 - July 31, 2024

Location: Online

Number of participants: 180

Number of certificated participants: 43

Participants came from the following countries: Brazil

A brief description: The classes were conducted 100% online, with theoretical classes held in the AEB Escola Virtual platform. The classes were recorded, so the students could do the course in their steps. Protocols, theoretical introductions, videos, and other educational materials are accessible to the trained even after the end of the course. The theme of the training was how to become a Citizen Scientist with the GLOBE Observer and the focus was on the protocols of Clouds, Land Cover, Trees, and Mosquito Habitat Mapper.

5. GLOBE Teacher - GLOBE Observer App - 1st Class/2024

Date: March 15, 2024 - July 31, 2024

Location: Online

Number of participants: 103

Number of certificated participants: 21

Participants came from the following countries: Brazil

A brief description: The classes were conducted 100% online, with theoretical classes held in the AEB Escola Virtual platform. The classes were recorded, so the Teachers could do the course in their steps. Protocols, theoretical introductions, videos, and other educational materials are accessible to the trained even after the end of the course. The theme of the training was how to become a GLOBE Teacher and the focus was on the protocols of Clouds, Land Cover, Trees, and Mosquito Habitat Mapper.

- Science

From August 2023 to August 2024, the Brazilian Coordination of the GLOBE Program aimed to increase the number of data collections among teachers, students, and citizen scientists. Indeed, during this period, 29,766 GLOBE data points were collected across Brazil, as shown in the table below.

Data Collected from August 2023 to August 30th, 2024

Atmosphere	Measurements
Air Temperature	1519
Barometric pressures	2264
Clouds	24496
Precipitation	22



Relative Humidity	290
Surface Temperature	494
Biosphere	
Tree Height	302
Land Cover	118
Hydrosphere	
Mosquito Habitat Mapper	302
Water temperature	1
Pedosphere	
Soil carbonates	1
Soil fertility: Nitrate	6
Soil fertility: Phosphate	6
Soil fertility: Potassium	6
Soil pH	4
Total	29,766

Although the focus of training was on GLOBE Observer protocols, a significant amount of data was collected in other atmospheric protocols, such as Barometric Pressure and Air Temperature. The large amount of collected data is due to partnerships with educational institutions in Brazil, including the Federal University of Maranhão, the Federal University of Paraná, and the Belo Horizonte Department of Education. There was also significant participation from Citizen Scientists in data collection. Today, the GLOBE Program in Brazil has over 5,000 Citizen Scientists registered on the platform.

Another important step in implementing scientific research using GLOBE in Brazil was motivating participation in the 2024 International Virtual Science Symposium (2024 IVSS). A total of 13 Brazilian projects were submitted to the 2024 IVSS, a record among



countries in the Latin America and Caribbean Regional Coordination (LAC). The research topics were:

- Analysis of environmental conditions and their influence on the proliferation of *Aedes Aegypti* mosquito larvae.
- Landscape and microclimate analysis for correlation of dengue cases at CEFET-MG campuses I and II using the GLOBE Observer app - Mosquito Habitats protocol.
- Characterization of breeding sites and identification of mosquito larvae of the genera *Aedes* and *Culex* at the Municipal Educational Center Senator Archer: Codó, Maranhão.
- Dynamics of land use and occupation in areas of soybean cultivation expansion in the Chapadinha microregion, state of Maranhao (Brazil).
- Investigations on Climate: Understanding Earth as a System.
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- Isolation and growth of Amazonian microalgae: Allies in CO₂ reduction and arbovirus control.
- Land use and coverage in Urbano Santos, Maranhao, Brazil.
- Lively Environment Project from the Perspective of School Guardians: A Process of Citizenship Building.
- Study and monitoring of CO₂ in the Amazon River and wildfires - IVSS 2024 Globe Program.
- The Importance of Trees for Sustaining Life on Earth: Does a single species of large tree make a difference for local or global climate?
- Project related to activities carried out in Module 03 of the GLOBE Project - Mosquito Protocol.
- The strong El Niño tells the story of arbovirus epidemics in Brazil and the capital of Rio de Janeiro.

Many of the research projects stemmed from the partnership with the Federal University of Maranhão through the STEAM and Permanent GLOBE Project in Maranhão, initiated in 2023. The project served 10 schools in the State of Maranhão in 2023, reaching around 1,500 students. In 2024, six new schools joined the project, and we expect to serve 2,000 students this year.

In addition to the research submitted to IVSS, a Master's Dissertation was defended in 2024 by graduate student Alexandre David Zeitune, entitled: "Active Learning with Students with High Abilities: The Influence of Socio-environmental Conditions on the Proliferation of Disease-Transmitting Mosquitoes" in the National Network Graduate Program for Environmental Sciences Teaching at the University of Brasília.

In 2024, a partnership was also established with the Federal University of Rio Grande do Norte. Through the "Girls in Space" Project, female students will conduct scientific research in 40 schools in the state of Rio Grande do Norte.

- Community

For the community, we are pursuing a more organic approach by showcasing GLOBE's projects at events, science days, and on social media platforms like Instagram, Facebook, and our website. Additionally, we are encouraging our teachers, trainers, and students to involve their local communities in GLOBE-related projects and research. The goal is to engage more citizen scientists in a dynamic way. Interest in science and space has increased in recent years, and many events are being created around these topics, where we are highlighting GLOBE. By doing so, we aim to strengthen the connection between the program and the community.

- Technology



In the area of technology, AEB has been promoting the use of the AEB Escola Virtual platform to train teachers and citizen scientists in the GLOBE Program protocols and other space-related topics. The AEB Escola Virtual platform (aebescolavirtual.aeb.gov.br) is a virtual learning environment that offers courses in the space area to a variety of audiences. In addition, it provides a range of teaching materials and activities for the classroom in Portuguese and adapted to the reality of Brazilian schools.

- **Communications**

To enhance community engagement, we are proactively promoting a series of events and webinars across multiple channels, including our social media platforms. Our approach includes partnering with technical specialists and inviting experts to discuss topics that are relevant to GLOBE participants. Through these efforts, we aim to foster meaningful interactions and offer valuable insights that strengthen our community's connection to and involvement with the GLOBE Program.

Plans and Ideas for Next Year:

From July 2024 to June 2025, various initiatives have been planned and are currently underway.

We have renewed our partnership with the Federal University of Maranhão to engage in public schools throughout the state of Maranhão. As part of this collaboration, we conducted the GLOBE Workshop from August 6th to 8th, training 27 university professors and students on the Cloud, Mosquito, Land Cover, and Tree protocols. These university educators and students guided public school teachers and students in Maranhão in developing scientific research using the GLOBE protocols. The schools involved include those in peripheral urban areas, indigenous communities, and *quilombola communities* (communities founded by descendants of Afro-Brazilian slaves who established settlements known as quilombos). The goal is for these community-based research projects to produce scientific articles for publication in specialized journals.

Within the scope of the "Girls in Space" project, we conducted the GLOBE Workshop in Natal from August 21st to 23rd. The workshop trained 188 participants, including female students and teachers from public schools in the state of Rio Grande do Norte, on the Cloud, Mosquito, Tree, and Land Cover protocols. These students and teachers, with support from the Federal University of Rio Grande do Norte, conducted scientific research using the GLOBE protocols. At the end of the workshop, each school was able to present its research proposal.

In September 2024, new classes will open for the "GLOBE Teacher" course and the "Citizen Scientist" course on the AEB Virtual School platform. These courses will allow students and teachers across Brazil to learn about the GLOBE Program and its protocols.

We hope that these and other actions to be developed during this period will increase the number of participants in the program, the amount of data collected, and foster greater Brazilian participation in the IVSS.

References

1. <https://aebescolavirtual.aeb.gov.br/>
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