



Presentation to GLOBE to Slovenia

How Does NASA Study Our Planet from Space and How Can You Help?

Peter Falcon, Earth Science Communications

NASA, Jet Propulsion Laboratory

November 2024

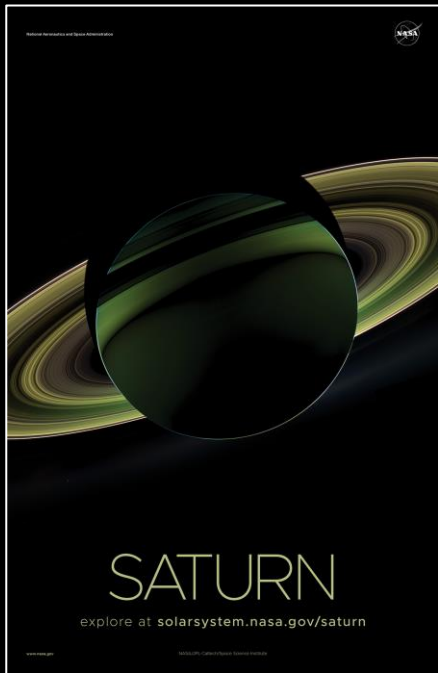
pcfalcon@jpl.nasa.gov



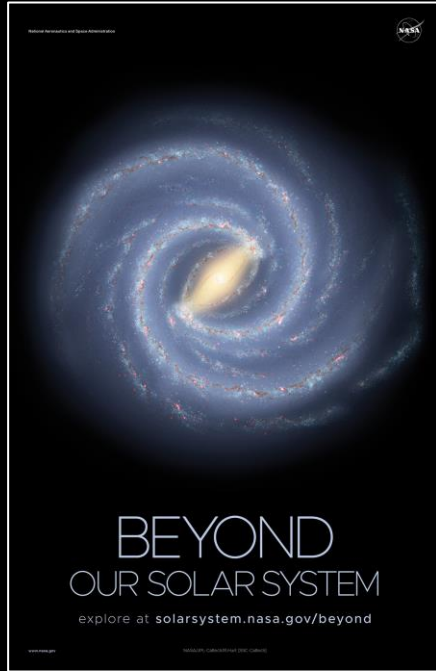
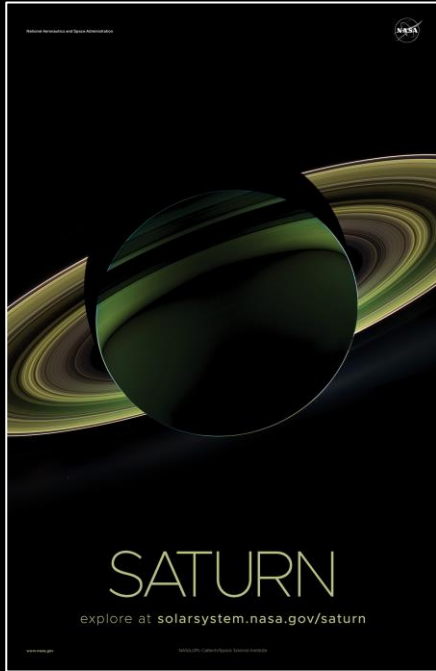
Jet Propulsion Laboratory
California Institute of Technology

What's GLOBE's Relationship with NASA?

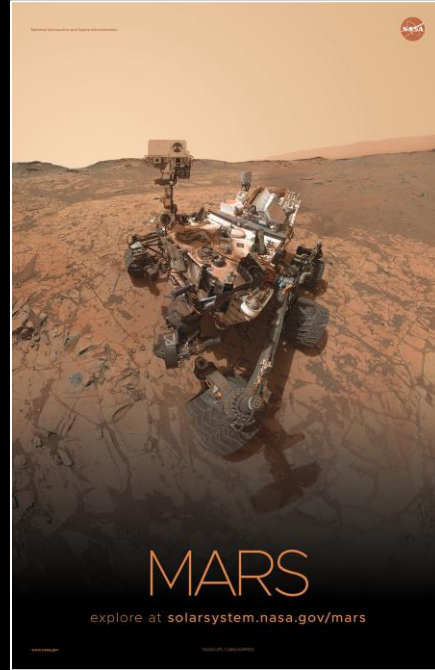
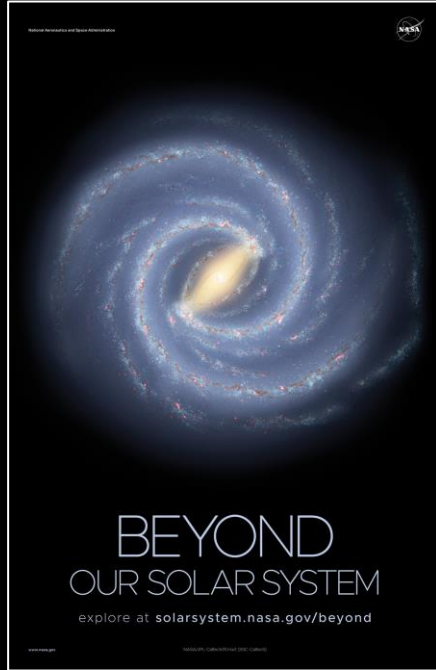
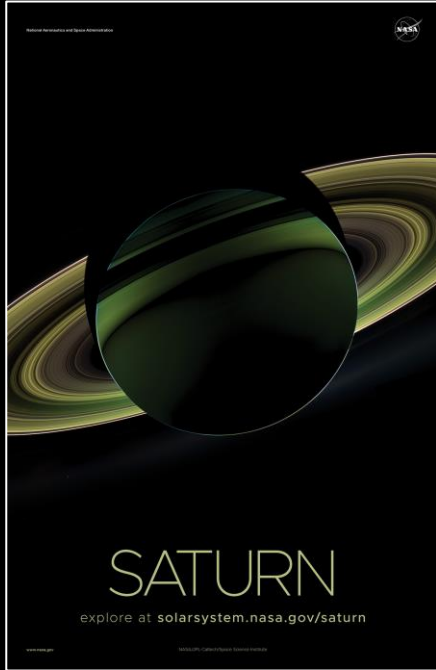
NASA Science



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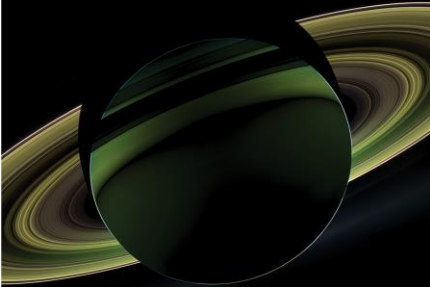



NASA Science



NASA Science



National Aeronautics and Space Administration



SATURN
explore at solarsystem.nasa.gov/saturn

www.nasa.gov NASA/Cornell University Space Science Institute



National Aeronautics and Space Administration



**BEYOND
OUR SOLAR SYSTEM**
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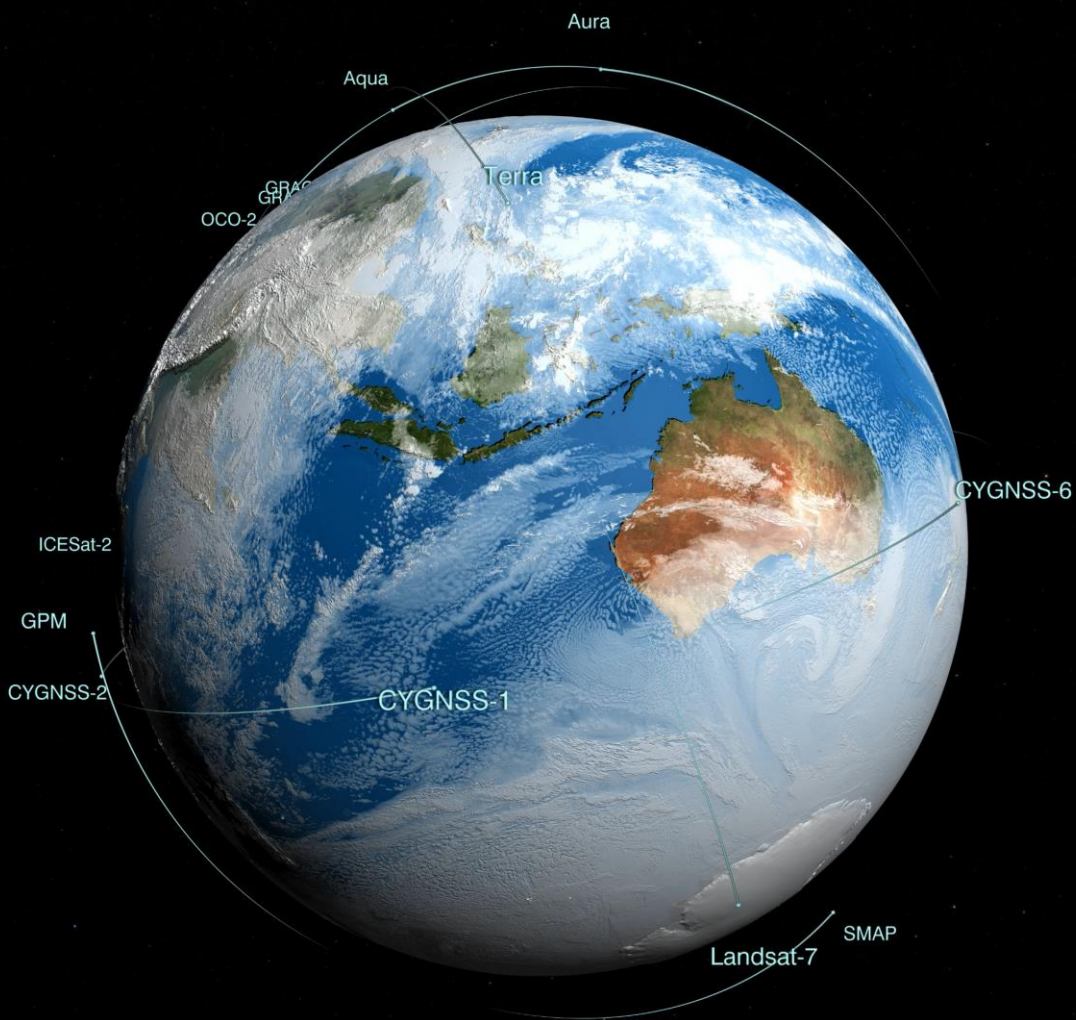
www.nasa.gov NASA/Cornell University

National Aeronautics and Space Administration



THE SUN
explore at solarsystem.nasa.gov/sun

www.nasa.gov NASA/Cornell University



Aura

Aqua

Terra

GRACE

OCO-2

ICESat-2

GPM

CYGNSS-2

CYGNSS-1

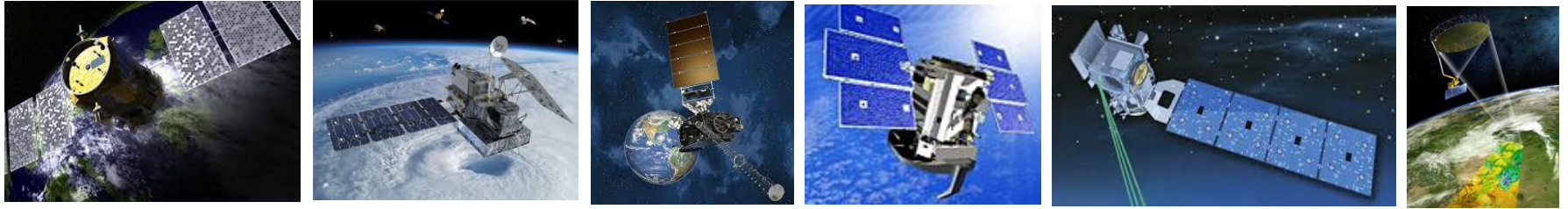
Landsat-7

SMAP

CYGNSS-6

Collaborating NASA Satellite Missions

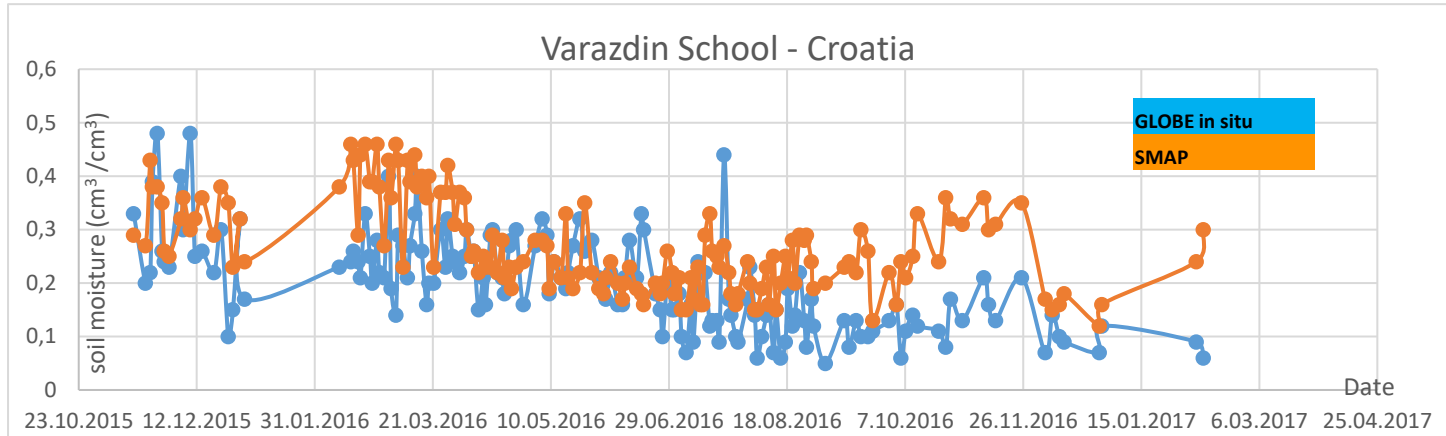
6 Earth Science Missions



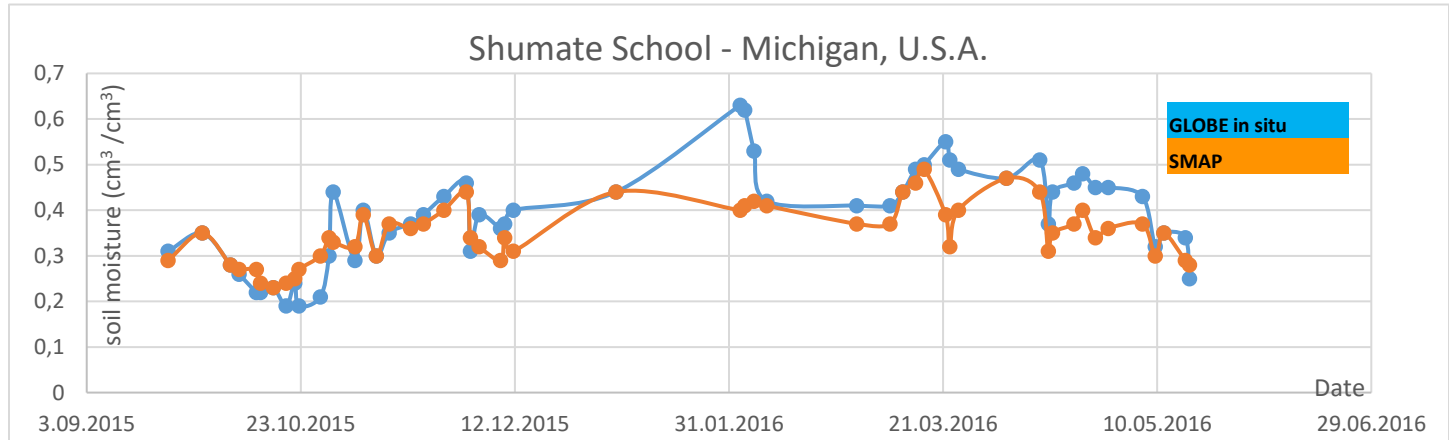
Six opportunities to take part in GLOBE Campaigns related to NASA Missions:

- CALIPSO = [Aerosols](#)
- Geostationary Operational Environmental Satellites – R Series (GOES-R) = [Climate](#)
- Global Precipitation Measurement (GPM) = [Rainfall](#)
- CloudSat = [Clouds](#)
- ICESat-2 = Ice thickness and land topography [Tree height](#)
- Soil Moisture Active Passive Mission (SMAP) = [Soil moisture](#)

SMAP/GLOBE Soil Moisture Comparison

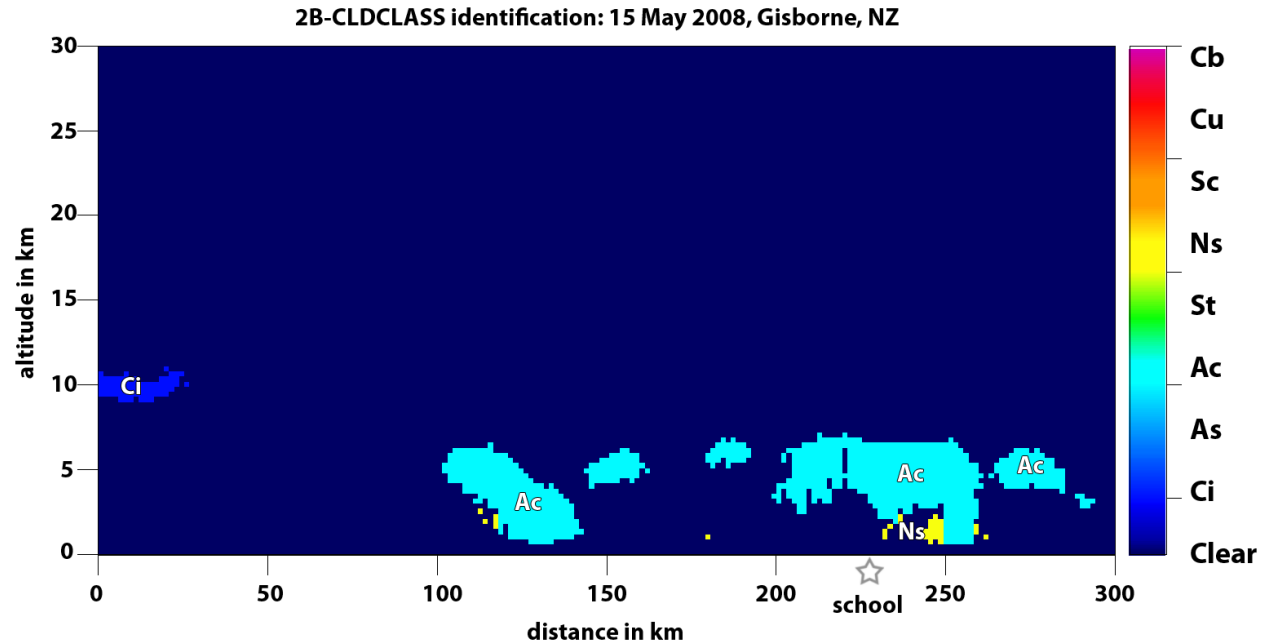


SMAP/GLOBE Soil Moisture Comparison



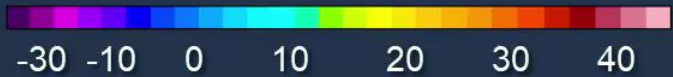
CloudSat – Student Comparison

Gisborne Boy's High School Data Comparison – Cloud Type



Eclipse shadow location is an estimation.

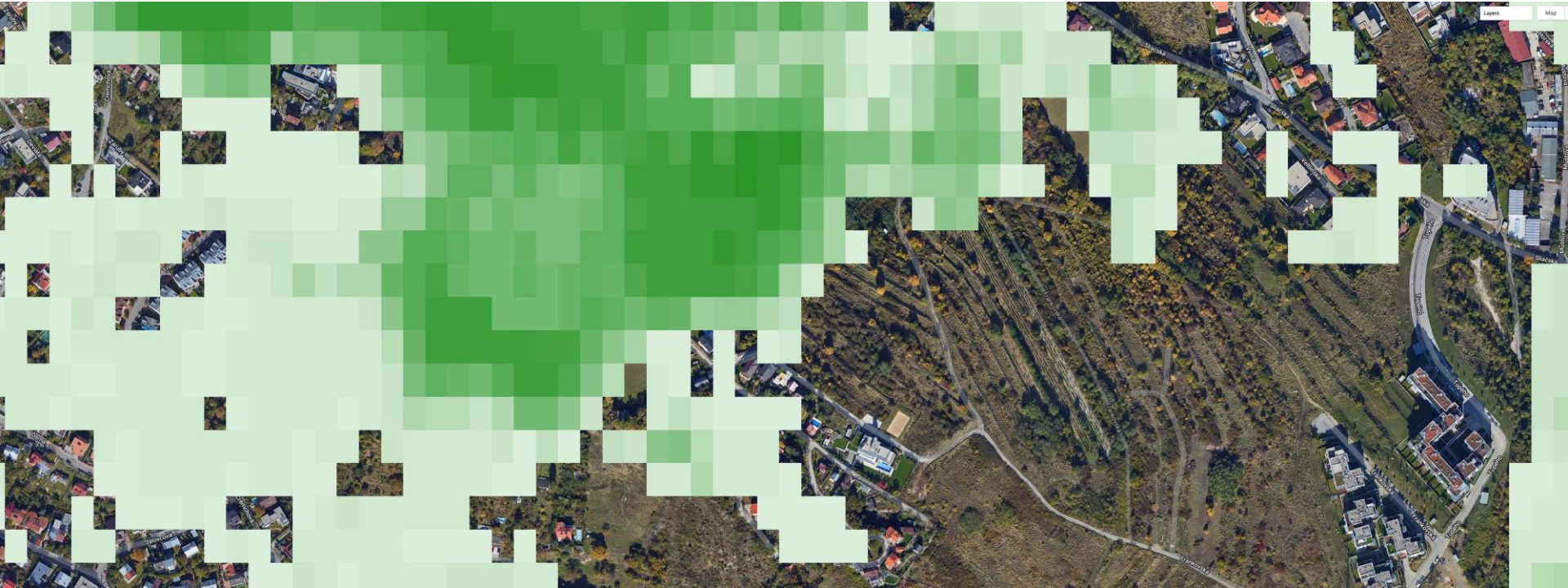
Air Temperature (°C)



August 21, 2017 Eclipse
Air Temperature Measurements



Earth Engine App - *Global Forest Canopy Height, 2000 & 2020*



[Global Land Analysis & Discovery, Earth Engine Apps](#)

Tree Height Measurements for ICESat-2 Study

Ground Truthing ICESat-2

- Two researchers are collecting tree height measurements to ground truth the IceSat-2 mission. They are accepting both student-based observations and citizen scientists' measurements using the GLOBE Observer and hand-held clinometer.
 - Mr. Brian Campbell (NASA, Wallops) is collecting year-round tree height measurements.
 - Dr. Nancy Glenn (Boise State University) is collecting tree height measurement in the snow.



IN THE GLOBE PROGRAM DATABASE, THERE ARE 140,079 TREE HEIGHT OBSERVATIONS FROM 48,012 GLOBAL LOCATIONS

Cloud Measurements Published in BAMS Publication

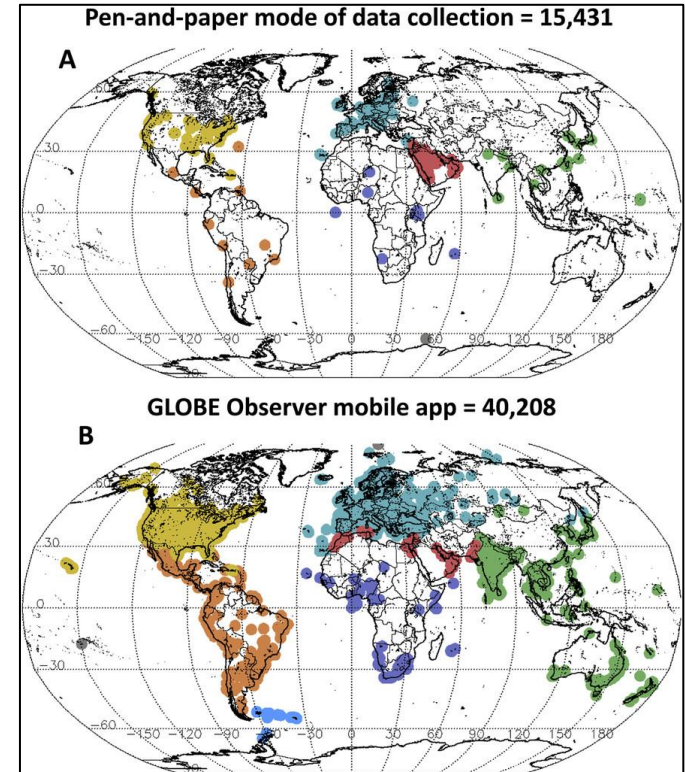
Clouds Around the World

How a Simple Citizen Science Data Challenge Became a Worldwide Success

Marilé Colón Robles, Helen M. Amos, J. Brant Dodson, Jeffrey Bouwman, Tina Rogerson, Annette Bombosch, Lauren Farmer, Autumn Burdick, Jessica Taylor, and Lin H. Chambers

- Data was collected from the Spring Cloud Challenge of 2018
- 55,000 observations from 15,000 locations, and 99 countries were recorded. Including every continent.
- Summary:
 - The Spring Cloud Challenge data collected can help to fill data gaps, track key climate change indicators, inform and improve model development, and document changes in areas with preexisting environmental challenges.

<https://journals.ametsoc.org/view/journals/bams/101/7/bamsD190295.xml>



Science Publications & Presentations

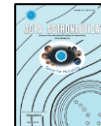
Using Your Data Observations!

Publications

- The Potential of citizen data to complement satellite and airborne lidar tree height measurements: lessons from The GLOBE Program [Environmental Research LettersV17,N7](#)
- Predicting Future Mosquito Larval Habitats Using Time Series Climate Forecasting and Deep Learning
- Land Use Land Cover Labeling of GLOBE images Using a Deep Learning Fusion Model [Sensors2022](#)
- MOSQUITO EDGE: An Edge-Intelligent Real-Time Mosquito Threat Prediction Using an IoT-Enabled Hardware System [Sensors2022V22N2](#)
- Do Citizen Science intense Observation Periods Increase Data Usability? A Deep Dive of the NASA GLOBE Clouds Data Set With Satellite Comparisons [Earth&SpaceScience](#)
- Adopt a Pixel 3km: A Multiscale Data Set Linking Remotely Sensed Land Cover Imagery With field Based Citizen Science Observation [Frontiers in ClimateV18 2021](#)
- A Descriptive Analysis of the GLOBE Data Collection Prior to and During the COVID-19 Pandemic [LinkHere](#)



<https://observer.globe.gov/publications>



Student Research Campaigns & IOPs

Regional and Worldwide Projects

We lead in projects that provide students with hands-on opportunities to explore and learn about Earth through a network of students, teachers and scientists.



- **Trees Around the World Campaign:** Measure tree height well NASA ICSSat-2 is overhead.
- **Mission Mosquito Campaign:** Help stop mosquito-borne diseases with the Globe Obs. app.
- **Urban Heat Island/Surface Temperature IOP:** Learn how global land surface temperature changed over time.

Student Research

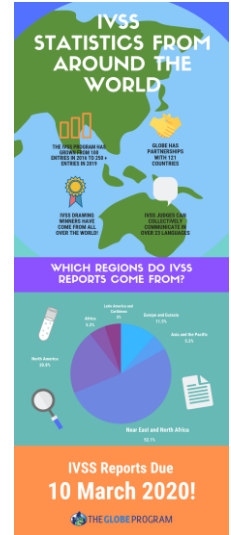
International Virtual Science Symposium (IVSS)

IVSS 2022, 220 student projects, from 25 countries submitted.

- Submit your team-based project with a chance to travel to the 2023 GLOBE Annual Conference and present your research findings.
- Your project will be viewed by NASA educators, scientists and GLOBE partners.
- NASA educators, scientist support IVSS by judging and mentoring schools.



[GLOBE IVSS 2023](#)



Social Media

NASA Promotes GLOBE on Twitter, Facebook and Instagram

We have a very active social media presence on most major platforms. Posting twice daily.

- We're always looking to highlight your observations, stories, photos.
- Check in to keep up to date on observation challenges from the clouds, trees and mosquito campaigns
- Facebook: **106,000** Friends
- Twitter: **10,200** followers
- IG: **3,750** followers
- We also have many regional accounts as well.



GLOBE **Trees**



U.N. Sustainable Development Goals

17 Goals to Transform Our World

The [Sustainable Development Goals](#) are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development which set out a 15-year plan to achieve the Goals.

Today, [progress](#) is being made in many places, but, overall, action to meet the Goals is not yet advancing at the speed or scale required. 2020 needs to usher in a decade of ambitious action to deliver the Goals by 2030.



<https://sdgs.un.org/goals>

GLOBE & Sustainable Development Goals

- The [GLOBE Science Working Group](#) has worked over the years on aligning the GLOBE Program Science Protocols to the UN Sustainable Development Goals.
- The working group came up with 4 SDGs that align with GLOBE (see image) **Quality Education**, **Clean Water And Sanitation**, **Life Below Water**, and **Life On Land**.

What does this Mean?

- GLOBE Campaigns, student work, workshops should align with the UN Sustainable Development GOALS.
- Future IVSS projects should also align with the S.D. goals and include the icons in research reports (posters, ppt, etc). GLOBE Malta has already included the goals in their field work protecting tortoise nesting areas.

Links

- [Infographics](#)
- [Goals and Icons](#)
- [The Global Goals for Sustainable Development and The GLOBE Program](#) (Document on the right)



THE GLOBE PROGRAM

The Global Goals for Sustainable Development and The GLOBE Program
 The Global Goals for Sustainable Development is a 17-point plan to end poverty, combat environmental changes and fight injustice and inequality. It was adopted by 193 world leaders at a United Nations Summit in 2015 and came into force on January 1, 2016. The GLOBE Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process. Since its initiation, GLOBE has been implemented in over 28,500 schools in more than 110 countries. The table outlines the correlations between the Global Goals for Sustainable Development and The GLOBE Program.



| Global Goals for Sustainable Development | GLOBE Program Spheres and Investigation Areas | GLOBE Science Protocols |
|--|---|--|
|  <p>4 QUALITY EDUCATION</p> | <p>Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.</p> <p>GLOBE is committed to improving education through teacher training, development of lessons and scientific protocols and the creation of opportunities for collaboration between scientists, educators and students. Sphere: Atmosphere, Biosphere, Hydrosphere, Soil (Pedosphere)</p> | <p>All (GLOBE Teacher's Guide)</p> |
|  <p>6 CLEAN WATER AND SANITATION</p> | <p>Ensure availability and sustainable management of water and sanitation for all.</p> <p>Students in The GLOBE Program are given the tools to deepen their understanding of the water cycle and to act as active hydrologists themselves through data collection and analysis. Sphere: Hydrosphere</p> | <p>Precipitation, Water Transparency, Water Temperature, Dissolved Oxygen, Electrical Conductivity, Salinity, pH, Alkalinity, Nitrate, Freshwater Macroinvertebrates, Salinity Titration</p> |
|  <p>14 LIFE BELOW WATER</p> | <p>Conserve and sustainably use the oceans, seas and marine resources for sustainable development.</p> <p>Ocean science protocols and data collection are incorporated into The GLOBE Program in areas with access to coastline. Sphere: Hydrosphere Investigation Area: Earth as a System</p> | <p>Seaweed Reproductive Phenology, Water Temperature, Salinity, pH, Dissolved Oxygen</p> |
|  <p>15 LIFE ON LAND</p> | <p>Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.</p> <p>GLOBE has developed science protocols for understanding many facets of the terrestrial ecosystem. Sphere: Biosphere, Soil (Pedosphere) Investigation Area: Earth as a System</p> | <p>Land Cover, Biometry, Fire Fuels, Green-Up, Green-Down, Phenology, Soil Characterization, Soil Temperature, Soil Moisture, Bulk Density, SMAP Block Pattern Soil Moisture, Soil Particle Density, Particle Size, Soil pH, Soil Fertility, Water Infiltration, Davis Soil Moisture, Soil Moisture Sensor</p> |

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GLOBE Observer Citizen Science Mobile App

Available in the Apple Store and Google Play



- Photograph clouds, recording sky observations, and comparing with NASA satellites, help scientists gain a new perspective on clouds that satellites just can't provide from the ground looking up! This new perspective will help refine satellite-derived models and enhance scientific understanding of Earth's atmosphere.



- Identify potential breeding sites for mosquitoes, sample and count mosquito larvae, examine photographs and ID the genus of your specimens. You'll help scientists to build more accurate models of mosquito population. Your data will be used by public health authorities to study vector born diseases.



- Photograph and classify land cover over an area the size of a soccer field, you'll be helping scientists to enhance global maps of land cover. Your observations will contribute to new maps with a finer spatial resolution than is possible using satellites alone.



- Photograph and measure tree height (and optionally tree circumference) to track the growth of trees over time. Tree height is the most widely used indicator of an environment's ability to grow trees. Observing tree height allows NASA scientists to understand the gain or loss of biomass which can inform calculations of the carbon that trees and forests either take in from or release into the atmosphere.

Science Resources

Science Resources for Students and Teachers

- NASA Science Resources:
<https://science.nasa.gov/get-involved/toolkits/nasa-science-resources>
- Eyes: <https://eyes.nasa.gov/>
- NASA Climate: <https://climate.nasa.gov/>
- NASA Worldview:
<https://worldview.earthdata.nasa.gov/>
- JPL Education(Teach):
<https://www.jpl.nasa.gov/edu/teach/>
- ArcGIS StoryMaps: <https://storymaps.arcgis.com/>
- Gallery of StoryMaps: [StoryMaps Gallery](#)





Jet Propulsion Laboratory
California Institute of Technology

jpl.nasa.gov

21st Century Skills

12 abilities you'll need to succeed in the Information Age

Learning Skills

- **Critical thinking:** Finding solutions to problems
- **Creativity:** Thinking outside the box
- **Collaboration:** Working with others
- **Communication:** Talking to others

Literacy Skills

- **Information:** Understanding facts, figures, statistics, & data
- **Media:** Understanding the methods & outlets in which information is published
- **Technology:** Understanding the machines that make the Information Age possible

21st Century Skills

How today's students can stay competitive in a changing job market

Learning Skills



critical thinking



creativity



collaboration



communication

Literacy Skills



information



media



technology

Life Skills



flexibility



leadership



initiative



productivity



social skills

21st Century Skills

12 abilities you'll need to succeed in the Information Age

Life Skills

- **Flexibility:** Deviating from plans as needed
- **Leadership:** Motivating a team to accomplish a goal
- **Initiative:** Starting projects, strategies, & plans on one's own
- **Productivity:** Maintaining efficiency in an age of distractions
- **Social Skills:** Meeting & networking with others for mutual benefit

21st Century Skills from Applied educational systems

<https://www.aeseducation.com/blog/what-are-21st-century-skills>

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technology

Life Skills



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leadership



initiative



productivity



social skills