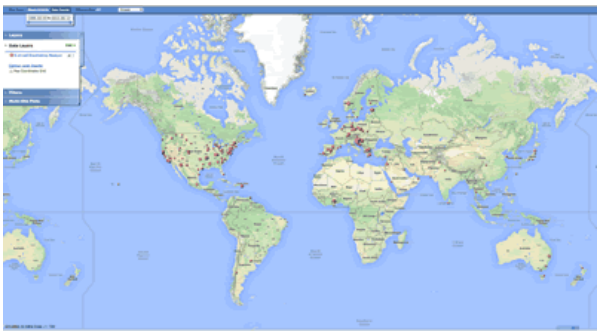
The SMAP/GLOBE Partnership: Citizen Scientists Measure Soil Moisture

Case Study Overview



Did you know that the amount of water in soils, called “soil moisture,” can influence precipitation rates and even national security? Soil moisture plays an important role not only in agricultural productivity but also in drought and wildfires, floods and landslides, human health (through the expansion of disease) and even national security. Knowing the water content of soils also plays a critical role in understanding the water, energy and carbon cycles.

In 2015, the National Aeronautics and Space Administration launched the *Soil Moisture Active Passive* (SMAP) satellite mission to collect data on soil moisture around the world. The SMAP mission is collaborating with the *Global Learning and Observations to Benefit the Environment* (GLOBE) Program to develop sound scientific protocols for citizens to use in collecting local soil moisture data NASA satellite data. Through the *SMAP/GLOBE partnership*, student volunteers are taking measurements to determine the moisture content of their local soils, then comparing them to NASA satellite data.

Project Description

The *GLOBE* Program is a partnership in science and education that gives students and the public worldwide the opportunity to help researchers understand the global environment and climate. Focusing on K-12 schools, *GLOBE* connects students, teachers, scientists and other citizens from around the world, helping them conduct real, hands-on science in their communities. Its goal is to foster both science and environmental literacy worldwide.

GLOBE students learn about science through hands-on investigations in their own communities, sparking their curiosity and stimulating their interest in science, technology, engineering and math. *GLOBE* helps students play an active role in adding to what we know about our global environment and planet.

The *GLOBE* Program developed a soil moisture protocol that aligns with satellite measurements from the SMAP mission. The SMAP spacecraft takes measurements of surface soil moisture and produces daily maps of soil moisture, with global coverage every three days.

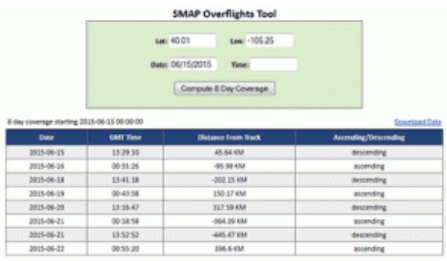
GLOBE students measure soil moisture at their local sites every day or as often as feasible. The recommended collection time is within a six-hour window (plus or minus three hours) from the time of satellite overpass at about 6 a.m. or 6 p.m., as determined by the *SMAP* Orbit

Calculator Tool. Accordingly, teachers and students collect soil moisture samples between 3 and 9 a.m. or between 3 and 9 p.m. local time.

The final step in the monitoring process is logging onto a secure website and entering the data collected into a master database. Students and *SMAP* scientists can see the data on the *GLOBE* website, using them to validate soil moisture measurements by satellite.

Challenges

For citizen science projects, data validity can be a concern. In response, the project uses a standardized protocol developed with input from *SMAP* scientists, and it requires repeated observations in the same place over time. Student participants enter the soil moisture data into a secure database. They do not put any personal information into the system.



Benefits and Outcomes

Both parties benefit from the *SMAP/GLOBE partnership*. *SMAP* scientists give the *GLOBE* Program expert guidance on soil moisture protocols and measurement procedures. They also review the citizen science data and interact with the *GLOBE* community. Through the partnership, citizen scientists can engage with a NASA mission and learn how satellite information can improve our knowledge of the planet.

SMAP benefits from the ground-truthing measurements collected by *GLOBE* volunteers, which help support the SMAP calibration and validation program. Additionally, *SMAP* gets feedback from students on how soil moisture information can benefit local communities. The partnership also builds public awareness of and appreciation for the *SMAP* mission and for *SMAP*'s high-quality data products.

As of June 30, 2015, 21 schools had submitted a total of 215 volumetric soil moisture measurements from 27 volumetric soil moisture sites. The schools were distributed across the following five *GLOBE* regions: Asia and Pacific, Europe and Eurasia, Latin America and Caribbean, Near East and North Africa, and North America.

Tips

The *SMAP/GLOBE partnership* case study illustrates the following steps in the Federal Citizen Science and Crowdsourcing Toolkit:

- **Design a Project — List Your Resources**
  In developing the infrastructure for global projects, especially the technology, remember that many countries have limited bandwidth for computer access. Although apps are becoming more popular in citizen science for data entry, community members from around the world can still have issues with access.

- **Build a Community — Engage Your Community**
  Creating a scientific protocol in a collaborative fashion takes time but pays off. Involving both scientists and educators in the process is key. Having scientists share their data analysis and findings encourages community engagement and ongoing data collection.

- **Manage Your Data — Analyze Your Data**
  Create a system that allows easy data entry and retrieval so that community members can access data quickly and effectively.

Learn More

- Website: SMAP/GLOBE Partnership
- *SMAP* Mission Overview
- *SMAP* Data Applications

Contact Information

Name: Ming-Ying Wei
Email: mwei@nasa.gov