

SMAP and the GLOBE Program

Erika Podest

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The GLOBE Program

THE GLOBE PROGRAM
A Worldwide Science and Education Program

20th Anniversary - 1995 - 2015

Featured
Anniversary Video Celebrates 20 Years of The GLOBE Program
NASA Administrator Charles Bolden and others discuss the impact of The GLOBE Program.

RECENT MEASUREMENTS
Pompano Beach High School, United States, Weatherbug, Measured on: 2015-06-03

Latest News and Events
NEWS EVENTS CAMPAIGNS

NASA's Soil Moisture Active Passive (SMAP) Mission Begins Science Operations
22 May 2015

GLOBE Europe and Eurasia Host Student Video Campaign
20 May 2015

2016 GLOBE International Virtual Science Fair
11 May 2015

GLOBE ON SOCIAL

GLOBE Stats
114 Countries
28,240 Schools
22,010 Teachers
127,241,141 Measurements
56,272 Measurements this month
View GLOBE Countries

Member Highlights
Featured Student Research Reports
TREATMENT OF DEVICE DYEING WASTEWATER BY PHOTOCATALYST WITH THE ABSORBENT
See All Student Research Reports

- **Objective:** to encourage students, teachers and citizen scientists to develop interest and skills in STEM through interactive learning activities
- **Statistics:** 114 countries; 28,279 schools; 127 million measurements; 20 years of operation
- **Sponsors:** NASA, NSF, NOAA, U.S. State Department

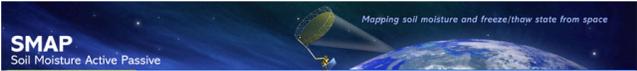
SMAP and GLOBE



The screenshot shows the GLOBE Program website. At the top left is the logo "THE GLOBE PROGRAM" with a globe icon. To the right is a language dropdown menu set to "English" and a "Log In" link. Below the header is a navigation bar with links: Home, Teaching & Learning, Explore Science, Community, News, Events, Media, About GLOBE, Join, and a search box. The main content area is titled "Field Campaigns" and has sub-tabs for "Field Campaigns", "Satellite Partnerships", "Earth System Science Projects", and "Field Campaign Archive". The selected tab is "Field Campaigns".

Soil Moisture Active Passive (SMAP) Satellite Mission

The SMAP Mission



NASA's Soil Moisture Active Passive Mission (SMAP) will measure soil moisture from space. Launching in early November 2014, SMAP will have applications in science, agriculture, and environmental management, each of them vital to Earth's health and sustainability. From understanding the processes that link the water, carbon, and energy cycles to improving weather and climate prediction models, SMAP will advance environmental knowledge. When the SMAP spacecraft is in orbit, it will be taking measurements of surface soil moisture and providing a global map of soil moisture every three days.



GLOBE Student Participants digging a soil sample for measurement at the 2013 GLOBE Annual Partners Meeting

To learn more about the NASA SMAP Mission, visit: <http://smap.jpl.nasa.gov>.

Want to learn more? Explore the links at the left for more detailed information.

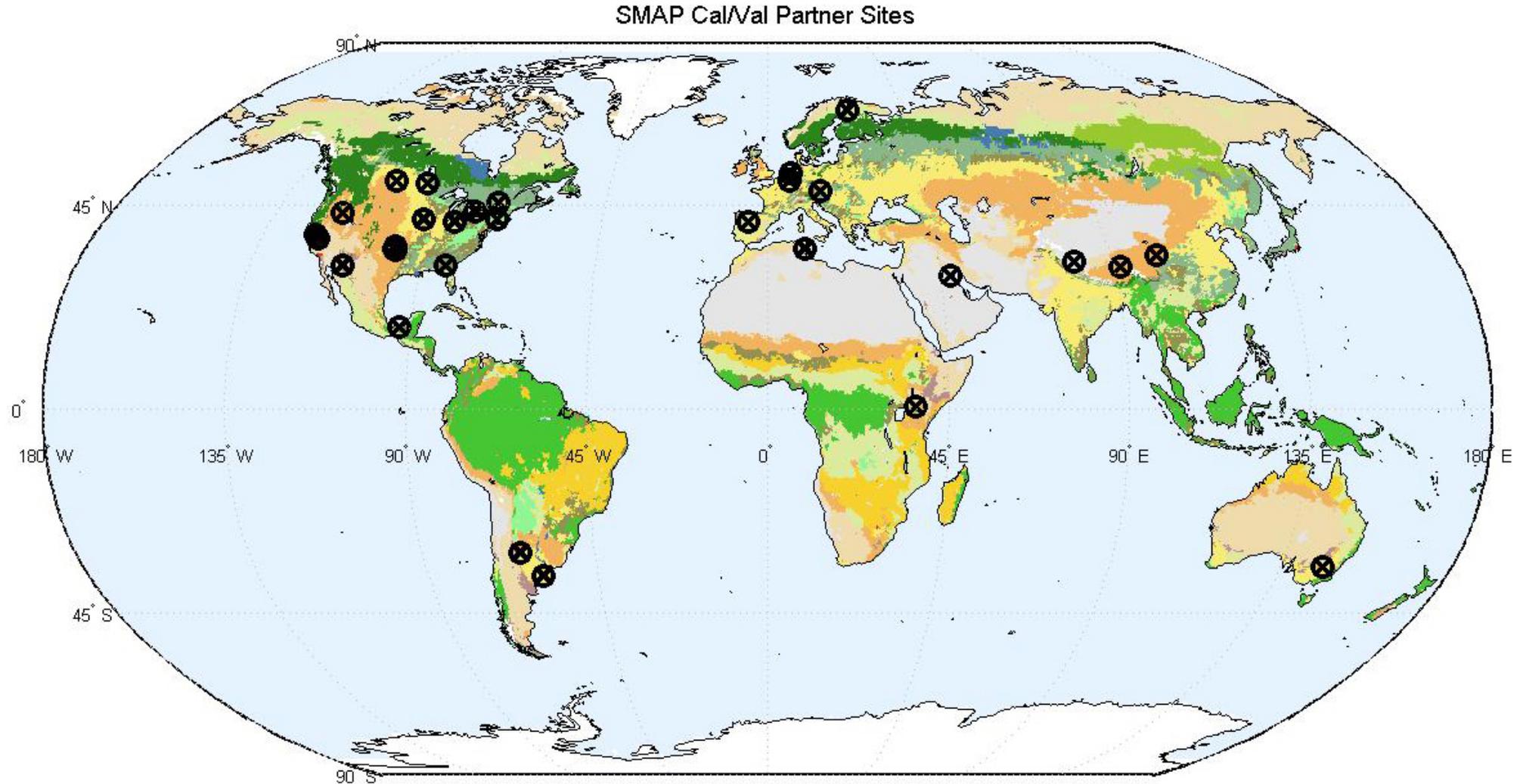
Left sidebar links:

- NASA Satellite Overpass Calculator
- CloudSat
- CALIPSO
- GPM
- SMAP
 - "The Hook"
 - How to Participate
 - Meet the STEM Team
 - SMAP Resources

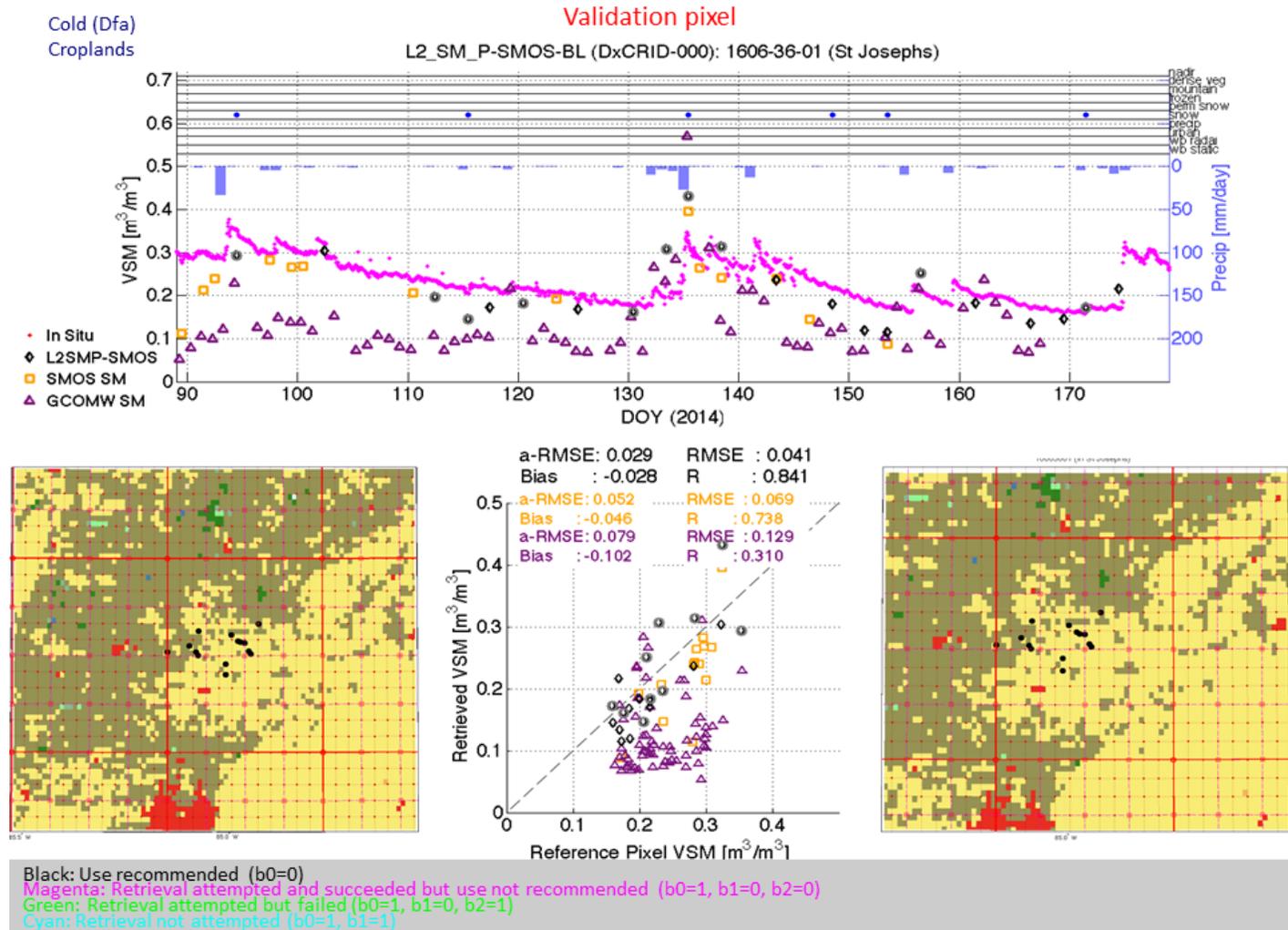
- SMAP has partnered with the GLOBE program to implement a volumetric soil moisture protocol
- The objective is to create awareness and interest in schools around the world about the importance of soil moisture and SMAP and to potentially use the measurements collected to help validate SMAP



SMAP Calibration/Validation Partner Sites



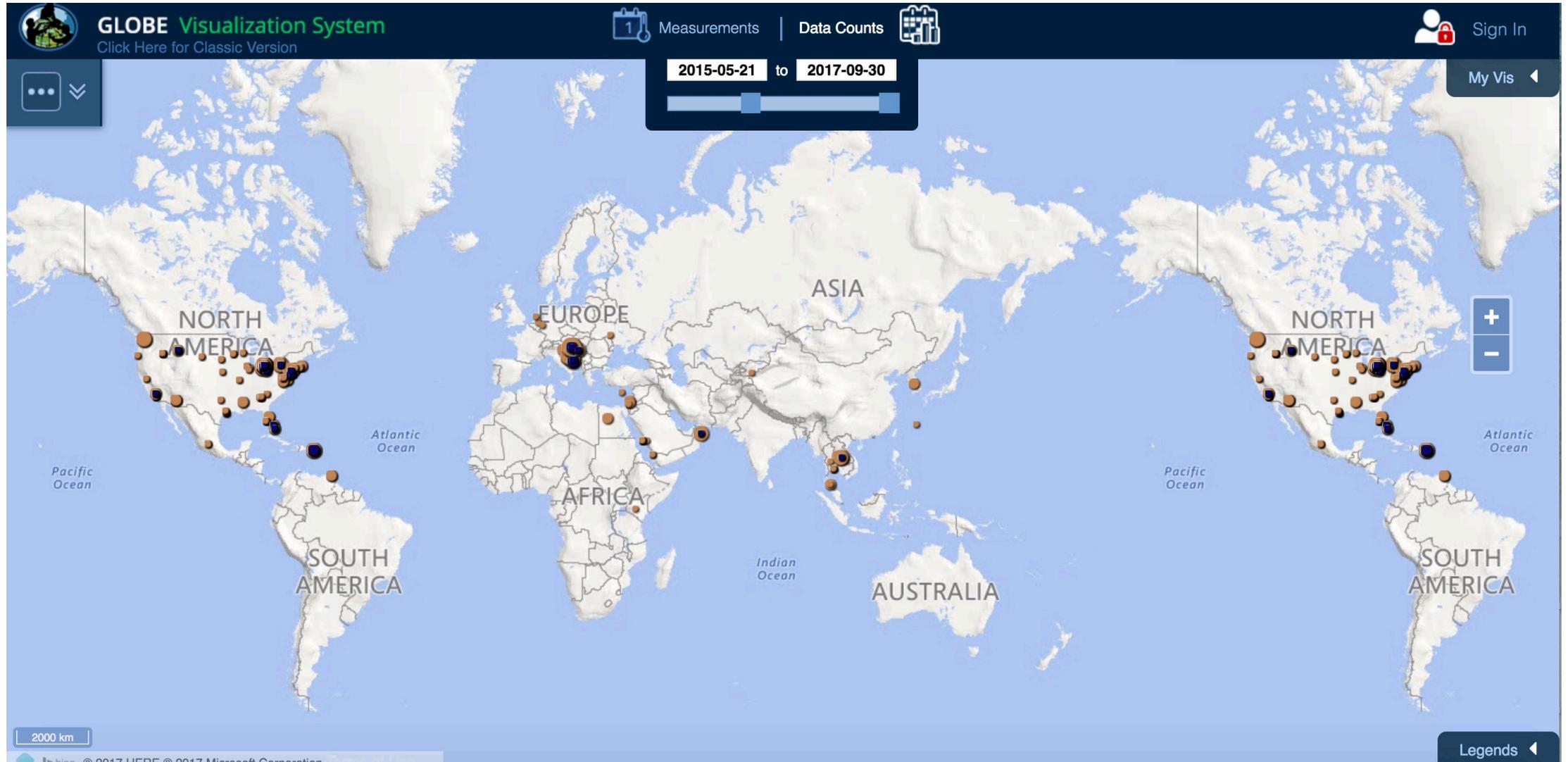
Comparison Between SMAP and an In Situ Station



(Prepared by A. Colliander)



GLOBE Schools Collecting Soil Moisture



SMAP Soil Moisture Protocol

- There are two ways of measuring soil moisture:
 1. Gravimetric: the ratio between the weight of the water and the weight of the soil
 2. **Volumetric: the ratio between the volume of water and the volume of soil. SMAP measures volumetric soil moisture.**

SMAP Soil Moisture Protocol

- To calculate volumetric soil moisture you need to:
 1. Calculate gravimetric soil moisture by collecting a sample of soil, weighing, drying, and weighing it again. The difference in weight is the weight of the water.
 2. Calculate the bulk density of the soil, which is the ratio between the dry weight of a soil sample to its volume. It is determined by calculating the dry weight of the sample and the volume of the can.
 3. Calculate volumetric soil moisture by multiplying gravimetric soil moisture by bulk density. The values should range from 0.02 to 0.8



Formulas for Calculating Volumetric Soil Moisture

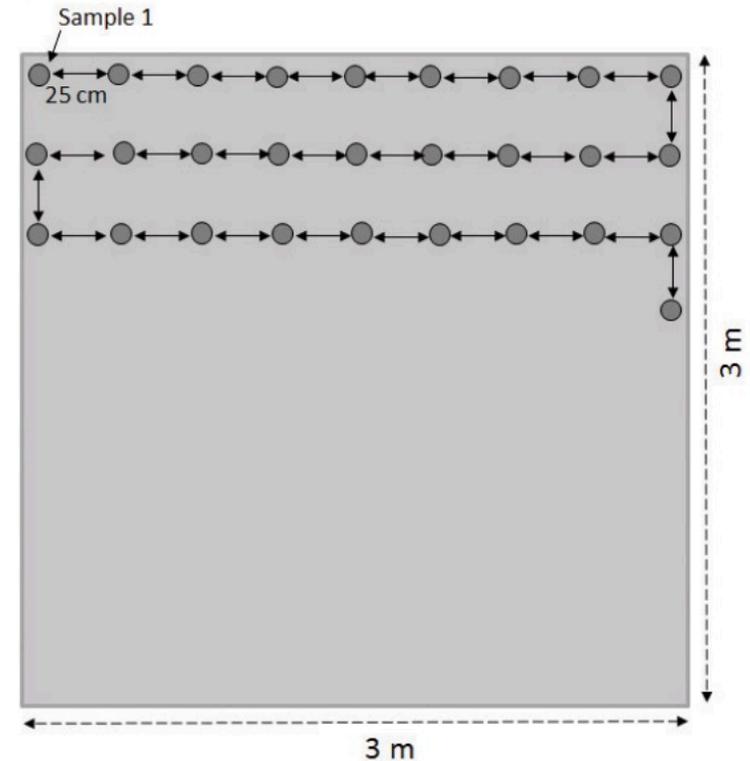
$$\text{Gravimetric soil moisture} = \frac{(\text{wet mass}) - (\text{dry mass})}{(\text{dry mass}) - (\text{container mass})} = \frac{\text{g}}{\text{g}}$$

$$\text{Soil bulk density} = \frac{(\text{dry mass})}{(\text{container mass})} = \frac{\text{g}}{\text{ml}}$$

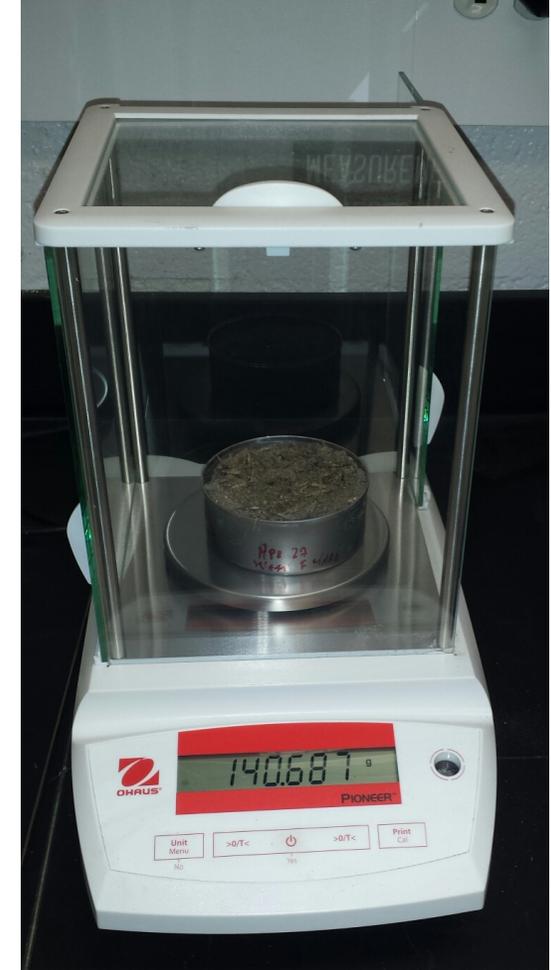
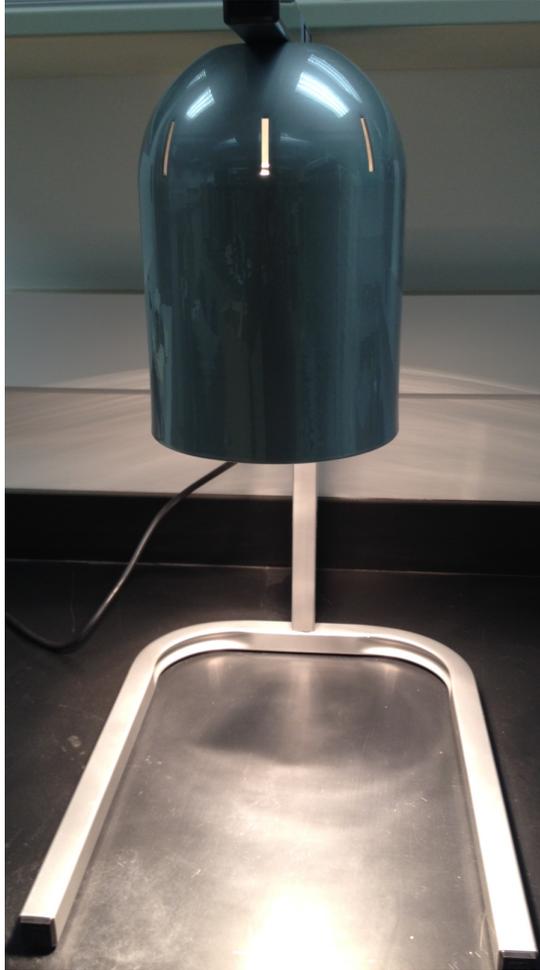
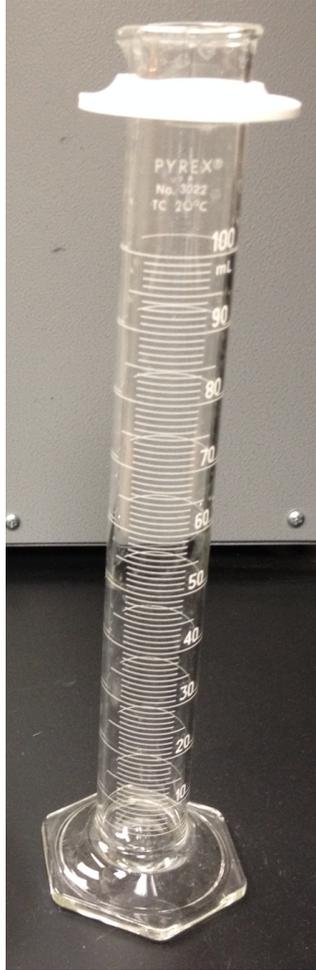
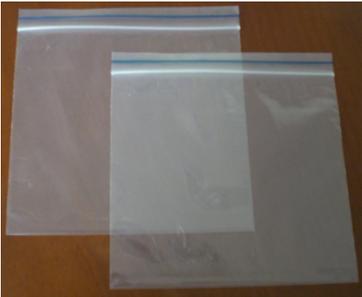
$$\text{Volumetric soil moisture} = (\text{bulk density}) \times \left(\frac{(\text{gravimetric soil moisture})}{(\text{water density})} \right) = \frac{\text{cm}^3}{\text{cm}^3}$$

Where and How to Collect Soil Samples

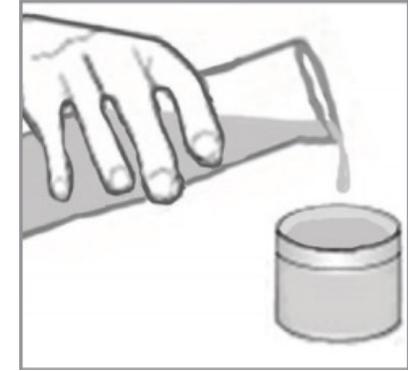
- Select a site that:
 - Is not artificially irrigated
 - Is not under a tree
 - Represents the natural conditions of the area
 - Does not have tall grasses
 - Is relatively flat
- Determine when SMAP flies overhead:
http://smap_op.apps.nsidc.org
- Define the soil sampling site by marking a 3x3 meter box and collecting one soil sample every time SMAP flies overhead. Never sample the same spot. Each sample should be collected 25 cm from the last one.



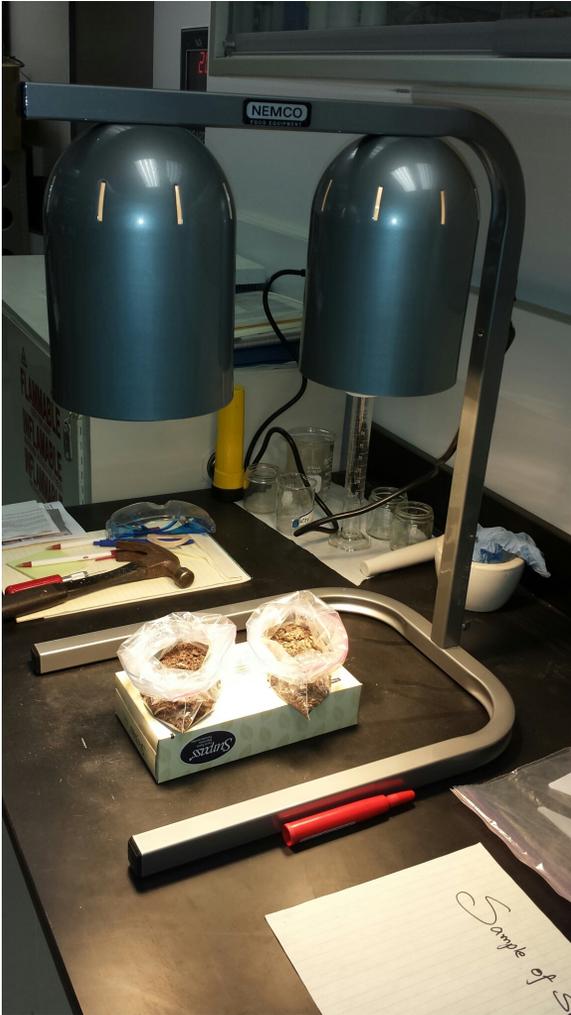
Equipment Necessary to Calculate Soil Moisture



Collecting Soil Samples and Measuring Soil Moisture



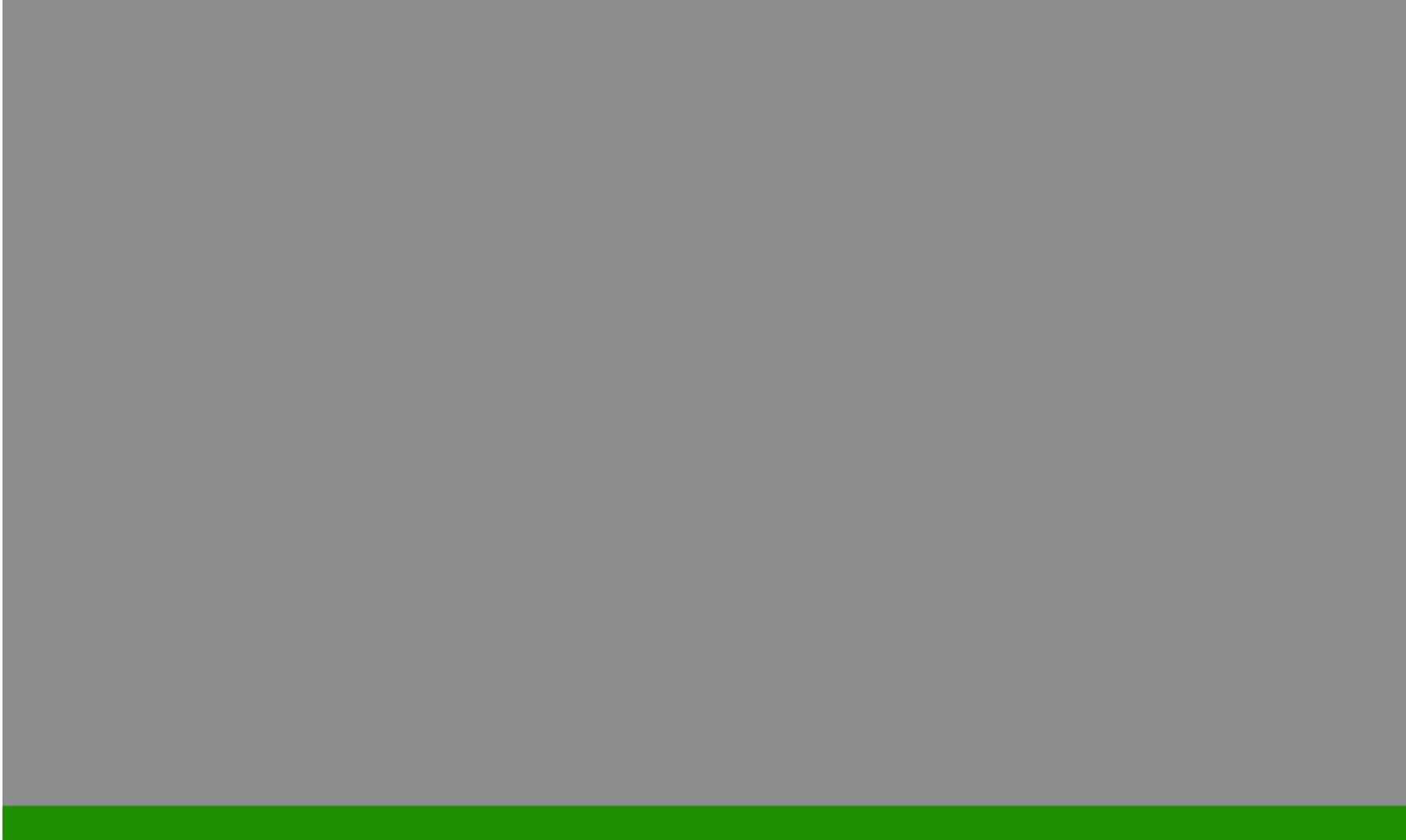
Drying the Samples



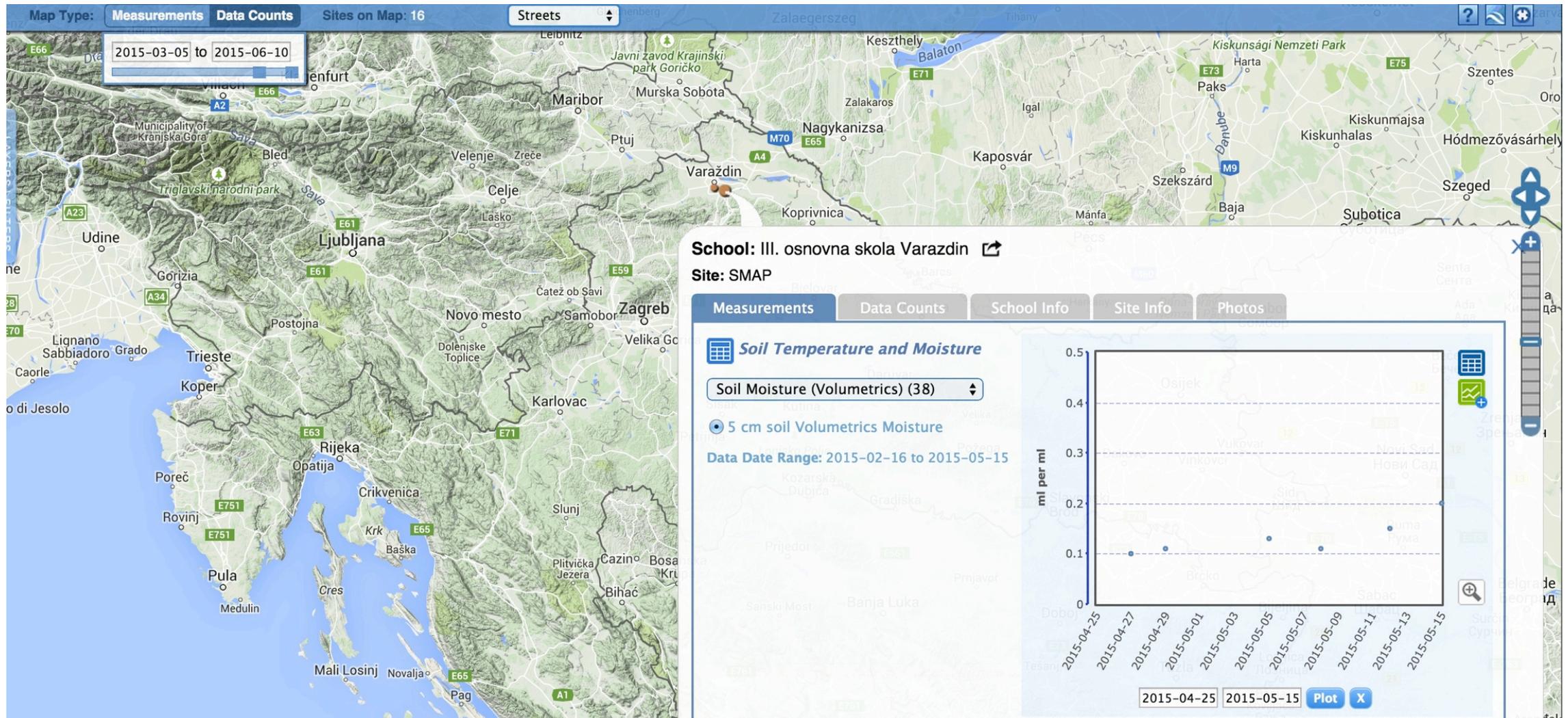
- Use a lab drying oven or a kitchen heating lamp. The lamp should have infrared bulbs that can raise the temperature underneath 65-75°C
- The sample in the plastic bag should be dried under the heating lamp for ~72 hours or more
- The weight of the sample is measured before and after drying using a weighing scale
- The bulk density of the soil should be calculated every 10 time that a sample is collected
- The soil sample should be collected at approximately the same time and as close as possible to the SMAP overpass. Ideally at approximately 9:00 am local time



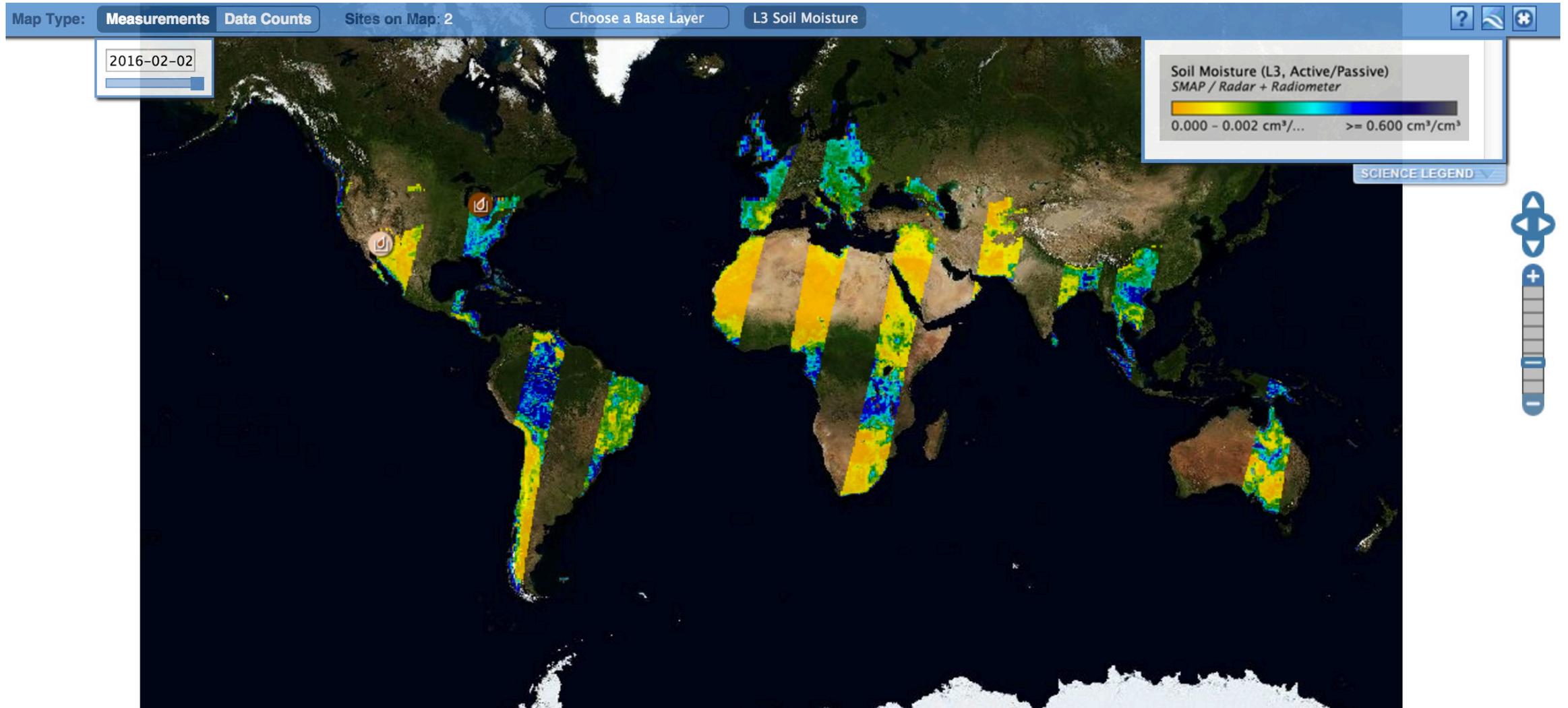
Instructional Video on How to do the Soil Moisture Measurement



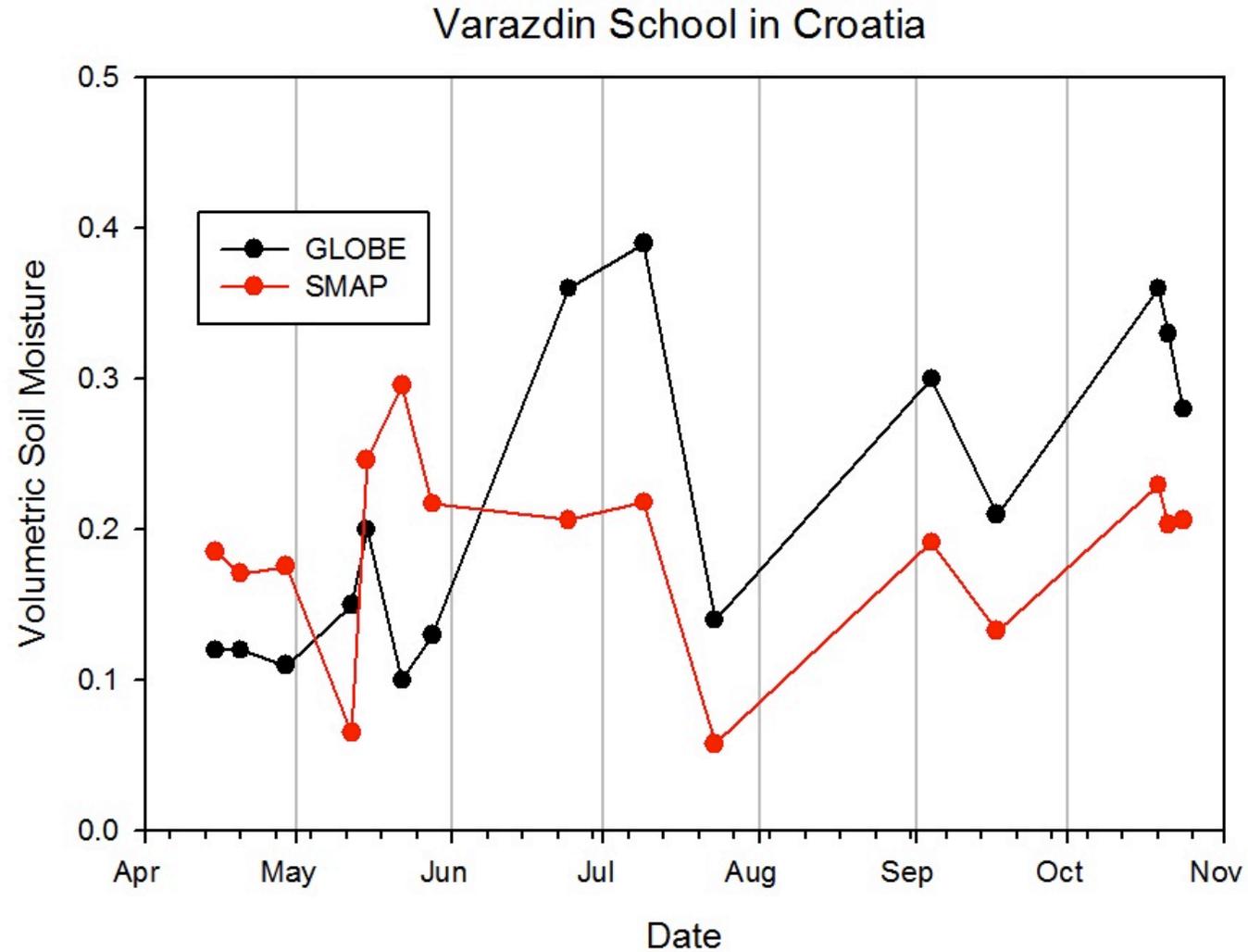
Uploading Soil Measurements to GLOBE



Visualizing SMAP Data



Comparison Between SMAP and GLOBE



Join the GLOBE Program and Participate in SMAP

<http://www.globe.gov/web/smap/overview/how-to-participate/>



smap.jpl.nasa.gov

