Citizen Science Sensor Development
SMAP | Soil Moisture Active Passive

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BACKGROUND

The Soil Moisture Active Passive (SMAP) satellite mission was launched in Jan. 2015 and is currently acquiring global measurements of soil moisture. The mission has partnered with the GLOBE program to engage students from around the world to collect in situ soil moisture and help validate SMAP measurements.

OBJECTIVES

• The main objective of our project is to develop a soil moisture sensor using Arduino that can easily be used by the GLOBE community.
• Ultimately, the goal will be to design and build a sensor device that is the most cost effective, as well as most reliable and efficient at the same time.
• We will develop a methodology to calibrate the sensor with various types of soils.
• A successful outcome will be having the sensor perform within a given accuracy.

METHODS

• The above chart shows the timeline of the SMAP satellite mission, and the time window that we have in order to help validate the satellite’s measurements.

• The moisture sensor is the key component to this project, so all types of moisture sensors will be researched, and then proceeding to build, test, and calibrate them. The above sensors/micro controllers are off-the-shelf, and will be tested alongside the homemade sensor. The five sensors that we chose to build will be tested in the field for accuracy, precision, reliability, and longevity.

RESULTS

• The above schematic shows a home-made soil moisture sensor that we are testing for potential use by the GLOBE community. This sensor measures resistance of a current between two prongs, which is then converted to soil moisture.
• It is comparable to the sensors that can be purchased off-the-shelf, however more robust.

• The above graph shows soil moisture (from the home-made sensor) as a function of resistance. As humidity in the soil decreases, resistance increases.
• This data is for a specific type of soil, local to JPL.

CONCLUSION

• We tested off-the-shelf sensors and a home-made sensor. Both perform within 2% accuracy; however, the home-made sensor is more robust. The downside is that assembly is more cumbersome.
• We conclude that the home-grown sensor is preferable for schools willing to build it, however the off-the-shelf sensor is recommended for a quick and hassle-free assembly.

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