During the spring of 2016, from April 4 – May 27, sixteen GLOBE schools participated in the GLOBE Aerosol Field Campaign – U.S. Pilot Study. Thirteen teachers from these schools had previously participated in the NASA LEARN program (Long-term Experience in Authentic Research with NASA) where they were GLOBE trained in Atmospheric protocols, and engaged in 1-3 years of research under the mentorship of NASA scientists. Each school was loaned two aerosol instruments for the Campaign duration, either 2 GLOBE sun photometers, 2 Calitoo sun photometers, or 1 of each. This allowed for students to make measurements side-by-side and in the case of the Calitoo, to compare AOT results immediately with each other for better consistency in data collection. Additionally, as part of the Field Campaign evaluation, multiple instruments allow for an assessment of the ease of use of each instrument for grade level of students, whether in middle school or high school. Before the Campaign, all GLOBE and Calitoo instruments were ‘checked out’ against an AERONET site, then checked again upon return after the Campaign. By examining all data, before, during and after the Campaign, this gives an indication of instrument performance and proficiency obtained by the students. Support was provided to each teacher and their students at the level requested, via email, phone or video conferencing.

School Name and Location

- Pan American School, Huston, Tx
- Moody Middle School, Henrico, VA
- Waldorf School of Baltimore, Baltimore, MD
- Arnold Magnet Academy, Columbus, GA
- Sunridge Middle School, Austin, TX
- Northbrook High School, Houston, TX
- Wylie E Groves High School, Beverly Hills, MI
- Stamford High School, Stamford, CT
- Fredonia Central, Fredonia, NY
- Moody Middle School, Henrico, VA
- Waldorf School of Baltimore, Baltimore, MD
- Arnold Magnet Academy, Columbus, GA
- Sunridge Middle School, Austin, TX
- Northbrook High School, Houston, TX
- Wylie E Groves High School, Beverly Hills, MI
- Stamford High School, Stamford, CT
- Fredonia Central, Fredonia, NY
- Moody Middle School, Henrico, VA
- Waldorf School of Baltimore, Baltimore, MD
- Arnold Magnet Academy, Columbus, GA
- Sunridge Middle School, Austin, TX
- Northbrook High School, Houston, TX
- Wylie E Groves High School, Beverly Hills, MI
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- Arnold Magnet Academy, Columbus, GA
- Sunridge Middle School, Austin, TX
- Northbrook High School, Houston, TX
- Wylie E Groves High School, Beverly Hills, MI
- Stamford High School, Stamford, CT

The participating schools experienced mostly cloudy skies throughout the Campaign resulting in sparse data collection. However the Alberta Canada fire, which started May 1, impacted all the schools, negatively affecting AOT measurements. Often schools have a single or a few data points in the same day among many days of no observations, so it’s difficult to gain an understanding of the value of the data without seeing it in the larger context.

The MODIS maps to the left show elevated smoke on May 6, 2016. The Crestwood High School in MI and Northbrook High School in TX Calitoo AOT data captured the smoke on this day. The separation in the AOT values for the three wavelengths indicates smaller particles. The PM$_{2.5}$ is elevated which could indicate smoke reaching the surface.

By examining AOT from satellites and surface AERONET sites and incorporating PM$_{2.5}$ measurements, it is easier to see how the student observations capture the fire event. The GLOBE photometers measure AOT in the column above the student, ‘looking up’, while AOT can be derived from satellites ‘looking down’ over large areas. However neither of these measurements tells anything about the horizontal distribution of the measured aerosol. At the surface, where we breath, the PM$_{2.5}$ (particulate with sizes 2.5 microns or less) is measured. From the CALIPSO satellite, the vertical distribution of aerosol is derived but for narrow paths. So by combining all these measurements it becomes clear what is really happening. All the smoke, smoke map and PM data are easily accessible to students to use in their own analysis. A good resource is the IDEA website located at http://www.star.nesdis.noaa.gov/smd/pisp/aq/.

Using CALIPSO for Data Analysis

The CALIPSO satellite detected the smoke from the Alberta Canada fire. Students measuring aerosol can detect such events and use images from CALIPSO to analyze their measurements. The path of the satellite is shown in the upper left. The backscatter plots show evidence of aerosol. The vertical feature mask plot confirms aerosol aloft. Then the aerosol subtype plot confirms the aerosol is smoke.

www.calipso.larc.nasa.gov/products/kidar/browse_images/show_calendar.php

On May 12, 2016 an elevated AOT can be seen in the MODIS plots to the right. This was also captured by the students at Pan American High School shown to the left. Students at Northbrook High School measured AOT throughout a single day. Their measurements compare well with AERONET as shown below.

**Future Opportunities**

If you are interested in participating in the 2016 Fall Aerosol Campaign please contact Dr. Margaret Pippin at m.pippin@nasa.gov or Jessica Taylor at jdavila@ksp.org.

Chris Marentette and Robert Bujosa participated in LEARN (Long Term Engagement with Authentic Research in AERONET) for two years. Both began as GLOBE students and each completed an LEARN project. They participated in the 2015 Spring Aerosol Campaign and will be analyzing the data for this poster during their Summer 2016 Teacher Internship at NASA.