A13N-2666

Granite Island in Lake Superior. A New Water Site for the Baseline Surface Radiation Network and Surface Validation of Satellites

Bryan Fabbri[1], Greg Schuster[2], Fred Denn[1], Jay Madigan[1], Robert Arduini[1]

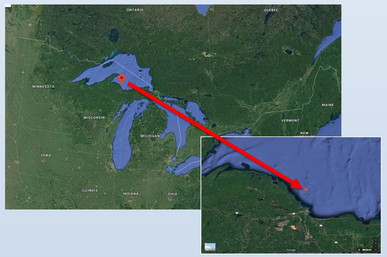
[1]Science Systems and Applications, Inc. (SSAI), Hampton, Virginia, USA, 23666

[2]Nasa Langley Research Center, Science Directorate, Hampton, Virginia, USA, 23681

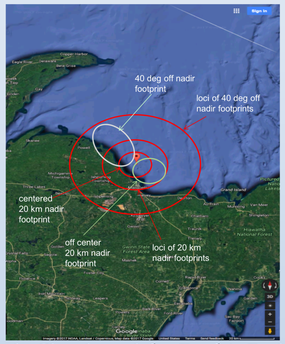
bryan.e.fabbri@nasa.gov

Introduction:

- A new water site with aerosol, radiometric and meteorological measurements with already in place evaporation measurements was established in June 2018, on Granite Island in Lake Superior to provide new understanding of Earth's surface energy budget.
- Surface validation of satellites, and becoming part of the Baseline Surface Radiation Network (BSRN) over a water site, were other motivating factors for establishing a measurement site at Granite Island.
- Granite Island is solar powered. A description of the setup will be discussed.
- Seagull and cold temperature mitigation efforts will be described.
- First results of aerosol optical depth, meteorological and radiometric data will be presented.



Granite Island is ~10 km from the nearest shore and ~18 km north of Marquette, Michigan, USA. Coordinates:
46.721 N (46° 43′ 15°N)
87.411 W (87° 24′ 41° W)

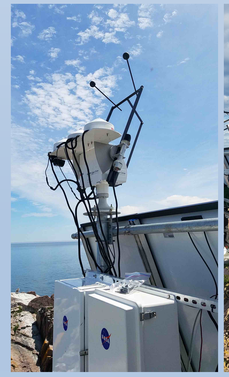


Sample Clouds and the Earth's Radiant Energy System (CERES) satellite footprints. If the satellite is centered overhead Granite Island, it sees nearly all water.

Granite Island's size is 0.01 square km (2.5 acres). Our location is depicted by the yellow circle. Depth of water near shore averages around 25 m and gets deeper as you move away from the island. Granite Island is 183 m above sea level.

Left: Full view of the entire installation. The large white box is the battery enclosure housing eighteen batteries wired in series and parallel for a 12 volt powered system. Right: View from boat. Our site is approximate 10 m above the water line. Four solar panels regulated by two charge controllers charge the batteries.

Left: Seagulls were found to be perching on the instruments soon after they were installed. Right: The solution to the seagull problem was modifying the shields with inverted screws and wire. After installation of the new shields, no seagulls have been seen perched on the instruments.

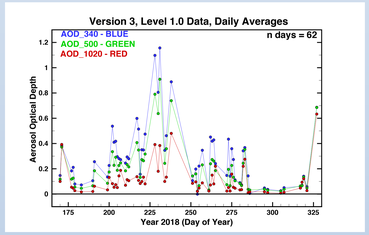


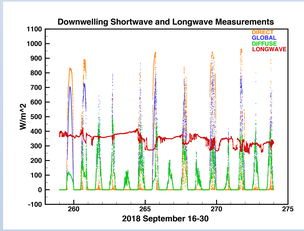
Left: Kipp and Zonen (K&Z) Solar Tracker with K&Z direct, diffuse, global and longwave instrumentation. Right: AERONET sunphotometer and meteorological instruments. Communications are by way of serial over IP and Freewave radios. All instrumentation and almost all hardware are rated to endure the frigid winters.

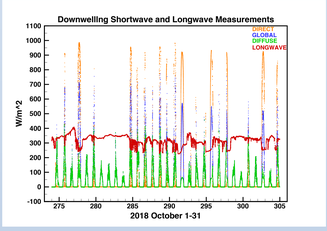
Eddy covariance data with CERES and surface measurements

Left: ~ 75 meters is the distance between our measurement site and the eddy covariance/evaporation measurement site. Middle: The bell tower. Right: Eddy covariance/evaporation instrumentation on top of the bell tower. NASA Langley is interested in combining measurements from these two sites along with CERES satellite data to improve understanding of Earth's energy budget.

AERONET and Radiation Data – First Results

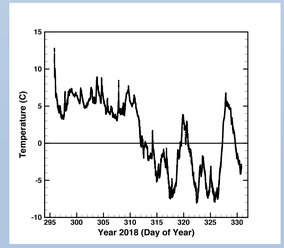


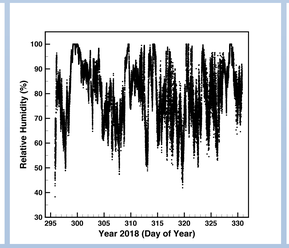


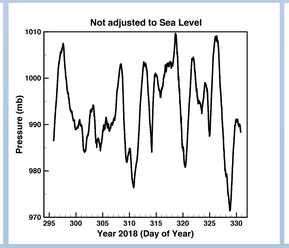


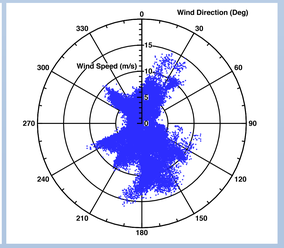
Left: Version 3, Level 1.0 AERONET data. Daily averages shown have a minimum of ten data points. Issues occurred with the serial over IP communication device and humidity sensor which limited the number of data days since the installation. Middle and Right: Due to the seagull issue that is now resolved, only 1.5 months of radiometric data is displayed.

Meteorology Data – First Results









In October 2018, A meteorological suite of instruments (temperature, relative humidity, pressure, wind speed and direction) were installed. Due to this recent installation, there is a small amount of data collected.

Summary:

- NASA Langley is interested in using BSRN quality measurements and CERES measurements with the Great Lakes Evaporation Network (GLEN) data to improve understanding of the Earth's energy budget.
- The radiometric and aerosol measurements were installed in June 2018 and a meteorological suite installed in October 2018.
- Granite Island is solar powered and all instrumentation and almost all hardware is rated to survive the very cold winters. Seagulls that were initially a problem has been resolved using modified shields to discourage perching.
- First results are displayed, but are limited due to a variety of factors discussed above and how recent the site became active.

Acknowledgements:

- We thank Scott Holman, owner of Granite Island, for allowing atmospheric research on his island.
- We thank Dan Chiconsky, John Lenters, and graduate students at Northern Michigan University who assisted in the initial and continued support of the Granite Island project.
- We thank AERONET and Brent Holben for providing a cimel sunphotometer at Granite Island.