

# Status and Operations at the Langley Research Center (LRC) BSRN Station

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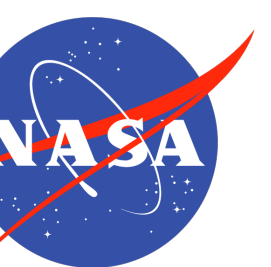
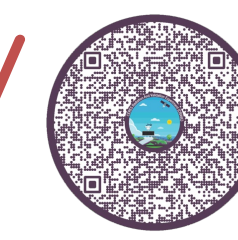
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Clouds and the Earth's Radiant Energy System (CERES) Radiation And Validation Experiment (CRAVE) website:

<https://science.larc.nasa.gov/CRAVE/>



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## Introduction:

- The Langley Research Center (LRC) BSRN site is in Hampton, Virginia, USA.
- The LRC site was initially established as a calibration site for the now closed Chesapeake Light House (CLH) BSRN site. It was expanded into an operational BSRN site late in 2014.
- A table of current measurements and instrumentation are shown.
- The LRC site serves as a surface validation site for CERES satellite measurements. A comparison between LRC and CERES measurements will be presented.
- The LRC BSRN site also serves as the calibration site for shortwave (SW) instruments that are used at the Granite Island, Michigan (GIM) site.
- A 'Round Robin' pyranometer calibration experiment was performed with Sandia Labs and the University of Oregon. Results will be shown.



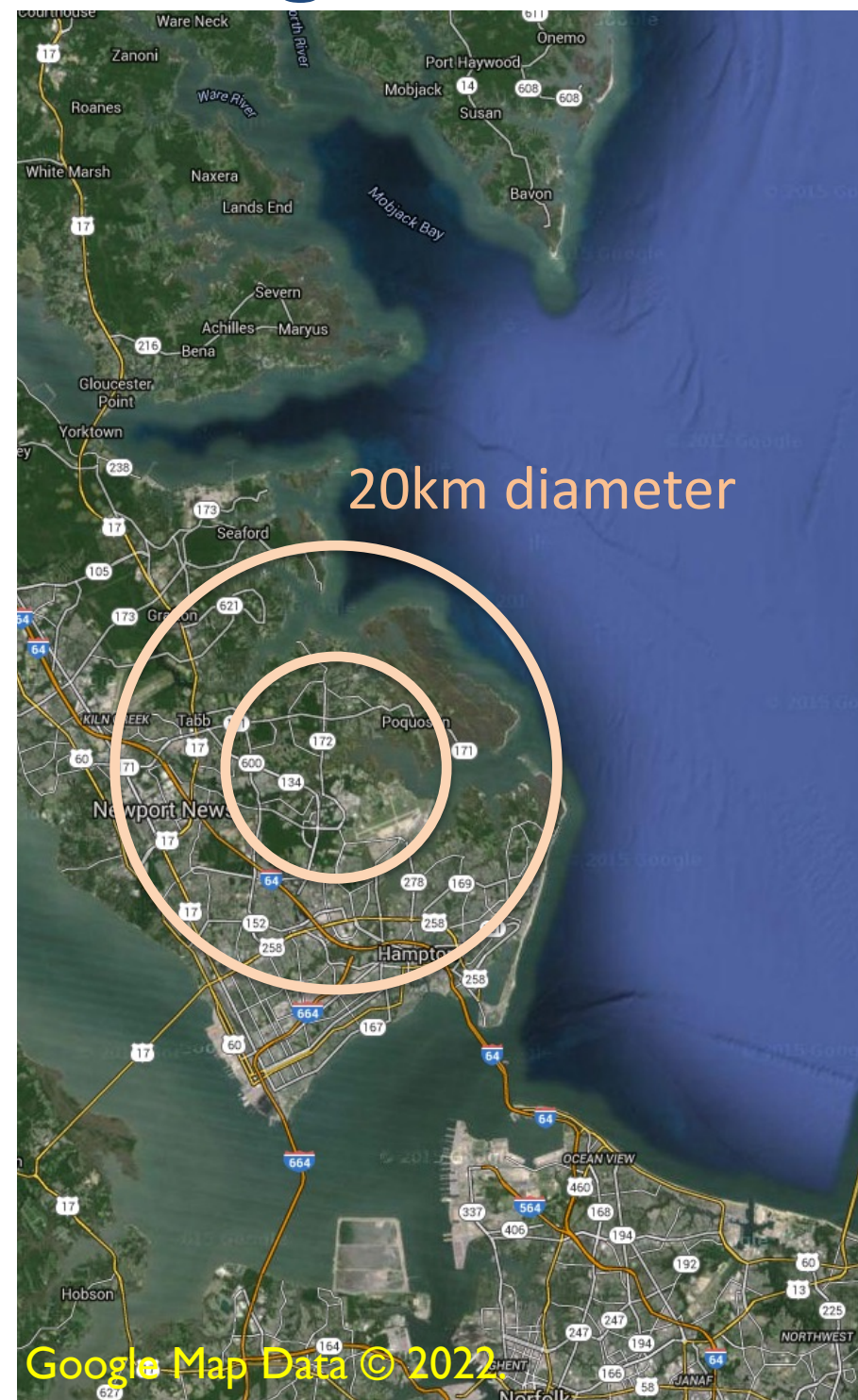
The Clouds and the Earth's Radiant Energy System (CERES) Synoptic (SYN1deg) product have several data products. One such product computes monthly averaged surface fluxes in 1° x 1° regions (e.g., shaded grid box). LRC is represented by the red star.

## Site Location



Terrain view of BSRN-LRC on the east coast of the United States.

## Background Scene



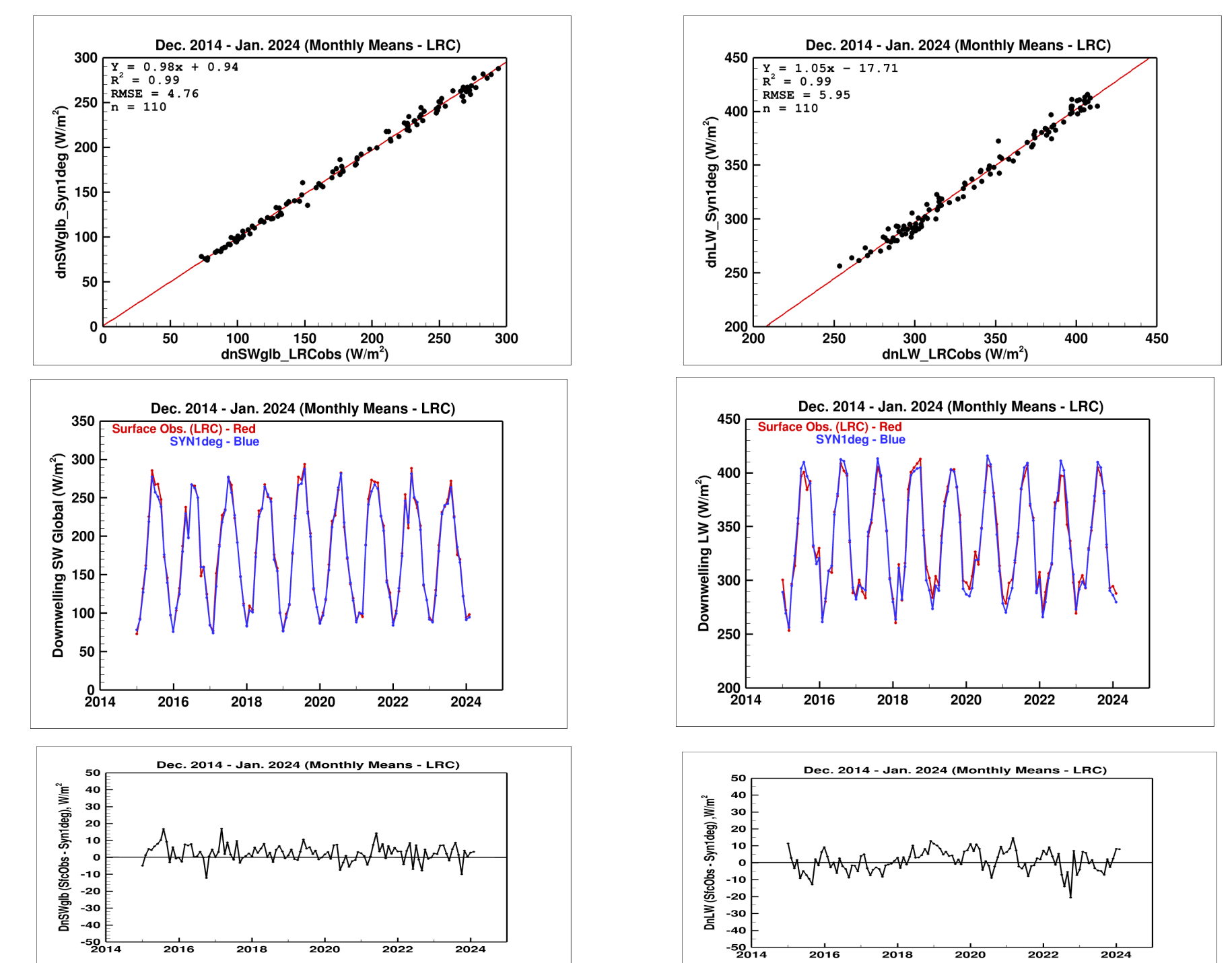
Satellite view of BSRN-LRC showing background scene types: Water, marsh, forest, and city.

## Measurement Site



BSRN-LRC measurement site, approximately 6 meters above sea level.

- LRC is in Hampton, Virginia, USA.
- Latitude: 37.10 N, Longitude: 76.39 W.



## Surface vs Satellite Comparison (Monthly Averages)

The monthly averaged downwelling SW global (left) and downwelling LW (right) comparison between BSRN LRC measurements and computed CERES SYN1deg (from shaded grid box above) are excellent. The 1:1 lines have strong correlation and the difference plots have nearly all data within +/- 15 W/m².

## List of Measurements

Measurement	Instrument (Model)	Units	Wavelength in nm	Remarks
Direct Shortwave Irradiance	Kipp and Zonen Pyrhemometer (CH1,CHP1)	W/m²	200-4000	Since 2014-12
Diffuse Shortwave Irradiance	Kipp and Zonen Pyranometer (CM21,CM22,CM31)	W/m²	200-4000	Since 2014-12
Global Shortwave Irradiance	Kipp and Zonen Pyranometer (CM21,CM22,CM31)	W/m²	200-4000	Since 2014-12
Longwave Irradiance	Eppley Pyrgeometer (PIR)	W/m²	5000-50000	Since 2014-12
Direct and Diffuse Narrowband Radiance	Cimel Electronique Multiband Sunphotometer (CE 318-T)		412, 443, 490, 532, 551, 667, 870 and 1020	Since 2011-09
Air Temperature	Vaisala (HMP60)	°C		Since 2014-12
Relative Humidity	Vaisala (HMP60)	Percent		Since 2014-12
Barometric Pressure	Vaisala (PTB110)	mb		Since 2014-12
Wind Speed and Wind Direction	R. M. Young (05108-45)	m/s and 0-360°		Since 2014-12
Photosynthetically Active Radiation (PAR)	LI-COR (LI-190/R)	µmol s <sup>-1</sup> m <sup>-2</sup>	400 - 700 nm	Since 2022-02
Many MET parameters	Tempest Weather System	Many different units		Since 2024-06

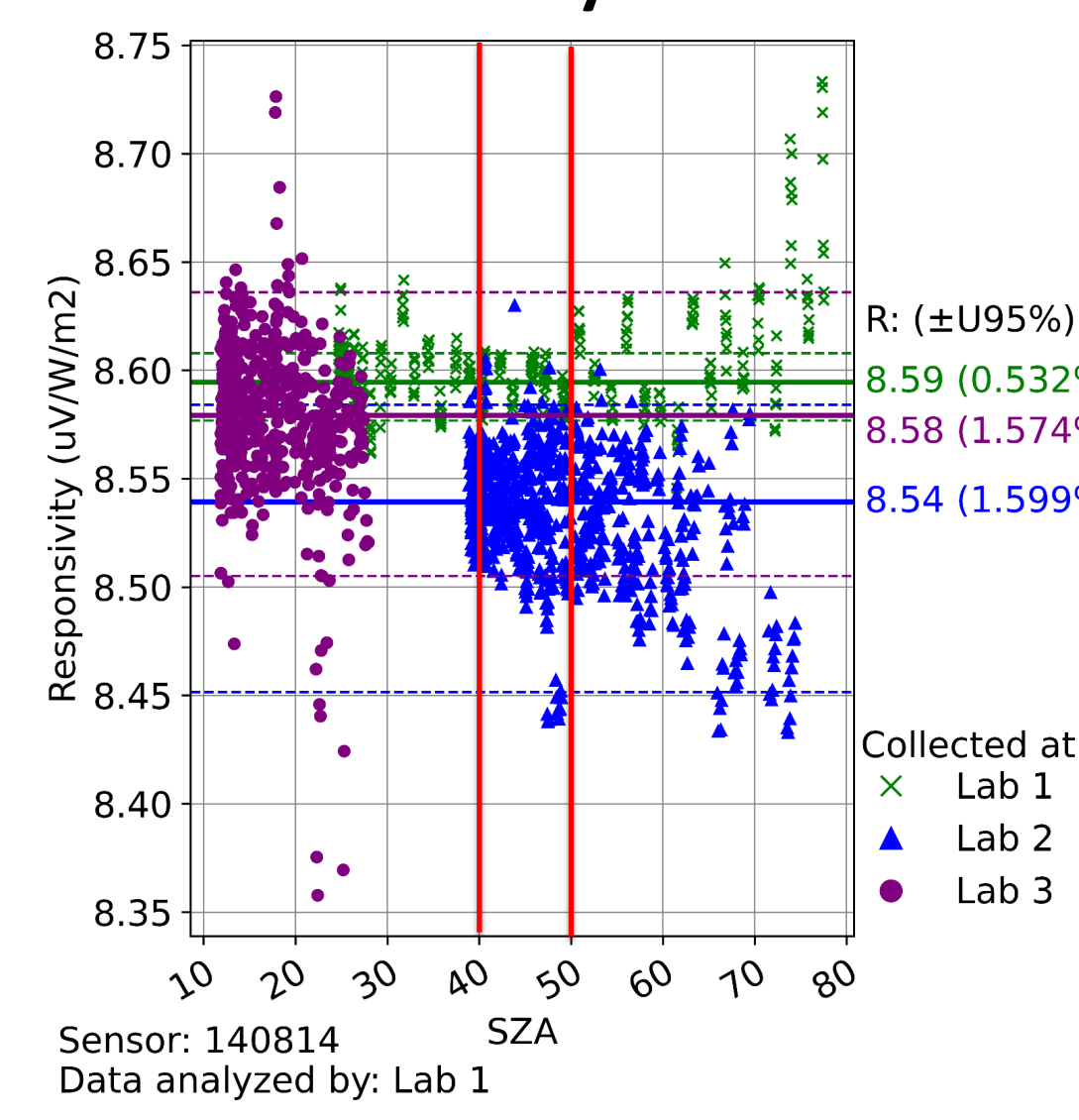
## Round Robin Pyranometer Calibration

- Three facilities participated in a Round Robin pyranometer calibration experiment:
- The University of Oregon Solar Radiation Monitoring Laboratory
  - Sandia National Laboratories
  - Analytical Mechanics Associates/NASA Langley Research Center

### Calibration Procedure:

Calibration measurements were made using the shade/unshade method, where the pyranometers under calibration are alternated between global and diffuse measurements. These measurements are computed and compared to a reference pyrheliometer (An Absolute Cavity Radiometer, or ACR) to determine a calibration coefficient (or responsivity) for each pyranometer.

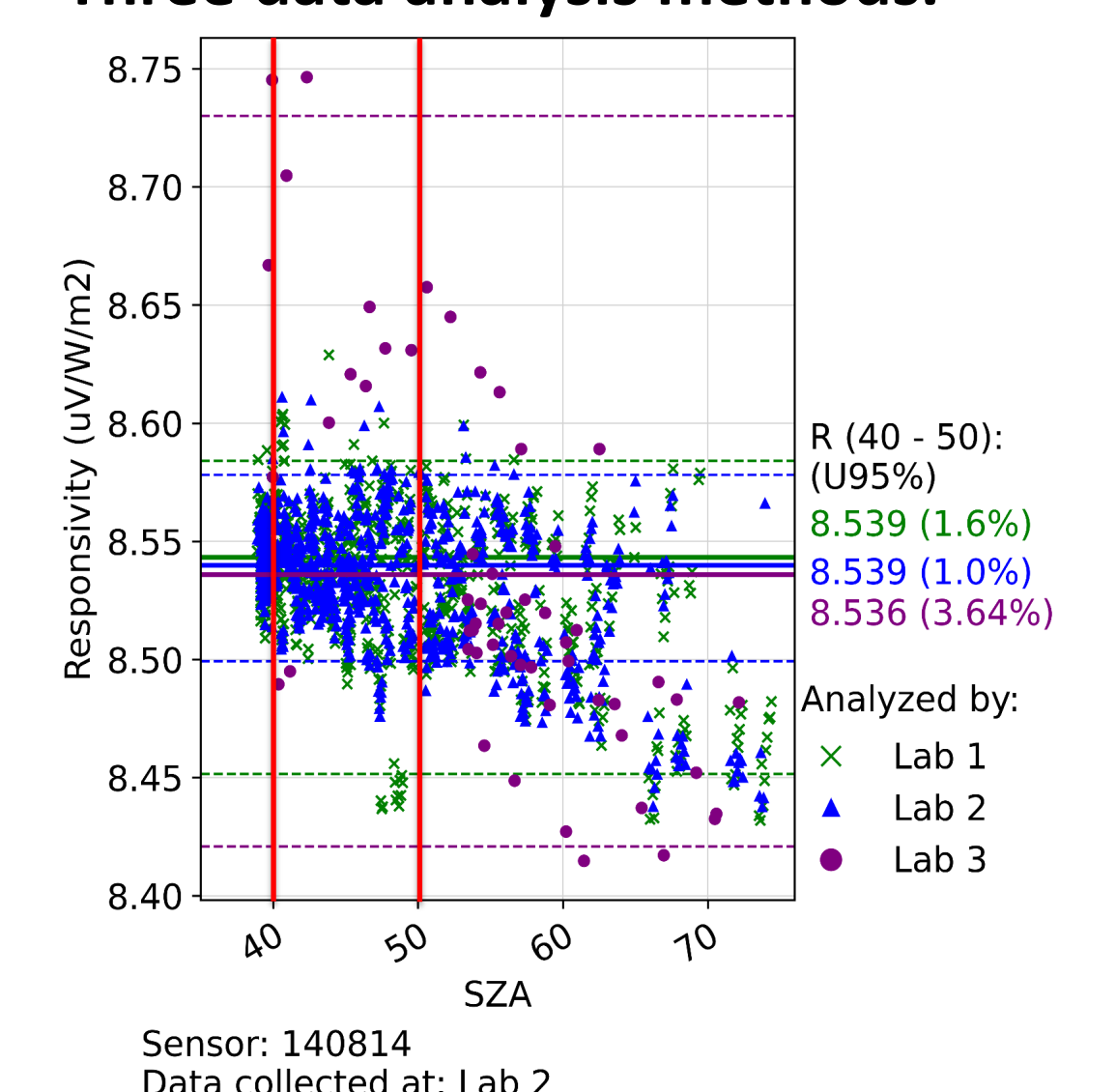
### Three data collection methods. One data analysis method.



Data collected at three sites using one labs data analysis method show differences as high as 0.05. The solar zenith angles were not consistent between the three sets of measurements.

**Conclusion:** Differences in measurement techniques need further analysis, and the solar zenith angle range should be more consistent.

### One data collection method. Three data analysis methods.



Three different data analysis programs yielded essentially the same result when limited to the same solar zenith angle range (40-50). Data were collected using the shade/unshade method by all three labs.

**Conclusion:** All three facilities have equally valid data processing protocols.

## Acknowledgements:

- We thank NASA Langley and the CERES project (PI: Norman Loeb) for funding the LRC site. <https://ceres.larc.nasa.gov/>
- We thank NASA Langley's Chemistry and Physics Atmospheric Boundary Layer Experiment (CAPABLE) for allowing establishment of a land calibration site for instrumentation. <https://science.larc.nasa.gov/CAPABLE/>