Exciting Changes to the MFRSR System

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Current Engineering Projects:

ENG0003399: Reconfigure MFRSRs at SGP Central Facility

Summary: Add new Yankee Environmental Systems, Inc. MFRSR to BRS instrument suite. Refurbish current C1 MFRSR to match E13 MFRSR. Doing so will improve confidence in AOD and related measurements, as well as helping to ensure a continuous data record.

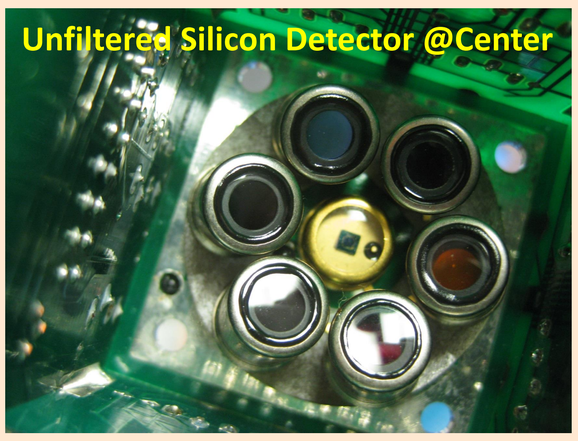
- *Test new Yankee MFRSR:* Underway. Two new Yankee MFRSRs have been installed on the Guest Instrument Facility (GIF) instrument deck. Work on ingest code has commenced.

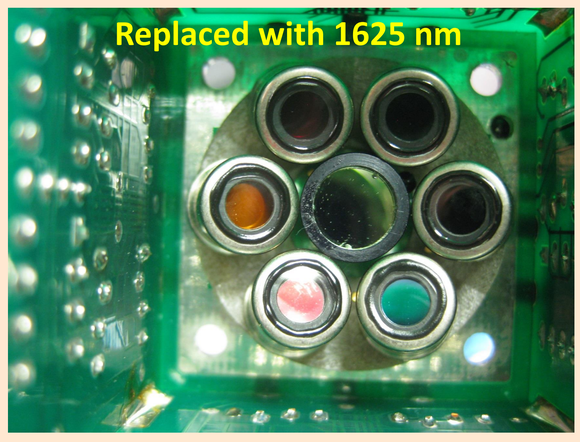
Feb 2018: Two new model MFRSRs installed on GIF. One will deploy with BRS instrument suite, and the other will be a spare. These instruments utilize a thermopile detector for broadband measurements, an improvement over the prior unfiltered silicon detector. The motor bracket has three fixed positions easing set-up and shadowband alignment. Head temp is maintained at 45^{o}C so will stay above ambient thereby improving stability.

- *Next steps:* Finish testing ingest code. Outfit a Campbell logger box enclosure to install at C1, and refurbish C1 sensor. May wrap this one up summer 2018.

ENG0001218: Add 1625 nm channel to all MFRSRs, MFRs and NIMFRs

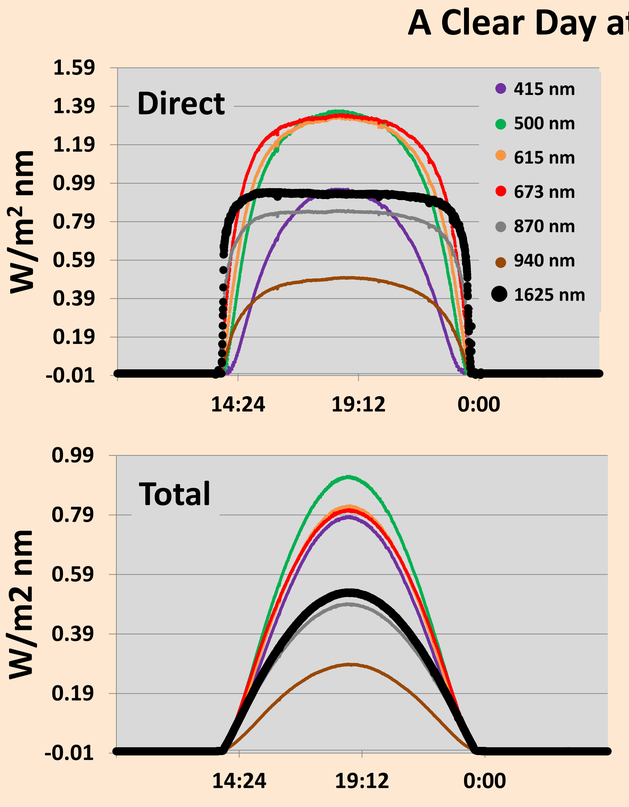
Summary: ARM is replacing the broadband detector with a 1625 nm sensor, creating a seven narrowband instrument to improve retrievals of aerosol and cloud properties.

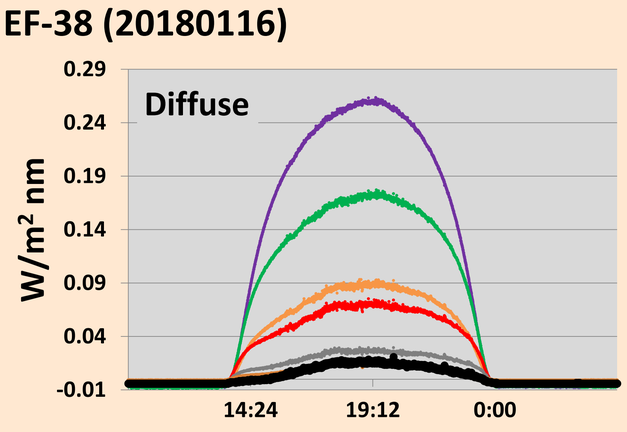




A workshop was held in Boulder 24-26 Oct 2017 to work out the details of installing the 1625 nm filterdetector. James Martin traveled from Oklahoma, and John Schmelzer participated via conference call. Fourteen heads were upgraded. One has been placed in service at SGP EF-38.

A Clear Day at SGP EF-38 (20180116)



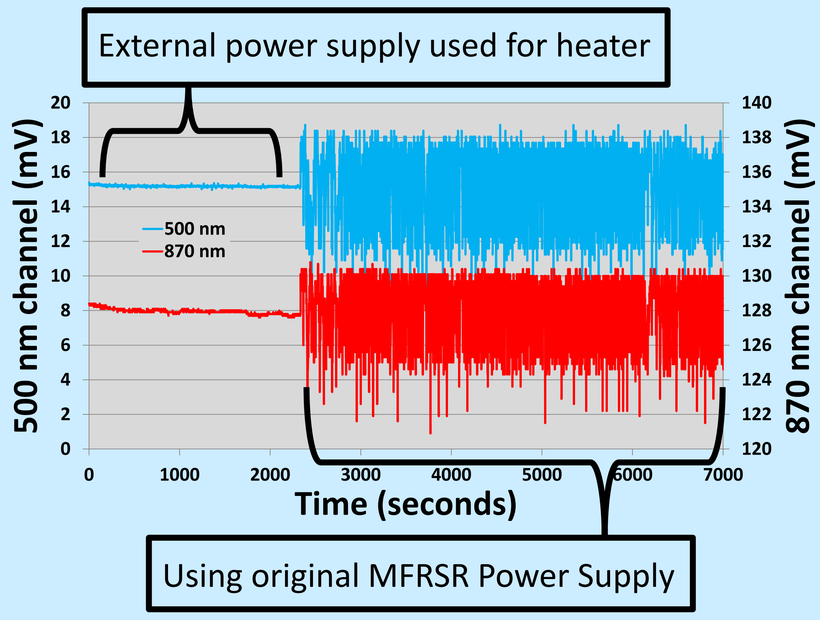


The first deployed sensor with a 1625 nm filterdetector in place of the unfiltered silicon detector is at SGP EF-38. Provided is a set of typical MFRSR plots showing direct, diffuse, and total irradiance. Note the calibration value for 1625 nm is yet to be determined, so plots are for illustration purposes only.

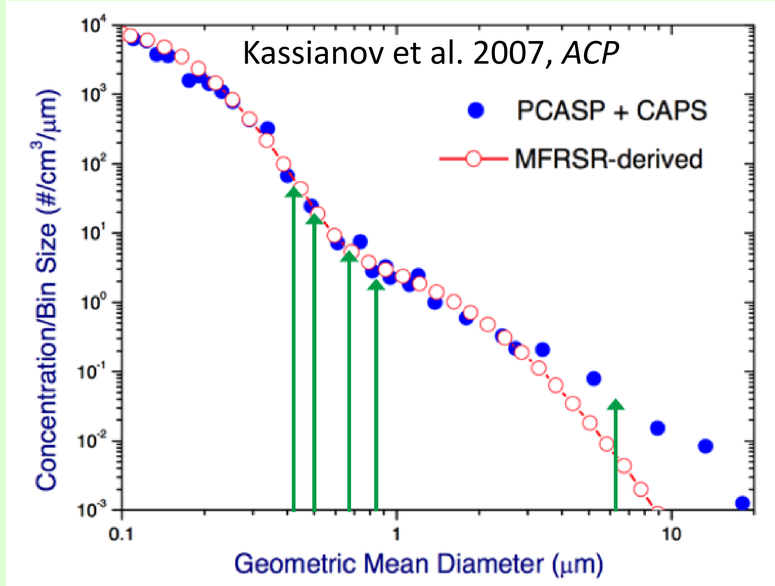
ENG00001024: Redesign MFRSR Heater Controller

Summary: Current board has high failure rate so redesigning heater board to reduce failures and compromised data.

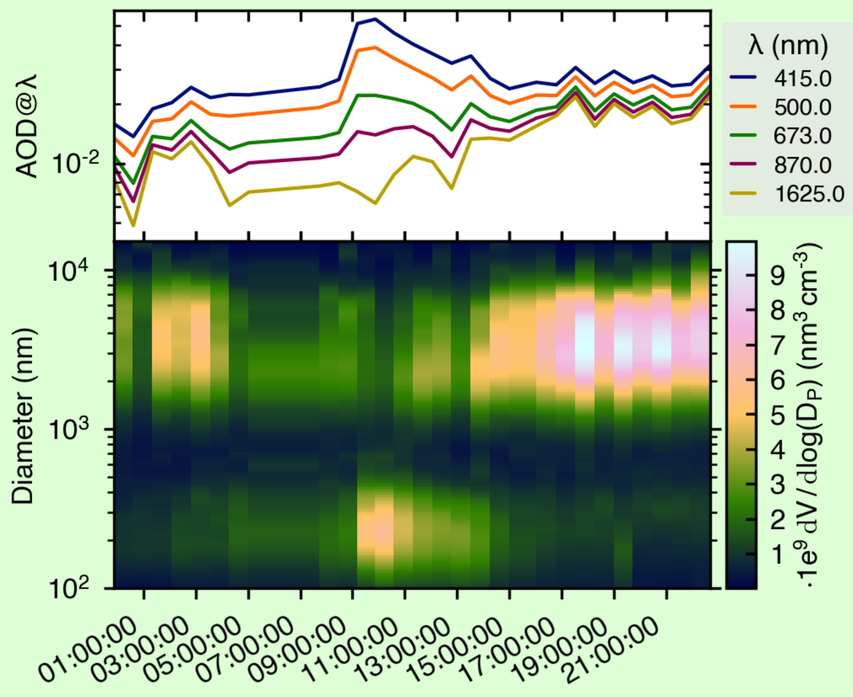
- *Heater design chosen:* We have settled on a Proportional Integral Derivative (PID) solution.
- *Field Test:* The PID prototype solution was field tested Oct 2017 at SGP. Unexpected noise was seen.
- *Lab Testing:* Careful lab testing may have isolated noise source. It is likely being introduced by the power supply coupled with the new configuration.



1625 nm Will Improve Retrievals



MFRSR derived size distribution (red) is well constrained relative to directly measured aircraft-based distribution (blue) only for aerosol of ~1.2 μm and smaller. Adding 1625 nm will constrain concentration of larger particles, thus better characterizing aerosol coarse mode and its impact on light extinction.



Lower panel is evolution of different sized aerosol throughout a SGP day as measured by the HTDMA-APS. Dominant mode oscillates between coarse and fine. Calculations of AOD for the measured size distribution show the utility of 1625 nm channel for providing information on coarse mode aerosol using the relative spread from shorter wavelength AOD.