

Breakout Session Report

ARM/ASR Joint User Facility and PI Meeting June 21-24, 2021

Breakout session reports serve as a record of discussion results from breakout and working group presentations. These reports serve as a resource for program managers when asked to provide highlights of programmatic results with short notice. They also provide information to the ARM Facility management about science needs of ARM users. In addition, they can help the program managers evaluate the progress of self-organized groups within the ARM and ASR communities.

Please provide a concise narrative discussing key findings, decisions, issues, needs, and/or future plans and action items. Not all session narratives will necessitate touching on all topics, but session report authors should aim to provide as much information as possible to address relevant points. Session reports are not expected to exceed two pages of text. It is not necessary to include a detailed list of presentations. Send completed reports by July 30, 2021 to Sally McFarlane, Shaima Nasiri, and Jeff Stehr.

Session Title: How will shortwave radiometer updates impact science in ARM?

Session Conveners: Laura Riihimaki, Manajit Sengupta, Connor Flynn, Peter Gotseff, Aron Habte

Session Date: Wednesday, June 23

Session Time: 11 am – 1 pm ET

Number of Attendees: ~50

Summary Authors: Laura Riihimaki, Manajit Sengupta, Pete Gotseff, Aron Habte

Main Discussion

The session contained two main sections. In the first half, discussion surrounded the work being done to upgrade SW broadband measurements at ARM sites. Pete Gotseff and Aron Habte presented information on new broadband SW instrumentation available that have lower error characteristics than the older instrumentation currently being used. Results comparing the cosine response of Eppley PSP, SPP, Kipp and Zonen CMP22, EKO MS-802, and Hukseflux SR25 and digital SR30 were shown. Diffuse comparison tests between CMP22, SPP, SR25, and Eppley 8-48s show agreement within 5% compared to a reference CMP22—a PSP would not do that well. Global measurements compared to a sum total from CMP22, SR25, MS80, and SPPs were shown for about a month of time. All have some cosine response, though generally remain within 5% of the reference. Nighttime offsets for CMP22, SR25, SPP, and 8-48 all show values generally well within 1-2 wats in a 6-month period.

1. RFI has been released, and looking at upgrading instrumentation, but not corresponding infrastructure (needs to fit within data logging, ventilator, BORCAL). Jennifer Comstock clarified that the contract would need to be competed so we can't choose an instrument, but can give input into requirements. The budget is for ~\$80,000 to be spent over a 3 year period.
2. The need for a diffuse instrument without an IRloss offset/correction needed was expressed.
3. Concern was expressed about changes in record for long-term measurements and a need to understand the impact of the instrument change would be on the record.
4. Some discussion around whether it would be advantageous to upgrade AMF deployments & fixed sites to best in class and potentially not upgrade the extended facility for the sake of cost to allow more flexibility in upgrade. Several concerns were expressed about this idea including 1) the need for consistency between the measurements at the extended facility and central facility for its use; 2) consistency for infrastructure operations including VAP processing; and 3) this is likely our chance to make the upgrade for the next few decades and it would make sense

Breakout Session Report

ARM/ASR Joint User Facility and PI Meeting June 21-24, 2021

to upgrade all instrumentation, especially as the instruments that are currently in use are no longer being produced.

5. Concern that Eppley may no longer be manufacturing instruments which would make it difficult for them to respond. NOAA colleagues reported on an email exchange with Tom Kirk who said that Eppley is not currently manufacturing new instruments, but is selling off inventory in stock and doing calibrations.
6. Gary Hodges and Christian Herrera described an adaptor they are making to allow Kipp and Zonen instruments to fit within an Eppley ventilator. Current cost to make the prototypes has been around \$400 but they expect that will go down significantly once the design is finalized and they can be produced in quantity.
7. Discussion about the need to upgrade the QCRAD VAP for new instrumentation that doesn't require an IR loss correction. This hasn't yet been done, so will need to be planned for. Pete also pointed out that the current generic IR loss correction in c1/s1 level QCRAD VAPs doesn't take into account the reduced offsets after DC fans were installed a few years ago, so the QCRAD data that is currently output in near real-time is overcorrected until c2 level processing is done. Plans need to be made with translators and mentors to work on this effort.
8. Desire to analyze the year of comparison instrumentation at SGP when a full year of data has been taken—Aron Habte agreed to take a look at this. BRS system now has Kipp and Zonen best in class instrumentation and S01 has newer Eppley models.

The second half of the breakout session contained talks by three instrument manufacturers describing hyperspectral instrumentation that is available or soon to be available. The talks were given by Steve Jones from Aerodyne about the TWST, John Wood about the HSP1, and Will Beuttell about the EKO 711. Results summarized in table below.

Discussion was short, but focused on the potential of doing a spectral radiometer intercomparison. NREL presented their capabilities for indoor characterization and calibration as well as EKO and Prede instrumentation for an outdoor calibration, and would be willing to schedule the intercomparison in 2022 or 2023. Joe Michalsky pointed out that their facility would work for the hemispheric instrumentation, but they weren't set up to calibrate the radiance measurements. More discussion is needed to discuss the potential of an intercomparison, but the instruments seemed in a promising state to test against current ARM instrumentation in the near future.

Instrument	Wavelength range & resolution	Field of View	Availability & price	Retrieval algorithms	Accuracy/stability	Other
HSP1	350-950/1050 nm; 3 nm resolution; 1 s temporal resolution	Hemispheric, diffuse and total	Late 2021 or early 2022 Price 12-15k	AOD retrievals being developed and code will be available	Calibration via lamp, accuracy 5%, stability 1%	Measures diffuse and total with no moving parts & can be

Breakout Session Report

ARM/ASR Joint User Facility and PI Meeting June 21-24, 2021

			british pounds			put on moving platforms
EKO 711	300-1100 nm with 7 nm resolution can be combined (Using 712 instrument can go to 1650)	Hemispheric irradiance or can be used with a collimating tube for 5 deg direct normal	Widely used and on the market	No current retrievals, but AOD and other retrievals under development	Use lamp cals and researching improvements of spectroradiometric calibrations through lasers and combined lamp/langleys cals --stability looked really good in the field—in between calibrations every two years, the NREL systems stayed within 2% for all wavelengths	Widely used in the field and have been around for a while
TWST	400-1665 nm (or 400-2500 nm with FTIR spectrometer)	Zenith radiance		Realtime COD retrievals currently available, Reff and phase under development and code could be made available	Still being assessed in the field, though calibration by lamps has fairly high uncertainties (e.g. 6% at 450 nm) working on developing a temperature controlled LED-based field calibrator to look at operational performance of calibration	

Key Findings

If applicable

Decisions

If applicable

Breakout Session Report
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Issues

If applicable

Needs

- Need to update QCRAD VAP for DC fans and potential new instrumentation

Future Plans

Several hyperspectral radiometers are now on the market or close to being on the market. The TWST has already been compared with the SASZE and CIMEL in a campaign at the SGP and TCAP AMF deployments with promising results. The hemispheric field of view instruments HSP1 and EKO 711 have not yet been compared with the SASHE, but both show promise for ARM uses. We would like to see ongoing discussion about the possibility of a comparison with these instruments in the next year or two to have more information about how ARM might want to proceed with spectral instrumentation.

Action Items

1. Determine scope and schedule for a spectral instrument intercomparison
2. Decide on preferred state of the art instrumentation to upgrade AMF deployments