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2017 ARM/ASR Joint User Facility PI Meeting: ARM Shortwave and Longwave Radiometer Calibrations

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Sensing, Measurement, and Forecasting Group and NREL's Quality Management Systems & Assurance Center

Provide high-quality meteorological and solar resource data for research, climate studies, and radiative transfer model verification

Measurements	Modeling	Standards
		
The right observations of wind and solar resources	Targeted predictions of solar resources	Raising everyone to the same level and enabling dialog

Overview

- The Atmospheric Radiation Measurement (ARM) program provides high-quality radiometric data from approximately 150 instruments deployed at the Southern Great Plains (SGP), Eastern North Atlantic, North Slope of Alaska, Oliktok, and the ARM Mobile Facilities sites.

- These instruments are deployed on the Solar Infrared Radiation Station (SIRS), SKYRAD, and GNDRAD instrument platforms.

- More than 500 radiometers are calibrated and used for instrument swaps and replacements.

- The National Renewable Energy Laboratory (NREL) and ARM, through the Radiometric Calibration Facility at the SGP site, provides Broadband Outdoor Radiometer Calibrations (BORCAL) for all shortwave (SW) and longwave (LW) radiometers that are deployed by the ARM program.

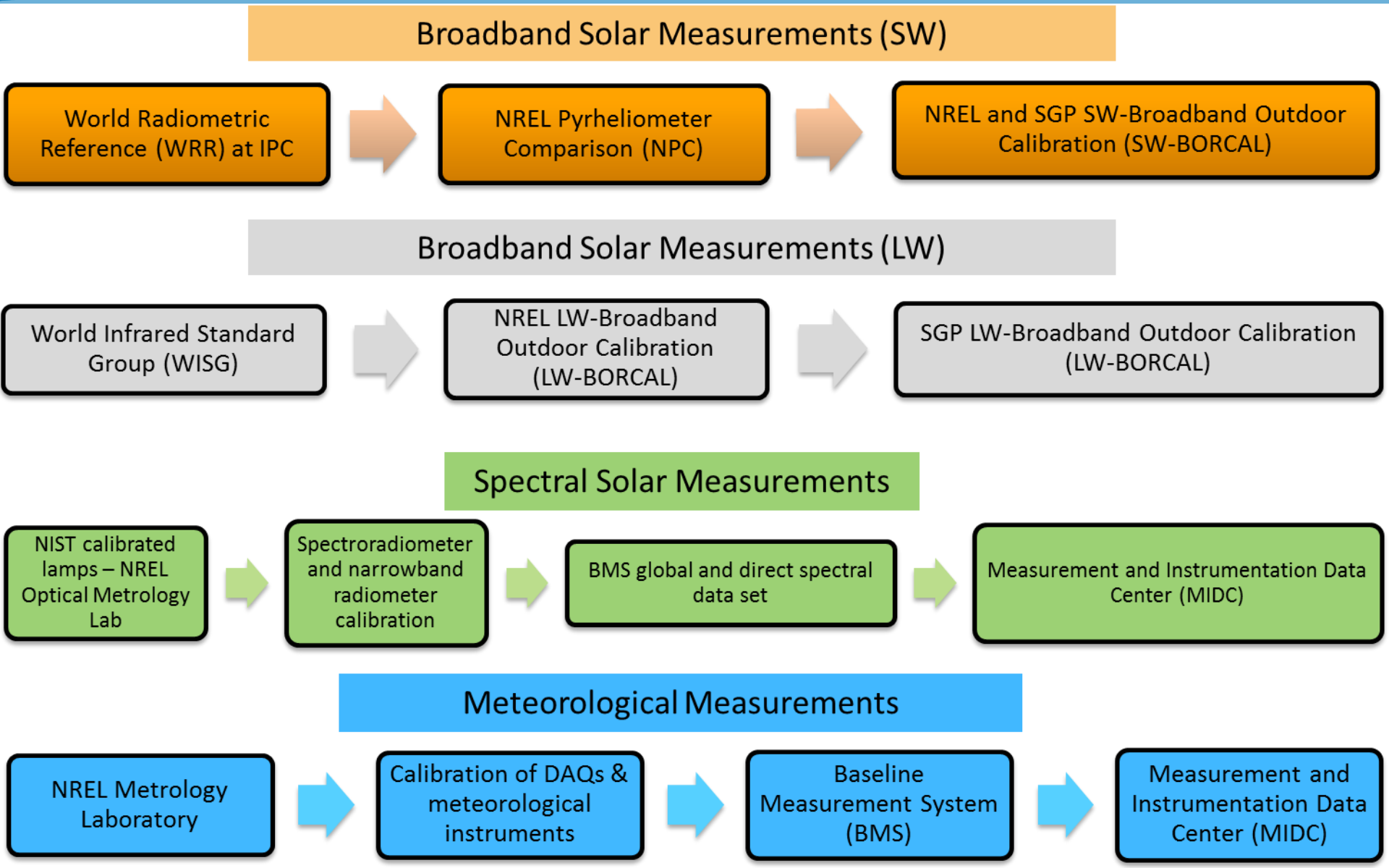
Overview

- The BORCAL-SW is traceable to the International System of Units (SI) through the World Radiometric Reference (WRR); however, the SI standard is not yet established for LW measurements.

- Deployment of BORCAL-LW capability has been performed under the ARM program ECO-00781, “Establish Pyrgeometer Calibrations Traceable to the WISG.” The stated purpose of the ECO is to adopt the consensus World Infrared Standard Group (WISG) for calibrating pyrgeometers used by the ARM program for broadband LW irradiance data collected from SIRS, SKYRAD, and GNDRAD instrument platforms.

- Both NREL and the ARM program continue to introduce new methods to improve radiometric certainty in calibration and field measurements.

The Measurement Workflow



Metrics for LW and SW BORCALs

LW BORCAL Summary

Time period	2015		2016		2015-2016	
Total number of Instruments calibrated	71		94		165	
Total number of individual Instruments calibrated	61		82		143	
Average Uncertainty (W/m²)	2.27		2.37		2.33	
Highest Uncertainty (W/m²)	2.46		2.81		2.81	
Lowest Uncertainty (W/m²)	1.69		1.50		1.50	
Average number successful calibrations per session	12		10.2		11.2	
Average length of time for BORCAL-LW to complete (days)	30		31		30	
Shortest BORCAL-LW event (days)	17		16		16	
Longest BORCAL-LW event (days)	44		49		49	
Range of K values	max	min	max	min	max	min
Current range of K0 values for all successfully calibrated instruments	3.660	-9.647	3.090	-13.689	3.660	-13.689
Current range of K1 values for all successfully calibrated instruments	0.346	0.209	0.376	0.194	0.376	0.194
Current range of K2 values for all successfully calibrated instruments	1.025	0.994	1.035	0.996	1.035	0.994
Current range of K3 values for all successfully calibrated instruments	-2.423	-5.404	-2.759	-5.834	-2.423	-5.834

SW BORCAL Summary

Time Period	Total Instruments	Calibration system Instruments	Test instruments to be deployed to sites or used as spares	NIPs	PSPs	8-48
SW 2016-01	113	15	98	28	66	18
SW 2016-02	85	14	71	18	52	15

Documentation of the LW and SW BORCAL processes conducted at the SGP can be found at http://www.nrel.gov/docs/fy15osti/65035.pdf.

Thank You!

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