Atmospheric Radiation Measurement
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Southern Great Plains
Newsletter

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Cloud Radars at the Southern Great Plains Site

The flip of a switch in February solved a dilemma in detection of cirrus clouds by an ARM Climate Research Facility (ACRF) instrument, and the millimeter wave cloud radar (MMCR) at the Southern Great Plains (SGP) site then passed inspection. In addition, concerns about data from the ARM Mobile Facility (AMF) w-band ARM cloud radar (WACR) were alleviated in March by intercomparison with the SGP WACR. Both radar issues turned out to be minor, but solving them was critical to ensuring the quality of data obtained in past and future field campaigns.

With their high sensitivity for detecting cloud boundaries, the MMCR and WACR are critical components of the ACRF instrument suite. However, the MMCR at the SGP site was not detecting cirrus clouds as well as it should. Unable to determine the source of the problem, ACRF operations staff hoped that a planned processor upgrade might be the solution.

Antennas for cloud radars: SGP WACR (left), SGP MMCR, and AMF WACR (right) (ARM photo).

Just before the upgrade, the ACRF radar mentor and the developer of the MMCR (a scientist from the National Oceanic and Atmospheric Administration) visited the SGP site in February to investigate the loss of sensitivity. They uncovered an out-of-sight, benign-looking diagnostic switch that had apparently been bumped, setting the radar to a polarization diagnostic mode and affecting the MMCR's cirrus mode performance. Flipping the switch corrected the problem.

The processor upgrade was subsequently completed, and the radar is operating properly once again. Users of MMCR data will be notified of any data quality issues related to this event per the routine

reporting process used by the Data Archive.

The WACR's travels around the world for AMF deployments have fostered concerns about potential damage to the antenna during shipping. Any necessary calibration offsets could affect data from previous campaigns, as well as the 2008 deployment in China. To assure data quality, the AMF WACR was returned to the SGP site at the end of its German deployment and subjected to three weeks of comparison with the SGP WACR.

The intercomparison demonstrated that data from the AMF WACR and the calibrated SGP WACR agreed as closely as possible — within 1 dB. Confidence in the calibration eliminated a need for data corrections before AMF deployments in Niger and Germany. Future data collection should also be worry-free.

Synchronizing ACRF Data

Accurate time stamps on data collected at the ACRF sites are required to use the measurements with confidence in research. At the dispersed facilities across the SGP site, making sure that all of the instruments and their associated data logging systems are on the same clock is no easy task. Because of their remote locations, many of these field facilities still rely on dialup Internet connections and are susceptible to frequent power outages.

GPS receivers are installed at all the extended facilities throughout the SGP domain (ARM photo).

After uncovering a minor but pervasive offset in time records, SGP site operations staff quickly diagnosed the problem and set about implementing a solution. New synchronization software installed throughout the site will ensure that future automatic clock resets account for any "drift" between the instrument hardware and data collection systems, keeping SGP site data in synch.

In February, SGP site operations staff discovered the flaw in the time-synch process used at the extended and intermediate facilities. During system startups or reboots, the method used for data transport — an Ethernet-based serial port — was causing clock instability. In addition, the startup process did not include access to the highly precise global positioning system (GPS) time signal available from the GPS receivers at each facility.

In cooperation with various ARM instrument mentors, SGP site operations staff identified a commercial synchronization product from the vendor of the GPS time servers at the ACRF ground sites. The new time synchronization software runs independently of off-site network connections and minimizes the risk of incorrect time settings, particularly when off-site communications not completely reliable. Testing of the synchronization software in March gave very consistent results, leading to installation of the software at all SGP extended and intermediate facilities.