

Quarterly Report of the Southern Great Plains Site Scientist Team

**For the period
June 1, 2001 – August 31, 2001**

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1. Introduction

The Southern Great Plains (SGP) Site Scientist Team (SST) prepares Quarterly Site Scientist Reports, outlining scientific support for site operations for the period covered by the report and assessing the efficacy of site operations in achieving the goals outlined in the *Site Scientific Mission Plan*. The reports are distributed to the ARM Science Team (Chief Scientist) and delivered to the ARM Program Office on March 1, June 1, September 1, and December 1 of each year. Updates on the SST's research and educational outreach programs are available in other documents provided to the ARM Program.

This report covers the period June 1, 2001 – August 31, 2001.

2. Site Activities during the Period – Executive Summary

a. IOPs and Campaigns

IOPs and campaigns during this period continued their focus on providing critical data sets on an episodic basis for the Science Team, as well as field support for instrument development and testing and collaborative campaigns.

Microwave Radiometer Comparison IOP (In Progress) 1 April-30 September 2001

To permit a long term side-by-side comparison of ARM microwave radiometers (MWR) that spans a wide range of integrated columnar water vapor amounts, a second MWR has been collocated with the MWR at the SGP central facility. Ric Cederwall and Barry Lesht are the principal contacts.

UPDATE: The value-added procedure to compare the second MWR with the central facility radiosonde (qmemwrcolE14) was been put into production on 31 July.

Multi-frequency Radar IOP (In Progress) 16 April-30 September 2001

Steve Sekelsky (U. Mass./MRSL) plans to bring the 95 GHz CPRS radar to the SGP for insect clutter investigation purposes. During this IOP, beginning in May, Kevin Widener (PNNL) plans to deploy the new MMCR being built by Radian, which incorporates polarization to discriminate insects from clouds, for comparison with the existing, non-polarized MMCR and the UMASS CPRS radar. Kevin will also serve as IOP coordinator. Also during this IOP Chris Williams (NOAA/Aeronomy Lab) plans to deploy a 2.8 GHz wind profiling radar to support the development of a profiling rain gauge.

UPDATE: All three radars continue working well.

Nowcasting IOP (Concluded) 20 June-1 August 2001

Under support from the U.S. Army, 4 radiosondes per day are being launched from the Purcell, OK boundary facility for 6 weeks to provide data needed to validate a near-real-time, short range weather forecast ("nowcast") model being developed by Dave Stauffer (Penn State) for the Army.

In support of this effort, the coded message data output from the balloon-borne sounding system that are provided to the NWS have been modified to include data above the 100 mb level and to include additional levels below 100 mb.

UPDATE: This IOP was suspended during the period 6-25 July for computer upgrades at the Penn State nowcasting processing center. The IOP was successfully restarted on 25 July with the 2330 GMT launch. Due to the temporary shutdown, this IOP will continue to 21 August. This IOP was successfully concluded on 20 August.

NFOV Solar Spectrometer Cloud Optical Depth Retrieval Campaign (In Progress) 28 June-8 October 2001

Chuck Pavloski (Penn. State U.) plans to deploy a dual-spectrometer instrument that measures the hemispheric flux and the zenith NFOV radiance over 300-1000 nm at high temporal resolution and with a spectral resolution of 3 nm. These measurements will be used to estimate cloud optical depth for broken cloud fields over vegetated surfaces, which will be compared with optical depths retrieved using SGP CART instrumentation.

UPDATE: The concluding date has been extended to 8 October. Chuck Pavloski indicates that the instrument has been running well and also compares well with the ARM NFOV radiometer, which operates at 870 nm. Chuck Pavloski (Penn. State U.) plans to deploy a dual-spectrometer instrument that measures the hemispheric flux and the zenith NFOV radiance over 300-1000 nm at high temporal resolution and with a spectral resolution of 3 nm. These measurements will be used to estimate cloud optical depth for broken cloud fields over vegetated surfaces, which will be compared with optical depths retrieved using SGP CART Instrumentation.

A-band and Water Vapor band spectrometer (AWS) Campaign (Concluded) 14 June-15 July 2001

Qilong Min (SUNY-Albany) will deploy a high-resolution ($\sim 1 \text{ cm}^{-1}$) oxygen A-band and water vapor band spectrometer (AWS) to improve understanding of absorption of water vapor within clouds, and directly answer hypotheses regarding anomalous absorption. He will use inferred photon path length distributions from the oxygen A-band measurements to calculate the absorption of water vapor, and compare to the water vapor band measurements.

At the same time this instrument is deployed, SUNY-Albany personnel will re-deploy the repaired rotating shadowband spectrometer (RSS) and upgrade the USDA ultraviolet spectral radiometer (UVSR).

UPDATE: The campaign concluded successfully on 6 July. Qilong Min (SUNY-Albany) will deploy a high-resolution (~ 1 cm⁻¹) oxygen A-band and water vapor band spectrometer (AWS) to improve understanding of absorption of water vapor within clouds, and directly answer hypotheses regarding anomalous absorption. He will use inferred photon path length distributions from the oxygen A-band measurements to calculate the absorption of water vapor, and compare to the water vapor band measurements. At the same time this instrument is deployed, SUNY-Albany personnel will re-deploy the repaired rotating shadowband spectrometer (RSS) and upgrade the USDA ultraviolet spectral radiometer (UVSR).

SITAC Campaign (Concluded) 3-7 September 2001

Dave Pope, Spectral Information Technology Application Center (SITAC) and scientists from Lawrence Livermore National Lab (LLNL) have proposed to test methods for remotely sensing industrial emissions at the SGP. This will involve releases of various gases from the SGP central facility during over flights of a Twin Otter and the WB-57 aircraft.

UPDATE: Dave Pope and eight other participants from SITAC visited the SGP on 19 June to discuss arrangements for this campaign. Since their visit, the date of the campaign has been moved back one week. Dave Pope (SITAC) and Jim Teske are working on a subcontract with Aeromet Corp. to provide the materials and services to support this campaign. They will lease the field to the north of the central facility in order to deploy a variety of targets for their airborne imagers. Dave Pope, Spectral Information Technology Application Center (SITAC) and scientists from Lawrence Livermore National Lab (LLNL) have proposed to test methods for remotely sensing industrial emissions at the SGP. This will involve releases of various gases from the SGP central facility during over flights of a Twin Otter and the WB-57 aircraft. This campaign carried out four successful aircraft flights over the SGP central facility and concluded on 1 September.

Diffuse Shortwave IOP (Planned) 24 September-5 October 2001

Joe Michalsky (SUNY-Albany) and Tom Stoffel (NREL) plan to deploy approximately 15 radiometers of varying designs and manufacturers on the SGP Radiometer Calibration Facility (RCF) to compare the accuracy of these radiometers for diffuse shortwave measurements.

UPDATE: Final preparations for this IOP are now being carried out.

Precision Gas Sampling (PGS) Validation Campaign (Concluded) 9-28 July 2001

In order to provide validation data for the PGS equipment that has been deployed by Dr. Margaret Torn (Lawrence Berkeley Laboratory) on the 60-meter tower at the SGP central facility, Dr. Torn plans to deploy several self-contained CO₂ flux stations within a radius of 7 km of the tower. The flux stations would be deployed, operated and maintained by LBL personnel.

UPDATE: This campaign concluded successfully on 25 July. In order to provide validation data for the PGS equipment that has been deployed by Dr. Margaret Torn (Lawrence Berkeley Laboratory) on the 60-meter tower at the SGP central facility, Dr. Torn plans to deploy

several self-contained CO₂ flux stations within a radius of 7 km of the tower. The flux stations would be deployed, operated and maintained by LBL personnel.

Airborne Imaging Microwave Radiometer (AIMR) Cal/Val Campaign (Concluded) 16-26 July 2001

Amanda Cox, a University of Colorado graduate student at the Atmospheric Technology Division of NCAR in Boulder, has proposed to operate this instrument in a sky-viewing mode at the SGP central facility in order to calibrate it and then compare it against the MWR. (AIMR operates at 37 and 90 GHz).

UPDATE: This campaign concluded successfully on 24 July. Amanda Cox, a University of Colorado graduate student at the Atmospheric Technology Division of NCAR in Boulder, has proposed to operate this instrument in a sky-viewing mode at the SGP central facility in order to calibrate it and then compare it against the MWR. (AIMR operates at 37 and 90 GHz).

FALL SCM IOP (Cancelled)

There will not be a SCM IOP this fall.

International H₂O Project (IHOP) IOP (Proposed) May-June 2002

UPDATE: Tammy Weckwerth, Brigitte Baeruerle, and Jim Wilson (all from NCAR) toured the SGP central facility on 5 June. IHOP is apparently considering deploying instruments at several ARM SGP facilities. A meeting of IHOP participants has been scheduled for 7-9 November at NCAR in Boulder, CO.

THickness from Offbeam Returns (THOR) Campaign (Planned) March-April 2002

Robert Cahalan, NASA/GSFC, is planning a campaign to validate an engineering model multiple field-of-view lidar system. Cloud physical thickness and other cloud structure parameters are retrieved from THOR data. To validate these retrievals, THOR will be deployed on the NASA P3 in March or April 2002, to fly for several days over the ARM SGP, primarily at night. A related ground-based wide-angle lidar instrument from LANL is also likely to participate.

b. New Instruments and Data Streams

Microwave Radiometer Profiler (MWRP)

The MWRP was upgraded by Radiometrics in May and was redeployed at the SGP central facility on 27-28 June. Daily data (in netCDF format) and plots (in PNG format) are available at

<ftp://prospero.er.anl.gov/pub/outgoing/liljegren/mp>.

Total Sky Imager (TSI-880)

The TSI has been collecting data since July 1, 2000 at the SGP CF. Initially, the TSI images were collected once every minute. This resolution was changed to 30-second, then to the current 20-second resolution in recent months. The URL <http://armtsi1.pnl.gov> is a link to the TSI database and visualization site where users can browse the data, then order the data of interest from the Archive. It can also be used to view "current conditions" at the SGP site.

Images and cloud fraction data should be available from the Archive very soon. Once the TSI data are available from the ARM Archive, the Time Lapse Color Video (TLCV) system will be removed from service.

Broadband Radiometer System (BRS)

The BRS ingest processing module was recently made operational. Data from the BRS, which replaced the "bsrn" radiometer suite, are now available from the date of installation, in February 2001.

Rotating Shadowband Spectrometer (RSS)

Personnel from the Atmospheric Science Research Center (ASRC) at SUNY-Albany redeployed the repaired RSS on 14 June. Data are being acquired by ASRC and will be available from their web page soon. A commercialized version of the RSS will be deployed at the SGP in the next few months that will replace the SUNY-Albany unit. Data from this instrument will be available from the ARM Archive.

Aerosol Observing System (AOS) change

The Radiance Research nephelometer was removed from the AOS on May 22, 2001. Data from this instrument are now flagged as invalid in the AOS data stream. The next step is to integrate the nephelometer into the IAP aircraft payload. The engineering for this will be done over the summer, with deployment planned for the Oct-Nov 2001 timeframe.

c. Accomplishments

Extended Facility Communications:

Now that all EFs have been upgraded and operating for over a month, the SGP long-distance phone charges have dropped from about \$5,000 per month to about \$1,300 per month. Data from the intermediate facilities at Beaumont, Medicine Lodge, and Meeker are still acquired by long-distance dial-up connections, as are data from the partial EF (EBBR only) at Cement. Conversion of the IFs to the new data communications scheme requires additional software development, which is slated to begin later this year.

CSIRO IR Radiometer:

Richard Austin (Colorado State University) successfully repaired this instrument during his visit on 11 June.

MFRSR upgrades completed (BCR-329, 330, 331, 342):

Upgraded dataloggers and additional on-board data storage were installed for all MFR instruments at the SGP. These changes will permit data to be stored for two weeks now whereas formerly data could only be stored for 4 hours. This is expected to eliminate gaps in the MFRSR data streams.

Radiometer Calibration Facility (RCF) upgraded:

Steve Wilcox and Afshin Andreas (NREL) installed their Radiometer Calibration & Characterization (RCC) software on the new computer purchased by ARM for the RCF. This software shares the purpose of the original DOS-version (1994) to automate the BORCAL process while improving reliability and accuracy on the new Windows-based computer. The

new software, upgraded electronics for the absolute cavity radiometers, and other BORCAL refinements were planned to meet ARM's needs for radiometer calibrations at the RCF.

BORCAL #1 Completed;

BORCAL #2 to include NSA, TWP radiometers: The first of two annual broadband outdoor radiometer calibration (BORCAL) exercises was completed in July. These newly calibrated radiometers will be swapped with radiometers at half of the SGP extended facilities (EFs). The swapped radiometers will then be calibrated during the second BORCAL, then they will be swapped with those at the remaining half of the EFs. Two Kip & Zonen CM22 radiometers belonging to the ARM/UAV program were included in BORCAL #1: Radiometers from the North Slope of Alaska (NSA) CART site will also be included in the second BORCAL. In addition, several radiometers from the Tropical Western Pacific (TWP) CART site that have been BORCALed at NREL in July will be included in SGP BORCAL #2 to compare the resulting calibrations.

TWP Shipping / Receiving at SGP:

TWP shipping and receiving, formerly handled by Linda Gillen at Sandia National laboratory / ATOSS, has been transferred to the SGP and is now the responsibility of George Sawyer. By realigning available personnel, Jim Teske has been able to incorporate this task into SGP Site Operations without an increase in the cost of the contract with Aeromet.

JPL GPS Repaired:

Ron Muellerschoen (JPL) was on-site 12 July to replace the faulty antenna on this system. Ron Reed (SGP) installed the Local Data Manager (LDM) software used by SuomiNet onto the JPL computer. This permits the JPL GPS data to be routinely and automatically forwarded to SuomiNet along with the data from the collocated SuomiNet GPS receiver and antenna for processing and comparison.

Radiosonde Launch Schedule Change:

The 20:30 UTC daily sonde launch was moved to 17:30 UTC, effective 1 August. This will provide a sounding every 6 hours, which is preferable for the SCM/CRM working group, for matching NWS/NCEP analyses, and for EOS/Terra satellite validation efforts.

SuomiNet Monument Installations Completed:

Installation of concrete piers (a/k/a "monuments") for the SuomiNet GPS antennas has been completed at 14 extended facilities. The SuomiNet GPS antennas, receivers, and related equipment will be deployed at these sites in September.

d. Meetings

American Society of Safety Engineering (ASSE), 11-13 June 2001:

John Schatz traveled to Anaheim, CA to attend the ASSE conference and participate in several short courses relevant to his role as SGP Site Safety Officer.

SGP - SITAC, 19-20 June 2001:

Jim Liljegren traveled to the SGP to meet with the SITAC IOP participants to discuss their plans. Jim had also planned to meet with Oklahoma State Senator Paul Muegge and a film crew from OETA but, unfortunately, the senator and the film crew did not show up.

SGP - MWRP, 27-28 June 2001:

Jim Liljegren traveled to the SGP to install and calibrate the microwave radiometer profiler (MWRP). The MWRP will be operated at the SGP for several months as part of its evaluation.

DOT Shipping Training:

John Schatz, SGP Site Safety Officer, and George Sawyer, SGP Shipping and Receiving Manager, attended a training course on DOT shipping regulations and requirements 20-24 August in Oklahoma City.

ES&H Oversight:

Monte Brandner, ARM Operations Field Safety Coordinator, traveled to the SGP on 27-29 August to observe the SITAC Campaign and to meet with SGP personnel regarding ES&H issues.

IHOP Meeting in Boulder, CO (Aug 15-17):

Scott Richardson attended an IHOP Meeting in Boulder, CO to provide information as needed on the ARM program.

Data Quality meetings with Instrument Mentors:

In June, Chad Bahrmann and Randy Pepler traveled to Boulder and Golden, CO to meet with John Ogren and Pat Sheridan (AOS Mentor) and NREL (SIRS Mentor) respectively. These meetings were vital in getting feedback on the Data Quality work being accomplished by both the ARM Data Quality Office and the SGP SST.

3. SST Scientific Support for Site Operations during the Period**a. Data quality**

Chad Bahrmann spent considerable effort working with the ARM Data Quality office and ARM Instrument Team to upgrade all of the existing SGP Data Quality modules and web pages. The latest version of the web page, renamed to the ARM SGP CART Site Data Quality Health & Status, can be found at:

<http://r1.sgp.arm.gov/~sgpdq/QCNEW/home.html>

This latest work is in response to feedback provided by many mentors and others at this year's ARM Science Team meeting and individual meetings. The latest additions include a monthly Data Quality Calendar and enhanced versions of the hourly QC tables. These enhancements include allowing the user to mouse-over non green cells to determine what particular variable is failing and why. These enhancements allow for easier data quality assessments to be made on any given instrument. SGP Instrumentation available on the web site include:

- AOS
- BBSS
- BRS
- CM
- EBBR
- MFR10m
- MFR25m
- MFRIRT10m
- MFRIRT25m
- MFRSR
- MPL
- MWR
- NIMFR
- SIRS
- SMOS
- SWATS
- THWAPS
- TWR10x
- TWR25m
- TWR60m
- VCEIL

Progress during this period included:

- Chad Bahrmann, in conjunction with the ARM Data Quality Office, worked on algorithm maintenance/development and web site administration.
- A new menu was created that allows users to choose many subtopics associated with each instrument. These subtopics include links to the data quality web pages, instrument web page, and other available quicklooks.
- Meta-Data produced by site operations can be obtained directly on the new Data Quality Health & Status web site. This information, including Instrument Engineering Logs and Data Quality Problem Reports, can be found when viewing an individual instrument data quality web page.
- The production of batch DQRs is under development on the new Data Quality Health & Status web site. This will allow users to submit a batch dqr while assessing dq on the new web site.
- Improvements and additions to the suite of data quality diagnostic plots continue.
- The SST continued to issue and status “Data Quality Problem Reports” (DQPR’s) along with instrument mentors and the Data Quality Office to provide site operations information on non-operational or poorly functioning instrumentation.

b. Scientific guidance for site operations

The site weekly coordination teleconference was held most Tuesday mornings to discuss site status for the previous week relative to site operations, IDPC’s, MDN, data quality, and site development. Current and future IOPs and campaigns were discussed, as well as other

important scientific and operational issues affecting the site. Minutes of meetings conducted since September 1995 are available at the following web site:

<http://parker.gcn.ou.edu/~cimms/ARM/sscm/minutes.html>

Facilitation of e-mail and WWW-based scientific discussions relating to the SGP site was an ongoing task. This is done to generate timely discussions on important issues and to gather facts on long-term problems.

Specific scientific guidance activities for site operations included Chad Bahrmann continuing routine two-day trips to the central facility every other week to help provide on-site scientific support for site operations. He typically helps with computer programming issues and scientific issues related to preventative and corrective maintenance. Chad also visits with site operations field technicians to discuss any issues they may have with respect to instrument data quality and general science issues. During the period, Chad modified the data availability program to accommodate new instrumentation and new instrument deployments and to address the issue of multiple files for a given day.

Chad continued to work with Chris Klaus on quicklook issues, particularly for IOPs. This work can be viewed at the following website:

www.nsd.arm.gov

A job announcement for the new SST position was sent out in early June. This position will be actively involved with SGP Site Operations. Therefore, the new member of the SGP SST will work at the ARM CF for a period of 6-12 months to become familiar with the site, instruments, and operational constraints. This short-term tenure at the ARM CF will be followed by a relocation to work on campus at the University of Oklahoma. As of October 1, fifteen applicants have applied for this position.

IOP Support. Involvement in IOPs during this period was minimal because most of the ongoing IOPs are small in nature and did not require any SST presence on site.

The following Baseline Change Requests and Engineering Change Requests were submitted during this period.

SGP BCRs

BCR ID	Status	Priority	Summary
00363	Open	Very Important	Activate TSI880 collection/processing
00365	Closed	Very Important	Convert SMOS CR10 programs from PC208 format to PC208W format
00367	Closed	Very Important	Implement ARM AIA naming standard for production data system
00368	Closed	Routine	Suspend ECOR operation at EF1, EF3, EF10, EF11, EF16, EF24
00369	Closed	Very Important	Consider change to SGP radiosonde launch schedule

00370	Closed	Very Important	Release cm25m and cm60m ingests
00372	Open	Very Important	New release of mentor QC software
00374	Open	Very Important	Resume Shortwave Spectrometer (SWS) data collection at the SGP CF
00375	Open	Important	WSI Instrument Control Software Upgrade
00380	Closed	Very Important	Removal of Okmulgee ECOR system to the CF
00381	Open	Routine	SIRS Data Storage Module Substitution
00384	Closed	Very Important	Release of DIFFCOR1DUTT VAP
00387	Closed	Emergency	Disable DNS secondary servers
00388	Open	Important	SWATS IDPC Upgrade
00389	Open	Critical	Edit ecor doorstep to prevent transmission of incomplete datafiles to archive
00390	Open	Very Important	One more bug in tsi_ingest
00391	Open	Very Important	vceil_ingest correction per PIF

SGP ECRs

ECR ID	Status	Priority	Summary
00190	Closed	Critical	Replace SGP, TWP and NSA Artecon Network Attached Storage Systems
00191	Closed	Critical	Deploy SGP SDS Derivative to NSA/TWP
00195	Closed	Very Important	Cyber Security for ARM CART sites
00196	Closed	Very Important	Move collection of sgpaeri01 data
00198	Closed	Very Important	RSS from YES, Inc. installation at SGP
00200	Closed	Very Important	Special work needed ... MWR reprocessing for VAP

c. Instrument mentorship

Scott Richardson continued mentorship of the chilled mirror hygrometers. He completed the CM 25 m and 60 m DOD's and provided the ARM Engineering group with input on the BOD (birth of a data stream).

Scott also made several trips to the CF during this period for CM maintenance.

Scott was also responsible for mentoring the temperature and relative humidity calibration chamber now in use at the central facility.

Chad Bahrmann continued mentorship of the SWATS. All the archived SWATS data up to September 30, 2000 has been reprocessed. The new SWATS IDPC was deployed on April 1, 2001 so the remaining data from October 1, 2000 – March 31, 2001 will be reprocessed in the next period. Phase II of the SWATS reprocessing is on hold until Brian Ermold (ARM Engineering Group) can free up some time to assist Chad Bahrmann with this activity.

Chad made several trips to the CF and EF's during this period for SWATS maintenance visits. In addition, Chad visited EF20 Meeker, OK and EF25 Seminole, OK for SWATS troubleshooting.

Chad also spent considerable time updating the SWATS instrument web page to reflect the changes in the calibration technique.

4. Site Specific Research Program

Detailed updates on the Site Scientist's research program can be found at

<http://parker.gcn.ou.edu/~cimms/ARM/resannrp.html>

However, a number of site-specific activities are worth mentioning here.

Scott Richardson prepared for WV IOP meeting at U. Wisconsin. Scott is working with Barry Lesht on determining the prelaunch sonde scaling. In addition, Scott is working on paper with Barry Lesht describing radiosonde accuracy.

Scott submitted paper to AMS, which documents the monthly to annual, regional-scale feedback between the land-surface and atmosphere as measured by observations. This study extends the work begun by Long and Ackerman (1995) and Barnett et al. (1998) by including more surface variables and a full annual cycle of observations. This work will be submitted to a refereed AMS journal this month.

Chad Bahrmann has worked with Jeanne Schneider, Ken Fisher and Ron Elliot on a manuscript entitled Spatiotemporal Variations in Soil Water: First Results from the ARM SGP CART Network.

5. Outreach Program

The SST conducts educational outreach as administered by the Oklahoma Climatological Survey. Updates on this program can be found at

<http://parker.gcn.ou.edu/~cimms/ARM/outannrp.html>

The OCS SGP outreach website can be found at

<http://outreach.ocs.ou.edu/arm>

Chad Bahrmann conducted a number of outreach activities during this period. This included giving a site tour to the University of Oklahoma REU group on 6/14. This group consisted of about 15 individuals. Chad also assisted Jim Liljegren in giving a tour to a group from SITAC who plan on doing an IOP at the ARM SGP CF in late August.