Quarterly Report of the Southern Great Plains Site Scientist Team

For the period
September 1-November 30, 1999

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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 **September 1 through November 30, 1999**.

2. Site Activities during the Period - Executive Summary

From the July-December 1999 edition of the *Site Scientific Mission Plan*:

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. IOPs and campaigns included the continuation of the Jet Propulsion Laboratories (JPL) **global positioning system** (GPS) campaign, the **mesoscale convective systems** (MCS) campaign (May-September), the **microwave radiometer** (MWR) campaign (June-September), the Southern Great Plains **SGP-99** campaign (July 7-22), and the summer **SCM** IOP (July 12-22).

Instruments. The Colorado State University **SSP-3** was scheduled for deployment at the central facility. This is a much-desired spectral radiometer that would add redundancy to spectral radiometry at the SGP site. The USDA (Lee Harrison) **UV spectral radiometer** was also expected for deployment at the central facility. It was developed with funding from the USDA. Site operations preparatory work in anticipation of these two instruments was completed. Chris Rocken of NOAA/ETL is in the process of installing a 20-30-site **GPS micronetwork** for water vapor tomography studies in the immediate vicinity of the central facility. This network will be in place in time for fall 1999 water vapor measurement activity and will be left in the field for at least three years as an Instrument Development Program (IDP) initiative. If successful, the

network will formally become part of the SGP CART site. An Eppley **total ultraviolet radiometer** was added to the BSRN at the central facility. It measures total UV radiation and will be included in the conversion of the BSRN to the BRS. The U.S. DOE Small Business Innovation Research (SBIR) Program has awarded a Phase II program to Radiometrics, Inc. to field test a **microwave radiometer temperature and water vapor profiler** that is expected to be deployed at the SGP CART site this fall. And, the ASTI will continue to operate in an IOP mode as requested.

Facilities. SMOS tower replacements at all extended facilities were completed during the period. Operation of the RCF continued with two **Broadband Outdoor Radiometer CALibrations** (BORCALs). Successful BORCALs were also carried out in September 1996 and July-September 1997 and 1998. The phased implementation of the **Okmulgee extended facility** (wooded) included installation of SIRS and SMOS during the period. ECOR components have been ordered for later deployment. A commercially available **temperature and humidity calibration chamber** was installed. The chamber has been used to successfully calibrate a chilled mirror hygrometer for the TWP CART Site. A phased implementation of three trailers at **IDP-4** continued. This area will become a general depot for storage, spare parts, and ready-to-deploy spare instruments for all three CART sites. It is also being developed to accommodate IOP participants when the need arises. Plans were developed for the move of the **Cordell extended facility** 100 m west of its present location. This move is necessitated because of the construction of a new road. However, the SWATS and associated raingage will remain at their present location. The Oklahoma Department of Transportation will incur the costs of this move. Planning for two **new trailers** for the Central Facility was underway. These trailers will become the Guest Instrument facility trailer at the Optical Cluster and the Instrument Maintenance Facility trailer near IDP #3. These trailers are expected to be fully functional by December.

Scientific Support for Site Operations. Data quality **algorithm development** continued for data from longwave and shortwave radiometers and the ECOR. Development of long-term statistics on data quality metrics performance continued. Work also continued on Build 2 of the **Meta Data Navigator** (MDN). The MDN is a graphical user interface for perusing and obtaining ARM data that includes information about data quality. Build 1 was unveiled in March 1999 for a beta-test. Build 2 will contain quicklooks and a mechanism for submitting DQRs in batch mode. Build 2 will be alpha- and beta-tested in fall 1999. The **Continuous Quality Improvement (CQI) Program** continued during the period when extended, boundary, and intermediate facilities were assessed. A comprehensive CQI report was to be published in September. This program focuses on site and instrument maintenance and site safety with the goal of improving instrument performance, site management, and data quality. **Educational outreach tours** of the central facility and talks to local groups were provided during summer 1999, and the Oklahoma Climatological Survey (our SGP outreach partner) conducted an EARTHSTORM/ ARM/Oklahoma Mesonet **workshop for Oklahoma and Kansas teachers** during July 26-27, 1999.

3. SST Scientific Support for Site Operations during the Period

a. Data quality

Mike Splitt and Chad Bahrmann continued to spend significant effort developing new **data quality metrics and graphical displays** for diagnosing the quality of SGP data streams. All SST metrics and associated graphical displays can be found on the SST's **data quality web page**:

http://www.res.sgp.arm.gov/sst/dq_monitor/DISPLAYS.html

Progress during this period included:

- Mike Splitt continued work on **SIRS** (.a0 and .a1 level) and SMOS data in support of SIRS **broadband longwave quality control development**. He will be working to create an algorithm to control the pyrgeometer data that requires only SIRS data to execute. Current algorithm approaches also require SMOS data. Temperature measurements from the pyrgeometer dome will be used. Also during the period, Chad Bahrmann added current **SIRS metrics** into the web-displayed plotting routines for **E21**.

- New metrics were automated for assessment of the **quality of the ECOR systems**. The metrics are based on regression analysis of several of the power spectra data. The spectra are expected to follow a linear relationship (e.g., 5/3 slope) on a log/log plot. Regression estimates of this slope are then used to evaluate the data quality. The ECOR mentor, Dick Hart, reviewed the metrics and provided some guidance during this period. Chad Bahrmann helped generate graphs of these new metrics for the data quality web site.

- The **EF SMOS/THWAPS Current Conditions** displays continue to be automatically updated on the web every 30 minutes. **NWS forecast offices in Kansas** continue to use these displays in a near real-time mode. These displays can be seen at http://www.res.sgp.arm.gov/sst/dq_monitor/GIFS/sgpsmos.gif.

- Work continued on generating statistics on the **long-term performance of key metrics** for each instrument platform, to be displayed on the SST data quality web site. These graphs and statistics will be developed to help assess and document the longer-term health of instrument performance.

- **Future QC algorithm development activities** could include a SIRS/GRAMS comparison, a RSS/SWS spectral radiometer comparison, and analysis of the MWR/BBSS QME.

- The SST issued and suggested **work orders** to instrument mentors and site operators in its **weekly status reports** on instruments it scrutinizes, including MWR, AERI, EBBR, ECOR, SIRS, BRS, 915 and 50 MHz RWP, SWATS, MPLHR, SMOS, SWS, THWAPS, and Central Facility thermodynamics.

- The **CQI Program** reached formal fruition during the period with the issuance of the first CQI Program annual report (September). The CQI team is made up of Chad Bahrmann (SGP SST), Dan Nelson (SGP instrumentation/facilities manager), John Schatz (SGP site

operations and safety manager), and Monte Brandner (Argonne ER Division ES&H). Findings from this first report were listed in the June-August issue of this quarterly report.

- The SST participated during the period in the evaluation of **MDN Build 2.** Mike Splitt and Chad Bahrmann also initiated discussions with the site scientists from the NSA and TWP CART sites regarding the **batch submission of DQRs** into the MDN. This has led to Chad Bahrmann's forthcoming participation in a December 22 meeting in New Jersey on this subject and other subjects germane to the site scientists regarding data quality. Mike Splitt also forwarded to the MDN group a web link to a Florida State University data quality white paper that uses an approach similar to that being used by ARM in the MDN.

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, IDPCs, 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.

SST participation in the writing of the ***Site Scientific Mission Plan*** continued (Randy Peppler), with the production of the July-December 1999 edition and the writing of the initial draft of the January-June 2000 edition. Current and past plans can be viewed at:

http://www.arm.gov/docs/sites/sgp/internal_docs.html

Specific scientific guidance activities for site operations included Chad Bahrmann modifying the **data availability program** by assisting Jim Teske in making the statistics generated from the program into a color-coded HTML document. Chad, who had moved his base of operation to the University of Oklahoma in November, began making 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 helped re-establish a number of "**quicklooks**" on the R1 system after Y2K issues were taken care of. He worked with Chris Klaus to get the MMCR quicklook operational. Chad also ported the site scientist team's data quality web site to the R1 to reduce the number of file transfers needed.

IOP support during the period included Chad Bahrmann's participation in the **International Pyrgeometer Intercomparison** in September. He provided weather forecasts, site tours for visiting scientists, and developed a web page containing quicklooks for relevant data. Quicklooks were provided for the MWR, sonde profiles, tower T/H sensors, SIRS shortwave and longwave, and surface meteorological data. Later in September, Chad provided weather forecasts for the **DIAL intercomparison**. For this campaign, he added some items to his quicklook website, including a mixing ratio profile from sonde data. In October, Chad prepared data for Rolf Philipona from the pyrgeometer campaign. Chad and Randy Peppler provided **planning support** for all IOPs during the period. **IOPs and campaigns** during the period included:

- MWR campaign (June-September)
- MCS campaign (April-September)
- International Pyrgeometer Intercomparison (September 13-18)
- DIAL/Raman Lidar Validation Intercomparison (September 23-October 22)
- Fall SCM/NBL IOP in support of CASES-99 (October 1-31)
- CLEX-5 campaign (November)

IDPC activity remained light during the period because of the focus on getting the Y2K version of the SDS system operational. Status of SGP instruments as of the end of the period was:

- **AERI** - Connor Flynn, Krista Gaustad - currently collected and processed by EC. The script to bundle raw AERI data was completed.
- **AERI-X** - Connor Flynn - not a SGP Data System instrument
- **AOS** - John Ogren, Brian Ermold - currently collected and processed by the SDS and requires no renovation.
- **ASTI** - not an ARM instrument
- **BLC** - Connor Flynn, Brian Ermold - currently collected and processed by the SDS. Due to problems with the SDS collecting directly from the BLC work is being done to modify the instrument PC collections to produce hourly files in the same format as we receive from blc_comm. This will eliminate the need to do any work on the blc_comm code since we will be using ftp_comm after the PC has been updated. This problem has been PIFed (P991110.2) and a BCR (255) was submitted.
- **BSRN** - Tom Stoffel, Krista Gaustad - currently collected and processed by the SDS and requires no renovation.
- **CSPHOT** - Rangasayi Halthore - not a SGP Data System instrument

- **CM** - Scott Richardson, Krista Gaustad - currently collected by the SDS. Scott Richardson was working with Yan Shi to define the CM data object design (DOD).

- **EBBR** - Dave Cook, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **ECOR** - Dick Hart, Krista Gaustad - currently ingested by the SDS. Collections are still done manually. Dick has decided to not invest additional resources into upgrading old communications. Dick is in the process of setting up a new Linux system. In his mind this is the highest priority. When the new system is complete (it will be several months) we will probably be able to use existing (ftp_comm) methods to collect data.

- **GRAMS** - Tim Tooman, Brian Ermold - currently collected and processed by the SDS and requires no renovation. After talking with Tim Shippert it seems that it would be best to leave the b1 processing of the GRAMS data at the EC. Tim already has the ingest for this developed and it sounds like it would be easy for him to start sending the data to the Archive.

- **IAP** (was AOS-AIR) - John Ogren, Brian Ermold - no status

- **MFR/MFRSR** - Jim Barnard, Brian Ermold - currently collected and processed by the SDS and requires no renovation. A test system has been set up to collect from a test mfrsr at 2400 Stevens and initial testing has begun. John Schmelzer will be issuing a new BCR soon.

- **MMCR** - Kevin Widener, Krista Gaustad - currently collected and processed by the SDS and requires no renovation.

- **MPL** - Connor Flynn, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **MWR** - Victor Morris, Krista Gaustad - currently collected and processed by the SDS and requires no renovation.

- **NFOV** - Jim Barnard, Brian Ermold - was collected and processed by the SDS, but the instrument was out for maintenance throughout the Y2K upgrade. Thus, the instrument requires testing/validation when it is reinstalled. The XTTY will be tested for Y2K compliance.

- **RLDR** - Tim Tooman, Laurie Gregory - Revised and re-installed the rename script to parse the dates within the log files properly. This change was required because the dates within the log files had changed slightly once the implementation of the Y2K upgrade was fully completed. Any files not processed since 9/15/99 due to this problem were renamed and processed again to be named properly. No further renovation of the IDPC is required at this time.

- **RWP** - Rich Coulter, Brian Ermold - currently collected and processed by the SDS and requires no renovation. The CF RWPs push data while the IF RWPs pull data and require use of sneakernet. Y2K issues had not been resolved by the end of this reporting period.

- **RSS** - Joe Michalsky - this is not a SDS instrument.

- **SIRS** - Tom Stoffel, Krista Gaustad - currently collected and processed by the SDS and requires no renovation. Ingest will need to be revised when DQMS is added to the system.

- **SMOS** - Dick Hart, Krista Gaustad - currently collected and processed by the SDS and requires no renovation.

- **SONDE** - Barry Lesht, Krista Gaustad - currently collected and processed by the SDS. The sonde PU (binary) data is not being shipped (via sneakernet to the SDS). PIF P990806.1 has been submitted to re-institute binary sonde data processing, which will require the SDS to re-institute its ability to bundle and ship the data to the archive. Specifically, the digicora_rename.pl and pccora_rename.pl scripts will need to be updated and tested for y2k. Procedures and equipment to perform this will also be required at the site. Digicora sample data has been obtained from the site, the update of the digicora_rename re-script is in progress.

- **SWATS** - Chad Bahrmann, Brian Ermold - currently collected and processed by the SDS. Requires IDPC renovation because of rain gauge data. A name was selected for these precipitation data - sgpswatspcp.

- **SWS** - Jeff Griffin, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **THWAPS** - Barry Lesht, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **TOWER** - Dave Cook, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **VCEIL** - Bill Porch, Brian Ermold - currently collected and processed by the SDS. The IDPC was undergoing an ingest upgrade as of the end of this period.

- **WSI** - Tim Tooman, Laurie Gregory - the SDS collects these data and the ORNL data system completes the process. Archive WSI processing (ingest + VAPs) has been put on hold while a new release package is under development at the EC. This change is being done to fix some of the problems associated with PIF P991104.1. There will be no interruption to WSI collections through the SGP SDS while these revisions are being made.

Major discussions during the period related to **instruments** included:

- Use of a University of Oklahoma **SWS "clone"** at the SGP site. This was discussed by the IRF working group and ultimately rejected because of ARM's SWS operational problems.
- **MFRSR upgrades** - to be limited to the central facility for the time being.
- New **anemometer and barometer calibration test standards** for EBBR and SMOS - adopted.
- New **SMOS tower installations** were completed during the period.

- John Braun of UCAR installed a **micronet of 20 GPS sites** within 5-km and centered upon the central facility. The installations include a standard met package at each site. This network will be used for three years in a proof-of-concept study for 3-D water vapor tomography studies. If successful, the network will become a permanent part of the SGP CART.

SGP BCRs filed during the period included:

- **SGP-00235 -** Open - Upgrade SGP WSI for Y2K Compliance - 5 - Routine - Implementing
- **SGP-00236 -** Closed - MWR software upgrade - 5 - Routine - Completed
- **SGP-00237** - Open - SWATS IDPC Upgrade for Precipitation Data - 5 - Routine - In Review
- **SGP-00238 -** Open - Okmulgee Lightning Protection Upgrade - 5 - Routine - Implementing
- **SGP-00239** - Closed - Okmulgee Tower Bird Abatement - 5 - Routine - Completed
- **SGP-00240** - Closed - Raman Lidar Dehumidifier - 5 - Routine - Completed
- **SGP-00241** - Closed - SGP/Aerosol Observing System - Inlet filter during Weekly PM - 5 - Routine - Completed
- **SGP-00242** - Open - MWR/CF upgrade - 4 - Important - Implementing
- **SGP-00243** - Open - SWATS Enclosure Relocation - 5 - Routine - Implementing
- **SGP-00244** - Open - Move SGP AERI Collections from EC to site - 4 - Important - Implementing
- **SGP-00245** - Open - Change in sgp05okmX1.a1 and sgp15okmX1.a1 data streams DOD's - 5 - Routine - Implementing
- **SGP-00246** - Closed - Change to SIRS PM procedure/reports - 5 - Routine - Completed
- **SGP-00247** - Closed - Matlab for r1 quicklooks - 5 - Routine - Completed
- **SGP-00248** - Open - Publication of new BSRN, EBBR, MMCR, and TWR quicklooks - 5 - Routine - Implementing
- **SGP-00249** - Open - EF UPS and COS Enclosure Shading Modification - 5 - Routine - Implementing
- **SGP-00250** - Closed - UVSR PM Reports - 5 - Routine Completed
- **SGP-00251** - Open - SMOS Snow Depth Sensor Operational Change - 5 - Routine - Implementing
- **SGP-00252** - Open - Install watchdog timers in all RWPs - 5 - Routine - Implementing

- **SGP-00253** - Closed - MFRSR EF 12 - 3 - Very Important - Completed
- **SGP-00254** - Closed - Cordell, OK (EF22) Relocation - 5 - Routine - Completed
- **SGP-00255** - Open - Belfort Laser Ceilometer (BLC) instrument PC - 5 - Routine - In Review

c. Instrument mentorship

Scott Richardson continued his **mentorship of the chilled mirror hygrometers**. He finished the DOD for the chilled mirrors and is working with Dick Hart to make it similar to that at the NSA. Scott is still trying to get the CM at the central facility BBSS site reliable for extended periods; so far it is not looking good. He will have the CM sent back to the manufacturer if the next check of the T/H sensor shows no problems.

Scott was also responsible for mentoring the procurement and establishment of the **temperature and relative humidity calibration chamber** now in use at the central facility. He has worked with site personnel on the use of the RH chamber. Specifically, he worked with Craig Webb on CR-10 datalogger programming, introducing him to the programming language and showing him how to write simple programs so that Site Ops can modify the data collection system without having to work through Scott every time. This is something Craig was interested in learning.

Chad Bahrmann has continued the **mentorship of the SWATS**. During the period he completed work on the SWATS web page and helped troubleshoot various problems.

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.

Mike Splitt continued work that he and Randy Peppler started last summer with a student as part of the **Research Experience for Undergraduates** Program. This extended work focused on generating averaged C1 MWR values at 1998 sounding times. This work seeks to determine **to what degree the dry bias in sondes affects severe weather convective indices**. Results of this project will be presented at the 10th ARM Science Team meeting in March 2000. Our student, Kristin Kuhlman of UNC-Asheville, will attend the meeting and help present a poster.

Mike Splitt also worked with Ric Cederwall on the effort it would take to regularly produce VAD **winds from the WSR-88D systems** located in the vicinity of the SGP CART site.

Scott Richardson's **manuscript** on minimizing errors associated with multiphase radiation shields, with three co-authors, was published in *J-Tech* in November (volume 16, number 11, pp. 1862-1872). Another manuscript, co-authored by Mike Splitt and Barry Lesht, on the

enhancement of ARM surface meteorological observations during the fall 1996 water vapor IOP, was accepted for publications in *J-Tech*.

Scott Richardson continued work with Francoise Guichard (NCAR) examining **the impact of the Vaisala radiosonde correction on radiative fluxes**. A poster will be presented at the 10th ARM Science Team meeting in March 2000.

Scott Richardson has talked with Barry Lesht about comparing **the THWAPS RH data to those from the Rotronic RH**, which is part of the CM system. Scott would like to calibrate the THWAPS RH sensor in the RH chamber because there remains a discrepancy between these two sensors.

Scott Richardson also gave a general talk about ARM while at **the Hydrometeorological Institute of Slovenia** in Ljubljana, in fall 1999.

Randy Peppler continued coordination of a case study on the **Central American smoke episode** of May 1998 from the perspective of how it was detected by instrumentation at the SGP CART site (see poster title above). Work on a manuscript to the ***Bulletin of the American Meteorological Society*** is in progress, to be submitted this winter. This manuscript has 17 co-authors from across ARM. A detailed web site has been created to help describe the event:

http://parker.gcn.ou.edu/~cimms/ARM/smoke.html

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 the period. On September 29, he gave a site tour to students from Blackwell Junior High School. This group participates in the GLOBE Program and was very interested in weather and climate. Chad helped them understand how GPS works. On October 18, Chad gave a presentation about ARM in Medford to the Oklahoma Retired Educators Association of Grant County. The next day, he gave a site tour to the Lamont Lions Club.

On October 26, Chad and Randy Peppler, along with Doug Sisterson and Site Ops personnel, gave a **presentation and site tour** to several Oklahoma state senators, a Conoco executive, and the president of Northern Oklahoma College. The state senators, led by Sen. Paul Muegge of Ponca City, are interested in being as well educated as possible about climate change and global warming issues. A return visit with the State's Director of Technology is scheduled for March 2000. Finally, in late November Chad gave a tour of the SGP site to Bernie Zack and George

Leavitt of the NSA CART site. This tour was geared toward showing George the magnitude of the operation of the SGP site.