Quarterly Report of the Southern Great Plains Site Scientist Team

For the period
December 1, 1999-February 29, 2000

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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 **December 1, 1999 through February 29, 2000.**

2. Site Activities during the Period - Executive Summary

Planned activities from the July-December 1999 edition of the *Site Scientific Mission Plan* and actual events:

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. Events partially or completely held during this period included the **CLEX-5 Campaign** (November 28-December 7), **ARESE-II** (February 21-April 15) and the **Photoaccoustic Campaign** (February 21-March 17).

Instruments. The USDA (Lee Harrison) **UV spectral radiometer** was deployed October 21 at the central facility. It was developed with funding from the USDA. John Braun of NOAA/ETL installed a 20-30-site **GPS micronetwork** for water vapor tomography studies in the immediate vicinity of the central facility. This network was in place for the 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. The Radiometrics, Inc. **microwave radiometer temperature and water vapor profiler** was deployed at the SGP CART site in the fall and will be deployed throughout 2000.

Facilities. The development of **IDP #4** as an additional guest instrument location, as well as a storage and office facility, was completed on December 31. Two new trailer systems will be added to the central facility - **the Instrument Maintenance Facility (IMF)** and the **Guest Instrument Facility (GIF)**. The IMF is a triple-wide ANL surplus trailer that will provide a 36'x66' facility to consolidate instrument parts, repairs, the electronics lab, maintenance personnel, and restrooms. It will be located just east of the Conference Trailer and south of IDP #3. The GIF is a double-wide ANL surplus trailer that will provide open space (24'x52') for guests and their instruments. It will be located just north of the Optical Trailer. These facilities should be operational in summer 2000. There is an effort to look into the redesign of the **EFCOS switches** at each of the extended facilities. Currently, the SDS calls to dataloggers at each facility to acquire data. Most of these calls are long distance and are expensive in total. The proposed change would allow local PCs to replace the loggers and place local calls to a local Internet Service Provider (ISP) to **push** the data. This format would allow for more real-time retrieval of data. Buffering capacity in the computers would allow for at least two week storage. A prototype is being developed for the Pawhuska facility using a ruggedized laptop PC. The costs of the PCs and site modifications should be recoverable in less than two years, with significant savings after that.

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 was shelved until the formation of the Data Quality Office. Build 2 of the **Meta Data Navigator** (MDN) was scheduled for release in late winter 2000. 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 was tested in fall and early winter 1999. Results of the **Continuous Quality Improvement (CQI) Program** were further examined. A comprehensive CQI report was 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. No **educational outreach tours** or **talks** were given during the period, although Bernie Zak and George Leavitt of the NSA CART site visited the first week of December to learn more about the SGP operation.

3. SST Scientific Support for Site Operations during the Period

a. Data quality

Mike Splitt and Chad Bahrmann spent considerable effort on the analysis of **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:

- **Maintenance** of current metrics programs was required in response to **Y2K issues**. No new metrics development occurred during the period.

- 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 on generating statistics on the **long-term performance of key metrics** for each instrument platform was shelved until the establishment of the Data Quality Office. These graphs and statistics will be developed to help assess and document the longer-term health of instrument performance.

- 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 SST participated in the evaluation of **MDN Build 2.** Chad Bahrmann initiated discussions with the site scientists from the NSA and TWP CART sites regarding the **batch submission of DQRs** into the MDN. This led to Chad's participation in a December 22 meeting in New Jersey on this subject and other subjects germane to the site scientists regarding data quality. From this meeting came a number of recommendations on how metadata-generated data quality flagging could be incorporated into the ARM mainstream. The NSA has led this effort with something known as the **Quality Assessment Record**.

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 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. During the period, Chad helped Jim Teske with **severe weather forecasting** issues for central and supplemental facility operations.

Chad also continued to work with Chris Klaus to re-establish "**quicklooks**" on the R1 system after Y2K issues were alleviated. He particularly worked with Chris to get the MMCR quicklook operational and produced a new sonde quicklook.

IOP support during the period included Chad Bahrmann's participation in the **ARESE-II**, which began in mid-February. He provided weather forecasts and a related weather analysis web page, site tours for visiting scientists, and developed a web page containing quicklooks for relevant data. In particular, Chad attended the ARESE-II planning meeting at Sandia on December 8-9 and was at the central facility for most of the IOP, including visits to the Ponca City and Blackwell-Tonkawa Airports and the supplemental facilities created specifically for this and the later Cloud IOP (March). Chad performed the role of onsite scientific liaison for ARESE-II and interfaced directly with Bob Ellingson on stratus forecasting issues.

Mike Splitt helped **coordinate forecast support** for both the ARESE-II and the Cloud IOP by providing assistance both to Chad Bahrmann and Karen Sonntag of the University of Utah, who was in charge of forecasting for the Cloud IOP.

Chad Bahrmann and Randy Peppler provided **planning support** for all IOPs during the period, which included:

- CLEX-5 (November 28-December 7)
- ARESE-II (February 21-April 15)
- Photoaccoustic Campaign (February 21-March 17)

IDPC activity remained somewhat 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 - the SGP began shipping data to the EC on 10 February.
- **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 - the PC program to produce hourly files is still being worked on by Connor and one of his students. Once this program is complete collection from the BLC will need to be switched from blc_comm to ftp_comm. Since the format of the raw files will not change no changes will be needed for the ingest. See SGP BCR 255 for more information.

- **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 - Yan Shi completed ingest and submitted output to Scott Richardson for review and conformation. Also trying to coordinate SGP ingest development with TWP needs. The data stream and platform names have been submitted to the naming committee for approval. Dick Hart has no objection to using the DOD that has been developed for SGP to process the NSA data. He notes that the instruments are quite different. Since the NSA chilled mirrors output serial data once every 10 minutes, no standard deviations are produced. Those fields will always be missing for the NSA instruments. The flags that are produced by the NSA instruments either are not significant to the data user or can be reproduced during ingest (i.e., min-max QC flags).

- **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 - the following is the list of additions/changes being worked on: 1) install new NIMFR instrument at the CF; 2) upgrade mfrsrC1 to 32 channels from old style 16 channel logger; 3) upgrade mfrsrE13, mfrsrC1, mfr10m, and mfr25m to use a memcard (this includes EPROM upgrade and password change); 4) add 11 channels to mfrsrE13 & mfrsrC1. As of 7 February, the SDS is ready to collect from any MFR type instrument using xtty.

- **MMCR** - Kevin Widener, Krista Gaustad - currently collected and processed by the SDS and requires no renovation. MMCR and AERI bundle scripts were consolidated into the existing bundle script used for all other instruments. Testing on devenv is ongoing.

- **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. Vic Morris indicated that there is a request to have the ir_temp variable report a value of -999 rather than -1 to indicate missing data. If approved this would

be best implemented by changing the ingest to not read the ir_temp value from the raw data file and then set it as a global variable using the 'mwr<los>_missing' tdb key.

- **NFOV** - Jim Barnard, Brian Ermold - John Schmeltzer reports that the NFOV should be redeployed in mid February.

- **RLDR** - Tim Tooman, Laurie Gregory - Additional fields will need to be added to the RL ingest within the next few months. There are currently placeholders in the raw data files which are ignored by the ingest. The instrument will be modified in the near future to fill in these placeholders with real values. The descriptions of these fields still need to be provided before changes to the ingest can occur.

- **RWP** - Rich Coulter, Brian Ermold - currently collected and processed by the SDS and requires no renovation. All Y2K issues were resolved and the collections and ingests resumed for all RWPs. Also the above mentioned core dumping problem has not been seen since the MCS Campaign so this will be left as an open issue and addressed it if it ever happens again.

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

- **SIRS** - Tom Stoffel, Krista Gaustad - currently collected and processed by the SDS. NREL is back on schedule to deliver the DD_COR and LW_QA in February and did deliver the updated DQMS code in January. The Augustyn and Co. deliverable for C versions of these algorithms is back on schedule for March.

- **SMOS** - Dick Hart, Krista Gaustad - currently collected and processed by the SDS and requires no renovation. However, the change temp and relative pressure probes to the SMOS (T/H) are no longer being supported by Campbell Scientific. Thus, once we run out of sensors, we will need to upgrade. Marv Wesely would like to submit a PIF to get this problem into the system. We might be able to do this changeout piecemeal (Jim Teske says this would be acceptable), but in addition to the cost of the probes (about $1,000 per site), there will be some requisite rewiring and reprogramming needed, which will be a fairly large task in terms of engineering effort. A site changeout may require at least a day. Changes may affect the data stream thus impacting the ingest.

- **SONDE** - Barry Lesht, Krista Gaustad - currently collected and processed by the SDS. A method was developed to collect and store the binary files from the digicora ftp_comm.pl to collect the binary files from the digicora using ftp_comm.pl. Files are being delivered to the DMF/EC via removable disks approximately once a month. This eliminated the need to write the binary files to Jazz or Zip disks. As of 8 February, however, Barry has put the task of reestablishing the collection of the binary files (PIF P990806.1) on hold until further notice.

- **SWATS** - Chad Bahrmann, Brian Ermold - currently collected and processed by the SDS and requires no renovation.

- **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. Annette Koontz was working on the vceil_ingest upgrade. When she has completed it, it will be ported to the SGP data system.

- **WSI** - Tim Tooman, Laurie Gregory - Laurie started working on scripts to add WSI and other quicklooks similar to WSI (like satellite images) to the AIA quicklook site at the EC. Also, quicklooks were set up for the WSI being used for the UAV/ARESE IOP. These IOP quicklooks were put on a web server provided at the Archive.

SGP BCRs filed during the period were:

- **SGP-00256 -** Closed - Change antenna for GPS repeater on 60Meter tower at SGP CF - 5 Routine - Completed

- **SGP-00257** - Open - EBBR CR10 E-prom upgrade- 5 Routine - Implementing

- **SGP-00258 -** Closed - Create new transfer program for RWP - 3 Very Important - Completed

- **SGP-00259 -** Closed - Inclusion of THWAPS data in TWRMR Value Added Procedure - 5 Routine - Completed

- **SGP-00260** - Open - BLC Klett lidar profiles - 5 Routine - Implementing

- **SGP-00261** - Closed - AOS ingest on dev10 is sending invalid messages to the MDS - 1 Emergency - Completed

- **SGP-00262** - Closed - SGP Clouds Page Fixes- 3 Very Important - Completed

- **SGP-00263 -** Closed - Suggest change in sounding number -5 Routine - Completed

- **SGP-00264** - Closed - ECOR ingest not handling Y2K filenames properly - 4 Important - Completed

- **SGP-00265** - Open - Replace present audio amplifiers for 50 MHz RASS - 4 Important - Implementing

- **SGP-00266** - Open - Change RWP parameters slightly to pulse code 1 (formerly 0) - 2 Critical - Implementing

- **SGP-00267 -** Closed - Replace optical dome on SGP TLCV - 5 Routine - Completed

- **SGP-00268 -** Open - ECOR bundle script - 5 Routine - Implementing

c. Instrument mentorship

Scott Richardson continued **mentorship of the chilled mirror hygrometers**. He worked with Craig Webb to have THWAPS and chilled mirror T/H sensors calibrated in the T/H calibration chamber. There has been a consistent offset between the two sensors. Neither sensor seems bad but it appears that the THWAPS T/H sensor reads too high near saturation. The calibration showed this to be true but only at high temperatures (25° C). However, the field data indicates the THWAPS and CM T/H sensors diverge most when temperatures decrease to 0° C. This is being further investigated. Scott also worked with T/H calibration chamber manufacturer and the site operations staff to perform an on-site calibration of the chamber. Scott also worked with Jim Liljegren and site operations to deploy the chilled mirrors in support of the spring IOPs and wrote and installed a new program for chilled mirror data quality parameters for the instrument located near the BBSS and monitors these parameters every 1-3 weeks. Scott also completed and submitted *Meteorological Measurement Systems* to the publisher.

Chad Bahrmann continued **mentorship of the SWATS**. During the period he met with Jeanne Schneider to finalize plans for achieving full release of SWATS data. Chad also finished the Statement of Work and budget for the SWATS mentorship.

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 on the **Research Experience for Undergraduates** project with Kristin Kuhlman and Randy Peppler assessing impact of methods for **modifying ARM soundings for the dry bias** (RH error), including preparation of a poster with Randy Peppler for the 2000 Science Team meeting. Some preliminary results include:

- Adjustments of the sonde RH percentage for the dry bias are important. The dry bias can decrease the average Convective Available Potential Energy by 50% over month long periods. This has obvious impacts for SCM applications.

- Various MWR-based adjustment methods yield similar results in terms of how the adjustment affects convective indices. These are most sensitive to low-level moisture. The MWR-based methods include the slope adjustment, the offset adjustment, and the use of Raman-lidar data (which is calibrated with the use of the MWR).

- The various MWR-based methods, though, differ in how they adjust upper level humidity data. The impact of these differences has not been assessed, but will most likely affect the results of radiative models.

- The RH correction algorithm provided by Vaisala does not produce consistent results compared to the MWR based on two small sample periods. The Vaisala correction was

much wetter than the MWR-based corrections in May 1998, and then much drier in August 1998. This warrants further investigation and caution in the use of this algorithm.

Scott Richardson worked with Barry Lesht and Francoise Guichard on a Science Team poster regarding **sonde issues**.

Scott also did work with the **Eppley PIR pyrgeometer** on the effects of dome heating and sensor ventilation. This work was done using a PIR that has a dome with three thermistors (instead of the usual one). Eppley installed this unusual dome when the dome was replaced for the OASIS Project. This was done because it is unclear if the dome has large temperature gradients across it when there is strong solar forcing. NCAR has PIR sensors with three dome thermistors but they wire the thermistors in series and get only an average temperature instead of three separate temperatures. For this experiment, Eppley installed the three thermistors so that each temperature could be measured separately. The work Scott did examined the temperature gradient across the dome and the effects of this gradient on the measured longwave flux (when the dome temperature correction is applied). In addition, the PIR sensor was ventilated on some days and not on other days to examine the effects of ventilation on the dome temperature gradient. The end result was that the temperature difference between the dome temperature sensors can approach 0.5° C and this results in a peak-to-peak difference in radiative flux of more than 10 Wm^{-2}. When the sensor is ventilated, the temperature difference decreases to about 0.25 deg. C and the resulting difference in radiative flux decreases to less than 5 Wm^{-2}. A paper will be prepared for submission to a journal after a literature review is finished.

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). A manuscript was submitted to the ***Bulletin of the American Meteorological Society*** in January. 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 **provided a tour** to Bernie Zak and George Leavitt of the NSA CART to show George the magnitude of the SGP operation. Chad also talked to Kathryn Lang of ARM regarding a request to make a **cable public access channel video** about the SGP site.