

Status, Accomplishments, and Recent Developments at the ARM Climate Research Facility Southern Great Plains Site

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Introduction

Activities at the Atmospheric Radiation Measurement (ARM) Climate Research Facility Southern Great Plains (SGP) site in April 2003 through April 2004 encompassed intensive operational periods (IOPs) and field campaigns, new and upgraded instrumentation, and site development projects. The staff at the SGP site continually strives to improve the facility and instrumentation to provide quality data and equipment for use by researchers. Improvements and additions made at the SGP site over the past several years facilitated the transition of all ARM sites to their new status as a designated national user facility, as outlined in the July 2003 announcement by the U.S. Department of Energy (DOE) Office of Biological and Environmental Research.

Thirteen IOP campaigns during the 12-month period used the newly deployed and upgraded instruments, as well as improved and expanded guest instrument facilities. Many guest scientists visited the SGP site to conduct research during the IOPs. Several instruments were upgraded and improved to make them more robust and reliable. In particular, nine new eddy correlation systems were deployed.

The IOPs and field campaigns, new and upgraded instruments, and site developments can be summarized in the following table:

Accomplishment*	Details*
IOPs and Campaigns	
<ul style="list-style-type: none"> • AIRS Validation IOP: Jul 2002–May 2003 	Used DigiCORA-III ground station at central facility to launch 90 pairs of soundings in support of AIRS validation.
<ul style="list-style-type: none"> • Cloudiness Inter-Comparison IOP: Feb 19–Apr 30, 2003 	Assessed performance of the Nephelo (Groupe Leader/France), Infrared Cloud Imager (Shaw/MSU), and Scanning Infrared Thermometer (Long/PNNL) for measuring fractional cloudiness, particularly at night.
<ul style="list-style-type: none"> • Aerosol IOP: May 5–30, 2003 	Made ground-based and airborne measurements of aerosol absorption, scattering, and extinction to characterize and evaluate routine ARM aerosol measurements.
<ul style="list-style-type: none"> • Diffuse Shortwave IOP: Oct 6–17, 2003 	Worked to develop a consensus reference standard for shortwave diffuse horizontal irradiance, which lacks an absolute reference.
<ul style="list-style-type: none"> • PGS Validation 2003 Campaign: Apr 1–Aug 31, 2003 	Compared measurements of carbon, water, and energy fluxes made by PGS system on 60-m tower with similar measurements taken with portable flux systems in fields around SGP central facility.
<ul style="list-style-type: none"> • AERI Cross-Calibration Study: Jun 9–13, 2003 	Cross-calibrated and compared Bomem-built AERI (deployed by DOE Remote Sensing Laboratory) with UW-built SGP AERI.
<ul style="list-style-type: none"> • AIRS Validation IOP: Jul 2003–Feb 2004 	Made second round of soundings to support AIRS validation.
<ul style="list-style-type: none"> • AIRS Water Vapor Experiment-Ground (AWEX-G) IOP: Oct 27–Nov 16, 2003 	Ground-based experiment; compared NOAA Frostpoint hygrometer and RS-80H, RS-90 Snow White, Sippican, and Internet radiosonde technologies with NASA/GSFC scanning Raman lidar and AIRS overpasses.
<ul style="list-style-type: none"> • Spectral Liquid Water and Ice Experiment: Oct 14–Nov 4, 2003 	Made near-infrared spectral measurements of scattered sunlight under clouds; used the data to estimate path-integrated liquid and ice water paths; compared estimates to similar values from AERI and MWR.
<ul style="list-style-type: none"> • WSI Stereoscopic Experiment: Apr–Oct 2004 	Explored stereoscopic sky imaging capabilities of WSIs.
<ul style="list-style-type: none"> • Surface Albedo IOP: Feb 9–13, 2004 	Collected surface albedo spectra for representative surface types in the SGP domain to classify surface types for aerial/satellite remote sensing.
<ul style="list-style-type: none"> • Mid-Latitude Cirrus Experiment: Apr 2004 	Used overflights of the SGP central facility by the NASA WB-57 aircraft to study cirrus clouds.
<ul style="list-style-type: none"> • Broadband Radiometer Cleaning Study: Apr 1 2003–Apr 1, 2004 	Studied effects of radiometer cleaning schedules on accuracy of SIRS broadband shortwave and longwave irradiance measurements at SGP.

New and Upgraded Instruments	
<ul style="list-style-type: none"> • Millimeter cloud radar upgrade: Hardware and software 	Installed new hardware and replaced software to resolve operational problems and improve reliability.
<ul style="list-style-type: none"> • Linux system upgrade: Extended and intermediate facilities 	Upgraded Linux-based data collection computers to enable automatic restarts following power outages.
<ul style="list-style-type: none"> • Raman lidar backup laser and cooling system installation 	Installed backup laser head and upgraded cooling system.
<ul style="list-style-type: none"> • WSI calibration system implemented 	Implemented new calibration system (developed by Marine Physical Laboratory) for more accurate and timely calibrations of all WSI instruments.
<ul style="list-style-type: none"> • 50-MHz RWP upgrade: New transmitter and LAP-XM software 	Installed new RWP transmitter; upgraded computer systems from DOS-based POP4 software to new LAP-XM Windows-based system.
<ul style="list-style-type: none"> • 915-MHz RWP: Upgrades to LAP-XM system 	Upgraded RWP computer systems from DOS-based POP4 software to new LAP-XM Windows-based system.
<ul style="list-style-type: none"> • New RSS deployment 	Deployed new RSS built by Yankee Environmental Systems; work done by SUNY-Albany.
<ul style="list-style-type: none"> • New ECOR systems at nine sites 	Deployed nine new, more robust ECOR systems to measure CO ₂ fluxes, in addition to water vapor and heat fluxes.
<ul style="list-style-type: none"> • New WSI system 	Deployed new, upgraded WSI at central facility.
<ul style="list-style-type: none"> • CO₂ flux system installation 	Installed LBNL CO ₂ eddy flux system on 60-m tower and at ground site in nearby wheat field.
<ul style="list-style-type: none"> • Second AERI deployed at optical trailer 	Modified optical trailer at central facility to accommodate second AERI system.
<ul style="list-style-type: none"> • PGS system upgrade 	Upgraded PGS filters to fixed-filter setup to alleviate connector problems, making all lines usable.
Site Developments	
<ul style="list-style-type: none"> • Seminole, OK, extended facility redeployment, May 2003 	Deployed former Seminole, OK, extended facility equipment at new site at Earlsboro, OK; Seminole removed in April 2002 after sale of land.
<ul style="list-style-type: none"> • Raman lidar vestibule addition 	Added new vestibule to entrance of Raman lidar shelter to prevent airborne dust from entering shelter when door is open.
<ul style="list-style-type: none"> • New radiometer stands at several sites 	Deployed radiometer stands of new design to eliminate leveling problem caused by shifting soil.
<ul style="list-style-type: none"> • 60-m tower inspection and repair 	Corrected problems with power and data connectors noted in routine inspections by Tower Systems, Inc.

Development*	Details*
Site Developments (cont.)	
<ul style="list-style-type: none"> • GPS time synchronization at extended facilities 	Added inexpensive GPS receivers to extended facilities to provide local time synchronization for instrumentation.
<ul style="list-style-type: none"> • Upgrades to site access roads 	Crushed rock applied to central facility access road; work done by Grant County Road Department.
<ul style="list-style-type: none"> • Data retrieval upgrade 	Upgraded data transfers to Data Management Facility from daily to hourly.
<ul style="list-style-type: none"> • Rotating bird deterrent device at Okmulgee, OK 	Installed revised version of rotating bird deterrent device to prevent roosting turkey vultures from damaging equipment.
<ul style="list-style-type: none"> • LICOR-7500 IRGA calibrations 	Trained SGP technician on calibration procedures for LICOR-7500 IRGAs, which are part of the LBNL CO ₂ eddy flux system and new ECOR systems.
<ul style="list-style-type: none"> • T/RH calibration support for TWP 	Calibrated temperature and chilled-mirror hygrometers for TWP site; SGP technicians assisted.
<ul style="list-style-type: none"> • SuomiNet collection frequency increased 	Changed data collection in support of numerical weather forecasting research at NOAA/Forecast Systems Laboratory to 30-min intervals.
<ul style="list-style-type: none"> • Staging trailer roof repair 	Repaired roof of staging trailer to eliminate leaks caused by deterioration.
<ul style="list-style-type: none"> • RWP trailer air conditioning 	Installed auxiliary air conditioner to abate overheating of RWP trailer.
<ul style="list-style-type: none"> • Storage expansion planning 	Planned for new 3,600-square foot storage building, to be located west of shipping and receiving trailer.
<p>* Notation: AERI, atmospheric emitted radiance interferometer; AIRS, atmospheric infrared sounder; CO₂, carbon dioxide; ECOR, eddy correlation; GPS, global positioning system; GSFC, Goddard Space Flight Center; IRGA, InfraRed Gas Analyzer; LBNL, Lawrence Berkeley National Laboratory; MSU, Montana State University; MWR, microwave radiometer; NASA, National Aeronautics and Space Administration; NOAA, National Oceanic and Atmospheric Administration; PGS, precision gas sampling; PNNL, Pacific Northwest National Laboratory; RSS, rotating shadowband spectroradiometer; RWP, radar wind profiler; SIRS, Solar Infrared Station; SUNY, State University of New York; T/RH, temperature and relative humidity; TWP, Tropical Western Pacific; UW, University of Wisconsin; WSI, whole-sky imager.</p>	

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