Progress Report

Period: 10/01/97-04/30/1999

Proposal NAG56464

entitled:

EOS Validation Activity in a Desert Encroachment Zone of sub-Sahel Africa

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Dear Dr. Starr:

Enclosed please find the second report on the above referenced grant entitled: **EOS validation activity in a desert encroachment zone of sub Sahel Africa**. This report will emphasize progress made since the first report was submitted. We are pleased to report that our collaborators in Africa took an important initiative to train participants from that continent in observational methodologies of radiation observations. With support of local organizations, such as the Federal Ministry of Science and Technology, Abuja, Nigeria, the Nigerian Meteorological Service, and the International Centre for Theoretical Physics, Trieste, Italy, a workshop on **College on Solar/Atmospheric Radiation: Principles, Measurement and Applications** was held at Ilorin during October-November 1998, and will be described in more detail in this communication.

We hope you will find this report informative, and I am looking forward to a follow-up meeting to provide additional details.

Sincerely,

Rachel T. Pinker
Professor

Marissa N. Davis
Contract Administrator

Table of Content

1. Summary of First Report

A major part of the equipment needed for measuring surface radiative fluxes at the sub-Sahel EOS validation site was purchased. This equipment was evaluated at the University of Maryland, and configured for deployment at the site. The major items acquired were:

Solar tracker; Pyrgeometer; Pyranometers; Data acquisition computer and a SONY Monitor; NIP; Pressure sensor; Temperature and Humidity Sensors; Solar panels. The complete list with all the specs was provided in the first report.
In addition, a CIMEL sun photometer, cost-shared with the University of Maryland, was recalibrated at GSFC in the framework of the AERONET activity (B. Holben), and filters were upgraded. On April 14, 1998, the equipment was taken to Africa and deployed at the validation site. This was a major effort since under the new configuration it is possible to collect data ten fold larger than under the previous set-up. Moreover, the working conditions in Nigeria during the last year became very difficult. The country suffered from frequent interruptions in power supply, shortage of fuel, and very slow communication channels. There was a need for sufficient lead time to ensure that all the instruments work properly at the onset of the EOS-Terra mission of mid July 1999.

2. Activity since last report

2.1 The May 1998 BSRN Workshop

The Baseline Radiation Budget Network (BSRN) Workshop that was held in Budapest, Hungary during May 18-22, 1998, was attended by the P. I. and both Co-P.Is of the project. Dr. T. O. Aro, Co-P.I. updated the Workshop Attendees on progress made at the Ilorin site. The P.I. presented a talk on the use of the ground observations for EOS validation. Travel support for the Nigerian Co-P. I. was provided by the WMO/WCRP.

During the workshop, issues related to data transfer were discussed with the World Radiation Data Center participants from Zurich, Switzerland. We plan to distribute the data via this center, in formats specified by the BSRN Science Panel. Discussions were also held with Dr. Rolph Philipona from the World Radiation Centre, Davos, Switzerland who attended the workshop, on his possible participation at a workshop that was being organized at Ilorin, and his help with evaluating the observational set-up at Ilorin, and suggestions for improvements. Indeed, Dr. Philipona's site visit was very helpful in the development of the guidelines for station operation.

2.2 Status of station between May-October 1998

Initially it was believed that battery back-ups would be sufficient to ensure smooth operation. When fuel shortages became severe, there was not always sufficient fuel supply to power the generators or battery chargers. Subsequently, solar panels were installed where possible. During the April deployment, the data loggers wereset up on the roof, due to lack of appropriate nearby safe quarters. The view of the roof in April 1998, is presented in Figure 1. Shortly after the set-up was completed, problems with the data-logger developed. According to records, the CR10 data logger (S/N 12239), had a complete break-down at the end of May 1998. The apparent problem, as traced back from the original data archive, was an inconsistency in the storage locations and the timing of the CR10 output instructions. It is not clear what was the direct cause of this problem (power supply, harsh outdoors conditions, operator mistake, or CR10 problem). The CR10 is presently back to Campbell Scientific for upgrade and evaluation. During the April-October 1998 period, a room was build under the roof of the Physics Building on the Campus of the University of Ilorin, to serve the BSRN activities (Figure 2).

The CIMEL operated well since it was installed. Data from the CIMEL instrument on aerosol optical depth, size distribution, and phase function, are being now received in real time at GSFC, since April 24, 1998. The transmission of the data is via the METEOSAT, as accommodated by Dr. D. Tanre. We have arranged with the AERONET personnel to receive daily reports on the status of this instrument, which is also sent to Ilorin. Since e-mail to Nigeria is irregular (can take two weeks, if at all), we are alerting the local team by phone, if we detect a problem (usually related to low battery voltage).

2.3 October 1998 trip

The objective was to reconfigure the set-up after the construction of the BSRN room, situated under the roof, was completed. A new data logger, to replace the faulty one was also brought, and a wind sensor was added. The data logger and the computer dedicated to this project were set-up in this room. The equipment taken to Ilorin during this trip:

1. *wind sensor, Campbell Scientific, S/N WM3299, UMD Tag No. 106705*

2. *CR10 data logger, Campbell Scientific, S/N 002179*

3. *digital multi-meter, Keithley S/N 20461*

4. *miscellaneous items: 2 charge regulators; 2 solar panels; 4-way serial port switch; 3 port converters; soldering set; electronic parts and tools; miscell hardware; 4 UPS replacement batteries; 2 transmitter back-up batteries. At the completion of the set-up, the details of the BSRN room, top view of the CR10*

compartment, and the wiring details of the CR10 data logger, are described in Figures 3-5.

2.4 Participation in Ilorin training workshop

After a two year relentless effort, Professor T. O. Aro, under the sponsorship of the University of Ilorin, local government agencies, and the International Centre for Theoretical Physics (ICTP), Trieste, Italy, organized an International Training Workshop entitled: "College on solar/Atmospheric Radiation: Principles, Measurements and Applications". The workshop was held on the Campus of the University of Ilorin, during 26 October-6 November, 1998. Under the support from ICTP, Dr. Rolph Philipona as well as Dr. F. Miskolczi were sponsored to attend the workshop and present talks. About 50 people participated and the activity was quite successful. It brought visibility to the EOS project to local authorities, in particular, the Nigerian Weather Service, located in Lagos. We hope, that as a consequence, we would be able to pursue further cooperation with the service, so that additional meteorological information could be added to the Ilorin observations. This dialogue is in the early stages of development.

2.5 Training of local scientist

The success of this project strongly depends on local personnel, that attends the instruments on a daily basis.
We foresee a need to help in training. Our tentative plan is to bring periodically one person for training. Presently, the University of Ilorin has committed three people to this project. Dr. T. O. Aro serves as the Station Scientist; Professor C. Akoshile, the Chair of the Department of Physics, serves as Station Manager; J. Kayode and T. Israel are the station technicians who oversee the continuous operation of the station, including week-ends. Dr. Alex Willoughby, a recent Ph.D. in physics is to help in the preliminary data quality check, and augmenting the data base with additional information on environmental conditions, such as biomass burning.
Dr. Willoughby, under joint sponsorship of this project and WCRP, came to the University of Maryland in September 1998 for a two months training in data handling. Upon his return to Ilorin, Dr. Willoughby took along: 2 battery chargers; a 12 Ah lead acid battery (spare for the CIMEL transmitter); 20 m serial cable for the solar tracker, for connecting to computer; diskettes; scientific calculators, etc.).

3. Purchase of new equipment

There is a need to have information on UV radiation and ozone at this location. We conducted a search, to identify the most suitable UV instruments for this site. Discussion were held with Drs. DeLuisi, Dutton, Long, and Dr. McKanzie from New Zealand who did a thorough evaluation of UV instruments. The consensus was to get the Yankee Environmental Systems, Inc. UVB pyranometer. For

ozone, the recommendations were for the Solar Light Microtops Ozonemeter (discussions were held with B. Holben, L. Remer, J. Herman). The instruments were ordered and during the next trip to Ilorin, will be installed.

4. Plans for next site visit

We are planning to visit the site at the beginning of July, 1999, prior to the launch of Terra. First, the following tasks have to be completed:

1. Calibration of “old” instruments. The pyranometers and pyrgeometer at the site were replaced with recently calibrated instruments. Those that were at the site, have been sent for recalibration to Dr. E. Dutton. On the next trip, we plan to switch the instruments at the site with the newly calibratedones, and repeat the calibration. The calibration is needed also for the interpretation of the data that were collected with these instruments.

2. Need to evaluate the new equipment before taking it to the site.

3. Need to have another data logger for following reasons:

    a. as is, all channels are taken

    b. in case of data logger failure, having two independent loggers will minimize the risk of data loss.

4. Need to obtain invitations from the Vice Chancellor of the University to apply for a visa; vaccinations; coordination with local scientist of schedule.

5. Need to have a spare, calibrated head of the CIMEL instrument for exchange with the one at the site. Preparations are in progress with the AERONET group.

5. Connections with EOS Instrument Teams

We are in discussions with various members of the EOS validation teams, in particular, for CERES and MODIS, to coordinate activity and explore the possibility of “borrowing” a lidar for deployment during the peak of the Harmattan season, to obtain vertical profiles of the dust distribution.

6. Planned Activities and schedule

As yet, we have not developed a Web site describing this activity. We hope to do so in the near future. We plan to visit the site during July, 1999, update and service the station, and provide on site training. We also plan to hold several meetings

with University of Ilorin administration and the Nigerian Meteorological Service, to expand the local infra-structure of activity.

7. Miscellaneous information

Several scientists are already using the data from Ilorin.