

THE SCHWERDTFEGER LIBRARY
1225 W. Dayton Street
Madison, WI 53706

FINAL REPORT

University of Wisconsin - Madison SSEC/CIMSS
Sub-contract
from the
University of Maryland Baltimore County

Validation of MOPITT Column and Profile CO from Spaceborne, Airborne, and Ground-based Interferometers

NRA-97-MTPE-03

31 March 2002
Co-I: Robert Knuteson
Co - I: Wayne Feltz

The University of Wisconsin - Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS) has accomplished the following tasks as outlined in the subcontract to the Physics Department and the Joint Center for Earth Systems Technology at the University of Maryland Baltimore County for Validation of MOPITT Column and Profile CO from Spaceborne, Airborne, and Ground-based Interferometers (EOS NRA-97-MTPE-03):

- 1) Delivery of AERI radiances from all field campaigns following launch of the MOPITT
- 2) Delivery of the AERI retrieval algorithm with auxiliary software (including some software support) to allow temperature and moisture retrieval automation for the Baltimore Bomem AERI system
- 3) Ancillary UW AERI - BBAERI calibration intercomparisons at the University of Wisconsin - Madison and UMBC
- 4) Deployment at the Park Falls, Wisconsin WLEF tower (in situ Carbon Monoxide validation measurements are available from tower) with the University of Wisconsin - Madison SSEC AERIBAGO to collect radiances during MOPITT overpasses from May 23-25, 2000
- 5) Delivery of a complete S-HIS dataset of calibrated radiances from the SAFARI experiment in Southern Africa.

CIMSS/SSEC University of Wisconsin - Madison has successfully accomplished the above tasks within the budgetary and contractual constraints (\$33,000 total with an end date of March 11, 2002).

CIMSS/SSEC has participated in several field campaigns (Table 1) with the AERI system after the launch of the MOPITT instrument:

Field Experiment	Date/Location	Data
Pre-Move Experiment at DOE ARM SGP site	March 1999 / Lamont, Oklahoma	AERI retrievals/radiances
SGP ARM (including WVIOP 2000 and AFWEX)	July 1999 – current / Oklahoma/Kansas	Near real-time AERI retrievals/radiances for all SGP ARM systems
CLAMS	July 10 - August 2, 2001, Wallops Island, VA	AERI radiances and retrievals, surface met, GOES retrievals
Park Falls, WI Tower	May 23-25, 2000, Park Falls, Wisconsin	AERI radiances and retrievals; surface met, GOES retrievals, satellite imagery, ceilometer data

Table 1: AERI CO MOPITT Validation Field Experiment Data Sets

The data sets in table 1 have been delivered via internet or CD-ROM media for CO analysis by UMBC. Some upkeep for producing near real-time AERI temperature and moisture retrievals from the SGP ARM site was to allow near

real-time CO retrievals to be produced at UMBC for this sub-contract. AERI temperature and water vapor retrievals were calculated for the Park Falls, WI and CLAMS deployment specifically for CO MOPITT validation.

The AERI temperature and retrieval algorithm (aeriplus) along with supplemental processing software (fsl2ncdf, dmvtocdf, cdftobrf_50, etc) have been delivered to UMBC. Although never specifically a deliverable in the subcontract, this software was contributed to the UMBC CO MOPITT validation effort to allow retrievals to be performed with the new BB-AERI instrument acquired at UMBC. Significant software support under this contract was given by the University of Wisconsin - Madison SSEC/CIMSS for this effort.

The SSEC/CIMSS AERI and UMBC AERI systems were compared at the University of Wisconsin to provide confidence in calibration stability. The first intercomparison occurred in October 1999. Retrievals were performed on both AERI systems and analyzed for consistency. The data was delivered to UMBC for analysis. A second UMBC BBAERI radiance comparison was performed at UMBC with the UW AERI-00 within a Winnebago after the CLAMS deployment in August 2001. Both the retrieval and radiance analyses provided confidence in robustness of the IR spectral calibration for temperature, moisture and CO retrieval.

The University of Wisconsin - Madison SSEC/CIMSS deployed a Winnebago containing an AERI (Figure 1), ceilometer, surface station, and radiosonde launch unit at the Park Falls WLEF tower in northern Wisconsin to provide a MOPITT CO validation data set in the upper Midwest. The WLEF tower has several in-situ CO instruments installed permanently on its mast providing in situ profile validation. The UW Winnebago operated from May 23-25, 2000 during several MOPITT overpasses. AERI temperature and moisture retrievals were processed for this time period. A data set containing AERI radiances/retrieval, surface data, RUC-2 profiles, ceilometer cloud bases, and satellite imagery were provided to UMBC for CO retrieval calculations and MOPITT validation.



Figure 1. The AERIBAGO at the Park Falls Tower deployment.

The CIMSS/SSEC Scanning-HIS instrument participated in the SAFARI 2000 experiment during August and September 2000. The Scanning-HIS instrument flew on board the NASA ER-2 during several flights that were coincident with overflights of the TERRA spacecraft containing the MOPITT instrument. Table 2 contains the calibrated radiances from these flights that were made available to UMBC for use in MOPITT carbon monoxide validation.

Flight Date	Objective	Data Sets provided
August 24, 2000	Inhaca Island/Mozambique	S-HIS calibrated radiances
August 27, 2000	Okavanga Delta	S-HIS calibrated radiances
September 1, 2000	Zambia	S-HIS calibrated radiances
September 6, 2000	Mongu Tower, Zambia	S-HIS calibrated radiances, CO calculation
September 7, 2000	Timbivati, SA controlled fire	S-HIS calibrated radiances, CO calculation
September 11, 2000	Namibian coast	S-HIS calibrated radiances
September 13, 2000	Namibian coast	S-HIS calibrated radiances
September 17, 2000	Zambia	S-HIS calibrated radiances
September 21, 2000	Offshore Mozambique	S-HIS calibrated radiances
September 23, 2000	Skukuza Ground Station in Kruger Park	S-HIS calibrated radiances

Table 2: S-HIS CO MOPITT Validation Data Sets from SAFARI 2000 field experiment.

The data sets in table 2 have been delivered via internet or CD-ROM media for CO analysis by UMBC.

Estimated carbon monoxide total column optical depths were calculated for the 6 Sep 2000 and 7 Sep 2000 cases. The carbon monoxide datasets were provided to UMBC for use in validation. Figure 2 includes sample carbon monoxide effective optical depth results for 6 September 2000 (top) and 7 September 2000 (bottom). Elevated carbon monoxide levels can be seen in the 7 September data coincident with three overflights of the controlled fire near Timbivati, SA. In addition, the background level carbon monoxide effective optical depth for 6 September is noticeably higher than that of 7 September. This result is

consistent with 6 September's flight path being over a region of elevated aerosols, referred to as the "river of smoke."

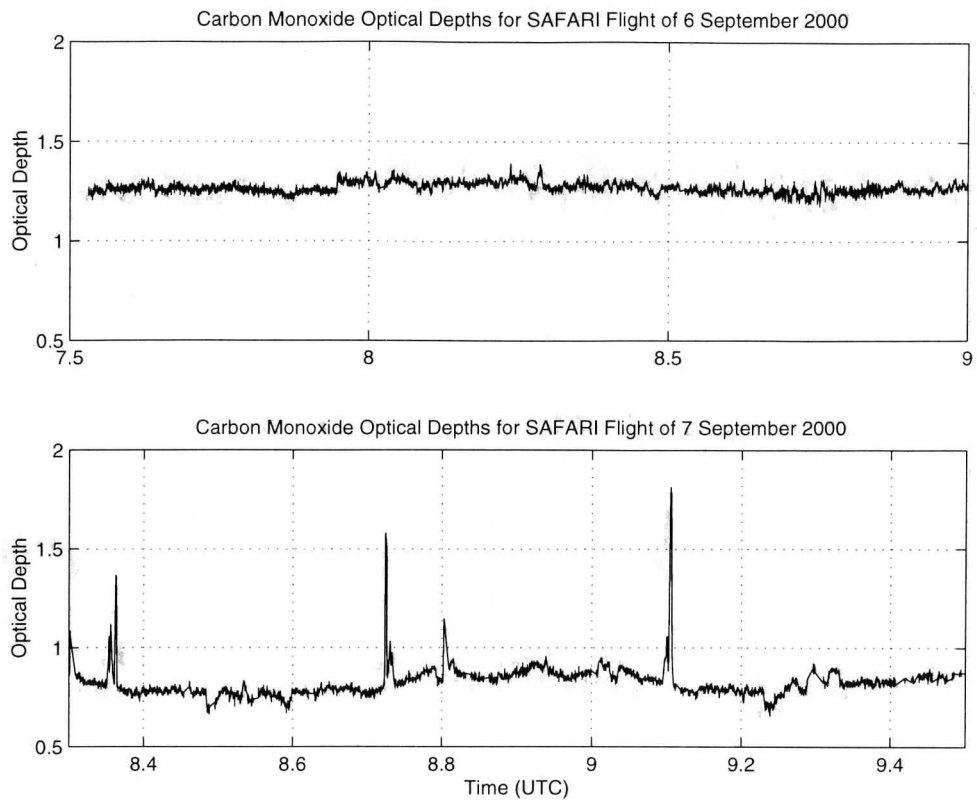


Figure 2. Carbon monoxide effective optical depth derived using the UW online/offline technique.