

**Airborne Sunphotometry in the SAFARI 2000 Dry Season Campaign**  
**Report for the SAFARI 2000 Workshop held May 30-31, 2001**  
**at Goddard Space Flight Center, Greenbelt, MD**

Philip B. Russell<sup>1</sup>, Beat Schmid<sup>2</sup> and Jens Redemann<sup>2</sup>

<sup>1</sup>NASA Ames Research Center, Moffett Field, CA

<sup>2</sup>Bay Area Environmental Research Institute, San Francisco, CA

May 22, 2001

As requested by the meeting guidelines, this report gives a 2-page summary with representative figures outlining progress in analyzing our measurements from the 2000 campaign(s), a schedule for completing our analyses, suggestions/desires for collaboration with other researchers on scientific papers to report results, and a list of submitted abstracts or titles of research through the next 6-8 months.

**Measurements and analyses, 2000 Dry Season Campaign.** We participated in the 2000 Dry Season Campaign from August 13 to September 25 by making measurements with the 14-channel NASA Ames Airborne Tracking Sunphotometer (AATS-14) aboard the University of Washington CV-580 during 24 data flights based at Pietersburg, South Africa; Kasane, Botswana; and Walvis Bay, Namibia. AATS-14 measures the transmission of the direct solar beam at 14 discrete wavelengths (350-1558 nm) from which we derive spectral aerosol optical depths (AOD) and columnar water vapor (CWV). Flying at different altitudes over a fixed location allows derivation of layer AOD and CWV. Data taken during feasible vertical profiles allows derivation of aerosol extinction and water vapor density. Measurements are summarized in the table at <http://geo.arc.nasa.gov/sgg/SAFARI/> (see also excerpt on p.2).

Examples of AATS-14 data are shown in Figures 1 and 2. Figure 1 shows an AOD profile at 12 wavelengths flown on September 6, 2000 near Mongu, Zambia. The AOD values measured during this profile rank among the highest encountered by the CV-580 during SAFARI-2000. Note that at the top altitude of 4.8 km (geometric altitude) the AOD at 500 nm is still 0.17. Also shown in Figure 1 is the corresponding aerosol extinction profile derived by differentiating smoothed spline fits to the optical depth profiles. Although the extinctions are high throughout, the profile seems to suggest a three-layer structure. At all altitudes, the AOD is strongly dependent on wavelength: an indication of the presence of smaller particles, presumably smoke.

Figure 2 shows the corresponding CWV and derived water vapor density profile. Above 3 km the water vapor density and the AODs are correlated. At the present stage of the analyses, we are unable to tell if this is caused by advection of airmasses or by hygroscopic growth of the aerosols.

**Schedule for completing analyses**

- AATS-14 data reduction to AOD( $\lambda$ ), Column H<sub>2</sub>O: First release for all flights: Sep 2001; Final version: Sep 2002.
- Journal publications submitted, including collaborative analyses: according to SAFARI publication schedule

**Suggestions/desires for collaboration with other researchers on papers to report results**

P. Pilewskie et al. (SSFR solar spectral forcing as a function of aerosol thickness); P. Hobbs et al. (CV-580 in situ comparisons); B. Holben et al. (AERONET comparisons); J. Welton et al. (MPL comparisons and derivation of complex refractive index); M. McGill, J. Spinhirne et al. (ER-2 lidar comparisons and joint analyses); L. Remer et al. (MODIS comparisons); J. Herman, O. Torres et al. (TOMS comparisons); C. Bruegge, R. Kahn (MISR, AirMISR comparisons); S. Platnick (MAS, dust outbreak over coastal stratus); R. Bruintjes (Aerocommander, CV-580 in situ comparisons). [Underlining indicates collaboration already in progress.]

**List of submitted abstracts or titles of research through the next 6-8 months.**

Schmid, B., P. B. Russell, P. Pilewskie, J. Redemann, J. M. Livingston, P. V. Hobbs, E. J. Welton, J. Campbell, B. N. Holben, M. McGill, J. Spinhirne, Airborne sunphotometry and closure studies in SAFARI-2000 dry season campaign, Accepted for presentation, 8<sup>th</sup> Scientific Assembly of IAMAS, Innsbruck, Austria, 10-18 July, 2001.

Schmid, B. et al., [title and coauthors similar to above], Abstract to be submitted (by 15 June 2001 deadline) to Safari 2000 Science Symposium, Siavonga, Zambia, 28-31 August, 2001.

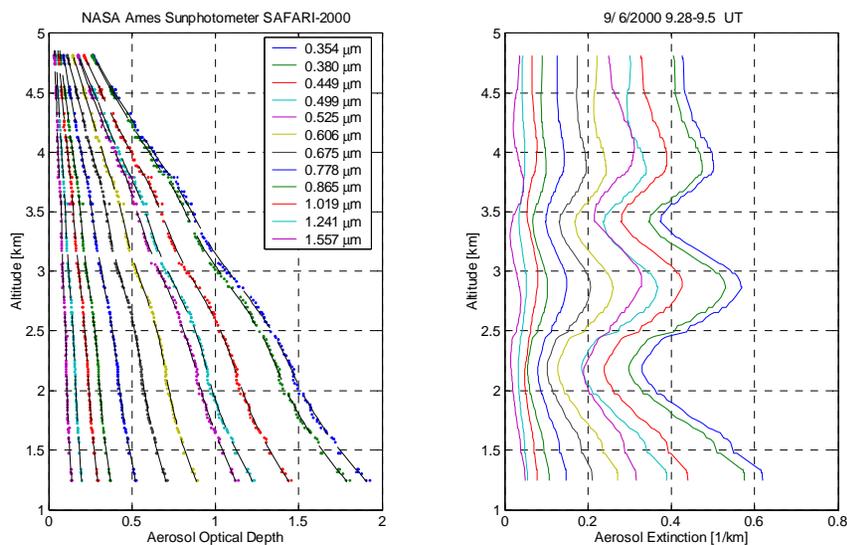
Related papers will be submitted to:

- 4<sup>th</sup> Global Aerosol Climatology Program (GACP) Science Team Meeting, Ann Arbor, MI, 24-26 Oct 2001
- EOS Inter-Disciplinary Science (EOS-IDS) Team Meeting, early November 2001
- Fall AGU Meeting, San Francisco, CA, 10-14 December 2001

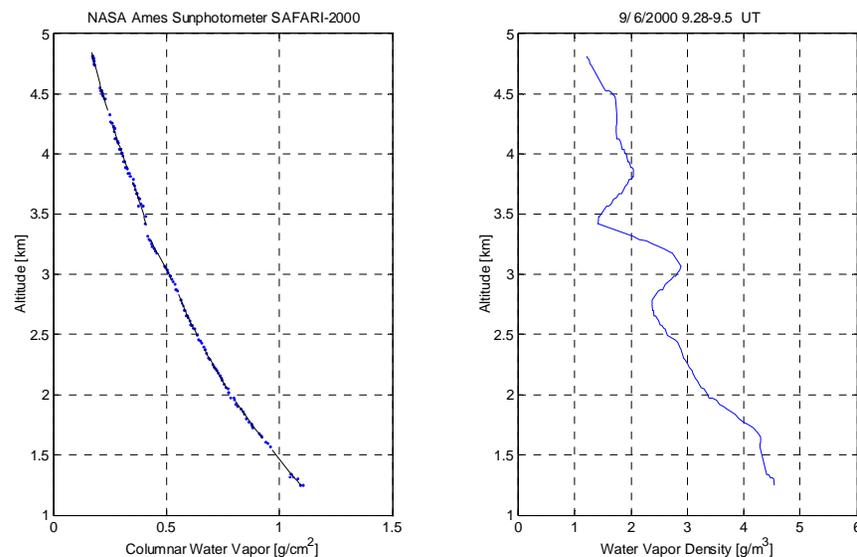
### Ames Airborne Tracking Sunphotometer (AATS-14) Operations aboard the UW CV-580 during SAFARI-2000

(Excerpt shown as example. Full table, describing 24 flights, is at <http://geo.arc.nasa.gov/ssg/SAFARI/>)

Date (2000)	Flt#	Engine On/Off <sup>1)</sup>	AATS-14 Unpark/Park	Operator	Raw Data File	Location	General comments	Notes
6-Sep	1832	7:00 10:58	7:07 10:56	Schmid	R06Sep00.AB	Kasane, Botswana to about 20 miles north of Mongu, Zambia. Return to Kasane.	Good measurements throughout. Very high AODs. Golden Day. Low-level run (500 ft agl) Senanga to Mongu. 100ft run north of Mongu. BRDF measurements over Mongu Tower. ER-2 overhead. 2 vertical profiles over Mongu Lidar, Climb to 17000 ft msl on leaving Mongu airport and still in haze layer!	AATS-14 window cleaned. Was not dirty. Nav data after 7:14
Notes:		1) All times are in UTC		2) All AODs are stated at 500 nm				



**Figure 1:** Left panel: Aerosol optical depth profiles calculated from AATS-14 measurements (13 wavelengths shown) acquired during an aircraft ascent near Mongu, Zambia. Right panel: Corresponding aerosol extinction profiles derived by differentiating spline fits (dashed lines in left panel) to the optical depth profiles



**Figure 2:** Columnar water vapor and water vapor density profile retrieved during same ascent as shown in Figure 1.