# Atmospheric Chemistry and Physics

An Interactive Open Access Journal of the European Geosciences Union

| Copernicus.org | EGU.eu |

| EGU Journals | Contact

## Home

## Online Library ACP

- Recent Final Revised Papers
- Volumes and Issues
- Special Issues
- Library Search
- Title and Author Search

Online Library ACPD

Alerts & RSS Feeds

**General Information** 

Submission

Review

Production

Subscription

## Comment on a Paper



ISI indexed



■ Volumes and Issues ■ Contents of Issue 5 ■ Special Issue

Atmos. Chem. Phys., 5, 1311-1339, 2005 www.atmos-chem-phys.net/5/1311/2005/
© Author(s) 2005. This work is licensed under a Creative Commons License.

Aerosol optical depth measurements by airborne sun photometer in SOLVE II: Comparisons to SAGE III, POAM III and airborne spectrometer measurements

- P. Russell<sup>1</sup>, J. Livingston<sup>2</sup>, B. Schmid<sup>3</sup>, J. Eilers<sup>1</sup>, R. Kolyer<sup>1</sup>,
- J. Redemann<sup>3</sup>, S. Ramirez<sup>3</sup>, J.-H. Yee<sup>4</sup>, W. Swartz<sup>4</sup>, R. Shetter<sup>5</sup>,
- C. Trepte<sup>6</sup>, A. Risley Jr. <sup>7</sup>, B. Wenny <sup>7</sup>, J. Zawodny <sup>6</sup>, W. Chu <sup>6</sup>, M. Pitts <sup>6</sup>,
- J. Lumpe<sup>8</sup>, M. Fromm<sup>9</sup>, C. Randall<sup>10</sup>, K. Hoppel<sup>9</sup>, and R. Bevilacqua<sup>9</sup>
- <sup>1</sup>NASA Ames Research Center, MS 245-5, Moffett Field, CA 94035-1000, USA
- <sup>2</sup>SRI International, Menlo Park, CA 94025, USA
- <sup>3</sup>Bay Area Environmental Research Institute, Sonoma, CA 95476, USA
- <sup>4</sup>Applied Physics Laboratory, Johns Hopkins University, Laurel, MD 20723-6099, USA
- <sup>5</sup>National Center for Atmospheric Research, Boulder, CO 80307-3000, USA
- <sup>6</sup>NASA Langley Research Center, Hampton, VA 23681-2199, USA
- <sup>7</sup>SAIC, NASA Langley Research Center, Hampton, VA 23681-0001, USA
- <sup>8</sup>Computational Physics, Inc., Springfield, VA 22151, USA
- <sup>9</sup>Naval Research Laboratory, Washington, DC 20375-5351, USA76, USA
- <sup>10</sup>Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO 80309-0392, USA

Abstract. The 14-channel NASA Ames Airborne Tracking Sunphotometer (AATS-14) measured solar- beam transmission on the NASA DC-8 during the second SAGE III Ozone Loss and Validation Experiment (SOLVE II). This paper presents AATS-14 results for multiwavelength aerosol optical depth (AOD), including comparisons to results from two satellite sensors and another DC-8 instrument, namely the Stratospheric Aerosol and Gas Experiment III (SAGE III), the Polar Ozone and Aerosol Measurement III (POAM III) and the Direct-beam Irradiance Airborne Spectrometer (DIAS). AATS-14 provides aerosol results at 13 wavelengths  $\lambda$  spanning the range of SAGE III and POAM III aerosol wavelengths. Because most AATS measurements were made at solar zenith angles (SZA) near 90°, retrieved AODs are strongly affected by uncertainties in the relative optical airmass of the aerosols and other constituents along the line of sight (LOS) between instrument and sun. To reduce dependence of the AATS-satellite comparisons on airmass, we perform the comparisons in LOS transmission and LOS optical thickness (OT) as well as in vertical OT (i.e., optical depth, OD). We also use a new airmass algorithm that validates the algorithm we previously used to within 2% for SZA<90°, and in addition provides results for SZA≥90°.

For 6 DC-8 flights, 19 January-2 February 2003, AATS and DIAS results for LOS aerosol OT at  $\lambda$ =400nm agree to  $\leq$ 12% of the AATS value. Mean and root-mean-square (RMS) differences, (DIAS-AATS)/AATS, are -2.3% and 7.7%, respectively. For DC-8 altitudes, AATS-satellite comparisons are possible only for  $\lambda$ >440nm, because of signal depletion for shorter  $\lambda$  on the satellite full-limb LOS. For the 4 AATS-SAGE and 4 AATS-POAM near-coincidences conducted 19-31 January 2003, AATS-satellite *AOD* differences were  $\leq$ 0.0041 for all  $\lambda$ >440nm, RMS differences were  $\leq$ 0.0022 for SAGE-



## Search ACP

Library Search
Author Search

## Maws

- Sister Journals AMT & GMD
- Financial Support for Authors
- Journal Impact Factor
- Public Relations & Background Information

# Recent Papers

01 | ACPD, 10 Feb 2009: Validation of urban NO<sub>2</sub> concentrations and their diurnal and seasonal variations observed from space (SCIAMACHY and OMI sensors) using in situ measurements in Israeli cities

02 | ACPD, 10 Feb 2009: Long-term study of VOCs measured with PTR-MS at a rural site in New Hampshire with urban influences

03 | ACPD, 09 Feb 2009: Validation of conventional Lagrangian stochastic AATS and  $\leq 0.0026$  for POAM-AATS. RMS relative differences in AOD ([SAGE-AATS]/AATS) were  $\leq 33\%$  for  $\lambda < \sim 755$ nm, but grew to 59% for 1020nm and 66% at 1545nm. For  $\lambda > \sim 755$ nm, AATS-POAM differences were less than AATS-SAGE differences, and RMS relative differences in AOD ([AATS-POAM]/AATS) were  $\leq 31\%$  for all  $\lambda$  between 440 and 1020nm. Unexplained differences that remain are associated with transmission differences, rather than differences in gas subtraction or conversion from LOS to vertical quantities. The very small stratospheric AOD values that occurred during SOLVE II added to the challenge of the comparisons, but do not explain all the differences.

■ Final Revised Paper (PDF, 4498 KB) ■ Discussion Paper (ACPD)

Citation: Russell, P., Livingston, J., Schmid, B., Eilers, J., Kolyer, R., Redemann, J., Ramirez, S., Yee, J.-H., Swartz, W., Shetter, R., Trepte, C., Risley Jr., A., Wenny, B., Zawodny, J., Chu, W., Pitts, M., Lumpe, J., Fromm, M., Randall, C., Hoppel, K., and Bevilacqua, R.: Aerosol optical depth measurements by airborne sun photometer in SOLVE II: Comparisons to SAGE III, POAM III and airborne spectrometer measurements, Atmos. Chem. Phys., 5, 1311-1339, 2005. Bibtex FindNote Reference Manager