FORM A: GACP ACCOMPLISHMENT REPORT

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TITLE:

SAM II, SAGE I, SAGE II, and Ground-Based Lidar Aerosol Data

ABSTRACT:

Aerosol data will be made available to the team from solar occultation spaceborne instruments and a ground-based lidar system operated by the Radiation and Aerosols Branch (RAB) at NASA Langley Research Center. These data include the following: (1) Aerosol extinction profiles (1-km vertical resolution) at a wavelength of 1.0 micron from SAM II (Stratospheric Aerosol Measurement II), which operated from 1978-1993 onboard Nimbus 7. Measurement latitudes varied from about 65 deg (N and S) at the solstices to about 80 deg (N and S) at the equinoxes. (2) Aerosol extinction profiles at a wavelength of 1.0 micron from SAGE I (Stratospheric Aerosol and Gas Experiment I), which operated from 1979-1981 onboard the Applications Explorer Mission B spacecraft. Measurement latitudes ranged from about 80 deg S to 80 deg N during each month. (3) Aerosol extinction profiles at wavelengths of 1.02, 0.525, 0.453, and 0.385 micron from SAGE II (Stratospheric Aerosol and Gas Experiment II), which has been operating from 1984 to the present onboard the Earth Radiation Budget Satellite. Measurement latitudes range from about 80 deg S to 80 deg N during each month. (4) Aerosol backscatter profiles and integrated backscatter at a wavelength of 0.6943 micron collected on a continuing basis since 1974 using a ground-based lidar system at Langley (37 deg N, 76 deg W).

GOALS:

Facilitate the use of aerosol data from the SAM II, SAGE I and SAGE II satellite instruments and the LaRC ground-based lidar in the Global Aerosol Climatology Project (GCAP).

TASKS COMPLETED:

1. Under the joint auspices of the Atmospheric Chemistry and Modeling Analysis Program and GACP, a composite aerosol climatology was constructed using SAGE II 1.02 micron aerosol extinction measurements for the period 1985-1991 and 1993-

1997. These data were filtered for clouds using SAGE II measurements at wavelengths of 0.525 and 1.02 micron following the technique described by Kent et al., 1995, accumulated in 1 km altitude intervals from 6.5 km to 25.5 km, and averaged by month. Data from 1991-1992 were excluded because the presence of aerosols from the eruption of Mt. Pinatubo made the removal of cloud-contaminated events problematical.

2. Hemispheric maps of the SAGE II aerosol climatology were produced for altitudes between 6.5 and 25.5 km at 1-km intervals.
3. A World Wide Web site was prepared that provides a brief summary of the stratospheric and upper tropospheric aerosol climatology derived from SAGE II data measurements (http://www-arb.larc.nasa.gov/sage2/data/).
4. An investigation was initiated to examine the impact of recent changes to the SAGE II aerosol retrieval algorithm (version 6.0). This new version includes modifications to the procedure for constructing transmission profiles from the instrument measurements and changes to the ozone and aerosol retrieval algorithm in the lower stratosphere and troposphere. Modifications to the SAGE I aerosol retrieval algorithm are also taking place and will also require future investigation

FUTURE PLANS:

1. Submit a manuscript for review to the Journal of Geophysical Research on the seasonal variation and geographical distribution of aerosols in the upper troposphere deduced from SAGE II observations.
2. Continue investigation on the effects of changes to the aerosol extinction retrieval algorithm for SAGE I and II.
3. Update the SAGE II aerosol climatology with 1999 observations and extend the trend analysis of upper tropospheric and stratospheric aerosol as reported by Kent et al., *J. Geophys. Res., 103, 1998.*

SIGNIFICANT HIGHLIGHTS:

The Stratospheric Aerosol and Gas Experiment (SAGE) II satellite experiment provides one of the longest aerosol records (1984-present) available to develop an aerosol extinction climatology of the upper troposphere and lower stratosphere. In the upper troposphere, aerosol extinction values are typically much lower than found near the Earth's surface, and consequently, contribute modestly to a direct radiative forcing of the Earth's climate by scattering and absorbing solar and terrestrial radiation. Upper tropospheric aerosols, however, may impose an indirect radiative forcing on the Earth-atmosphere through the modification of cloud properties and processes. This latter effect is not well quantified, but is of considerable potential significance in the upper troposphere where aerosols have lifetimes of a few weeks.

Figure 1 shows the geographic distribution of the upper tropospheric aerosol constructed from the SAGE II aerosol climatology for the months of January, April, June, and October. All plots are for an altitude of 6.5 km. This series of maps reveal that on average

more aerosol is found in the Northern Hemisphere than the Southern Hemisphere, which is believed to be the result of greater land area and a greater number of anthropogenic sources north of the equator. Each hemisphere shows a springtime aerosol enhancement for latitudes greater than 20°. The enhancement is linked to the long-range transport of aerosols produced from the burning of biomass over South America and Africa. In the Northern Hemisphere, the rise in extinction in spring is more pronounced and biased towards high latitudes. Meridional variations are more significant than zonal variations and extinction values decrease with altitude (not shown). The overall springtime enhancement in the Northern Hemisphere is probably due to a combination of the lofting of dust over the Asian deserts, the upward pumping and transformation of industrial effluents, and the downward flux of stratospheric aerosol.

(Postscript File for Figure 1 can be found at the anonymous ftp site:
ftp-arb.larc.nasa.gov
cd /pub/chip/GACP
get gcap_report.eps)

FORM D: GACP BIBLIOGRAPHY

Name:
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BIBLIOGRAPHY:

a. List of publications

b. List of printed technical reports and non-refereed papers.

c. List of presentations

C. Trepte, G. Kent, and P. Lucker: SAGE II Upper Tropospheric Aerosol Climatology, presented at the American Meteorological Society 10th Atmospheric Radiation Conference, Madison, WI, June 28-July 2, 1999.