TITLE: AEROSOL IN THE PACIFIC TROPOSPHERE

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Overview

The objective of our research in support of the NASA/GLOBE program emphasizes the use of near real-time optical techniques for the measurement of mid-tropospheric aerosol over the Central Pacific. The primary focus is on measurement of the aerosol size distribution over the range of particle diameters from 0.15 to 5.0 μm that are essential for modeling CO_2 backscatter values in support of the LAWS program.

The measurement system employs a LAS-X (Laser Aerosol Spectrometer-PMS, Boulder CO.) with a custom 256 channel pulse height analyzer and software for detailed measurement and analysis of aerosol size distributions. A thermal preheater system (Thermo Optic Aerosol Descriminator-TOAD) conditions the aerosol in a manner that allows the descrimination of the size distribution of individual aerosol components such as sulfuric acid, sulfates and refractory species (soot, salt or dust). This allows assessment of the relative contribution of each component to the BCO_2 signal. This is necessary since the different components have different sources, exhibit independent variability and provide different BCO_2 signals for a given mass and particle size. Our field activities involve experiments designed to examine both temporal and spatial variability of these aerosol components from ground based and aircraft platforms.

Significant Accomplishments During the Past Year

1) The LAS-X TOAD system was configured for deployment at Mauna Loa Observatory (MLO) and operated during the springtime transition from a relatively "clean" period of "background" aerosol to one displaying the characteristic transport of dust from Asia. MLO is one of four NOAA stations monitoring atmospheric constituents in remote sites as part of its Geophysical Monitoring for Climatic Change (GMCC) program. During nighttime downslope air flow the 3,500 m elevation at MLO provides an opportunity for the sampling of "background" mid-tropospheric air from a ground based platform. A preliminary analysis of our data suggest that dust present during periods of Asian dust transport (approximately one half of the year) dominates the BCO_2 backscatter signal expected for LAWS but is reduced to a secondary contributor when compared to sulfates during the "clean" low-dust periods (see publication below for details). Characterization of these "clean" periods is important since they are expected to be more characteristic of conditions at higher altitudes and they reflect conditions where signal to noise considerations for LAWS operation may be most critical.

2) We have also designed and built a virtual impactor that can increase the relative contribution of dust particles by a factor of ten prior to sampling with the LAS-X TOAD system. This effectively reduces sampling time under "clean" conditions and improves sampling statistics. Tests and calibrations of this impactor are ongoing.

Current Research & Plans for Next Year

1) We are currently modifying a CLIMET-252 optical particle counter for the analysis of coarse particles (>5 μm) not readily measured by the LAS-X. We hope to have this new instrument operational for a new MLO study in November 1988.

2) We are currently designing and building an isokinetic aerosol sampling inlet for our participation in the Pacific flight series scheduled for Spring 1989.

3) A new LOPC-TOAD system is also being designed in preparation for the Pacific flight series.

4) We are preparing for participation in a new MLO intensive comparison study in November 1988. Data analysis for the spring and winter 1988 MLO studies will be continued and integrated into a report.

5) We intend to participate with our instrumentation in both the spring and fall Pacific flight series scheduled for 1989.

Publications

A. D. Clarke, Preliminary Results of Aerosol Measurements Made at Mauna Loa Observatory in Support of the NASA/GLOBE Program, (submitted Jour. Geophys. Research-Atmospheres, May 1988).