Experimental Studies of the Distribution of Minor Constituents and Dynamic Processes in the Atmosphere

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FINAL REPORT

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Introduction

Minor constituents play an important role in atmospheric chemistry and serve as tracers in transport and mixing studies in tropospheric-stratospheric exchange processes. Measurements of trace gases are essential to an understanding of the mechanisms by which minor constituents originating in the troposphere, both naturally occurring and anthropogenic, reach the stratosphere. Many of these gases are sources of species directly involved in the chemistry of ozone depletion in the stratosphere and ozone generation in the troposphere. Some contribute to the warming of the atmosphere. Data on tracer distributions are important in the development of models for predicting photochemical effects in the stratosphere and troposphere. Data on atmospheric dynamics are important for the development of models for predicting the transport of photochemical species and for characterizing the nature of stratospheric motions.

Accomplishments

As part of the work under the cooperative agreement, Louis Salas performed laboratory trials of new components to the PANAK airborne instrumentation package. PANAK is an airborne, computer controlled, gas chromatograph chemical analysis system which collects and analyzes trace amounts of reactive nitrogen and oxygenated compounds in the troposphere.

In preparation for the PEM Tropics-B deployment, the PANAK package was redesigned to reduce its size and weight, incorporate new data collection and backup systems, and install a second detector to the oxygenated compound analysis section. Following lab tests, Mr. Salas transported the instrument to NASA - Dryden Flight Research Facility, performed further ground tests and calibration, and integrated the instrument package aboard the NASA DC-8. He operated the PANAK experiment during the month-long deployment to South America and the South Pacific.

Jeff Grose has been actively modifying the balloon-borne ARGUS tracer instrument in preparation for the SOLVE campaign scheduled for early 2000. These changes include improvements to both the electronics and optical systems. To increase reliability of the instrument, Mr. Grose has been preparing and testing spare computer boards, reconfiguring wire bundles, and redesigning board to wire connectors, to facilitate ease of replacement of flight-ready boards with their spares. To improve signal-to-noise ratios achievable by the instrumentation optics, Mr. Gross purchased a commercial sample cell and tested many prototype alignment options and new custom

optical mounts for the optimum alignment.

In addition, Jeff helps to schedule activities of his research group, organize NASA and county laboratory safety documents for ISO 9000, and assemble and document an ElectroStatic Discharge safe work bench in preparation for working on the ARGUS electronics.

Jon Dean-Day has been calibrating and re-processing MMS data from the ER-2 POLARIS and the DC-8 SONEX campaigns. A final POLARIS data set was issued which accounts for aircaft flexure, aerodynamic upwash effects on the attack angle sensor, and the use of dual inertial navigation systems which have different internal gravitation corrections. For the SONEX data, he has developed a new correction scheme for static pressure, based on direct computation of the pressure errors during pitching maneuvers.

Mr. Dean-Day statistically modeled the results and found the corrections to be highly dependent on attack angle variation. The previous method for this calibration depended on interpreting oscillations in the computed wind during turns as proportional to the static tap error. While this method has worked well for high altitude ER-2 data, Jon proved that such oscillations can also be generated by serendipitous sampling of gravity waves. The DC-8, which flies at considerably lower altitude, is prone to sample gravity waves which have not been filtered out by an overlying jet stream. Mr. Dean-Day has worked closely with Dr. Stuart Bowen in designing the new aerodynamic corrections and in updating the calibration and processing software to accept these changes.

Publications

There were no publications prepared by the participants of this agreement at this time.

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