http://www-gte.larc.nasa.gov/IGAC.html NASA Global Tropospheric Experiment 1998

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IGAC Activities NewsLetter

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The NASA Global Tropospheric Experiment: Recent Accomplishments and Future Plans (TRACE-P)

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1. Introduction

The NASA Global Tropospheric Experiment (GTE) is a program of aircraft-based experiments dedicated to improving our knowledge of global tropospheric chemistry and of its implications for the biosphere, climate, and stratosphere. The program arose in the late 1970's and early 1980's to address science priorities established in a National Academy of Sciences study (NAS, 1984). It has taken advantage of NASA's research aircraft fleet, technological innovation, and experience in managing large-scale projects.

Changes in the levels of tropospheric chemical species are key observables in greenhouse gas buildup and in degradation of air quality in clean air regions of the world. The troposphere is also the ultimate source and sink for trace gas species in the stratosphere, so a full understanding of stratospheric ozone depletion is not possible without an understanding of tropospheric chemistry. The scale of such phenomena makes tropospheric chemistry a natural, highly important target for space observations. NASA is developing systems that, early in the next decade, will provide global-scale tropospheric chemistry observations of some key species from space. With a few notable exceptions, such as distributions of H_2O, CO, CO_2 and O_3, most tropospheric chemistry studies by NASA have so far been conducted from aircraft.

The NASA aircraft provide excellent platforms for the investigation of chemical and transport processes in the troposphere. They can sample with high vertical resolution through the depth of the tropospheric column over an extended range, and they can carry a large payload of *in situ* measurements that is particularly effective when complemented with ground-based and sonde measurements. They also will play a particularly important role in calibration and validation of future tropospheric chemistry space measurements.

The measurement of tropospheric composition from aircraft has a relatively short history. Twenty years ago, reliable instrumentation was available only for O_3, CO, and a few long-lived gases and only with relatively poor time resolution. The measurement requirements of global tropospheric chemistry are very challenging. A long-standing commitment of GTE has been to meet this challenge by (1) broadening the ensemble of species measured from aircraft; (2) increasing the accuracy, time resolution, and compactness of instrumentation; and (3) developing new technology for chemical flux measurements. GTE has conducted the Chemical Instrumentation Test and Evaluation (CITE) series of missions to provide rigorous, double-blind instrument intercomparisons as a necessary step to gain confidence in the data base being generated. This activity has resulted in high-quality aircraft payloads that have provided *in situ* characterization of a large ensemble of species needed to address global tropospheric chemistry questions.

Guided by science priorities of the tropospheric chemistry community, GTE has conducted missions in diverse parts of the world that are particularly important in understanding atmospheric chemical change (Table 1, Figure 1). The ABLE experiments focused on the surface sources and sinks of atmospheric gases and aerosols and the meteorological processes that mix such gases into the boundary layer and the free troposphere. The TRACE-A and PEM projects measured the distributions of aerosols and gases over a greater altitude range (up to 12 km) and over very wide geographical areas They have provided a baseline against which to measure future pollution impacts on the remote troposphere and defined a test bed for tropospheric chemistry process models.

Table 1. Field Missions of the Global Tropospheric Experiment

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Feedback on Langley Products and Services
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