Major goals of the TRACE-P mission were: 1) to investigate the chemical composition of radiatively important gases, aerosols, and their precursors in the Asian outflow over the western Pacific, and 2) to describe and understand the chemical evolution of the Asian outflow as it is transported and mixed into the global troposphere. The research performed as part of this proposal addressed these major goals with a study of the organic chemical composition of gases in the TRACE-P region. This work was a close collaboration with the Blake/Rowland research group at UC-Irvine, and they have provided a separate report for their funded effort.

The specific research activities funded by this proposal were:

1) Continue collaboration with the UCI group to maintain continuity in the measurement of organic nitrates, HCFC's, HFCs, and selected halocarbons.

2) Using NCAR analytical protocol, measure organic nitrates, HCFC's, HFC's, and halocarbons on a subset (5-10%) of samples (from both P3 and DC8 aircraft) collected by UCI.

3) Based on the target compound analyses, or other in-flight criteria, select representative samples for full-scan GC/MS characterization of organic constituents

Summary.

Of a total of about 5500 samples collected and analyzed by the UCI team, our NCAR group contributed separate results on 680 samples (12%). The data were made public as part of the TRACE-P data archive. Data was reported for the following trace gases:

Organic Nitrates
CH$_3$ONO$_2$, C$_2$H$_5$ONO$_2$, i-C$_3$H$_7$ONO$_2$, n-C$_3$H$_7$ONO$_2$, 2-C$_4$H$_9$ONO$_2$, 3-C$_5$H$_{11}$ONO$_2$, 2-C$_5$H$_{11}$ONO$_2$, 3-CH$_3$-2-C$_4$H$_8$ONO$_2$

Hydrofluorocarbons
HFC-134a

Hydrochlorofluorocarbons
HCFC-141b, HCFC-142b, HCFC-22, HCFC-21, HCFC-123, HCFC-124

**Halons**
Halon 1211, Halon 2402, Halon 1301, Halon 1202

**Alkyl Halides**
CH$_3$Br, C$_3$H$_7$Br, CH$_3$Cl, C$_2$H$_5$Cl, CH$_2$Br$_2$, CHClBr$_2$, CHBr$_3$

**Halogenated Solvents**
C$_2$H$_3$Cl, CHCl$_3$, CH$_2$Cl$_2$, 1,2-C$_2$H$_4$Cl$_2$, C$_2$HCl$_3$, C$_2$Cl$_4$

**Sulfur Species**
OCS

In addition, we worked with UCI to provide standard calibration factors for organic nitrates and a number of halocarbon and other trace gas species. Even for those gases with independent calibration scales, there was excellent agreement between the analysis reported by NCAR and by UCI. This comparison maintains a standard comparison begun in the NASA PEM Tropics-A campaign, and which has extended through all NASA GTE and other missions in the interim. A few examples of the comparisons between UCI and NCAR data are shown in Figures 1 – 4 below (all concentration units in pmol mol$^{-1}$).

In addition to the target analyses, a limited number of full scan mass spectral analyses of TRACE-P were made. These data have only been partially analyzed, but they do indicate an interesting array of trace gas emissions from the TRACE-P study area. In particular, there are exceptionally high concentrations of vinyl chloride and chlorobenzenes in the Tokyo region that are characteristic of industrial emissions. Also, methyl acetate was an unusual gas found to be correlated with other urban emissions from Japan.

**Data Interpretation/Publications.**

Data analysis from the TRACE-P campaign was done collaboratively with members of the science team and publications have appeared or are in review for JGR. In addition, the TRACE-P data is being actively used to interpret measurements taken along the US West Coast as part of other campaigns that are examining long-range, intercontinental transport. For example, the high sulfur emissions, relative to CO, are shown to be unique for certain Asian emissions. See Figure 5 below.

Publications that were supported in full or part by this research project are listed below:


Figure 1. Comparison of HCFC 141b (pmol mol-1) from TRACE-P measured in the UCI and the NCAR laboratories.
Figure 2. Comparison of perchlo­rethylene (pmol mol-1) from TRACE-P measured in the UCI and the NCAR laboratories. A small calibration offset is noted between the labs for this compound.
Figure 3. Comparison of alkyl nitrates (C1 – C3) (pmol mol$^{-1}$) from TRACE-P measured in the UCI and the NCAR laboratories.
Figure 4, Comparison of methyl chloride (pmol mol\(^{-1}\)) from TRACE-P measured in the UCI and the NCAR laboratories.
Figure 5. From Blake et al., in review, 2004. (Figure 8 from manuscript) Plots of OCS and CS2 vs. CO and CO2 for different air masses (defined in text): Continental SE Asia (blue filled circles), S China (black crosses), N China (red open triangles) and Japan+Korea (green open circles). (Note: Top 5% of data have been removed to better represent regional averages)....