The Caltech chemical ionization mass spectrometer flew aboard the NCAR C-130 aircraft during MILAGRO and IMPEX, which took place from March through May of 2006. MILAGRO focused measuring the impact of Mexico City pollution outflow on the local, regional and global scales, while the focus of IMPEX was with the long range transport and aging of pollution, specifically looking at the export of Asian pollution to the North America.

The CIMS measures atmospheric trace gases (acids and hydroperoxides) by forming specific product ions through with a reagent ion directly in ambient air of the following reactions [Crounse, et al, 2006]:

A) \[ CF_3O^- + HA \rightarrow HF + M + CF_3O^- + M \] (very acidic)
B) \[ CF_3O^- + HA + M \rightarrow CF_3O^- + HA + M \] (less acidic)

The product ions separated with a quadrupole and detected with a channel electron detector operated in pulse counting mode.

During MIRAGE and IMPEX we flew two instruments: a single quadrupole instrument and triple quadrupole instruments. While the triple quadrupole has reduced sensitivity, it does allow separation of mass analog product ions when operated in MS/MS mode. This afforded the first atmospheric CIMS measurements methyl hydrogen peroxide during IMPEX.

CIMS measurements for the following trace gases have been reported to the NASA archive:

- NOX
- \( H_2O_2 \)
- peroxynitrous acid (PNA)
- hydrogen acetate
- methyl hydrogen peroxide (MHP)

With additional work the following CIMS measurements may be reported at a later time:

- peroxynitric acid (PNA)
- hydrogen acetate
- methyl hydrogen peroxide (MHP)

Instrument issues:

- No “fast” water measurement on C-130. Knowing \([H_2O]\) is crucial for determining sensitivity.
- Instrument backgrounds still limit the precision of several measurements, including \(SO_2\) and the organic acids.
- Triple quadrupole instrument suffers from low sensitivity (factor of 4-10 less than single quad).

Data:

The following figures show column measurements for various species measured by the Caltech CIMS. Left-hand panels are the IMPEX data, and right hand panels are the IMPEX data. The blue points are the original data, the red diamonds are the median values for 1 km bins, and the black lines are the upper and lower quartile medians.

**Conclusions**

While there is always room for improvement, the CIMS technique is a sensitive and fast technique for measuring a wide suite of interesting atmospheric trace gases. We are continuing to improve the sensitivity of the triple quadrupole instrument, and improving the backgrounds for both instruments.

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