Ozone Export Deduced from CO-NOy Correlations

The relationship between CO and NOy during September, October, and November is shown in Figure 6. A positive correlation was present during the photochemically active months of September and October. This indicates that NOy photochemically produced from anthropogenic O3 precursors over eastern North America, was exported over the site. However, no significant correlation was observed during November, implying either significant production or non-significant destruction of NOy in the air sampled.

The d[O3]/d[CO] slopes during September and October (0.5 ± 0.02) are higher than those reported for the fall measurements in a previous study in the same region (0.25-0.35) [4]. This 30% increase in the slope can only partially be attributed to a reduction in the CO emissions. (U.S. CO emissions dropped 4.7% over this period according to U.S. EPA [8] and may have dropped more based on CO and NOy measurements in urban areas [6].) This change therefore implies greater amount of NOy export in 1997 than in 1993.

Figure 7 shows a comparison of the CO-SLOPES obtained during individual events of polluted transport to the site. These slopes are consistent with the slopes based on data collected during September and October. An estimate of the NOy export flux from North America during the fall may be obtained by multiplying the observed September-October slope by the daily CO emission from the eastern U.S. with the expectation that a majority of these emissions are exported eastward. The resulting NOy flux is approximately 2 Gmoles per day.

Conclusions

- Export of NOy in the MBL increased in proportion to the amount of exported O3 decreased, during the period September-October, 1997. This shift is attributed to reduced photochemical activity as the fall progresses.
- Potential O3 formation due to exported NOy (~3-Gmole/day during late fall) is greater than direct O3 export (~2-Gmole/day during earlier fall).
- Similar measurements further downwind would provide a further constraint on the amount of O3 formed in situ. These are the objectives of the PICO-NARE study described to the right.

References