Persistent Emissions of Halocarbons in the United States of America and Canada

D.F. Hurst[1], P.A. Romashkin[1], J.W. Elkins[2], B.C. Daube[1,3], C.H. Gerbig[3], J.C. Lin[3], and S.C. Wofsy[3]

[1]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder 80309; 303-497-7003, Fax: 303-497-6290, E-mail: dale.hurst@noaa.gov
[2]NOAA Climate Monitoring and Diagnostics Laboratory, Boulder, CO 80305
[3]Dept. of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138

The atmospheric burdens of several important halocarbons are currently in decline because of severe reductions in their global production during the last decade. However, even in developed countries like the United States and Canada where production ceased by 1996, reservoirs (banks) of some halocarbons continue to slowly but persistently leak into the atmosphere. Are these bank releases a significant fraction of modern global emissions that also emanate from ongoing production and consumption in developing countries? Halocarbon emissions in developed nations are increasingly difficult to estimate because their once ubiquitous sources have diminished, both in magnitude and spatial uniformity. Consequently, regional- to continental-scale halocarbon emissions can no longer be accurately estimated from only localized measurements. Such assessments now require measurements of polluted air masses over large areas to capture the patchiness of emissions.

To this end, CMDL's 4-channel Airborne Chromatograph for Atmospheric Trace Species (ACATS-IV) recently measured seven halocarbons (CFC-11, CFC-12, CFC-113, CH_3CCl_3, CCl_4, $CHCl_3$, and $CBrClF_2$) and five other trace gases (N_2O, CH_4, SF_6, CO, and H_2) in the boundary layer and lower free troposphere over large regions of the United States and Canada as part of the 2003 CO_2 Budget and Regional Airborne-North America (COBRA-NA 2003) study. Two 11,000-km flight racetracks around the United States and Canada were completed along with several regional flights in the northeastern and southern central United States. The data reveal that halocarbons are still being emitted in many regions of the USA and Canada, and that the releases of several halocarbons are correlated with emissions of CO. For each pollution plume encountered, emission ratios of halocarbons have been quantified relative to CO. These emission ratios are spatially scaled to regional emission estimates by mapping gridded CO emission inventories onto plume backtrajectories simulated by the Stochastic Time-Inverted Lagrangian Transport model [Lin et al., *J. Geophys. Res., 108*, 4493, doi: 10.1029/2002JD003161, 2003].

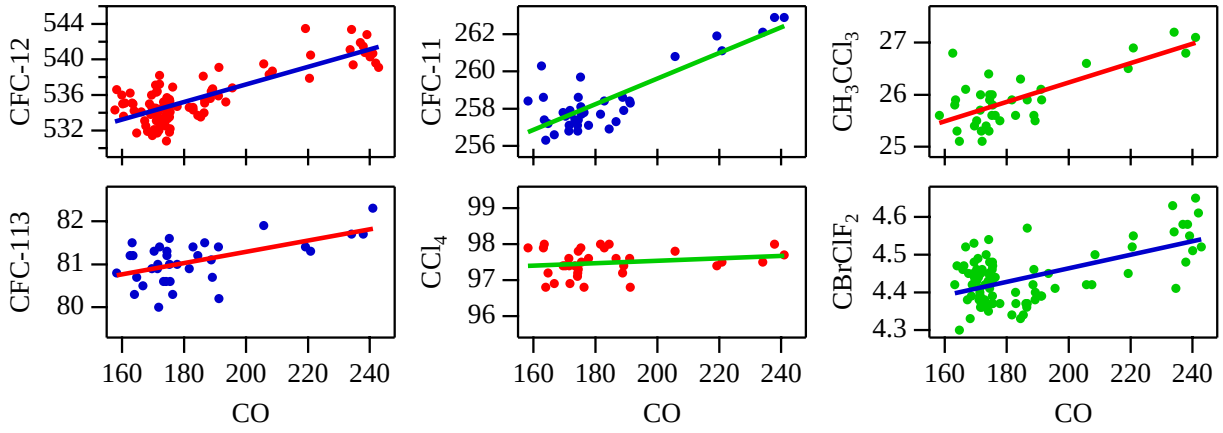

Figure 1. Correlations between ACATS-IV measurements of halocarbons (in ppt) and Harvard University measurements of CO (in ppb) for polluted boundary layer air masses encountered near Harvard Forest, MA, on June 6, 2003. Slopes of the linear regression fits, representing the emission ratios for these air masses, are significantly different from zero at the 95% confidence for every halocarbon except CCl_4.