Chloroform Emissions Estimated with the CarbonTracker-Lagrange North American Regional Inversion Framework

G. Dutton[1], S.A. Montzka[1], A.E. Andrews[1], B.R. Miller[2,1], C. Sweeney[1], C. Siso[2,1], M.J. Crotwell[2,1] and J.W. Elkins[1]

[1]NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305; 303-497-6086, E-mail: geoff.dutton@noaa.gov
[2]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309

Chloroform or trichloromethane ($CHCl_3$) is the second largest source of natural atmospheric chlorine after methyl chloride (CH_3Cl). More than half of $CHCl_3$ global emissions are from natural sources such as soils and biomass burning the remaining anthropogenic sources include paper production and water treatment processes. ESRL/GMD has been measuring this gas for about two decades via *in situ* and flask grab samples at the surface and aboard aircraft. During this time, zonal and global averages have shown an increase in the atmospheric abundance (about two parts-per-trillion or 20%) along with a sizeable inter-hemispheric difference indicating predominant northern hemispheric sources. The ESRL/GMD Barrow Atmospheric Baseline Observatory (BRW), located at Utqiaġvik, Alaska, is ideally situated to observe changes in the Arctic where previous studies have detected $CHCl_3$ emissions. Tundra $CHCl_3$ emissions are persistent throughout the summer when little or no snow cover is present, but low or no emissions when snow covered. It is unknown if soil temperature or hydrology are the dominant drivers for emissions.

This presentation makes use of high-frequency *in situ* measurements from Barrow, Alaska as well as surface and aircraft flask samples acquired at about 30 North America sites. Seasonal surface fluxes and emissions from 2010 to 2014 are estimated using a regional inverse modeling system. The CarbonTracker-Lagrange framework uses surface sensitivity footprints from Lagrangian particle dispersion models driven by a high-resolution Weather Research and Forecasting (WRF) meteorology. Preliminary results indicate tundra soils dominate emissions in the northernmost Arctic latitudes.

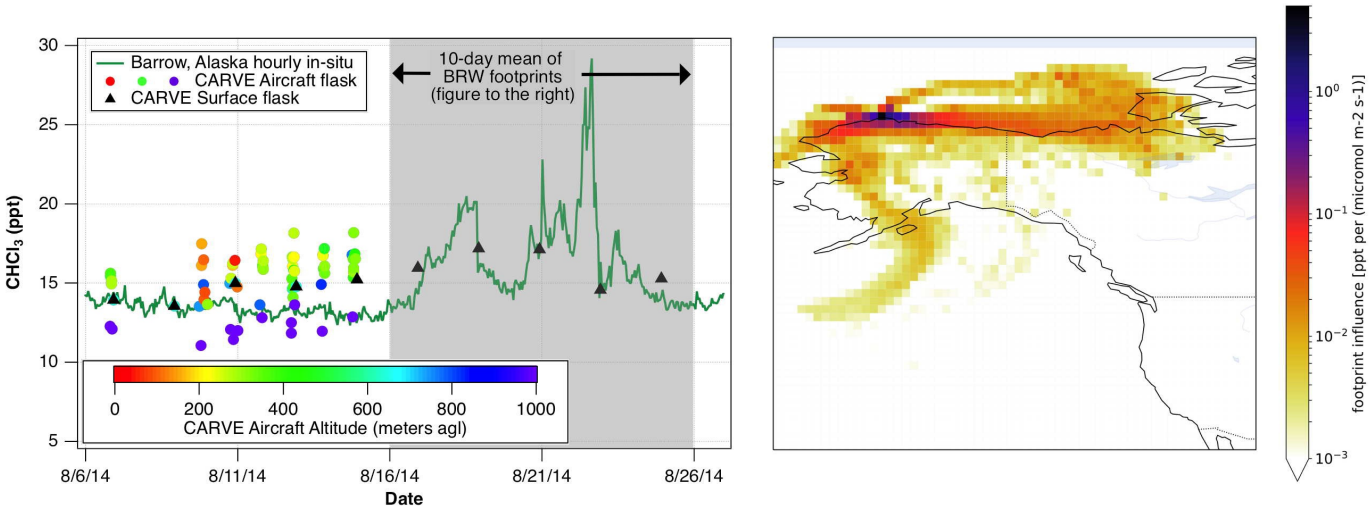

Figure 1. An example of the different measurements during mid-summer of 2014 used in the Carbon Tracker-Lagrange inversion (**left panel**). Surface flask samples collected near Fairbanks, Alaska during the Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) compare well with hourly *in situ* measurements at BRW. CARVE aircraft flask samples (filled circles) show gradients in both latitude and altitude (color bar shown). A ten-day mean footprint (**right panel**) for BRW from August 16th to the 26th show where air masses originate and their relative influence on air parcels measured. These and other ESRL/GMD data are used to model emissions in the Northern Hemisphere.