Stable Isotopic Analysis of Carbon Monoxide During Two Summers at Indianapolis, Indiana

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We present results from a study of carbon monoxide (CO) stable isotopes done at Indianapolis, Indiana as part of the INFLUX project. One of the goals of this project is to seek out measurement techniques best suited to characterizing urban emissions, in order to compare top-down measurement results with bottom-up inventory and modeling results. One species of interest in this study is fossil fuel produced carbon dioxide (CO_2). Characterizing fossil fuel emissions of carbon dioxide has been done at Indianapolis through radiocarbon measurements, and these measurements have been compared to fossil fuel CO_2 estimates calculated using carbon monoxide as a correlate tracer. These results found CO to be a poor tracer during the summer months due to significant contributions to the CO budget from non-fossil combustion sources. These sources are thought to be biogenic non-methane hydrocarbons (NMHC's) produced largely during the growing season and summer months. Stable isotopic measurements of CO are being used to try to better characterize these sources of CO at Indianapolis.

Here, we present a preliminary analysis of the Indianapolis carbon monoxide budget during two summers. We aim to better understand the variability of biological NMHC-derived CO, and separate the NMHC-CO and fossil fuel CO signals. This result will provide insight into the combustion CO:CO_2 relationship during the summer at Indianapolis, which may improve estimates of fossil fuel produced CO_2 from CO correlate tracer methods.

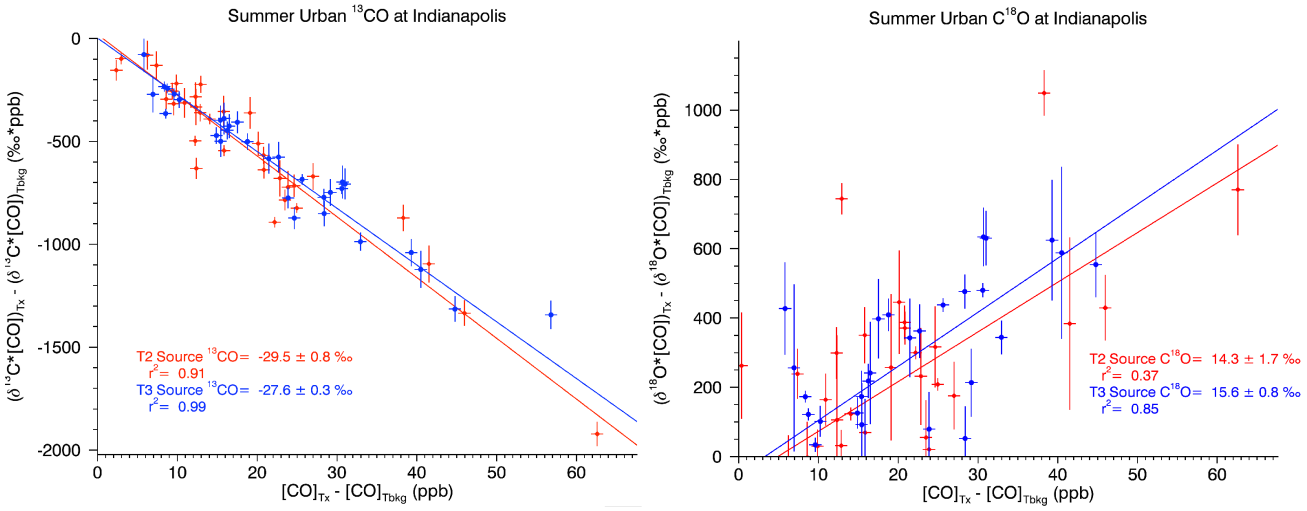

Figure 1. Preliminary determination of carbon monoxide d^{13}CO (left), and dC^{18}O (right) source signatures at two tall towers within the INFLUX network using regression analysis (Miller and Tans, 2003). T2 indicates 'Tower 2' and is shown in red, and T3 indicates 'Tower 3' and is shown in blue. 'BKG' indicates the measured values at a background site (Tower 1). Tower 1 is located west of the city, and samples were taken when the wind was from the west. Tower 2 is on the eastern edge of the city, and tower 3 is located near the center of the city. Fits were done using multiple OLS regressions in a Monte Carlo simulation.