Partitioning of Urban Fossil Fuel CO_2 Emissions by Source Sector: Results from the INdianapolis FLUx EXperiment (INFLUX) Project

J. Turnbull[1], A. Karion[2], C. Sweeney[2], M. Hardesty[3], S. Lehman[4], T. Newberger[2], I. Vimont[4], K. Davis[5], T. Lauvaux[5], N. Miles[5], S. Richardson[5], P. Shepson[6], M. Cambaliza[6], K. Gurney[7], L. Iraci[8] and J. Whetstone[9]

[1]GNS Science, New Zealand, and Cooperative Institute for Reseach in Environmental Sciences, University of Colorado, Boulder, CO 80309; +64 4 570 4726, E-mail: j.turnbull@gns.cri.nz
[2]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309
[3]NOAA Earth System Research Laboratory, Boulder, CO 80305
[4]Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder, CO 80309
[5]Pennsylvania State University, Department of Meteorology, University Park, PA 16802
[6]Purdue University, Department of Chemistry, West Lafayette, IN 47907
[7]Arizona State University, Tempe, AZ 85287
[8]National Aeronautics & Space Administration (NASA) Ames Research Center, Atmospheric Science Branch, Moffett Field, CA 94043
[9]National Institute of Standards and Technology (NIST), Boulder, CO 80305

Most fossil fuel CO_2 (CO_2ff) is emitted from urban areas, and cities are often leading the way in efforts to reduce GreenHouse Gas (GHG) emissions. In addition to information on total CO_2ff emissions, mitigation efforts will require details on the contributions from the various source sectors (electricity production, industry, vehicles, etc.). The INdianapolis FLUx eXperiment (INFLUX) aims to develop and evaluate methods for detection and attribution of urban GHG fluxes, including a large suite of measurements, a bottom-up CO_2ff data product and meso-scale modeling. We use multi-species flask and *in situ* observations from the INFLUX towers to separate CO_2ff by source sector. $\Delta^{14}CO_2$ measurements have shown that in winter, the total CO_2 enhancement over Indianapolis approximates the CO_2ff added. This somewhat surprising result allows us to use the wintertime *in situ* total CO_2 and CO measurements to determine the observed CO:CO_2ff ratio (RCO) at high resolution. Electricity production (~28% of CO_2ff) produces almost no CO, whereas other urban CO_2ff sources have RCO of up to ~15 ppb/ppm. Thus RCO can potentially be used to partition CO_2ff by source sector. We will present results examining spatial and temporal variability in RCO in Indianapolis to understand how this method might be applied.

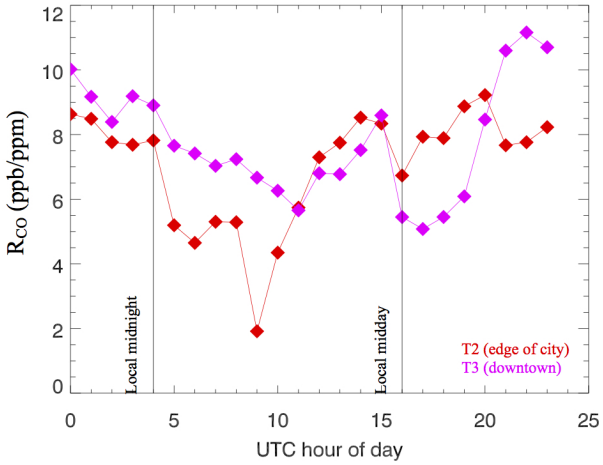

Figure 1. The typical Towers 2 and 3 RCO is 8 ppb/ppm, roughly consistent with expectations of the averaged urban RCO estimated from bottom-up data products. During late afternoon, RCO at Tower 3 increases, suggesting that vehicle emissions are more dominant in the signal. At other times of day (early morning at Tower 2 and early afternoon at Tower 3), RCO drops to much lower values, suggesting a stronger influence from electricity production in the tower footprints at these times.