Holiday CO_2: Inference from the Salt Lake City data

Ju-Mee Ryoo[1], Inez Fung[1], James R. Ehleringer[2], Britton B. Stephens[3]

[1]Department of Earth and Planetary Sciences, University of California, Berkeley, Berkeley, CA 9472;

[2]Department of Biology, University of Utah, Salt Lake City, UT 84112;

[3]National Center for Atmospheric Research, Boulder, CO 80307

A network of high-frequency CO2 sensors has been established in Salt Lake City (SLC), Utah (http://co2.utah.edu/), and the annual/monthly pattern of CO2 variability is consistent with a priori estimates of CO2 fluxes (McKain et al., 2012). Here we ask if short-term changes in anthropogenic sources can be detected, and present a case study of Thanksgiving holiday, when traffic and energy use patterns are expected to be different from that the rest of the month. CO_2 mole fraction is much higher during the Thanksgiving holidays than the other days in November 2008 for all 5 sites in SLC, and a similar pattern is found in other years. Taking into account that the wind speed is relatively low in downtown SLC compared to the other SLC sites, the downtown site is further investigated to minimize the meteorological influence on CO_2.

In order to understand the relative contributions in the high level of CO_2 during the Thanksgiving holidays, we carried out a multiple linear regression (MLR) analysis of the rate of CO2 change against various sources. Mobile CO2 sources are assumed to be proportional to local traffic data and residential CO_2 sources are assumed to depend exponentially on temperature. Vulcan data were used to specify the other anthropogenic sources (commercial, industrial, nonroad, electricity, aircraft, and cement). The MLR analysis shows that during the Thanksgiving holidays CO2 contributions from residential and commercial CO_2 are larger than that during the rest of November, and mobile sources represent only a relatively small contribution.

The study demonstrates the feasibility of detecting changes in urban source contributions using high-frequency measurements in combination with daily PBL height and local traffic volume data.