1B.5: Urban Land Cover Type Influences CO_2 Fluxes within Phoenix, Arizona

Monday, January 7, 2019
09:30 AM - 09:45 AM
North 126A

Modification of land surface characteristics by urbanization should have an impact on local energy, water and carbon cycles. For instance, cities are responsible for more than 70% of the global anthropogenic CO_2 emissions, despite their relative small land area. Nevertheless, little is known on the dynamics of urban carbon fluxes or net ecosystem exchange (NEE), particularly over the multitude of land cover patches present within cities. In this study, we present a comparison of NEE measurements in four urban landscapes within the Phoenix Metropolitan Area. A mobile eddy covariance (EC) tower was deployed at a xeric landscaping (XL), a parking lot (PL) and a mesic landscaping (ML) during consecutive, non-simultaneous, short-term (~40 days) measuring periods and compared to a reference site (REF) in a suburban neighborhood over a longer deployment (~9 months). Analysis of the diurnal cycle and the daily and seasonal variations of NEE in the context of the measured meteorological conditions were carried out, including the surface energy budget. EC observations were then related to vegetation conditions through a satellite-based Normalized Difference Vegetation Index and comparisons between days with low and high incoming shortwave radiation, as well as to anthropogenic activities through local traffic counts and days with high and low traffic (weekdays and weekends). Additionally, the effect of precipitation events on NEE and the evaporative fraction was explored. All sites showed important differences in NEE with respect to the REF location due to the influence of the urban landscape sampled in the EC footprint. Daily NEE values at all sites exhibited differences among days of the week that were linked to traffic conditions, with higher values during weekdays and lower values during weekends. The diurnal behavior of NEE showed different trends depending on the amount of vegetation and the proximity to nearby roads. Minimum midday (around noon) values of NEE were noted where urban plants absorbed CO_2, while maximum peaks of NEE occurred during rush hours (around 8 am and 6 pm) where the traffic influence was high. Three of the four sites (XL, ML and REF) with low to moderate vegetation had significant difference between days with high and low incoming shortwave radiation, showing an influence of plant activity. Overall, in the moderate vegetated landscape (ML) and highly urbanized (PL) landscapes, vegetation and traffic, respectively, were the main factors controlling NEE and CO_2 concentration. In mixed landscapes (XL and REF), however, a joint effect of both factors was noted. Thus, the characteristics and function of urban patches should have a strong control on the NEE within cities, which can be reliably measured using the EC method.

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