B43E-2594 Examining long-term dynamics and budgets of CO2 flux dynamics in a suburban community in Phoenix, Arizona

Thursday, 14 December 2023

14:10 - 18:30

Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Cities are increasingly becoming focuses on reduction of greenhouse gas emission and on mitigation of extreme climatic events, such as heat waves and drought stress. Eddy covariance (EC) is a direct approach to measure turbulent fluxes between urban surface and the atmosphere to quantify energy exchanges, water, and carbon dioxide (CO_2) emissions. Quantifying CO_2 emissions across different local climate zones in complex urban landscapes are indispensable for independent emission evaluation and for verification of top-down estimation based on remote sensing and modeling. In 2012, the Central Arizona Phoenix Long-term Ecological Research (CAP-LTER) program established a 26-m EC tower within a low-rise residential neighborhood of Phoenix, Arizona. Previous studies examined the EC datasets in 2012 and 2015 to investigate the seasonal dynamics of water, energy, and CO_2 fluxes and to identify the role of urban landscape properties, including irrigated areas and impervious cover, within the tower footprint. But long-term variability and the effects of different seasonal conditions on the flux measurements have not been analyzed. Here, we utilize data from 2012 to 2021 to perform a first set of analysis on the long-term variability from intra-seasonal to interannual time scales of the water, energy, and CO_2 fluxes. We focused on comparing wet versus dry seasons in the recent record, for instance the exceptionally dry and hot summer of 2020, and the role of heat waves on CO_2 emissions and thermodynamic processes in the urban environment. We also test if the low-rise residential site shows the presence of the oasis effect identified at a nearby irrigated park, which occurs prominently during excessive heat warning days. During oasis effect days, advected energy from the urban environment augments local fluxes, leading to high rates of

evapotranspiration when water is present. We demonstrated that long-term *in situ* monitoring in urban areas is critical for quantifying the temporal and spatial variability of water, energy, and CO_2 fluxes, particularly during periods of extreme heat and drought stresses. Monitoring these fluxes provides critical insights into urban carbon dynamics, which contributes vital policy-relevant information for urban planning and management.

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