Roisin
Commane
Columbia University
Sean Crowell, LumenUs Scientific, LLC
Rory Barton-Grimley, NASA Langley Research Center
Jonathan Franklin, Harvard University
Andrew Hallward-Driemeier, Columbia University
Amin Nehrir, NASA Langley Research Center
Chris O’Dell, Colorado State University
Maryann Sargent, Harvard University
Luke Schiferl, Columbia University
Yuwei Zhao, Columbia University
Oral
Urban areas emit 70% of global fossil fuel related carbon dioxide (CO2) emissions. Urban fluxes of CO2 and methane (CH4) are of great interest to city and state governments who wish to evaluate the efficacy of their climate mitigation policies. While a few cities have implemented arrays of surface-based greenhouse gas (GHG) sensors, space-based observations may provide the only practical approach for monitoring most large urban areas, especially those in the rapidly developing world. Existing and planned space-based GHG sensors have struggled to monitor CO2 and CH4 fluxes from cities, especially coastal cities, because they do not have the combination of spatial resolution and sensitivity to detect and quantify concentration anomalies contributed by a complex, distributed array of sources.

Here, we investigate the requirements for space-based resources for monitoring CO2 and CH4 emissions from the largest city in the US: New York City (NYC). With a population of 20M in the metro area, NYC is the largest urban source of CO2 in the US. Our airborne and in situ observations of methane, as well as co-emitted species ethane and CO, indicate that widely-used methane inventories underestimate methane by a factor of 3 to 5 depending on the season. Airborne active and passive remote sensing projects (HALO on NASA STAQS and MethaneAIR) sampled over the NYC area in summer 2023. We generated profiles of surface influence footprints using a Lagrangian transport model (STILT) driven by 3 km HRRR meteorology. By coupling the surface influence footprints with various inventories, we calculated the expected XCO2 and XCH4 for New York City. Our results highlight the need for high spatial resolution ground coverage (< km) to resolve carbon fluxes in coastal areas and a wide swath to capture signals from the entire city. Given the climate impacts of urban GHG fluxes and the ability of cities to implement mitigation policies, future space-based observations need to incorporate these requirements to constrain CO2 and methane fluxes for large urban areas.
Meeting homepage
IWGGMS-20 Workshop
Download to PDF