

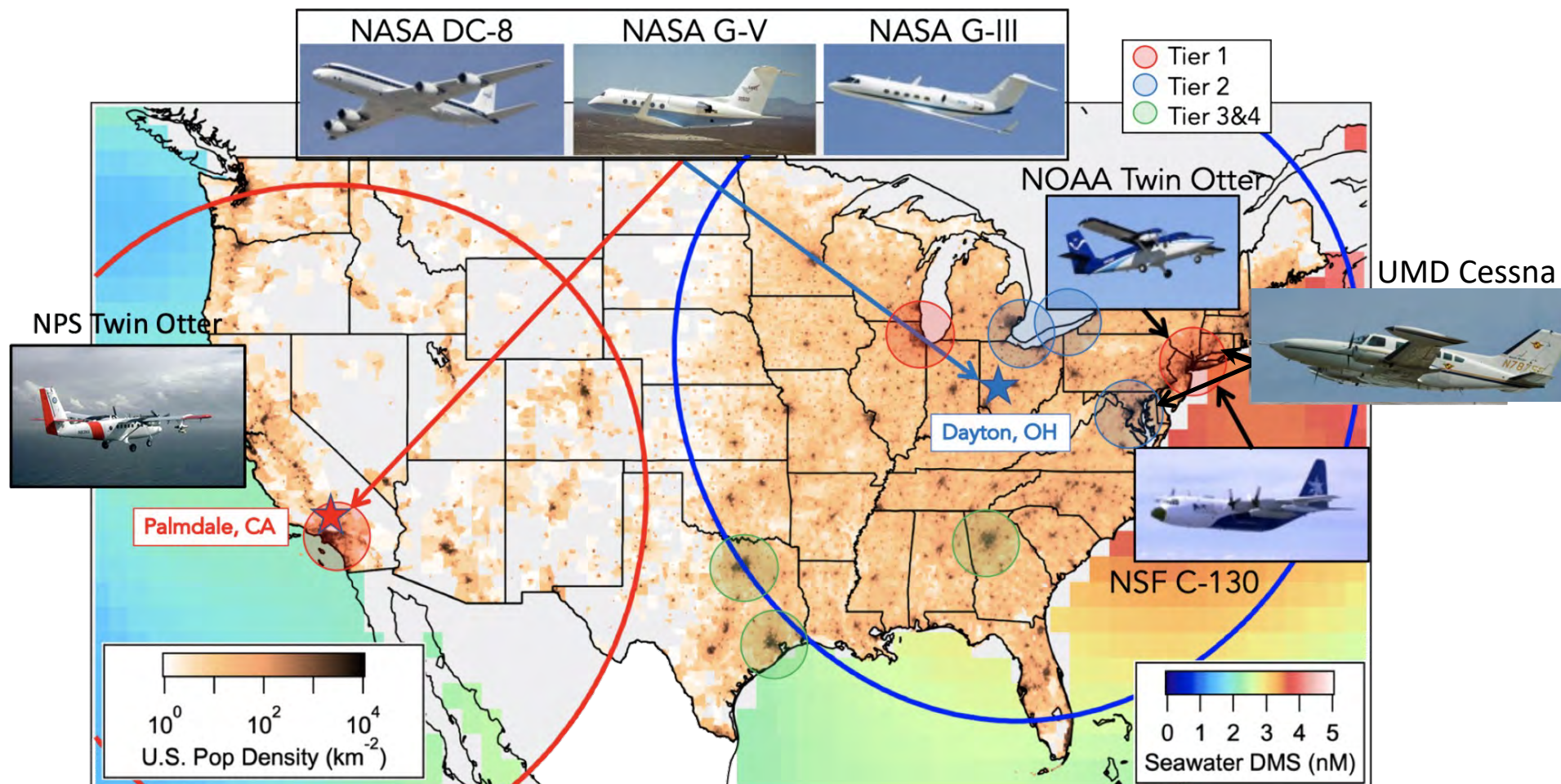
# NOAA-ARL/UMD's Aircraft and Mobile Measurements during NEC-AQ-GHG 2023 (*Northeast Corridor Air Quality and Greenhouse Gases*)

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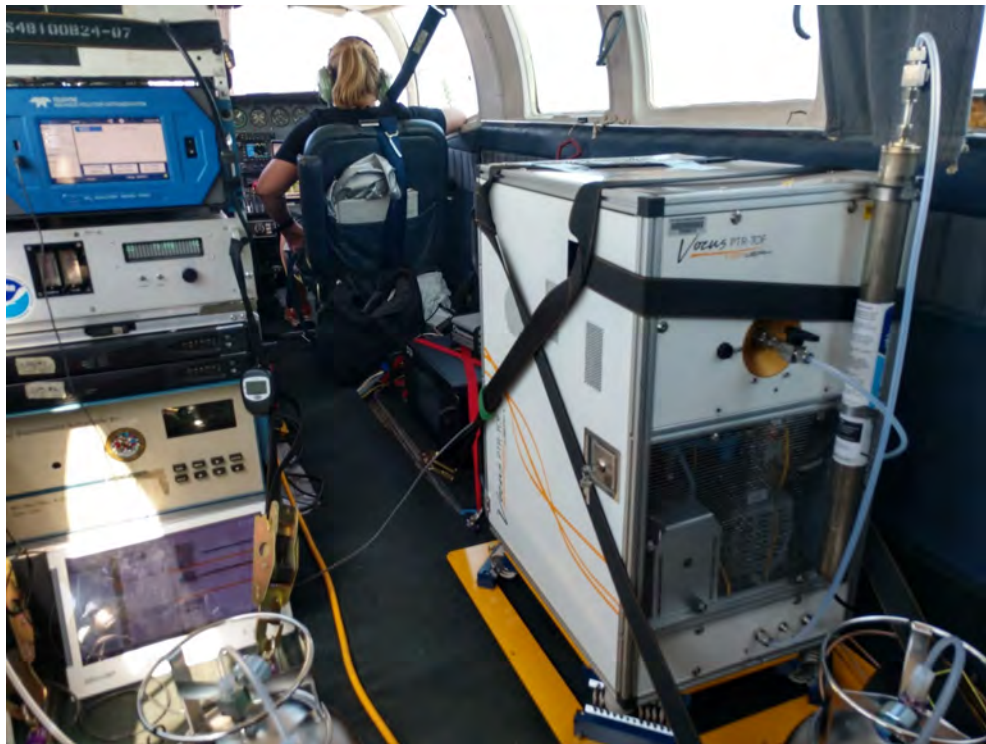
<sup>3</sup>Johns Hopkins University



<https://csl.noaa.gov/projects/aeromma/planning/images/rangemap.png>

# NOAA-ARL/UMD's Aircraft Measurements during NEC-AQ-GHG 2023

## Cessna 402 Research Aircraft



## Cessna Research Aircraft Instrumentation

Variable	Method
Position	GPS
Meteorology (T, RH, P, 2-D Wind)	Thermistor Hygristor, Capacitance Manometer, Differential GPS
Fast Greenhouse Gas Analyzer (CH <sub>4</sub> /CO <sub>2</sub> /CO/H <sub>2</sub> O)	Cavity Ring Down Spectroscopy Picarro Model G2401-m
Ethane Detector	Mid-IR Absorption, Aeris Ultra
Ozone (O <sub>3</sub> )	UV Absorption
Nitrogen Dioxide (NO <sub>2</sub> ), Nitric Oxide (NO), Nitrogen Oxides (NO <sub>y</sub> )	CAPS, Teledyne Chemiluminescence, Thermal dissociation to NO
Black Carbon (7 wavelengths at 370, 470, 520, 590, 660, 880, 950 nm)	Aethalometer, AE43
VOCs*	TofWerk PTR-ToF-MS

\* Support is needed for PTR-ToF-MS (PI: Pete DeCarlo, Johns Hopkins).

# NOAA-ARL/UMD's Aircraft Measurements during NEC-AQ-GHG 2023

## Objectives

- To characterize spatial and temporal patterns of O<sub>3</sub> and its precursors during high ozone events.
- To examine meteorological conditions (e.g., low-level jets, land-sea breeze).
- To investigate urban emissions of NO<sub>x</sub>, CO, CH<sub>4</sub>, and VOCs and to evaluate emission inventories.

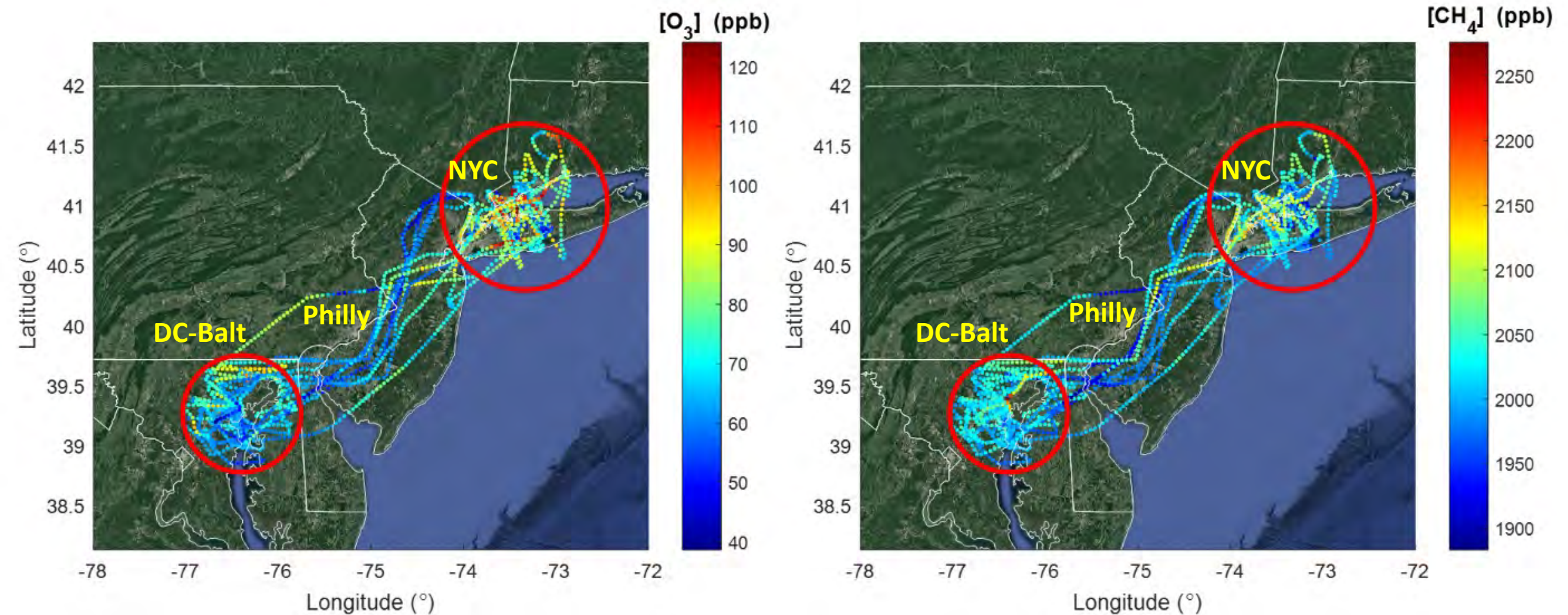
## Duration

- June – August 2023
- Total ~100 flight hours (~50 hours for NYC, ~5 times of deployments/2-3 days each)

## Areas of Focus

- Air chemistry/air quality + Greenhouse gas emissions
- NYC-Long Island Sound + Washington, DC-Baltimore

# NOAA-ARL/UMD Aircraft Measurements during NEC-AQ-GHG 2023



Airborne measurements of  $O_3$  (Left) and  $CH_4$  (Right) made from the Cessna research aircraft during summer 2020.

# Mass Balance Approach

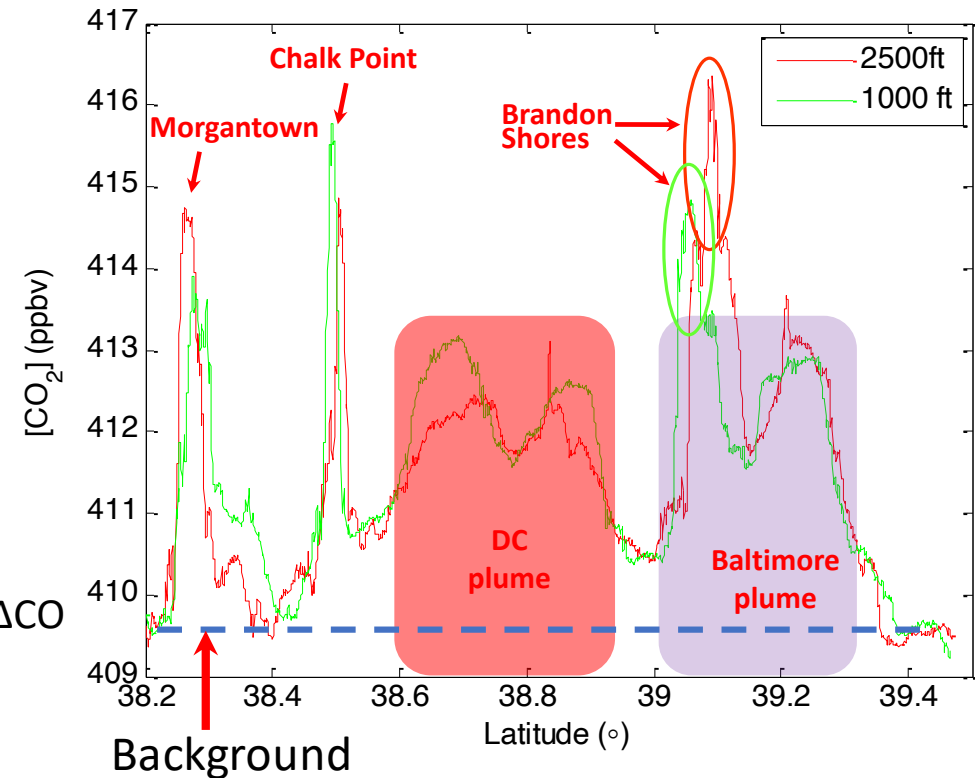
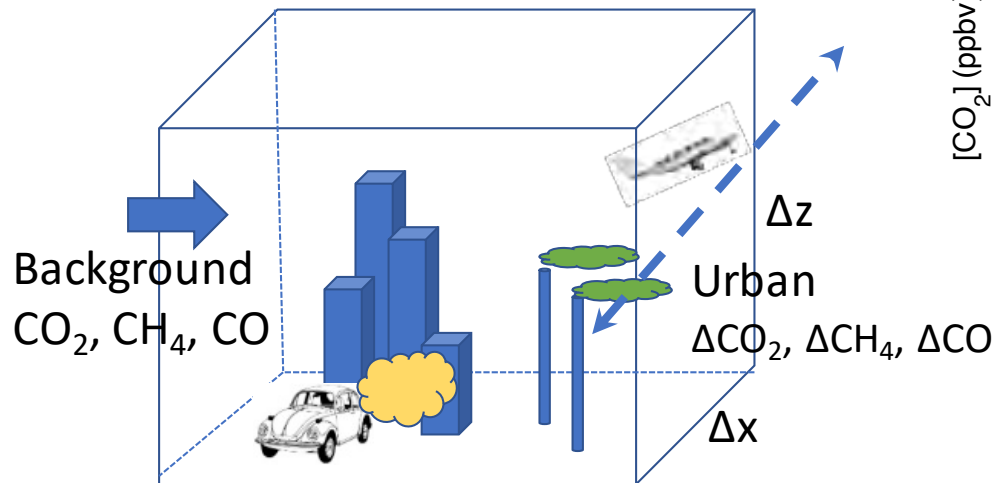
$$E.R._{CH_4} = \int_0^{z_i} \int_{-x}^{+x} ([C] - [C]_b) \times U_{\perp} dx dz$$

E. R. : emission rate (flux)

[C] : concentrations (downwind)

[C]<sub>b</sub> : concentration in background

U<sub>⊥</sub> : perpendicular wind speed



# NOAA-ARL/UMD Mobile Measurements during NEC-AQ-GHG 2023

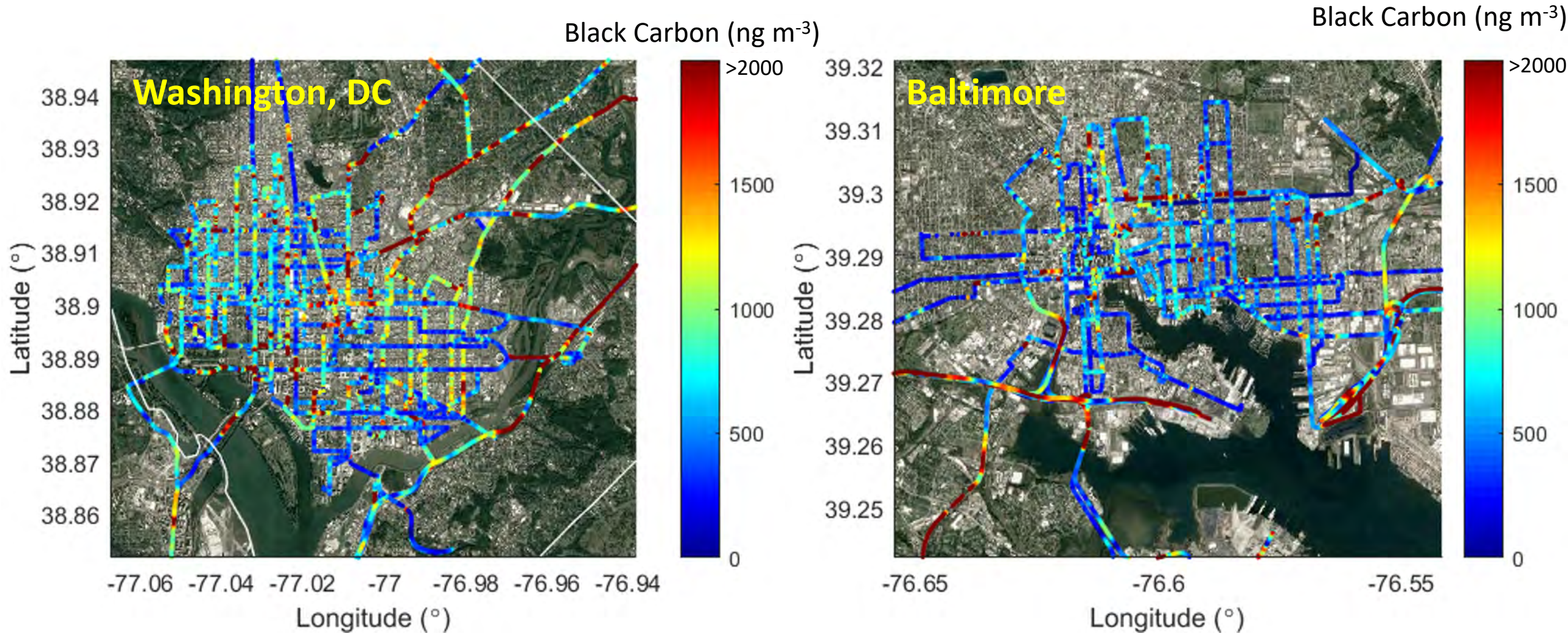
## NOAA's ARC (Air Resources Car)



## Measurement Suite:

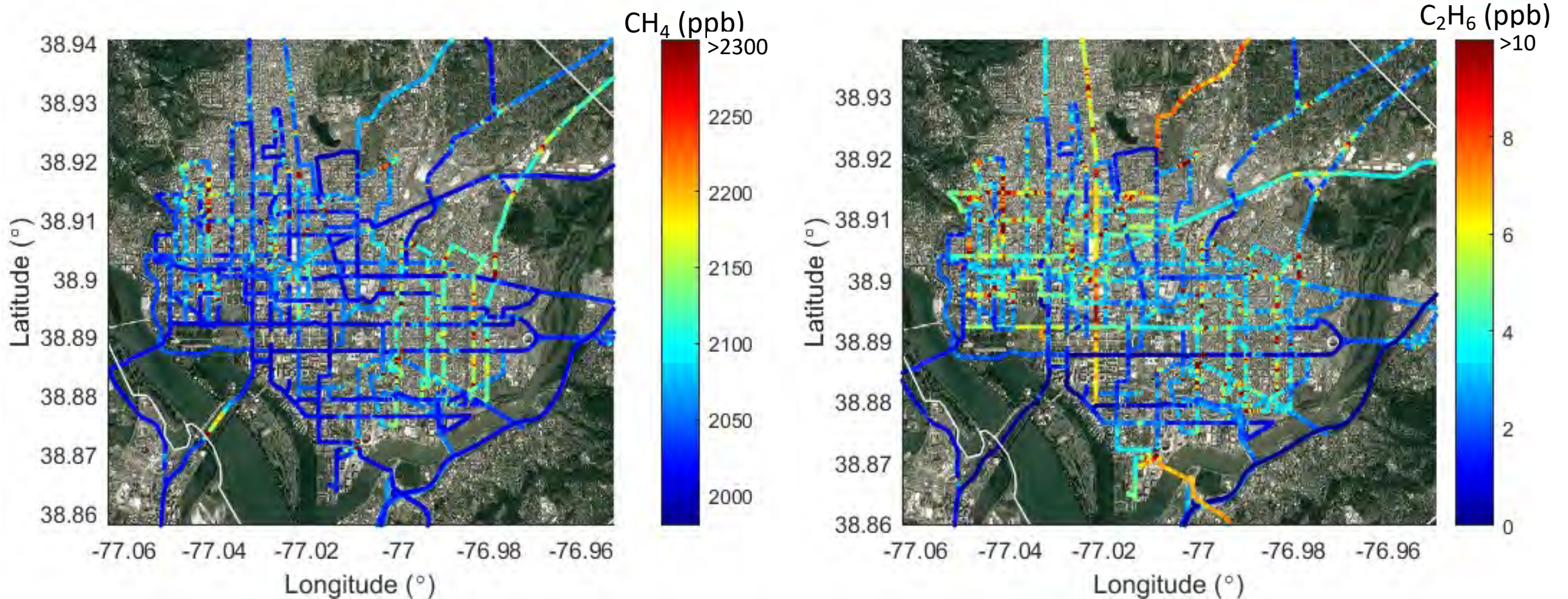
- (1) Picarro 2401-m for CO<sub>2</sub>/CH<sub>4</sub>/CO/H<sub>2</sub>O
- (2) Picarro G2201-i CO<sub>2</sub>/CH<sub>4</sub> isotope analyzer
- (3) Aeris CH<sub>4</sub>/ethane analyzer
- (4) Teledyne U500 CAPS NO-NO<sub>2</sub>-NO<sub>x</sub> analyzer
- (5) Teledyne T500U CAPS NO<sub>2</sub>
- (6) AE43 Aethalometer for black carbon
- (7) Picarro G2103 NH<sub>3</sub> analyzer
- (8) Met: T/P/RH/3-D wind with DGPS
- (9) Ozone

# Black Carbon in Washington, DC and Baltimore



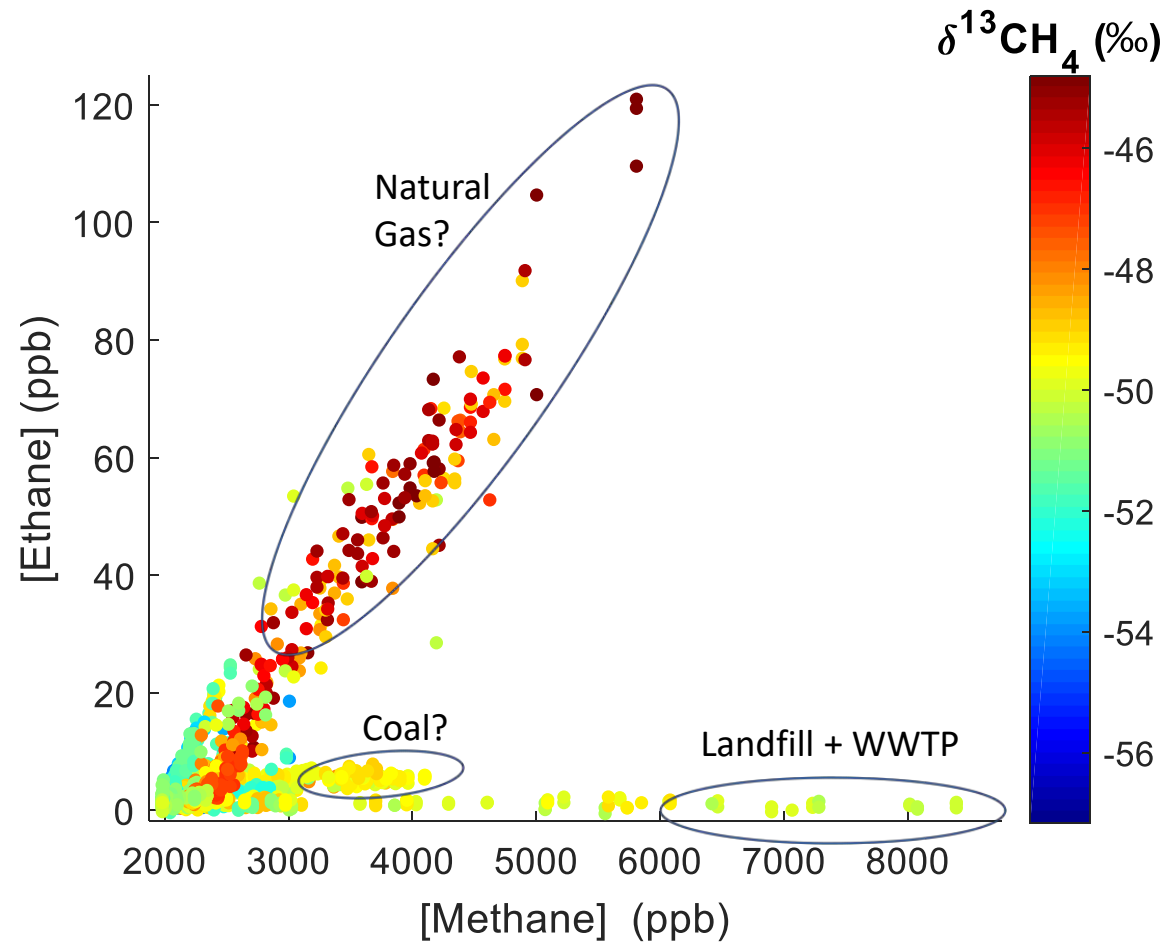
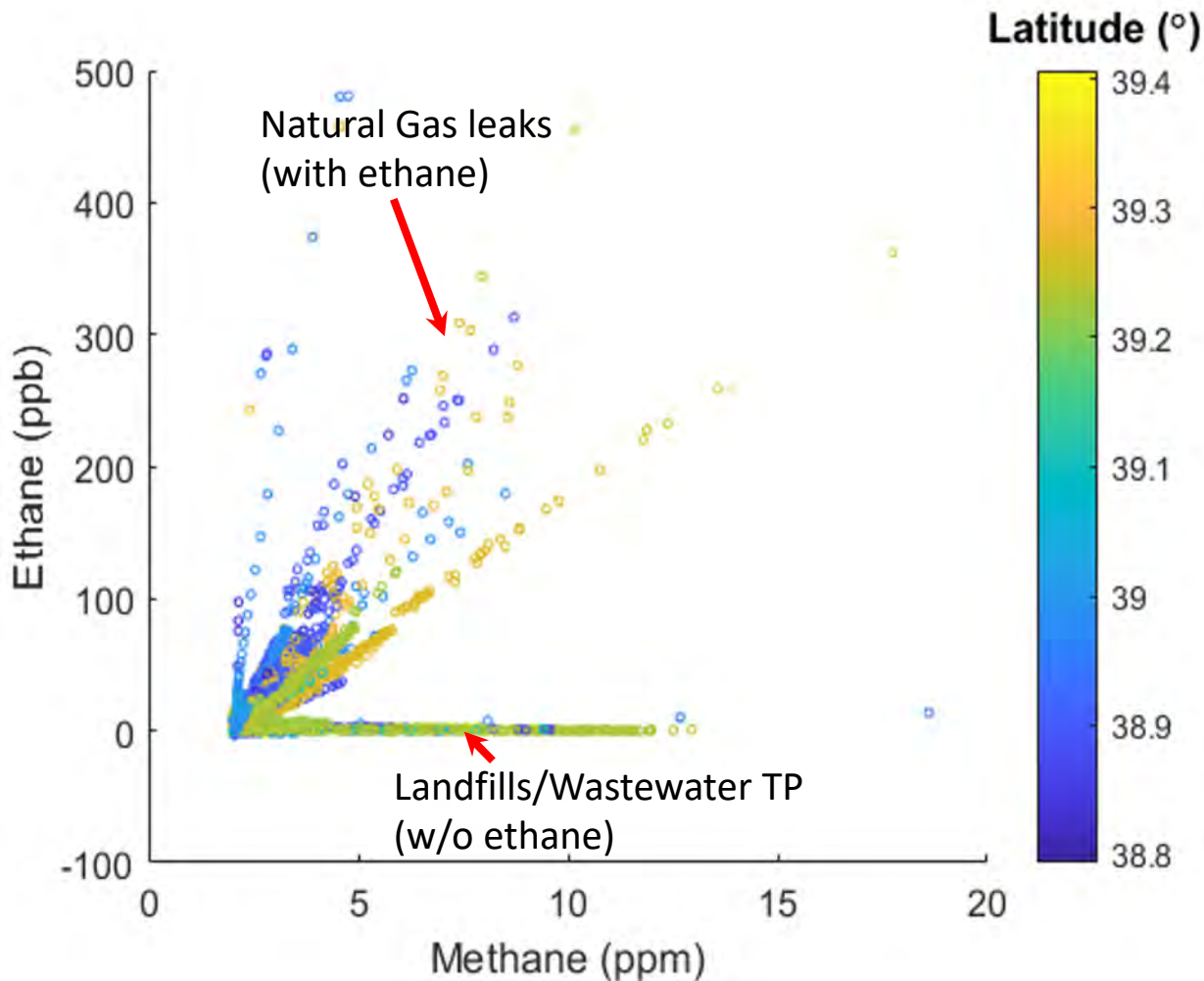
We plan to conduct similar street-level mobile measurements of air pollutants and GHGs in both New York City and Washington-Baltimore in summer 2023

# CH<sub>4</sub> & C<sub>2</sub>H<sub>6</sub> Measurements in Washington, DC





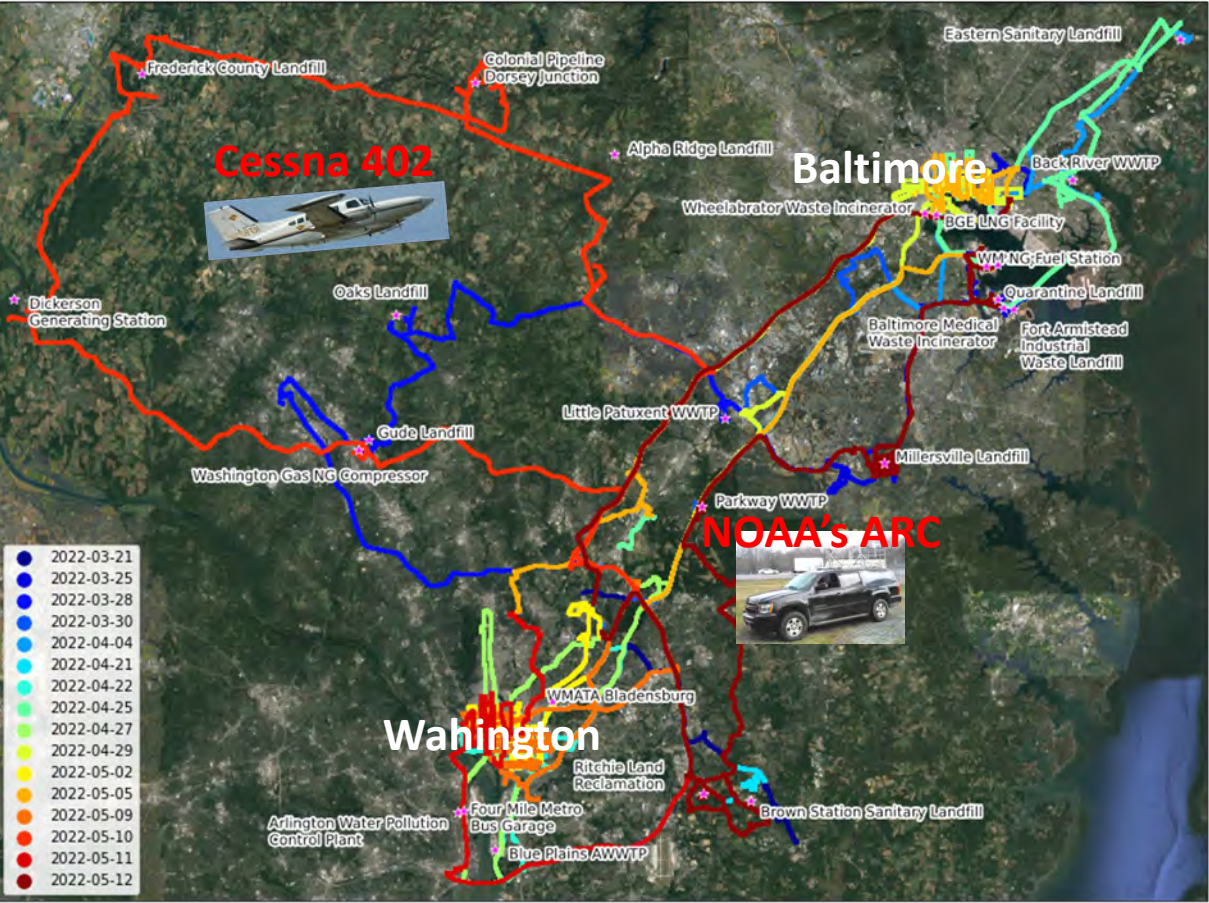
# Ethane and Methane Isotope for Source Attribution



Ethane as an indicator for natural gas leaks

$\Delta[\text{Ethane}] / \Delta[\text{Methane}] = 3.2\%$  in Baltimore  
 $4.3\%$  in Washington, DC

# Simultaneous Mobile and Aircraft Measurements in NYC and DC-Baltimore in Summer 2023



Mobile measurements in DC-Balt in Spring 2022

