NYC-METS (New York City metropolitan Measurements of Emissions and TransformationS) Overview: Manhattan and Downwind

Drew Gentner, Andy Lambe, & many others

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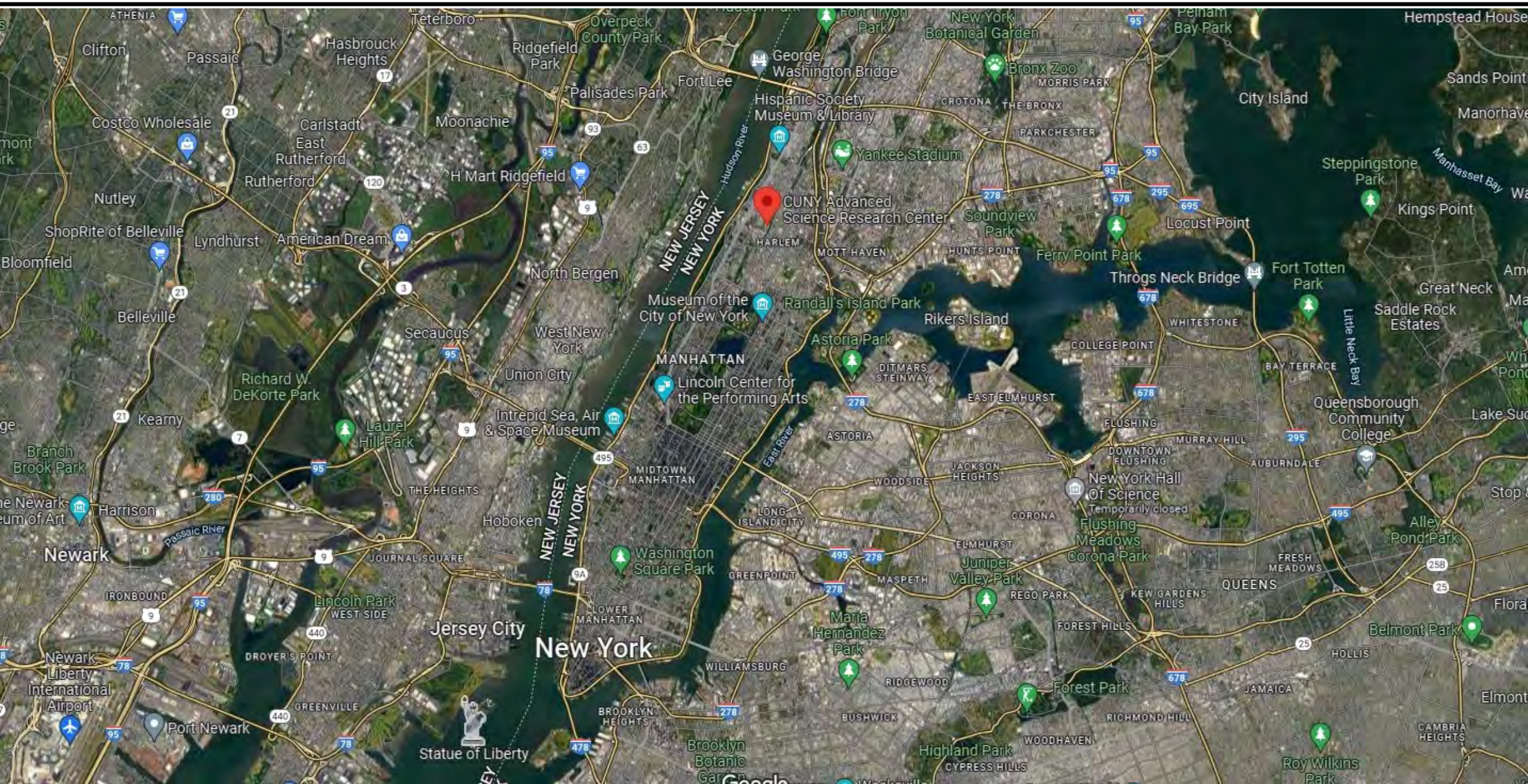
Overview of NYC-METS and Related Sites

Manhattan Site (CUNY ASRC): 85 St. Nicholas Terrace, New York



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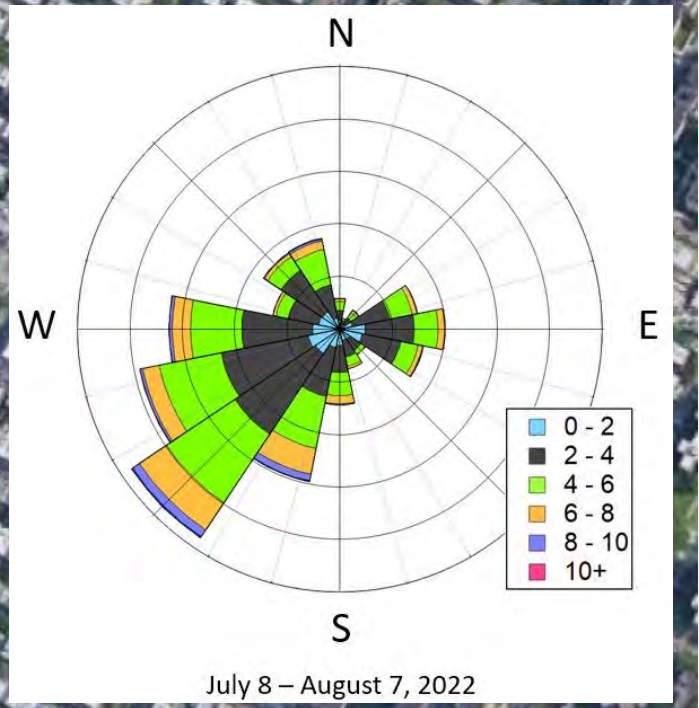
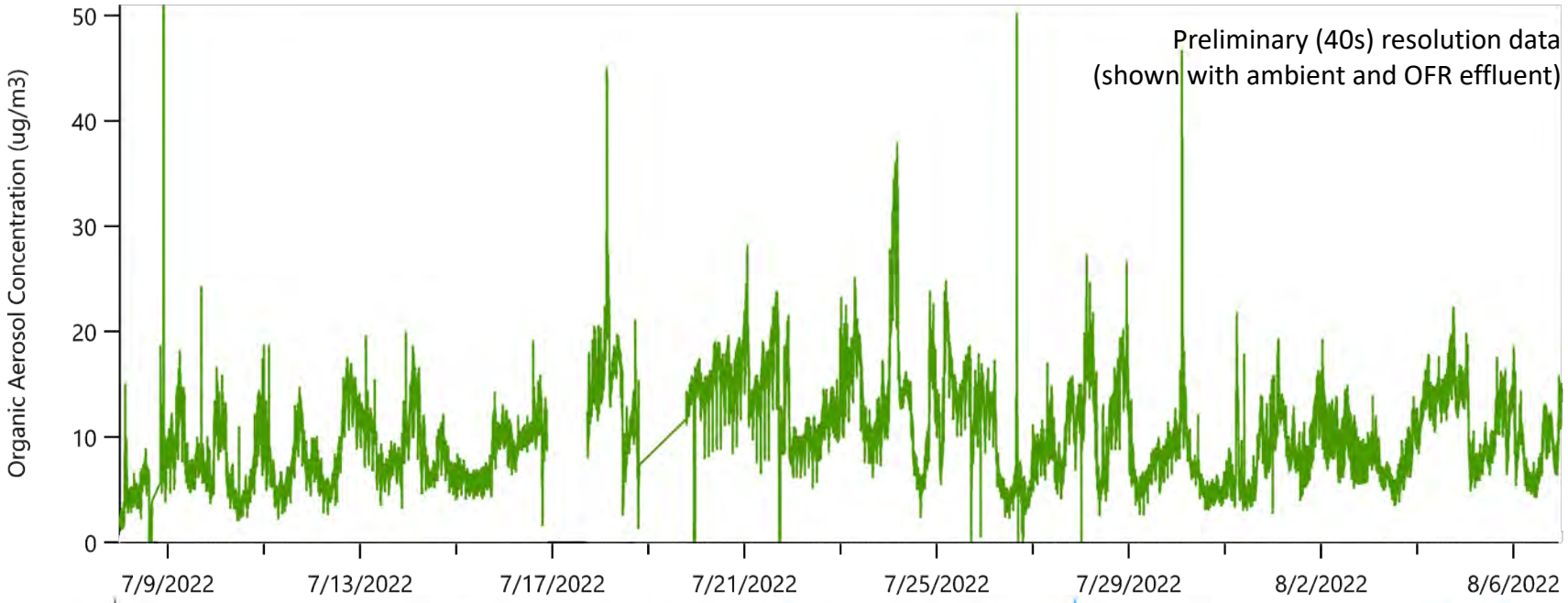
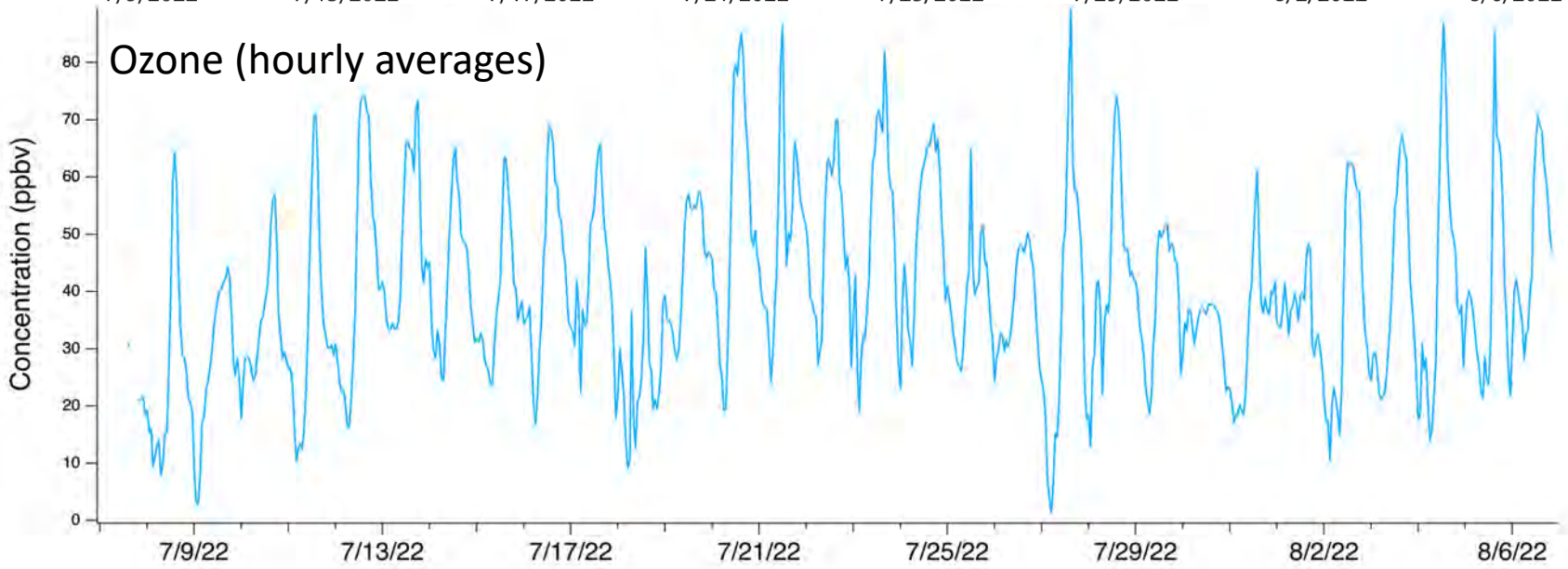


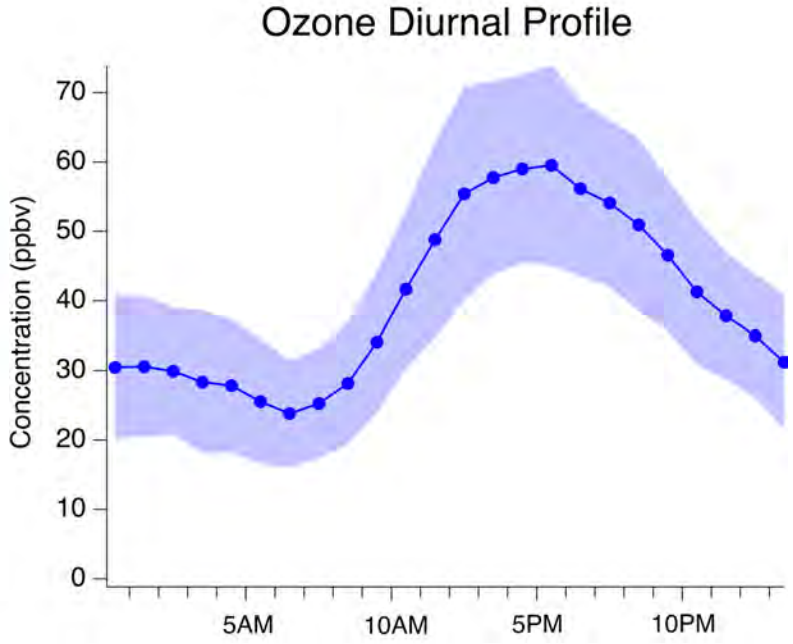
Google

Manhattan **Preliminary** Data (Summer 2022)





- Daytime highs ranging 24-34 C (at 90 m ASL)
- Variable RH with citywide average of ~60% (July)
- Average NO_X: 9 ppbv
- O_3 periodically exceeding 80 ppb (1 hour avg.)

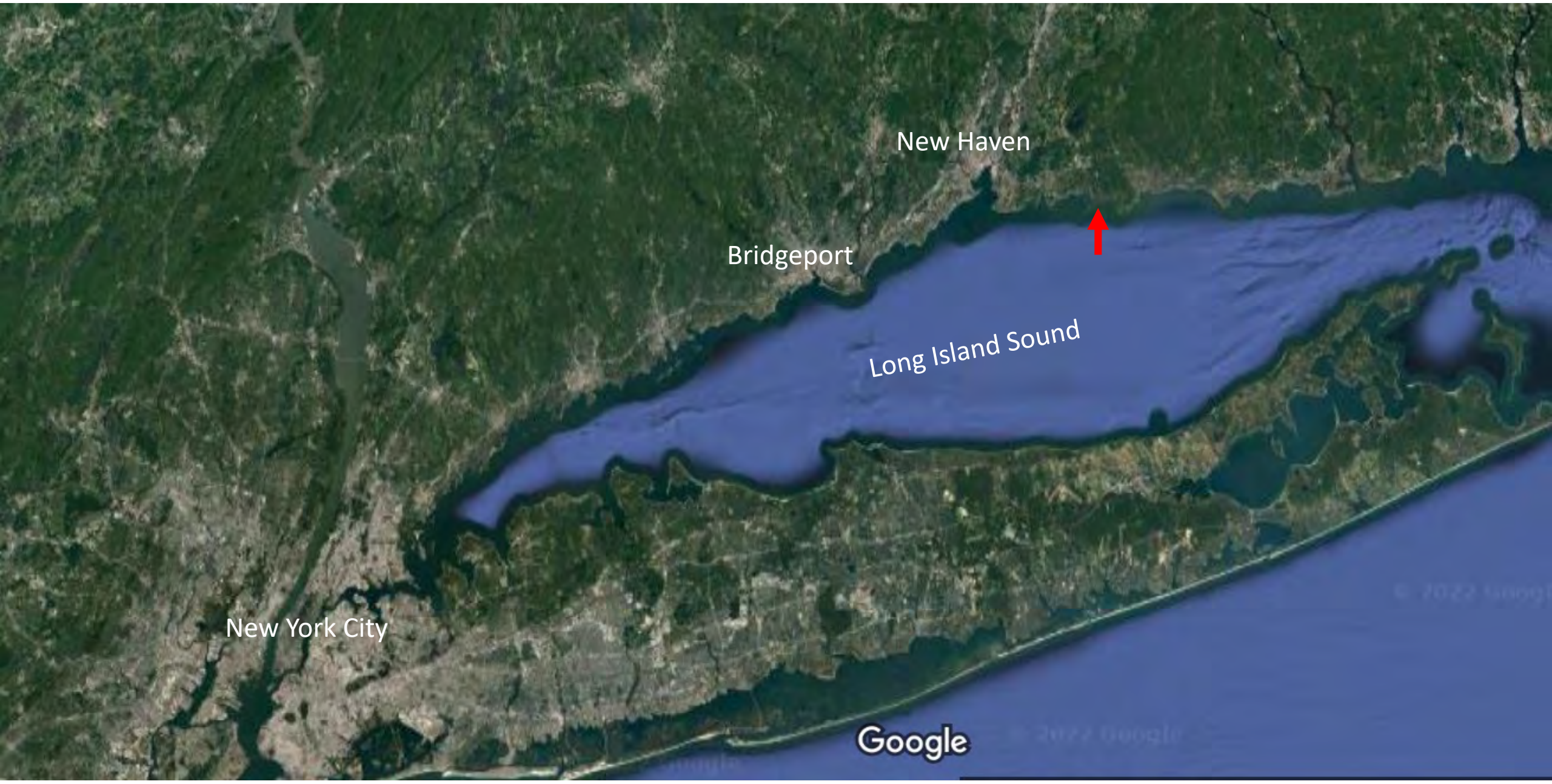


Manhattan Site: Summer 2023 Instrumentation Overview

Species Measured	Technique	Instrument PI names	Institution(s)
Initial NYC-METS project			
VOCs-SVOCs, e.g., C_6-C_{12} aromatics, $(CH_3)_2CO$, CH_4S, $C_7H_4ClF_3$, D5-siloxane	Vocus PTR-ToF	Drew Gentner, Manjula Canagaratna	Aerodyne, Yale
Gas-phase compounds, e.g., HNO_3, HONO, HO_2NO_2, HNCO, N_2O_5, PANs, HCOOH, $CH_2(COOH)_2$, $C_5H_9O_4N$	Iodide HR-ToF-CIMS	Andy Lambe	Aerodyne
Greenhouse and trace gases (CO, CO_2, CH_4, H_2O)	Tunable Infrared Laser Direct Absorption Spectroscopy	Rob Roscioli	Aerodyne
Gas-phase VOCs - SVOCs (C_6-C_{25})	Offline GC-TOF/MS analysis of adsorbent tubes	Drew Gentner	Yale
Particle-phase IVOCs - ELVOCs	Offline LC-TOF analysis of PM filter samples	Drew Gentner	Yale
Particle-phase organics, NO_3-, SO_2-, NH_4+, Cl	Aerosol Chemical Speciation Monitor	Ben Nault, Phil Croteau	Aerodyne
in situ OH/O_3/NO_3/Cl oxidation products of VOCs, I/SVOCs, OVOCs	Oxidation Flow Reactor	Andy Lambe	Aerodyne
O_3, NO/NO_2, SO_2, BC/BrC, Meteorology (e.g., high-resolution 3-D sonic wind data, ceilometer)	Supporting measurements	Misc.	CUNY, Yale, Aerodyne
NOAA AC4 AEROMMA funded collaborators			
Speciated hydrocarbons and OVOCs	Online GC-TOF-MS	Megan Claflin, Pawel Misztal	Aerodyne, U. Texas Austin
OH reactivity	Comparative reactivity method with PTR-TOF-MS	Seawung Kim	UC Irvine
Size resolved organic aerosol composition	MOUDI, offline AMS, UHR/MS, single particle microspectroscopy	Rachel O'Brian, Andy Ault	William & Mary, U. Michigan
Gas- and particle-phase organic compounds, and HNO_3, $ClNO_2$, biogenic sulfur compounds	FIGAERO HR-ToF I-CIMS	Joel Thornton, Sally Ng	U Washington, Georgia Tech
Peroxy and hydroperoxy radicals (RO_2 + HO_2)	ECHAMP peroxy radical monitor	Ezra Wood	Drexel U.

Also: Possible overlap with Roisin Commane (Columbia): long-term CH_4, CO_2, CO via Picarro analyzer

Coastal CT Site (Yale Coastal Field Station): 276 Old Quarry Rd., Guilford, CT



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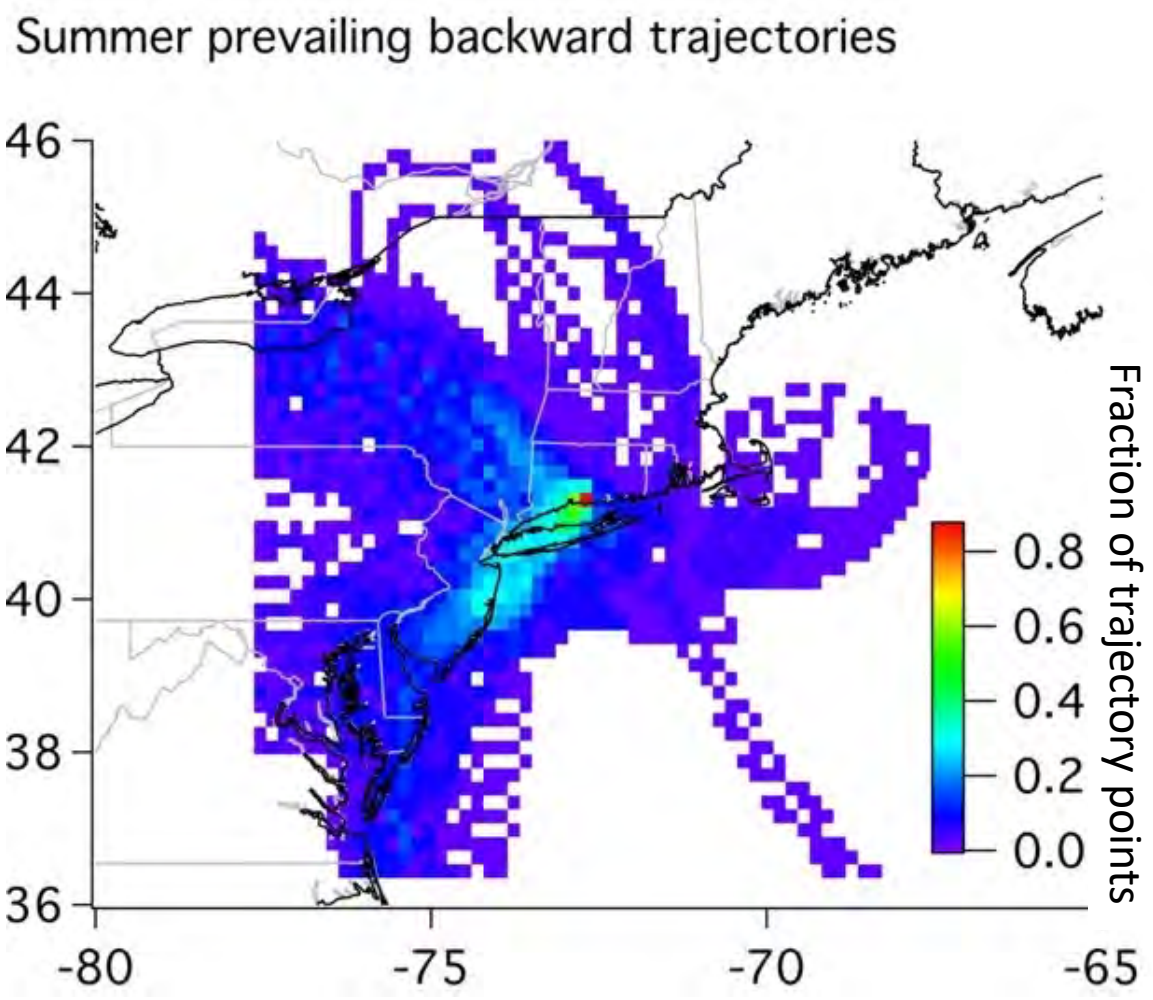
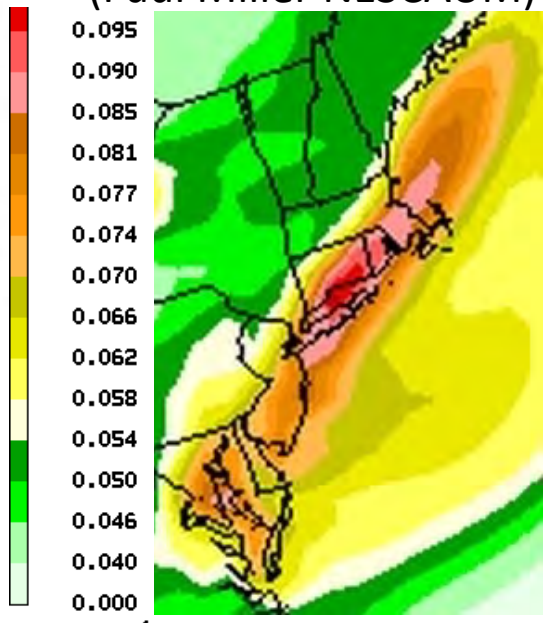
Coastal CT: Site Background

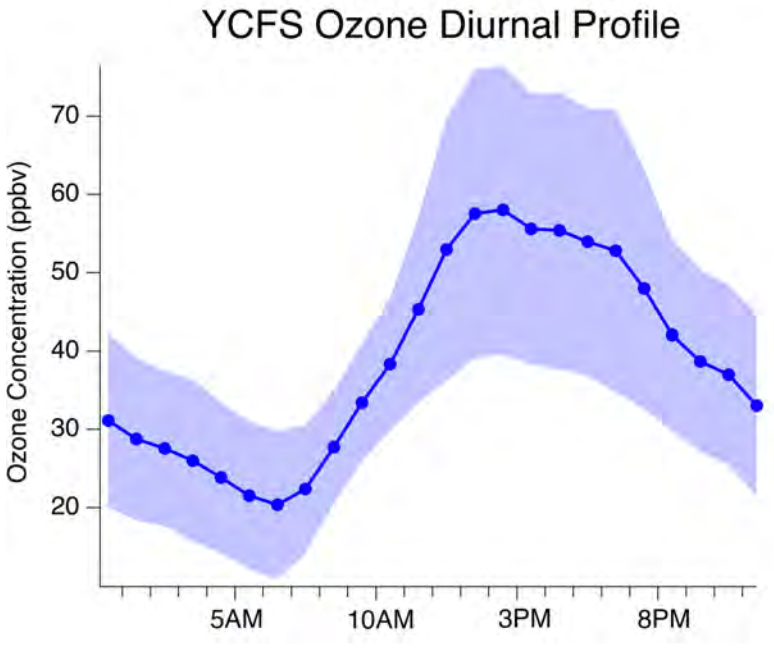


Ditto et al. 2022 ACP

- Ozone varies by day with hourly ozone often reaching 80+ ppb, and sometimes 100 ppb
- Frequent high RH and daytime highs up to 32 C
- NO_X present chemistry, though typically ≤ 5 ppb with onshore flow
- Prior aerosol (and gas) speciation (Ditto et al. 2020, 2022) highlights aqueous-phase chemical processes and abundant N-containing species

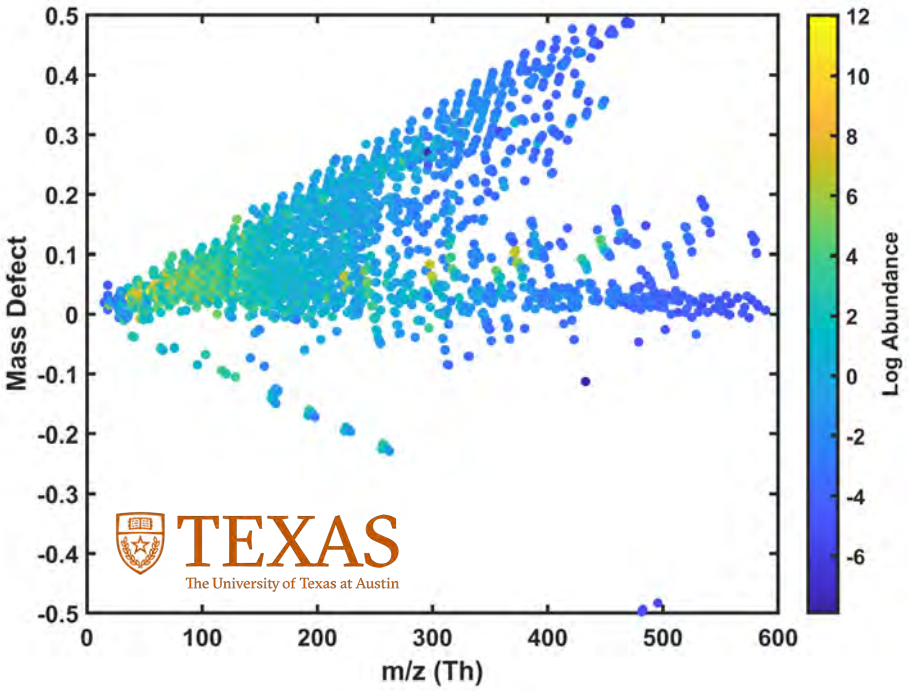
Example O_3 model prediction (Paul Miller NESCAUM)

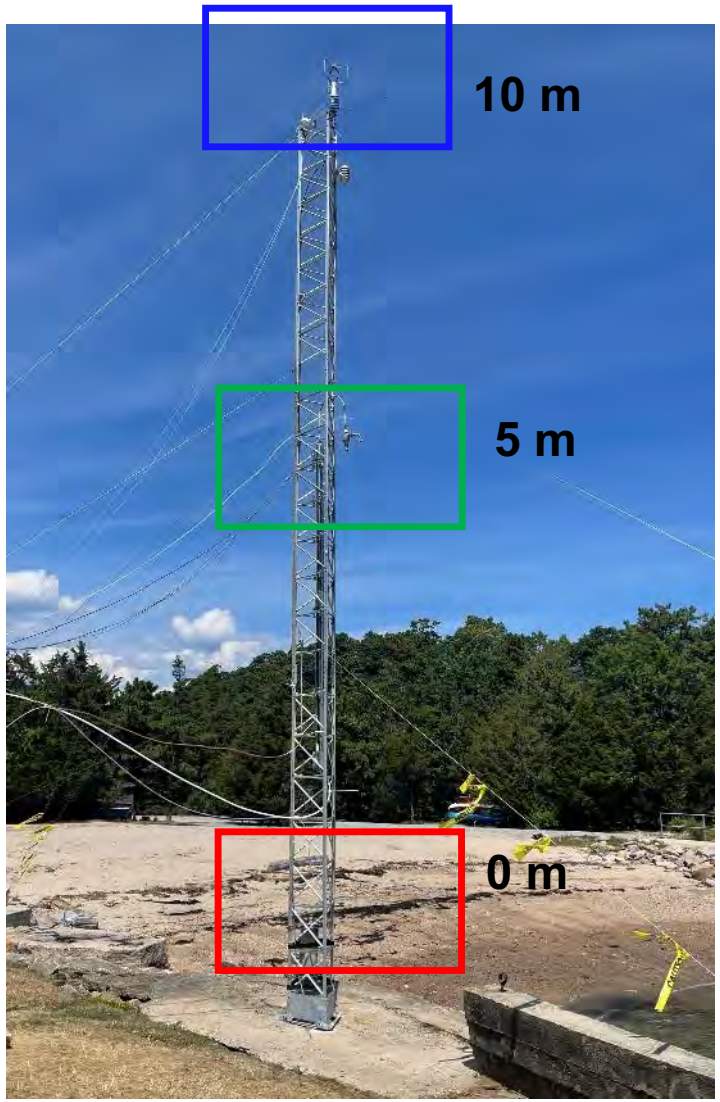


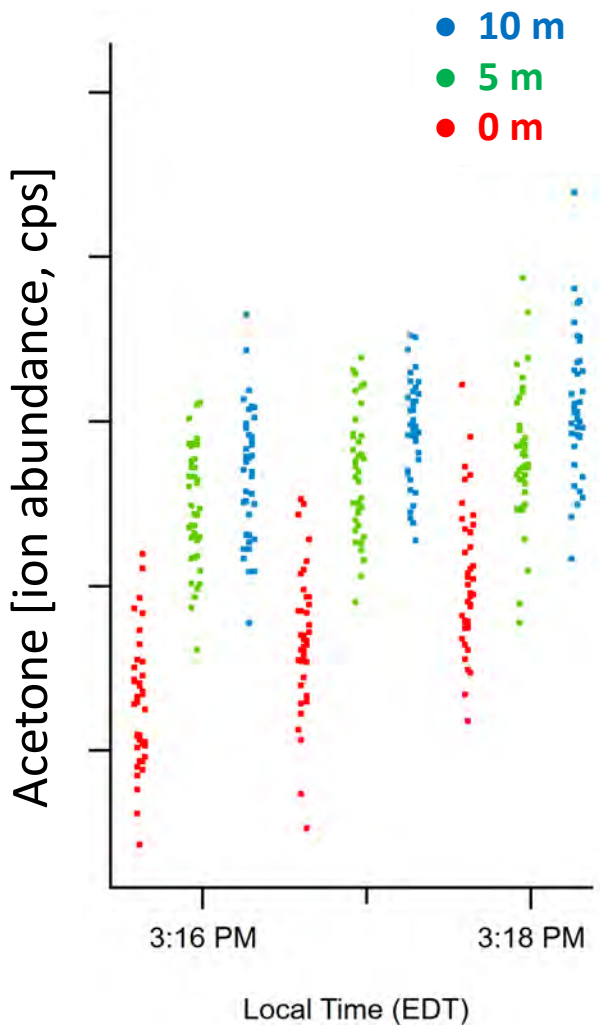


Coastal CT: **Preliminary** Summer 2022 Data

- Multi-inlet setup used to perform vertical gradient measurements in 2022 using Vocus PTR-TOF with Pawel Misztal (UT Austin)
  - At “0”, 5, and 10 m
- Also fast 3-D sonic (10 Hz) at 10 m
- Over 1500 ions in preliminary mass list







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O_3, $PM_{2.5}$, NO/NO_2, SO_2, CO, SO_2, BC/BrC, Meteorology (e.g., high-resolution 3-D sonic wind data)	Misc. supporting measurements	Drew Gentner	Yale
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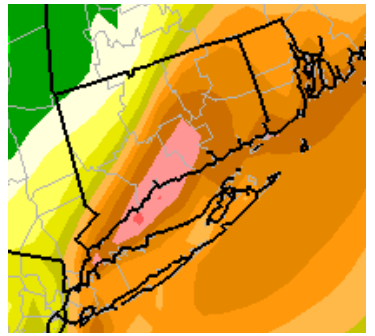
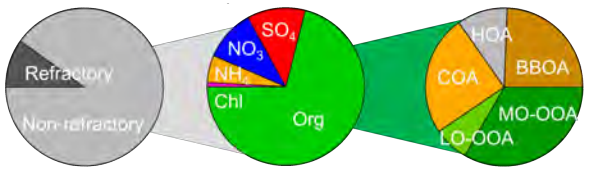
Size resolved organic aerosol composition	MOUDI, offline AMS, UHR/MS, single particle microspectroscopy	Rachel O'Brian, Andy Ault	William & Mary, U. Michigan

- Ongoing discussions about other instrumentation and opportunities for additional online, offline, or optical/spectroscopic measurements (with large waterfront area).
- Also, boat and dock facilities available.

Overarching scientific goals and foci across the NYC-METS team

- Emissions and source apportionment of reactive gases and aerosols, and their contributions to OA/SOA and ozone
- Atmospheric chemistry in NYC and downwind, including the influence of marine-related sources and chemistry
- Paired measurements in NYC and coastal CT with dual ACSM, Vocus PTR-TOF, and FIGAERO-CIMS deployments, as well as offline aerosol speciation/characterization across multiple labs
- *in situ* oxidation flow reactor studies in NYC
- Understanding present day to future AQ and its health effects in NYC and downwind
- Collaborations across field measurement platforms, emissions inventories, and models





Joo et al. 2021