GOTHAAM 2025

GreaterNY Oxidant, Trace gas, Halogen and Aerosol Airborne Mission

Funded by the US National Science Foundation (ACP, GEO)

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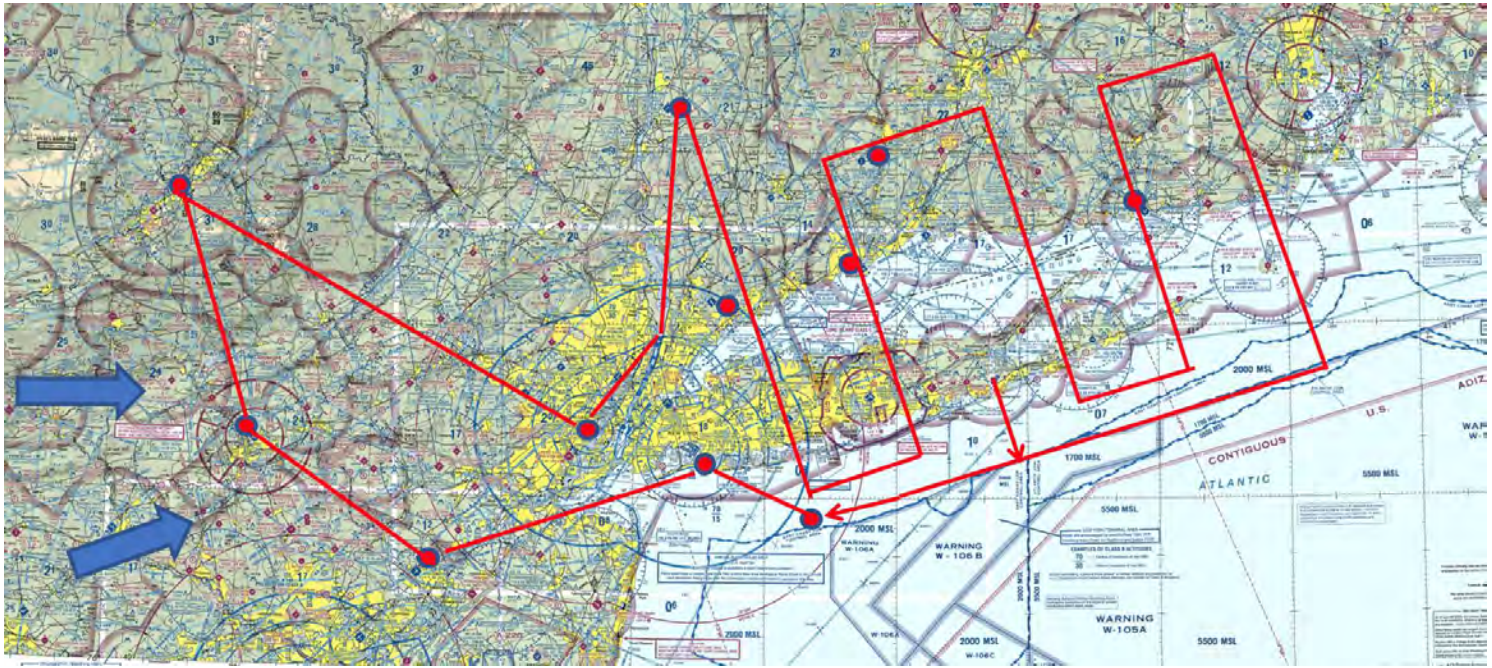
Location: ***Greater New York City***

Projected: ***July 1-August 12 2025***

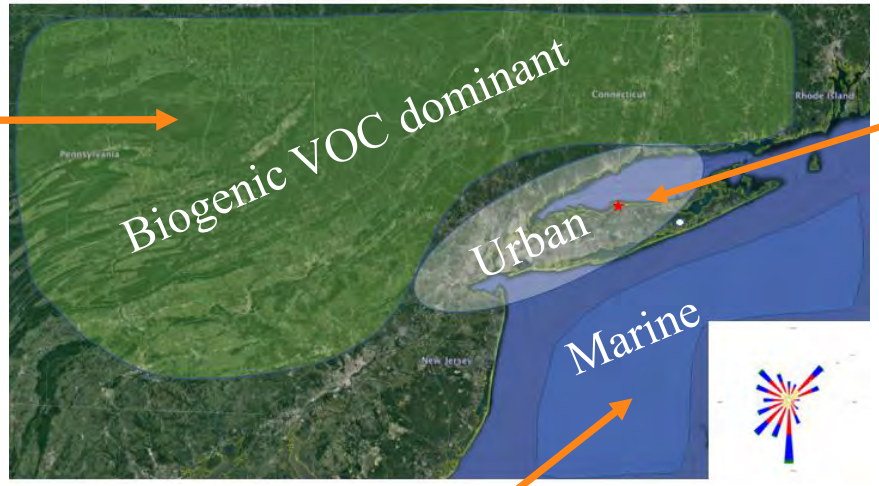


The New York City region is comprised of three chemical systems:

- Biogenic/terrestrial (biogenic volatile organic compounds are dominant)
- Urban/industrial (NOx, Volatile Consumer Products (VCPs), VOC from fossil fuels, potentially leading to high O_3)
- Marine (halogen emissions)

Each system has characteristic trace species emissions that uniquely impact chemistry.

Biogenic summertime emissions surrounding NYC are very large; temperate forest coverage of the surrounding regions (NY, NJ, CT, MA, PA) is greater than 20 million hectares.



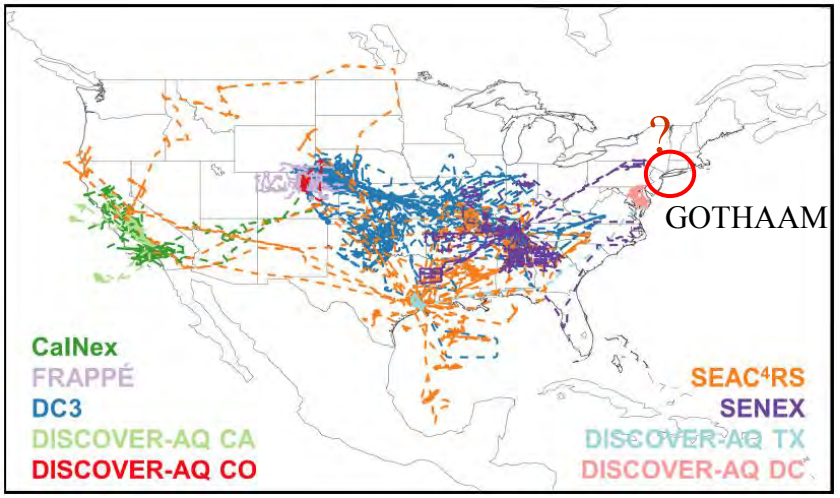
Urban plume (with high NOx, anthropogenic VOCs, VCPs, aerosol) mixes with Biogenic and Marine systems.

Nighttime Cl_2 in the **marine layer** can be very enriched in the NY region (black line) compared to the west coast (red line), leading to **rapid oxidation at sunrise.** (Spicer et al, Nature, 1998; Finlay and Saltzman, GRL, 2006)

Summertime flow is often from the S-W quadrant; polluted quadrant for NY Metropolitan area (>20 million people impacted).

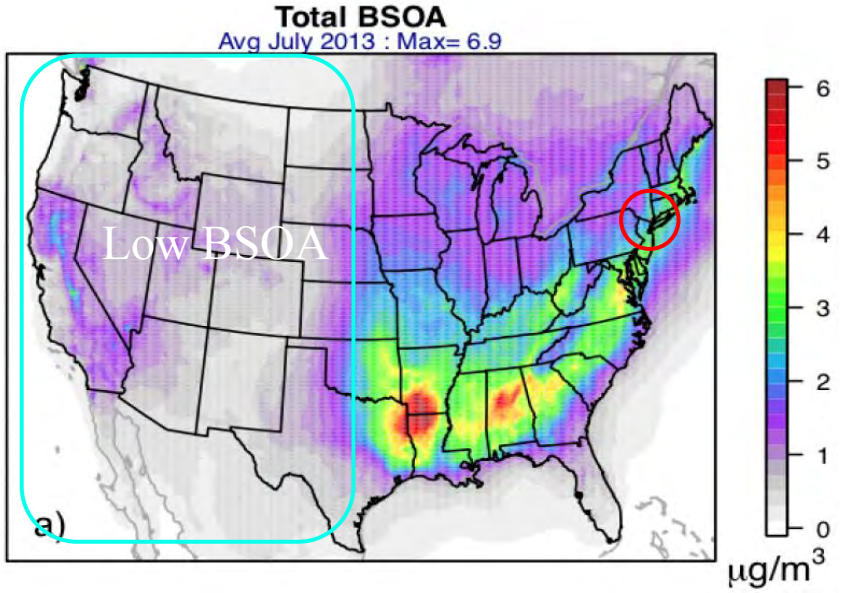
What makes GOTHAAM unique?

- Biogenic precursors to SOA are among the highest outside SE US.
- Proposed diel study of night-into-day chemical mechanisms would be a first, especially with proposed instrumentation.
- The NYC region is the most densely populated region in CONUS (>23 million).
- There has not been a recent comprehensive airborne study of the atmospheric chemical processes focusing on this region.
- GOTHAAM's integrated state-of-the-art chemistry payload.



Recent VOC-centric aircraft campaigns* underscore the lack of information in the NE US (Chen et al., 2019). GOTHAAM encompasses VOC studies.

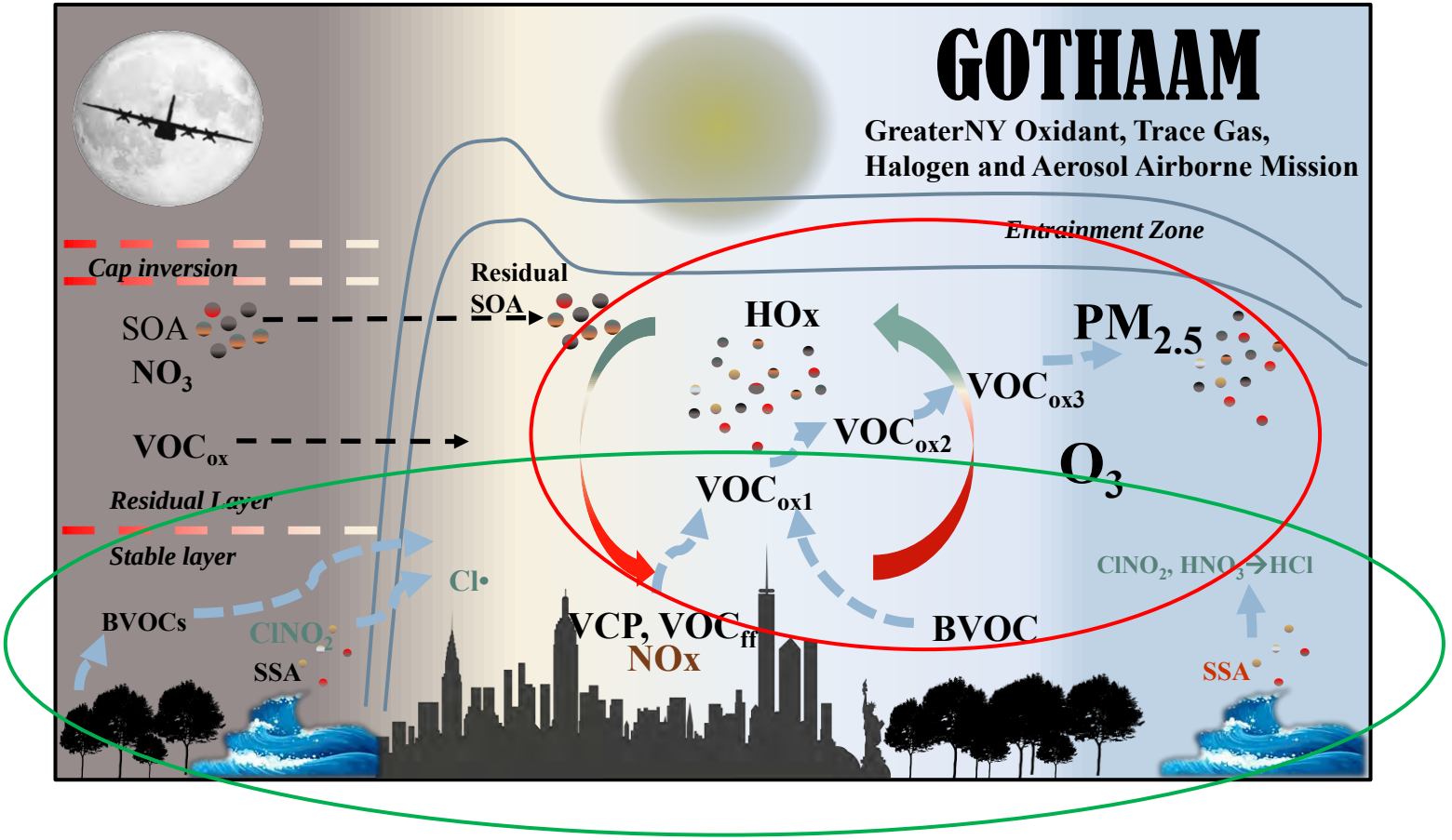
*SOAS, NOMADDS cover the similar region as SENEX



Biogenic derived SOA (BSOA) in July 2013 illustrates the significant production in the GOTHAAM region. There is a large difference between the NYC region and the central/western US. (Carlton et al., 2018)

GOTHAAM Scientific Objectives

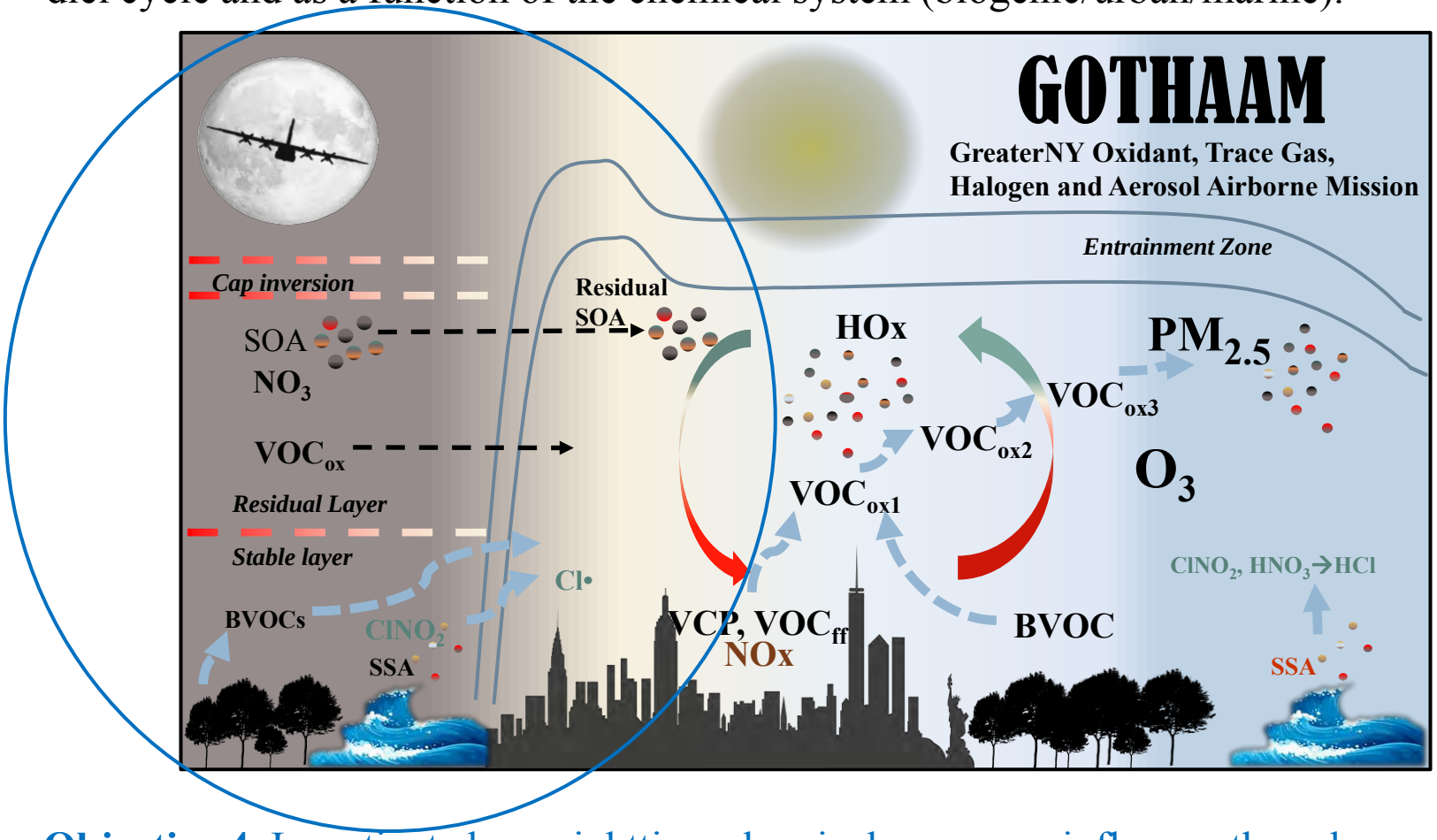
Objective 1. Quantify the relative contributions from the various volatile organic compound (VOC) sources (biogenic, fossil fuel, combustion, consumer products) and how they contribute to chemical reactivity.



Objective 2. Determine the relative potential contribution of each VOC class to secondary organic aerosol (SOA) as the anthropogenic plume evolves.

GOTHAAM Scientific Objectives

Objective 3. Quantify the relative importance of the various oxidation processes for both gas phase and aerosol species, and how the relative importance of these processes vary across the diel cycle and as a function of the chemical system (biogenic/urban/marine).



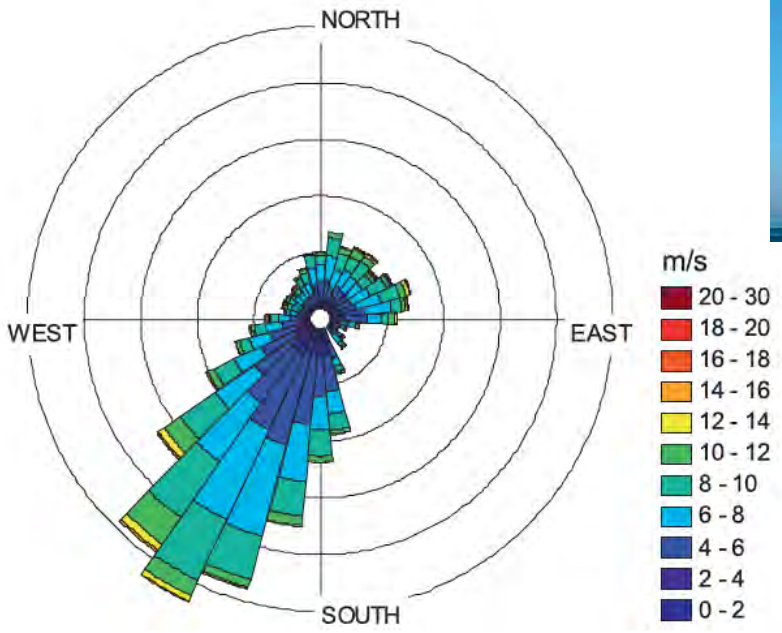
Objective 4. Investigate how nighttime chemical processes influence the subsequent day's initial chemical composition.

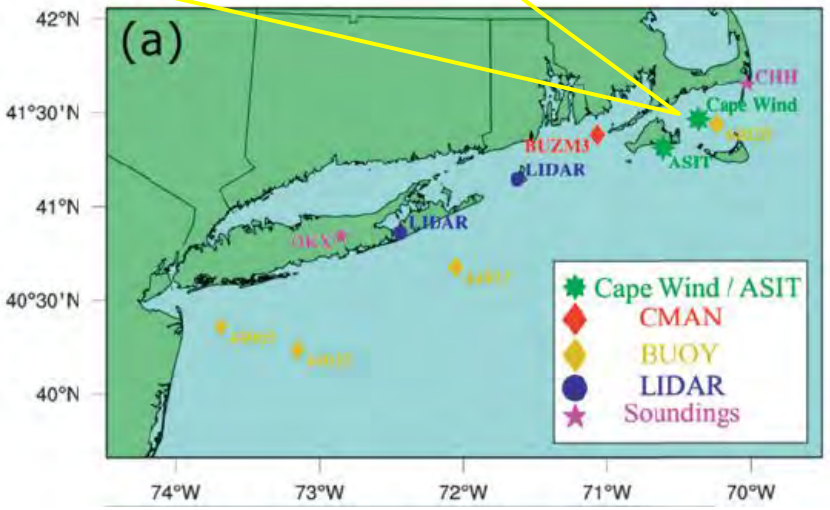
GOTHAAM instrumentation payload*

Instrument	Measurement	Requested or PI supplied	Relevant objectives
CIMS (CU)	OH, HO_2, RO_2, H_2SO_4	PI supplied (Lee)	2,3,4
I-TOFCIMS (ACOM/UW)	VOCs, oxidation products, chlorinated species, $ClNO_2$, Cl_2, HONO, N_2O_5, etc	ACOM/PI (Thornton, Palm)	1,2,3,4
PTRTOFMS Vocus (UW)	VOCs (VCPs, VOC_{ff}, BVOC)	PI supplied (Bertram)	1,2,3,4
ATOFMS (UM)	Single particle composition, including sea salt quantification	PI supplied (Pratt)	2,3,4
AMS (CSU)	SOA composition	PI supplied (Farmer)	1,2,3,4
TOGA-TOF (ACOM)	Organic gases; ACOM	Requested	1,2,3,4
ISAF (UMd)	CH_2O	PI supplied (Jason/Glenn)	1,2,3,4
Fast NOx, NOy, O_3 (ACOM?)	*NOx, NOy, O_3*	*ACOM?*	*2,3,4*
PANs (ACOM)	PAN	ACOM	2,3,4
Picarro 2401m (ACOM)	GHG/CO/SO_2	ACOM	3,4
TRAC (SBU/Purdue)	Aerosol impaction collector	PI supplied	2,3,4
Mini WAAS (ACOM)	VOCs	ACOM	1,2,3
Picarro SI2108 (SBU)*	HCl	PI Supplied	3

*EOL requested aerosol instruments not shown

NYMR observations, July-August

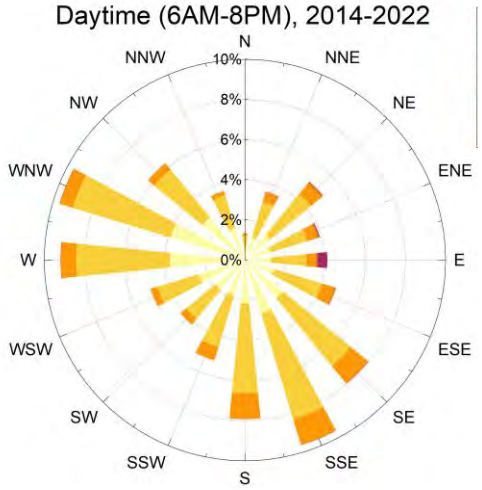


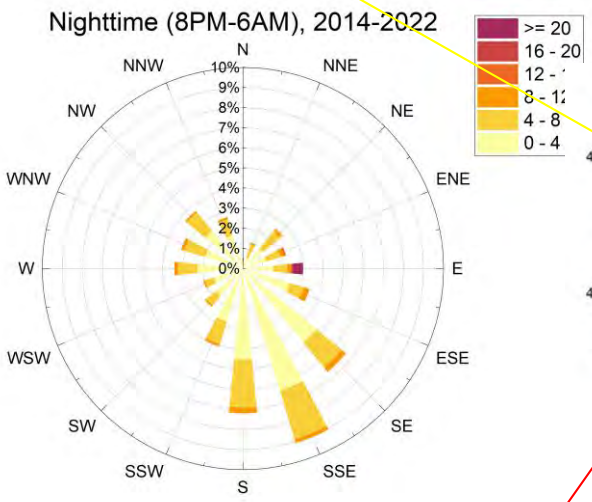


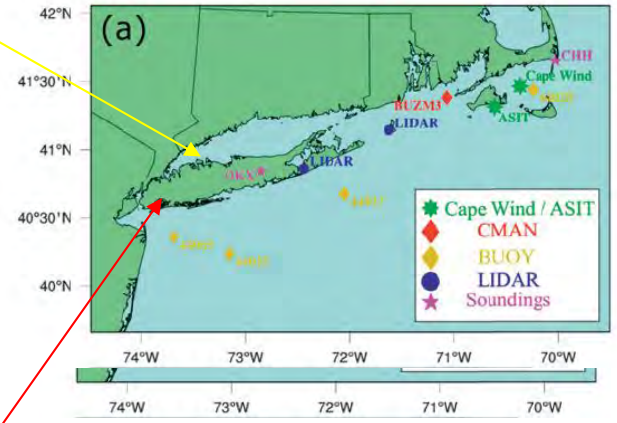
Wind rose from Cape Wind offshore Tower (@20m MSL), JJA 2003-2007 (Colle et al., BAMS, 2016)

Regional met observations, July-August

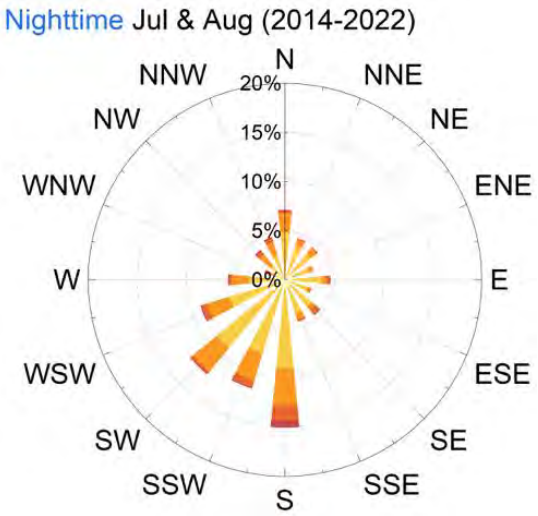
Stony Brook University obs

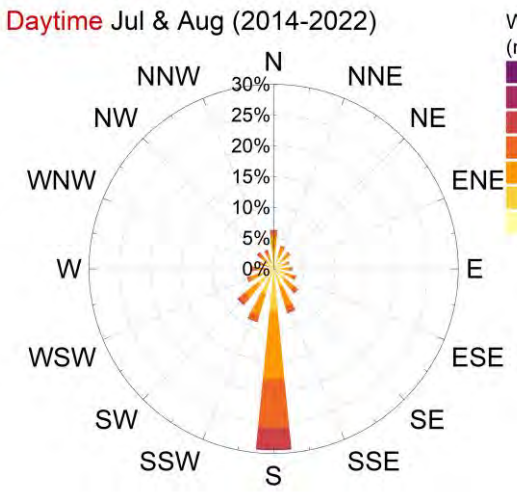


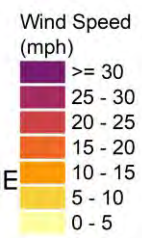


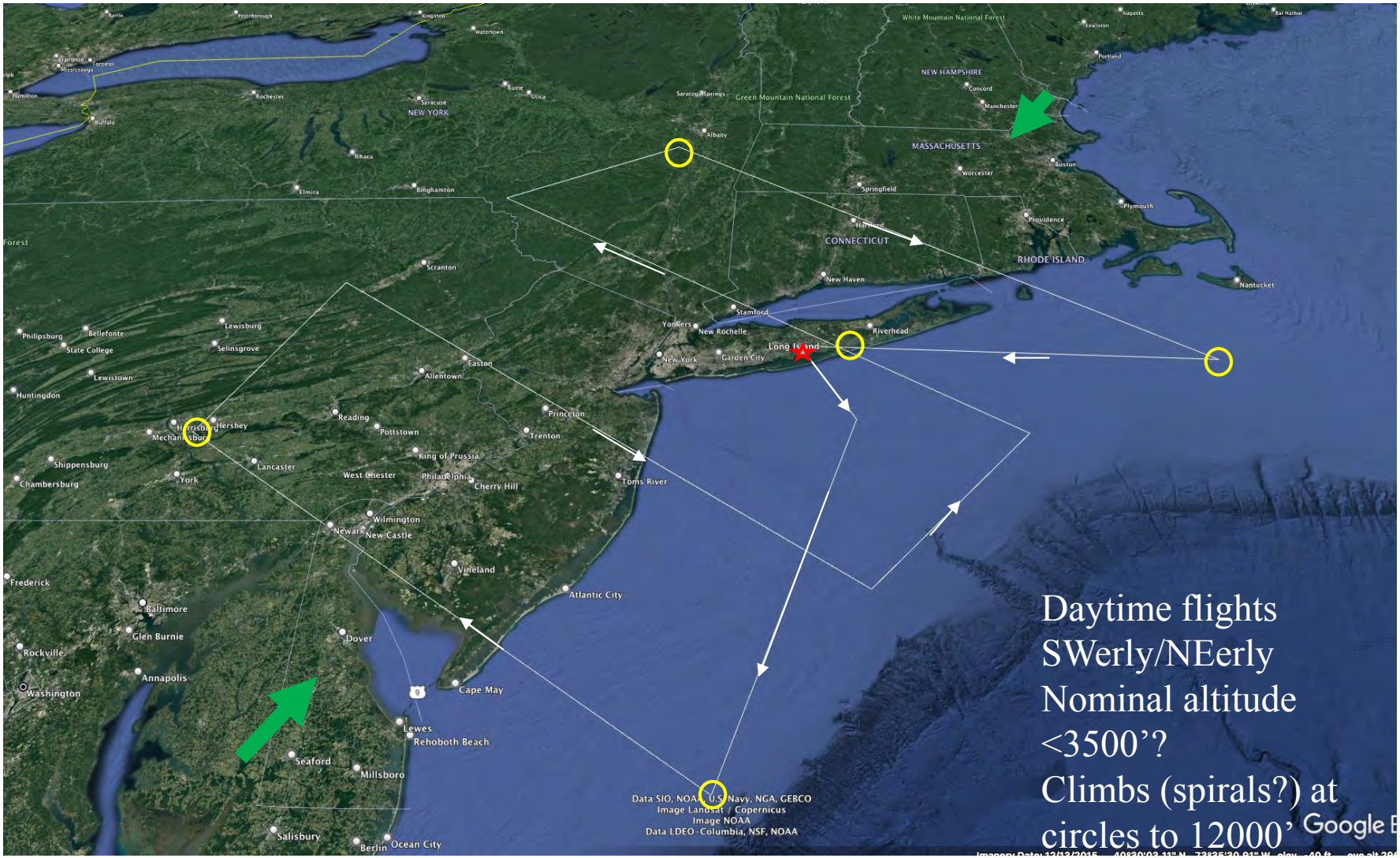


JFK obs

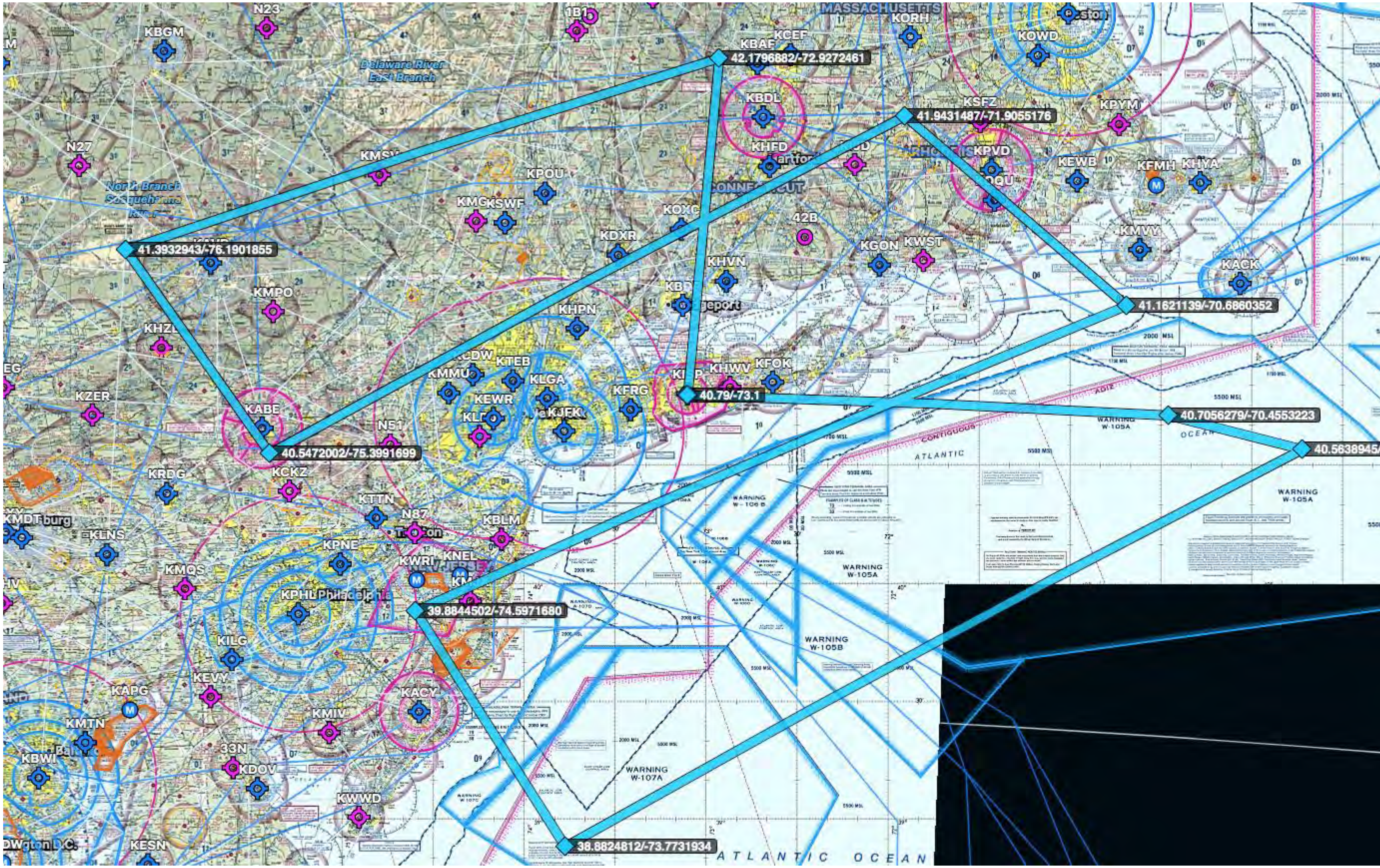







Daytime flights
SWerly/NEerly
Nominal altitude
<3500'?
Climbs (spirals?) at
circles to 12000'
Google
NEW YORK
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
NEW HAMPSHIRE
Green Mountain National Forest
White Mountain National Forest
Long Island
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image NOAA
Data LDEO-Columbia, NSF, NOAA


NEW YORK
Albany
Ithaca
MASSACHUSETTS
Boston
Worcester
Springfield
Elmira
Binghamton
Plymouth
Providence
Hartford
CONNECTICUT
RHODE ISLAND
Scranton
New Haven
Nantucket
Stamford
Yonkers
New Rochelle
Long Island
New York
Garden City
Easton
Allentown
Princeton
Reading
Pottstown
Trenton
King of Prussia
Lancaster
West Chester
Philadelphia
Cherry Hill
Toms River
Wilmington
Newark
New Castle
Vineland
Atlantic City
Dover
Cape May
Lewes
Rehoboth Beach
Seaford
Millsboro



42.1796882/-72.9272461
41.9431487/-71.9055176
41.3932943/-76.1901855
41.1621139/-70.6860352
40.79/-73.1
40.7056279/-70.4553223
40.5638945/-6
40.5472002/-75.3991699
39.8844502/-74.5971680
38.8824812/-73.7731934
KBGM
N23
1B1
KORH
KOWD
KBDL
KHFD
KSFZ
KPYM
KPVD
KEWB
KFMH
KHYA
KMVY
KACK
KGON
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42B
KHVN
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KHPN
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N87
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KLNS
KPNE
KWRI
KNEL
KMQS
KPHL
KILG
KEVY
KAPG
KACY
KMIV
KMTN
KBWI
33N
KDOV
KWWD
KESN
Delaware River East Branch
North Branch Susquehanna River
MASSACHUSETTS
ATLANTIC OCEAN
WARNING W-105A
WARNING W-105B
WARNING W-107A

New for 2025:

We are hoping to deploy some ground based capabilities on Governors Island (700m south of Manhattan, 400 m west of Brooklyn), including met, doppler lidar (Z. Wang's Van, SBU), PTRTOFMS, etc. in collaboration with the New York Climate Exchange (https://nyclimateexchange.org/)

GI is an ideal site for upwind/downwind sampling to/from Manhattan as well as for capturing evolution of things like the sea breeze, evolution of the nocturnal layer, etc. Its like being in the city without being in the city (try setting up something in Battery Park).

There's even glamping accommodations on GI…
After all, this IS New York…