Long Island Sound Tropospheric Ozone Study (LISTOS)

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Paul J. Miller, NESCAUM

Chief Scientist & Deputy Director

The Need: Science in support of public health goals

NYC metro area/Long Island Sound region is complicated

◦ Chronic regional ground-level ozone (smog) problem

◦ Local air toxics "hot spots"

◦ Multiple pollution transport pathways affecting area

◦ Complicated, varied, and dense pollution source region

◦ Land-water interactions downwind of NYC

Northeast Ozone Nonattainment Areas 2015 8-hr NAAQS 0.070 ppm

Final designations announced April 30, 2018:

1. Moderate: New York-Northern New Jersey-Long Island, NY-NJ-CT

2. Marginal: Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE

3. Marginal: Greater Connecticut, CT

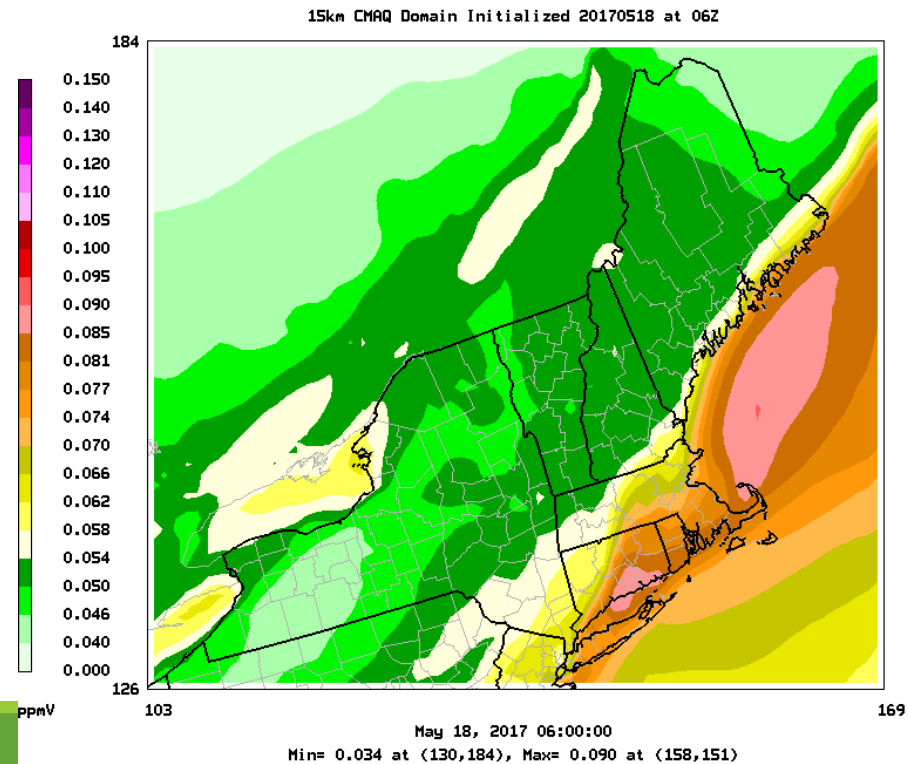4. Marginal: Washington, DC-MD-VA
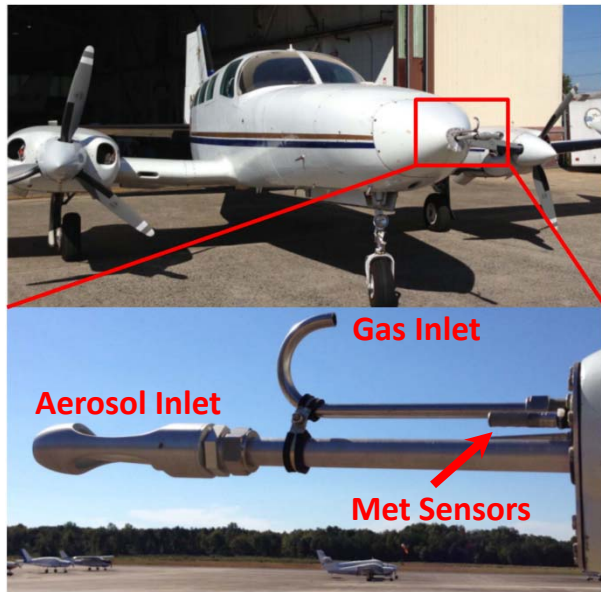
Multiple Pollution Transport Paths
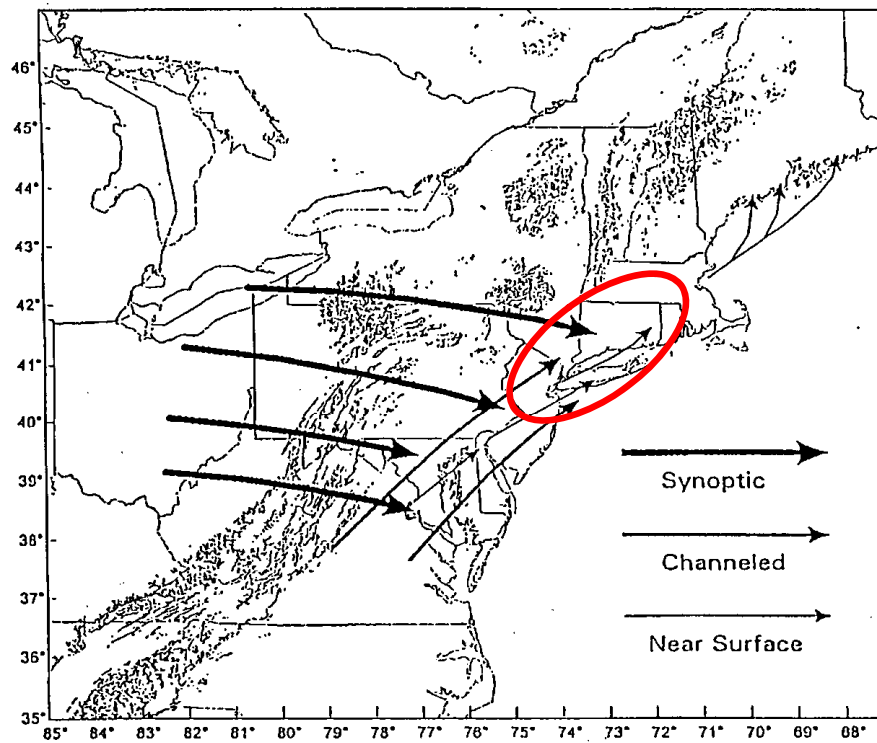
Over water transport

Synoptic

Channeled

Near Surface

Transport Regimes Observed During NARSTO-Northeast

2017 Initial Efforts

University of Maryland Aircraft Flights
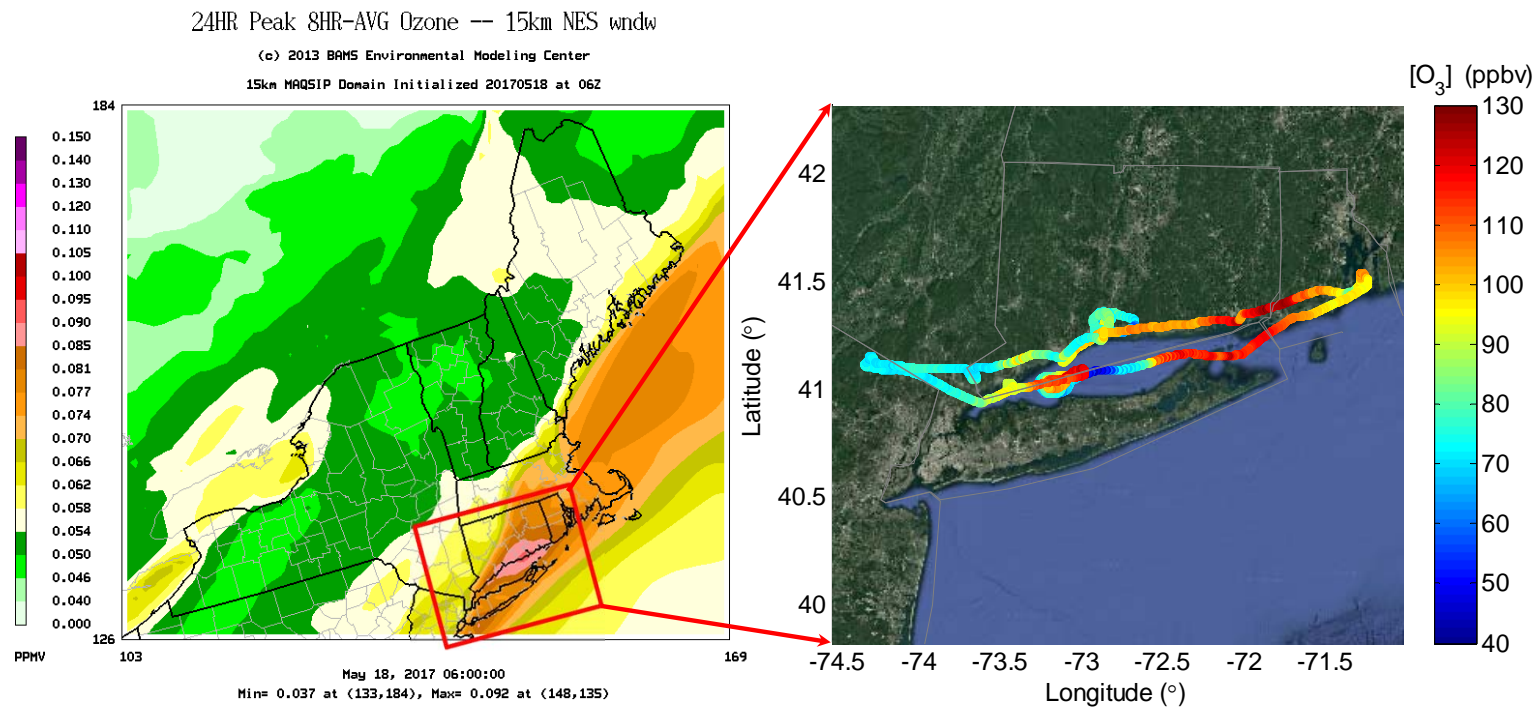
May 18, 2017 air quality forecast

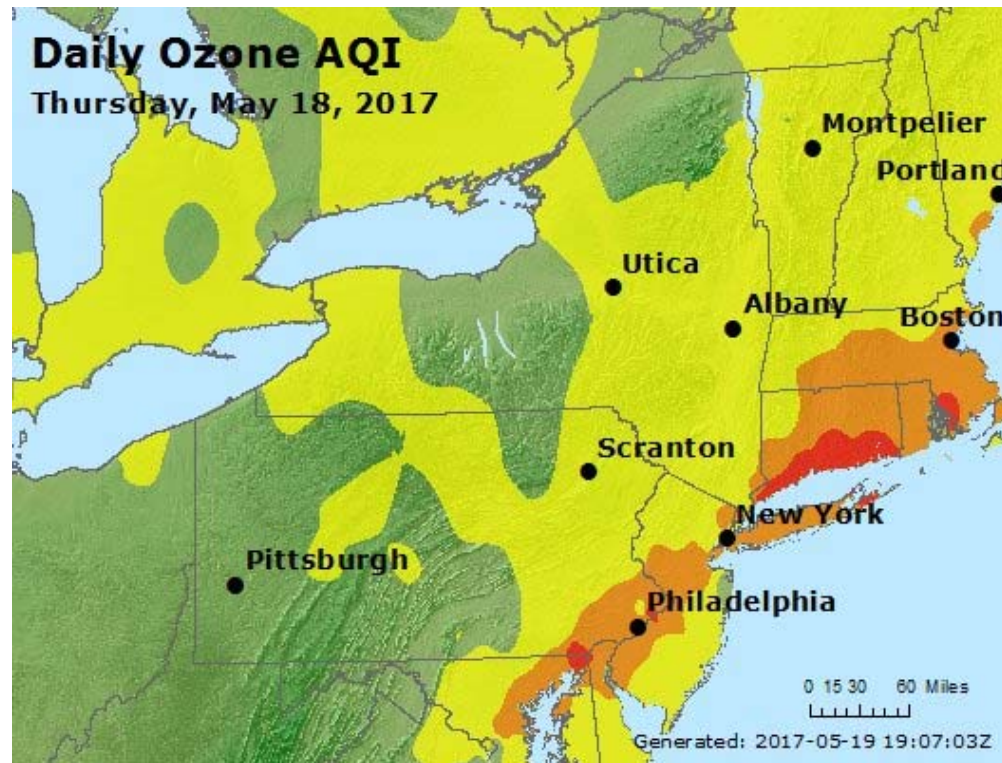# May 18, 2017 Afternoon Flight

Ozone forecast   **Observed O$_3$ on flight track**

The ozone episode was well forecast by the model!

Flights on May 17 & May 18, 2017

2-day classic
Northeast
Corridor
episode

Workshop at Lamont-Doherty, Columbia U., May 24-25, 2017 & Follow-up

❖ Convened research and policy experts in energy & air quality data gaps workshop

- NYSERDA-funded

❖ Follow-up activities

- Whitepaper with research recommendations as basis for future efforts
- Monthly calls *ad hoc* research group

2018 Expanded Efforts

Long Island Sound Tropospheric Ozone Study (LISTOS)

❖ http://www.nescaum.org/documents/listos

2018 Participants

❖ Multiple groups and agencies getting involved

- NOAA-Boulder
- NASA-Langley and NASA-Goddard
- EPA ORD and EPA Region 1 (New England)
- CT DEEP, NYS DEC, NJ DEP, ME DEP
- City College of New York
- University at Albany, Atmospheric Sciences Research Center
- Univ. of MD, College Park
- Stony Brook University
- NESCAUM

Supporters

❖ Funders
  - o CT DEEP
  - o NJ DEP
  - o NYS DEC
  - o National Fish & Wildlife Foundation
  - o NY State Energy Research & Development Authority (NYSERDA)

❖ Federal collaborators with own funding
  - o NOAA
  - o NASA
  - o EPA

Planned 2018 Activities

❖ Mostly solid activities (funding in-kind, received, or expected)
1. State AQI forecasters for predicting ozone episodes to launch activities
2. 8-12 UMD flights (depends on episodes, flight durations)
3. ME DEP and NYS DEC labs VOC canister analysis
4. 20-30 NASA GeoTASO high altitude flights
5. EPA Pandora instruments along Long Island Sound (LIS) coastline, Rutgers PAMS, in NYC, etc.
6. CCNY boat measurements in LIS
7. CCNY aerosol LIDAR in northern Manhattan
8. NOAA oxygenated/consumer product VOC mobile van measurements in NYC during March
9. Stony Brook Univ. oxygenated VOC measurements at Flax Pond PAMS site (Long Island north shore) during summer
10. Stony Brook Univ. aircraft fine resolution wind field measurements over LIS
11. Univ. at Albany O_3, NOx, VOC mobile measurements across Long Island south to north shore transects
12. Ozone sonde balloon launches for ozone/wind profiles from Long Island and possibly boat in LIS
13. Ozone LIDARs upwind at Rutgers Univ., NJ, and downwind on CT's LIS shoreline
14. CT DEEP equipping 2 Long Island Sound ferries with ozone monitors on Bridgeport-Port Jeff. Route
15. PAMS VOC measurements at Rutgers & the Bronx, with new NYS DEC PAMS site at Flax Pond, Long Island
16. Post-summer 2018 workshop (dates/location tbd)

2018 Activities Already Underway

❖ NOAA-Boulder monitoring van in NYC during late March 2018

   o Consumer product VOCs vs. transportation VOCs

❖ UMD flight on March 26, 2018 around NYC

   o VOC canister collection to compare with NOAA-Boulder surface measurement
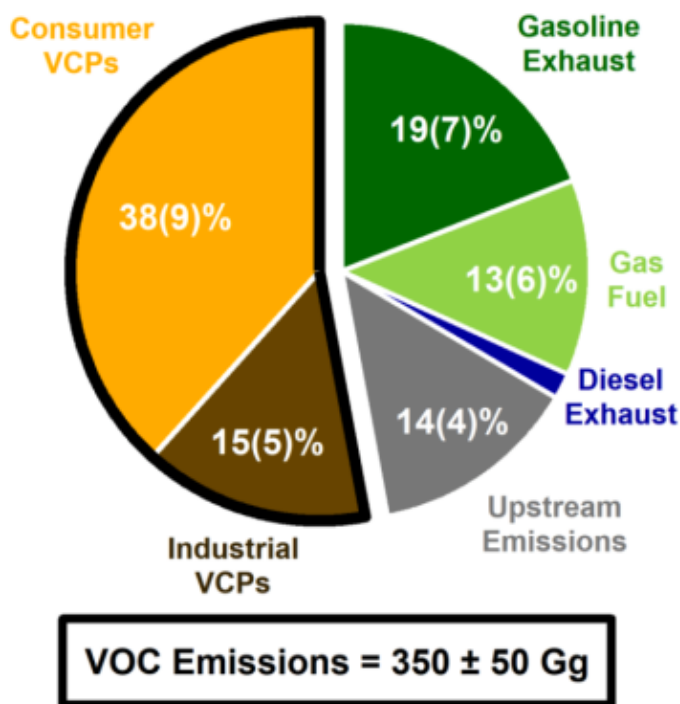
   o NYS DEC canister VOC analysis

VOC Inventories, LA Example

NYC Deployment, March 2018

Consumer VCPs 38(9)%
Gasoline Exhaust 19(7)%
Gas Fuel 13(6)%
Diesel Exhaust
Upstream Emissions 14(4)%
Industrial VCPs 15(5)%

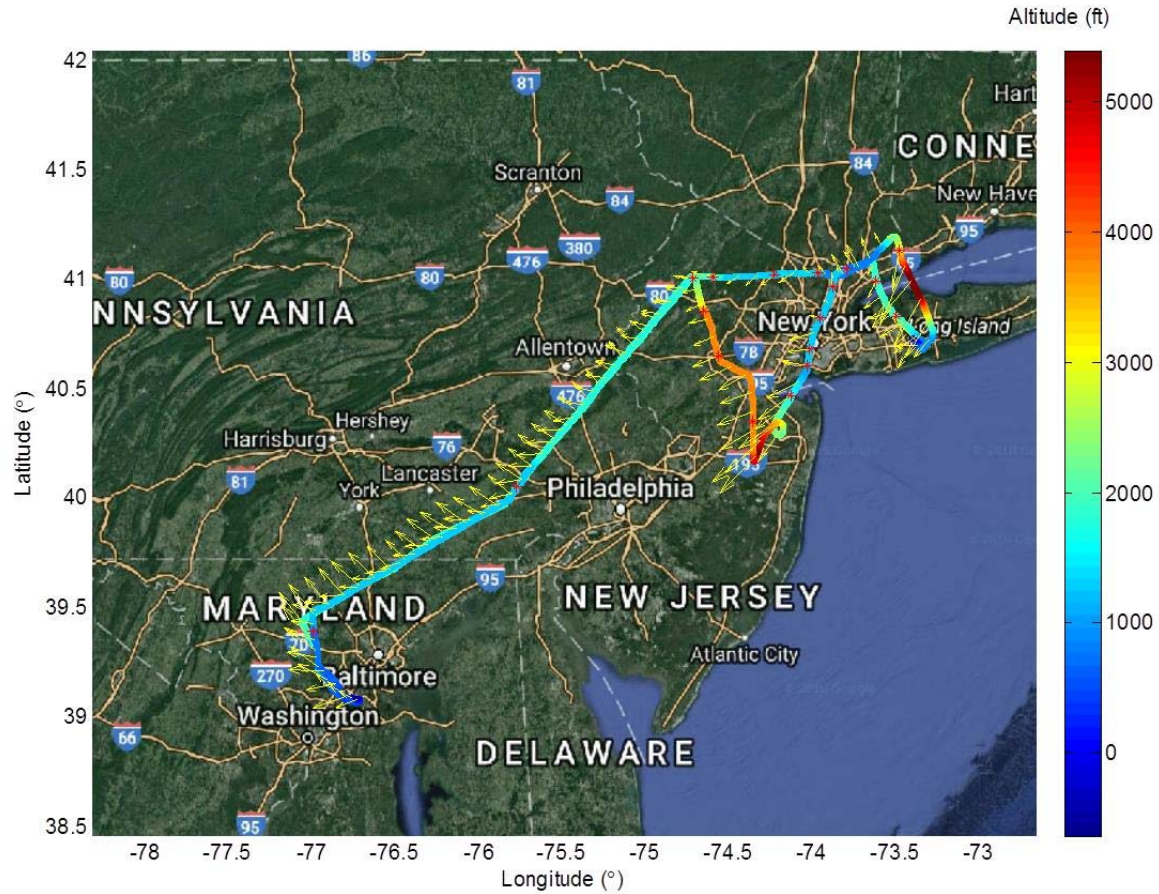VOC Emissions = 350 ± 50 Gg

Science, 2018

Van parked at CCNY in northern Manhattan

Driven around NYC metro region on some days

Expected Outcomes
- NO_x source apportionment
- VOC/NO_x emissions characterization
- Diurnal profiles
- Importance of chemical products
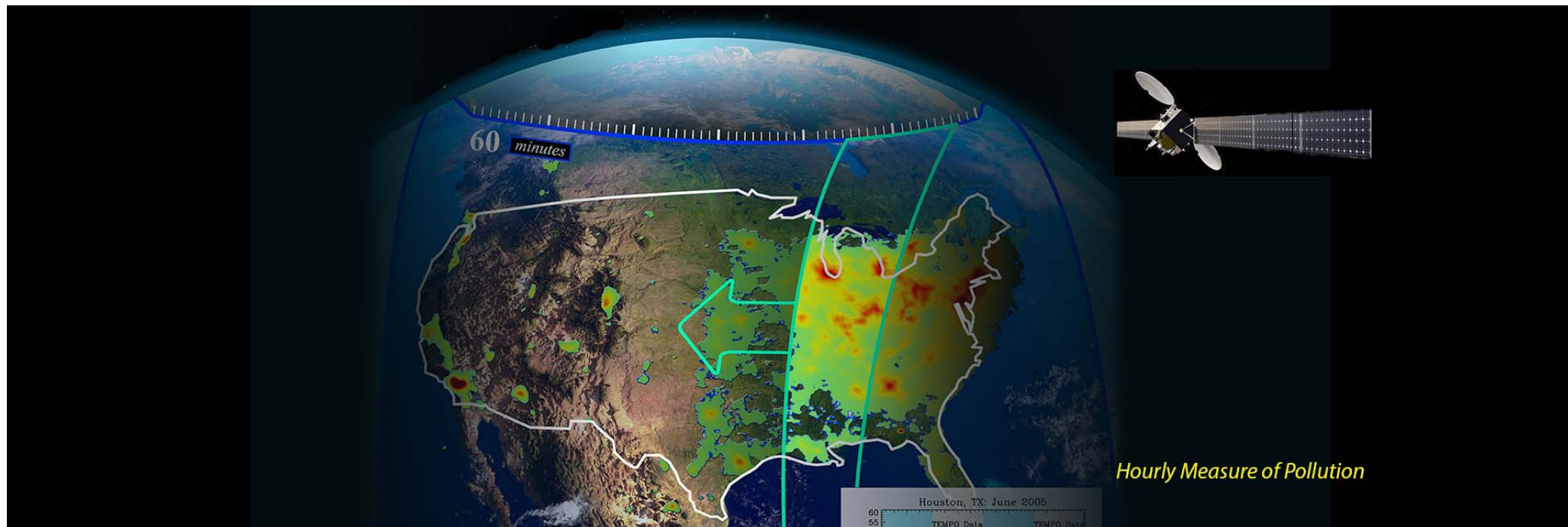- Importance of diesel engines

UMD Aircraft Flight March 26, 2018 - VOCs
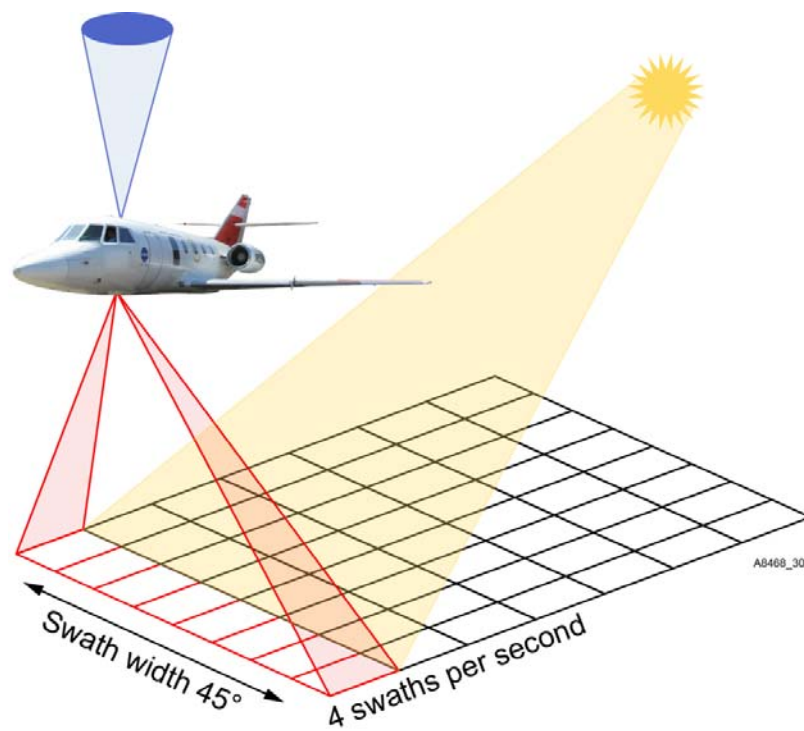

Yellow arrows show WD and relative WS

* = VOC sample locations

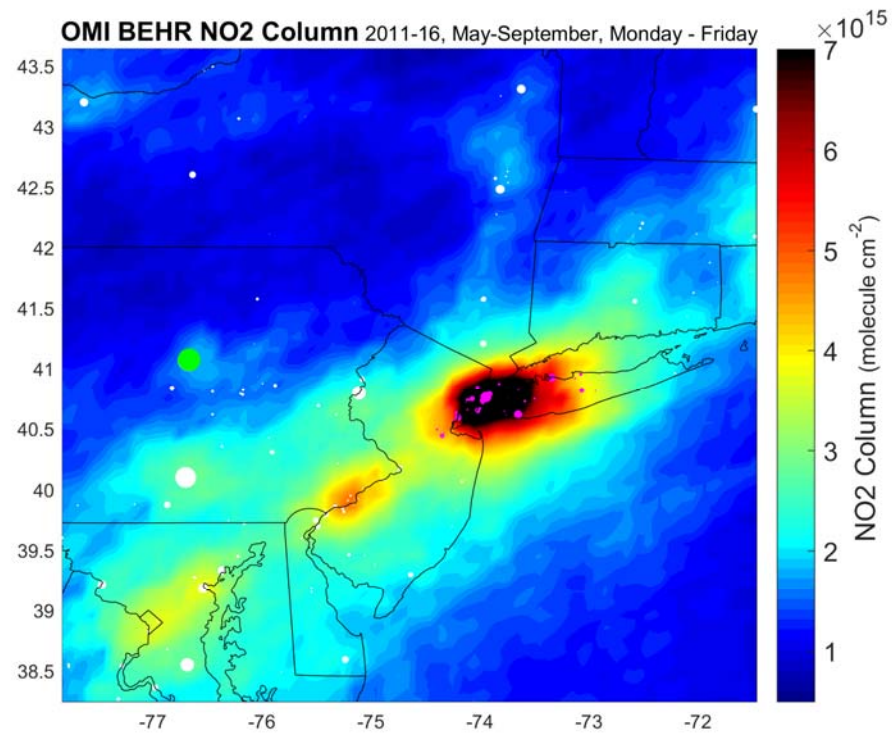# TEMPO – Tropospheric Emissions: Monitoring of Pollution

Hourly Measure of Pollution

Coordinating with GeoTASO Observations by NASA
Airborne Test Bed for TEMPO Satellite

Swath width 45°
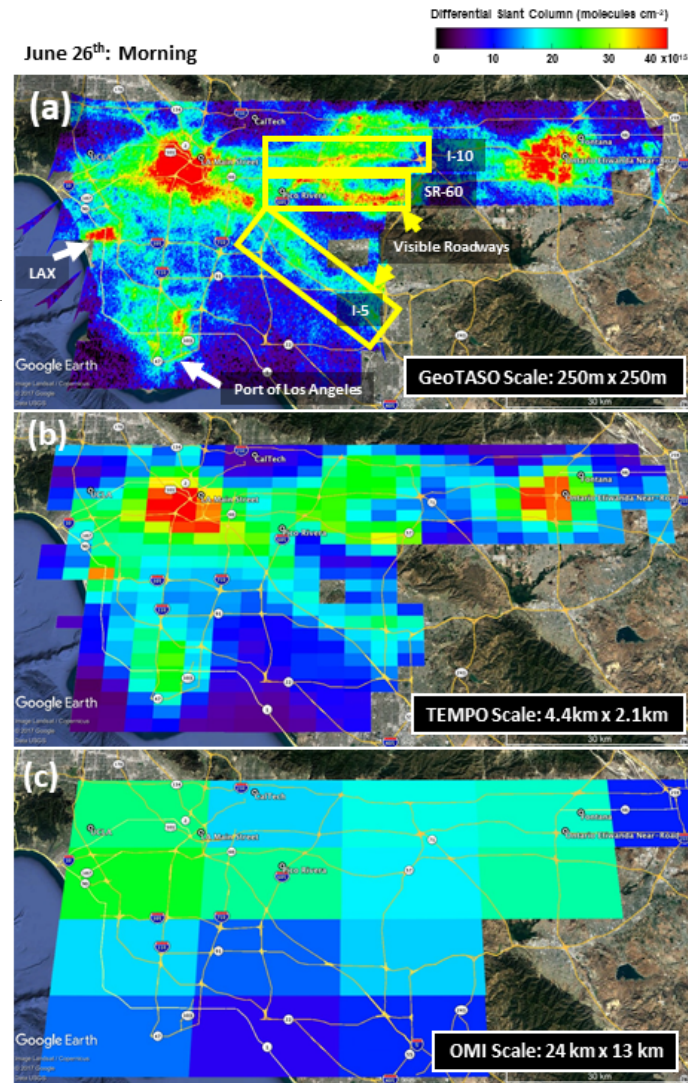
4 swaths per second

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A NYC NO$_2$ "Volcano" – Low Resolution

Hi-Res NOx Emissions

Los Angeles Example:
Opportunity for much higher
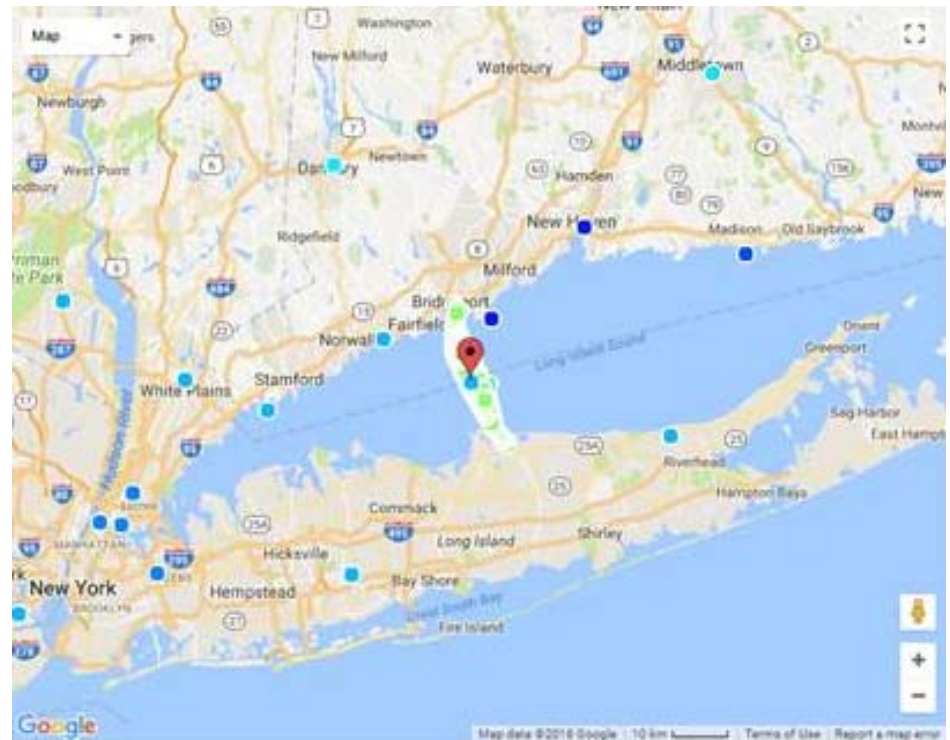resolution of NOx emissions
in NYC region

Pandora Ground-Based Spectrometers

- Solar source spectrometer (280 - 525 nm: 0.6 nm resolution) – column NO_2, O_3, HCHO, and SO_2 every 80 sec.

- Developed as validation instrument for OMI measurements

- EPA working with NASA to site Pandoras at PAMS as research instrument to provide improved characterization of emissions and serve as a U.S. ground-based satellite validation network

- NO_2/HCHO to assess of formaldehyde as a radical source (primary and secondary) and O_3 formation in an urban and downwind environment

CT DEEP: O3 Monitoring on LIS Ferries

M/V Park City: Bridgeport, CT – Port Jefferson, NY

Goals for 2018 Ozone Season

1. Better understanding of key VOC species
   - Consumer products vs. transportation sources

2. Improved temporal and spatial resolution of NOx emissions

3. Compare mobile source emissions to MOVES estimates

4. Direct measurements of pollutant flows/marine mixing layer in LIS

5. Flexibility to seize other opportunities that may arise

6. Lay foundation for possible 2019 activities

Questions?