Long Island Sound Tropospheric Ozone Study (LISTOS)

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Talk Outline

• Northeast U.S. ozone pollution problem
• LISTOS general overview
• Use of AQ forecasting to guide LISTOS activities
• LISTOS activities to date
• LISTOS data availability
Northeast States for Coordinated Air Use Management (NESCAUM)

• Eight NESCAUM states: ME, NH, VT, MA, RI, CT, NY and NJ

• NESCAUM directors are the eight state air agency chiefs

• NESCAUM provides technical & policy advice to our member states in support of their air quality and climate planning needs
Northeast Ozone Nonattainment Areas
2015 8-hr NAAQS 0.070 ppm

Final designations announced April 30, 2018:

2. Marginal: Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE
3. Marginal: Greater Connecticut, CT
4. Marginal: Washington, DC-MD-VA
Connecticut 8-hr Ozone Trends

Number of Days Exceeding the Ozone NAAQS in Connecticut

- 70 ppb NAAQS
- 75 ppb NAAQS
- 84 ppb NAAQS
- Poly 3rd (70 ppb)
- Poly 3rd (75 ppb)
The Need: Science in support of policy to meet air quality and public health goals

*NYC metro area/Long Island Sound region is complicated*

- Chronic regional ground-level ozone (smog) problem
- Multiple pollution transport pathways affecting area
- Complicated, varied, and dense pollution source region
- Land-water interactions downwind of NYC
LISTOS Launched in 2018

❖ LISTOS – Long Island Sound Tropospheric Ozone Study
❖ http://www.nescaum.org/documents/listos
LISTOS Goals

Science in support of ozone pollution reduction strategies

1. Better understanding of key VOC species (e.g., consumer products, 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 2019 activities
Supporters

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

❖ Federal collaborators with own funding
  o NOAA
  o NASA
  o EPA
2018 LISTOS Participants & Activities

1. State AQI forecasters predicting ozone episodes to launch activities
2. NOAA-ESRL oxygenated/consumer product VOC mobile van measurements in NYC during March and July
3. Univ. Maryland 8-12 flights (depends on episodes, flight durations)
4. Maine DEP and NYS DEC labs VOC canister analysis
5. NASA GeoTASO 20-30 high altitude flights; ozone sondes at Rutgers, NJ
6. EPA Pandoras Long Island Sound (LIS) coastline, Rutgers PAMS, NYC; ozone sondes & continuous HCHO at Westport, CT
7. CCNY boat-based air pollution measurements in LIS
8. CCNY aerosol LIDAR in northern Manhattan
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 O₃, NOx, VOC mobile measurements across Long Island south to north shore transects
12. Univ. at Albany ozone sondes from Long Island
13. NASA ozone LIDARs upwind at Rutgers Univ., NJ, and downwind on CT’s LIS shoreline
14. CT DEEP ozone monitor on LIS ferry between Bridgeport, CT and Port Jefferson, NY
15. PAMS VOC measurements at Rutgers, NJ & the Bronx, with new NYS DEC PAMS site at Flax Pond, Long Island
16. Yale Univ. Coastal Field Station – VOCs on CT coast
LISTOS in One Picture
Forecasting Approach for LISTOS

• State AQ forecasters call every week-day 2pm local time, sometimes weekend updates
  • Regular state forecasting for AQI public messaging
  • Daily and long range synopsis

• LISTOS participants call immediately following state AQ forecasting calls
  • State forecasts used as launch point for identifying candidate days for research activities
    • For ozone events, typically looked for SW-NE wind flow coupled to high ozone forecasts
    • Also looked for low-cloud days with different wind directions for emissions inventory and other project goals.

• Early morning “go/no go” calls with forecasters to verify cloud forecasts prior to aircraft take-off
University of Maryland Aircraft

Credit: Xinrong Ren, NOAA; Russ Dickerson, UMD
Coordinating with GeoTASO Observations by NASA

*Airborne Test Bed for TEMPO Satellite*

Credit: Jay Al-saadi, et al. NASA
TEMPO – Tropospheric Emissions: Monitoring of Pollution

Credit: NASA/SAO
Higher Resolution

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

GeoTASO to be coordinated with UMD flights, Pandora measurements

“Good” and “bad” ozone days
A NYC NO$_2$ “Volcano” – Low Resolution

Credit: Luke Valin, EPA
June 30, 2018 NASA GeoTASO NO$_2$
June 20, 2018 – NO$_2$ over time in NYC
Pandora Ground-Based Spectrometer

- Solar source spectrometer (280 - 525 nm: 0.6 nm resolution) – column NO₂, O₃, HCHO, and SO₂ 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

- NO₂/HCHO to assess of formaldehyde as a radical source (primary and secondary) and O₃ formation in an urban and downwind environment
CT DEEP: O3 Monitoring on LIS Ferry

M/V Park City: Bridgeport, CT – Port Jefferson, NY
Long Island Sound  Wind Field Mapping
Early July 2018 Episode
July 2, 2018 Compared to Clean Day
July 2 from Above

View from UMD airplane over Manhattan
NYC Bad Air Day: July 2, 2018

Highest ozone since 2006:

8 hr: 115 ppb
1 hr: 143 ppb
UMD Aircraft Flight Path July 2 afternoon
NASA Aircraft Flight Grid July 2

Source: Laura Judd, Jay Al-Saadi, NASA
July 2, 2018 NASA GCAS NO\textsubscript{2}

Preliminary Data
Source: Laura Judd, Jay Al-Saadi, NASA
Western Smoke Plumes in Summer 2018

16-Aug-2018

Fires and smoke (color) from NOAA Hazard Mapping System (HMS)  https://www.ospo.noaa.gov/Products/land/hms.html
The website is located at: https://www-air.larc.nasa.gov/missions/listos/index.html
Thank you

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