Update on EPA activities on Develop Ground Validation Sites Across the United States Air Quality Network (Supplemental Material)

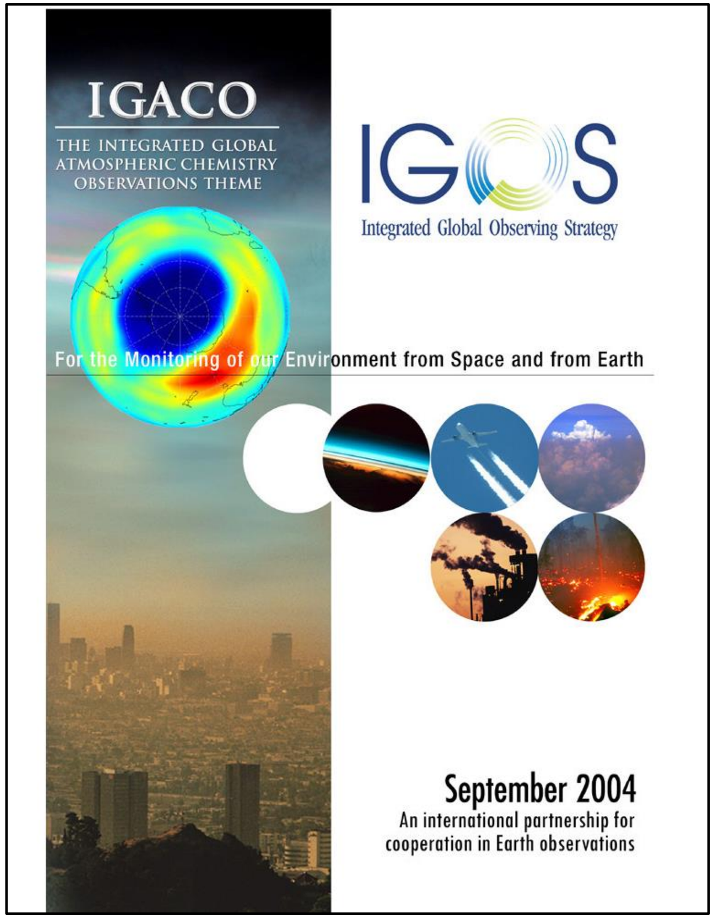
Luke Valin
Valin.Lukas@epa.gov

Jim Szykman
Szykman.Jim@epa.gov

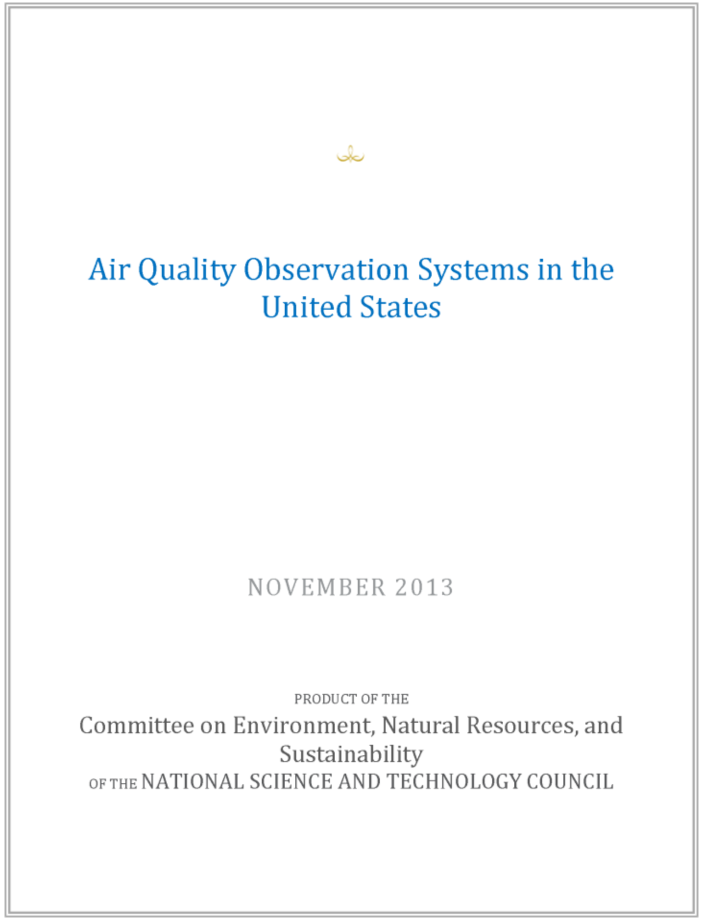
U.S. EPA
Office of Research and Development
Center for Environmental Measurements and Modeling

Integrated AQ Monitoring Network Spanning Space Satellites to In-situ

SATELLITE BASED MONITORING



INTEGRATION OF MONITORING ASSESTS



Air Quality Observation Systems in the United States

NOVEMBER 2013

PRODUCT OF THE
Committee on Environment, Natural Resources, and Sustainability
OF THE NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

ENABLING IMPLEMENTATION

65292 Federal Register / Vol. 80, No. 206 / Monday, October 26, 2015 / Rules and Regulations

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 50, 51, 52, 53, and 58

[EPA–HQ–OAR–2008–0699; FRL–9933–18–OAR]

RIN 2060–AP38

National Ambient Air Quality Standards for Ozone

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Based on its review of the air quality criteria for ozone (O_3) and related photochemical oxidants and national ambient air quality standards (NAAQS) for O_3, the Environmental Protection Agency (EPA) is revising the primary and secondary NAAQS for O_3 to provide requisite protection of public health and welfare, respectively. The EPA is revising the levels of both standards to 0.070 parts per million (ppm), and retaining their indicators (O_3), forms (fourth-highest daily maximum, averaged across three consecutive years) and averaging times (eight hours). The EPA is making corresponding revisions in data handling conventions for O_3 and changes to the Air Quality Index (AQI); revising regulations for the prevention of significant deterioration (PSD) program to add a transition provision for certain applications; and establishing exceptional events schedules and providing information related to implementing the revised standards. The EPA is also revising the O_3 monitoring seasons, the Federal Reference Method (FRM) for monitoring O_3 in the ambient air, Federal Equivalent Method (FEM) analyzer performance requirements, and the Photochemical Assessment Monitoring Stations (PAMS) network. Along with exceptional events schedules related to implementing the revised O_3 standards, the EPA is applying this same schedule approach to other future new or revised NAAQS and removing obsolete regulatory language for expired exceptional events deadlines. The EPA is making minor changes to the procedures and time periods for evaluating potential FRMs and equivalent methods, including making the requirements for nitrogen dioxide (NO_2) consistent with the requirements for O_3, and removing an obsolete requirement for the annual submission of Product Manufacturing Checklists by manufacturers of FRMs and FEMs for monitors of fine and coarse particulate matter. For a more detailed summary, see the Executive Summary below.

DATES: The final rule is effective on December 28, 2015.

ADDRESSES: EPA has established a docket for this action (Docket ID No. EPA–HQ–OAR–2008–0699) and a separate docket, established for the Integrated Science Assessment (ISA) (Docket No. EPA–HQ–ORD–2011–0050), which has been incorporated by reference into the rulemaking docket. All documents in the docket are listed on the *www.regulations.gov* Web site. Although listed in the docket index, some information is not publicly available, *e.g.*, confidential business information or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and may be viewed, with prior arrangement, at the EPA Docket Center. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the Air and Radiation Docket and Information Center, EPA/DC, WJC West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744 and the telephone number for the Air and Radiation Docket and Information Center is (202) 566–1742. For additional information about EPA's public docket, visit the EPA Docket Center homepage at: *http://www.epa.gov/epahome/dockets.htm.*

FOR FURTHER INFORMATION CONTACT: Ms. Susan Lyon Stone, Health and Environmental Impacts Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Mail code C504–06, Research Triangle Park, NC 27711; telephone: (919) 541–1146; fax: (919) 541–0237; email: *stone.susan@epa.gov.*

SUPPLEMENTARY INFORMATION:

General Information

Availability of Related Information

A number of the documents that are relevant to this action are available through the EPA's Office of Air Quality Planning and Standards (OAQPS) Technology Transfer Network (TTN) Web site (*http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_index.html*). These documents include the *Integrated Science Assessment for Ozone* (U.S. EPA, 2013), available at *http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_2008_isa.html*; the *Health Risk and Exposure Assessment* and the *Welfare Risk and Exposure Assessment for Ozone*, Final Reports (HREA and WREA, respectively; U.S. EPA, 2014a, 2014b), available at *http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_2008_rea.html*; and the *Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards* (PA; U.S. EPA, 2014c), available at *http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_2008_pa.html*. These and other related documents are also available for inspection and copying in the EPA docket identified above.

Table of Contents

The following topics are discussed in this preamble:

Pandonia Global Network Collaboration with EPA AQ Networks

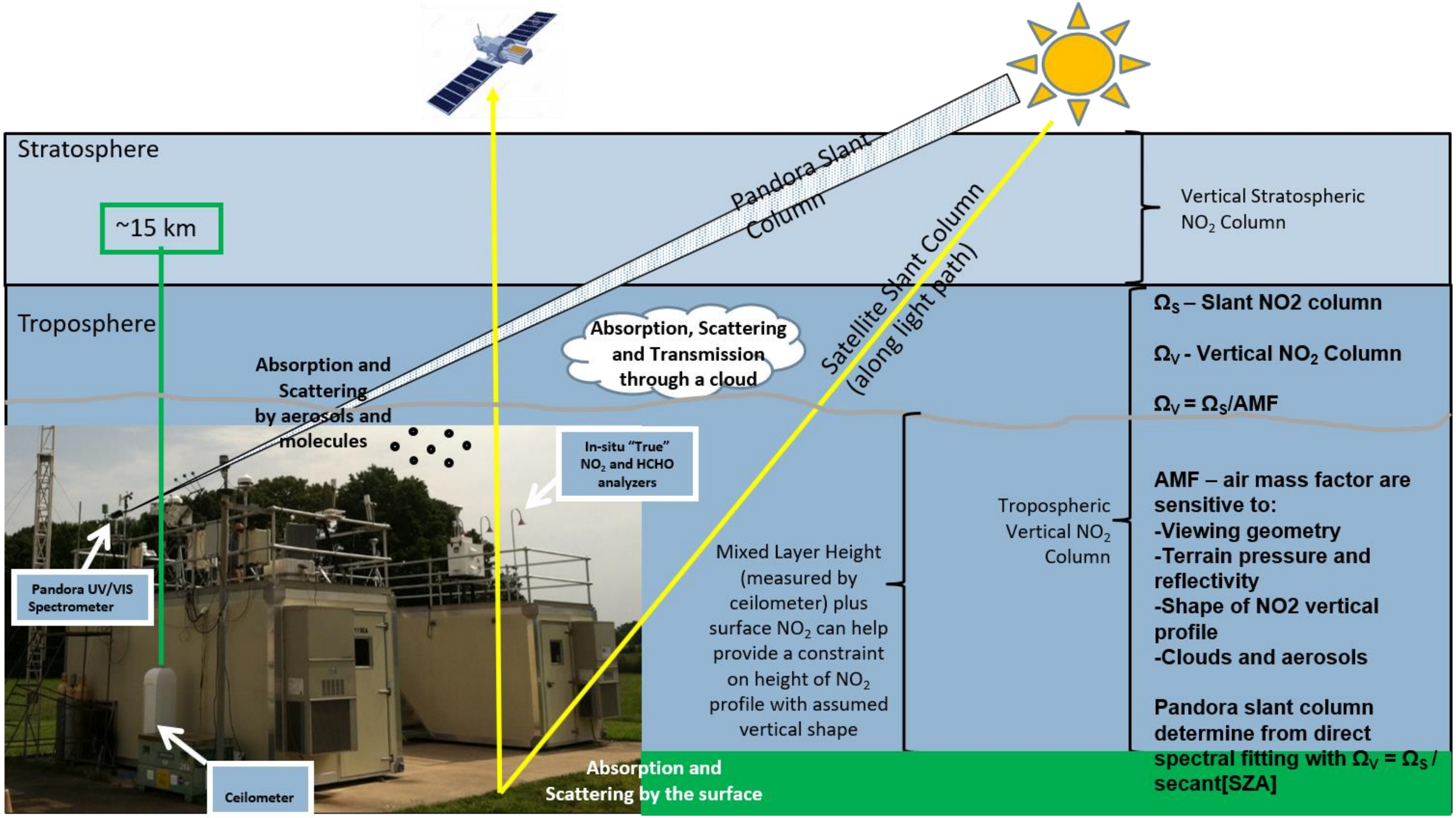
- High-level agreements in place: In collaboration with the NASA Pandora Project, EPA is implementing a subset of surface air quality sites to host Pandora spectrometer instruments which contribute to larger Pandonia Global Network. Effort facilitated by Agency level EPA-NASA Memorandum of Agreement and EPA as part of validation team for TEMPO mission.
- Demonstrated past success: Demonstrated past success: DISCOVER-AQ, KORUS-AQ, plus other campaigns demonstrated Pandora is highly relevant to air quality and ability to provide observations of NO2 a key O3 precursor (HCHO not a standard PGN product yet, and should not be used to inform AQ policy – QC criteria lacking).
- Early Adopter PAMS/EMP operations, Summer 2018: Initial PAMS-EMP deployment included 9 long-term units (May 2018) within Ozone Transport Region at NYDEP, NYDEC, and CTDEEP sites. This effort also supported the Long Island Sound Tropospheric Ozone Study (LISTOS Summer 2018) and on-going S5P TROPOMI validation (S5P Validation Project 28695).
- PGN-EPA Outlook: ~Formal beginning of new PAMS requirements October 2021. Placement at up to 40 sites possible. Agreement to place Pandora instruments at EPA-operated CASTNet sites (Rural, regional).

Current Status of EPA-NASA Pandoras with the PGN

- September 2019 - Upgraded Pandora five 1S-units and redeployed: Bronx, NY; Queens College, NY; Old Field, NY, Rutgers, NJ; New Haven, CT
- May 2020 - New Pandora 1S-unit deployed to Chiwaukee Prairie - Wisconsin DNR monitoring site on WI/IL boader) in collaboration with Dr. Brad Pierce - Space Science and Engineering Center (SSEC) Univ. of Wisconsin
- Summer 2020 (COVID-19 restrictions dependent) – nine Pandora 1S-units Bayonne, NJ; Westport, CT; Madison, CT; East Providence, RI; Londonderry, NH; Cape Elizabeth, ME; Bristol, PA (and/or City of Philadelphia); Lawrenceville (Pittsburg, PA); McMillian Reservoir, DC
- July 2020 - Pandora 2S at EPA Duke Forecast Research Site Sept 2019; 145 ft. research tower for deposition research – supports U.S. EPA CASTNet program; Leosphere 200S wind cube, Lufft CHM15K and Vaisala CL-51 ceilometer; Multitude of trace gas and aerosol measurement include NO2 fluxes for new dry deposition research
- Late 2020 - Five 1S-units under procurement. Target deployments include U.S. CASTNet and western U.S.
- 20 units to be placed into the PGN Network NLT the end of 2020.

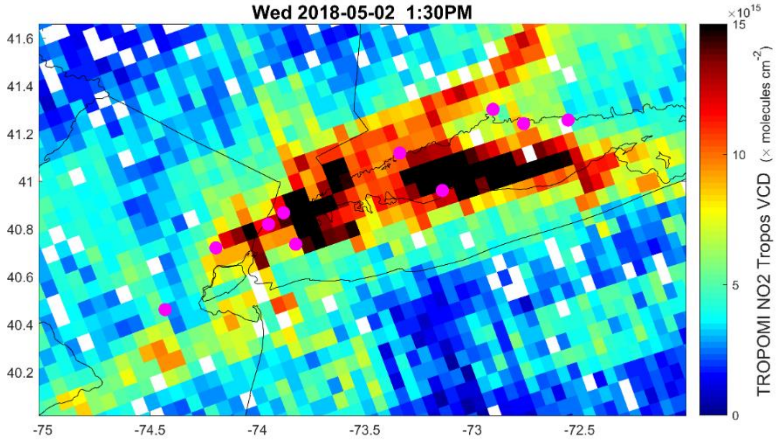
In the U.S. the PAMS-EMP effort will result in an Integrated Ground Observation Network focused on connecting surface air quality and satellite validation.

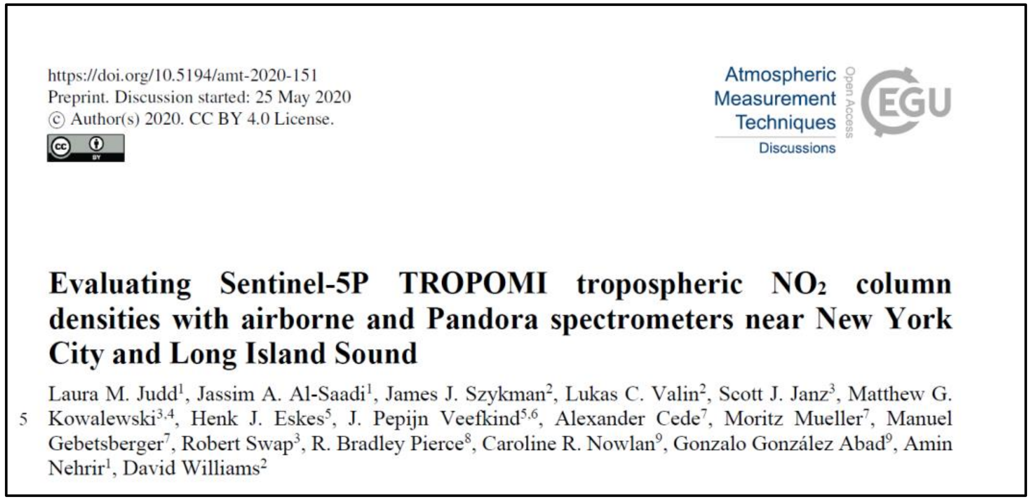
- **Mixed Layer Height**
  - Ceilometer
- **Pandora**
  - NO2, HCHO, ozone total columns
  - **Surface Monitors**
  - ‘true’ NO2, PM, ozone, HCHO surface mixing ratios



Pandora deployment at a subset of U.S. air quality sites provide validation necessary to make AQ management decisions in defensible manner

TROPOMI RPRO/OFFL v1.2.2, v1.3 : 25 June 2018-25 June 2019



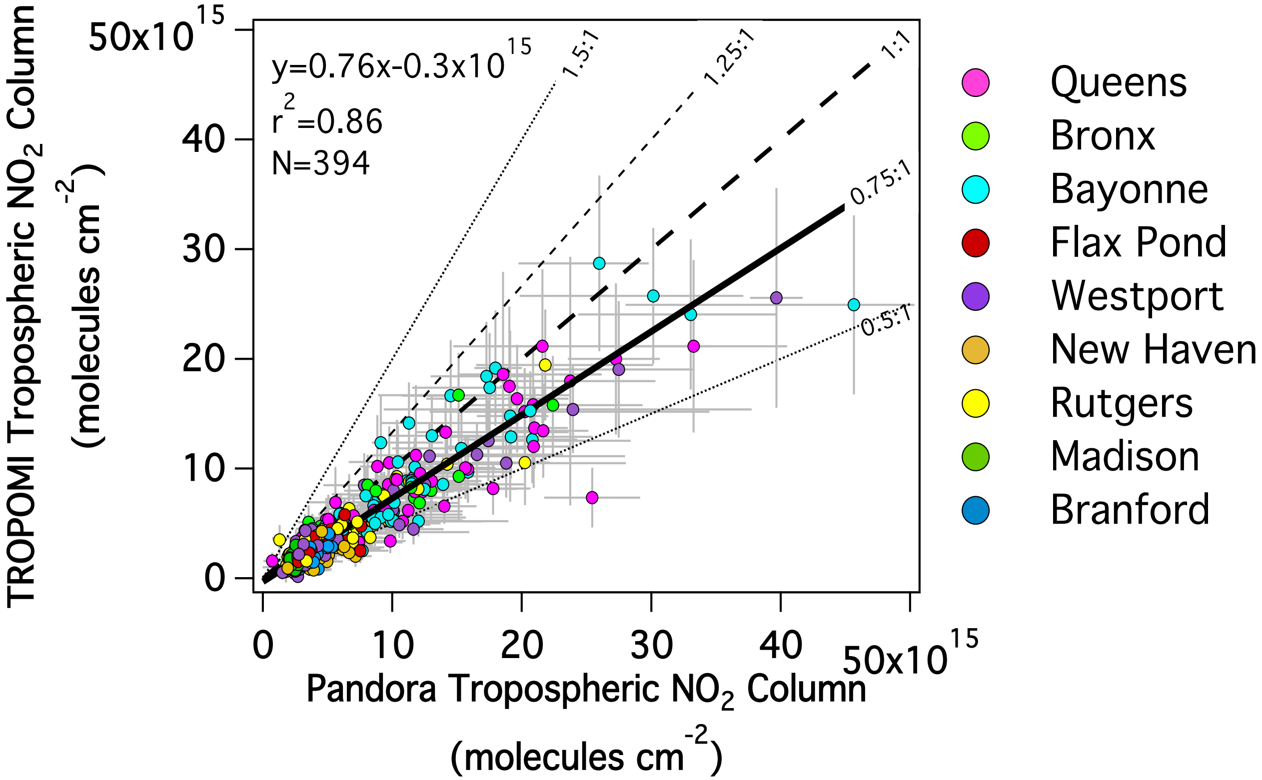


https://doi.org/10.5194/amt-2020-151
Preprint. Discussion started: 25 May 2020

Atmospheric Measurement Techniques Discussions

Evaluating Sentinel-5P TROPOMI tropospheric NO_2 column densities with airborne and Pandora spectrometers near New York City and Long Island Sound

Laura M. Judd[1], Jassim A. Al-Saadi[1], James J. Szykman[2], Lukas C. Valin[2], Scott J. Janz[3], Matthew G. Kowalewski[3,4], Henk J. Eskes[5], J. Pepijn Veefkind[5,6], Alexander Cede[7], Moritz Mueller[7], Manuel Gebetsberger[7], Robert Swap[3], R. Bradley Pierce[8], Caroline R. Nowlan[9], Gonzalo González Abad[9], Amin Nehrir[1], David Williams[2]



- The Pandora and TROPOMI are highly correlated with a consistent low bias of ~30% in relation to Pandora.
- Least polluted bin has median difference -0.8×10^{15} molecules cm^{-2} and an interquartile range < 1×10^{15} molecules cm^{-2}

EPAMS Profiler and Ceilometer Network

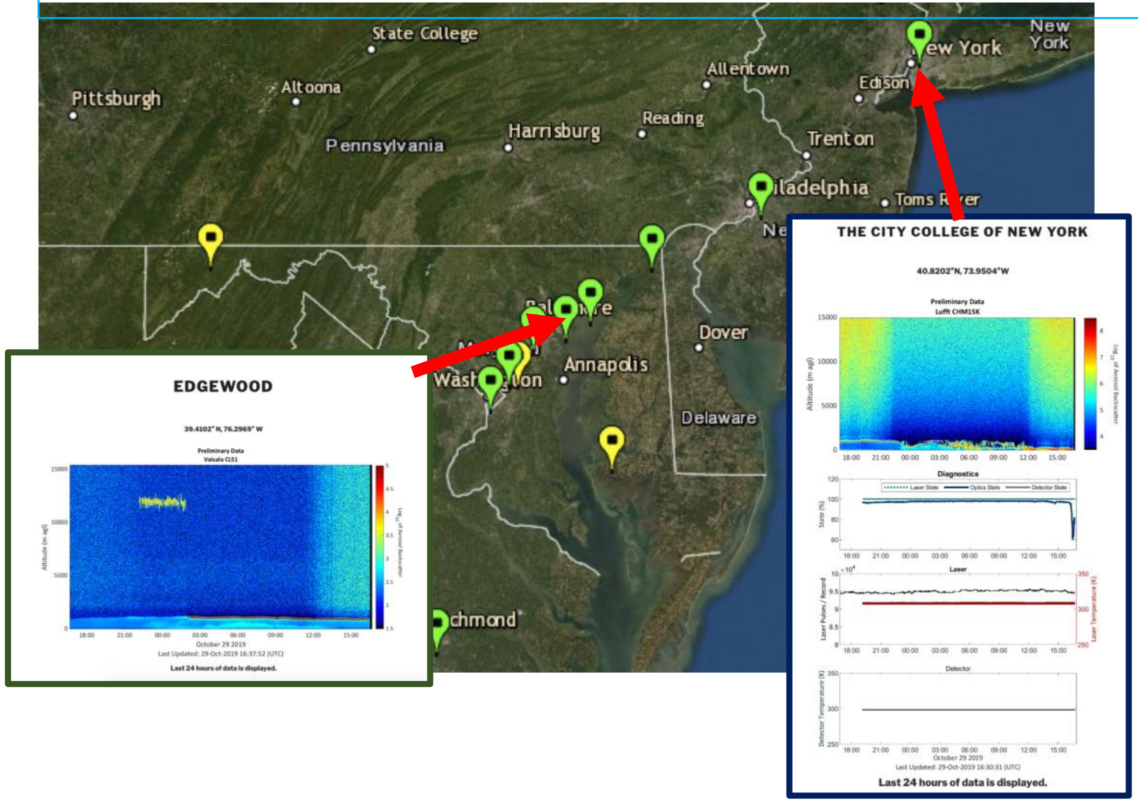
The Enhanced-PAMS (**EPAMS**) Profiler and Ceilometer Network is a joint research effort between the University of Maryland, Baltimore County (UMBC), EPA, NASA, and the Maryland Department of the Environment (MDE) to help guide the new hourly PBL requirements and supplement a ceilometer testbed

- Common algorithm for Mixing Layer Heights
- Real-time data display of backscatter plots
- Real-time optics monitoring
- Real-time data processing (MLH, NBL, residual layer (RL), aerosol layers. Clouds, and precipitation screening)
- Data archive with display for retrospective analysis including exceptional events

Operational Procedures:

- Instrumental signal evaluation
- Standardized retrieval development
- Data Archiving and Processing

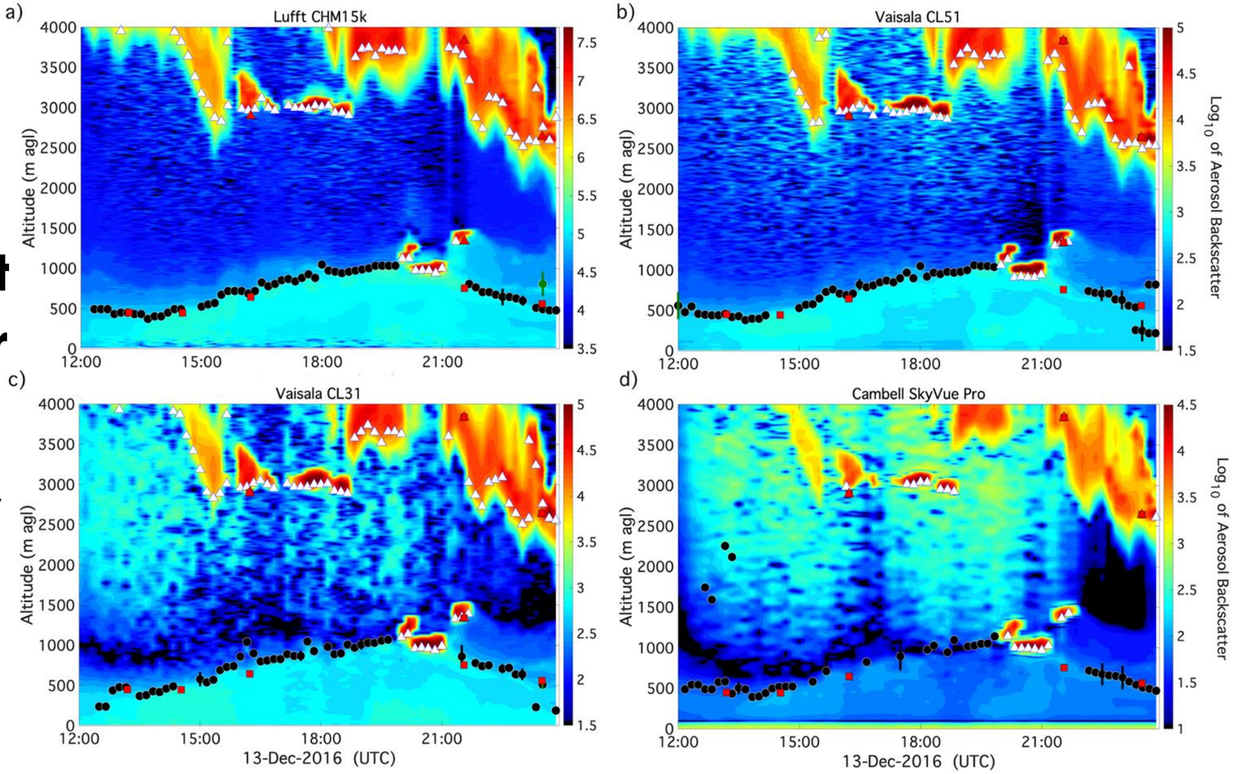
https://alg.umbc.edu/ceilometer-testbed/



Development of standardized retrieval algorithms for heterogeneous network

Covariance Wavelet Transform Algorithm developed by University Maryland Baltimore County

- <u>**Automated**</u> algorithm **corrects for instrument signal** quality and **automatically screens for precipitation and cloud layers**
- **Layer attribution** for the planetary boundary layer height with continuation and time-tracking parameters and <u>uncertainty calculations</u> through <u>automatic filtering</u>



December 13, 2016 ($\overline{CWTC}$) profiles from CHM15k (a), CL51 (b), CL31(c), and SkyVue Pro (d) ceilometers. PBLH retrievals from the automated algorithm are displayed in black circles, while CBH retrievals are displayed as white triangles. Radiosonde heights for both PBLHs and CBH are displayed as red squares. Error bars display 10-minute retrieval uncertainties every 30 mins for display clarity purposes although uncertainties are calculated with every retrieval.

Caicedo et al. (2020) under review

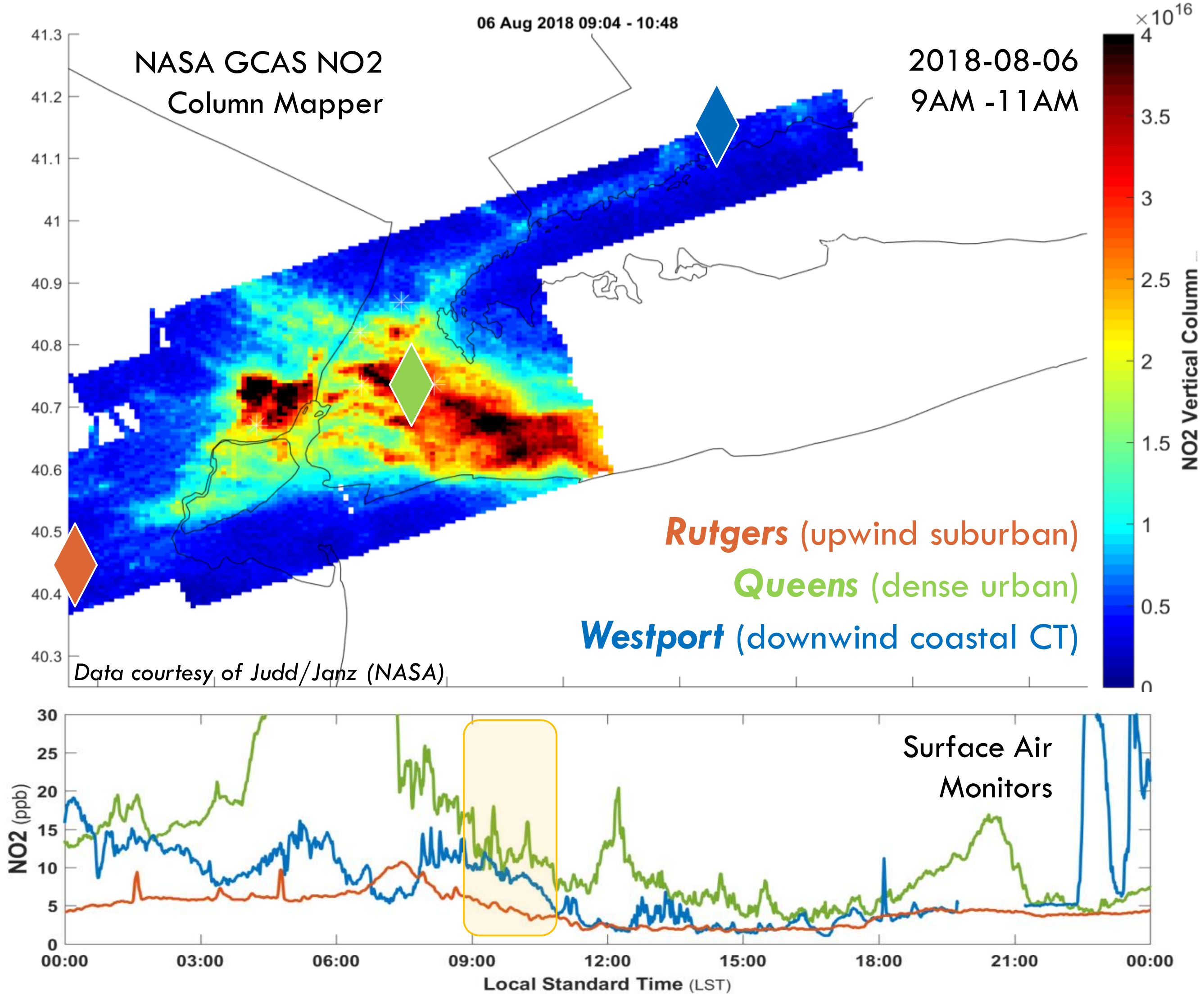
"An automated common algorithm for planetary boundary layer retrievals using aerosol lidars in support of the U.S. EPA Photochemical Assessment Monitoring Sites Program"

Considerations in designing a TEMPO validation network
Synergetic areas that support both Science and Regulatory needs

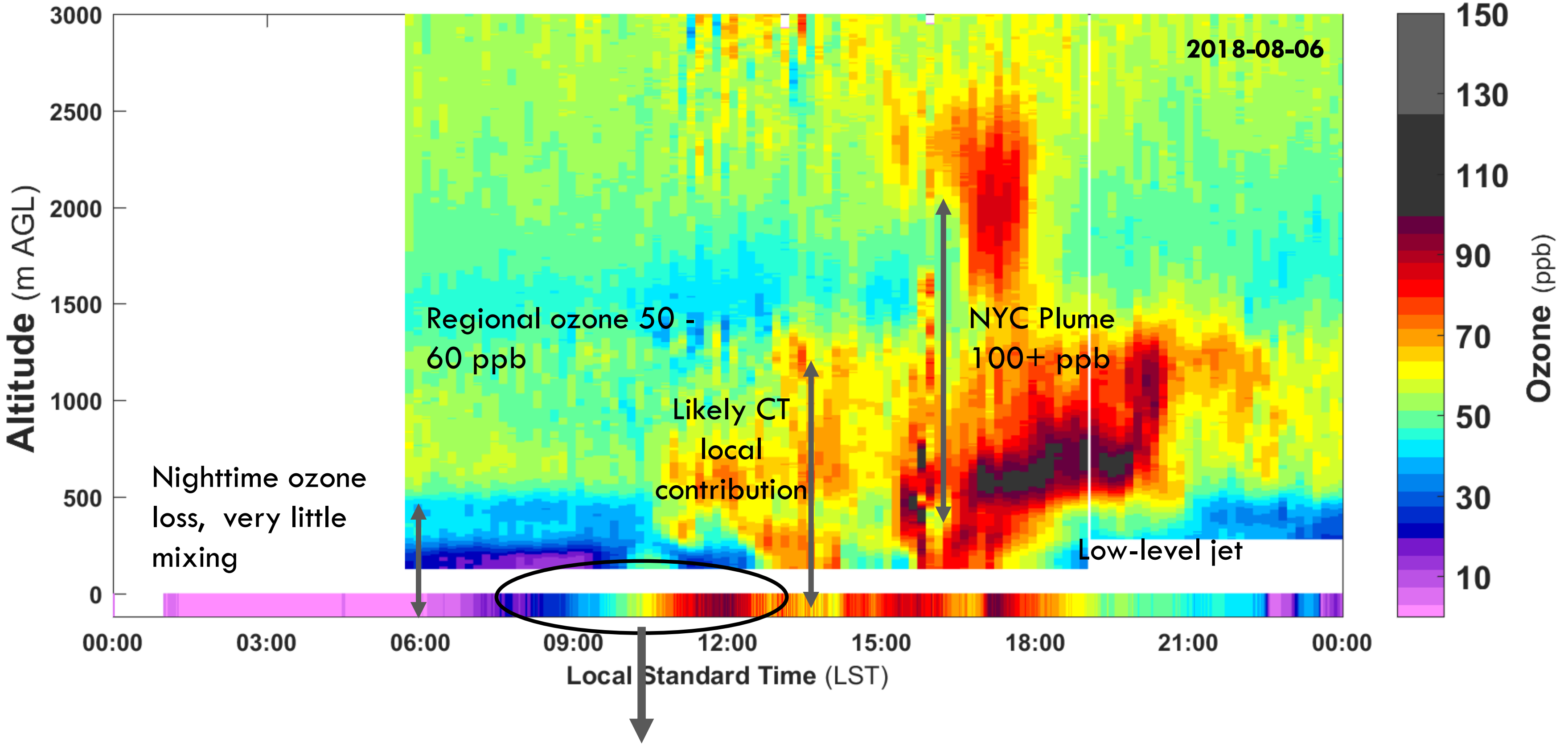
- Background Ozone: NOx lifetime, NOx emissions, Ozone transport
  - Improved understanding of Background NOx in the Boundary Layer and Free Troposphere (e.g., Silvern et al., 2019) → Pandoras at CASTNET
- Measurements in and around source area which can provide improved characterization of spatial and temporal factors to adjust data for hourly inputs on sector emissions for air quality model. (E.g., Schiller Park)
- Dispersion plume modeling from large point sources (permitting issues)
- Ozone transport pathways, particularly dense urban outflow areas to more rural areas with impacted air quality (Western Shore Lake Michigan, NE urban corridor) this includes varying density of measurements to assess regional vs local scale impacts.
- **Goal: AQ management decisions in defensible manner**

NYC Integrated Observing System August 6, 2018: 3 of 10 joint AQ / satellite validation sites shown

A very small amount of NOx (top image) has an outsize impact on the chemistry affecting Westport CT site because its all contained in a very shallow mixing layer (bottom image)



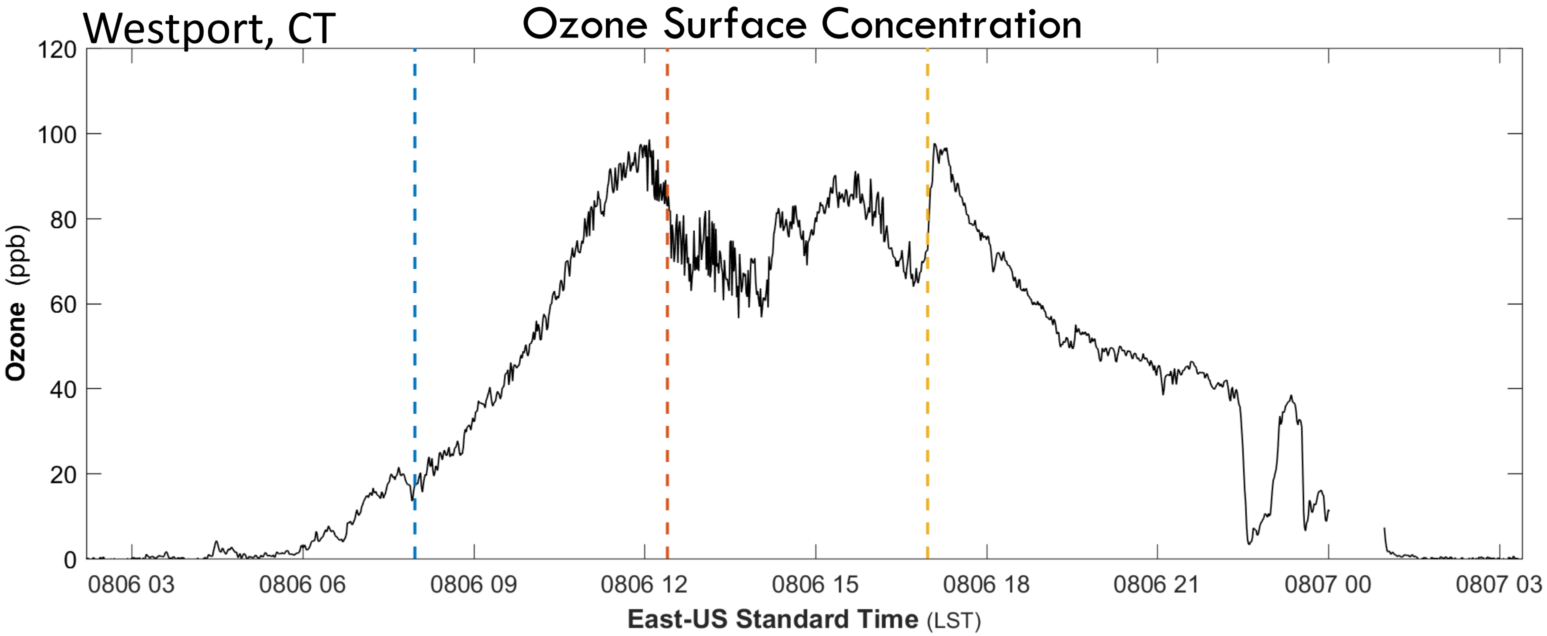
Ozone at coastal Connecticut is being produced locally below 100 m throughout morning hours

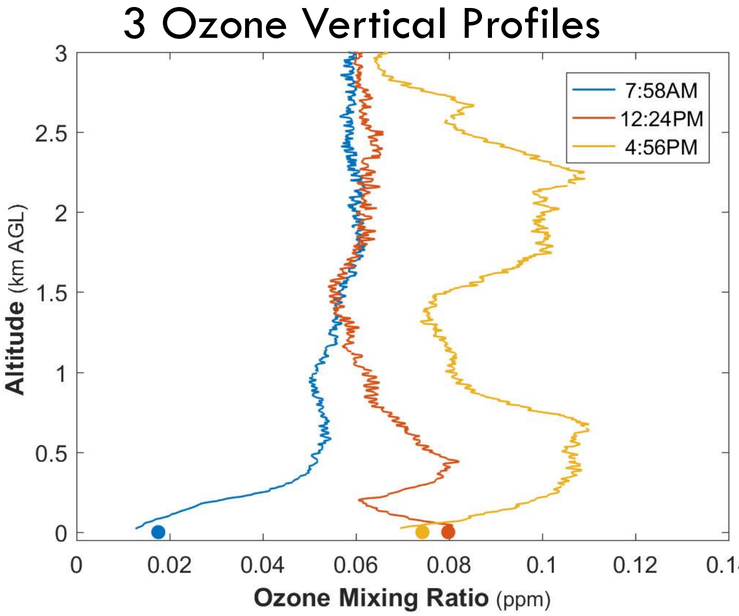


There is rapid growth of ozone in a very shallow layer (<100m) from 8AM to 12PM. There is 60 ppb more at the surface than at 100m

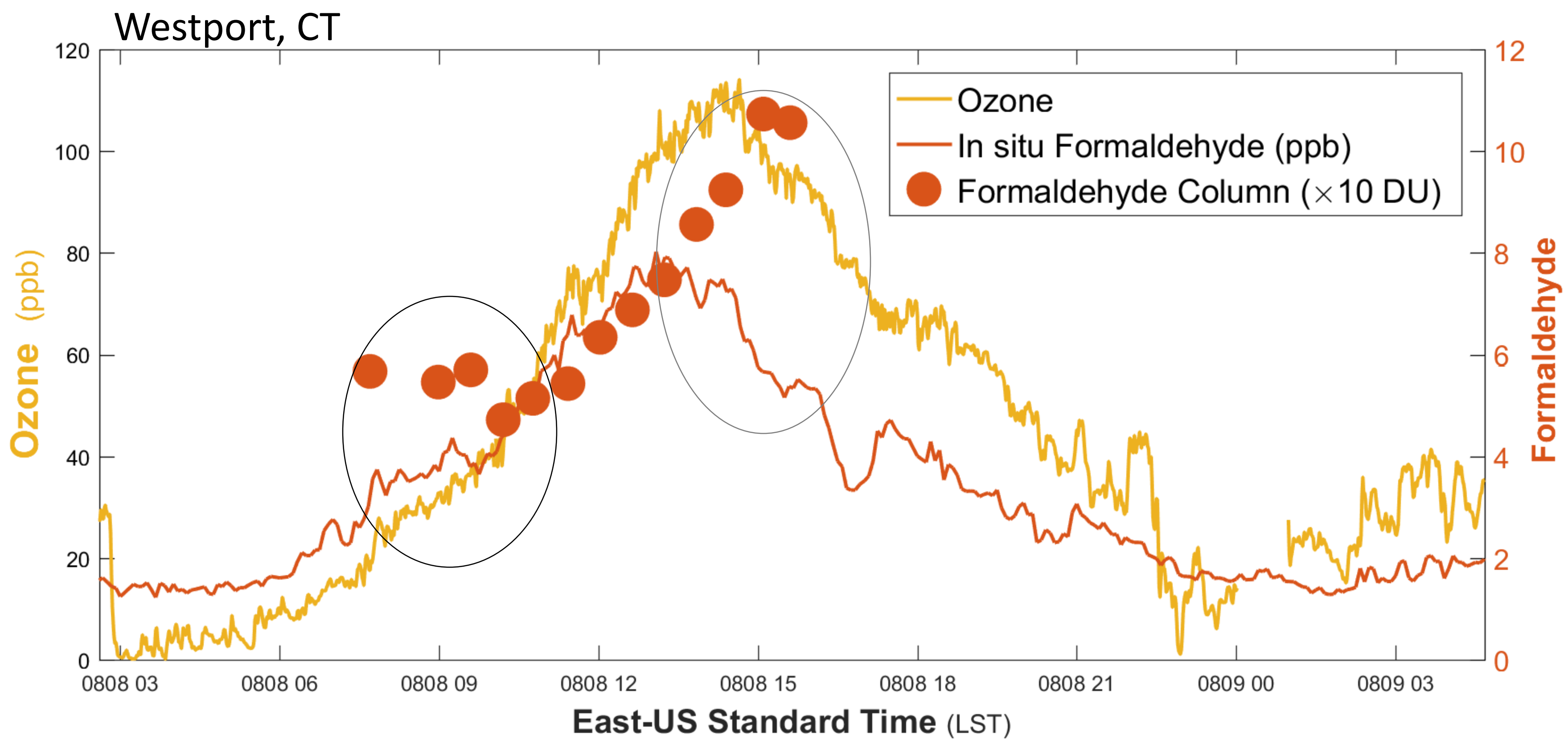
Data courtesy of Tim Berkoff (NASA LaRC), CT DEEP

Calibrated surface ozone measurements and routine profiling of lowest 100 – 200m critical for connecting LIDAR to surface AQ data





HCHO Column can help fill in details of dynamics overhead



Morning surface increase is not associated with column increase

→ Increase due to entrainment

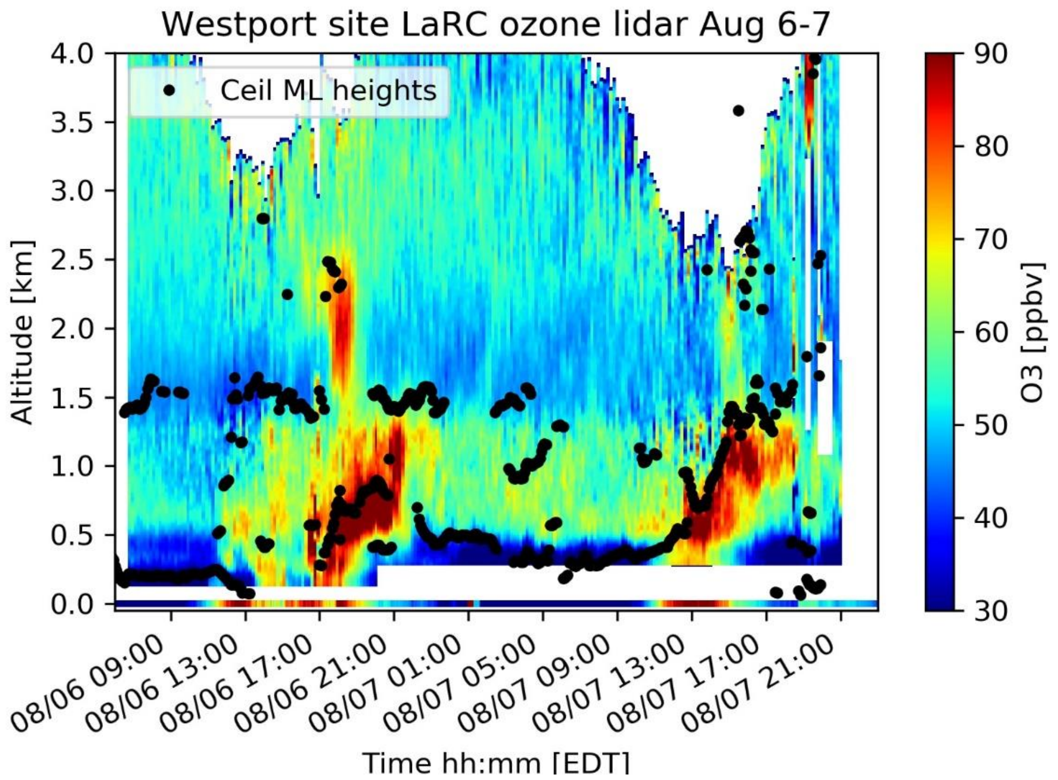
Afternoon surface decrease is associated with continuing column increases

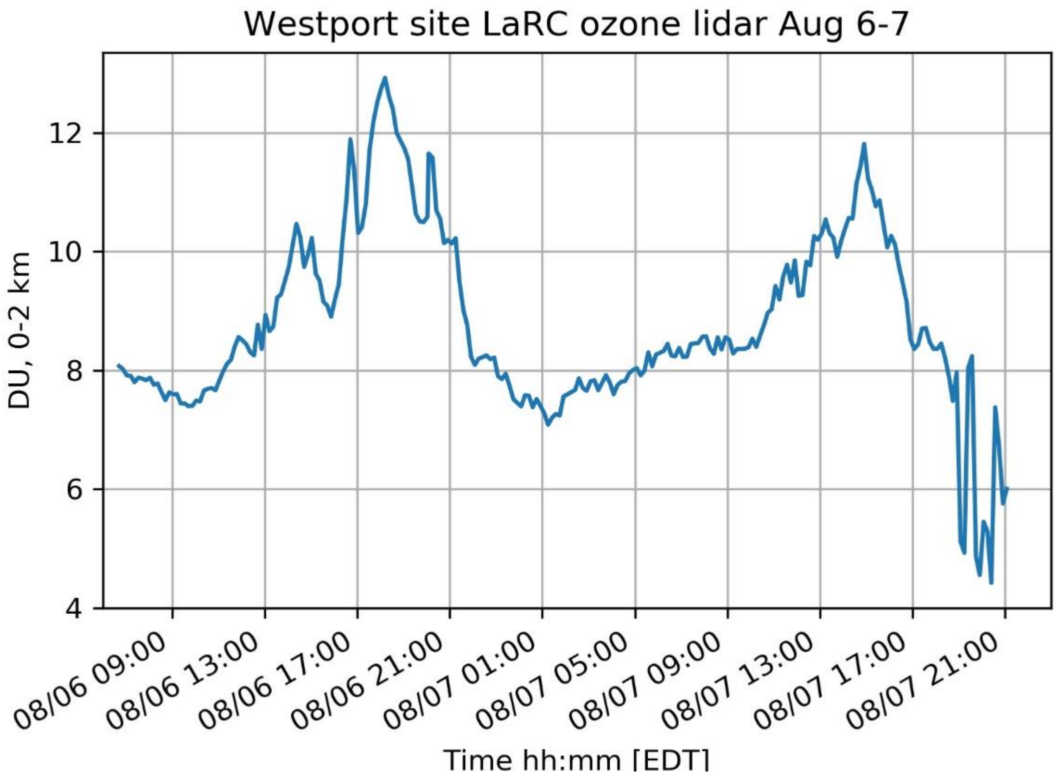
→ decrease at surface is isolated from what is occuring overhead

Data courtesy of Andrew Whitehill ORD/CEMM, Elena Lind (Va Tech)

LISTOS 2018 Study provides key measurement insights into the 0-2 km ozone variability

Westport, CT Air Quality Site is one of the highest Ozone sites in the NE U.S.





Credit: Langley Mobile Ozone Lidar Team, PI Tim Berkoff