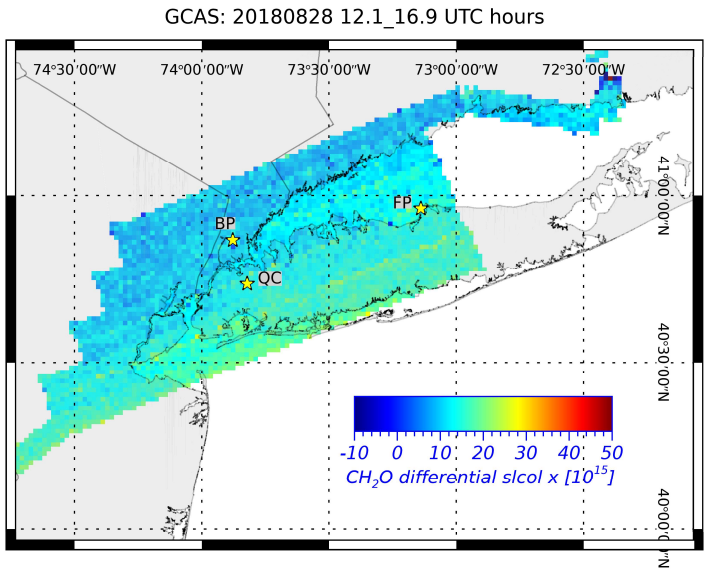
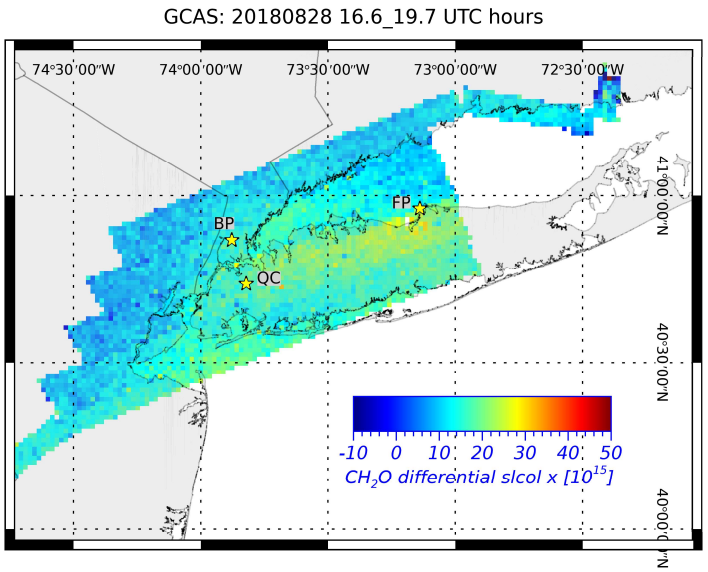
GCAS Measurements of Slant-Column Formaldehyde: First Results





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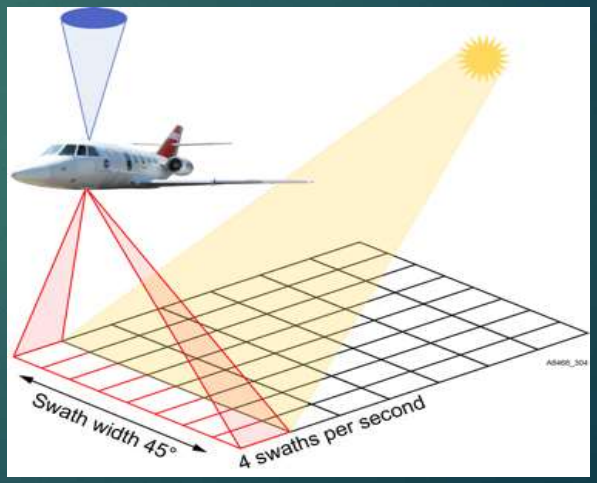
Instrument description

- Two separate instrument packages were flown during the months of June through Oct (16 days)
- This data set includes GCAS measurements only on the LaRC KingAir (13 days)
- GeoCAPE Airborne Simulator (GCAS)
  - Two independent pushbroom spectrometers
    - **UV-Vis (air quality/trace-gases)**
      - **300-480 nm, 0.6 nm resolution (NO_2, CH_2O, SO_2, O_3)**
    - Vis-NIR (coastal ocean products)
      - 450-900 nm, 1.2 nm resolution
- 45 degree swath
  - Contiguous mapping of LISTOS/NYC domain
    - 80 x 50 km^2 4x per day
    - 120 x 60 km^2 2x per day
    - Raw data binned to ~250 m^2

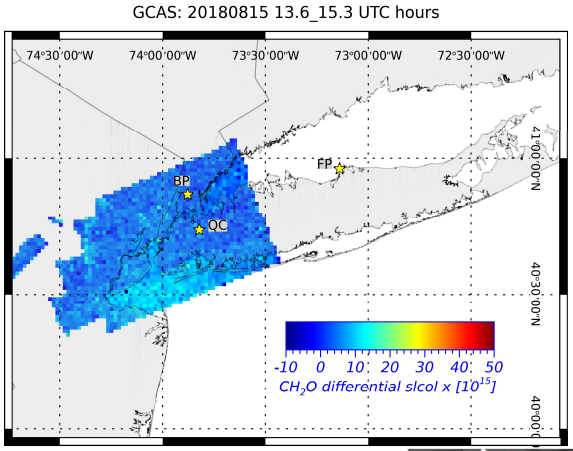


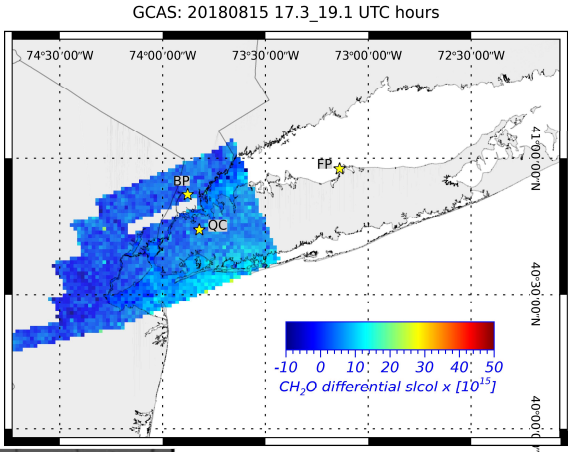
Measurement description

- Reference spectra were chosen on a relatively clean day during a Bronx-Pfizer ground site overpass.
- Slant column absorption retrievals using standard DOAS methods were performed at 250 meter resolution.
- Binned to 1.5 km^2 to increase sensitivity to trace-gas absorption [CH_2O minimum ~2E15 molecules/cm2].
- Results corrected for geometrical air mass (AMF) differences between reference location/time and measurement location/time.
- Differential slant column => absorption relative to downward looking reference column.
- No corrections have been applied for surface albedo variations, profile changes, or aerosols.
- Data set includes morning and afternoon measurements on: July 2nd, **19th**, 20th, Aug. 5th, **6th**, **15th**, 16th, **24th**, 28th, 29th, Sept. 6th, Oct. 3rd, 10th.
- [1]Bronx-Pfizer ground site 8hr CH_2O dataset overpass at ~11 am.

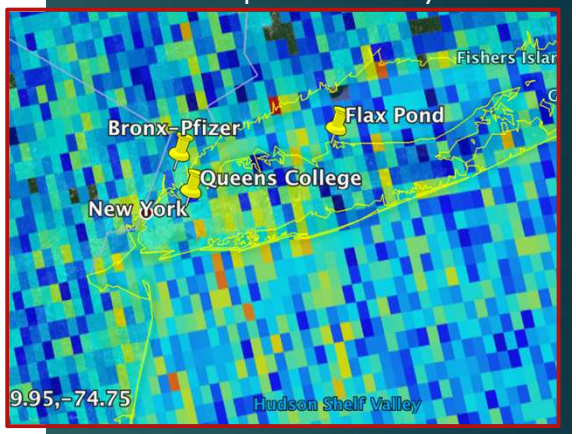
[1]Data courtesy of Amanda Carpenter

Low Pollution day



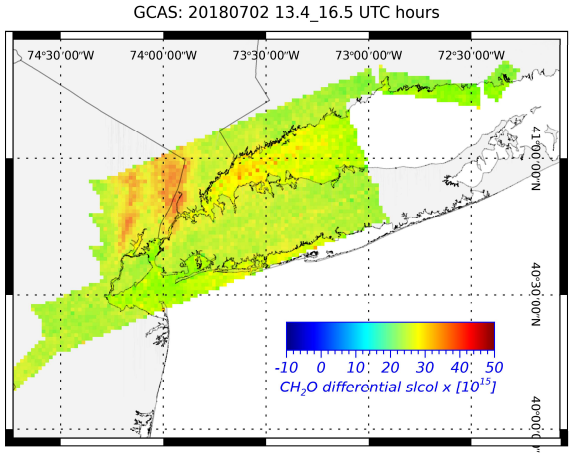


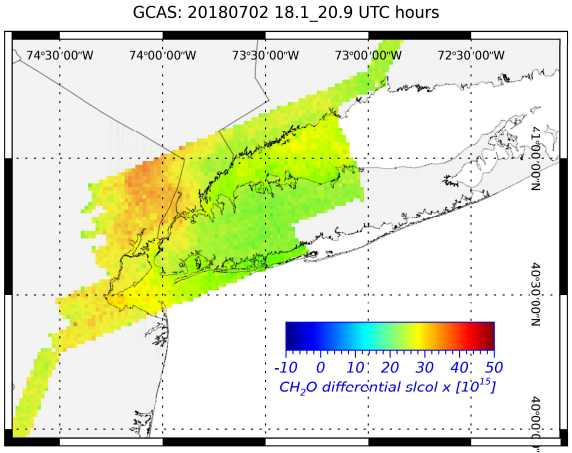
TROPOMI preliminary L2



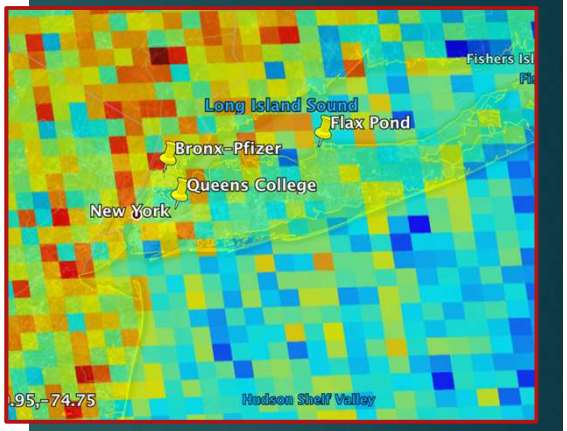
- August 15th reference at 11 am/Bronx-Pfizer location
- Light winds from west
- Color bar scale same for TROPOMI overpass at 1707 UTC
- GCAS generally lower (expected)

High Pollution day



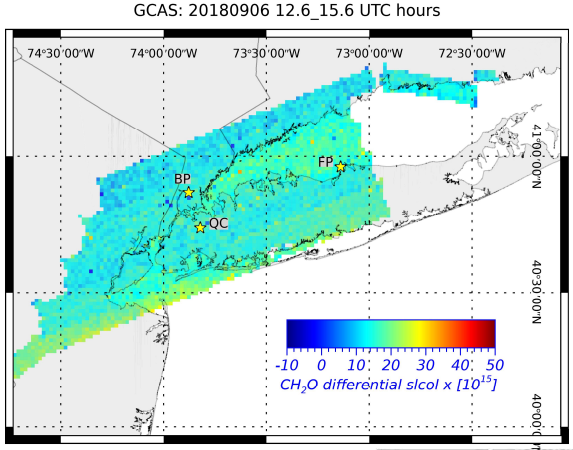


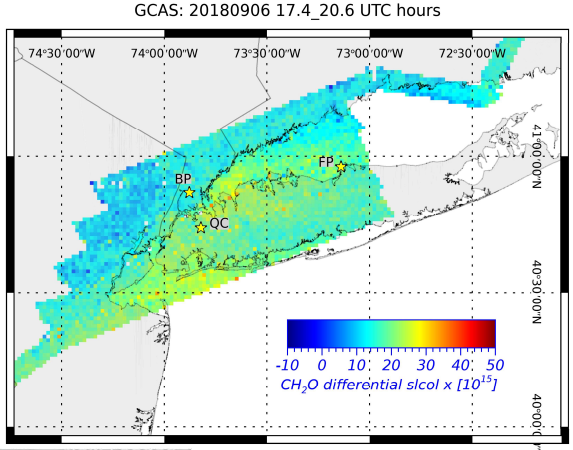
TROPOMI preliminary L2



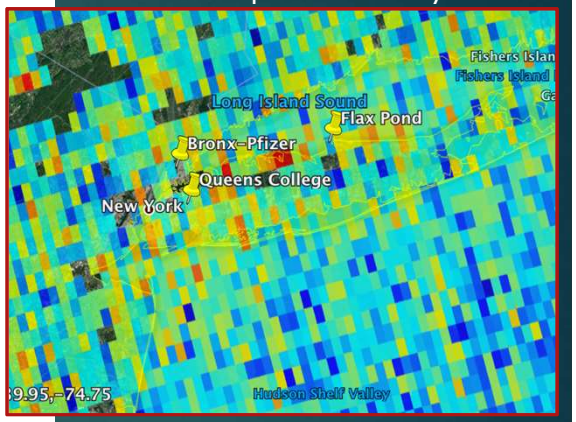
- July 2nd peak values in data set
- Light winds from south/variable
- Color bar scale same for TROPOMI overpass at 1734 UTC
- Good qualitative correlation with TROPOMI
- GCAS generally higher when TO lower and lower when TO high (need more extensive AMF modeling)

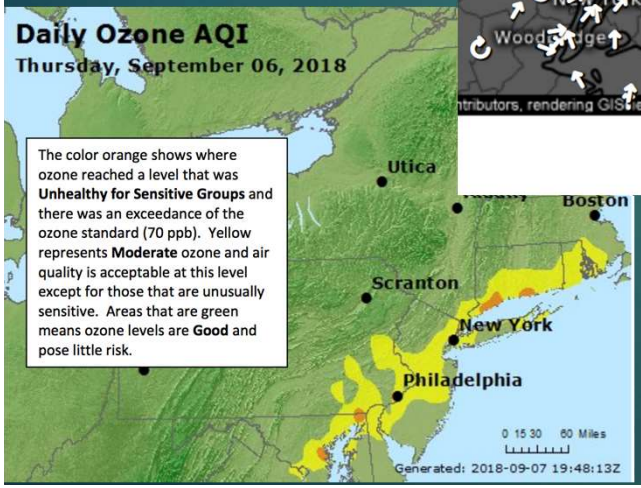
LI Ozone Event day





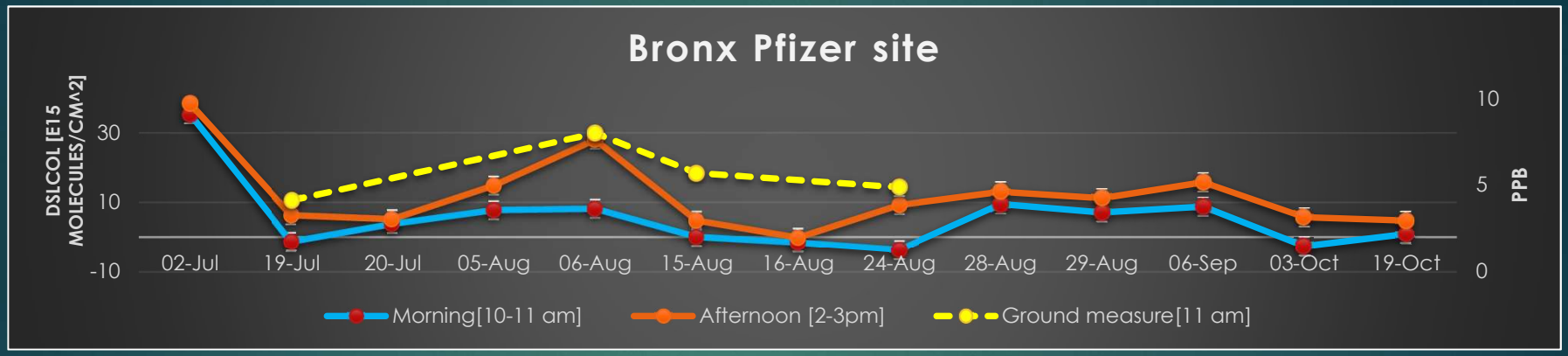
TROPOMI preliminary L2

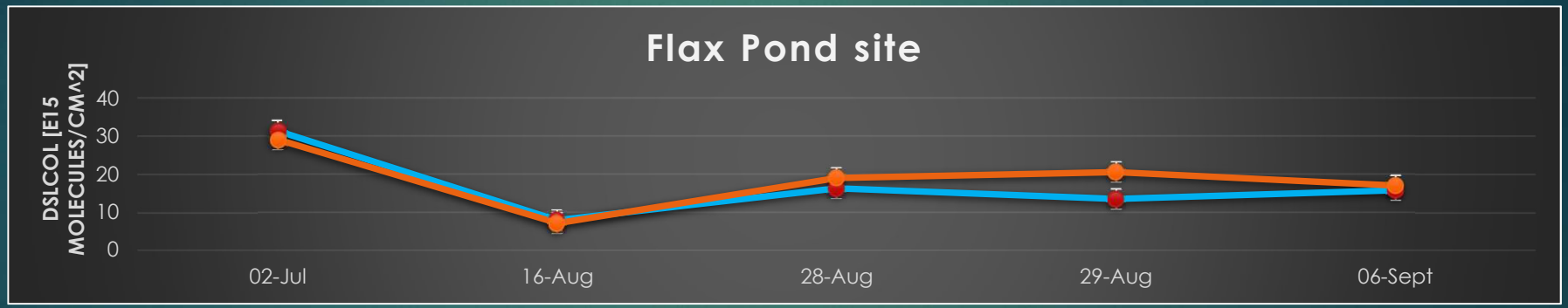




- September 6th (similar to Aug. 28th)
- Winds from southwest
- Color bar same for TROPOMI overpass at 1652 UTC
- Good qualitative correlation with TROPOMI
- Buildup morning->afternoon over LI sound evident
- GCAS generally lower (expected)

Time Series at two ground sites





- Peak values seen on July 2nd and Aug 6th
- Values observed during Bronx Pfizer site overpass consistent with surface 8hr measurements beginning at 11am.
- LISTOS westerly flow events evident on Aug. 28th,29th,Sep. 6th

Summary and plans

- Next steps are to use RTM code to calculate AMF and convert to vertical columns below aircraft.
- Use CH_2O surface measurements, along with TROPOMI vertical columns, as a constraint on the background levels during reference measurements.
- Analyze additional data obtained using GeoTASO and cross-validate (October sorties).
- Analyze and correlate GCAS/GeoTASO samples of TROPOMI[2] coincident pixels.

[2]TROPOMI CALVAL Data policy statement next slide

TROPOMI Data Policy Statement

"The presented work has been performed in the frame of the Sentinel-5 Precursor Validation Team (S5PVT) or Level 1/Level 2 Product Working Group activities. Results are based on preliminary (not fully calibrated/validated) Sentinel-5 Precursor data that will still change. Sentinel-5 Precursor is a European Space Agency (ESA) mission implemented on behalf of the European Commission (EC). The TROPOMI payload is a joint development by ESA and the Netherlands Space Office (NSO). The Sentinel-5 Precursor ground-segment development has been funded by ESA with national contributions from The Netherlands, Germany, and Belgium."