

High-resolution tracking of NO_2 / CH_2O emissions during high O_3 episodes over NYC

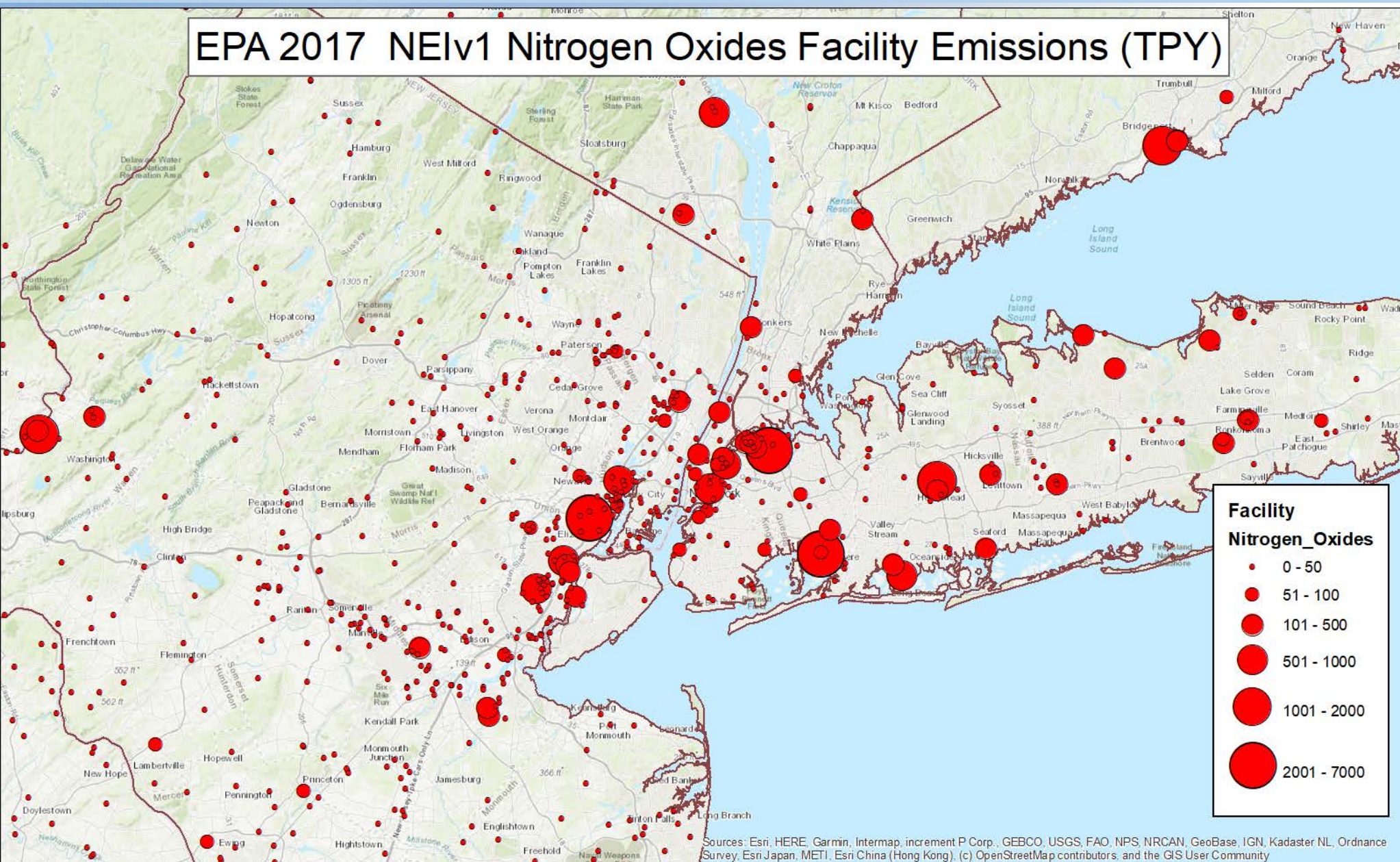


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Using TEMPO to Monitor Emissions Over NYC

- After reviewing data from the Long Island Sound Tropospheric Ozone Study 2018, it was apparent that the area around NYC emits noticeably larger amounts of NO₂ on days that monitor elevated ground level ozone.
- Because Connecticut continues to monitor the highest ozone design values on the East Coast, it is vital that the source, strength, and timing of the ozone precursors be determined, especially during the 'ozone season,' which typically occurs between May 1 and September 30.
- Although the TEMPO spatial resolution will not match the 250 meter resolution of the GCAS images, the instrument would be able to scan more frequently (10 minute time intervals) and produce spatial resolution images greater than the nominal 2.1 km x 4.7 km pixel size.
- In addition to the point source EGU plumes, it would be useful to determine contributions from mobile source emissions (NO₂, H₂CO, and C₂H₂O₂) along major highways and from marine vessels in shipping channels and along the land/water interface.
- Furthermore, with the geostationary TEMPO measurements, it would be highly informative to track NO₂ emissions activity over time in the study area during daylight hours spanning multiple days of a high ozone episode.

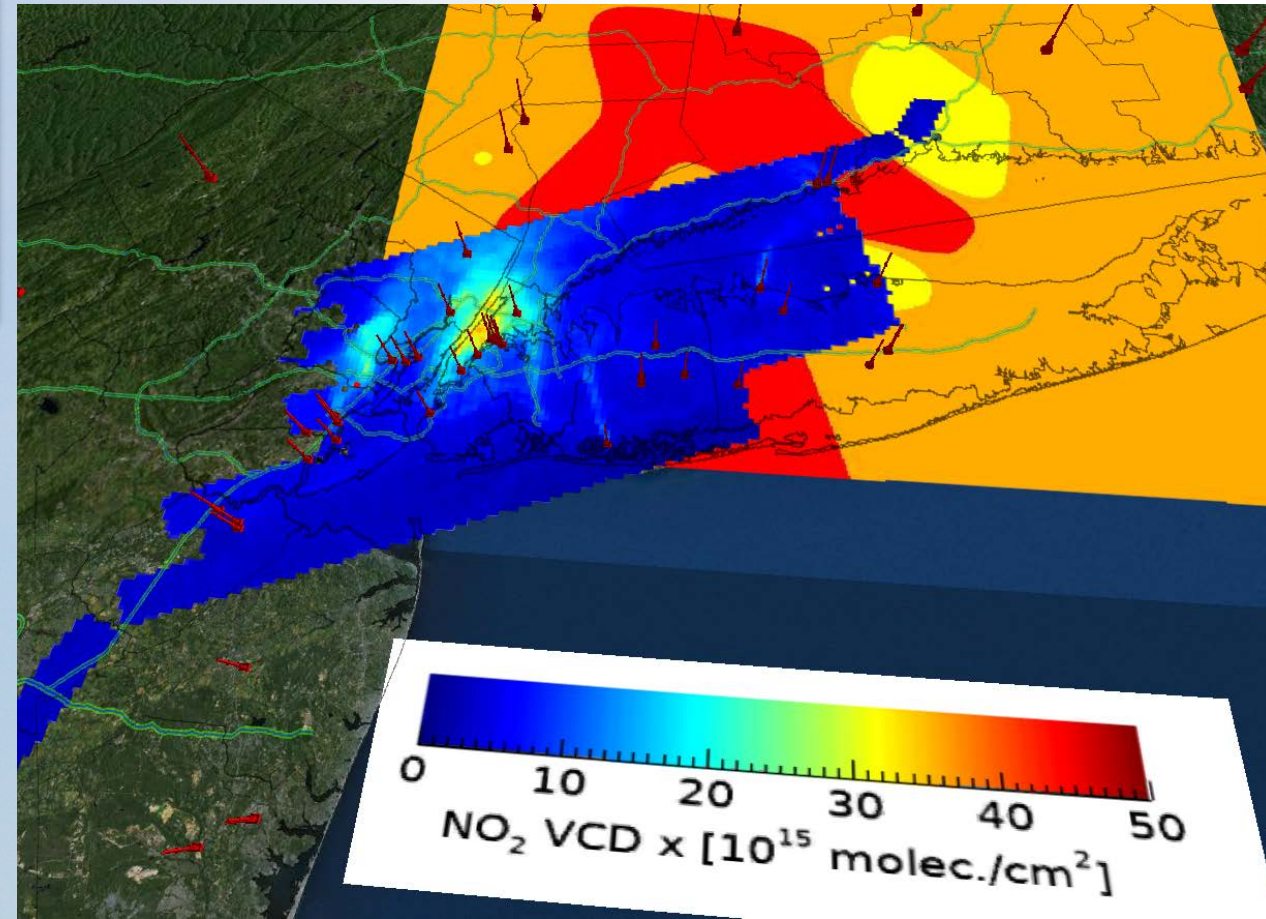
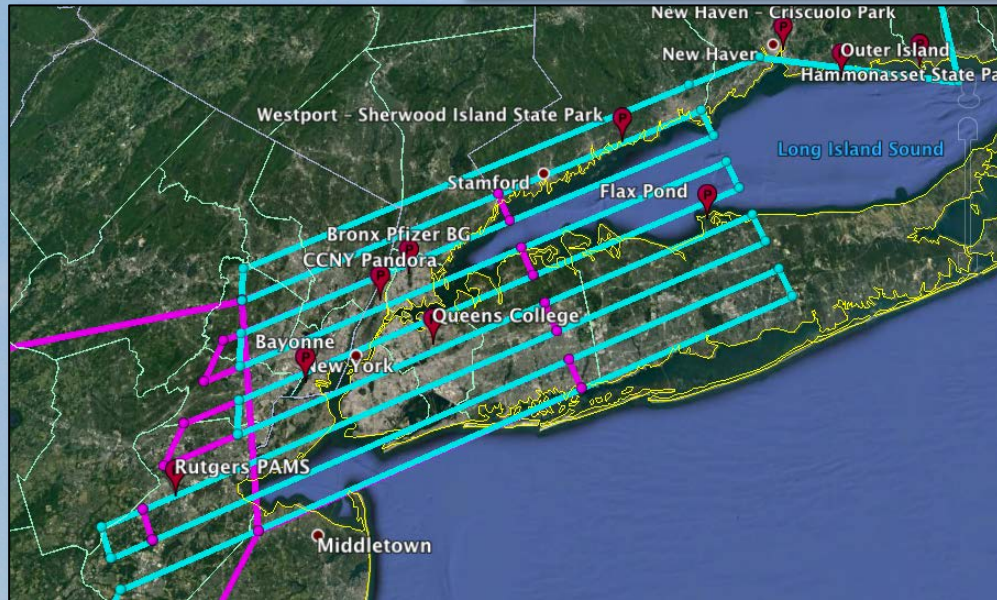
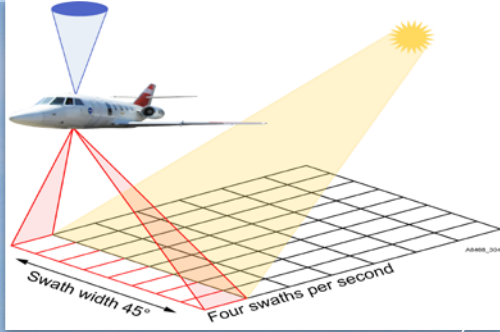
Monitoring Emissions Over NYC



We have a good idea where the point source NO₂ emissions come from, but that is only part of the equation.

To develop better control strategies, we need to know where the emissions come from on high ozone days.

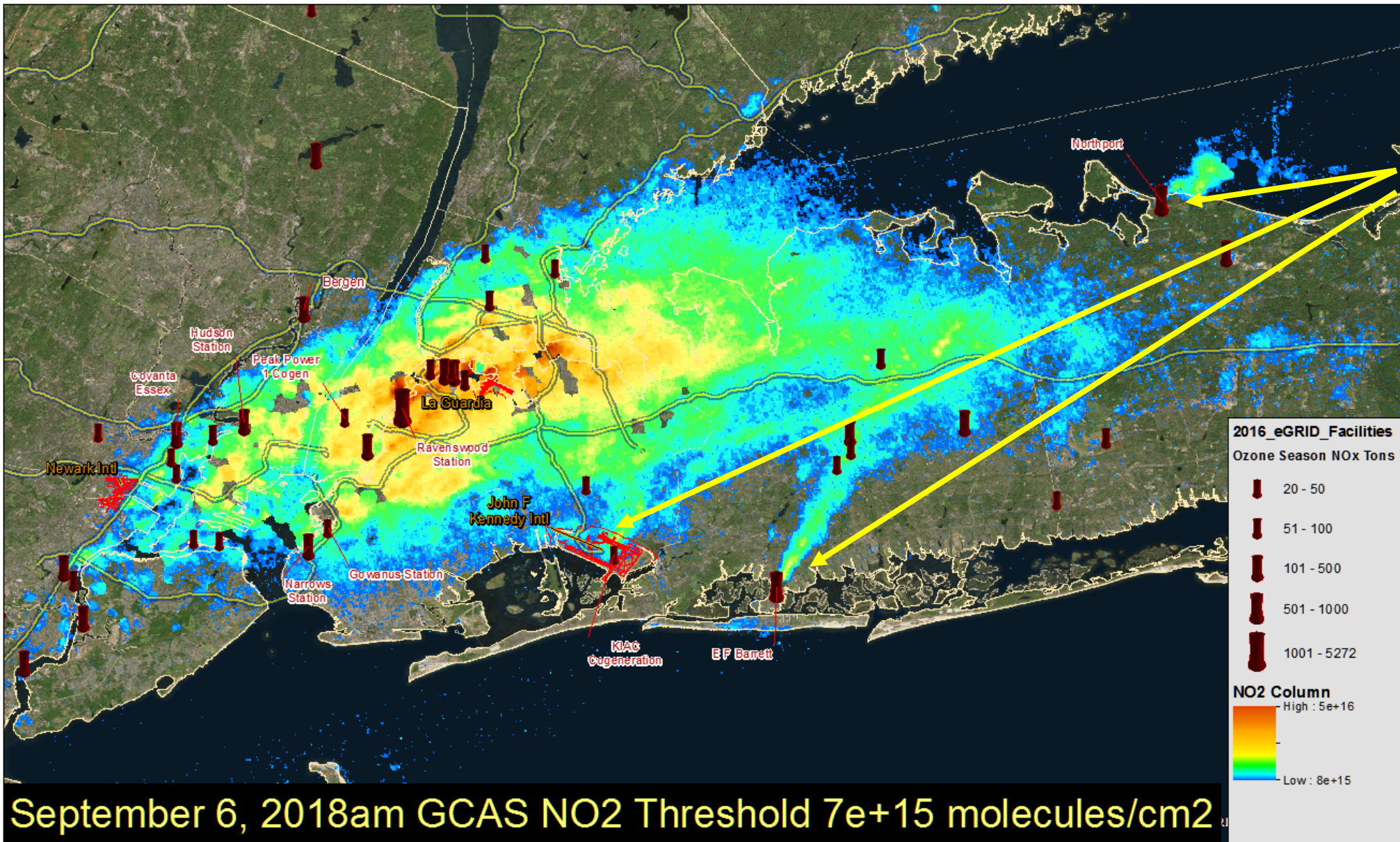
LISTOS GCAS CH₂O/NO₂ ratios



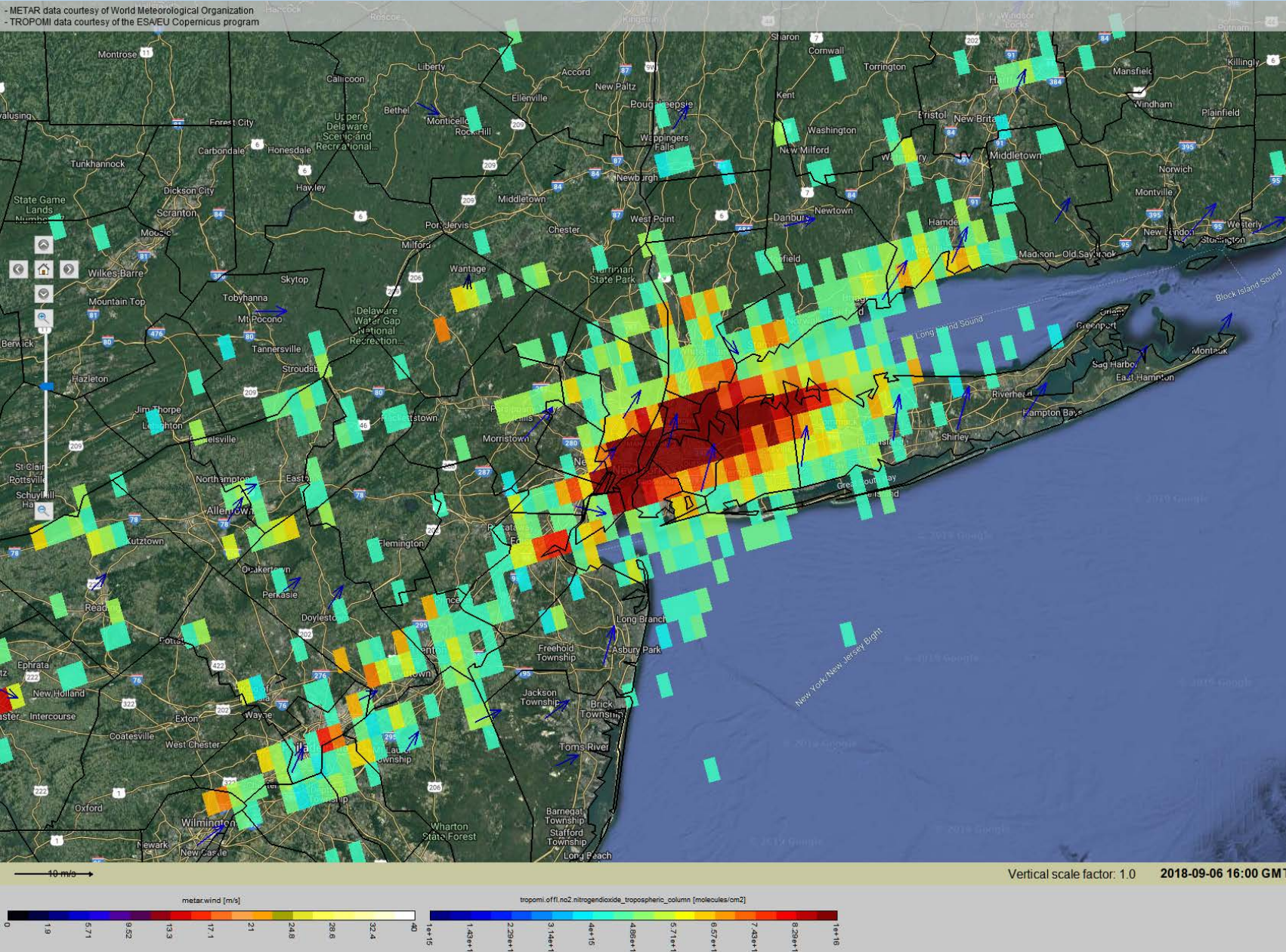
- The NASA flights used the GCAS instrument, and flew a grid pattern around NYC that had a resolution of 250 meters.
- Unlike the TROPOMI satellite, this resolution could pick out individual point source NO₂ plumes.
- By plotting NO₂, CH₂O and the CH₂O /NO₂ Ratios for high ozone days, these snap shots can help us determine how close the NYC area is to the 'tipping point' for a NO_x sensitive regime.

September 6, 2018 LISTOS GCAS NO2

This high resolution image clearly shows emissions coming from several point sources on a high ozone day.

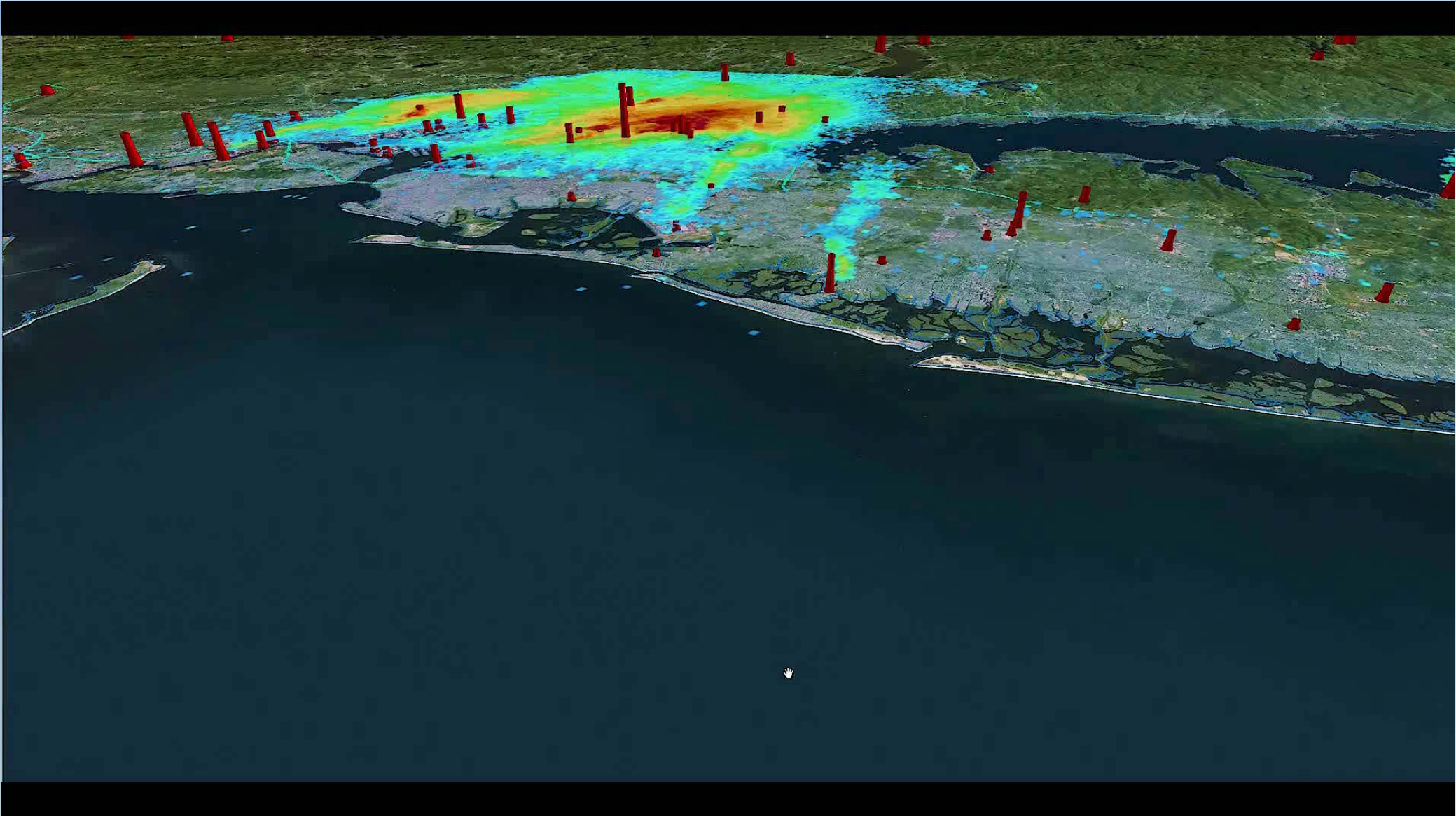


September 6, 2018 TROPOMI NO2



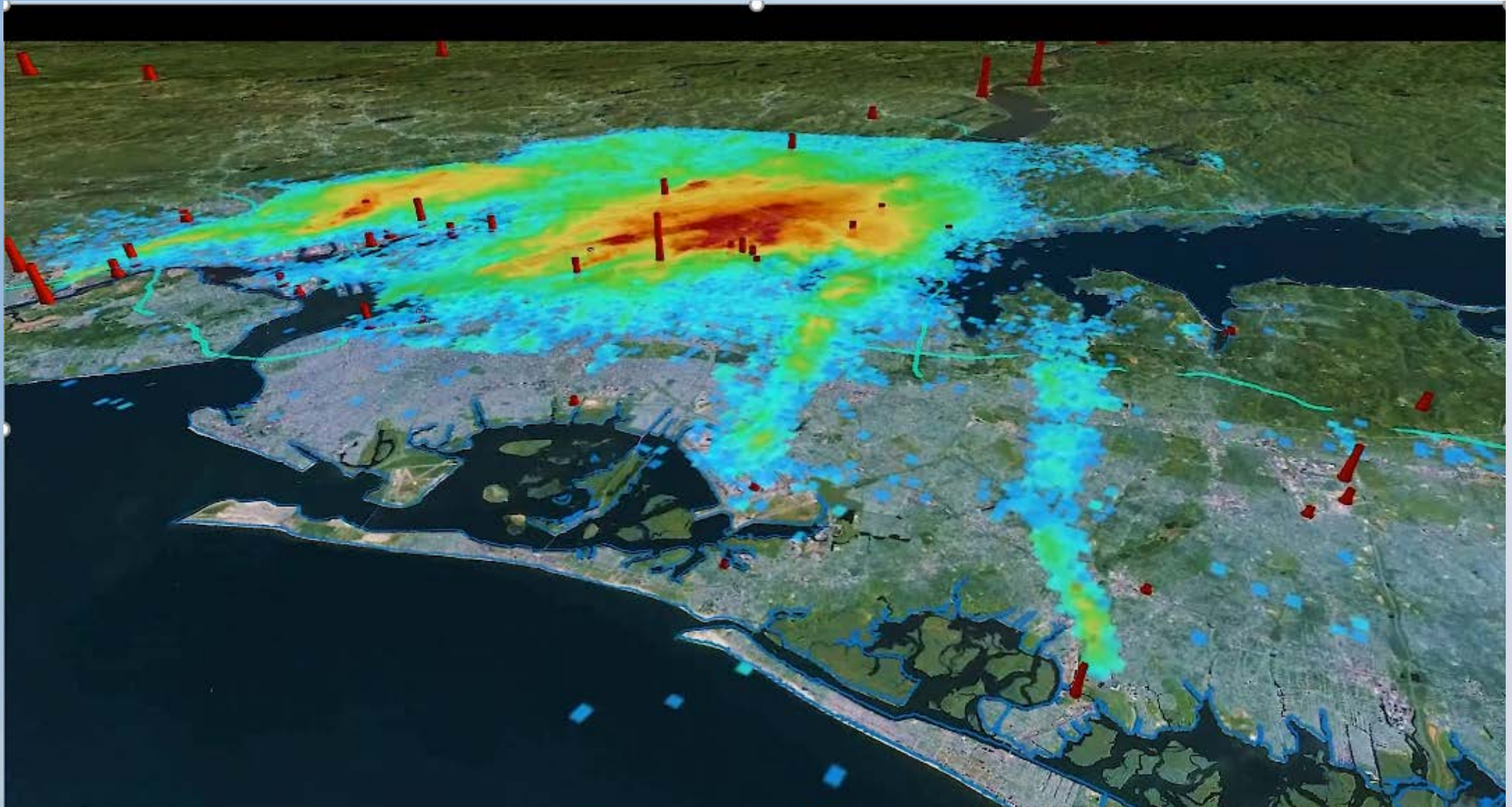
- The TROPOMI satellite was operational during the LISTOS study and verifies the elevated NO2 around NYC.
- However, it does not have the resolution to capture the individual NO2 point source plumes.

July 2, 2018 GCAS NO₂ NYC Flyover Animation



This animation with the GCAS NO₂ plotted with the EGU stacks around NYC shows much of the NO₂ plumes coming off the EGU stacks and airports on the afternoon of July 2, 2018. On this day, very high ozone levels were measured to the north of NYC.

July 2, 2018 GCAS NO₂ NYC Flyover Close-up



Conclusions

- It would be very valuable to have these ~10 minute scans during the morning hours over NYC to show the position and strength of the NO₂ plumes and to track their movement over the land/sea interface.
- These would also complement the afternoon TROPOMI overpasses, since morning meteorology produces different patterns of pollutant dispersion.
- It would be preferable to use an over-sampling technique to improve the spatial resolution enough to single out point sources of emissions .
- High ozone events appear to have become more of a local issue for Connecticut, rather than regional. This shows that NO_x reductions have been effective on a regional scale, but still are needed in large urban areas.
- Using TEMPO to provide high resolution imaging during high ozone days over the NYC area would be invaluable to air quality managers in developing better control strategies.

Extra Slides

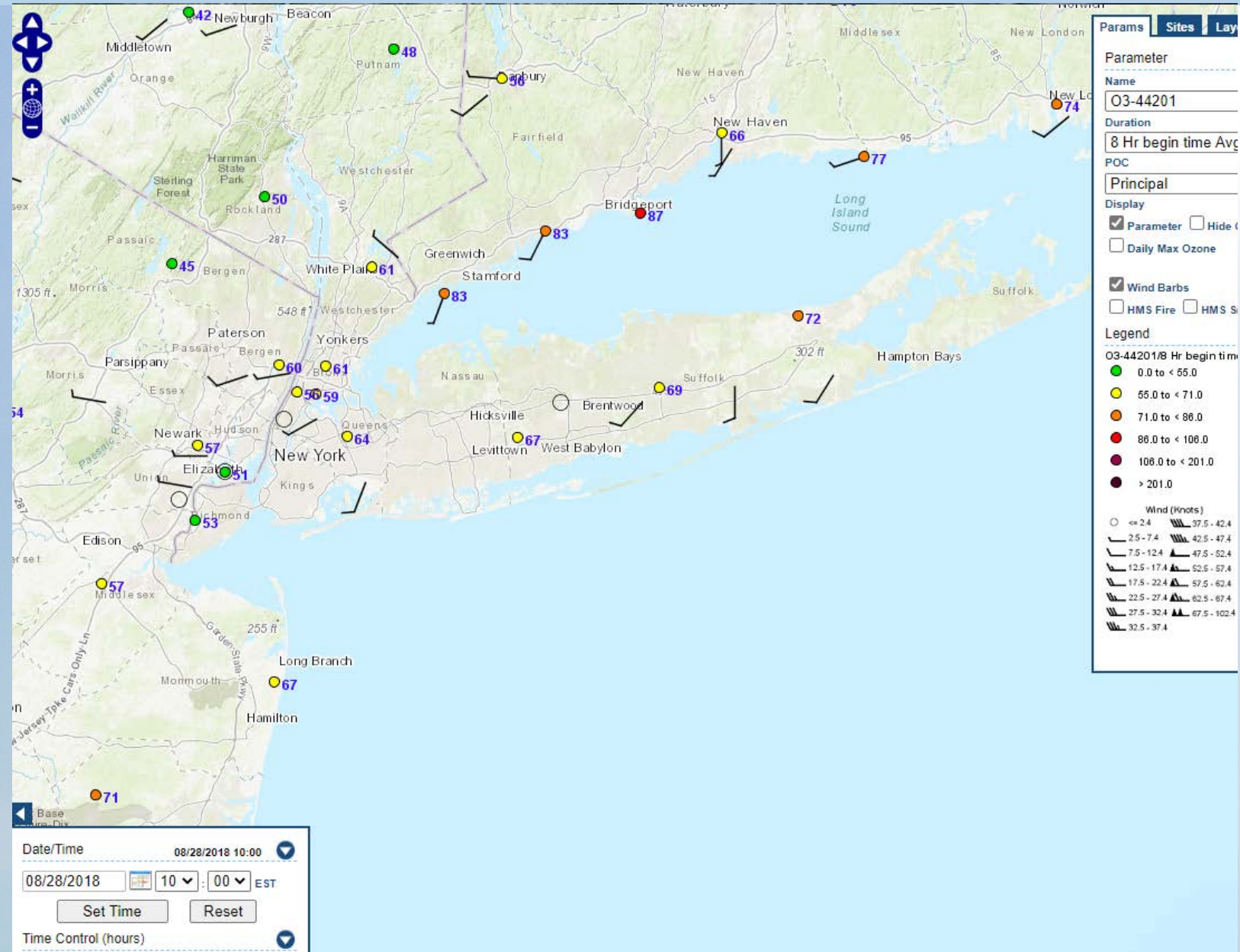


August 28, 2018 Satellite and Ozone

Click to
Advance

On this day, there was a dense smoke plume, mostly to our south. The visible satellite clearly shows the smoke plume over the ocean.

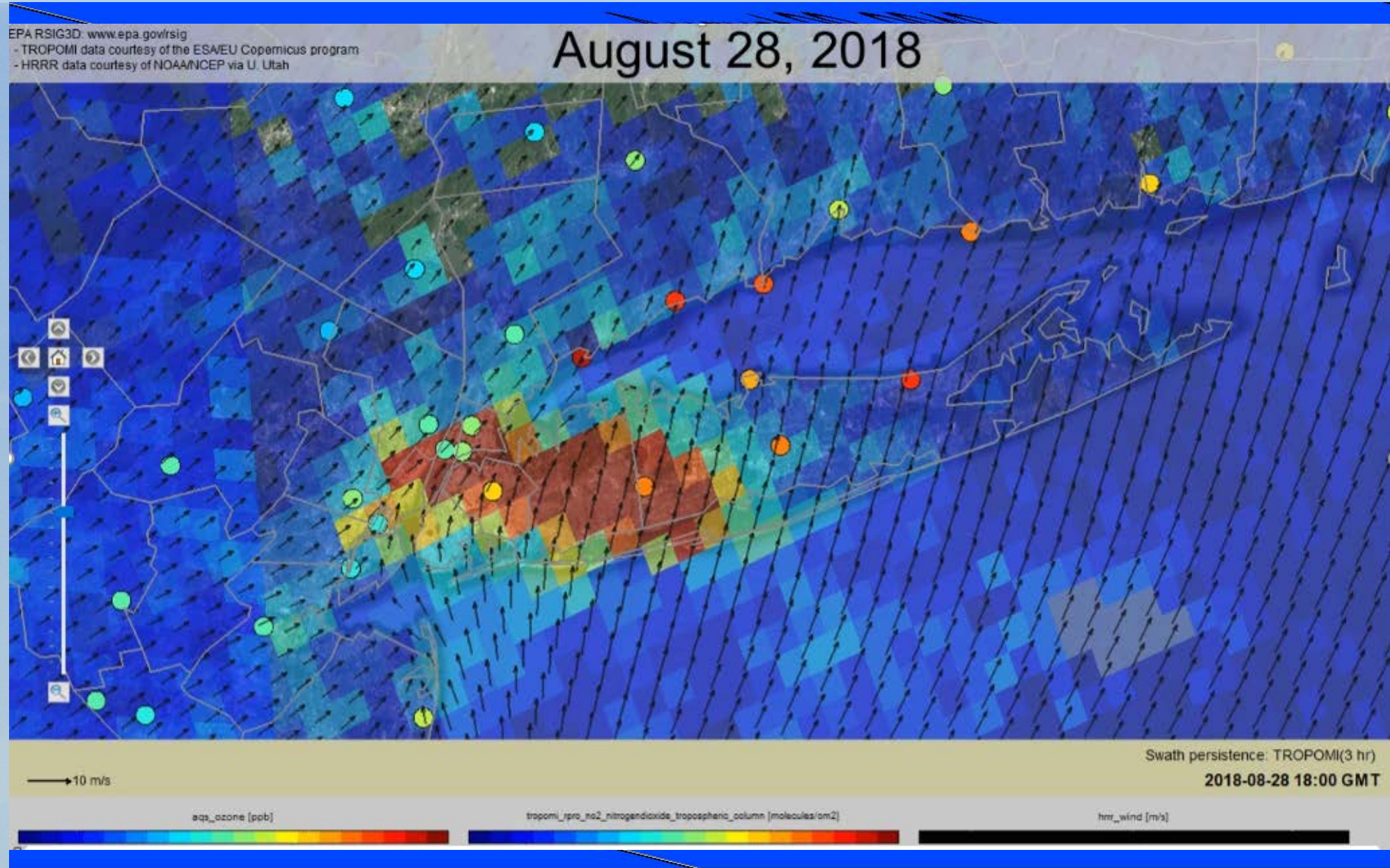
Winds were from the southwest, which allowed pollutants from NYC to enter LIS and produce ozone.



August 28, 2018 Ozone-Wind-NO2 Animation

One can see from this animation how the surface winds can blow the NYC NO2 plume into LIS, where ozone is produced and driven into Connecticut.

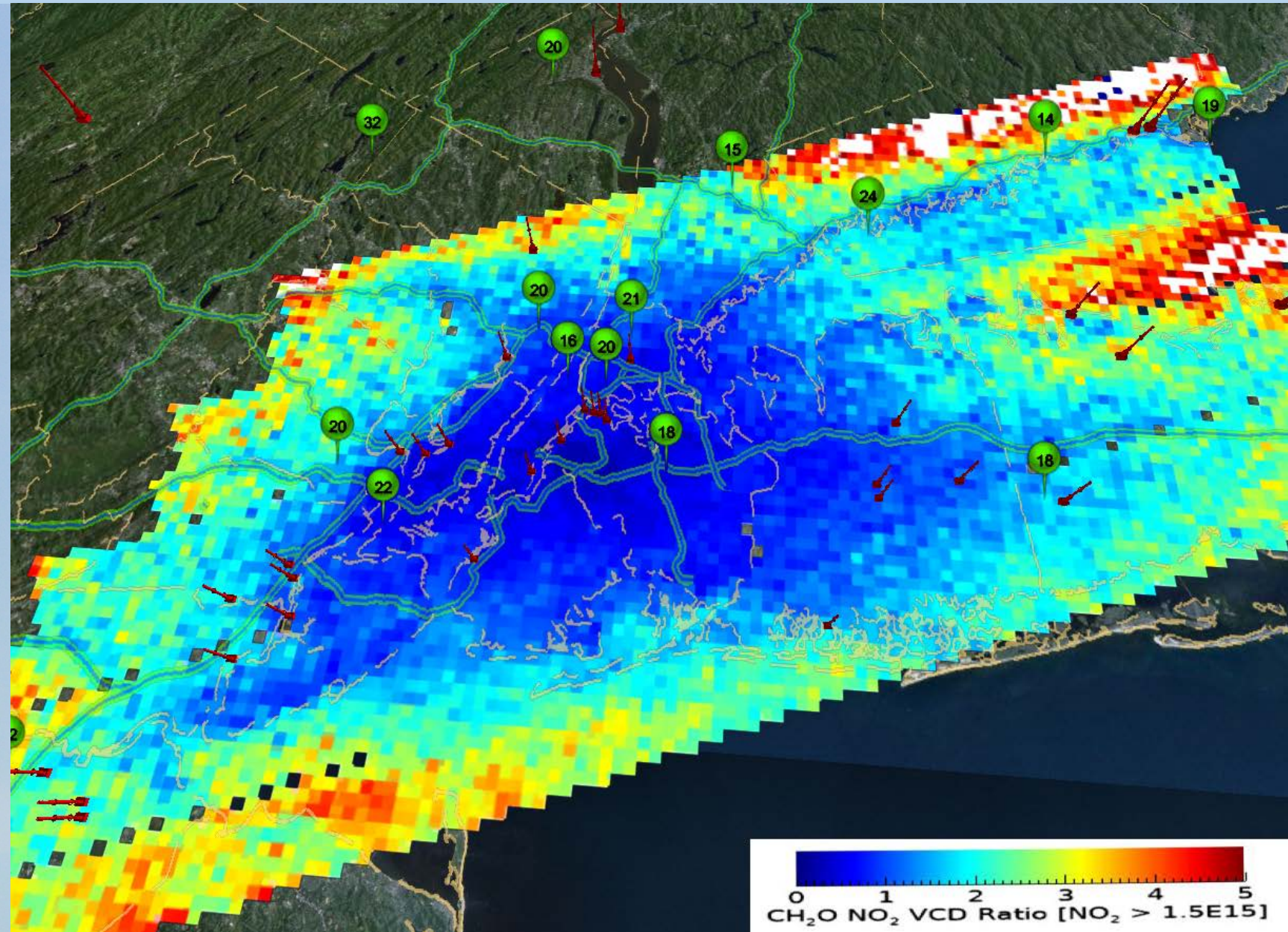
If several high resolution satellite images were produced during the day, it would more clearly track the movement of pollutants with the ozone production.



Morning August 28, 2018 (8:08-10:59 am EDT)

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During the morning, ozone levels were low.



Afternoon August 28, 2018 (12:47-03:41 pm EDT)

[Click to Advance](#)

Just after noon, the southwest winds are blowing the NO₂ plume into LIS.

Note the plumes that can be detected coming off of the EGU stacks.

Because of the smoke, CH₂O levels are still elevated and highest over Long Island.

