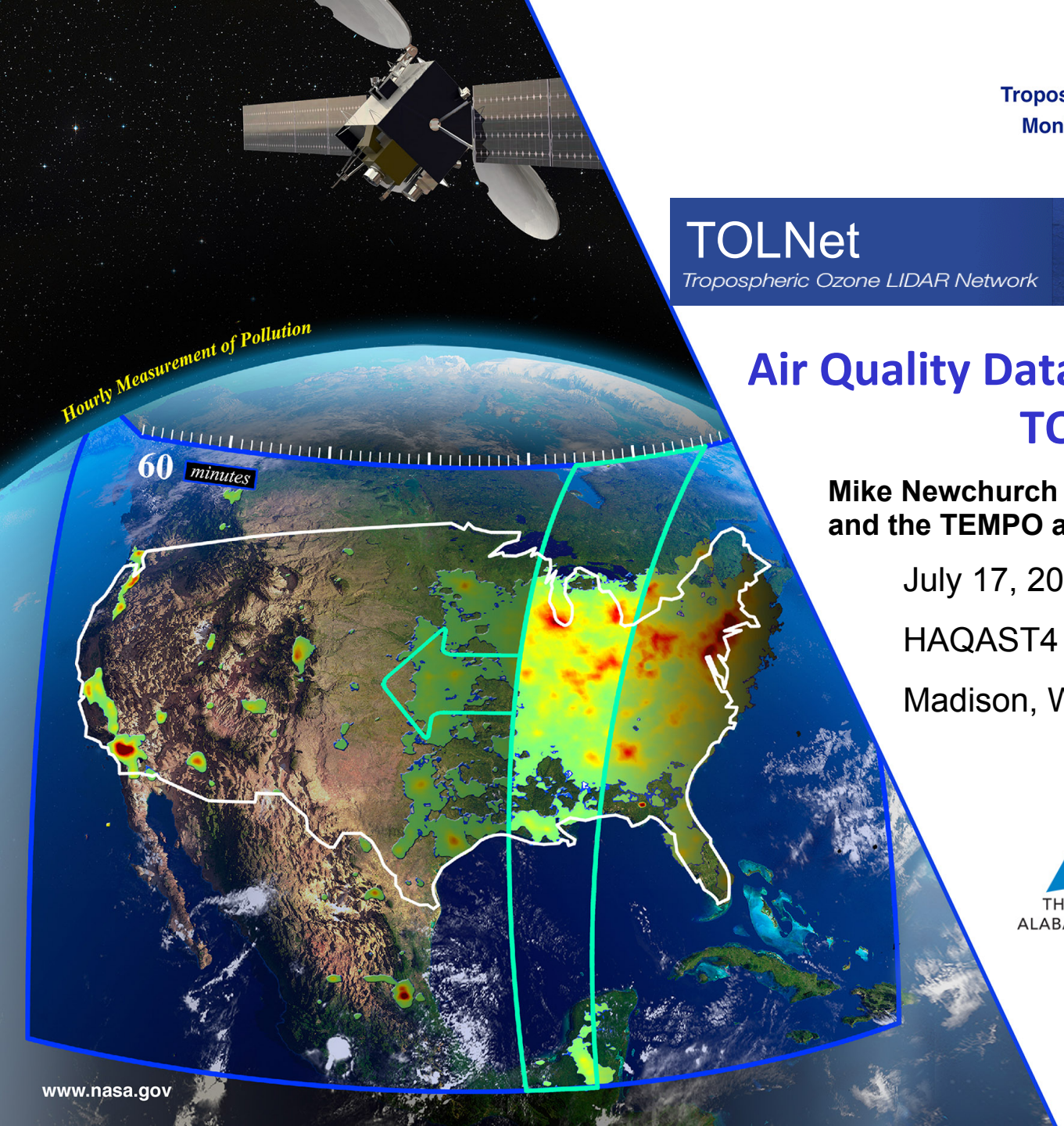
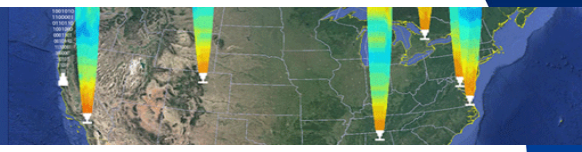


Tropospheric Emissions:
Monitoring of Pollution

TEMPO

TOLNet
Tropospheric Ozone LIDAR Network



Air Quality Data from TEMPO and TOLNet

Mike Newchurch
and the TEMPO and TOLNet Science Teams

July 17, 2018

HAQAST4

Madison, WI

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

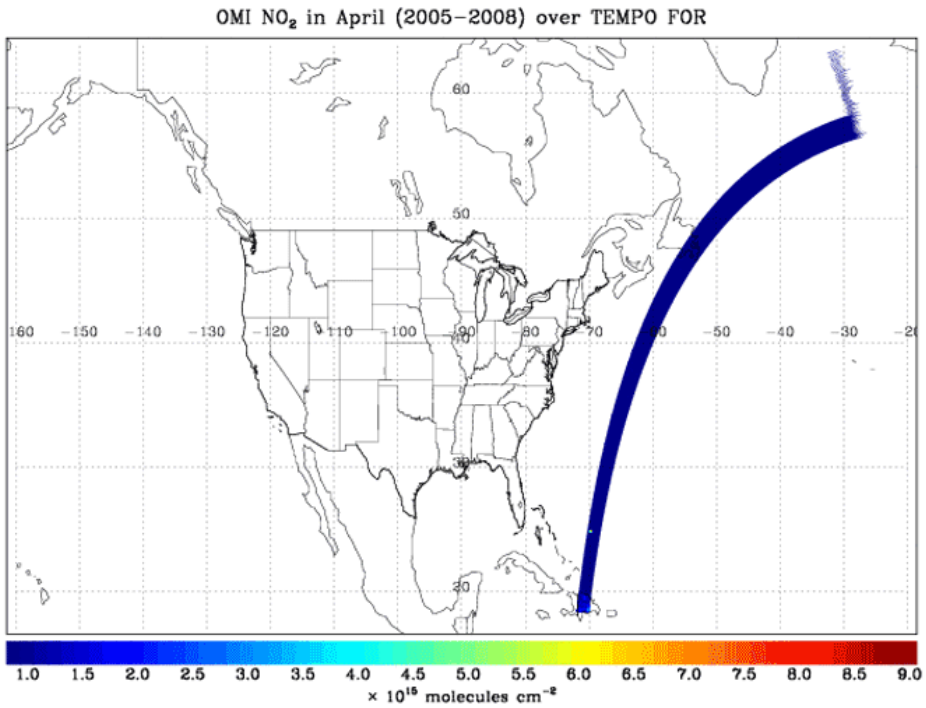
NOAA

Smithsonian

NASA

TEMPO measurements

- Hourly daylight measurements from TEMPO will effectively monitor the air quality conditions over North America
- Monitoring will be accomplished at sub-urban scales due to spatial resolution of 2.1 x 4.7 km
- Multi-spectral capabilities (ultraviolet & visible channels) will help distinguish between BL, free tropospheric, and stratospheric O_3

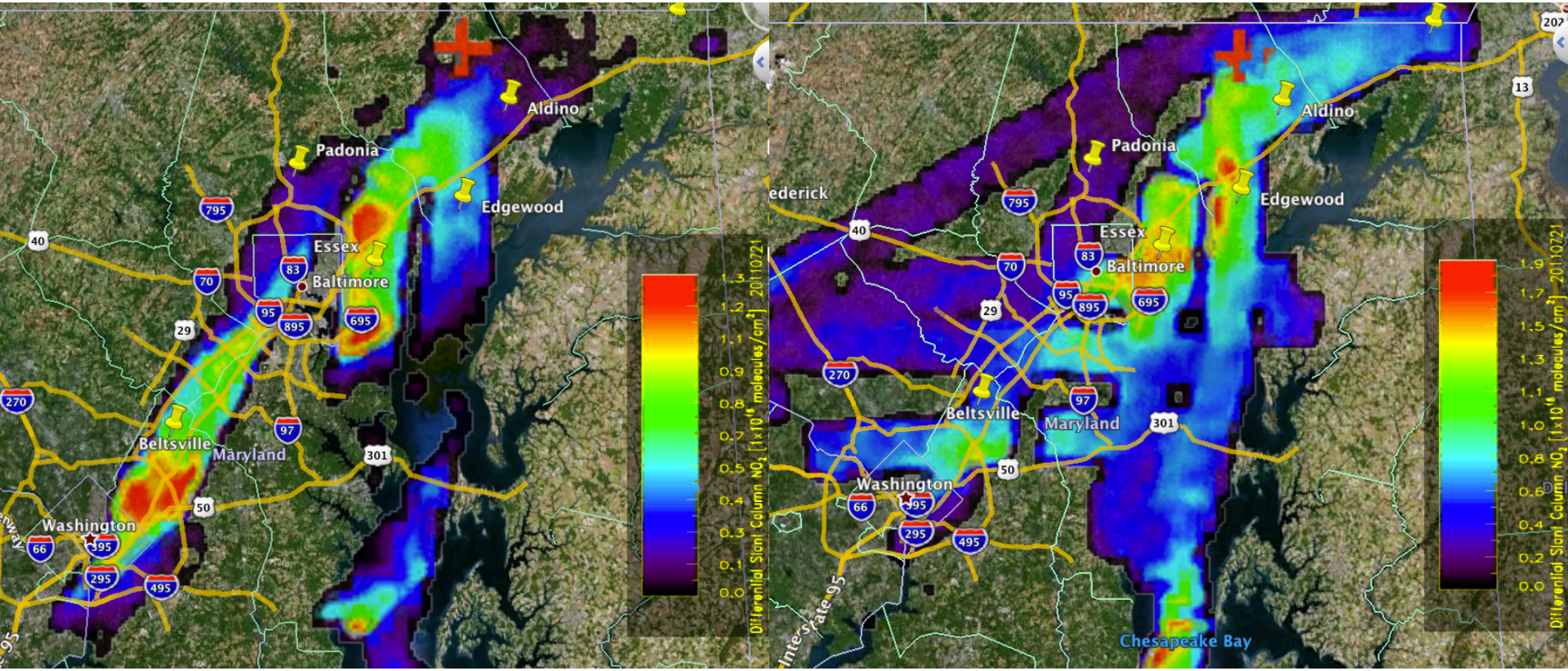


TEMPO
Baseline and threshold data products

Species/Products	Required Precision	Temporal Revisit
0-2 km O_3 (Selected Scenes) Baseline only	10 ppbv	2 hour
Tropospheric O_3	10 ppbv	1 hour
Total O_3	3%	1 hour
Tropospheric NO_2	1.0×10^{15} molecules cm^{-2}	1 hour
Tropospheric H_2CO	1.0×10^{16} molecules cm^{-2}	3 hour
Tropospheric SO_2	1.0×10^{16} molecules cm^{-2}	3 hour
Tropospheric $C_2H_2O_2$	4.0×10^{14} molecules cm^{-2}	3 hour
Aerosol Optical Depth	0.10	1 hour

- **Minimal set of products sufficient for constraining air quality**
- **Across Greater North America (GNA): 19°N to 57.5°N near 100°W, 67°W to 125°W near 42°N**
- **Temporal scales to resolve diurnal changes in pollutant distributions**
- **Collected in cloud-free scenes**
- **Geolocation uncertainty of less than 4 km**
- **Mission duration, subject to instrument availability**
  - **Baseline 20 months**
  - **Threshold 12 months**

TEMPO Aircraft Simulator:
ACAM Spatial/Temporal Variability NO_2 July 21st
MD Deployment



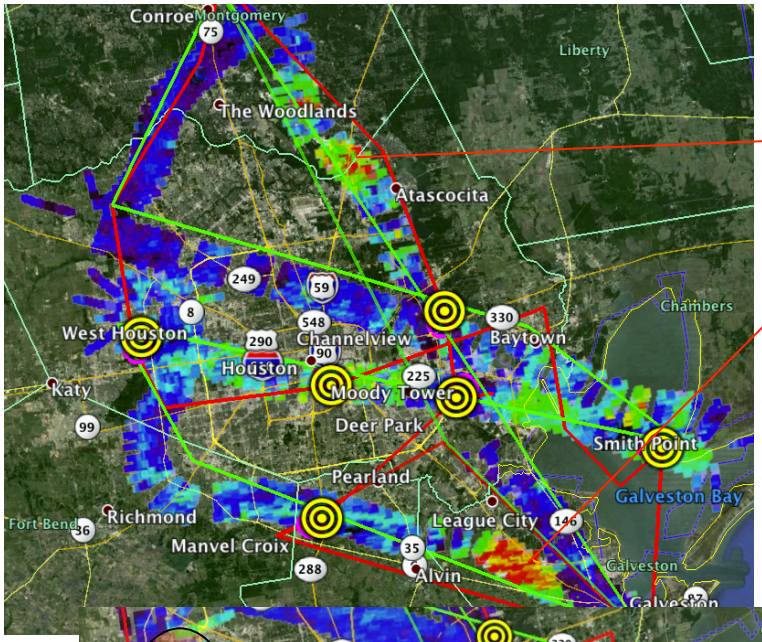
Morning

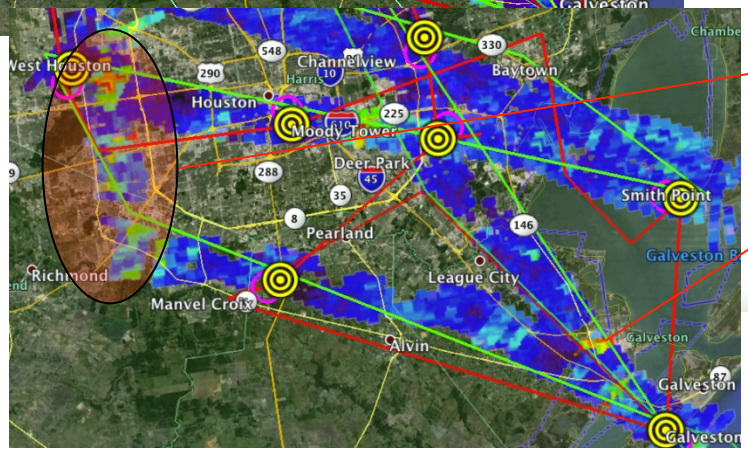
0.005° x 0.005° grid of 3 km^2 average, differential slant column abundance. “Clean scene” reference at cross.

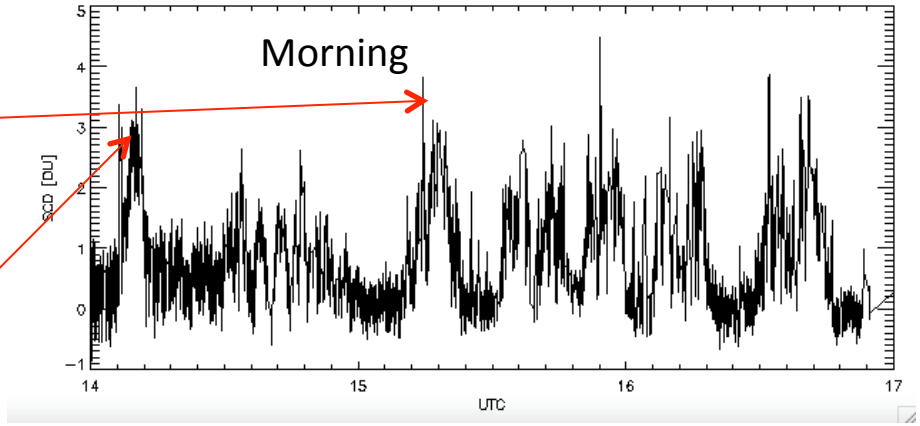
Afternoon

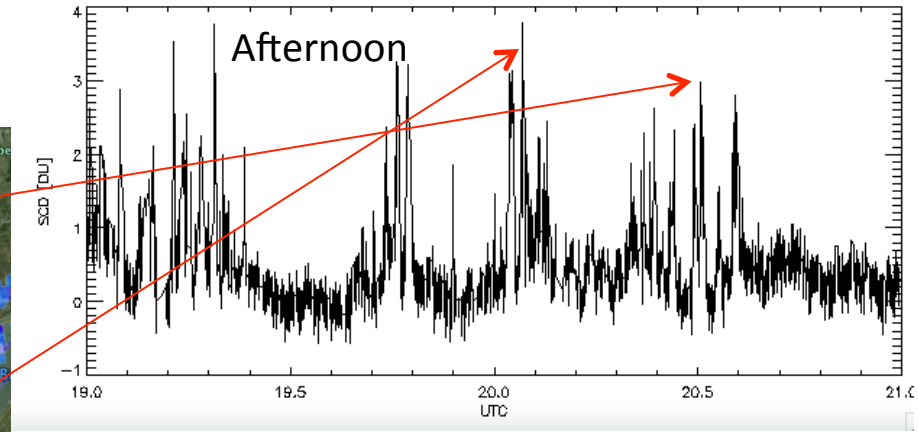
TEMPO Aircraft Simulator: GCAS CH_2O Sept. 24th

Houston deployment









Highest levels of CH2O seen of the four deployments. Comparisons with DFGAS complicated by cloud interference.

Example Measurement: Ozone Water-Land Environmental Transition Study

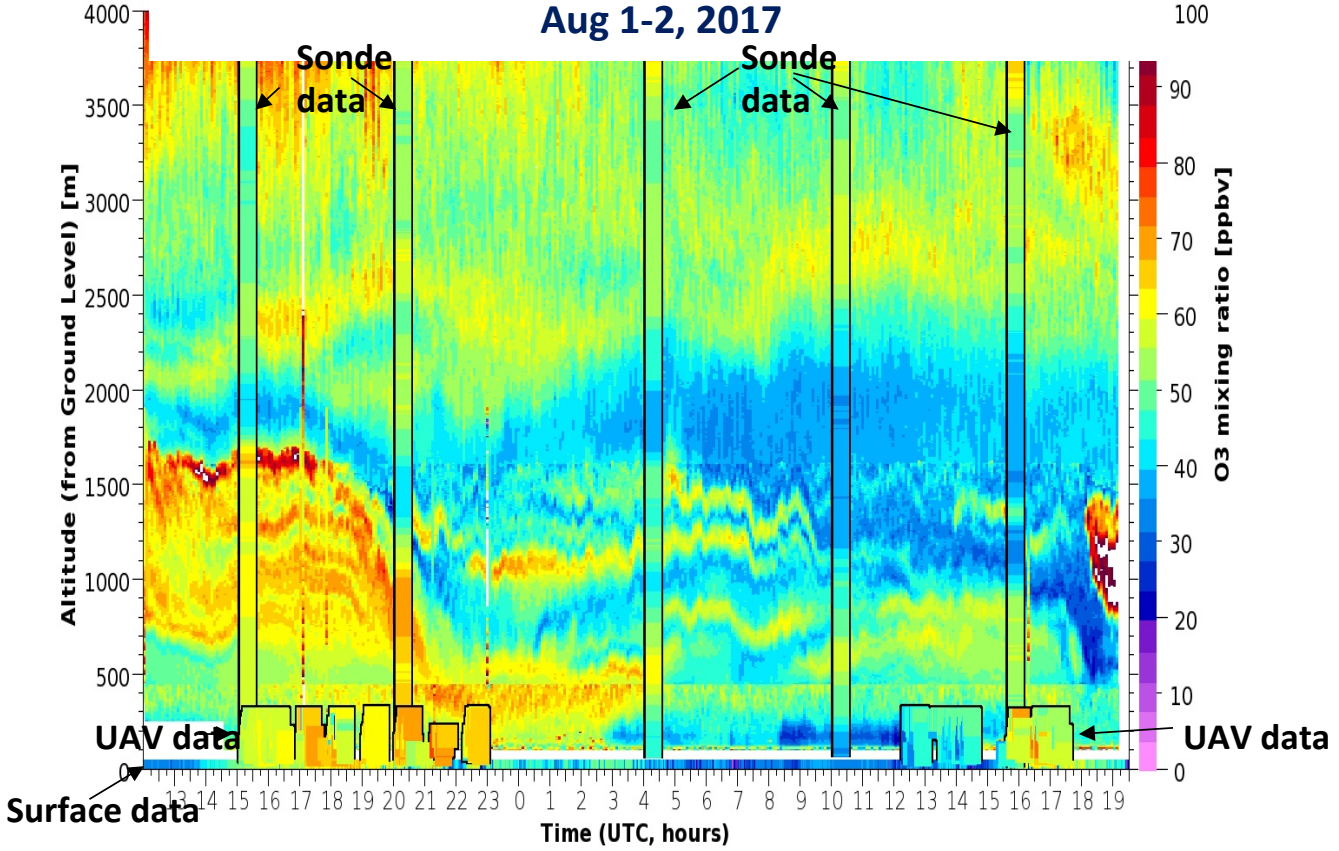
NASA Science Innovation Fund (SIF) awarded project

PI -T. Berkoff, J. Sullivan, G. Gronoff, D. Allen, J. Neilan, M. Pippin, T. Knepp, T. McGee

TOLNet Langley Mobile Ozone Lidar: Preliminary Data

Ozone Data Obtained at the "over-water' CBBT site

Aug 1-2, 2017



During the Summer 2017 Ozone Water Land Environmental Transition Study (OWLETS) in the Tidewater region of Southern Virginia, ozone profile data were obtained at the third island of the Chesapeake Bay Bridge Tunnel, 7.5 miles off-shore. On Aug 1-2, the Langley Mobile Ozone Lidar (LMOL) ran for 30+ hours capturing diurnal cycle ozone dynamics resulting from the collapse of the Aug 1 daytime boundary layer and resultant residual layers leading into Aug 2. Also highlighted are the ozonesonde launches and data collected by a UAV/drone carrying an in-situ ozone sensor. The UAV/drone sensor provided the ability to investigate near-range variability, and helped to validate the capabilities of a new near-surface lidar channel on LMOL. This data when combined with other OWLETS measurements will help evaluate ozone transition behavior from land to water in complex coastal scenes where large gradients in ozone can occur.

Pilot Project: Public Health

- How can TEMPO be used to assess the impact of air pollutant exposure on hospital readmission rates for cardiopulmonary disorders? See Prof Susan Alexander
- Collaboration with Alabama Department of Public Health and Alacare Home Health & Hospice
- TEMPO proxy products will be used to build the readmission rate prediction model
- The spatial/temporal resolution of air pollutants from TEMPO offer the capacity to assess environmental risk factors on health and provide critical time and space information to healthcare end users for mitigation actions

http://tempo.si.edu
http://nsstc.uah.edu/atmchem/
https://www-air.larc.nasa.gov/missions/TOLNet/