LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

Lessons Learned from the 2017 Lake Michigan Ozone Study (LMOS 2017)

Angela Dickens, Ph.D.
LADCO Data Scientist

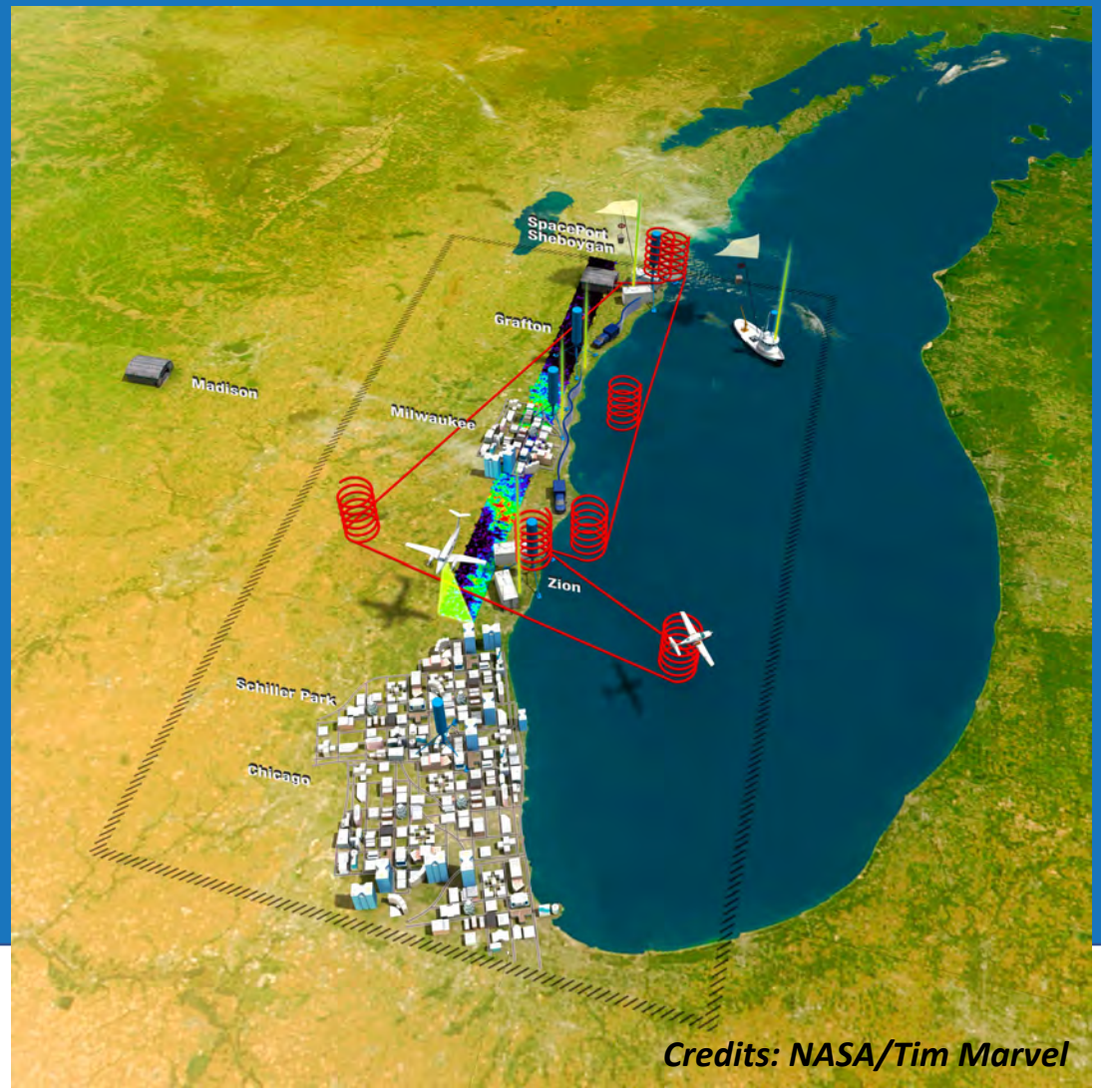
2022 AGES Workshop, September 29, 2022

The 2017 Lake Michigan Ozone Study

- Collaborative, multiagency field study in May-June 2017

LADCO

The 2017 Lake Michigan Ozone Study



Credits: NASA/Tim Marvel

- Collaborative, multiagency field study in May-June 2017
- One major goal: improve air quality modeling of ozone along the complex lakeshore
- Included observations from aircraft, vehicles, ground super-sites, ships, and ground-based remote sensing

- Overview in Stanier et al. (2021) "Overview of the Lake Michigan Ozone Study 2017", BAMS, https://doi.org/10.1175/BAMS-D-20-0061.1

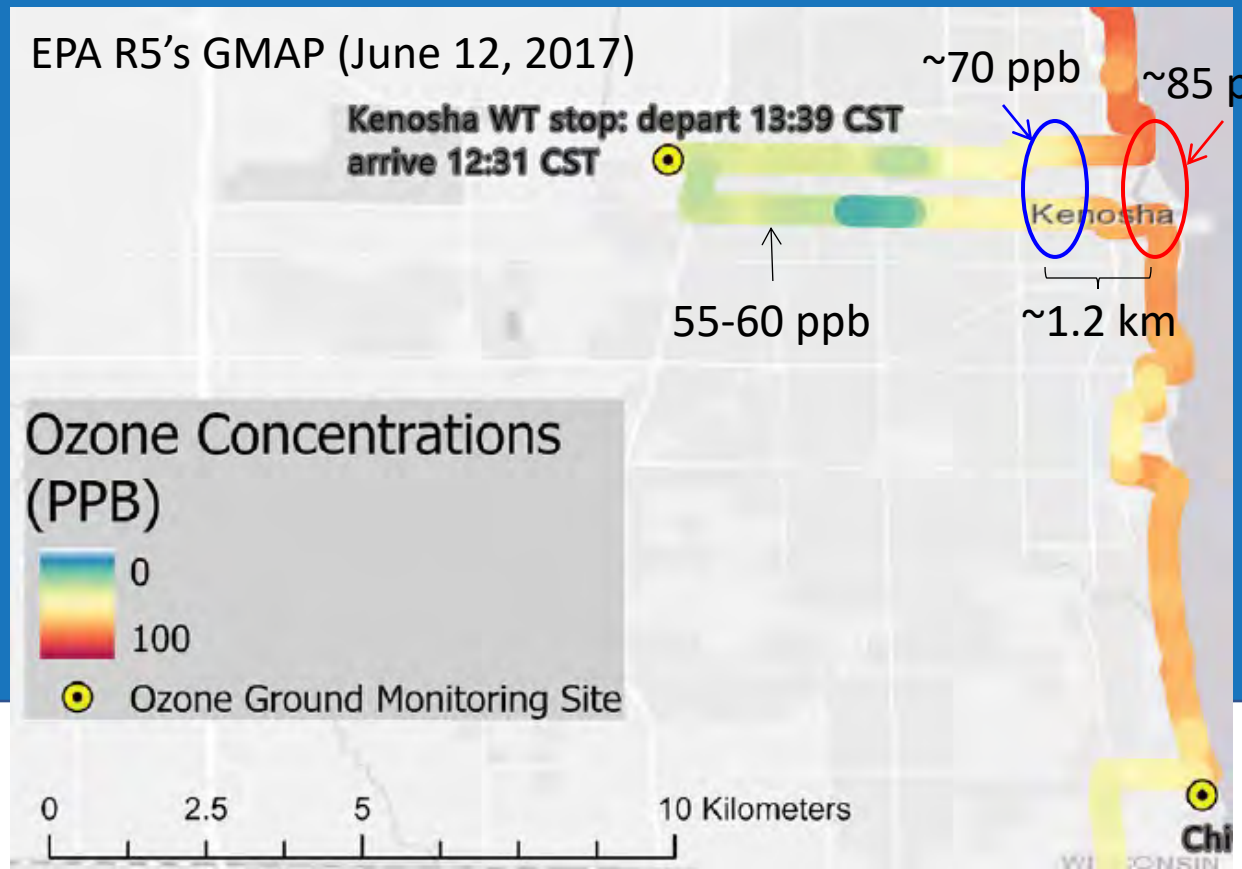
LADCO

The 2017 Lake Michigan Ozone Study: Lessons Learned

1) The power of collaborations between air quality managers and researchers
2) The importance of VOC-sensitive chemistry in the Chicago area
   - Evolution of chemistry during transport
   - Variability from day to day
3) The fine scale and sharp gradients in many lake breeze-related features

The 2017 Lake Michigan Ozone Study: Lessons Learned

3) The fine scale and sharp gradients in many lake breeze-related features



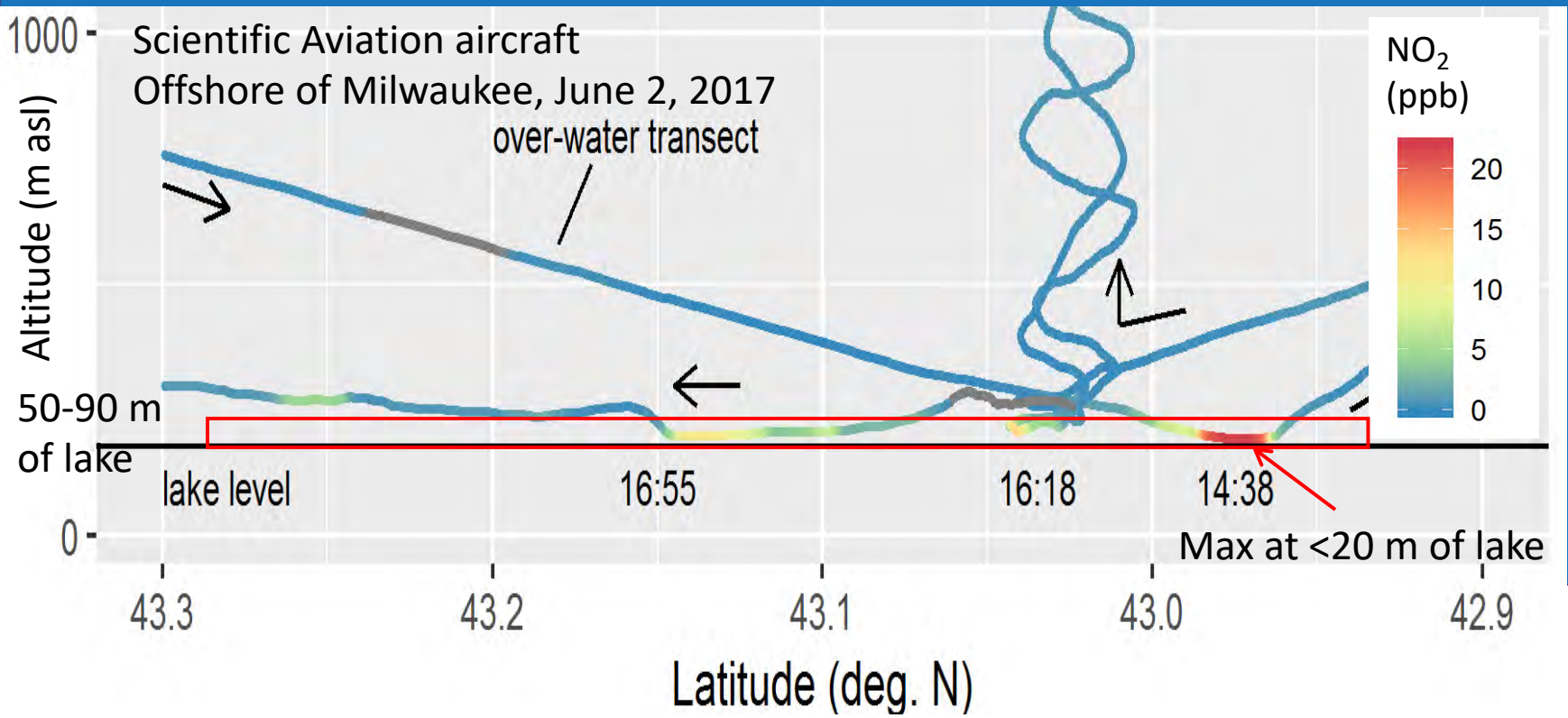
Horizontal/inland gradients in ozone

Stanier et al., 2021, BAMS

LADCO

The 2017 Lake Michigan Ozone Study: Lessons Learned

3) The fine scale and sharp gradients in many lake breeze-related features



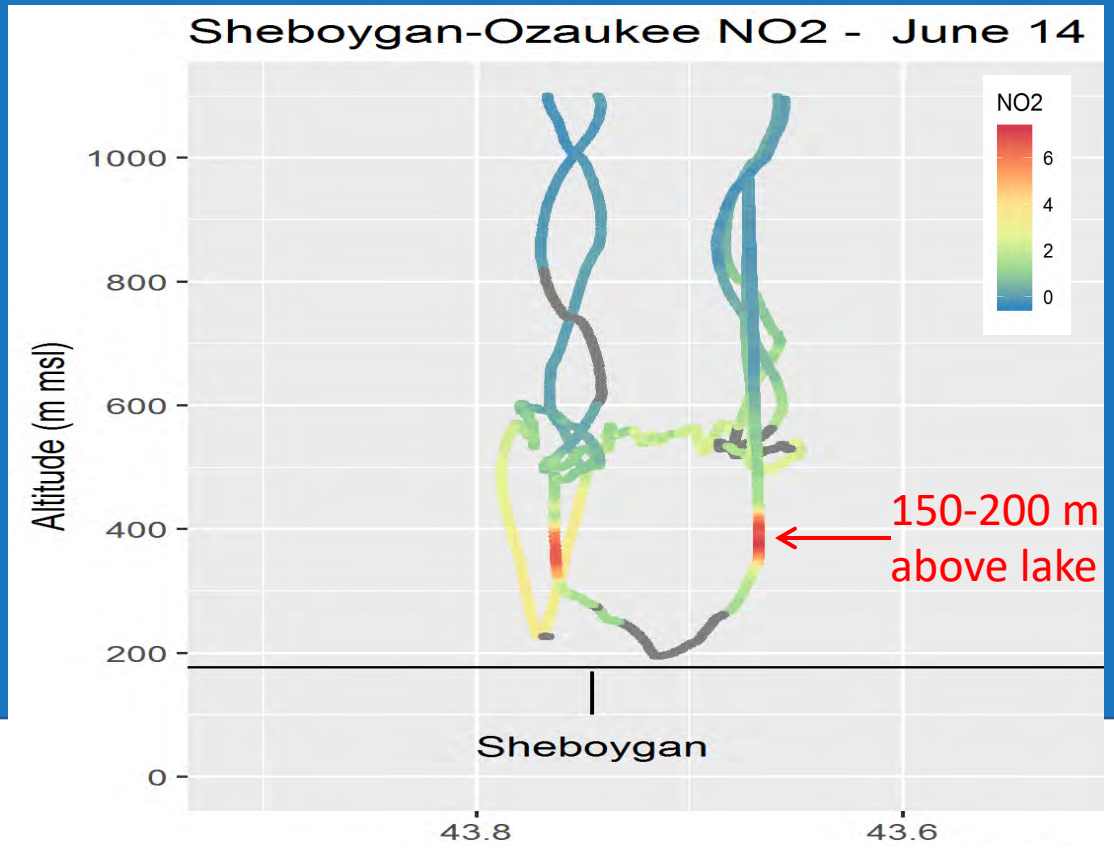
Vertical gradients in NO_2

Similar for O_3 but slightly less sharp

LADCO

The 2017 Lake Michigan Ozone Study: Lessons Learned

3) The fine scale and sharp gradients in many lake breeze-related features



Vertical gradients in NO_2

Similar for O_3 but slightly less sharp

NO_2 plumes sometimes elevated above the lake

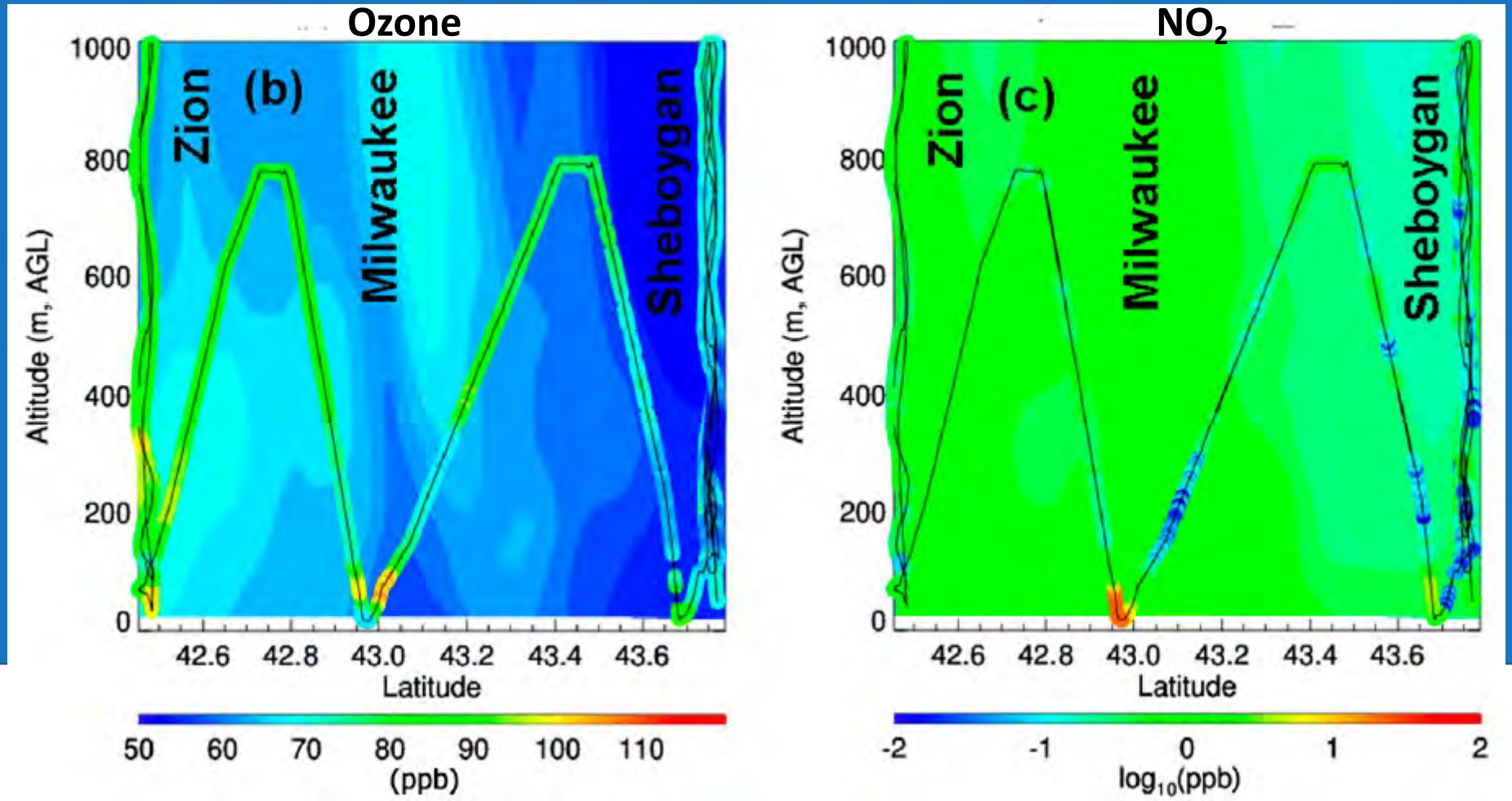
LADCO

The 2017 Lake Michigan Ozone Study: Lessons Learned

1) The power of collaborations between air quality managers and researchers
2) The importance of VOC-sensitive chemistry in the Chicago area
3) The fine scale and sharp gradients in many lake breeze-related features
4) Difficulty of models reproducing ozone and precursors

The 2017 Lake Michigan Ozone Study: Lessons Learned

4) Difficulty of models reproducing ozone and precursors



WRF-Chem model compared with aircraft measurements, June 2, 2017

Stanier et al., 2021, BAMS

LADCO

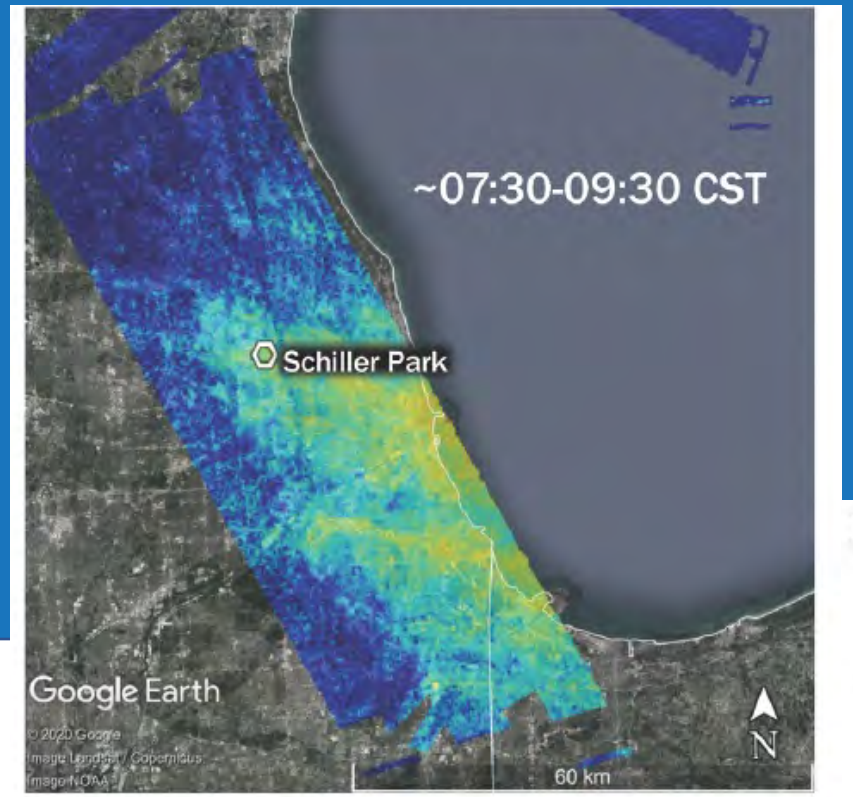
The 2017 Lake Michigan Ozone Study: Lessons Learned

1) The power of collaborations between air quality managers and researchers
2) The importance of VOC-sensitive chemistry in the Chicago area
3) The fine scale and sharp gradients in many lake breeze-related features
4) Difficulty of models reproducing ozone and precursors
5) Hints that inventories over-estimate light-duty vehicle emissions (cars) and under-estimate heavy-duty vehicle emissions (trucks)

The 2017 Lake Michigan Ozone Study: Lessons Learned

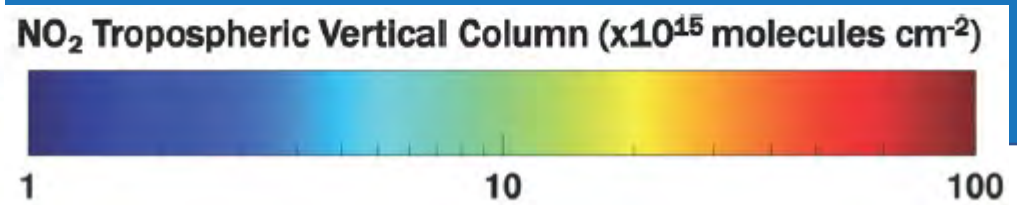
5) Hints that inventories under-estimate heavy-duty diesel vehicle emissions (HDDV)

GeoTASO, June 19, 2017



Likely two components:

- Use of defeat devices lead to underestimates of all HDDV emissions
- Underestimating diesel idling emissions
  - Biggest impacts at warehouses & intermodal facilities with long wait times



Stanier et al., 2021, BAMS

LADCO


Thank you!
dickens@ladco.org