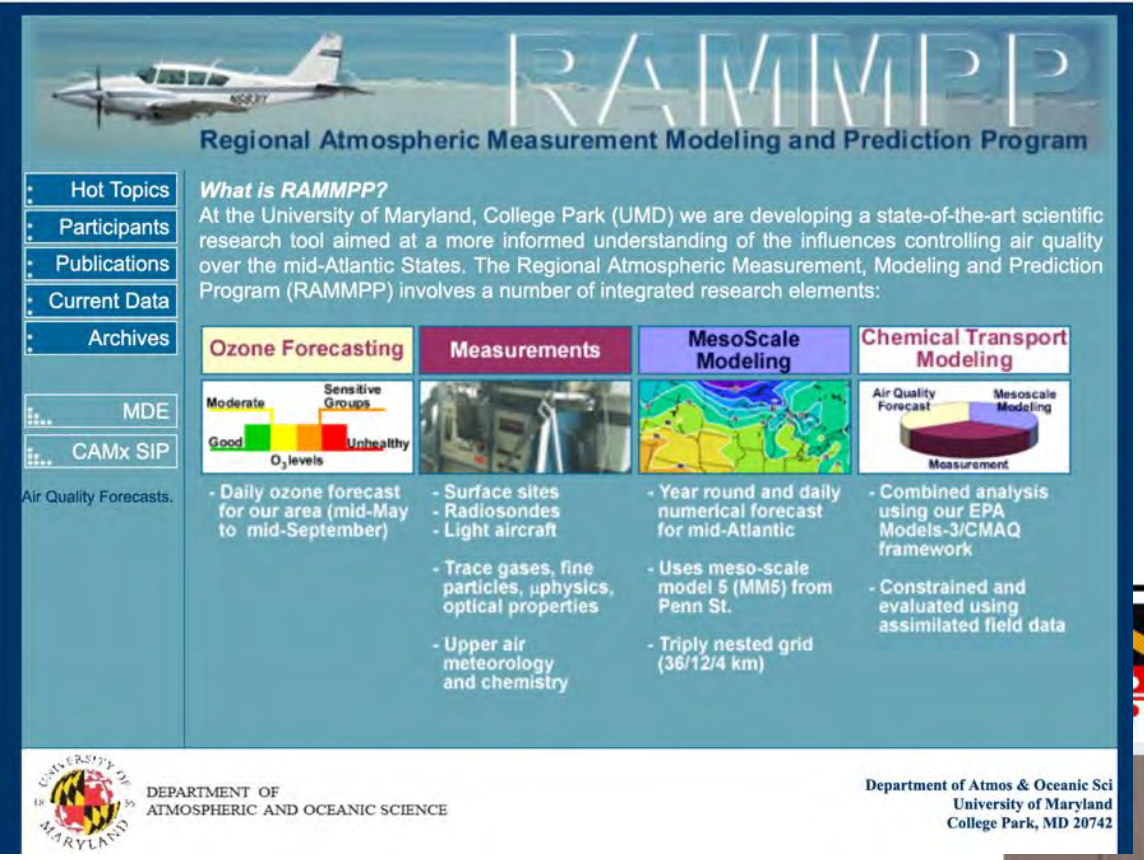
Historical and current policy-relevant research on GHGs and AQ in the Baltimore/Washington area

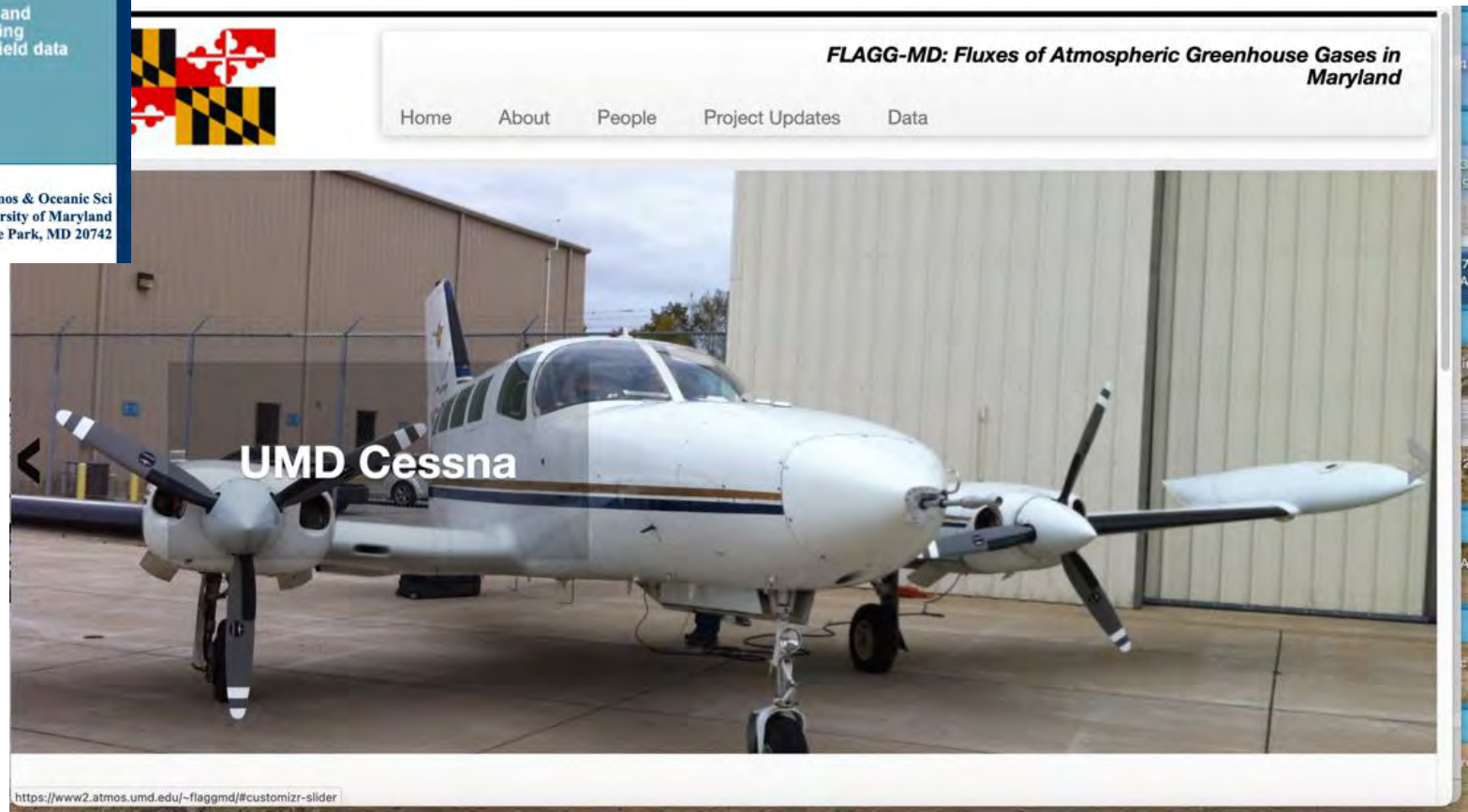
Russell Dickerson, UMD
UMD/URF Cessna and NOAA's ARC

2025 AiRMAPS Coordination Workshop
Sept. 2024



https://www2.atmos.umd.edu/~rammpp/
(being updated)

MDE support
(still have $$, no airplane now)



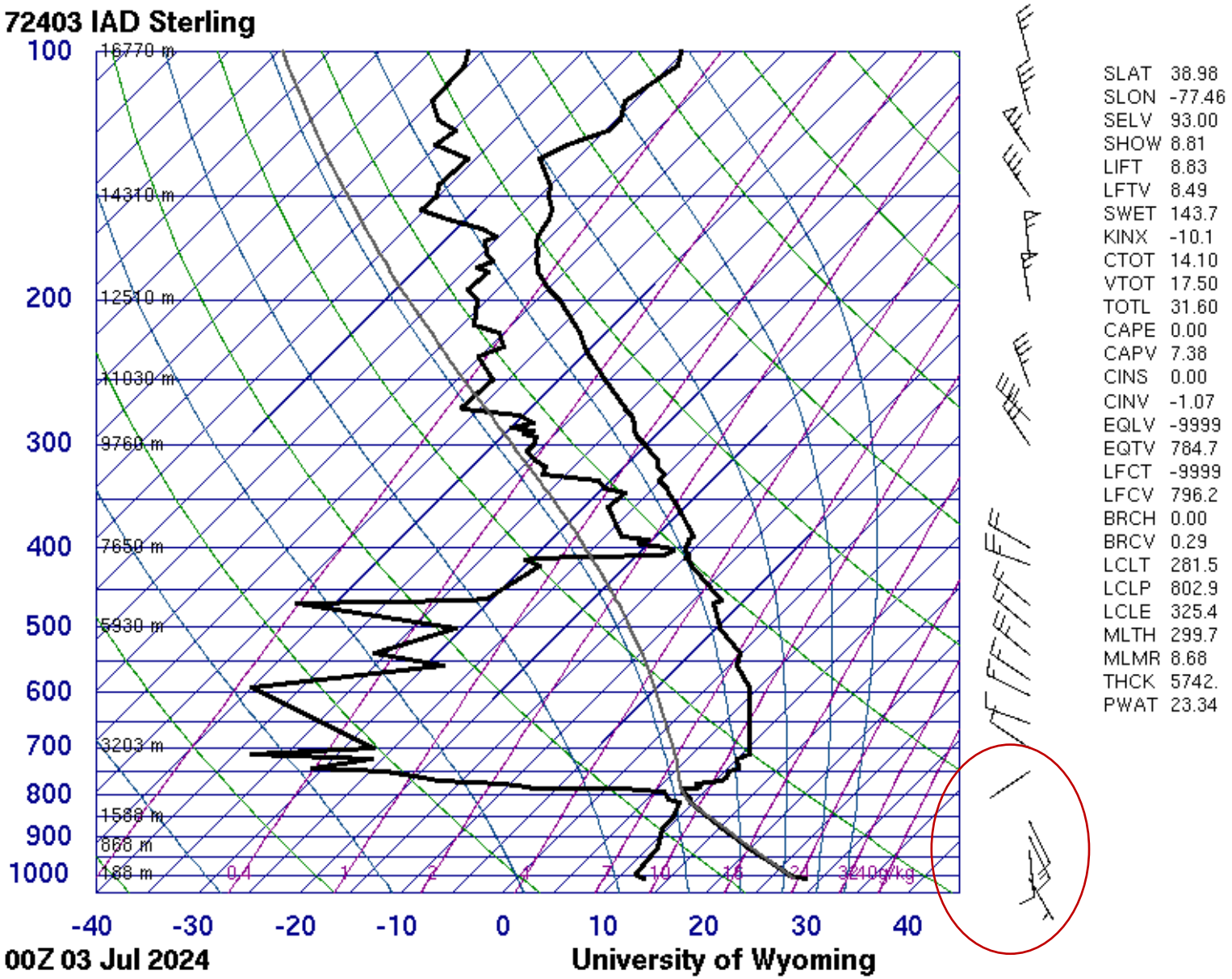
- **Discovered CH_4 emissions inventories were Low.**
- **Lagrangian Modeling (Israel L-C)**
- **NIST Support**

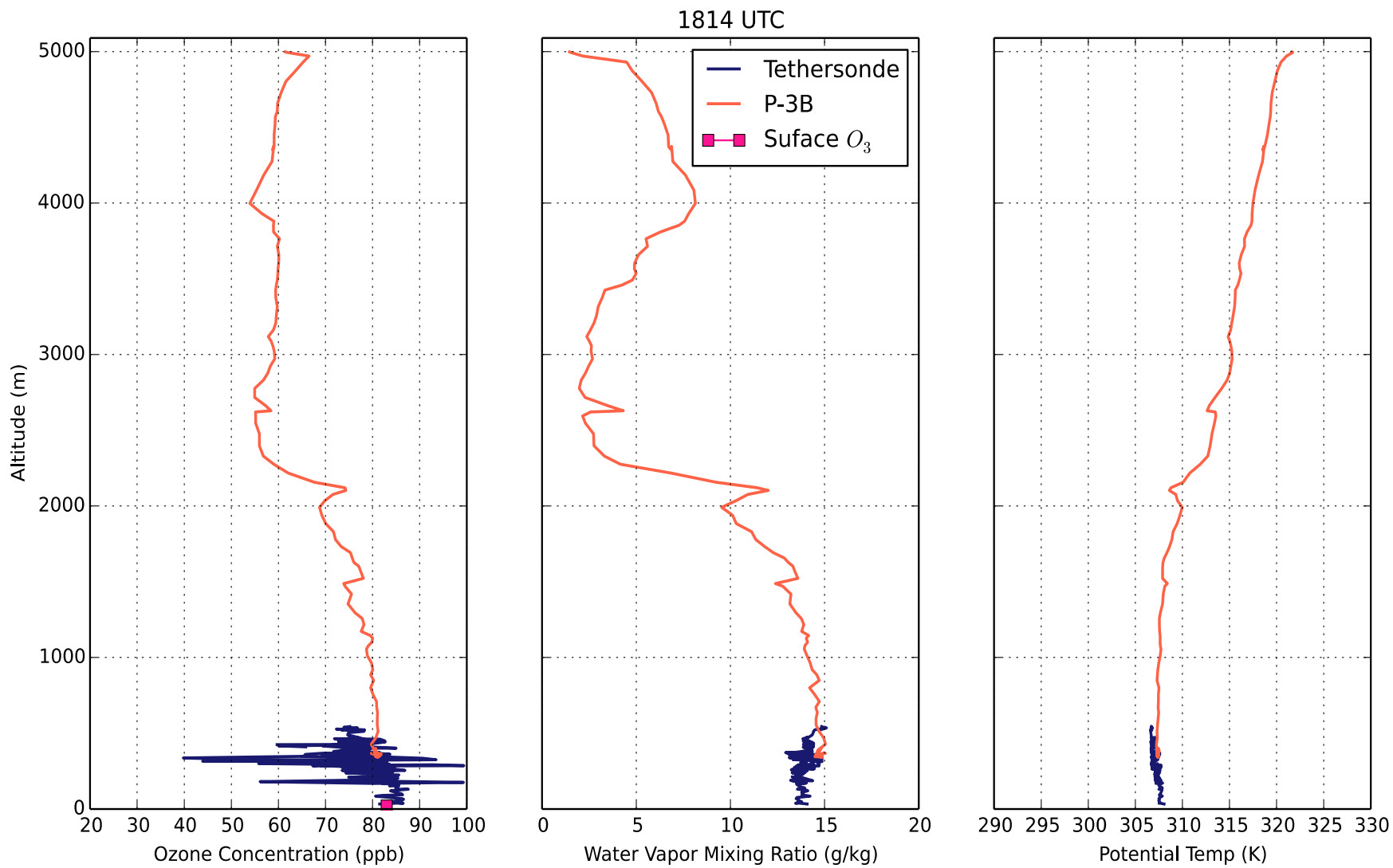
Typical summer winds
Veer from S to W or NW aloft.

Exchange between PBL and LFT.

Transport from Balt/Wash to NE.

Hao et al.



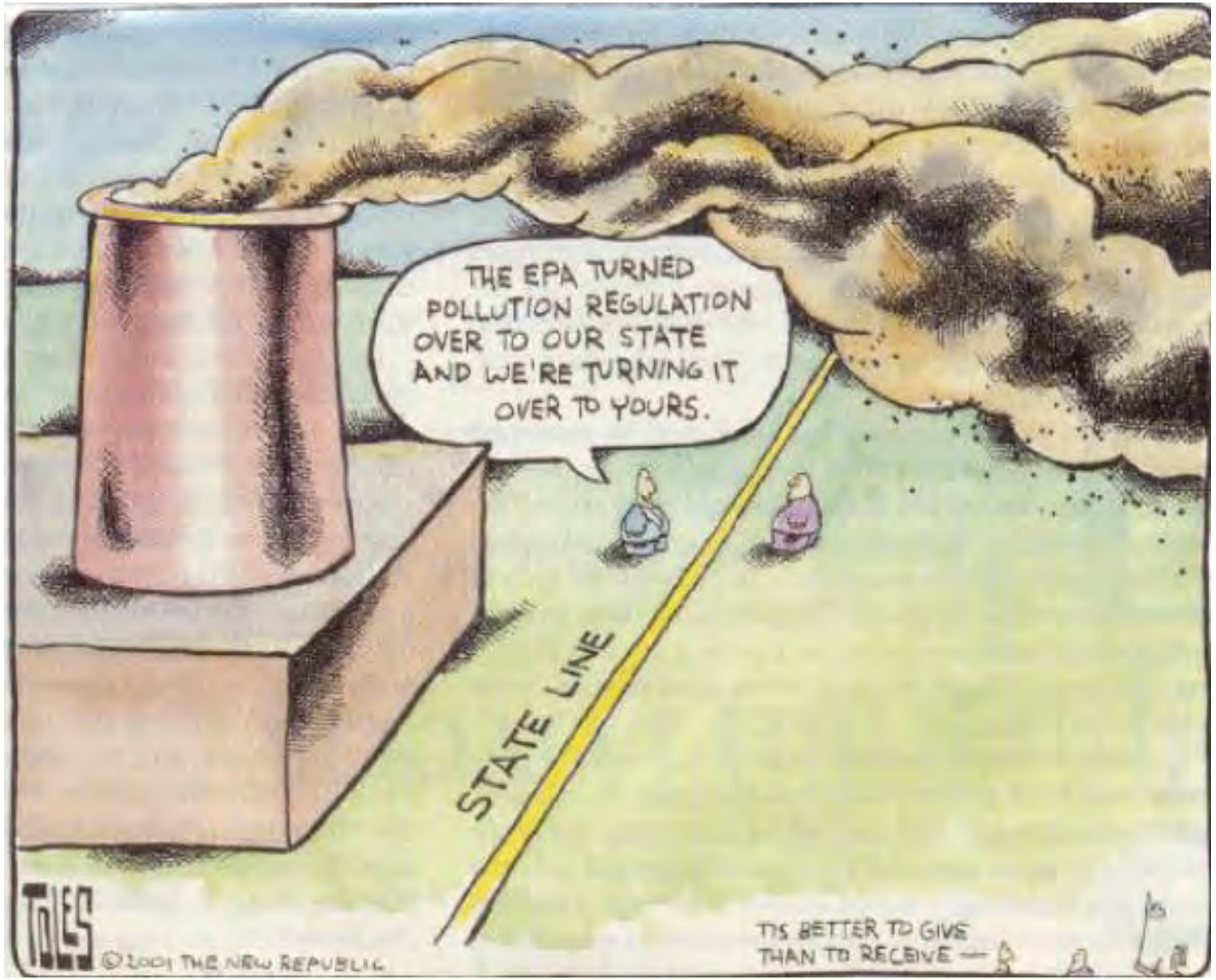


Mazzuca tether sonde

History and ongoing projects

- Interstate Transport
  Supreme Court
- Emissions
  NOx, CO_2,CH_4, H_2O, BC
- PBL venting & transport
- Sea and Bay breeze.
- Photolysis rates j(NO_2) = f(z) $(NH_4)_2SO_4$ vs. Bc vs. BrC.
- Biomass burning
- Modeling & remote sensing.
  - Lifetime alkyl nitrates & NOx
  - Which VOC's?

Go to Court: 2013: Homer City Generation L.P. vs. EPA and American Lung Assoc.



Supreme Court

2024 – refused to consider

RAN *rief.*

No. 23-1157 (and the consolidated cases)

IN THE UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA CIRCUIT

State of Utah, by and through its Governor, Spencer J. Cox, and its Attorney General, Sean D. Reyes,

Petitioner,

v.

Environmental Protection Agency and Michael S. Regan, in his official capacity, as Administrator of the U.S. Environmental Protection Agency,

History and ongoing projects

- Interstate Transport
  Supreme Court
- Emissions
  NOx, CO_2,CH_4, H_2O, BC, VOCs, C_5H_8
- PBL venting & transport
- Sea and Bay breeze.
- Photolysis rates j(NO_2) = f(z) $(NH_4)_2SO_4$ vs. Bc vs. BrC.
- Biomass burning
- Modeling & remote sensing.
  - Lifetime alkyl nitrates & NOx
  - Which VOC's?

REVIEW: NATURAL VOLATILE ORGANIC SUBSTANCES AND THEIR EFFECT ON AIR QUALITY IN THE UNITED STATES

CENSORED

Environmental Sciences Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, U.S.A.

(*First received* 18 *October* 1982; *in revised form* 6 *April* 1983 *and received for publication* 12 *May* 1983)

Abstract—The literature on source emission rates, emission inventories, ambient air concentrations, lifetimes and reaction products of natural volatile organic compounds has been reviewed. Relationships between emission inventories and air quality measurements are considered. The effectiveness of natural hydrocarbons in contributing to ozone formation and aerosol formation in ambient air are discussed. It is concluded that natural hydrocarbons do not contribute substantially to the formation of either ozone or aerosols in ambient air.

Emissions models are improving.

A. Christiansen et al.: Constraining long-term NO_x emissio

History and ongoing projects

- Interstate Transport
  Supreme Court
- Emissions
  NOx, CO_2,CH_4, H_2O, BC, VOCs, C_5H_8
- PBL venting & transport
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- Photolysis rates j(NO_2) = f(z) $(NH_4)_2SO_4$ vs. Bc vs. BrC.
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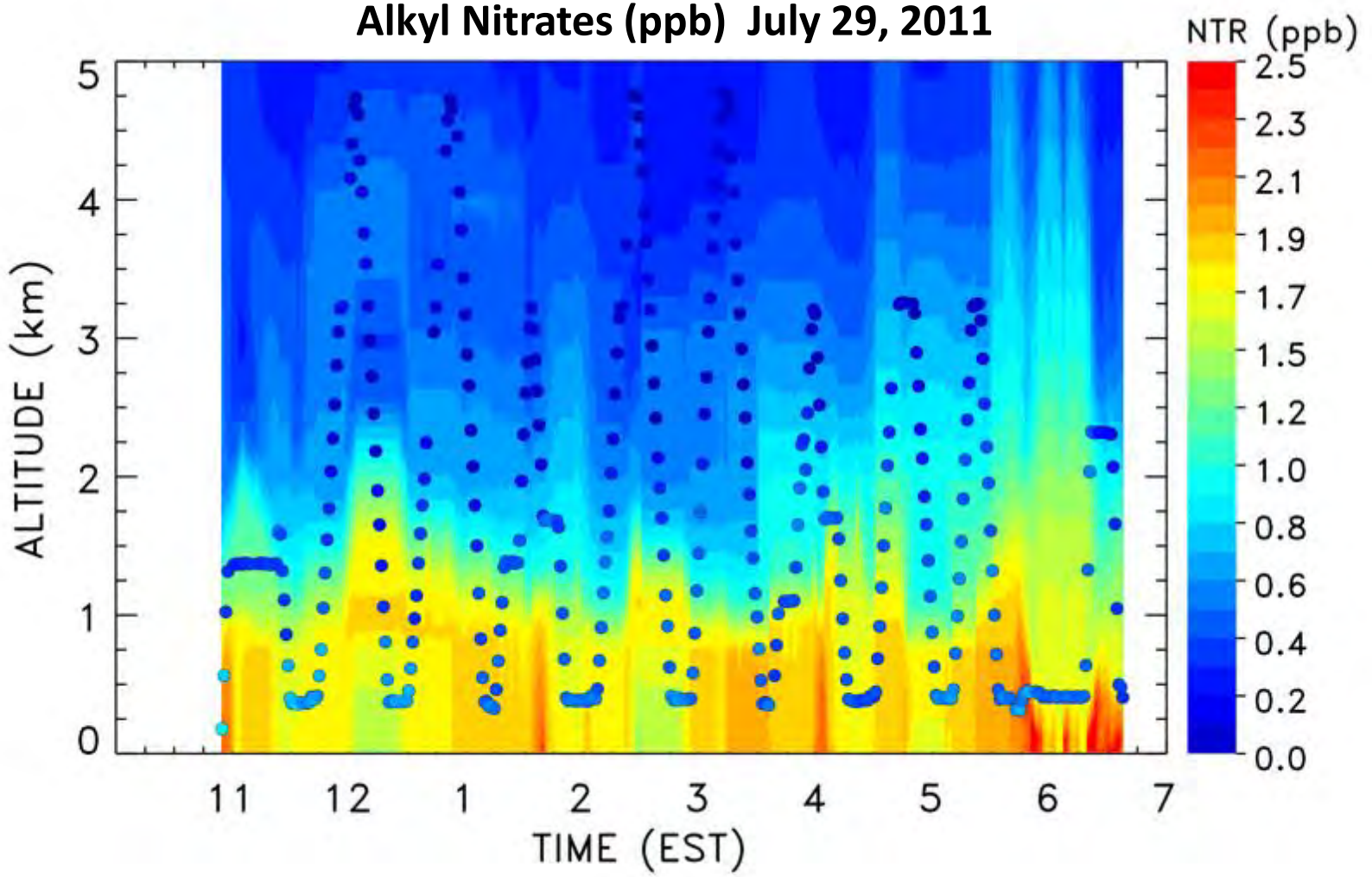
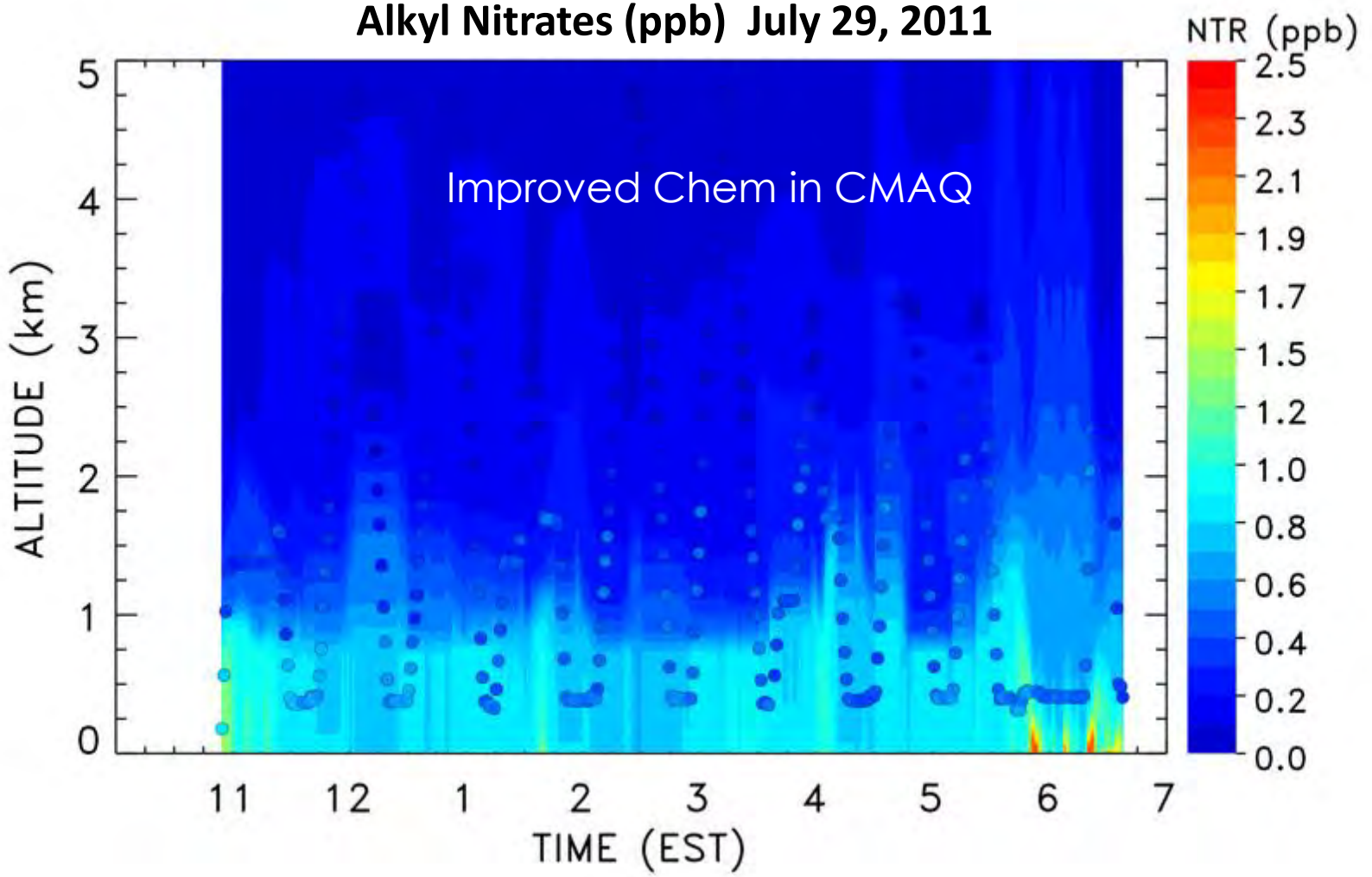
  - Lifetime alkyl nitrates & NOx
  - Which VOC's?



Background Contour → CMAQ Baseline
Colored points → DISCOVER-AQ Flight #14

Canty et al., 2015



Background Contour → CMAQ decreased NTR lifetime
Colored points → DISCOVER-AQ Flight #14

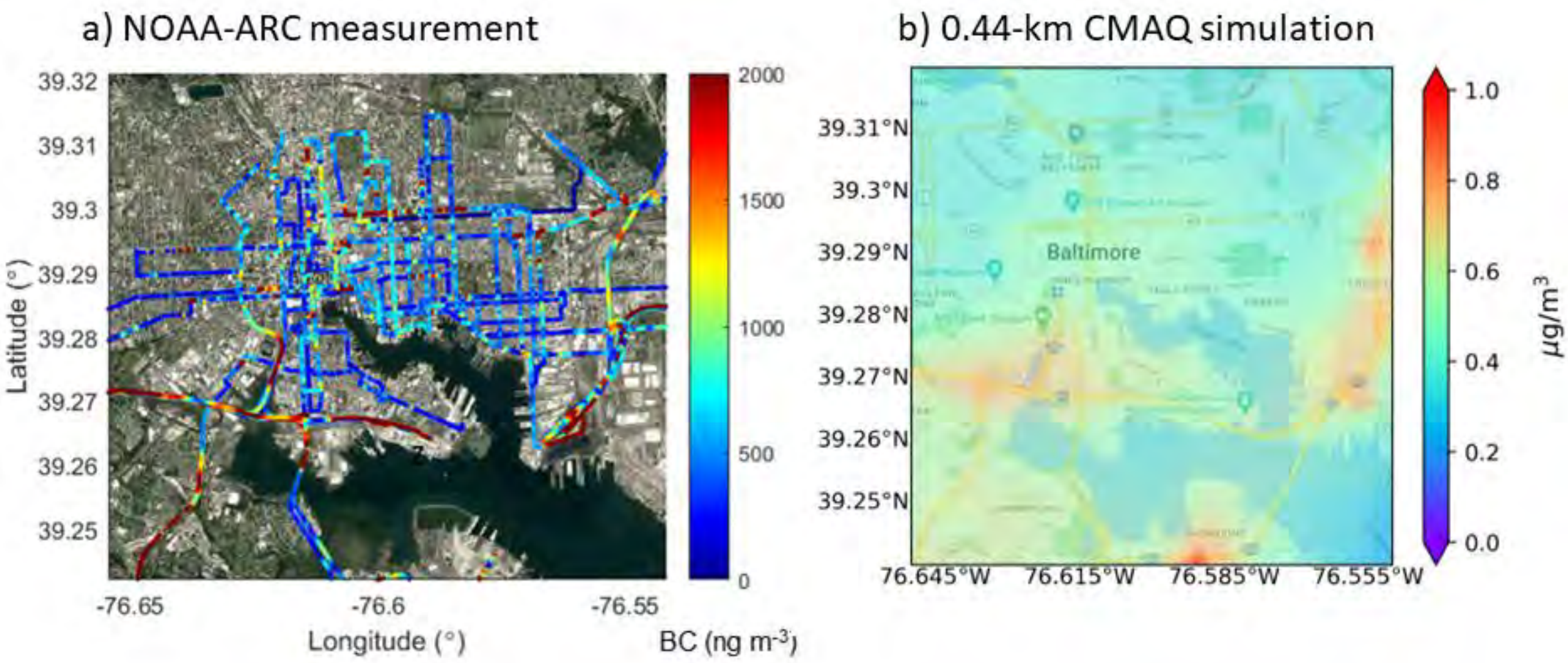
Canty et al., 2015

Ongoing and future projects (Discussion points)

- Less fossil fuel burning, more Biomass burning (BrC)
- Biogenic CH_4 and Organic Aerosols, VCPs
- Increased attention on GHG's inc. N_2O
- BrC flux
- NH_3
- Plastics
- Environmental Justice. Hyper-local.
  - Short-lived or primary species e.g., BC, metals, PM_{10}

Curtis Bay, facing south. EPA/MDE/NOAA/UMD

Photo credit: Summer Youth Environmental Justice Scholars; R. Gattis, Panorama drone photograph, 2023.



High-resolution WRF-CMAQ (0.44 km) simulations resolve hot spots of BC seen by NOAA's-ARC.

Hao He; Prelim data, do not propagate.

UMD Research Aircraft Cessna 402B

What's missing?

Fast response C_2H_6 and other VOCs
Oxygenates

Isotopes

Aerosol composition

Ammonia

Lidar winds and aerosol scattering.

Summary and Questions

- Huge success on O_3 and $PM_{2.5}$
- Interstate (Synoptic/meso-scale) transport still important.
- Emissions of CH_4, CO_2, N_2O(?), NOx, VOC, BC, BrC… still uncertain.
- Despite attainment of NAAQS….
- Chem Transport Models continue to need improvement.
- Meso- or micro-meteorology can decide attainment or not.
- Environmental Justice emerging issue.

The Guilty Parties