UORVP/ESP01: Aircraft Results

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$PM_{2.5}$ and Electric Power Generation: Recent Findings and Implications

Omni William Penn Hotel, Pittsburgh, Pennsylvania

April 9–10, 2002

Presentation Outline

- Why do Upper Air Profiling
- Introduction to RAMMPP
- Summary of 2001 Activity
- Results Relevant to UORVP, PAQS, ESP01
- Summary

Upper-Air Data: Who Cares?

NETL Meeting Goals: *W.W. Aljoe 0800 04/09/2002*

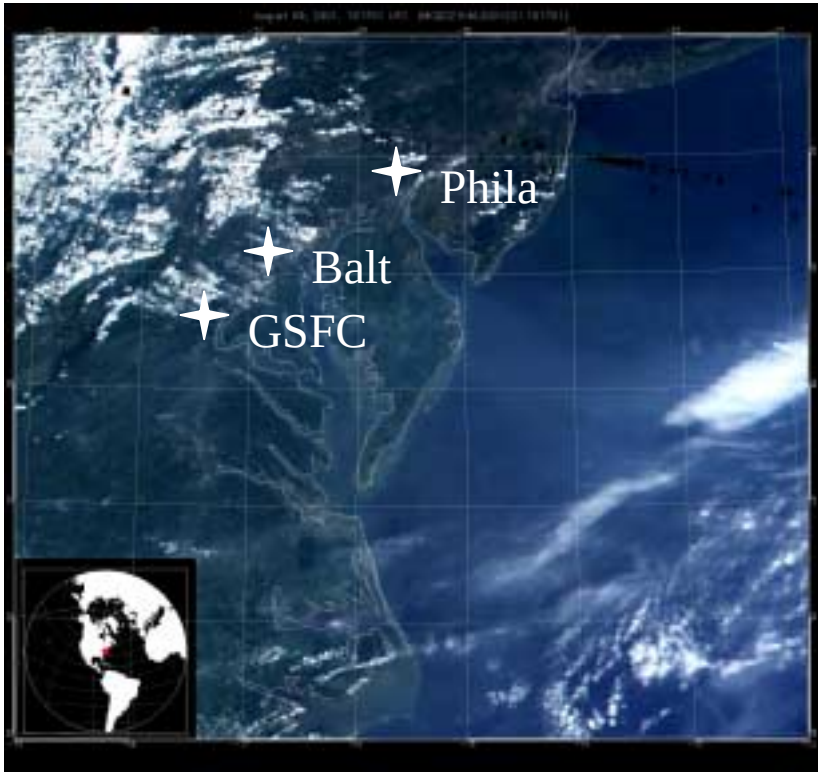
-
- (to gain a) ***better understanding of atmospheric processes involving $PM_{2.5}$ formation and deposition***
-

You Do… *(Or You Should)*

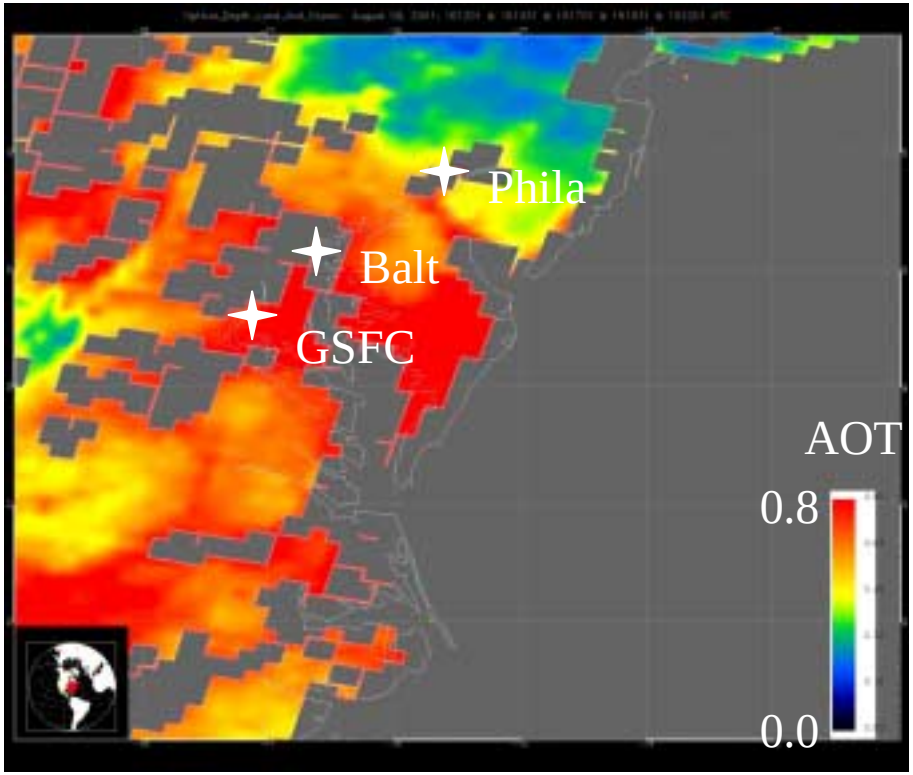
Views From Space: August 9, 2001

Highest Ozone of the Summer

GOES "Visible" Composite



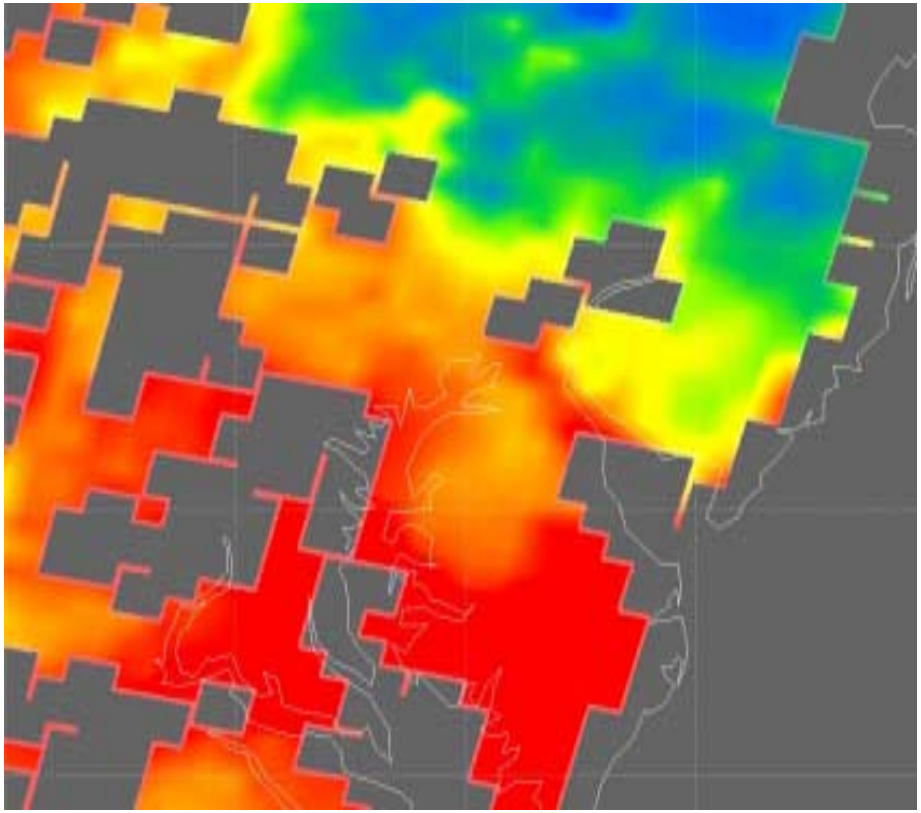
MODIS AOT at 550 nm



Robert Levy, 2001

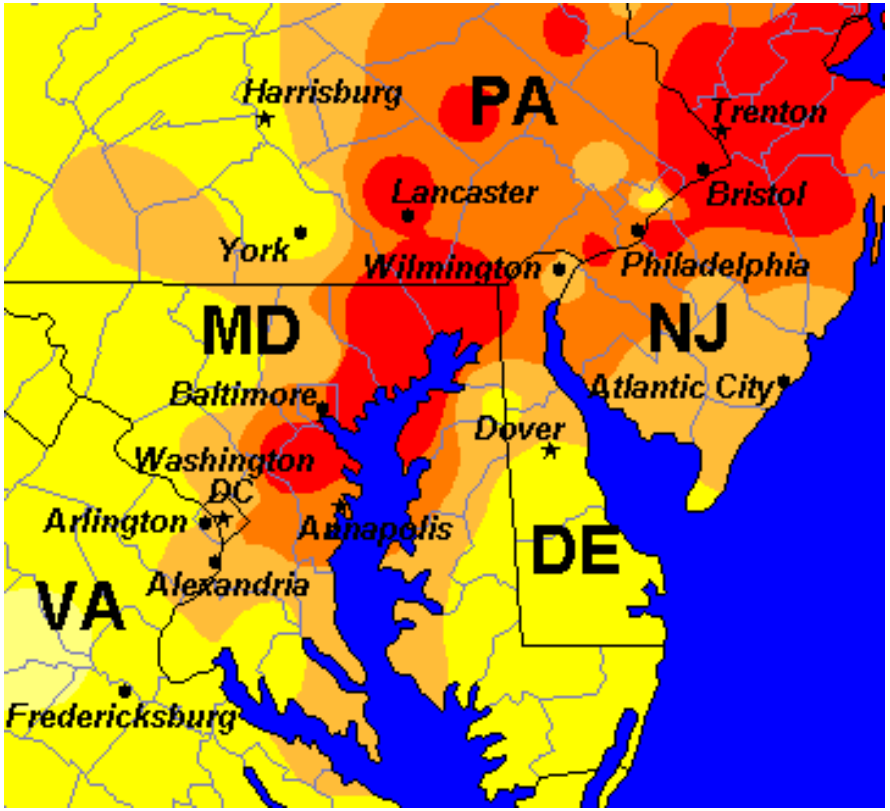
Regional Pollution: August 9, 2001

"Column Haze"



NASA/GSFC

Surface O_3



EPA/OAQPS

RAMMPP Operational Components

(Regional Atmospheric Measurement Modeling & Prediction Program)

MM5

Dynamical Model

36- / 12- / 4-km Resolution

Forecasting

Input

Emissions Inventories

Emissions Models

(Chem. Engineering)

Models-3

- **Modular**
- **Open Code**
- **Collaborative w/EPA**

Hindcasting

Photochemistry

Aerosols

Transport

Deposition

Observations

Surface:

Fort Meade, MD
Philadelphia, PA
Greenbelt, MD
Shenandoah N.P., VA

Aloft:

Aztec Aircraft
Radar Profilers
Radiosondes

Remote *(NASA/ESA):*

TOMS (O_3)
MODIS (particles)
GOME (O_3)

RAMMPP 2001: UMD Players

Forecasting

Charles Piety

Bill Ryan *(PSU)*

Modeling

Da-lin Zhang

Jeff Stehr

Brian Bloomer *(EPA)*

Russ Dickerson

Aircraft

Emily Tenenbaum

Lackson Marufu

Fort Meade, MD

Antony Chen

Satellite

Rob Levy ***(NASA)***

RAMMPP Surface Activities 2001

Fort Meade, MD MARCH-Atlantic

http://www.meto.umd.edu/~bruce/MARCH-Atl.html

Philadelphia, PA NE-OPS

http://lidar1.ee.psu.edu/

Greenbelt, MD *(with NASA-GSFC)*

http://aeronet.gsfc.nasa.gov:8080/

Shenandoah National Park, VA *(with NPS)*

http://www.nature2.nps.gov/ard/gas/enhanced.htm#regional

UMD Aircraft Activities 2001

http://www.meto.umd.edu/~bruce/rammpp01.html

Pittsburgh, PA PAQS & UORVP

http://homer.cheme.cmu.edu

http://www.netl.doe.gov/

Philadelphia, PA NE-OPS

http://lidar1.ee.psu.edu/

Mid-Atlantic RAMMPP

Includes: Balt-Wash; RIC; RDU; CLT

ESP01/NE-OPS Measurements

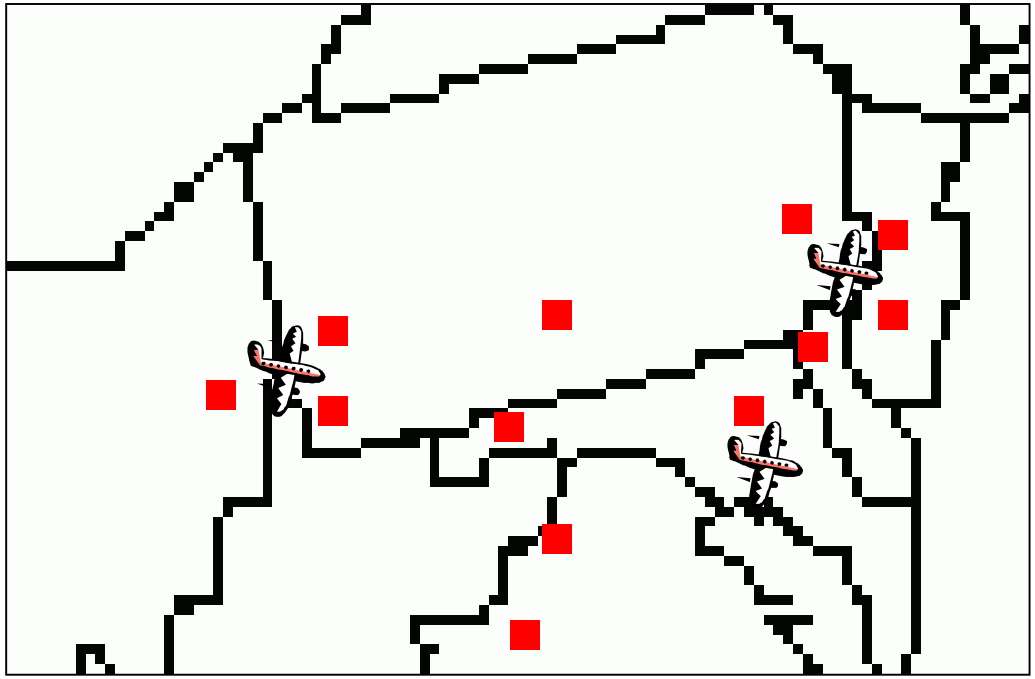
- Profiles
- FBOs

UORVP

ESP01

NE-OPS

RAMMPP



UOVRP / ESP01 / NE-OPS 2001

	Days	Flts	Hrs	Profiles
2001 Total	37	66	180	159
PA Region	17	35	97	80
Pittsburgh Area	**4**	**11**	**24**	**22**

Operational: Jun 27–Aug 1 For ESP01

Bases of Operation:

College Park, MD (CGS) *MD / WV*

Philadelphia, PA (PNE) *PA / DE / NJ*

Pittsburgh, PA (AGC) *PA / OH*

Aztec-F Research Aircraft N500Z

GPS Position (°Lat, °Long)

Meteorology (T, RH, Pr, P_{alt})

Carbon Monoxide (CO)

Ozone (O_3)

Sulfur Dioxide (SO_2)

Aerosol Optical Properties:

- **Absorption, B_{ap}** (565 nm)
- **Scattering, B_{scat}** (450,550,700 nm)

GPS Winds (AIMMS-10 *u,v* components)

Aerosol Chemistry (PIXIE Streaker)

Aerosol Particle Size (MetOne)

- **6 cuts – Range 0.3-1.0 μm**

Pittsburgh: Sure… the view is nice

…but my legs are killing me!

Emily Tenenbaum **Bruce Doddridge**

ESP01 Aircraft Intercomparison

Extremely important: data quality, comparability

T, P, RH, O_3, B_{scat}

Conducted July 6, 2001 west of Pittsburgh, PA

1640–1830Z, 1240–1430 EST

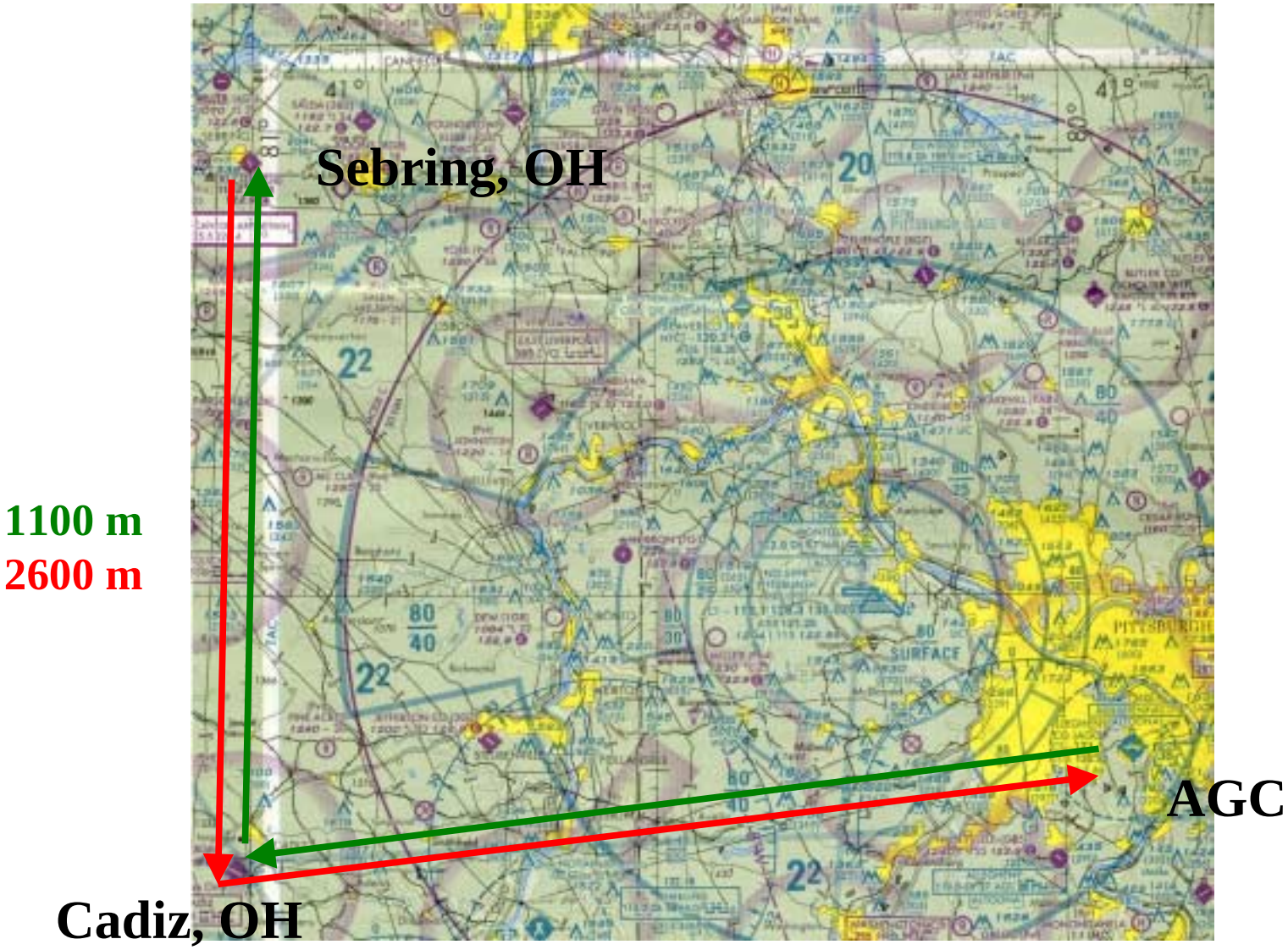
Involved 3 research aircraft:

University of Maryland Aztec-F N500Z

Purdue University Cessna 210 N8052M

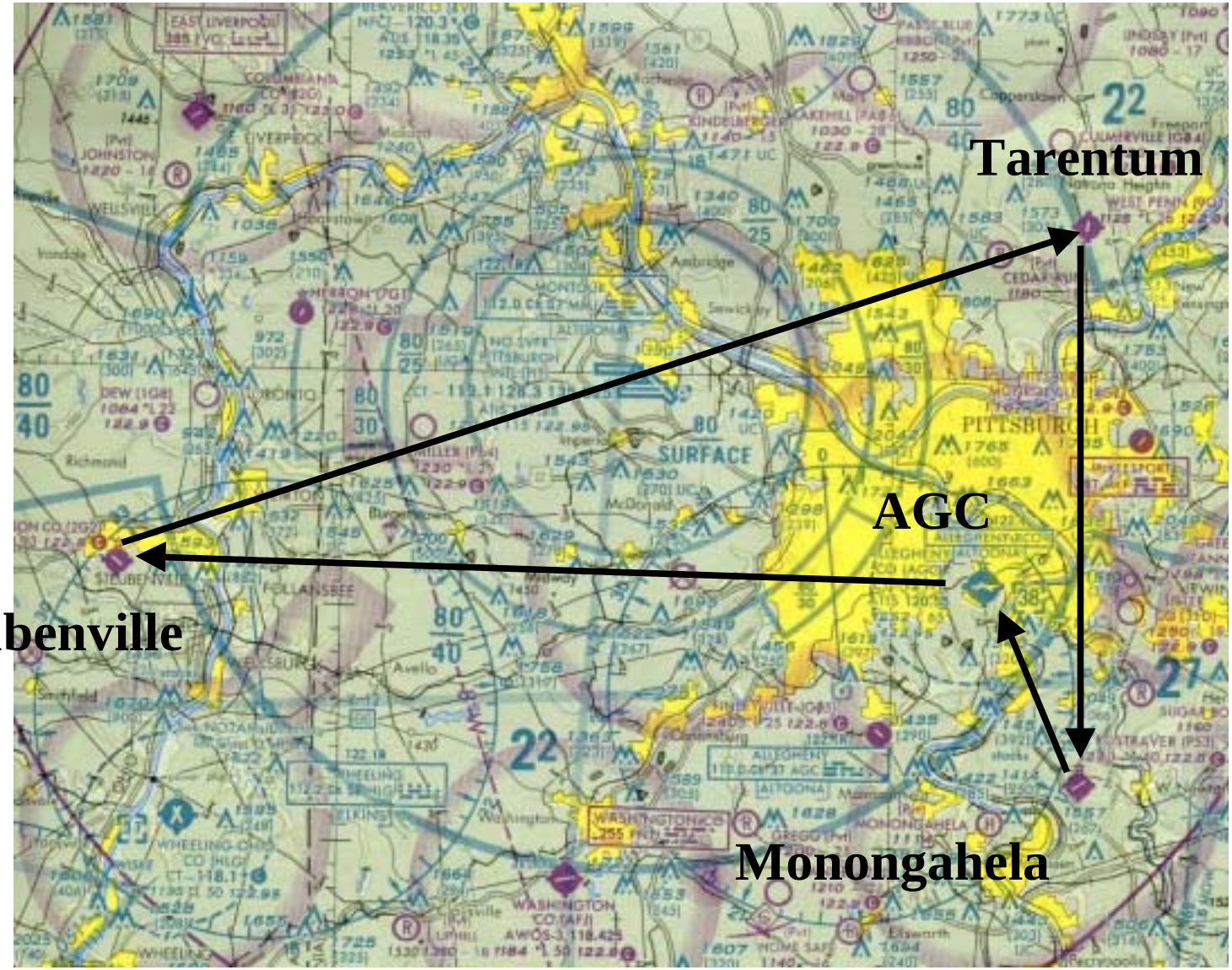
WIDNR Cessna 337 N2397S

ESP01 Aircraft Intercomparison



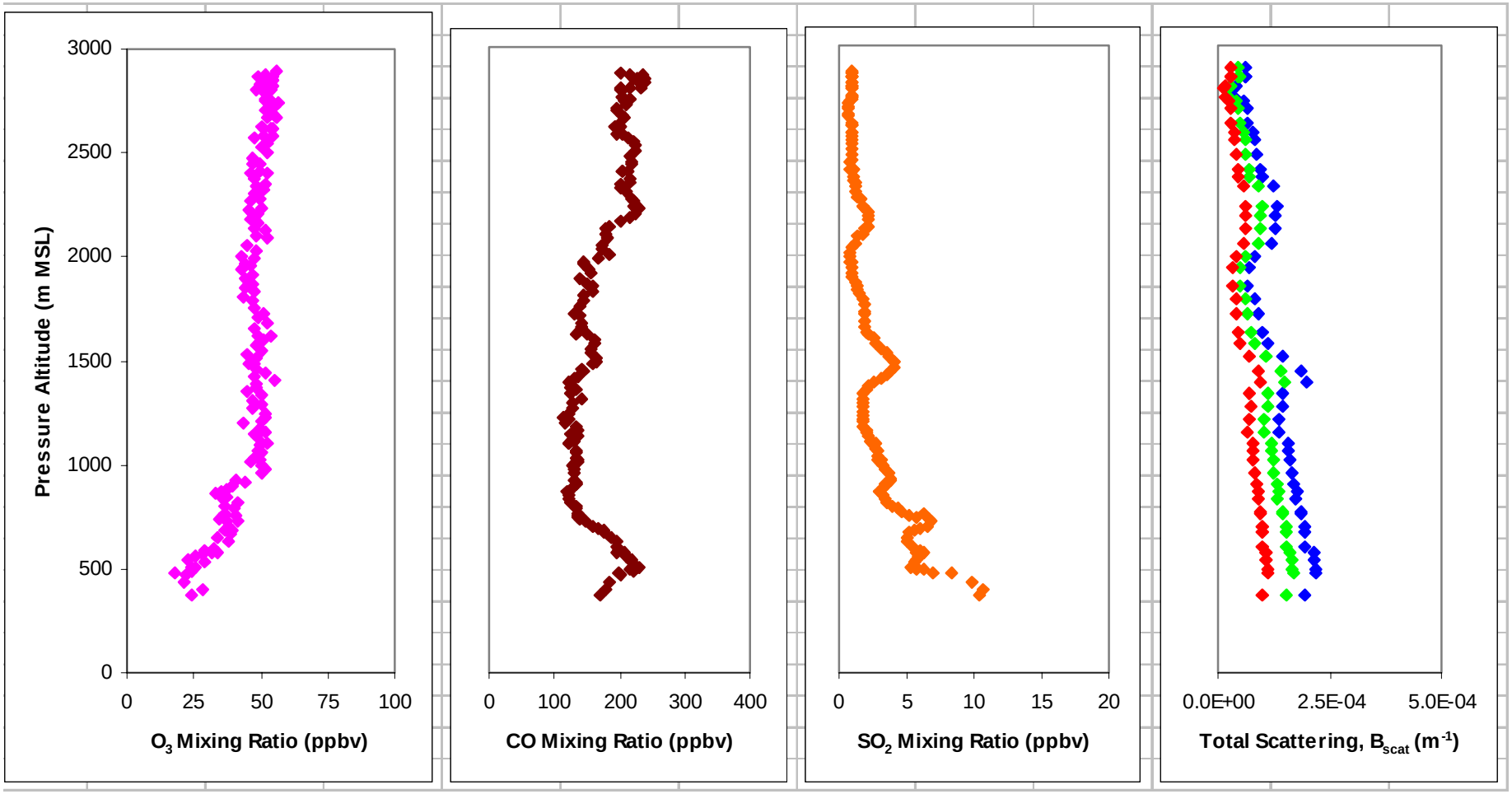
ESP01 Aircraft Intercomparison

UMD Aircraft: UORVP, PAQS, ESP01



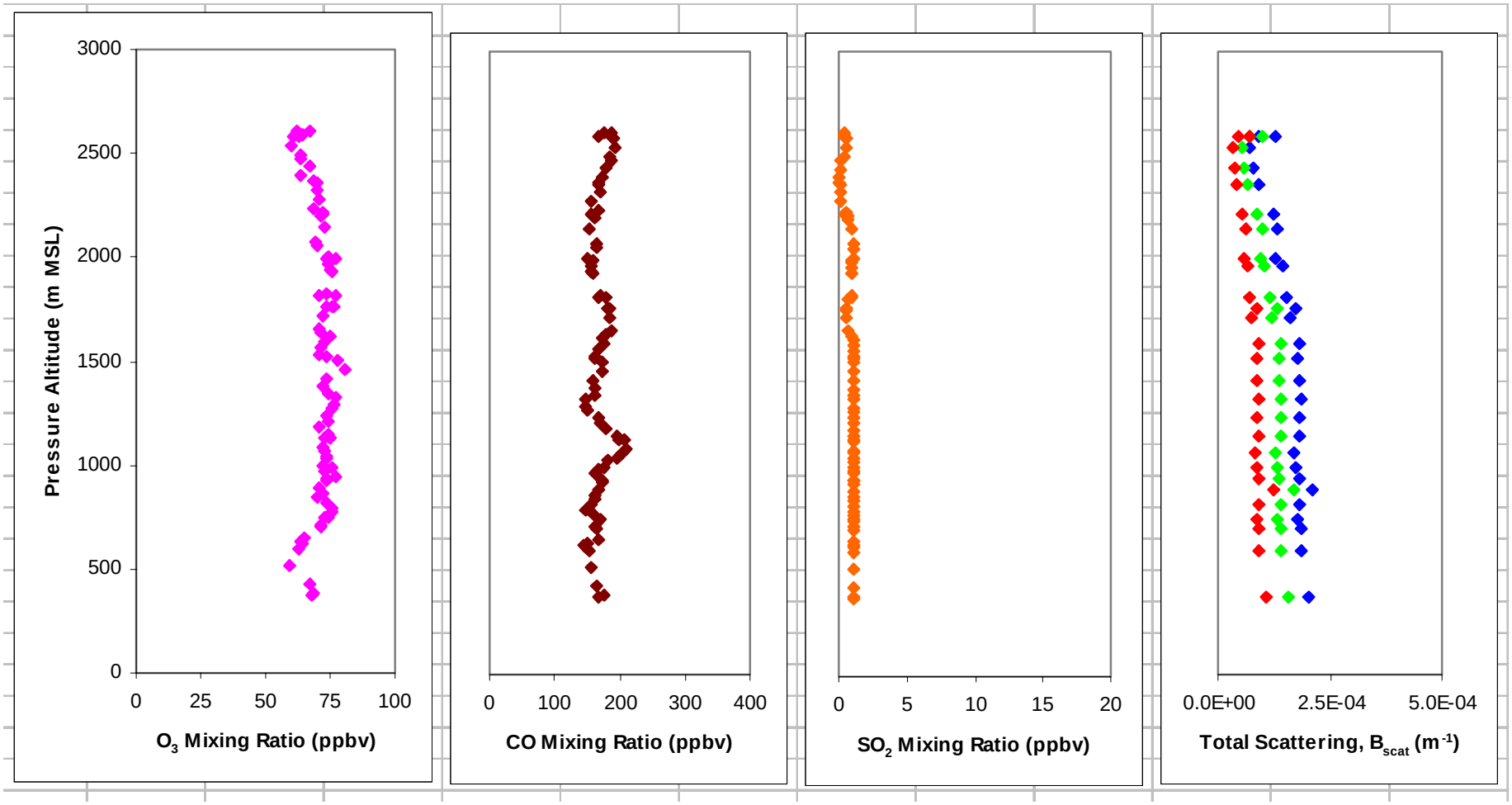
07/23 AM Upwind of Pittsburgh

Steubenville, OH: 0840–0900 EST

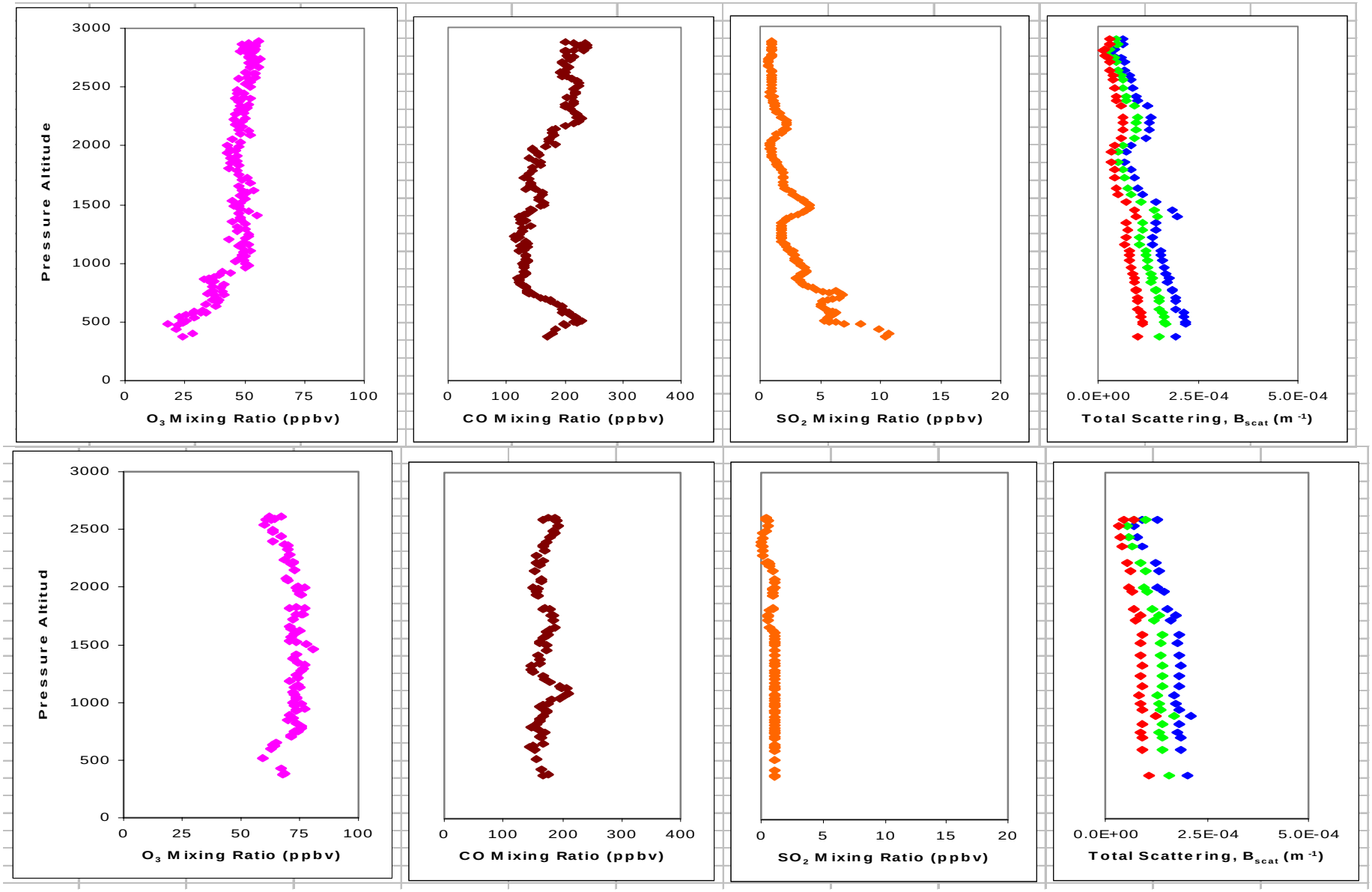


07/23 PM Downwind of Pittsburgh

Tarentum, PA: 1420–1435 EST

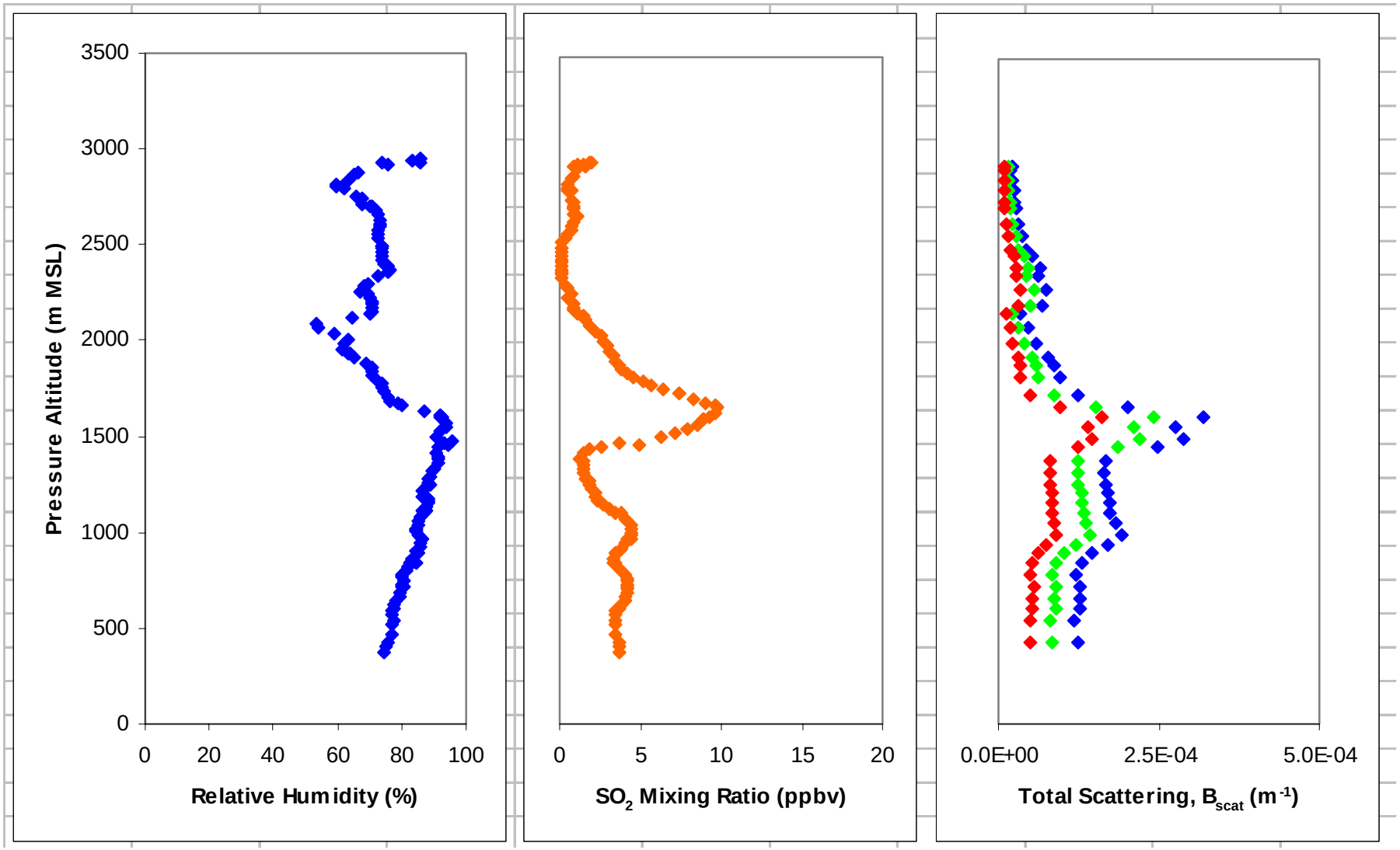


Cross-Corridor: Pittsburgh 07/23



SO_2 & B_{scat} Over SE Pittsburgh, PA

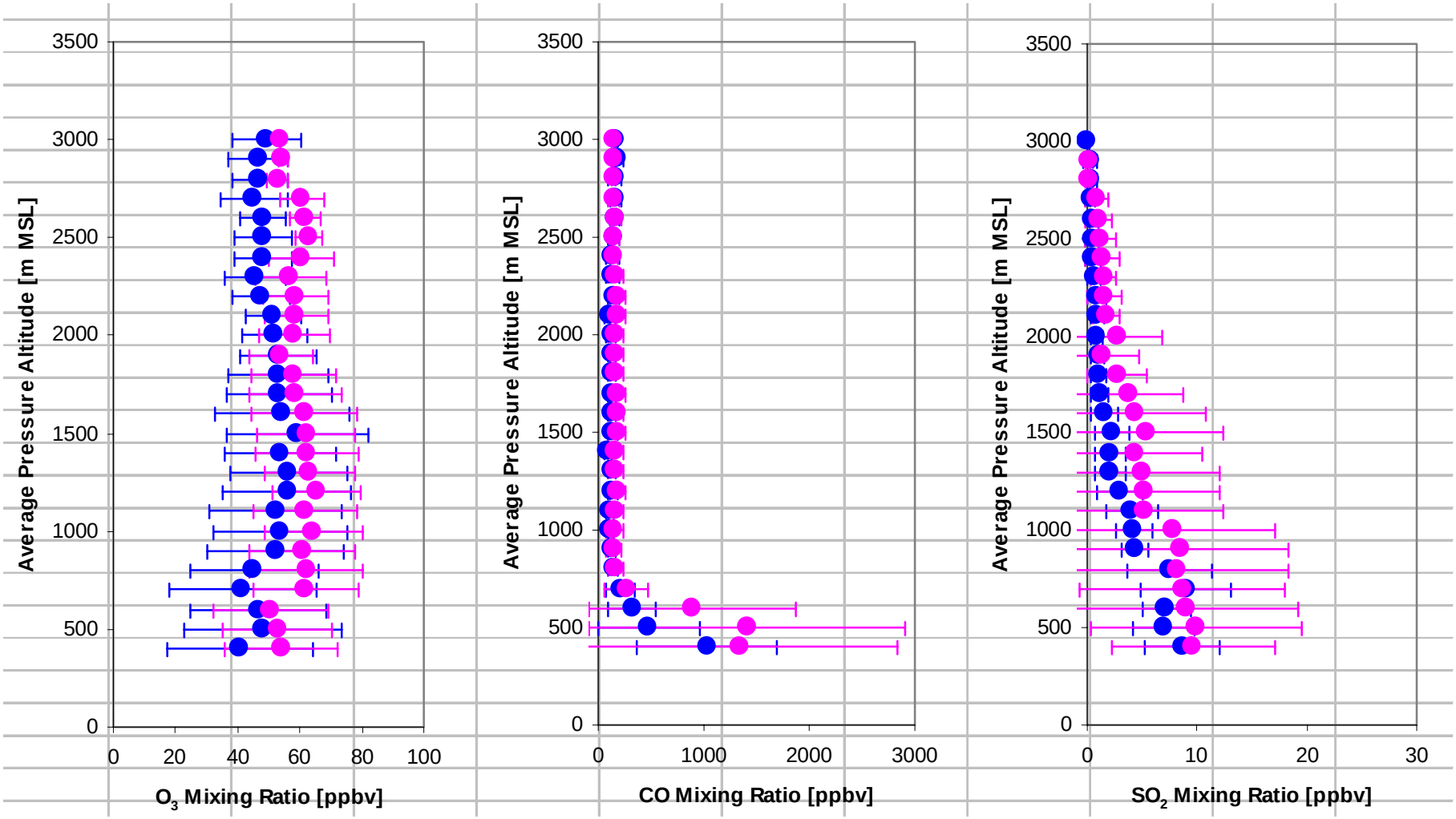
Monongahela, PA: 1100–1130 EST 07/23/2001



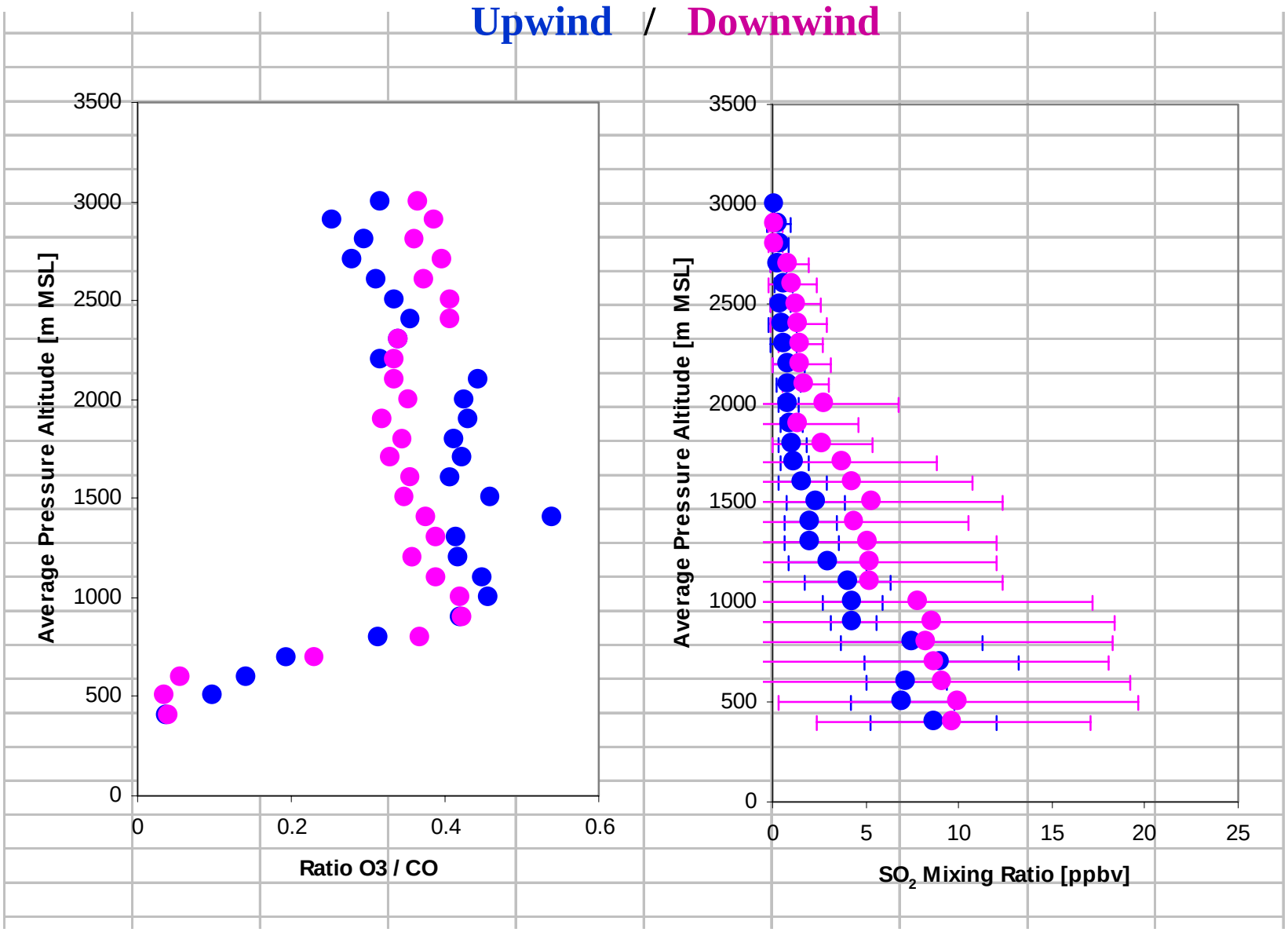
Pittsburgh Urban Effect

Summer 2001 Average Profiles

Upwind / Downwind



O_3 Production Over Pittsburgh



Concluding Remarks

24 flight hours in 11 flights over 4 days 06/27–08/01

22 vertical profiles surface–3.1 Km MSL

Intercomparison flight with 3 other ESP01 aircraft

Observed stratified layers aloft from W transport

near-*surface air quality rarely = that aloft*

Pittsburgh urban center a substantial source?

Observe O_3 and fine PM haze production downwind

Data available to selected collaborators from the PI

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US-EPA *through* NARSTO/NE-OPS
VA Department of Environmental Quality
Constellation Energy Group
EPRI
NASA
NC Division of Air Quality
Southern Energy
AES Warrior Run / NPS

Project Website:

http://www.meto.umd.edu/~bruce/rammpp01.html

Thanks For Listening!