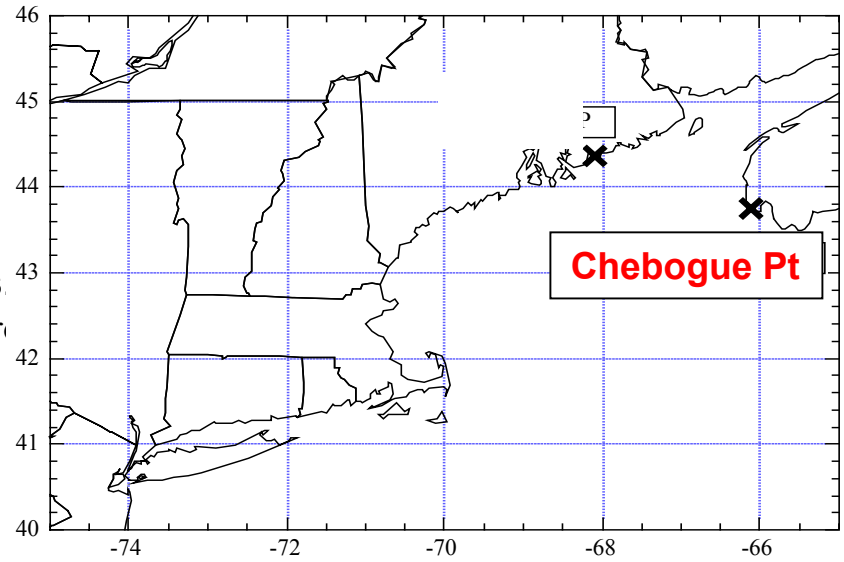
Chebogue Point Ground Site 2004



In Situ gas phase measurements:

Allen Goldstein (**U.C. Berkeley**) VOCs-GC/FID/MS, OVOCs-PTR/MS.CO, CO_2, H_2O, O_3, met parameters

Ron Cohen (**U.C. Berkeley**) inorganic and organic oxidized nitr

Dan Jaffe (**U. Wash – Bothell**) - Rn-222

Jim Roberts (**NOAA AL**) – PANs

Rob Tordon (**MSC Canada**) - gas phase mercury

In Situ aerosol measurements:

Doug Worsnop (**Aerodyne, U. Colorado, U.C. San Diego**) Aerosol Mass Specs.

Hugh Coe (**UMIST**) Aerosol size distribution by DMA & HTDMA

Allen Goldstein (**U.C. Berkeley**) and Susanne Hering (Aerosol Dynamics) in-situ thermal desorption GC-MS measurement of speciated organic composition of aerosols

John Ogren (**NOAA CMDL**) Aerosol light scattering and backscattering (450, 550, 700 nm), Aerosol light absorption (565 nm), Total aerosol number, CCN Size resolved aerosol total mass and chemistry (with NOAA PMEL)

Ellsworth Dutton (NOAA CMDL) Aerosol optical depth (380, 440, 500, 675, 870 nm)

Steve Cliff (**U.C. Davis**) Aerosol elemental composition by DRUM Sampler

Mark Thiemens (**U.C. San Diego**) Stable isotopes of sulfate and nitrate aerosols

Remote measurements:

Allen White (**NOAA ETL**) radar wind profiler.

Tom Duck (**Dalhousie University**) Lidar measurements of cloud and aerosol backscatter, depolarizaton, and extinction, and possibly water vapor, sun photometer.

Ellsworth Dutton (**NOAA CMDL**) direct, diffuse and total broadband solar irradiance (downwelling), total downwelling IR irradiance.

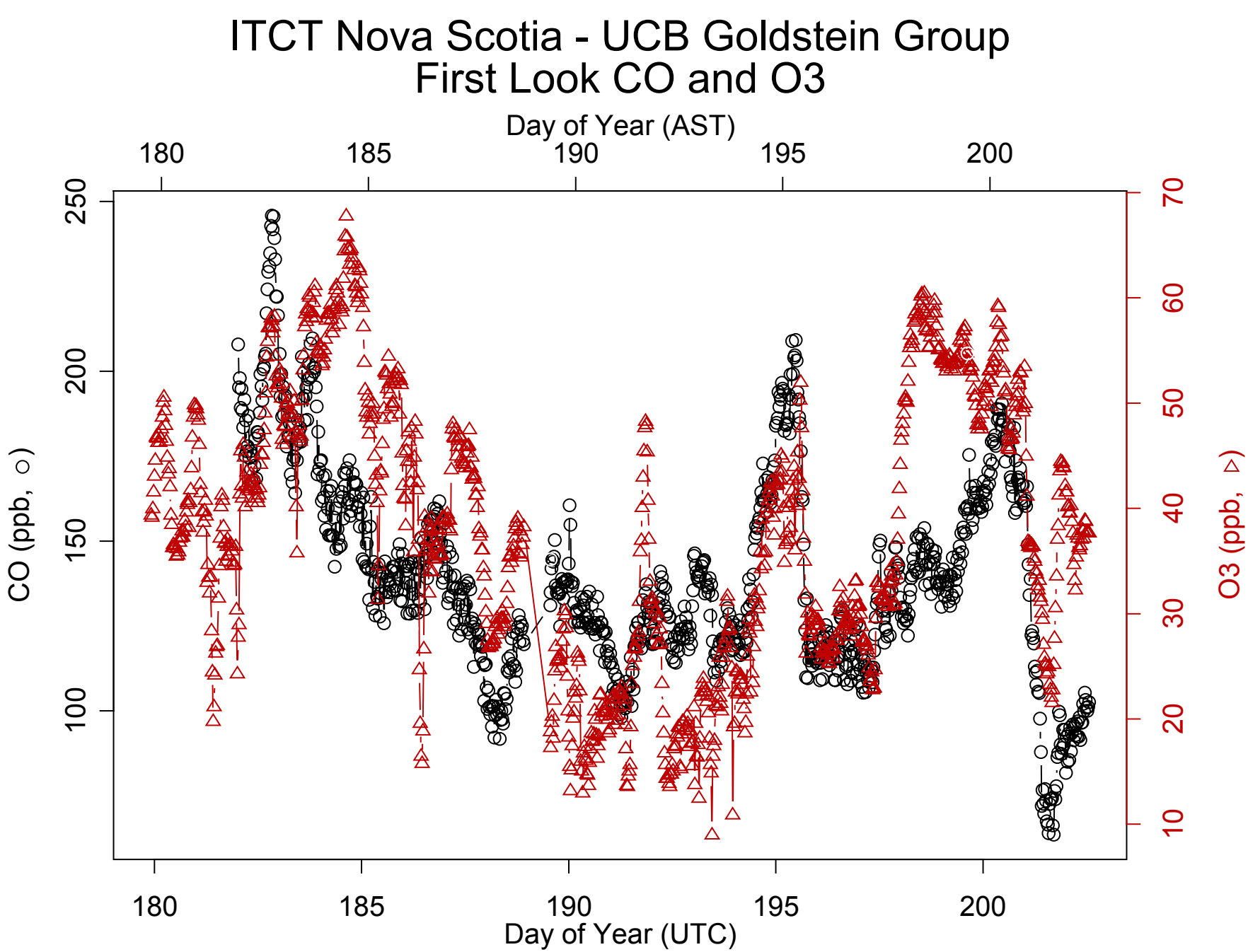
Ozone sonde releases from Yarmouth

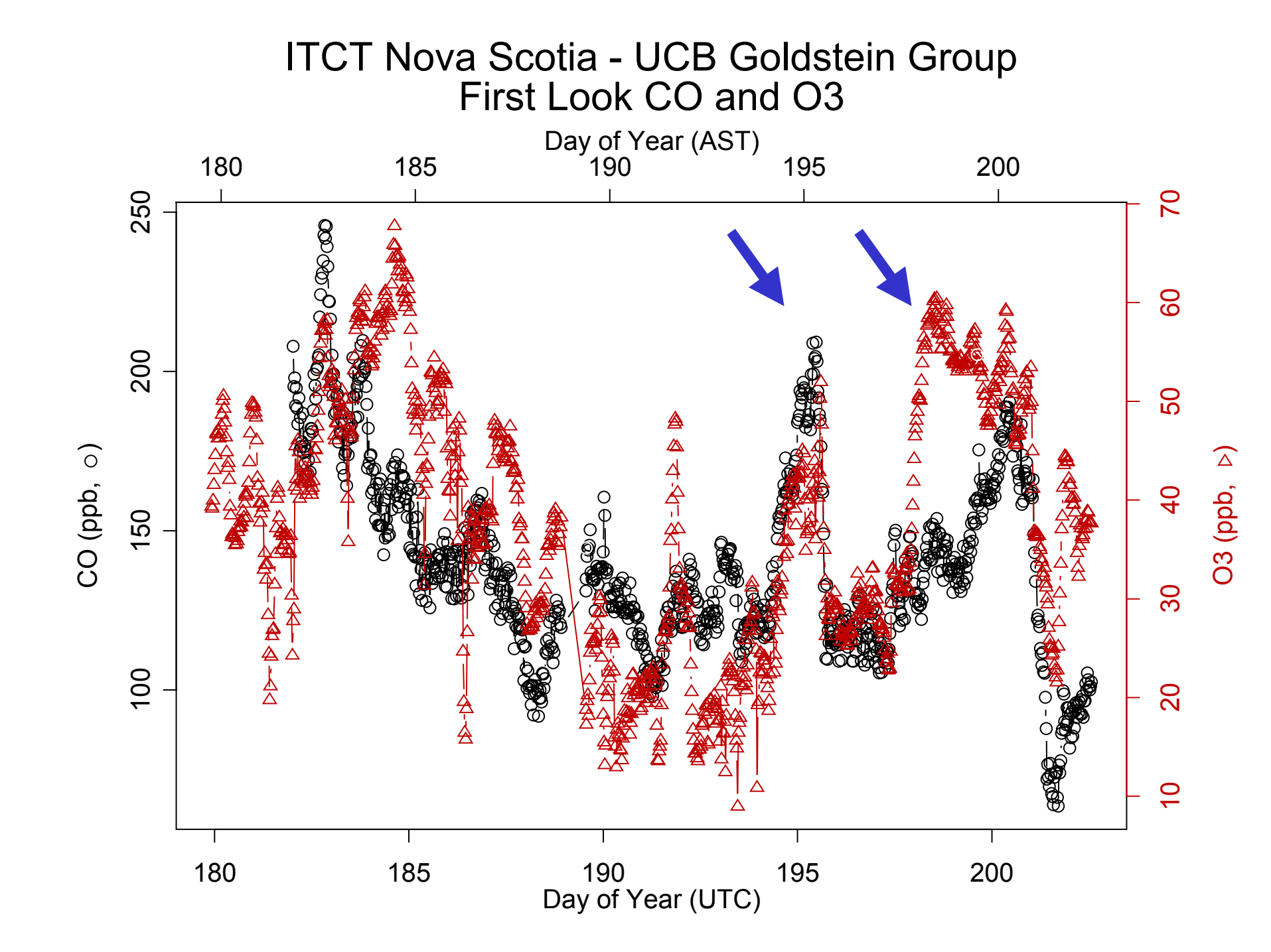
The site

The locals

The first day

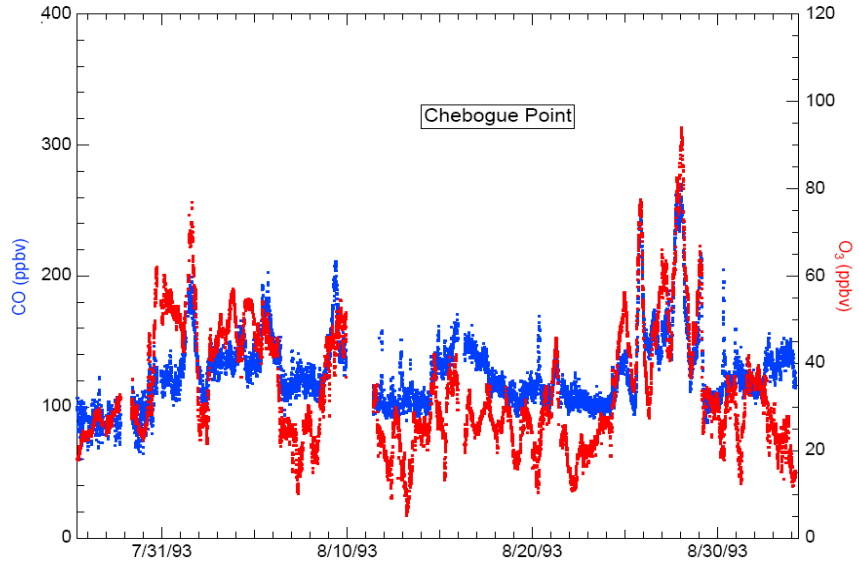
Every other day

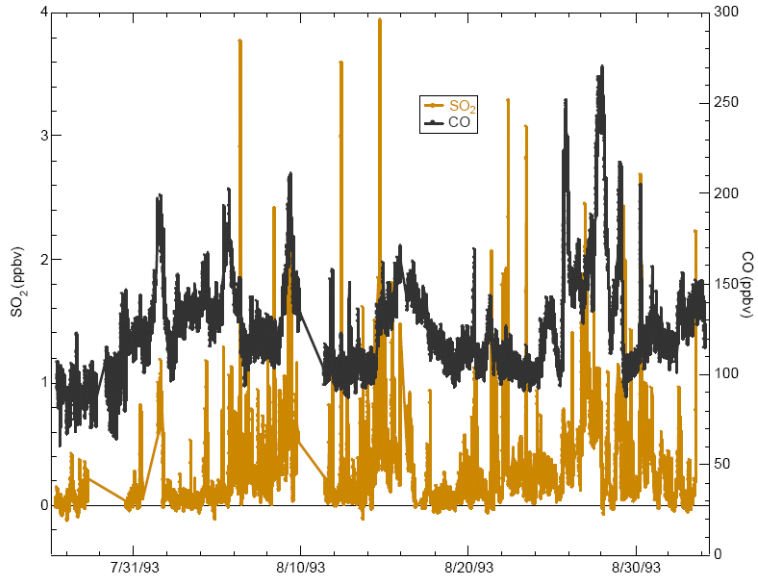

ITCT Nova Scotia - UCB Goldstein Group
First Look CO and O3
Day of Year (AST)
180
185
190
195
200
CO (ppb, ○)
250
200
150
100
O3 (ppb, △)
70
60
50
40
30
20
10
180
185
190
195
200
Day of Year (UTC)


ITCT Nova Scotia - UCB Goldstein Group
First Look CO and O3
Day of Year (AST)
180
185
190
195
200
CO (ppb, ○)
250
200
150
100
O3 (ppb, △)
70
60
50
40
30
20
10
Day of Year (UTC)

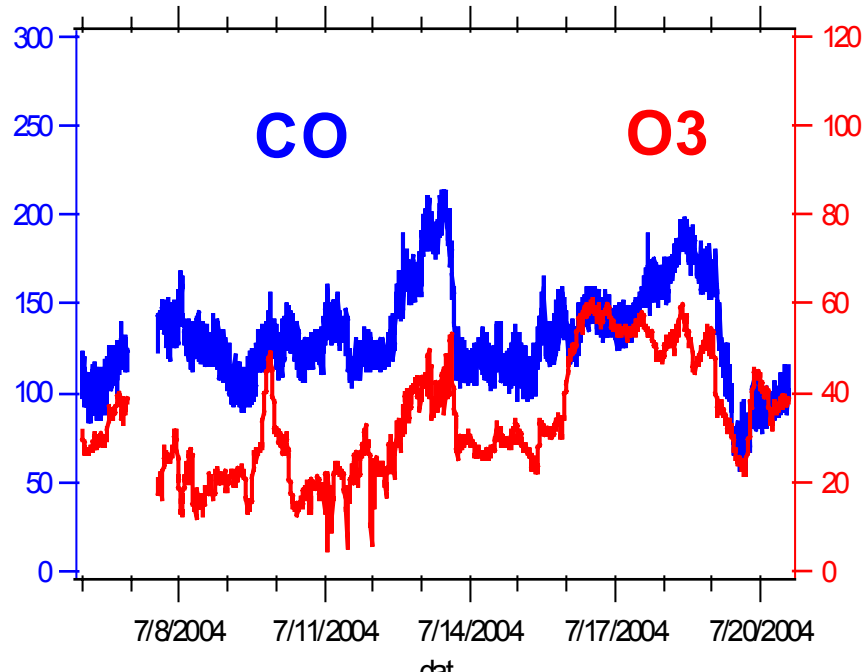
CO, O3 and SO2 at Chebogue Point, 1993 and 2004

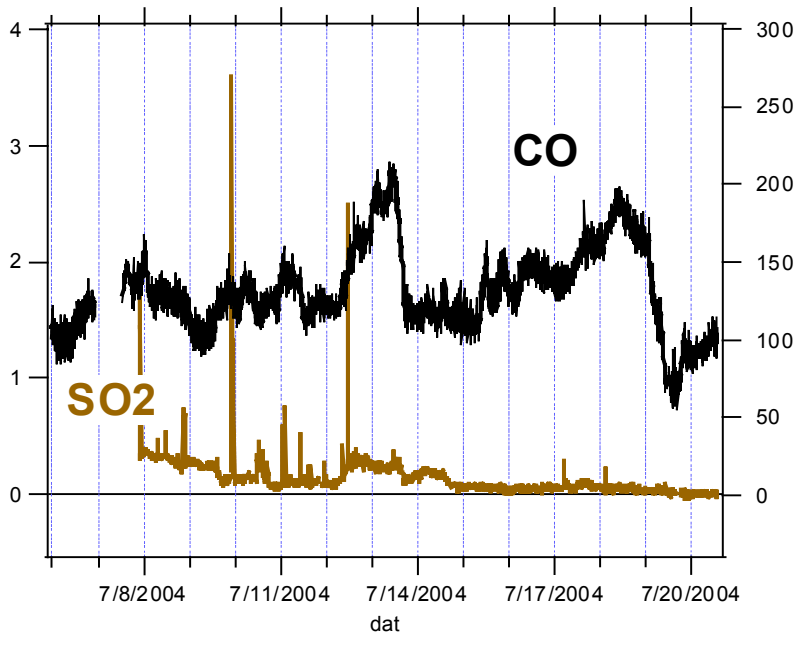
1993





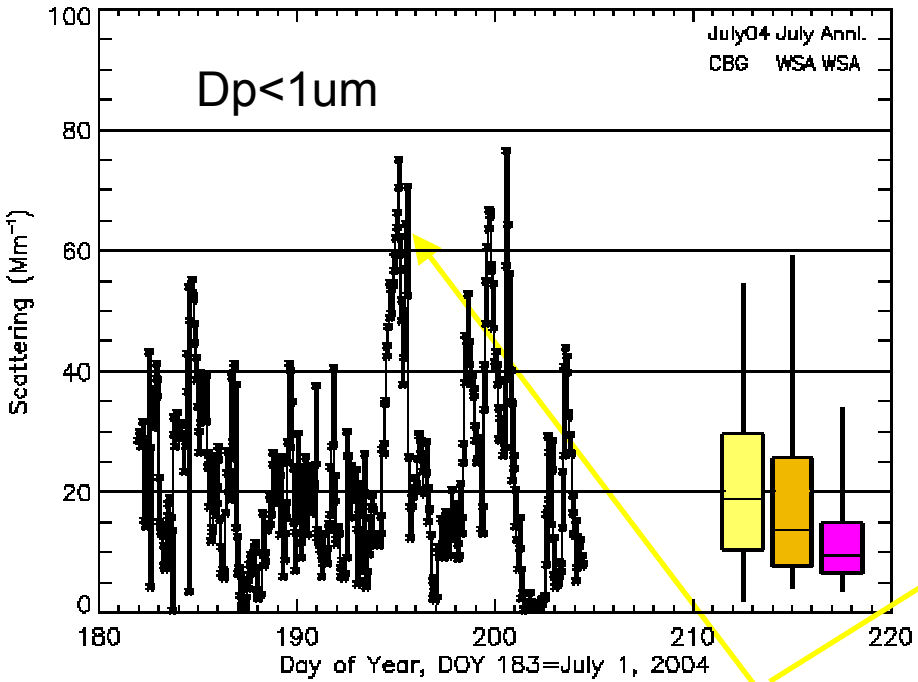
2004



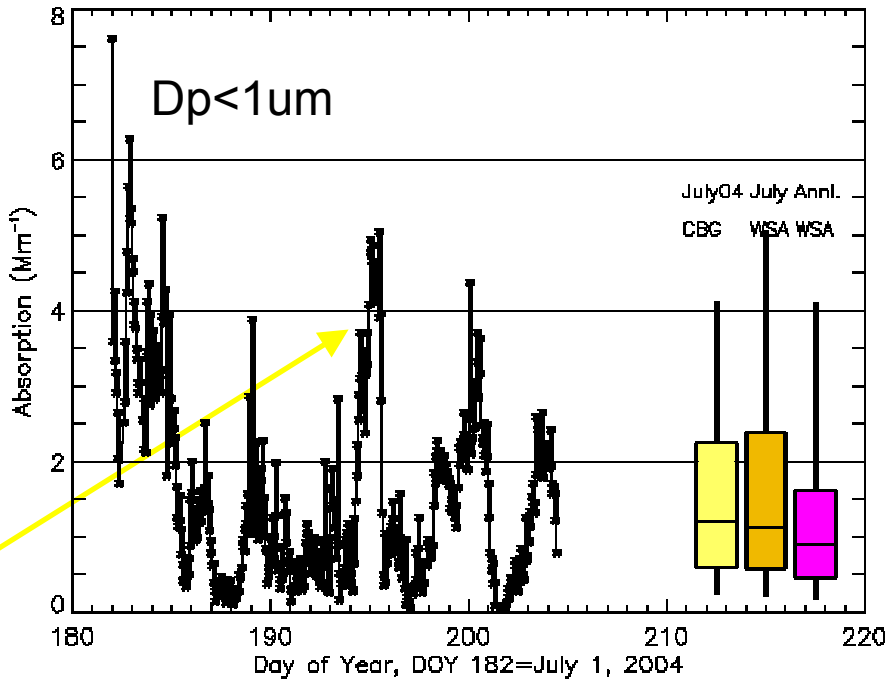


Comparison of recent measurements at Chebogue Point (CBG) with long term measurements at Sable Island (WSA)

LIGHT SCATTERING



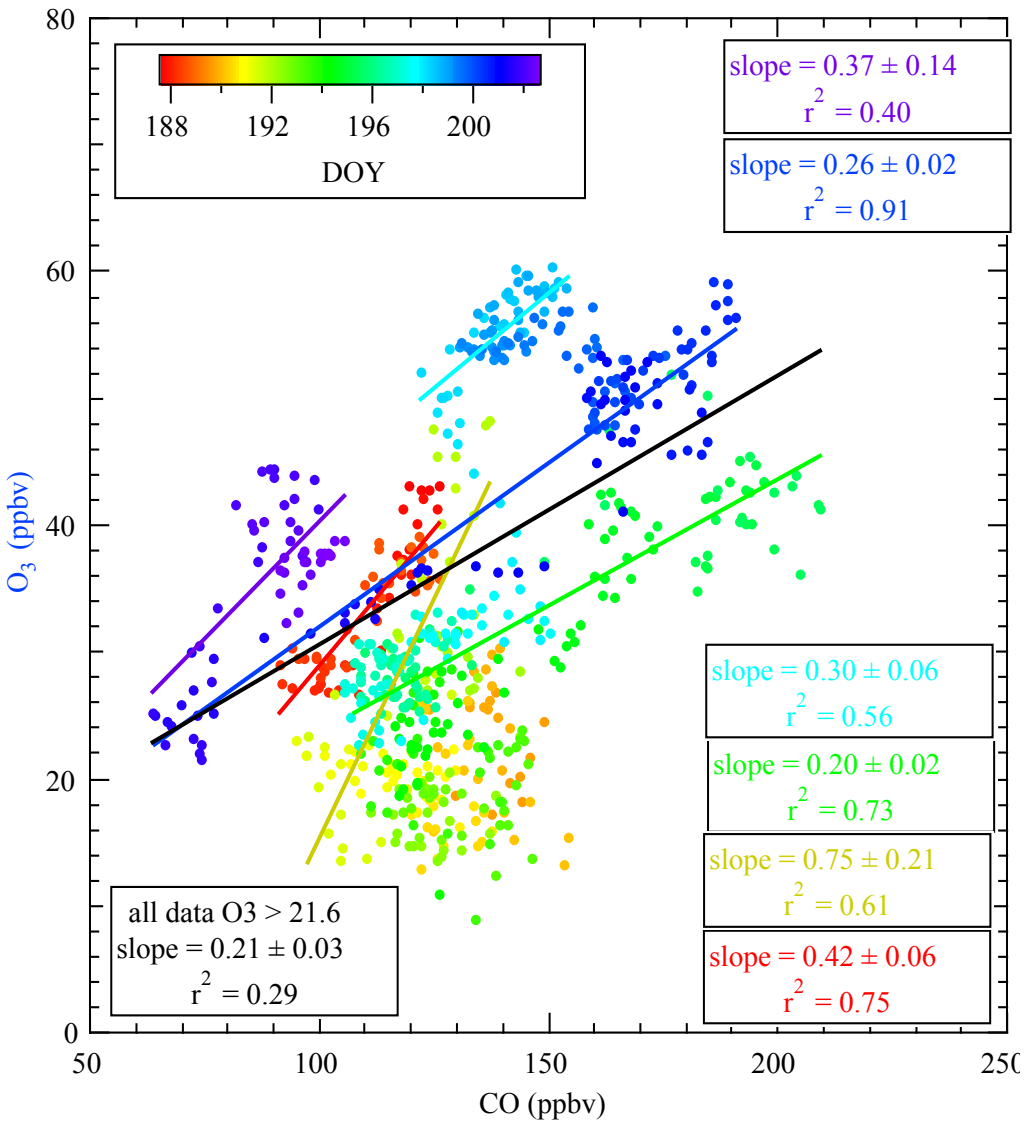
LIGHT ABSORPTION

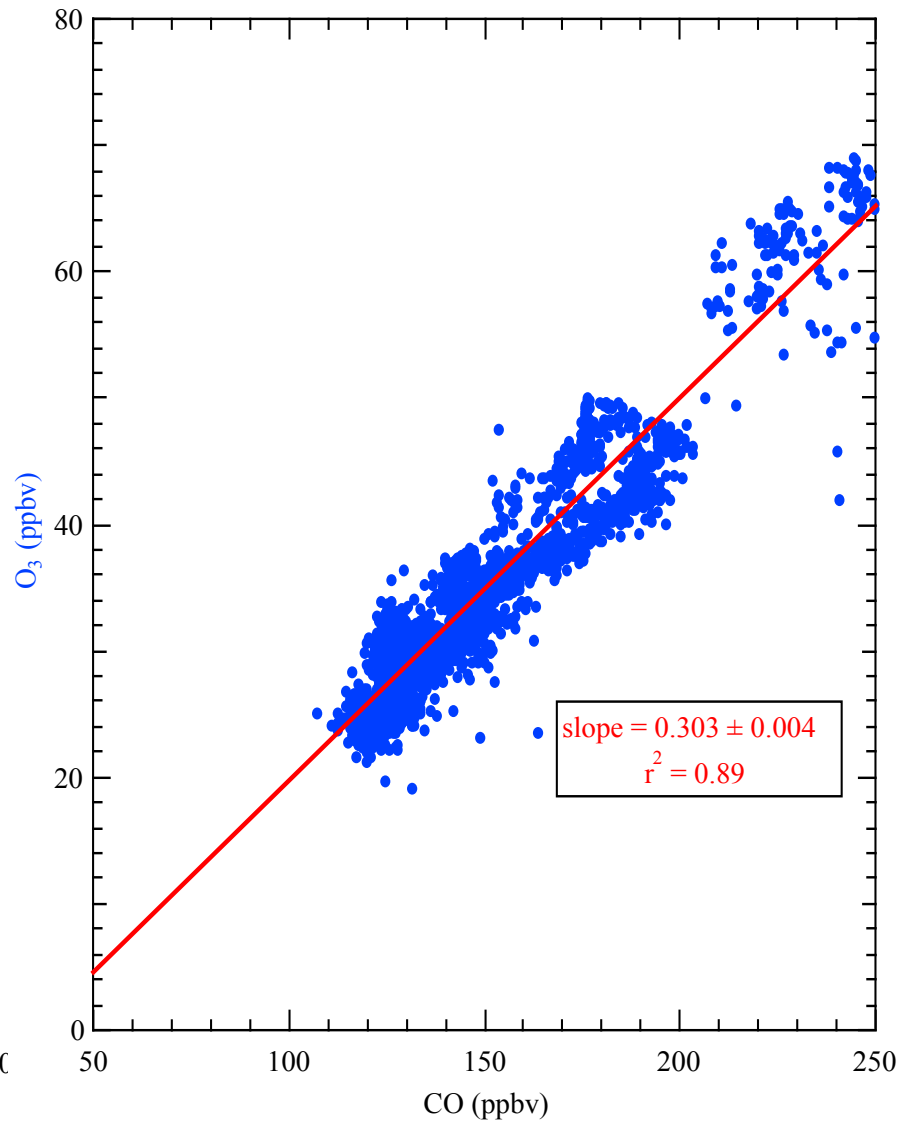


- CBG measures similar light scattering and absorption as WSA
- Possible pollution event on DOY 195 (July 13)

WSA=Sable Island, Canada (1992-2000)
CBG=Chebogue Point, July 2004

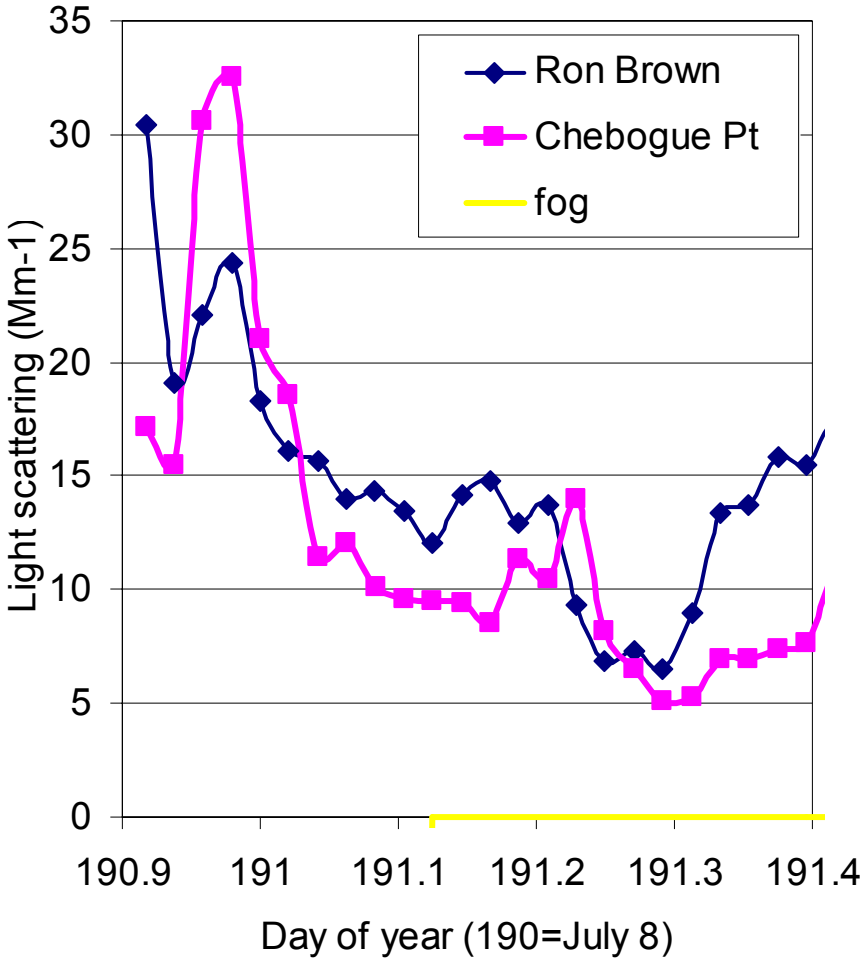
NOAA CMDL

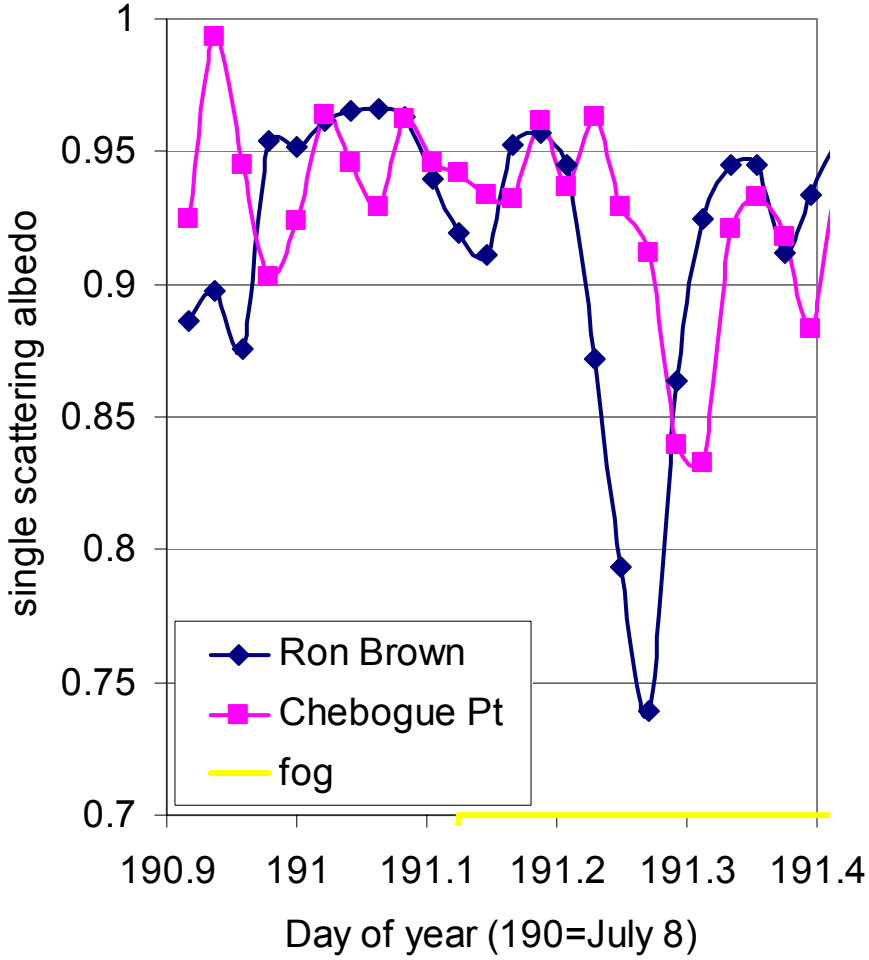




Dave Parrish, NOAA

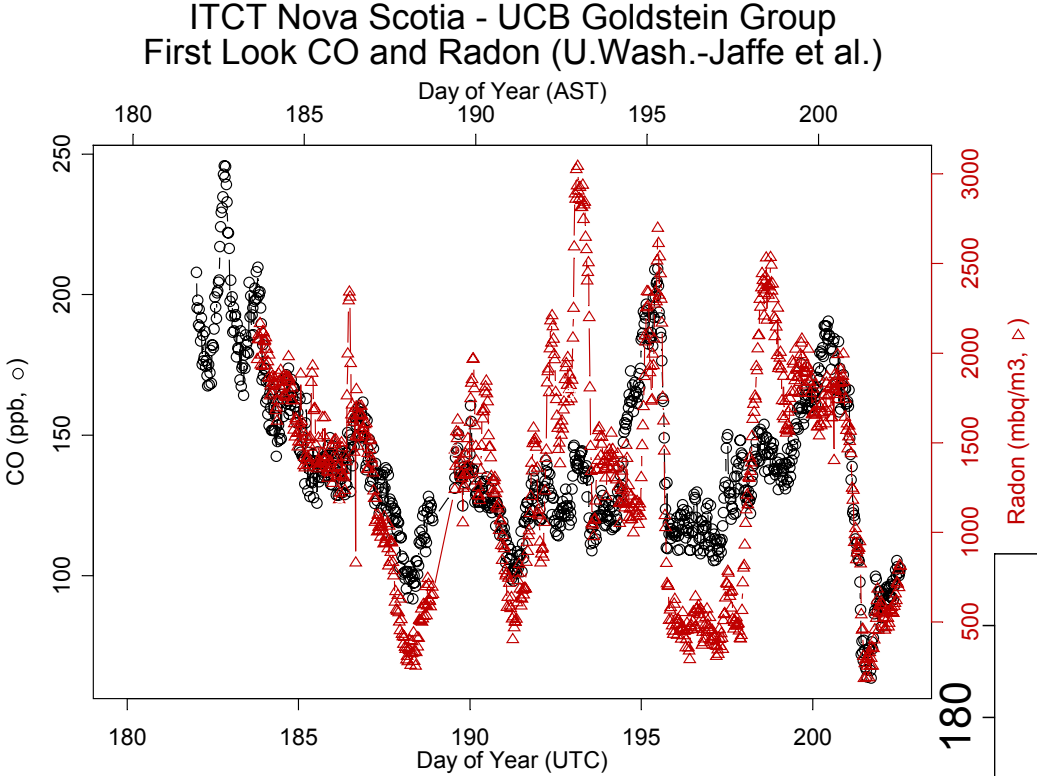
Chebogue Point and Ron Brown side-by-side measurements

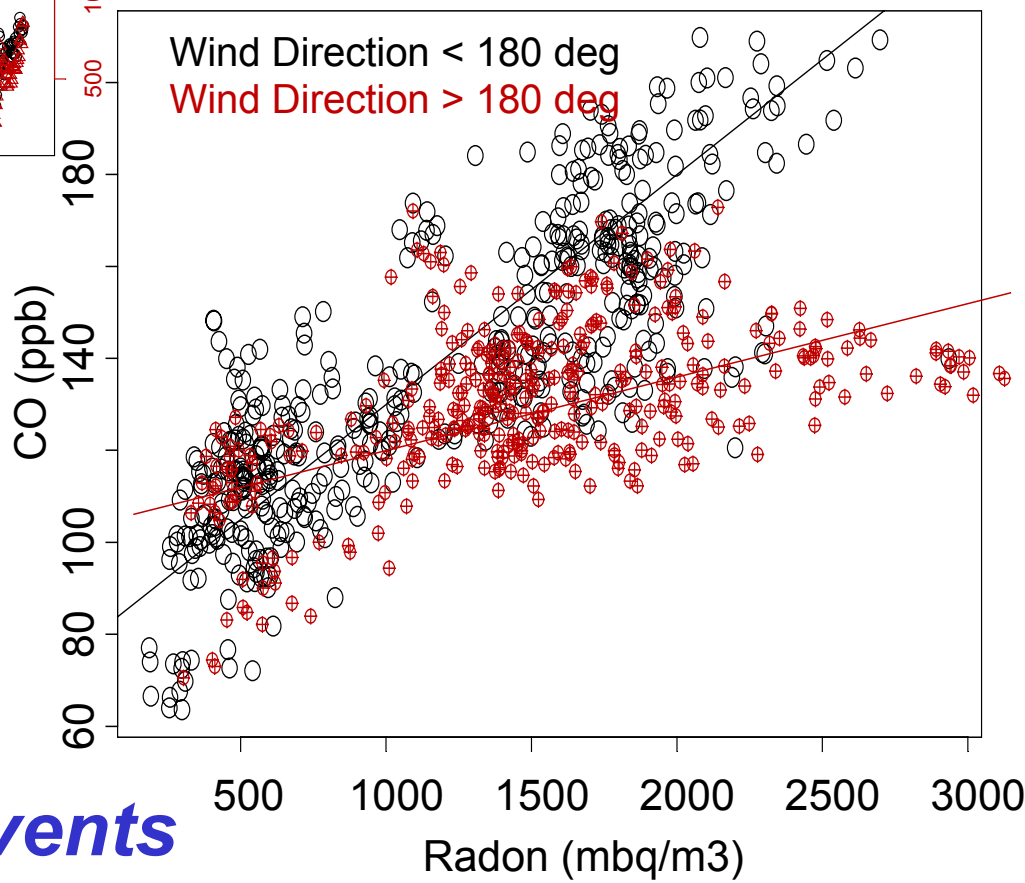




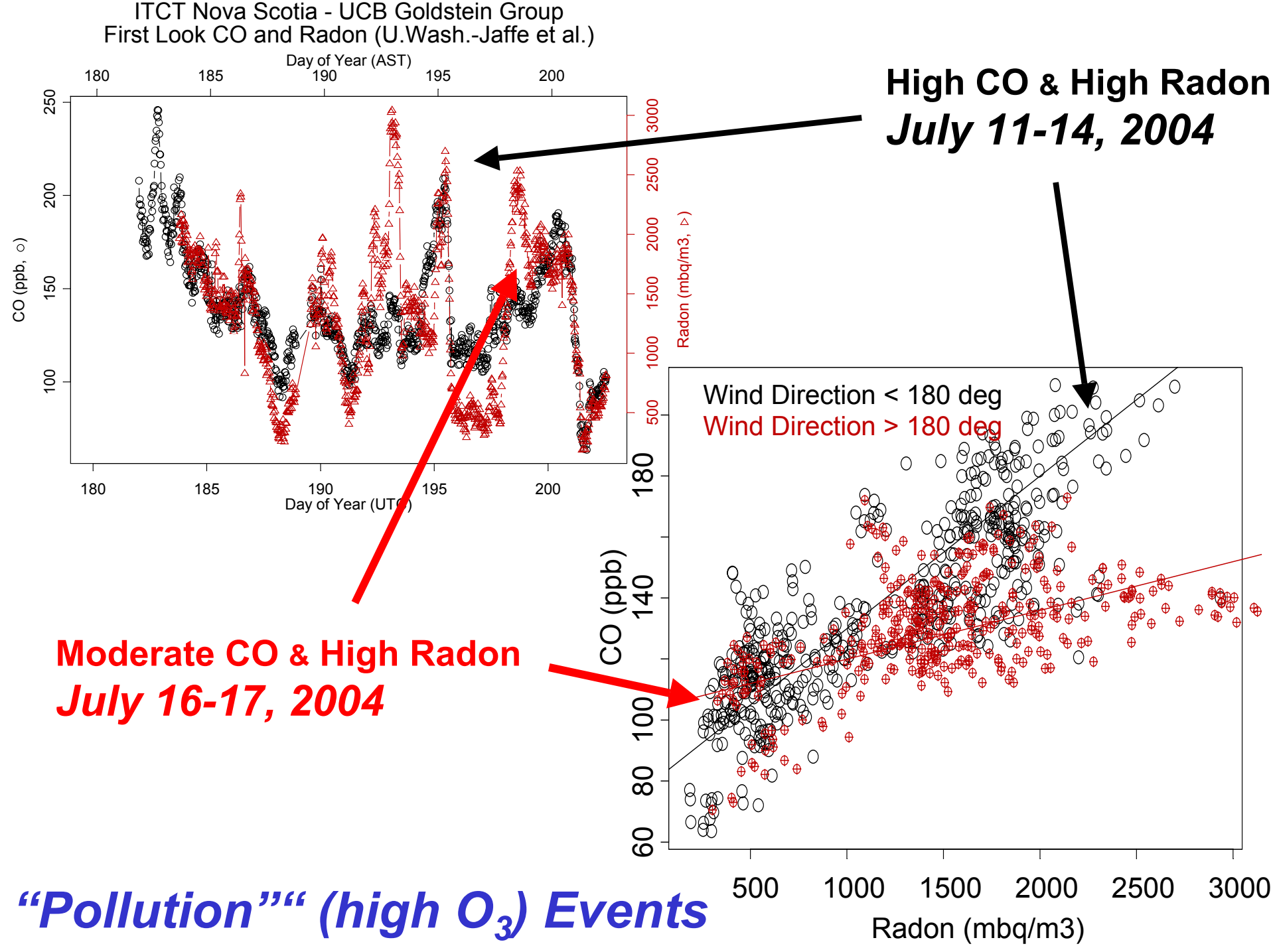
- Similar aerosol at both sites
- Fog occurs later at CBG than on Ron Brown:
  - lower light scattering and single scattering albedo

Betsy Andrews
NOAA CMDL

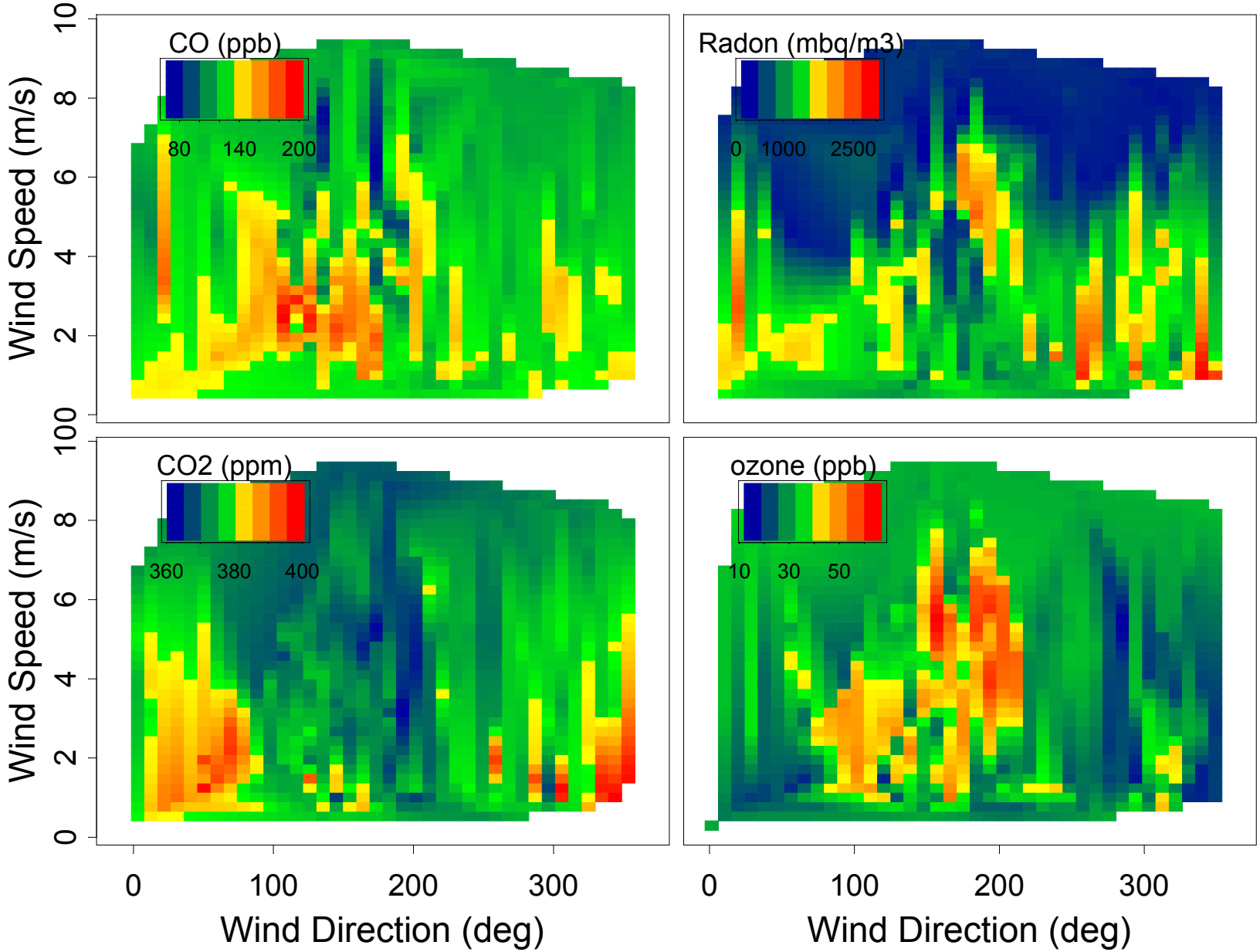




"Pollution"" (high O_3) Events

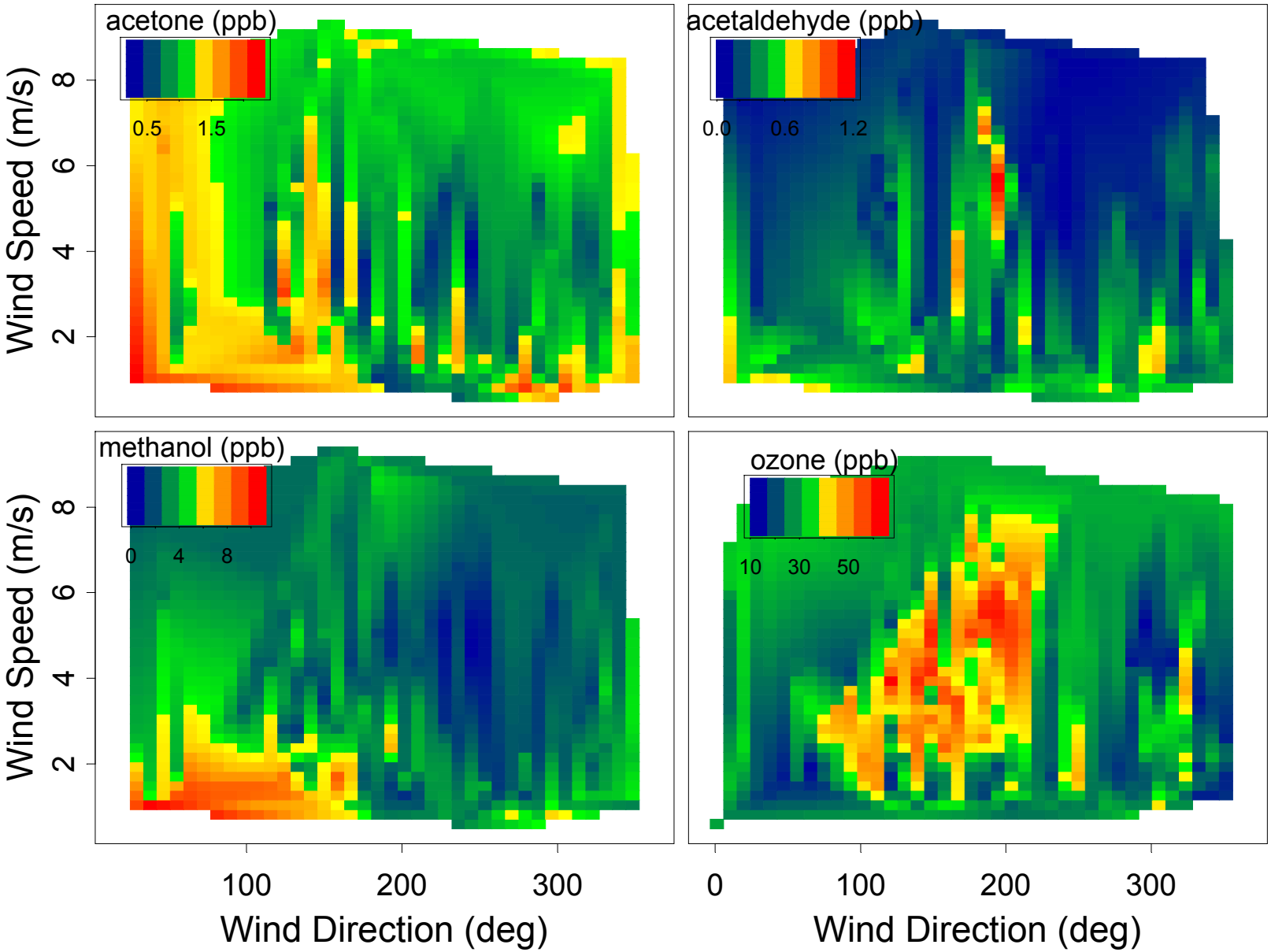

ITCT Nova Scotia - UCB Goldstein Group
First Look CO and Radon (U.Wash.-Jaffe et al.)
Day of Year (AST)
Day of Year (UTC)
CO (ppb, ○)
Radon (mbq/m3, △)
High CO & High Radon
July 11-14, 2004
Moderate CO & High Radon
July 16-17, 2004
Wind Direction < 180 deg
Wind Direction > 180 deg
CO (ppb)
Radon (mbq/m3)
"Pollution"" (high O_3) Events

First Look Data: CO, Rn, CO2 and O3



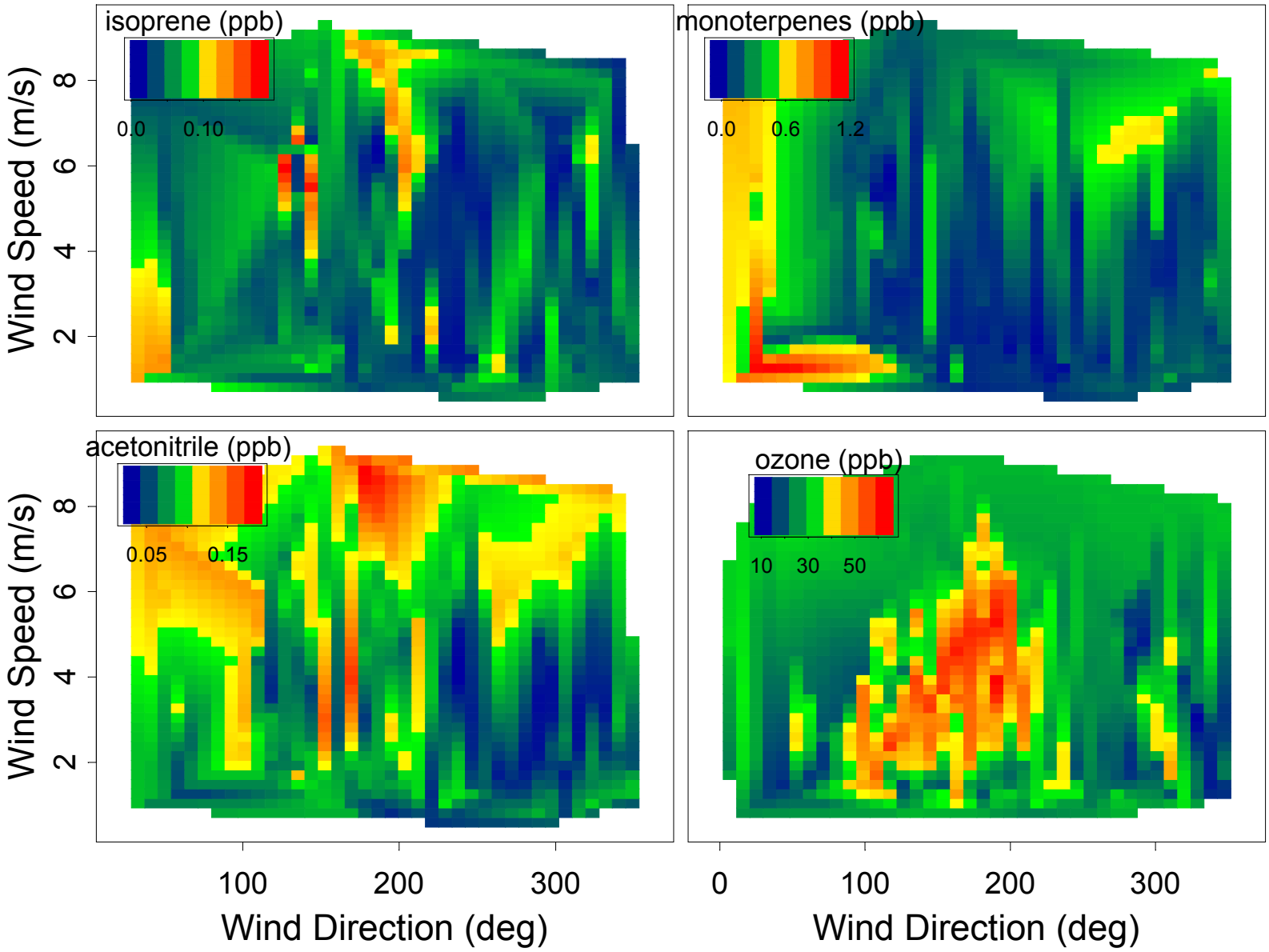
Goldstein et al. UCB,

First Look Data: PTRMS – acetone, acetoald., MeOH vs O3



Holzinger et al. UCB,

First Look Data: PTRMS – Isprene, Monoterp., Acetonit. vs O3



Holzinger et al. UCB,

FACTOR ANALYSIS OF FIRST LOOK DATA

(Goldstein, Holzinger, et al.)

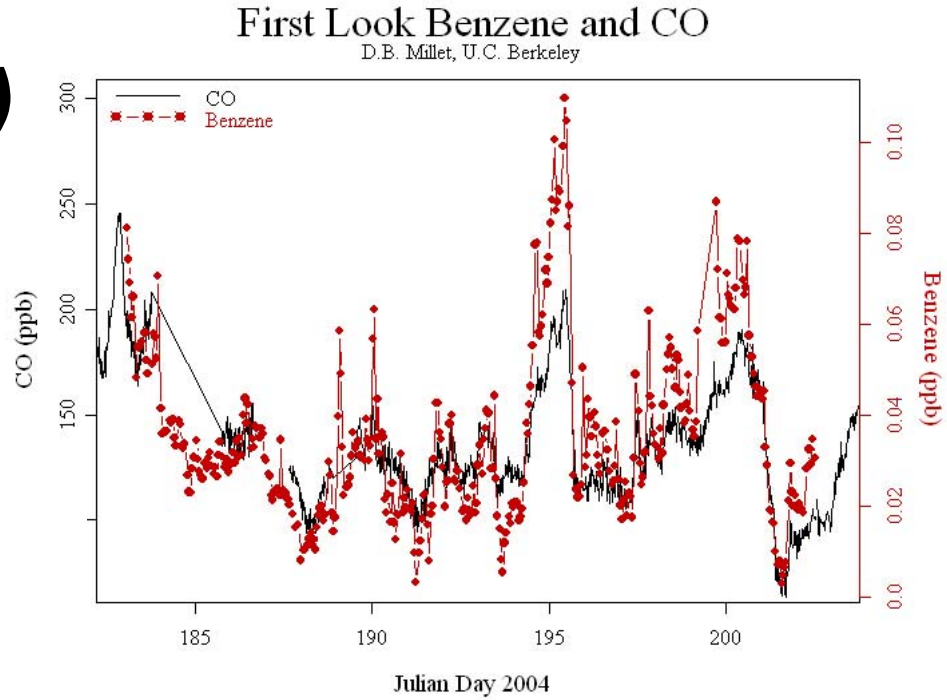
	Factor1	Factor2	Factor3	Factor4	Factor5
Methanol	0.397	0.770			
Acetonitrile			0.699		-0.416
Acetaldehyde	0.589	0.385	0.393		
Acetone		0.866			
Isoprene	0.799				
MVK+MACR	0.932				
Monoterpenes				0.452	0.588
Ozone	-0.321		0.543	-0.639	
Water					0.956
CO_2				0.921	
CO			0.728		
Radon			0.872		

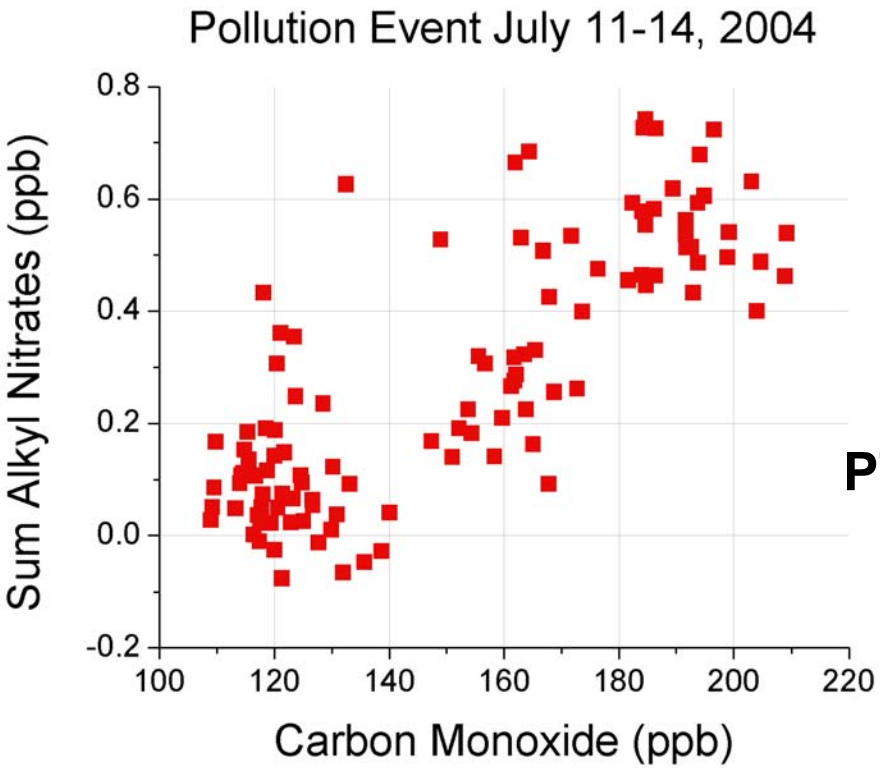
High ozone (Factor 3) is coincident with transport from North America: high CO, radon, acetonitrile, and slightly elevated acetaldehyde.

Low ozone (Factors 1 and 4) is coincident with local surface exchange: high CO_2 (respiration), monoterpenes, isoprene, MVK+MACR, acetaldehyde, and methanol (all local biogenic/agricultural origin).

First Look Data (UCB)

GC-MS ***Millet et al.***

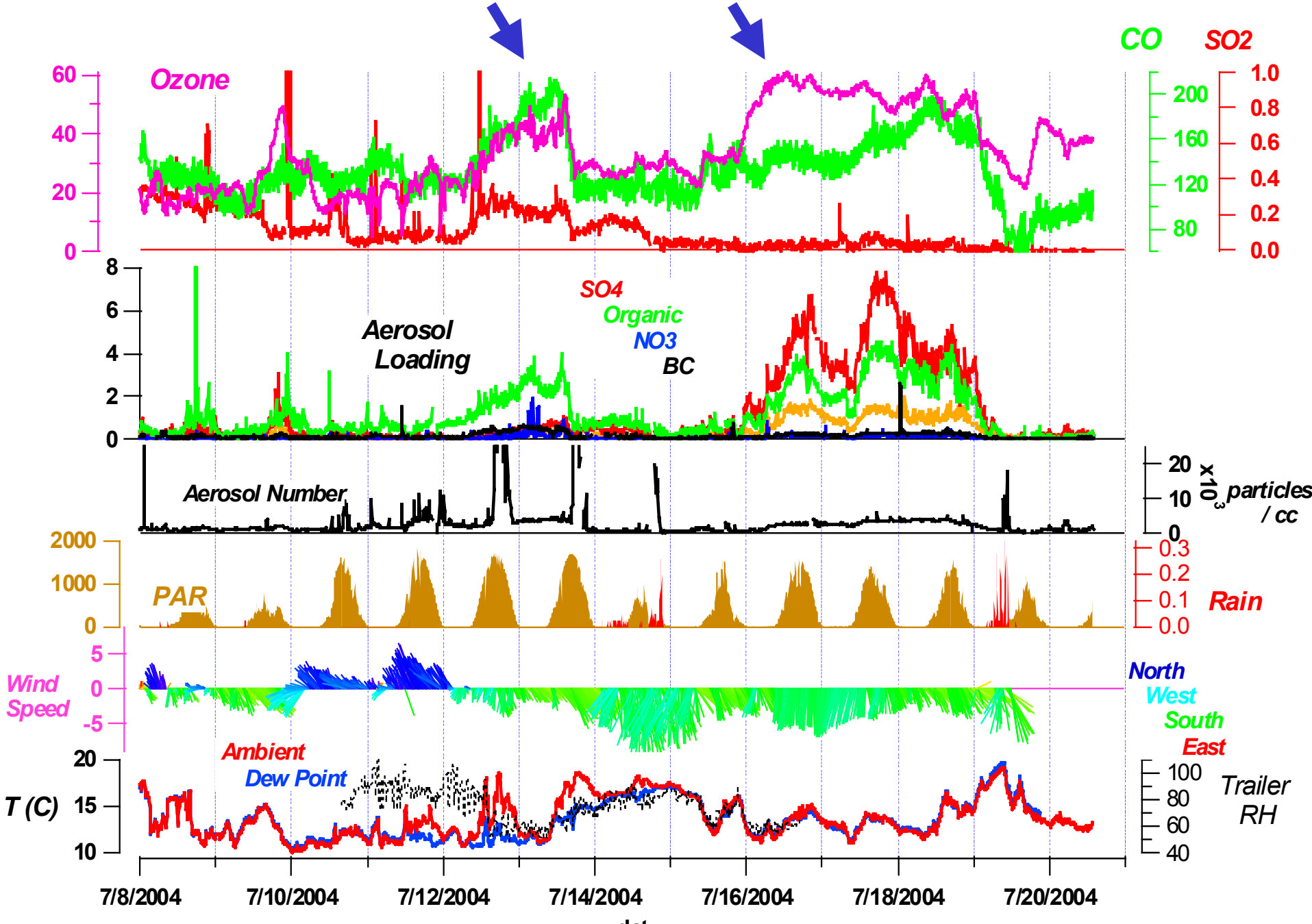


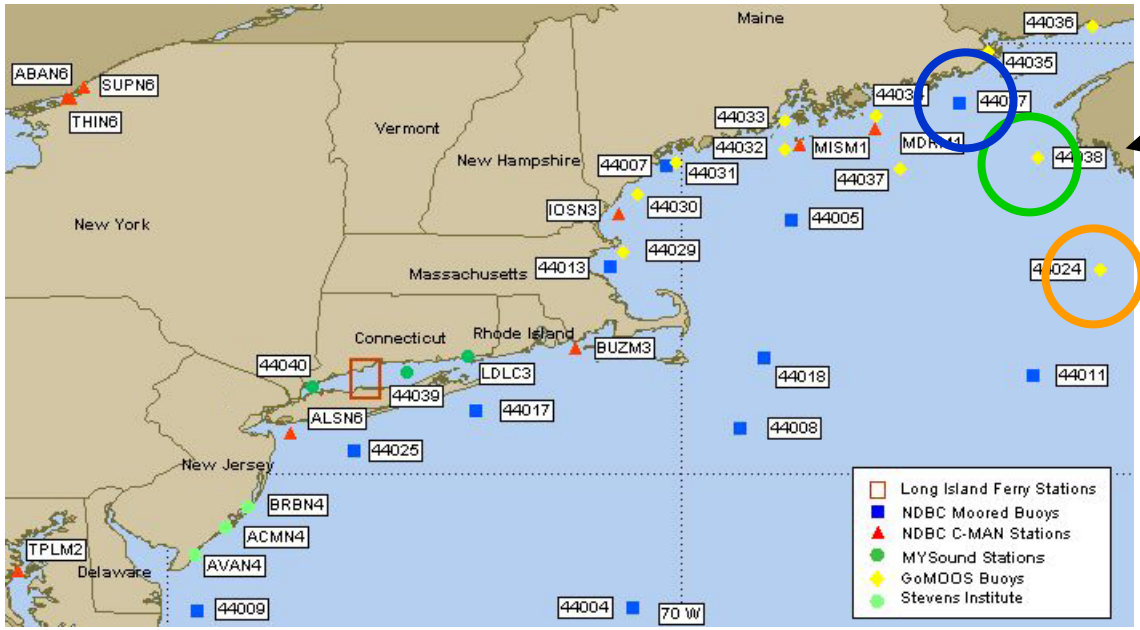


PTRMS ***Murphy et al.***

Much more to come ….

Chebogue Gas, Aerosol, Radiation and Met Parameters

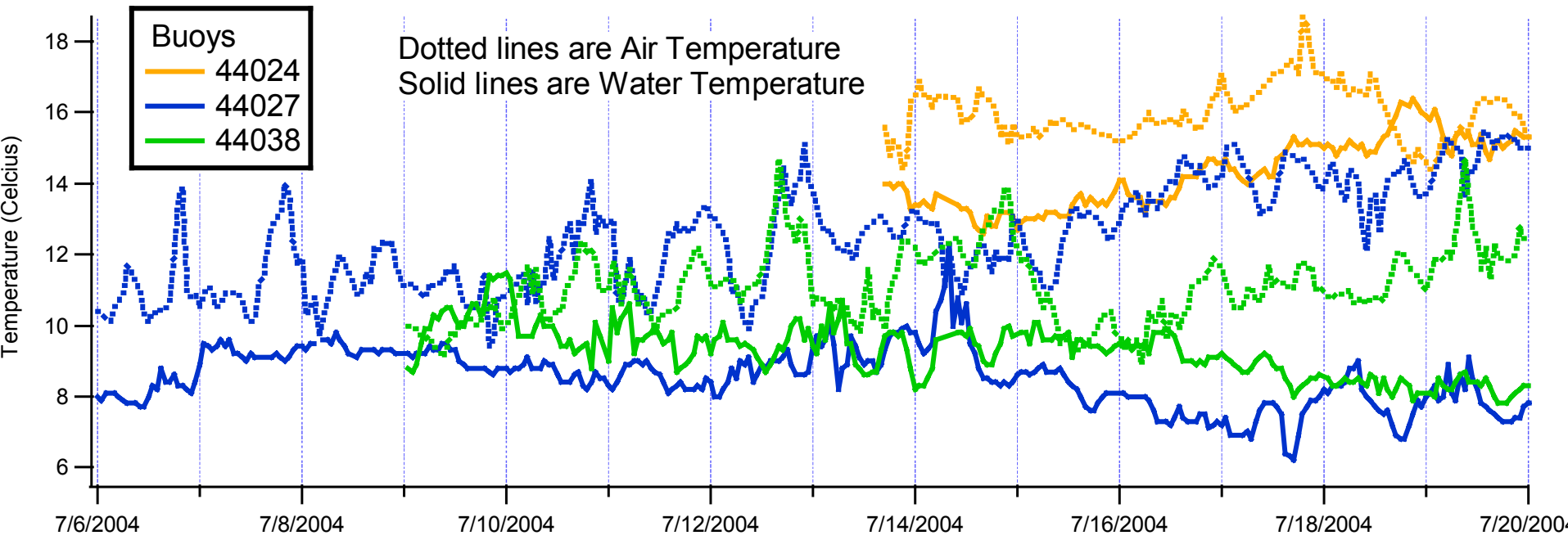


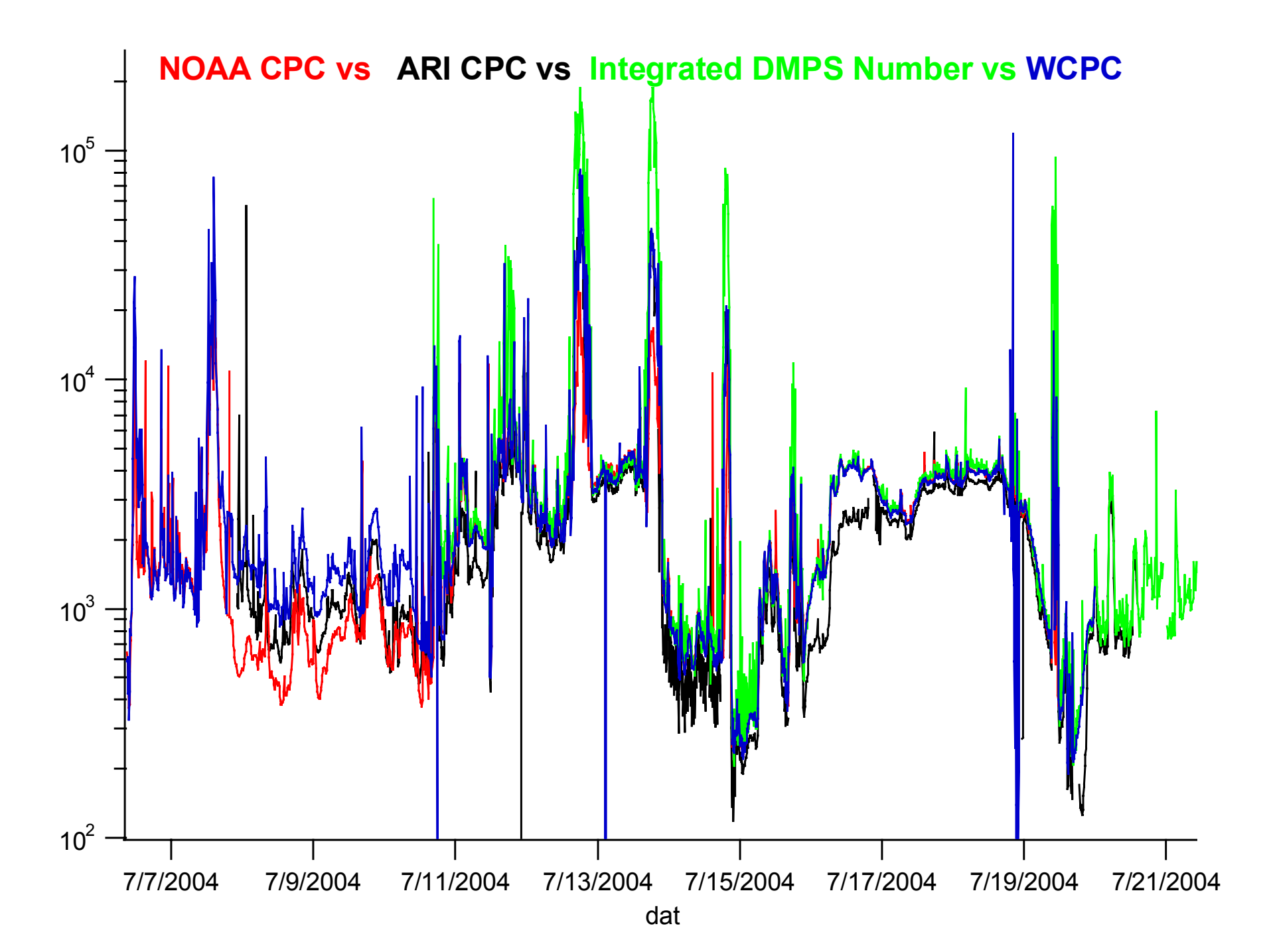


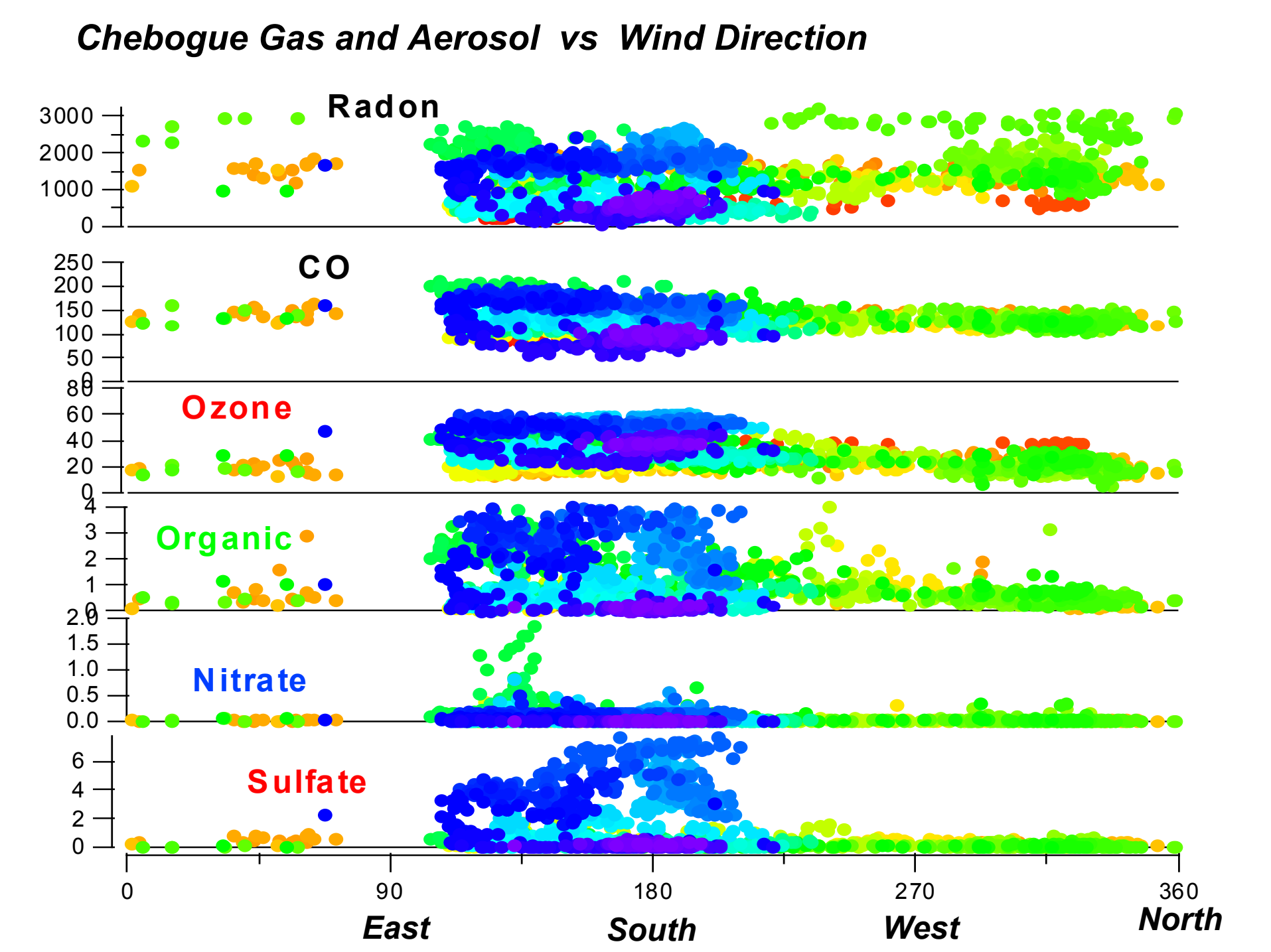
Chebogue Point,
Nova Scotia

NOAA Buoys

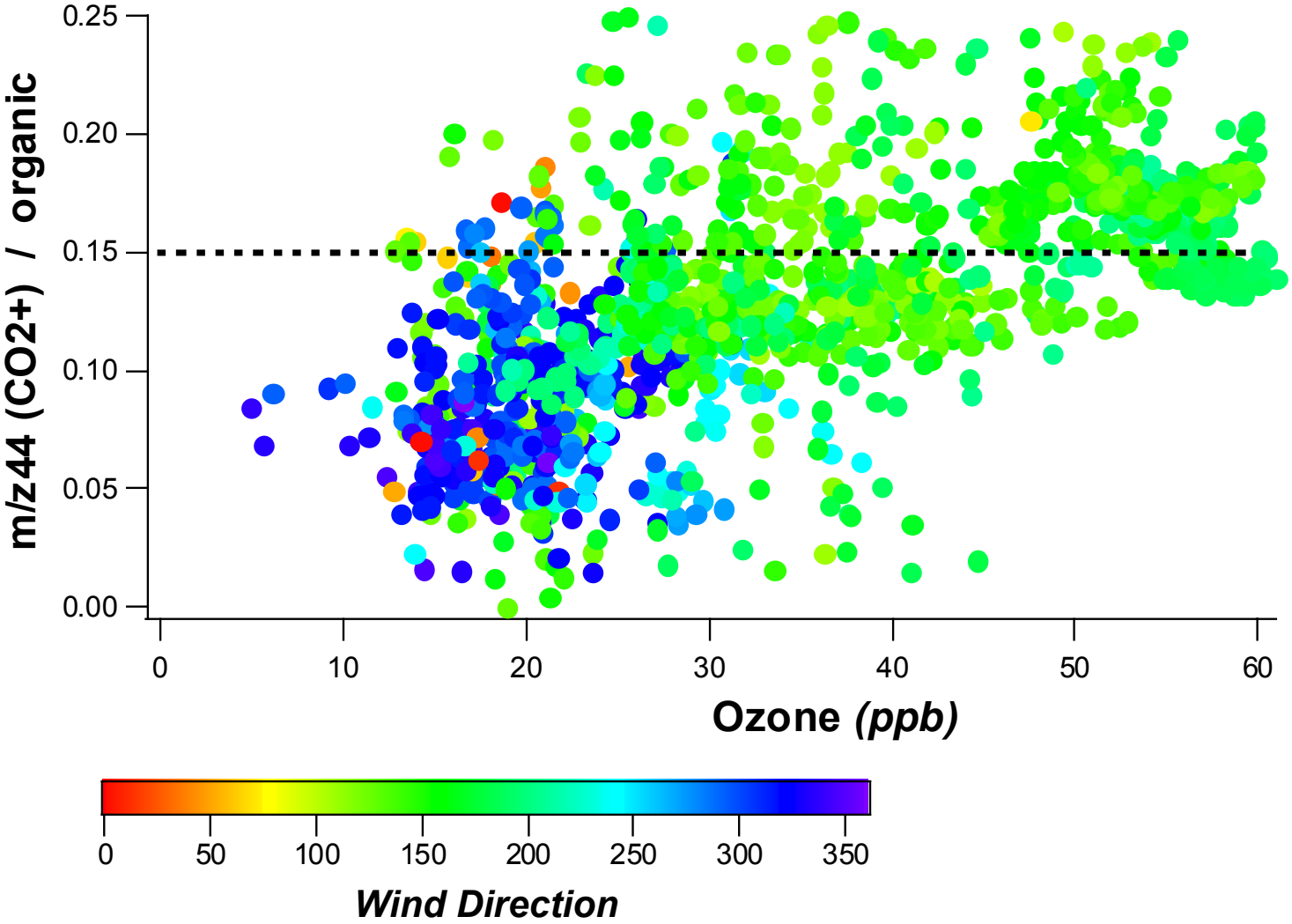
via Peter Decarlo,
U. Colorado



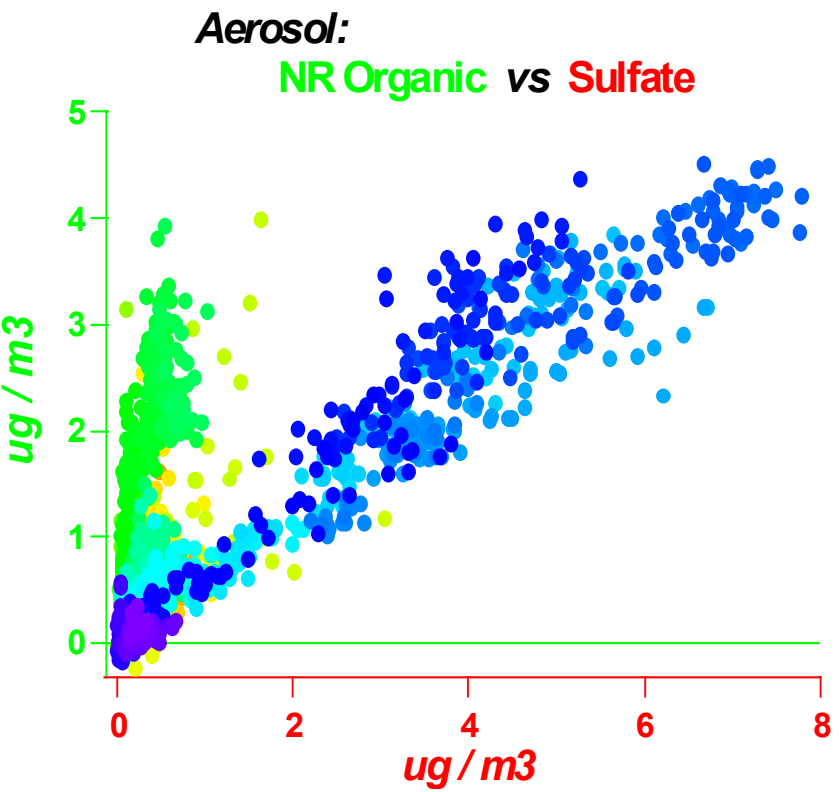

NOAA CPC vs
ARI CPC vs
Integrated DMPS Number vs
WCPC
10^5
10^4
10^3
10^2
7/7/2004
7/9/2004
7/11/2004
7/13/2004
7/15/2004
7/17/2004
7/19/2004
7/21/2004
dat

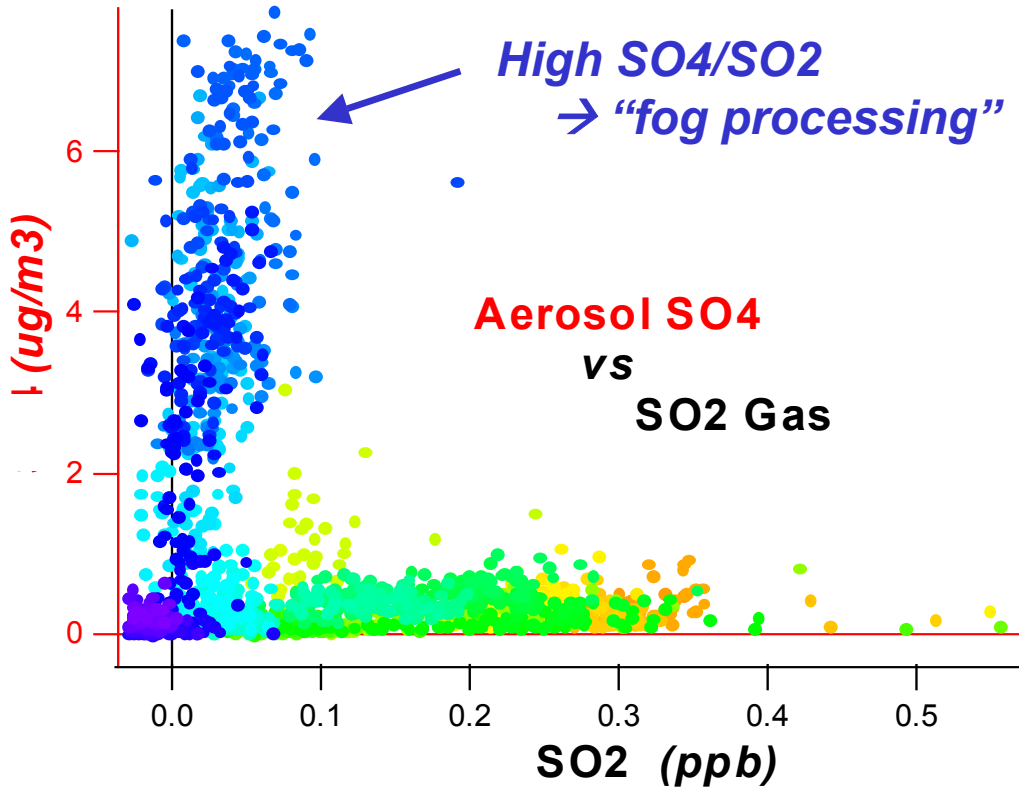

Chebogue Gas and Aerosol vs Wind Direction
Radon
3000
2000
1000
0
CO
250
200
150
100
50
0
Ozone
80
60
40
20
0
Organic
4
3
2
1
0
Nitrate
2.0
1.5
1.0
0.5
0.0
Sulfate
6
4
2
0
0
90
180
270
360
East
South
West
North

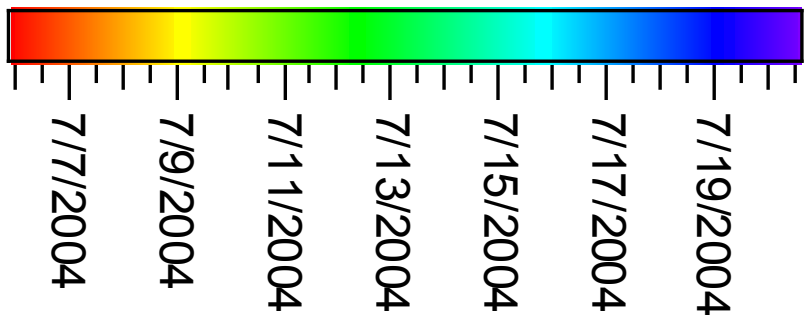
Secondary Organic Oxidation



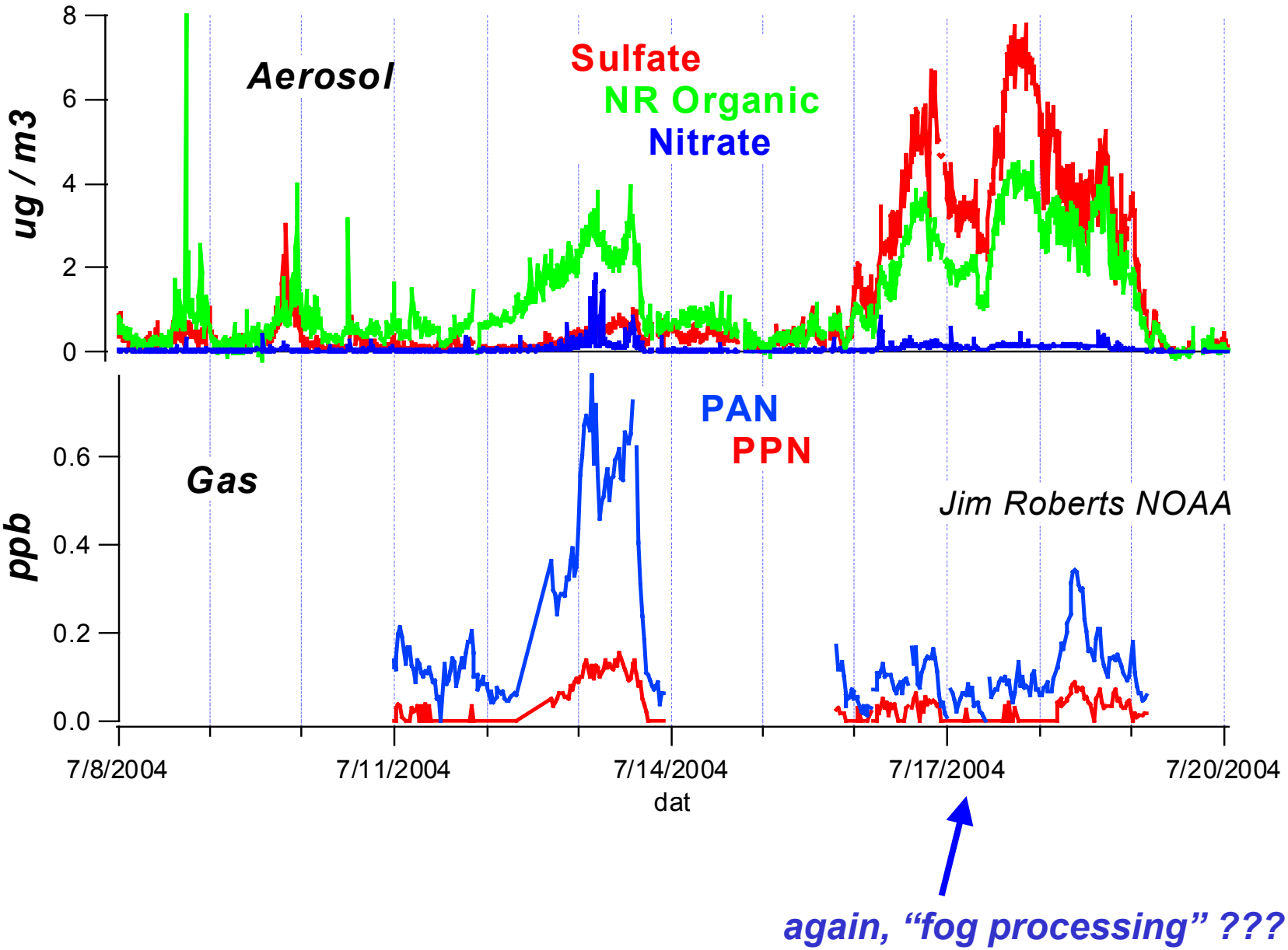
July 11-12 *compared to* July 16-17



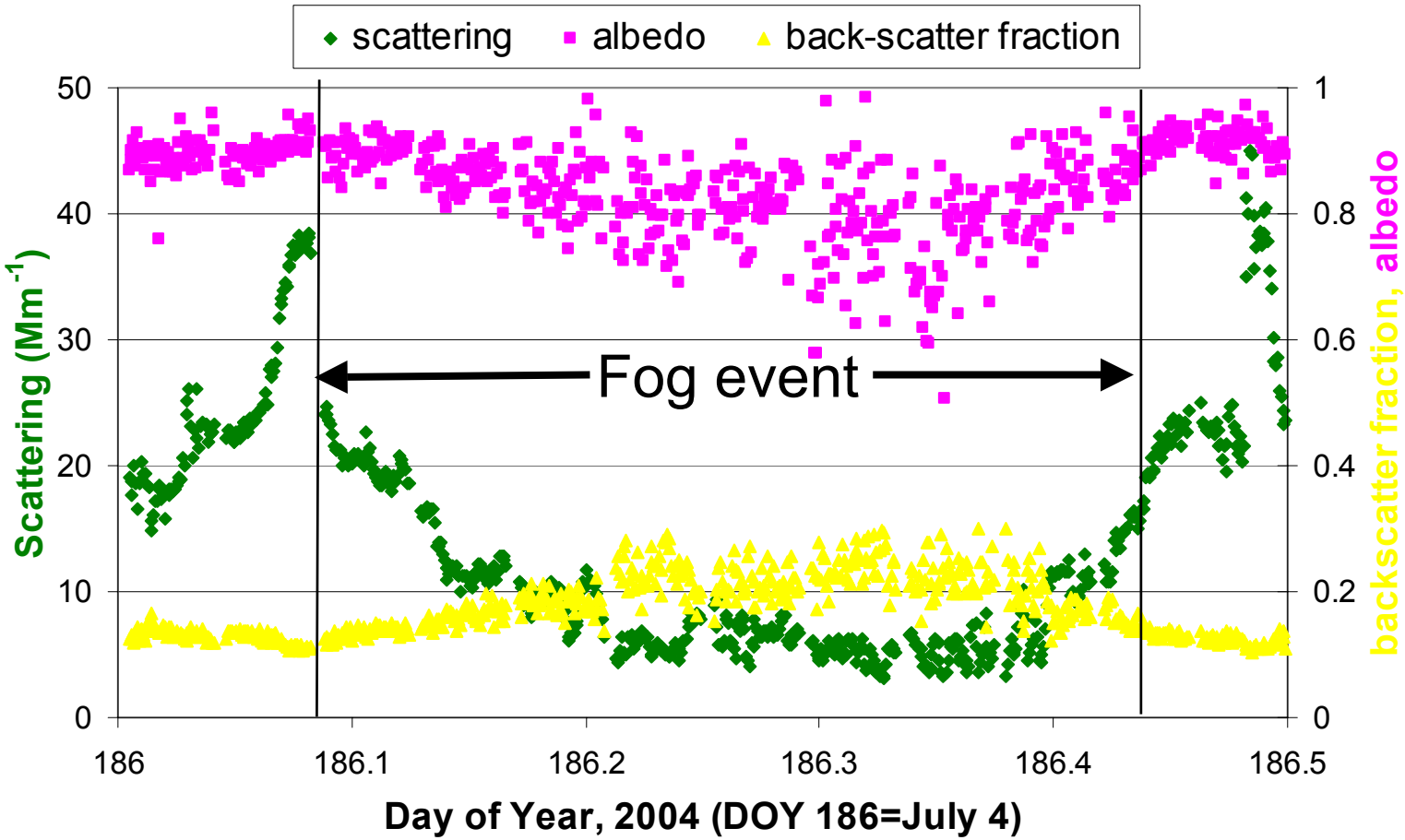




Aerosol ↔ PAN (PPN) Comparison

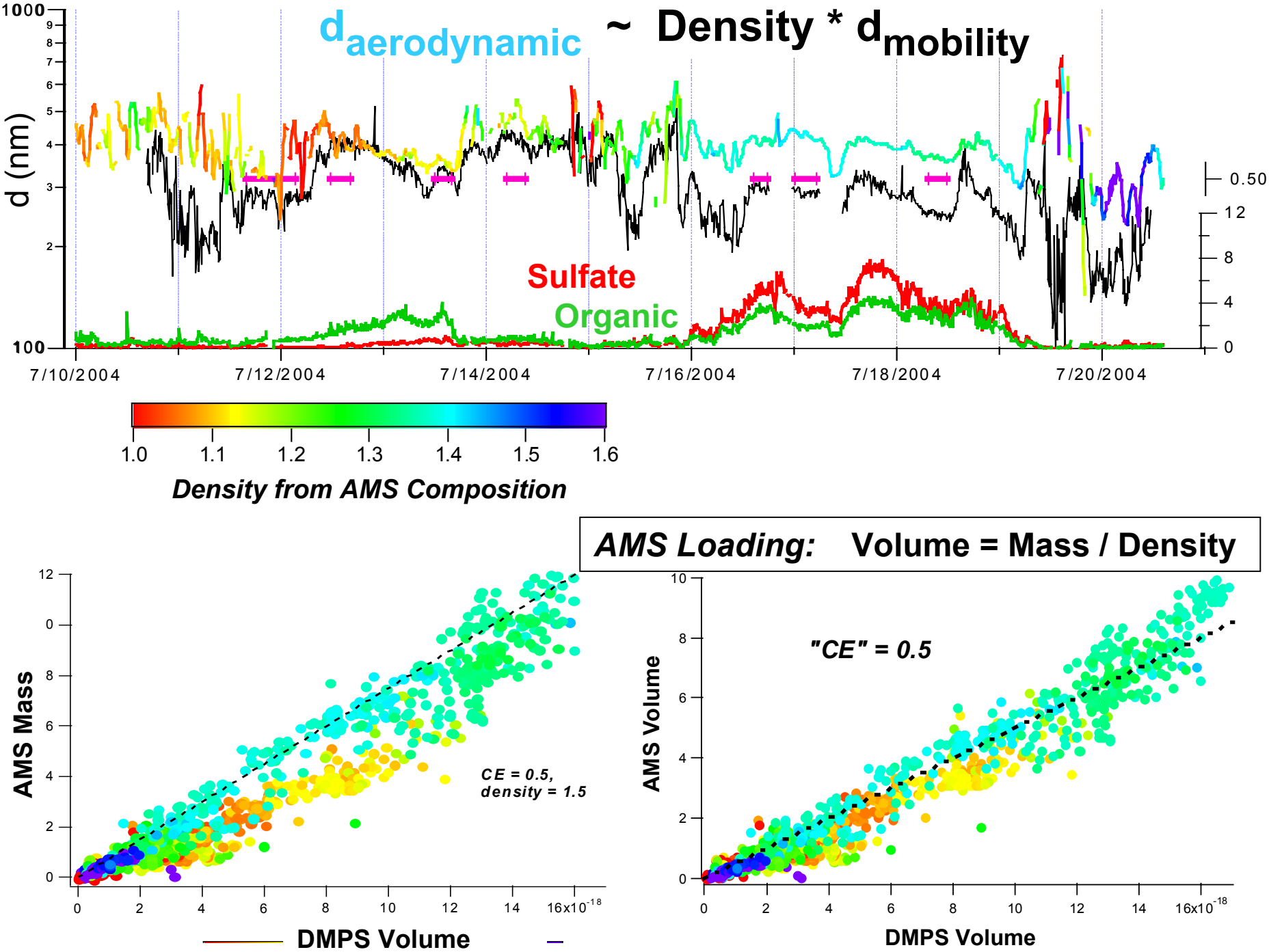


Effect of fog on aerosol optical properties

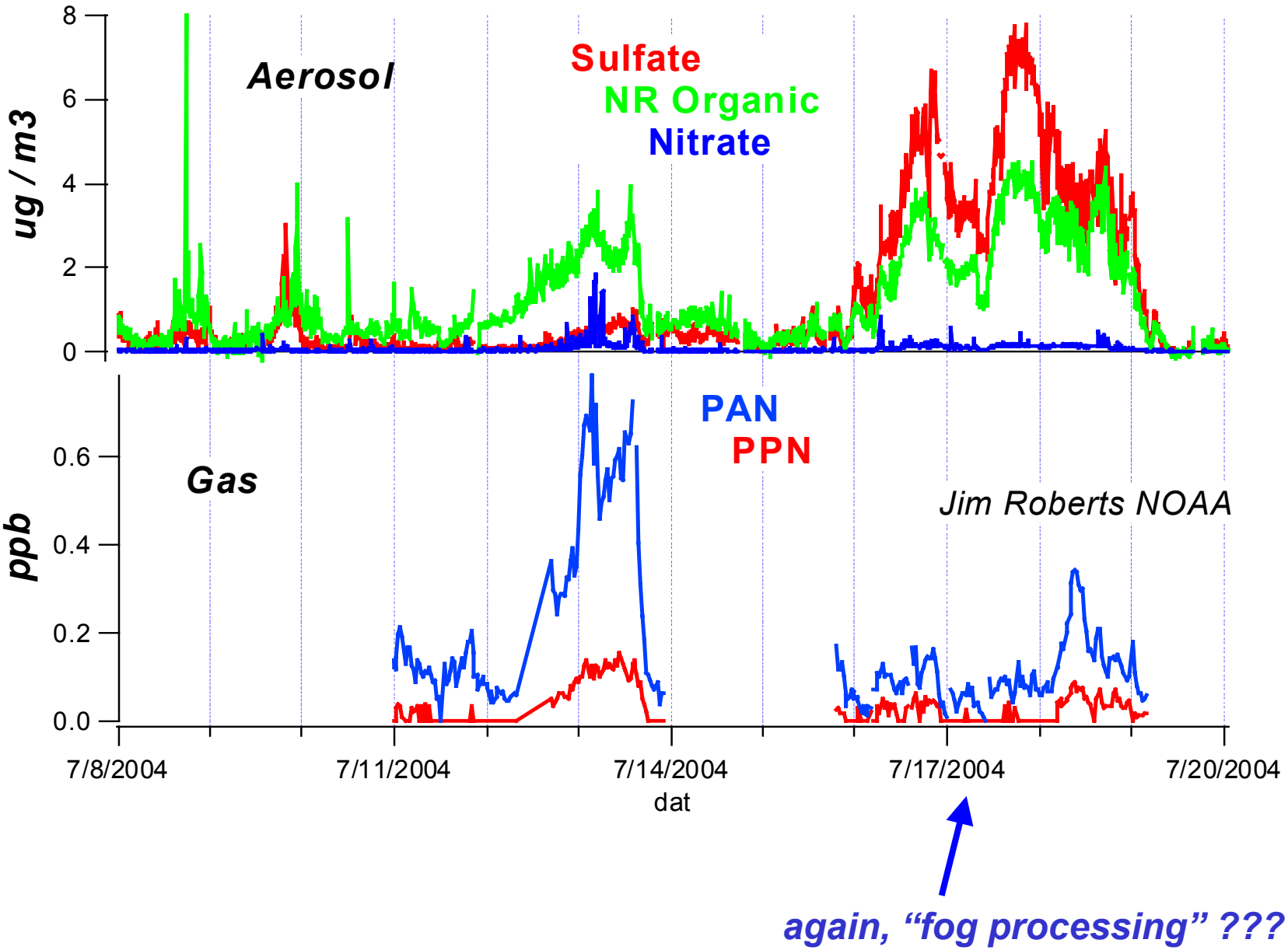


- Onset of fog causes:
  - Decrease in light scattering,
  - Increase in back-scatter fraction
  - Decrease in single scattering albedo

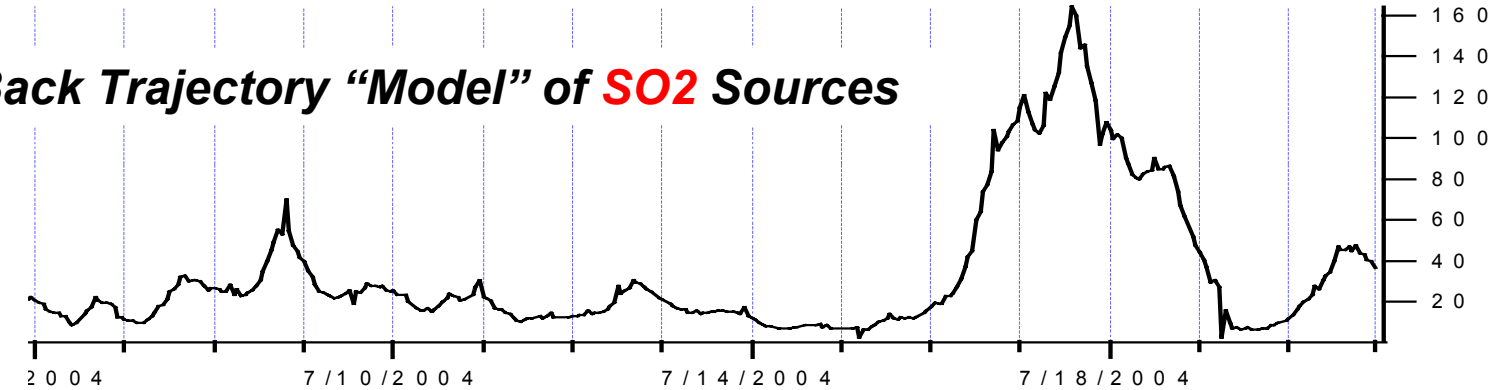
Betsy Andrews
NOAA CMDL


d aerodynamic ~ Density * d mobility
d (nm)
1000
9
8
7
6
5
4
3
2
100
Sulfate
Organic
0.50
12
8
4
0
7/10/2004
7/12/2004
7/14/2004
7/16/2004
7/18/2004
7/20/2004
1.0
1.1
1.2
1.3
1.4
1.5
1.6
Density from AMS Composition
AMS Loading: Volume = Mass / Density
AMS Mass
CE = 0.5,
density = 1.5
16x10-18
DMPS Volume
AMS Volume
"CE" = 0.5
16x10-18
DMPS Volume

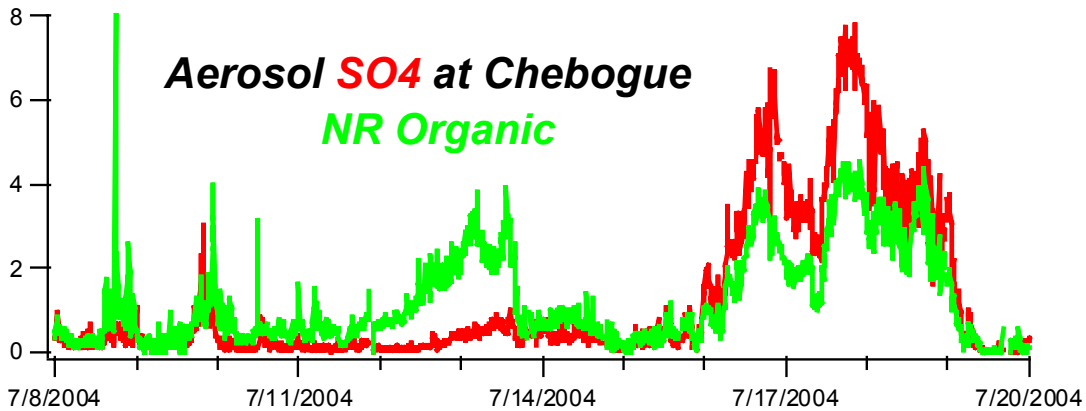
Aerosol ↔ PAN (PPN) Comparison



Back Trajectory "Model" of SO2 Sources



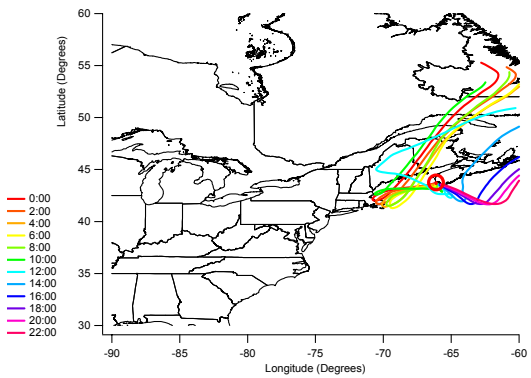
Predicted SO4

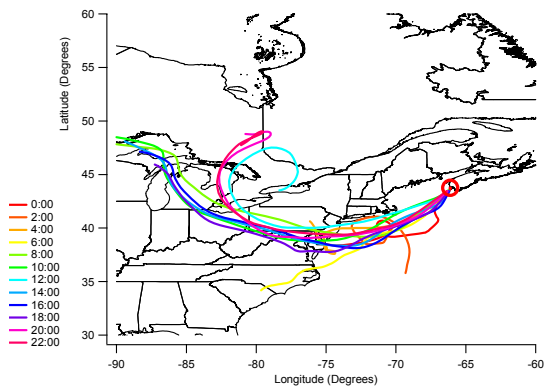


Doug Tompsett
Carolyn Hayek
Boston College

"High CO"

"Moderate CO"





UMIST	***James Allen*** ***Mike Cubison***
U of Colorado	***Peter DeCarlo*****, Jose Jimenez** **Alex Huffman**
Boston College	***Eben Cross*** ***Doug Tompsett*****,** ***Carolyn Hayek***
UC Berkeley	***Allen Goldstein*** ***Dylan Millet*** **Rupert Holdinger**
NOAA CMDL	***Betsy Andrews*****, Pat Sheridan** **Ann Jefferson**
NOAA AL	***Jim Roberts, Dave Parrish***
U Washington	**Dan Jaffe**
UC San Diego	**Katie Holderness**
Aerodyne	***Tim Onasch*** **Megan Northway, Manjula Canagaratna**