

Measurements at Thompson Farm and Appledore Island during the ICARTT 2004 Summer Campaign



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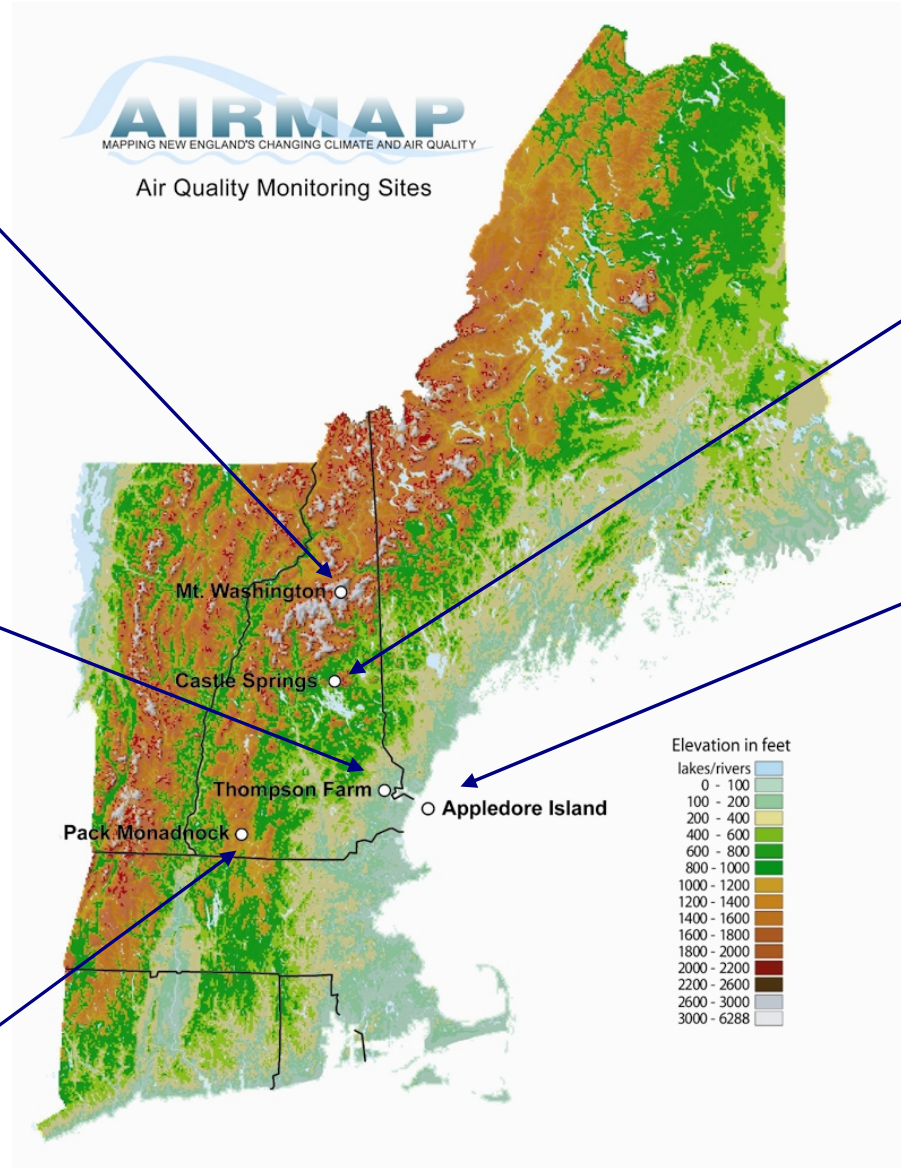
Climate Change Research Center

March 30, 2005



SCIENTIFIC MOTIVATION

- ◆ **What are the processes controlling air quality in the region?**
- ◆ **What is the relative contribution of long-range versus more local pollution sources?**
- ◆ **What is the impact of marine derived trace gases and aerosols on air quality in New England?**
- ◆ **What is the impact of extensive natural emissions in New England on air quality?**
- ◆ **How is regional climate changing?**
- ◆ **How are seasonal climate and air quality linked?**



Atmospheric measurements conducted at the AIRMAP monitoring sites.

Species	Thompson Farm	Pack Monadnock	Appledore Island	Castle Springs	Mount Washington
O ₃	✓	✓ *	✓	✓	✓
CO	✓	✓	✓	✓	✓
NO	✓	✓	✓	✓	✓
NO ₂	✓				
PAN	✓				
NO _y	✓			✓	✓
SO ₂	✓			✓	✓
SO ₄	✓				
CO ₂	✓	✓	✓		
Hg	✓	✓			
Hydro/Halocarbons	✓				
Alkyl Nitrates	✓				
JNO ₂	✓			✓	✓
AMS Single Particle Comp.	✓				
Bulk Aerosol Comp.	✓				✓
CN	✓			✓	✓
PM2.5 Mass Conc.		✓ *			
PM2.5 Scattering	✓			✓	
PM2.5 Absorption	✓				
MC/IC Aerosol Comp.	✓				

* Operated by The New Hampshire Department of Environmental Services (DES)



- About AIRMAP
- Background
- Data
- Outreach
- Assessment
- More Info.

What is AIRMAP?

The primary mission of AIRMAP is to **develop a detailed understanding of climate variability and the source of persistent air pollutants in New England**. Our goal is to identify the causes of climate variability, predict air quality changes as an addition to daily weather forecasts, and to demonstrate new forecasting technologies.

What are we doing?

Our efforts focus on **collection and analysis of physical components** (temperature, precipitation, extreme events) and **chemical components** (ozone and its precursors together with fine respirable aerosols) **of the New England atmosphere**, as well as development and implementation of high resolution weather and air quality models.



Thompson Farm, Durham, NH
Real-Time Meteorological and Air Quality Data



Current Readings	Last Update	ET
Temp (F)	28	10-DEC 11:15 AM
Ozone (ppbv)	27	10-DEC 11:15 AM

Detailed Thompson Farm

- Castle Springs Data
- Mt. Washington Data
- Appledore Island Data

[All AIRMAP Sites Data](#)

- [Why New England?](#)
- [News](#)
- [Weather](#)
- [Air Quality Forecast](#)

What's New!

- POST-DOCTORAL RESEARCH ASSOCIATE (Grant-Funded)**
The Climate Change Research Center in Institute for the study of Earth, Oceans, and Space (EOS) at the University of New Hampshire invites applications for a Post-Doctoral position in air quality modeling.



[What's New Archive](#)



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Home

AIRMAP Sites

- Thompson Farm
- Castle Springs
- Mount Washington
- Appledore Island

Location Map

Archived Data

Aerosol Data

Pease Wind Profiler

Durham NH Met Data

Current NHDES Ozone Data

CAMNET Sites

New England Weather

Air Quality Standards

Actions

Health Effects

Site Map

Contact Us

Current Data

The Thompson Farm air quality monitoring site is located in Durham, NH approximately two miles south of University of New Hampshire (43.11N, 70.95W, elevation 75ft). The site is characterized by rolling fields surrounded by mixed forest. Most of the air quality measurements are performed on air sampled from the top of a forty foot tower. One of [NOAA's Climate Reference Network](#) meteorological stations is also located at Thompson Farm.



Thompson Farm Webcam

Thompson Farm Real-Time Air Quality Data 10-DEC			
	Current Data	Last Update ET	View Graph
O ₃ (ppbv)	31	12:00 PM	<input checked="" type="checkbox"/>
PM _{2.5} (ug/m ³)	24	12:00 PM	<input type="checkbox"/>
CO (ppbv)	334	12:00 PM	<input checked="" type="checkbox"/>
SO ₂ (ppbv)	6.45	12:00 PM	<input type="checkbox"/>
CO ₂ (ppmv)	391	12:00 PM	<input type="checkbox"/>
NO (ppbv)	9.3	12:00 PM	<input type="checkbox"/>
NO _y (ppbv)	22.4	12:00 PM	<input type="checkbox"/>

[Generate Custom Plots from Archived Data](#) 1 Day

Current Relative Ozone Levels

Relative Ozone Levels Chart Comparison

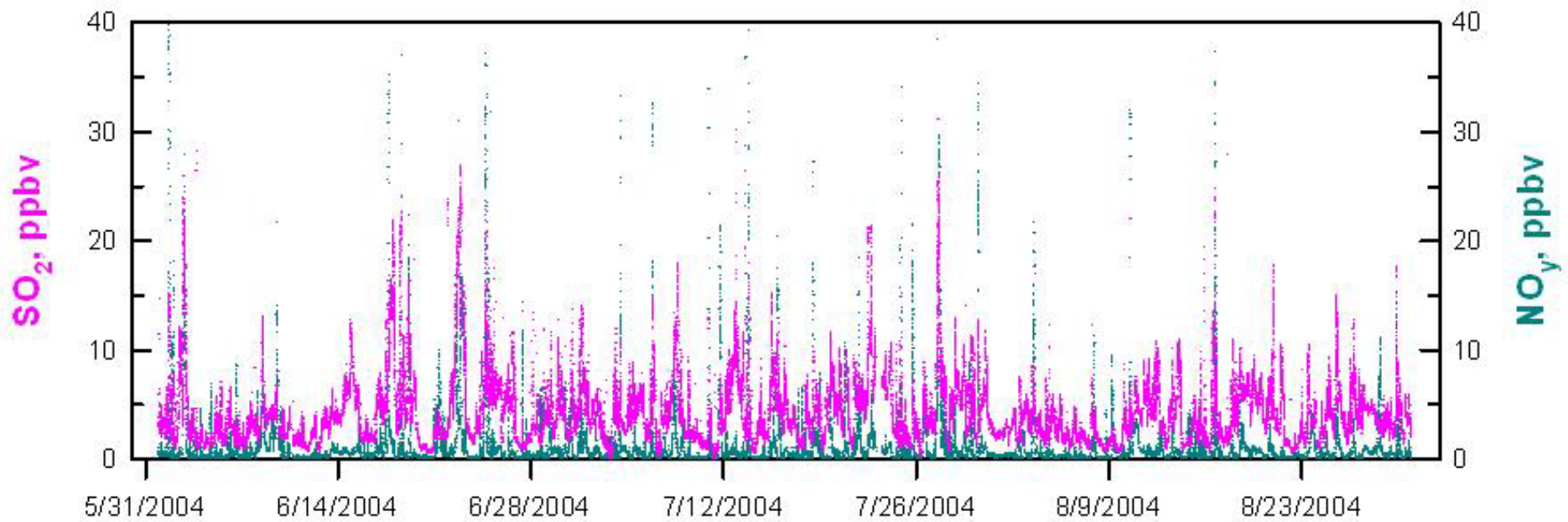
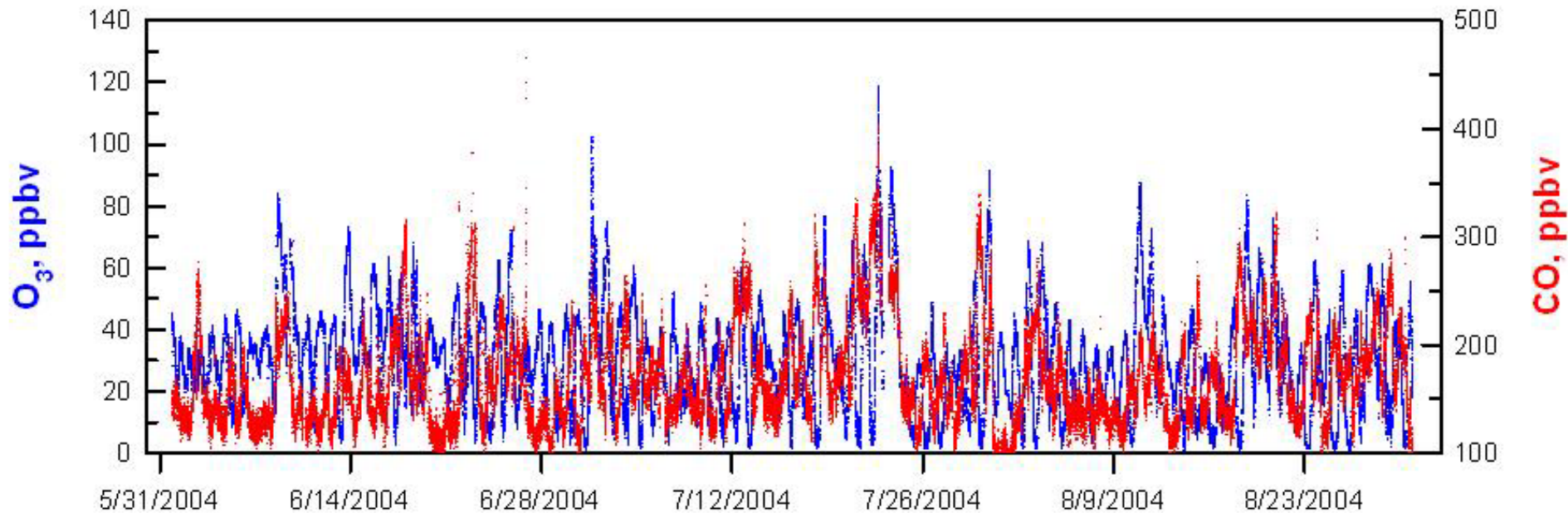
Good Moderate Unhealthy (Sensitive Group) Unhealthy Very Unhealthy Hazardous

Thompson Farm Meteorological Data 10-DEC

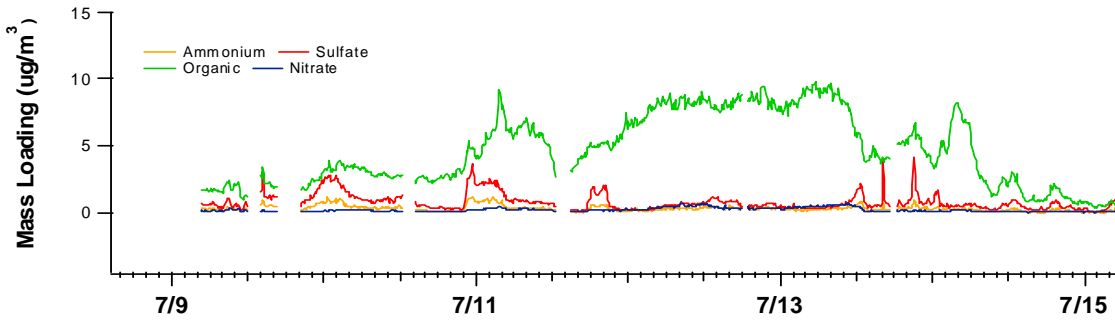
airmap.unh.edu



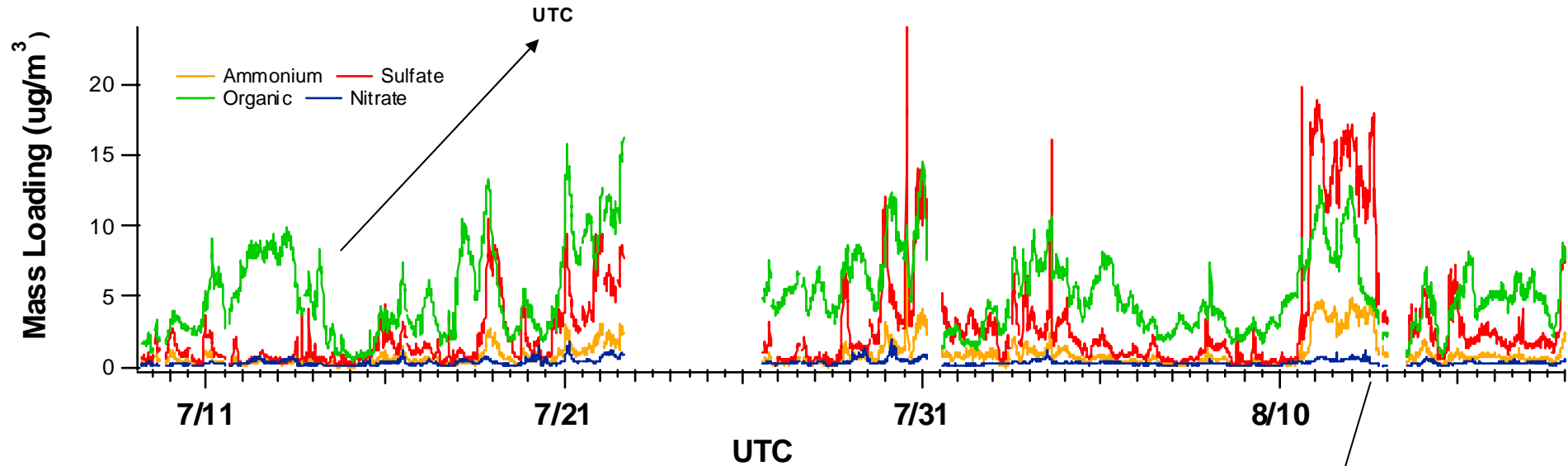
General Distributions at Thompson Farm



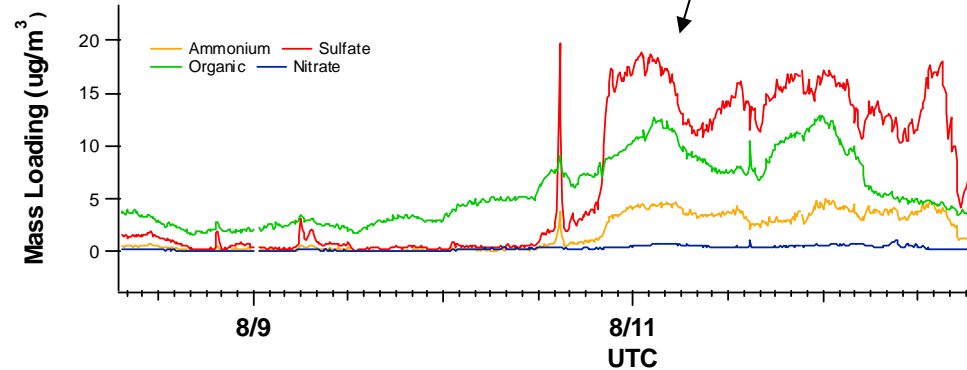
AMS Measurements at Thompson Farm



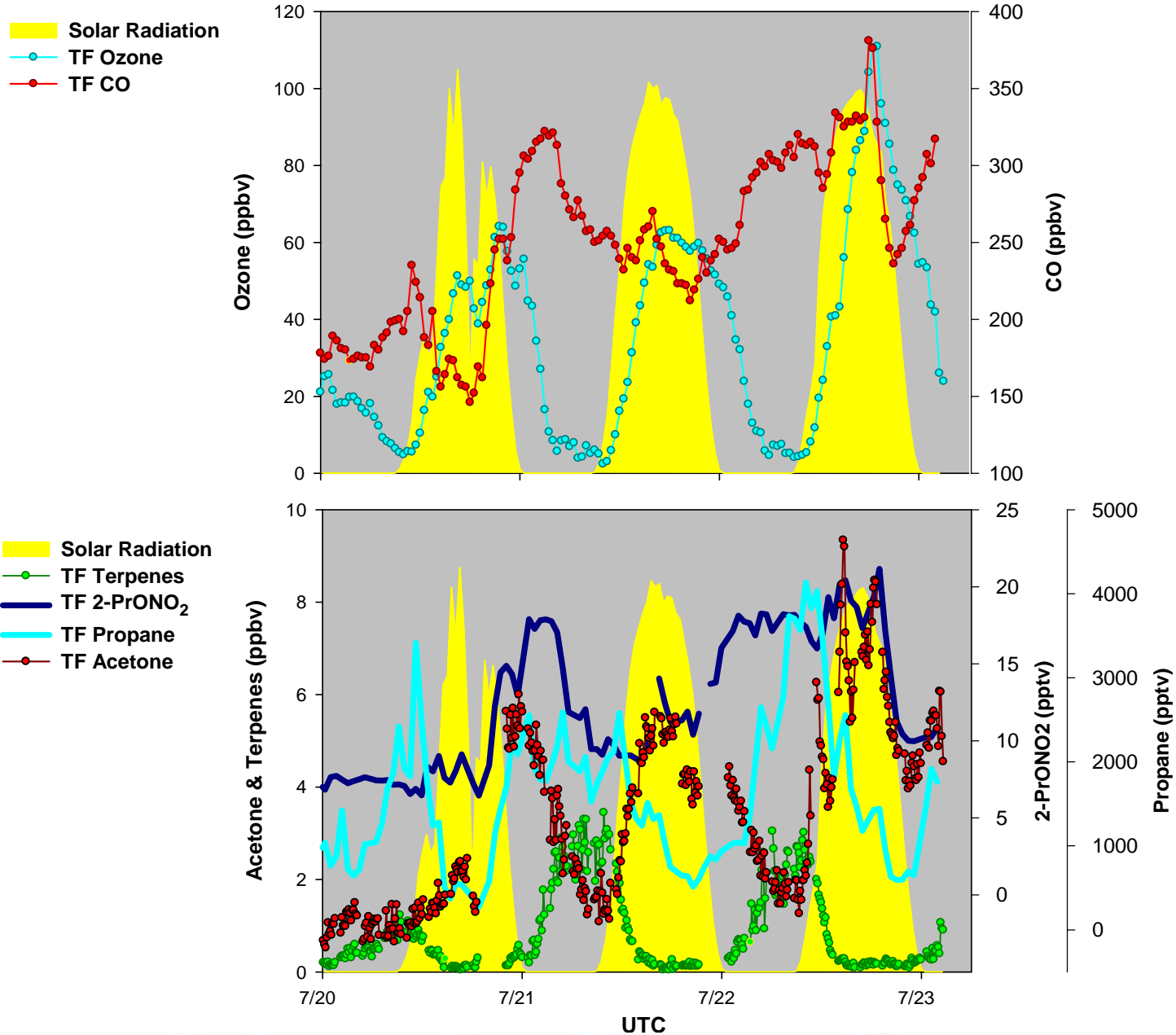
High organic, low sulfate event
Evidence for Alaskan wildfires



Large Sulfate and Organic Loadings
Acidic Sulfate
Highly processed organics

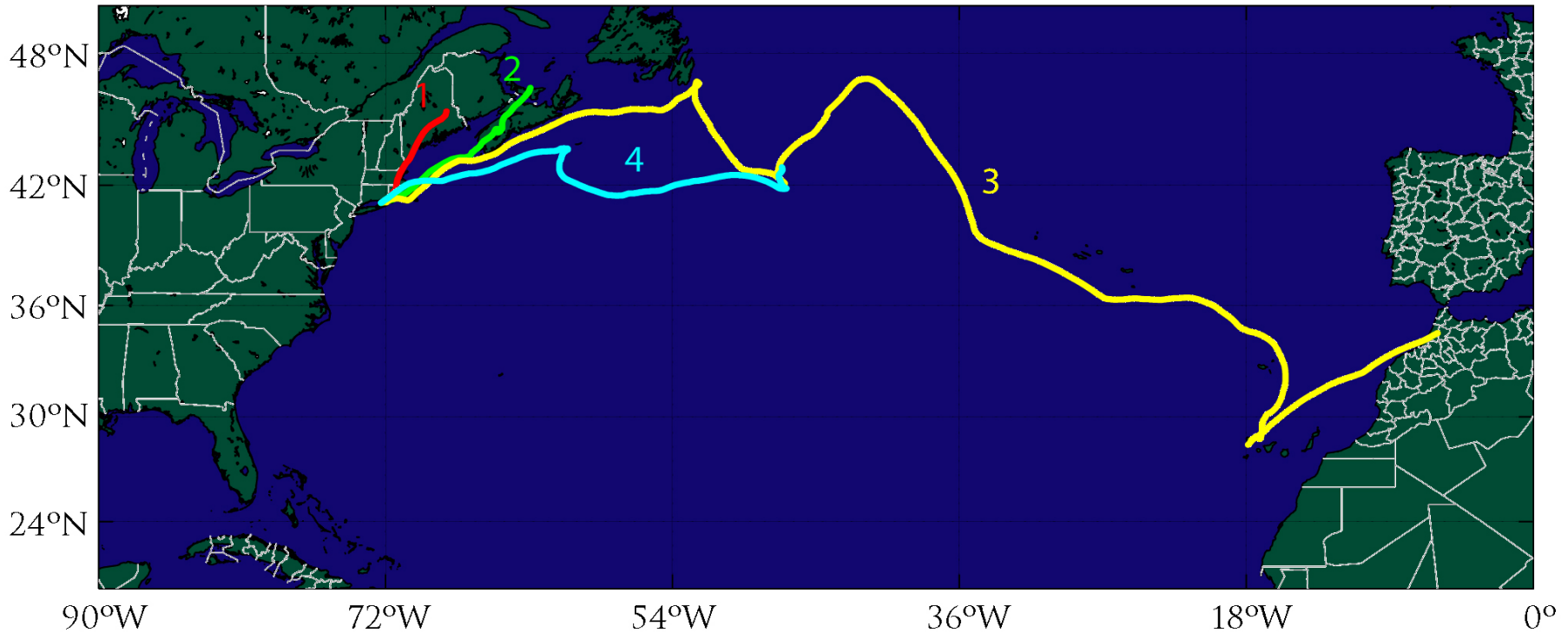


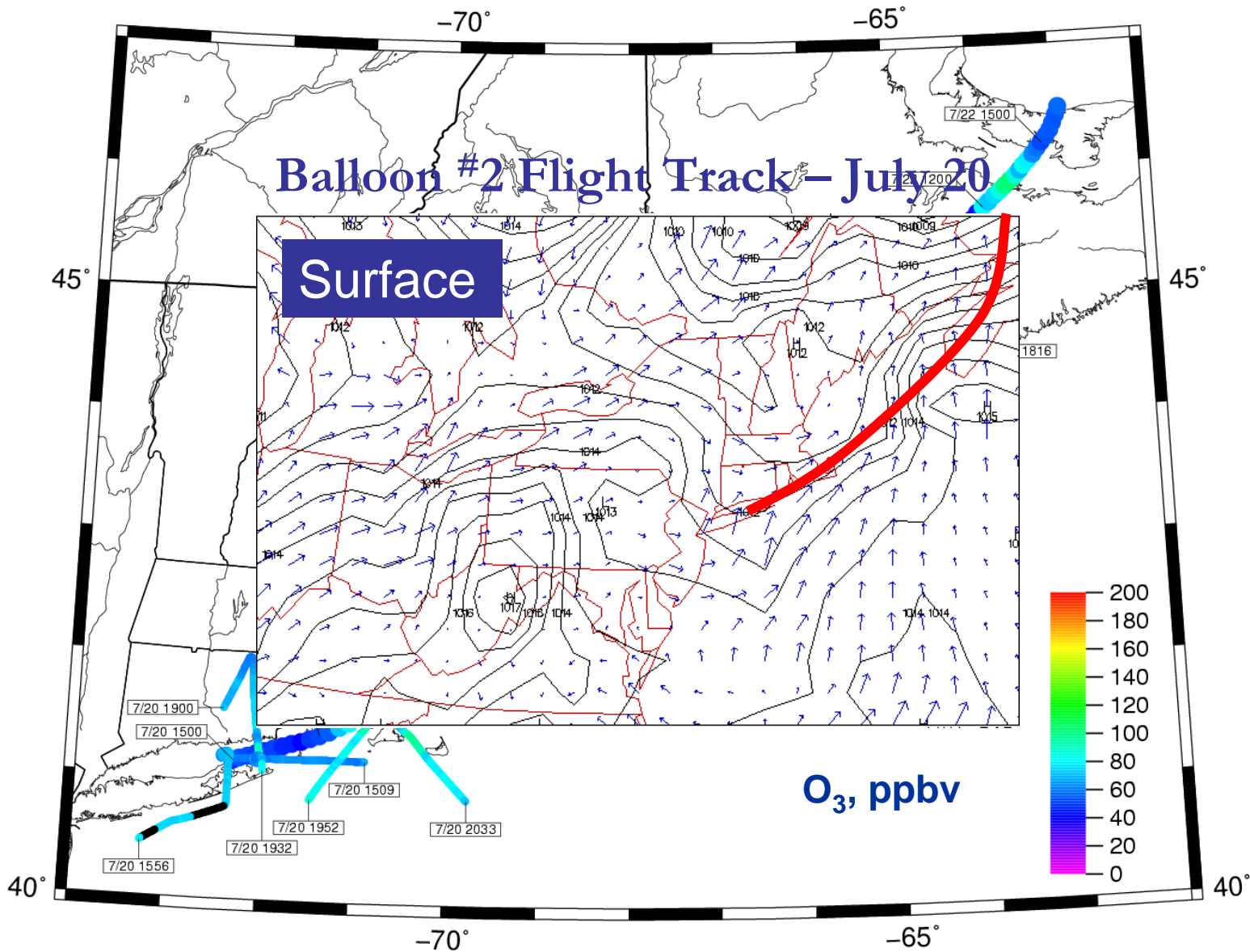
Ozone Event at Thompson Farm



Balloon Flight	Duration hrs. (d)	Distance Traveled (km)
1	21 (0.88)	568
2	49 (2.0)	1030
3	295 (12.3)	6780
4	85 (3.5)	2530

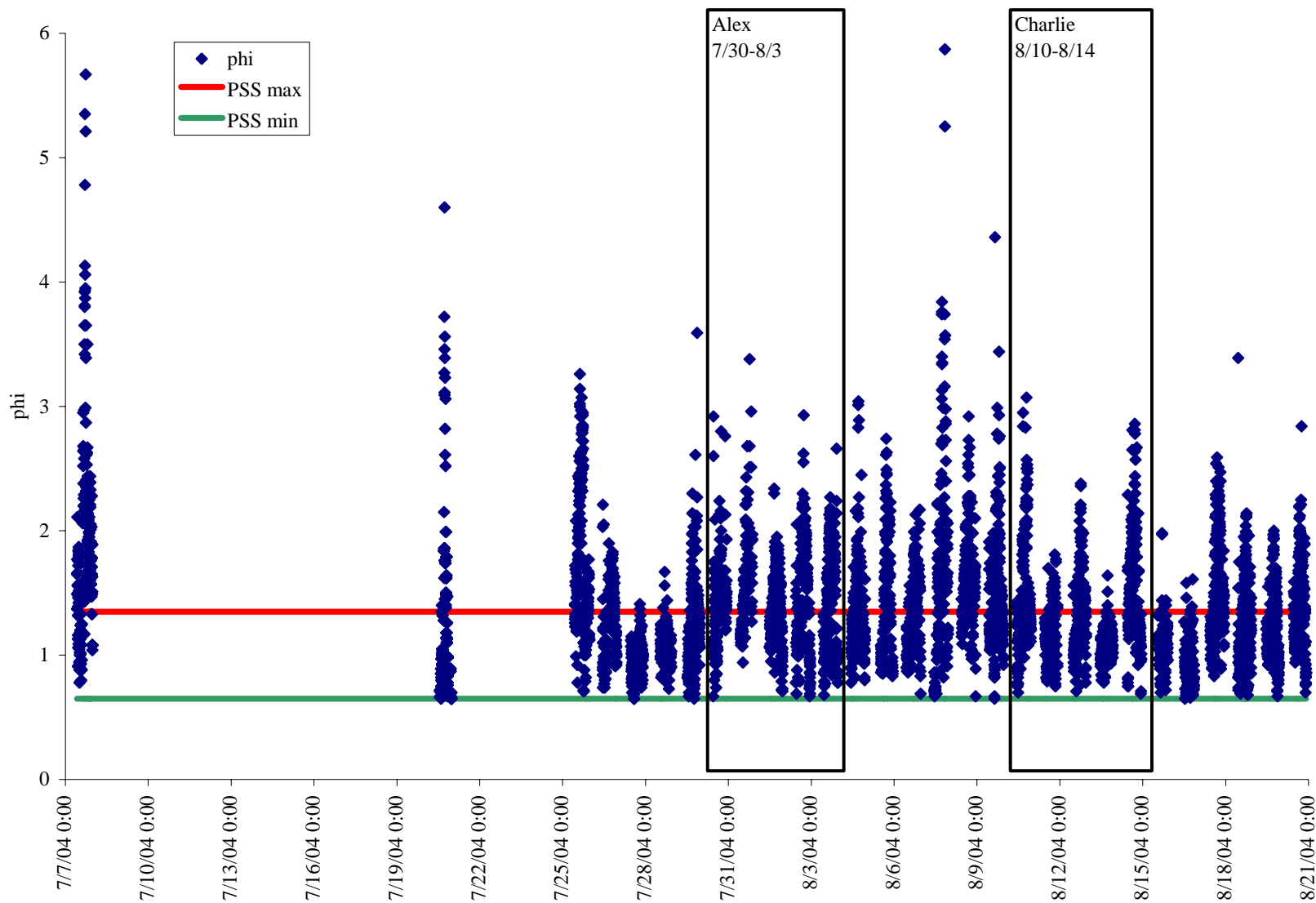
SMART BALLOON TRACKS





$$\phi = j_{\text{NO}_2}[\text{NO}_2]/k_{\text{NO-O}_3}[\text{NO}][\text{O}_3]$$

Consistent Deviation from PSSA

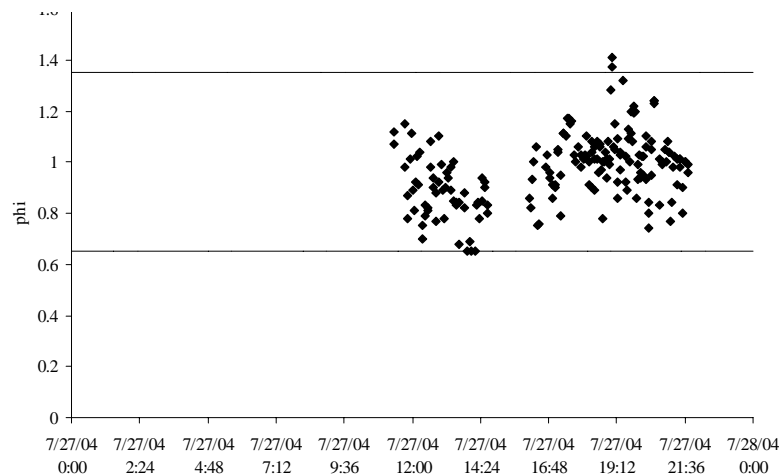
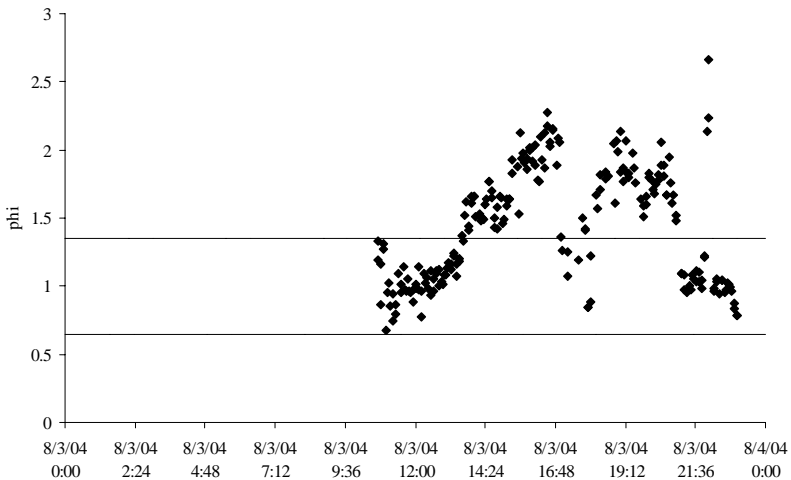
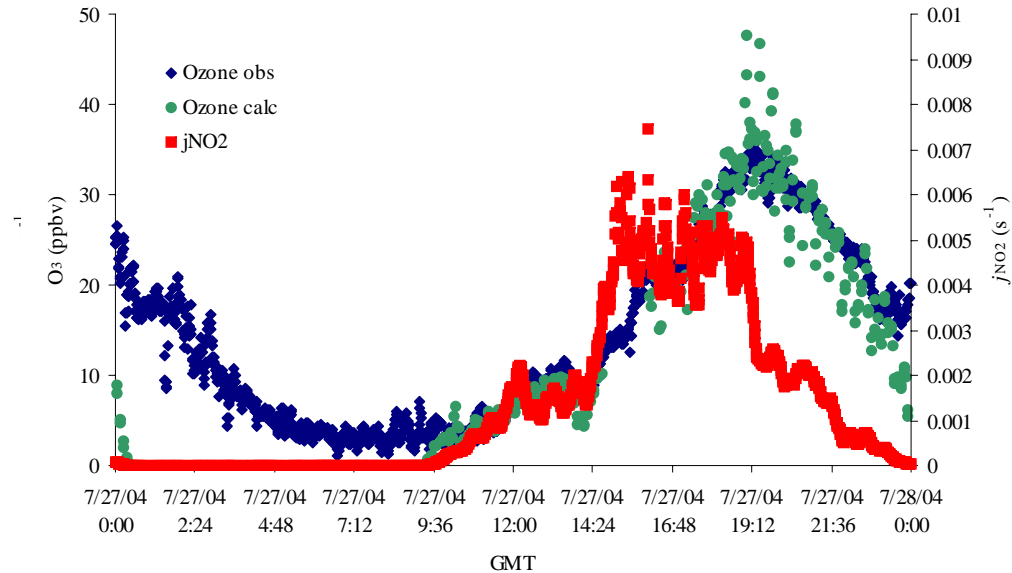
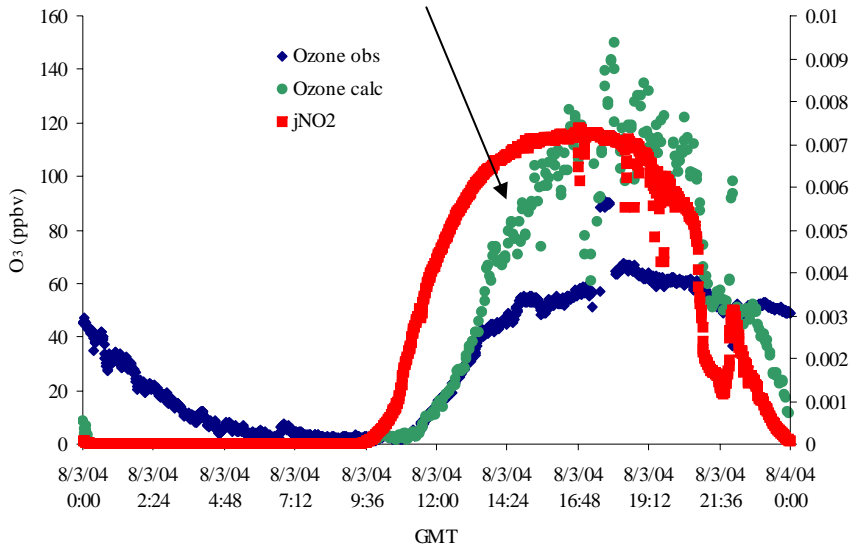


$$\phi = j_{\text{NO}_2}[\text{NO}_2]/k_{\text{NO-O}_3}[\text{NO}][\text{O}_3]$$

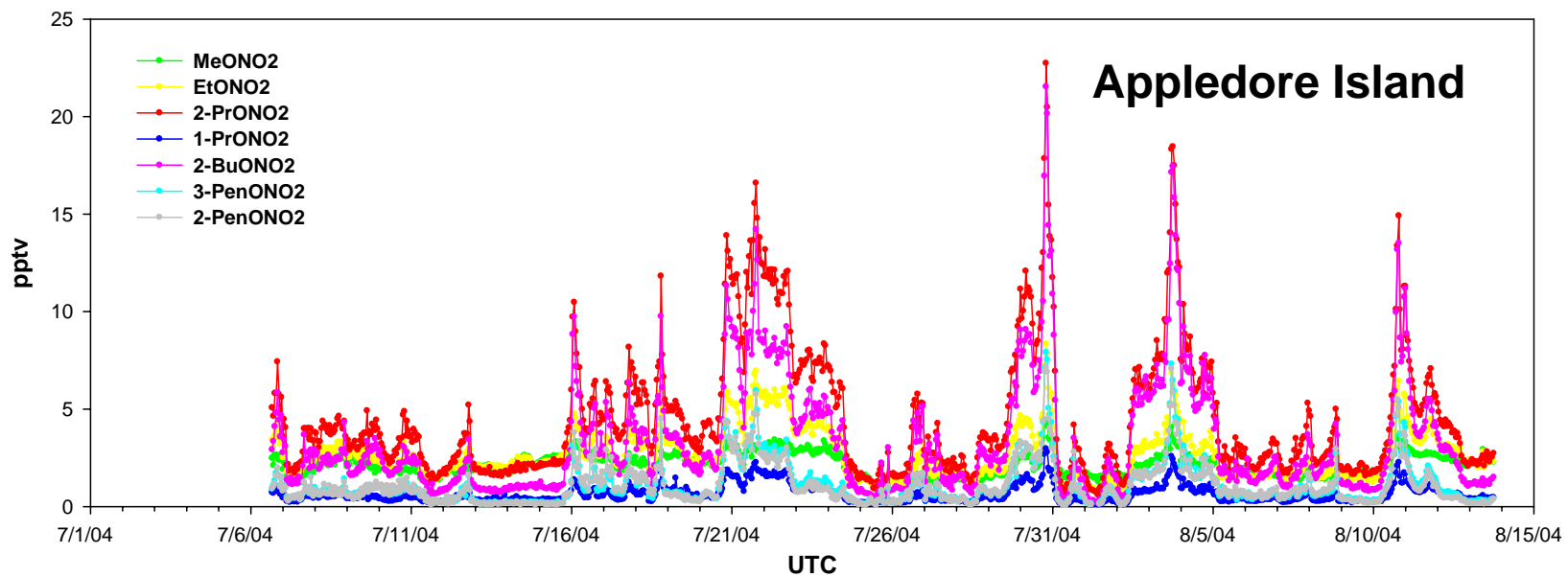
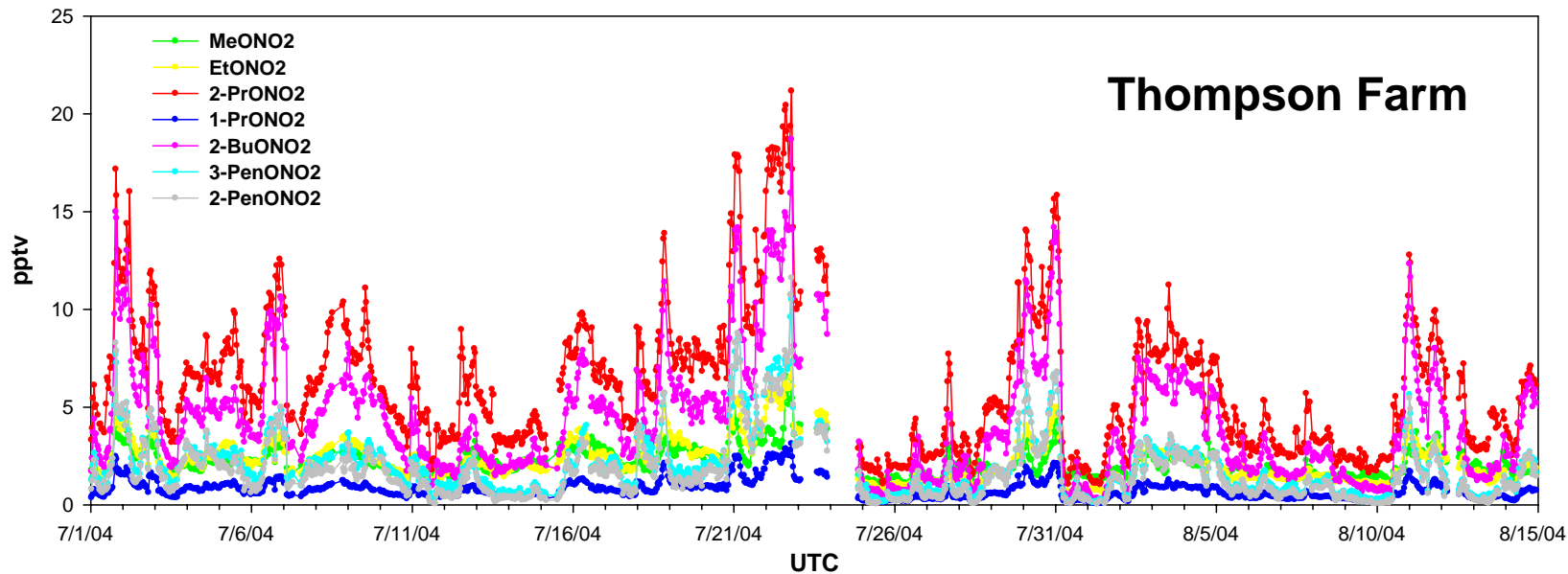
Example of Deviation

PSSA Agreement

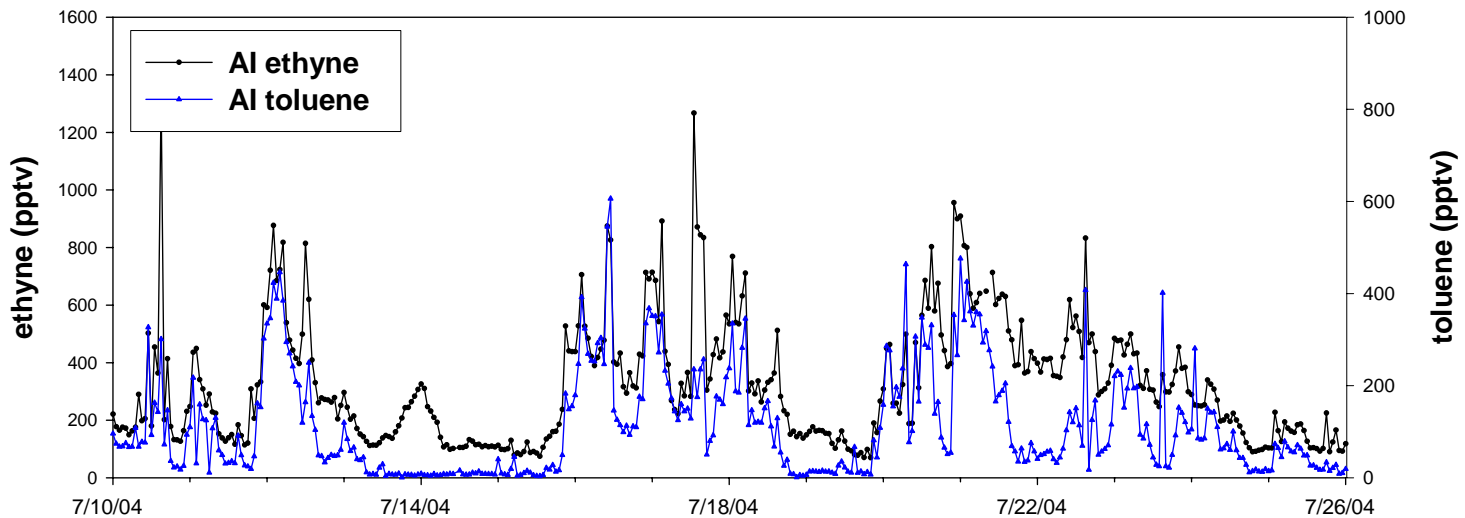
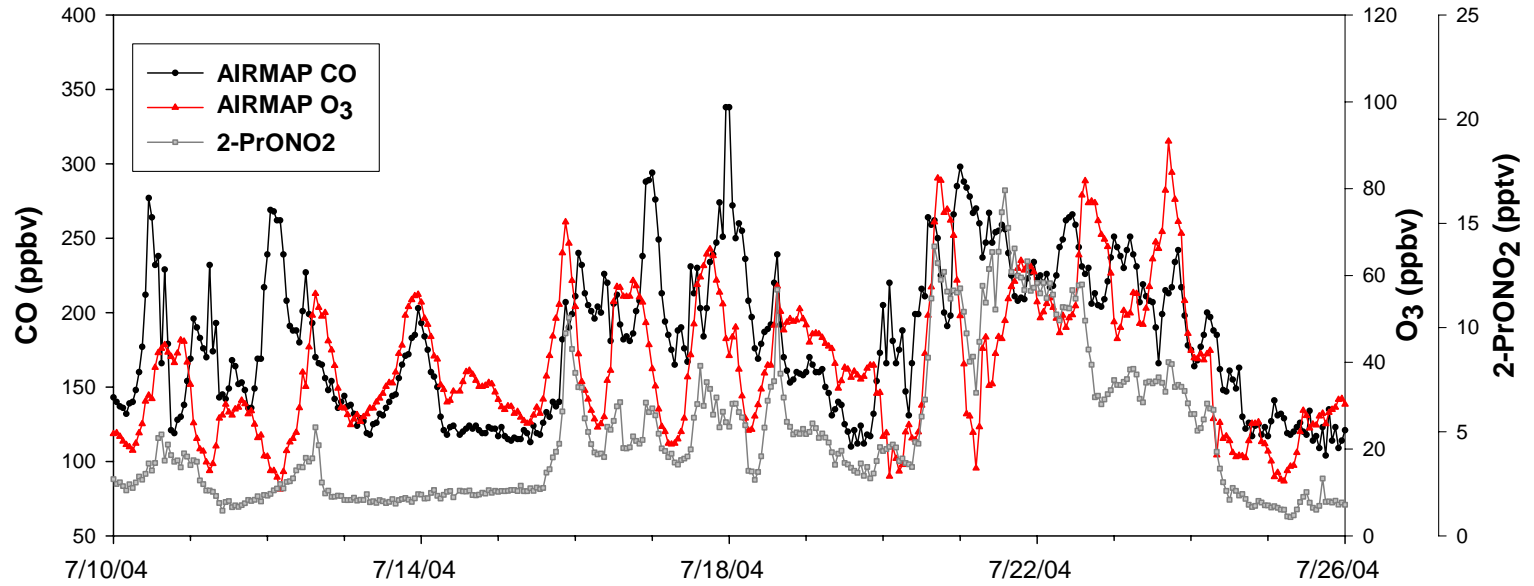
Over prediction of ozone when not in PSS



General Distributions at Thompson Farm and Appledore Island



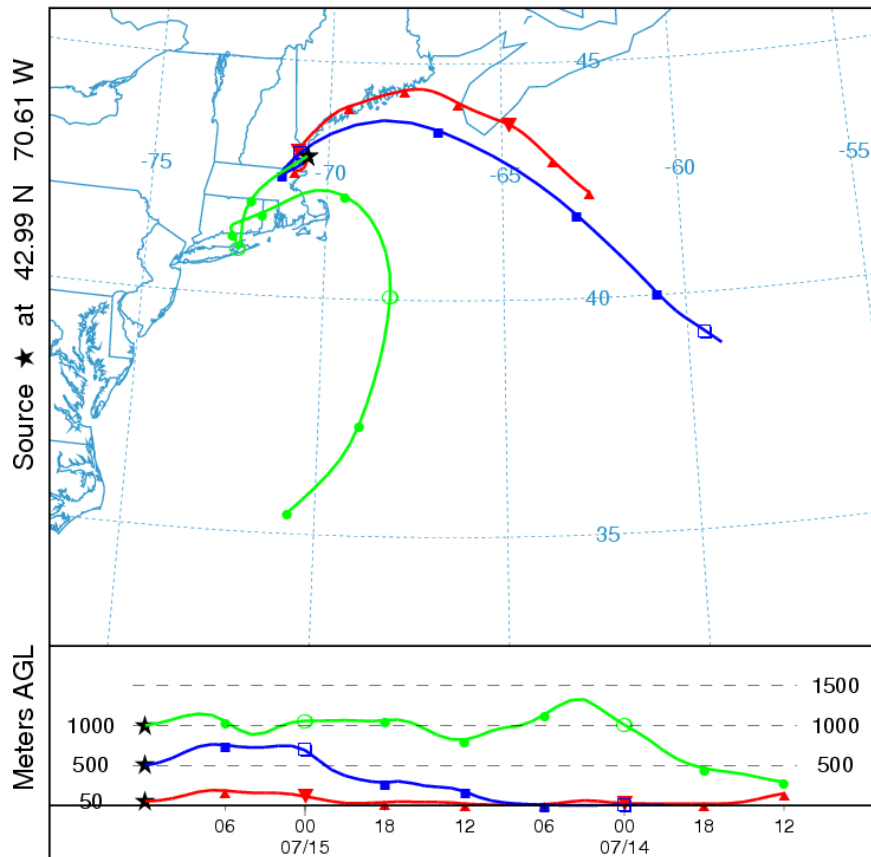
Pollutant Outflow at Appledore Island



Back-Trajectories

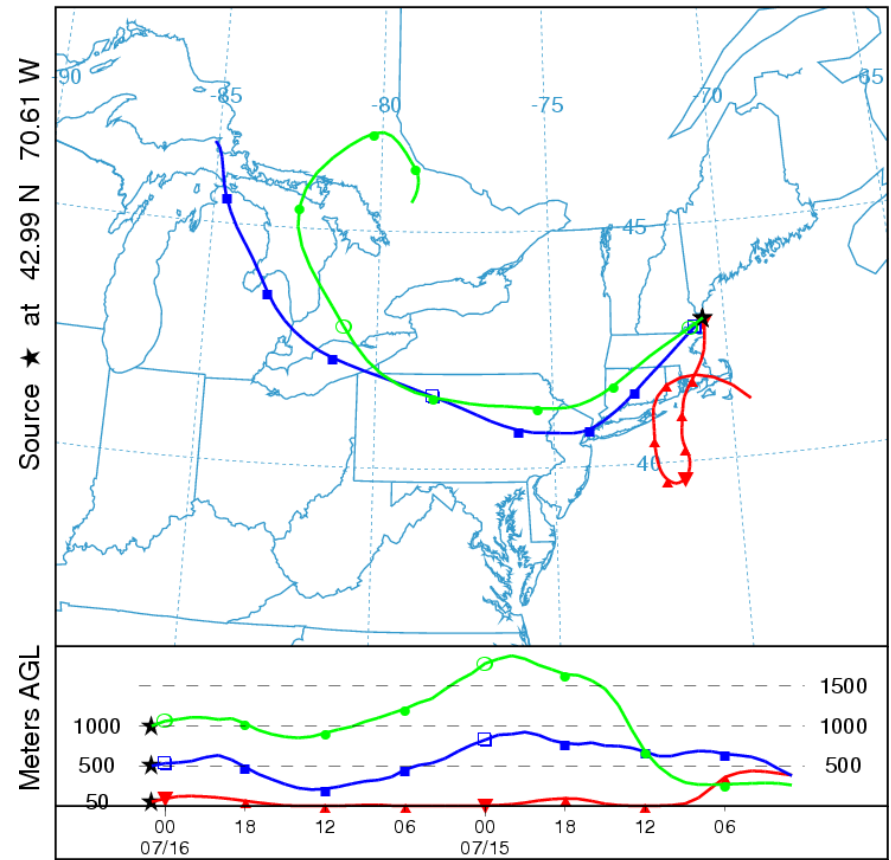
Clean Period
8am EDT 7/15/04

NOAA HYSPLIT MODEL
Backward trajectories ending at 12 UTC 15 Jul 04
EDAS Meteorological Data

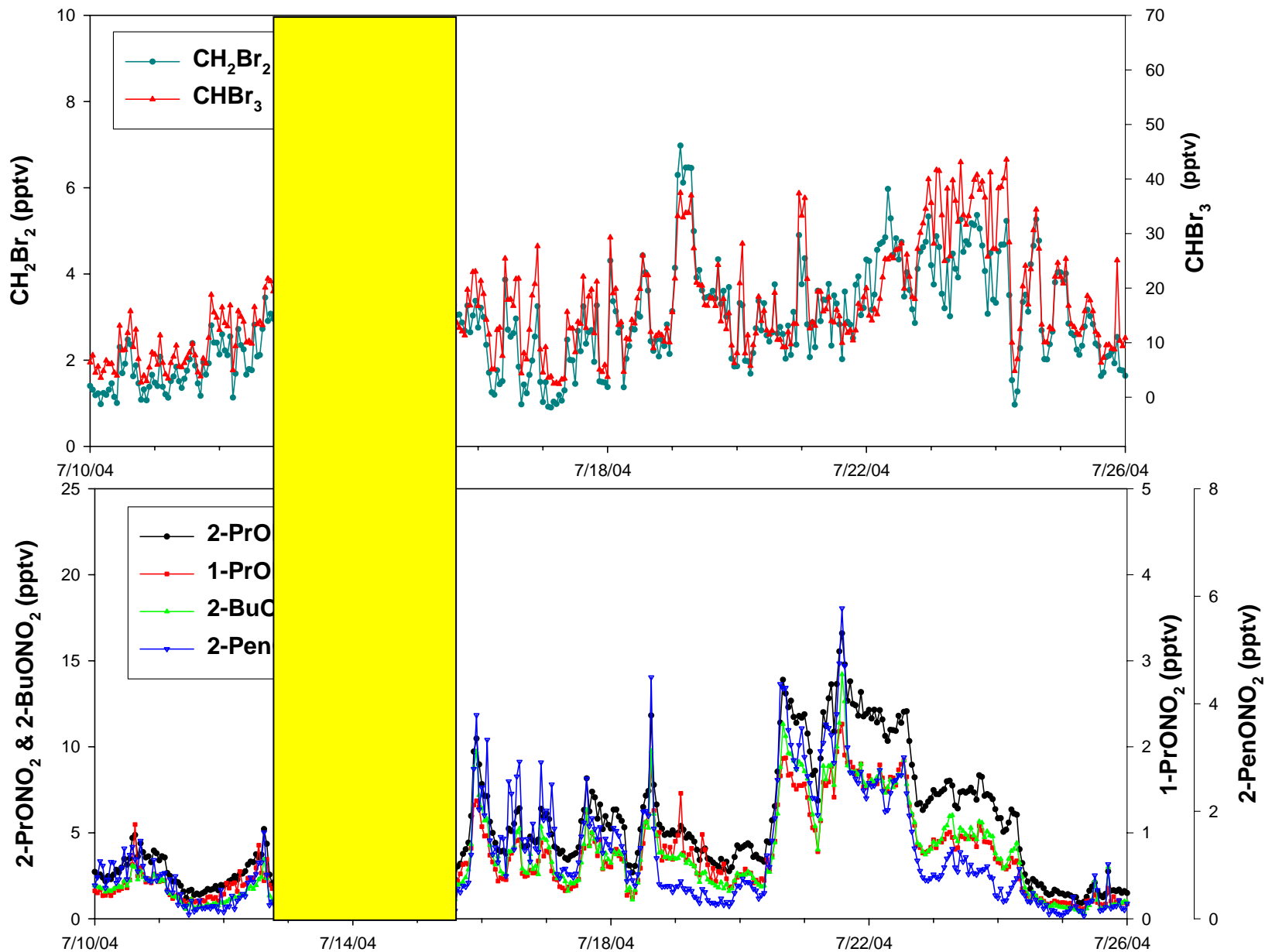


Polluted Nocturnal Period
9pm EDT 7/15/04

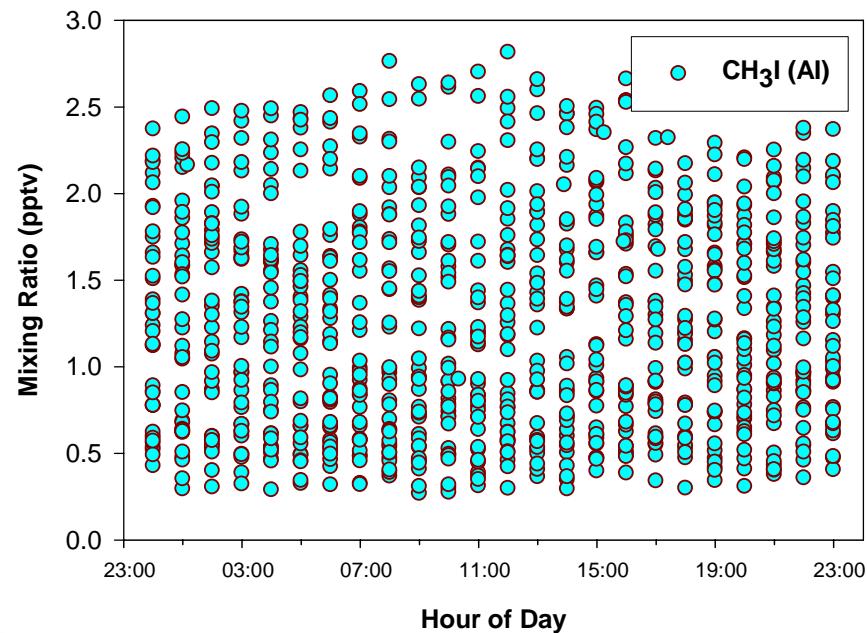
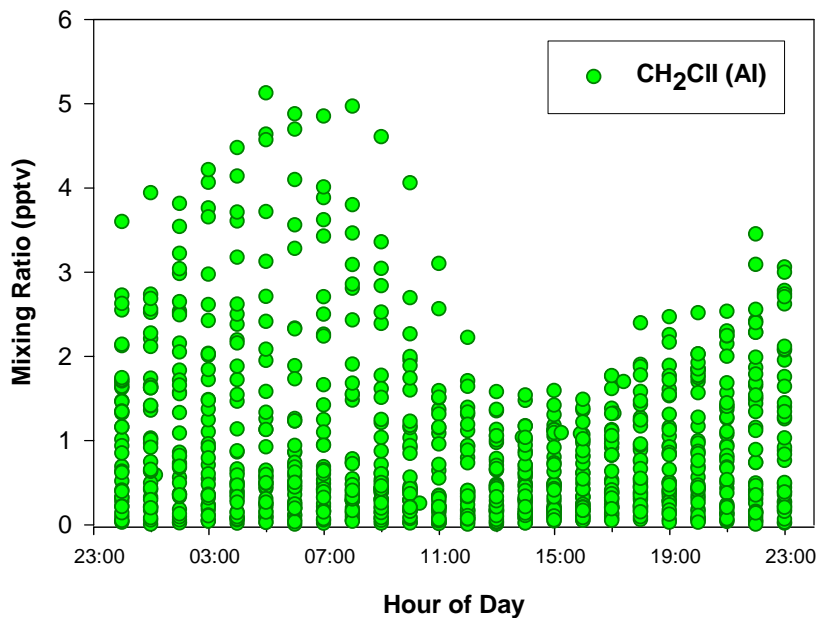
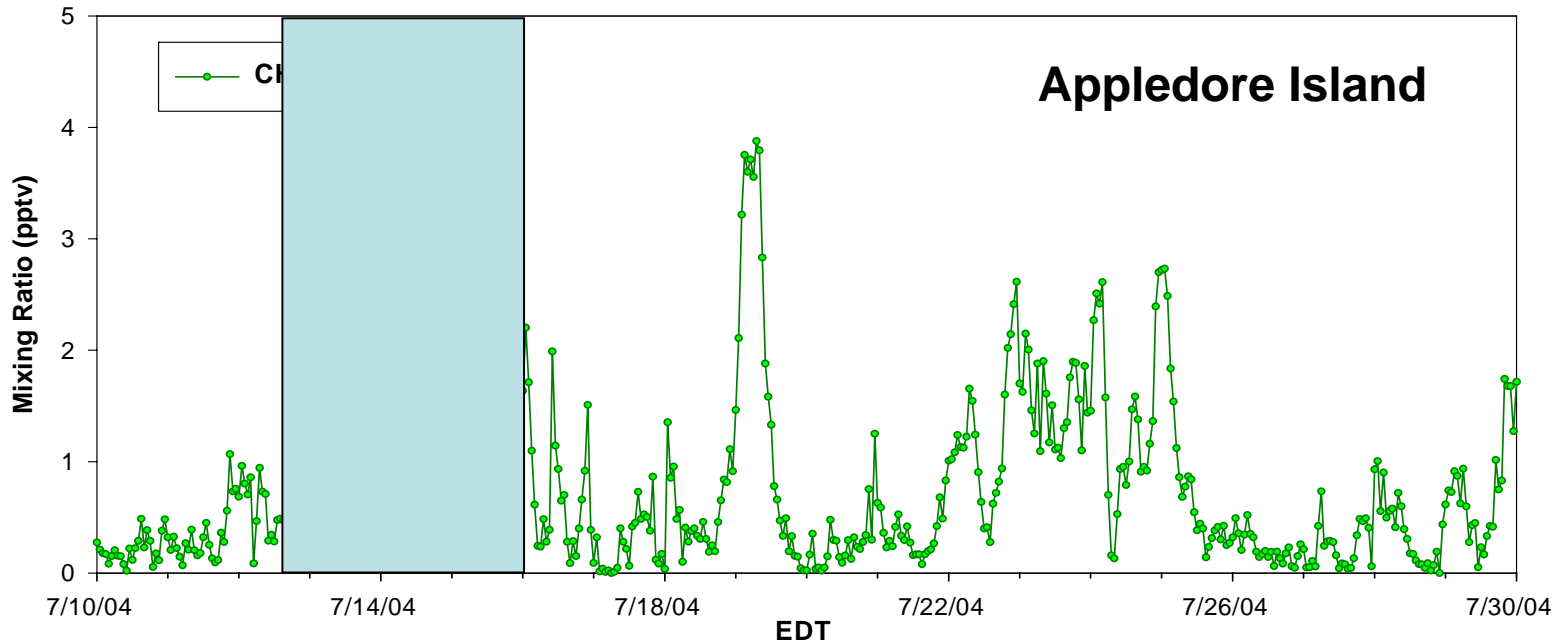
NOAA HYSPLIT MODEL
Backward trajectories ending at 01 UTC 16 Jul 04
EDAS Meteorological Data



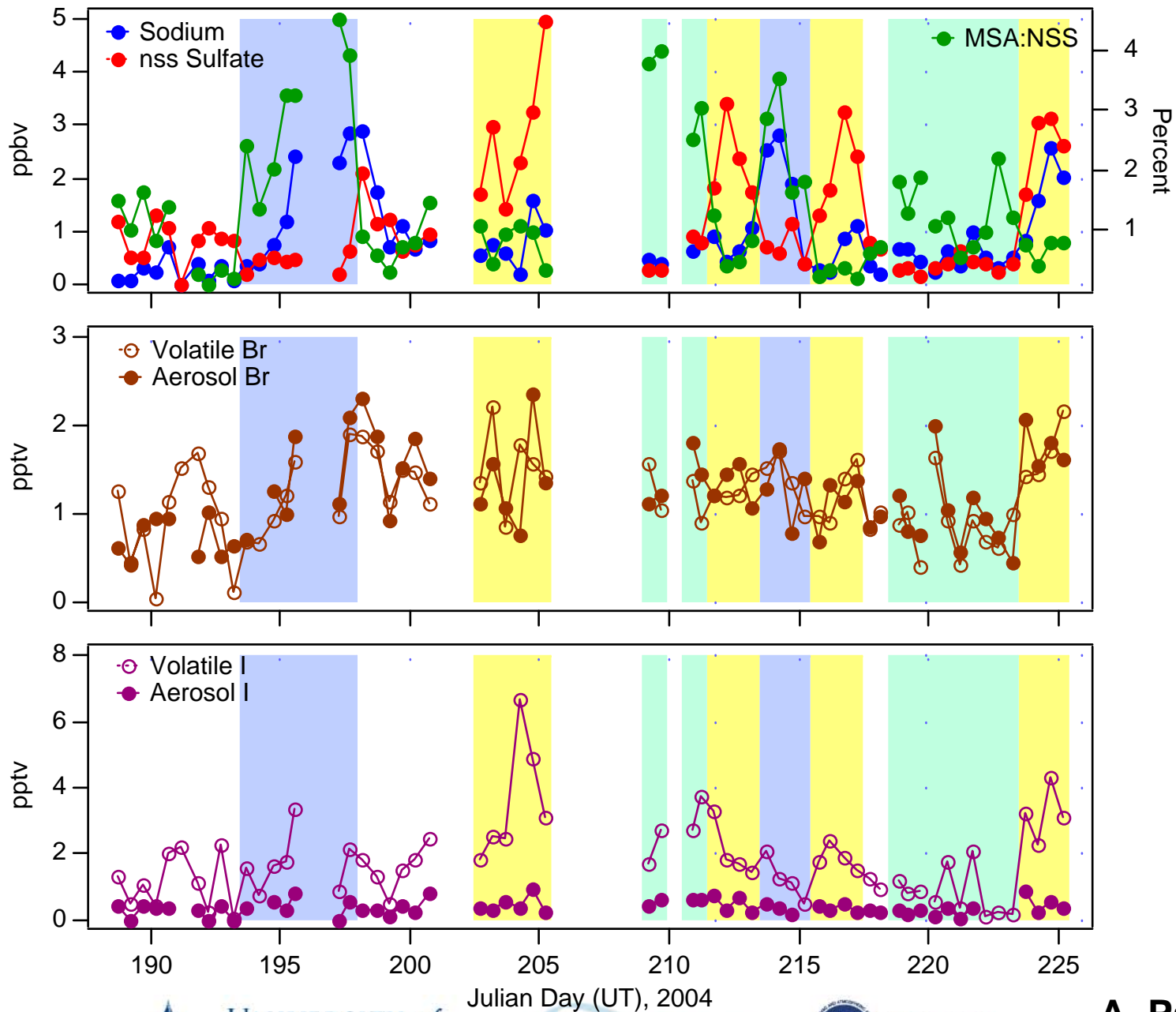
Pollutant Outflow at Appledore Island



Pollutant Outflow at Appledore Island

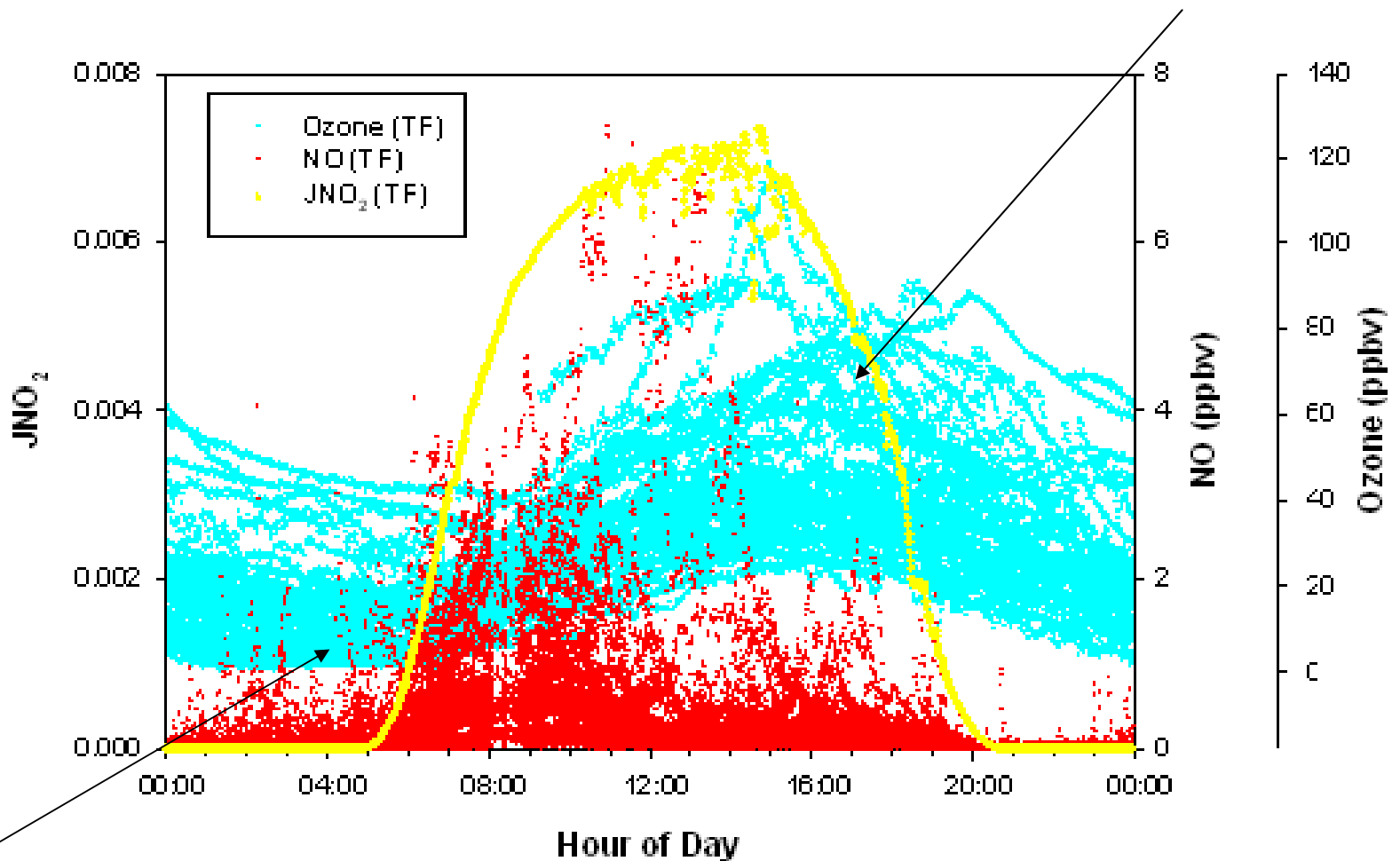


Pollutant Outflow at Appledore Island



Diurnal Cycles at Thompson Farm

Ozone peaks in the late afternoon

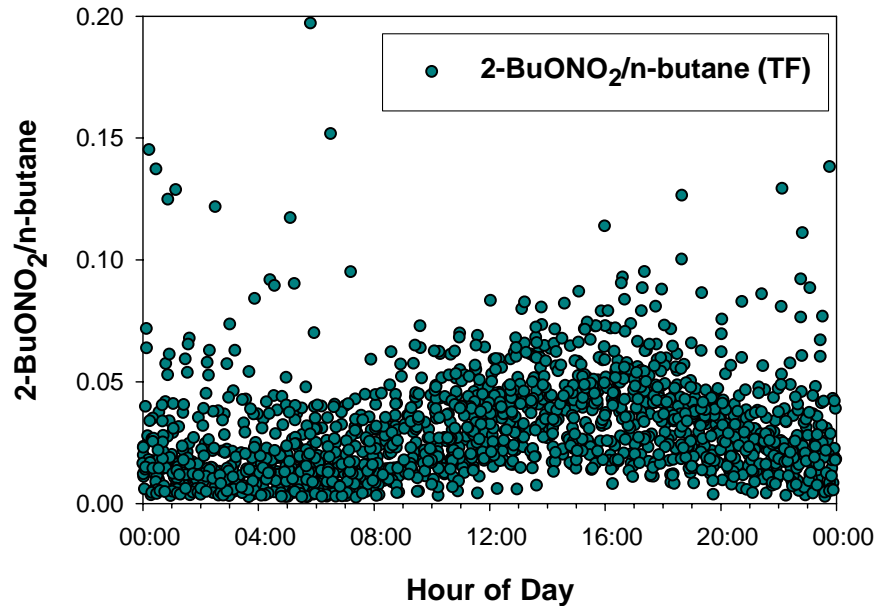
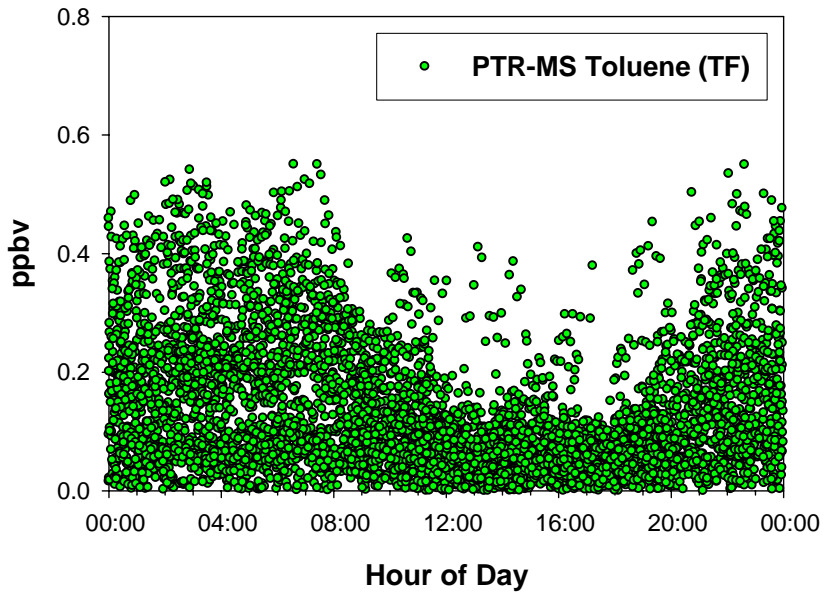
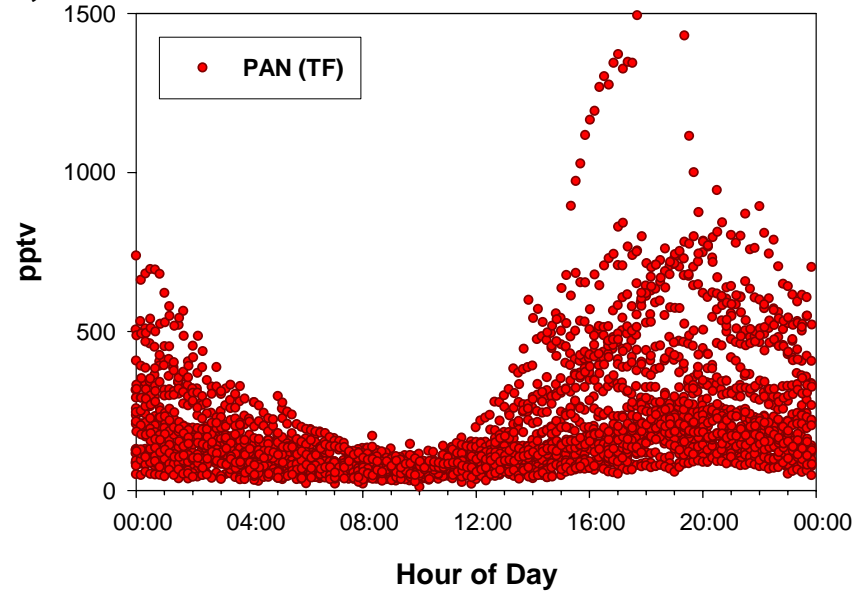
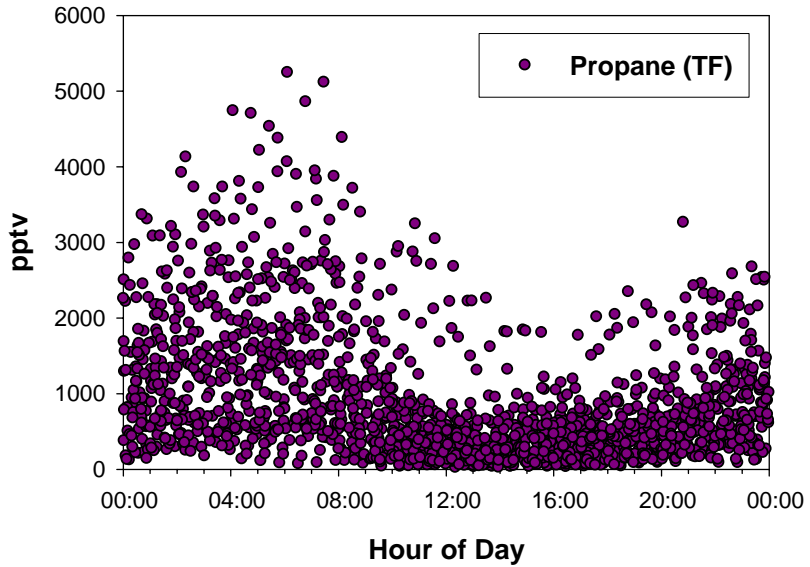


Ozone regularly drops to zero

July 1 to August 15, 2004

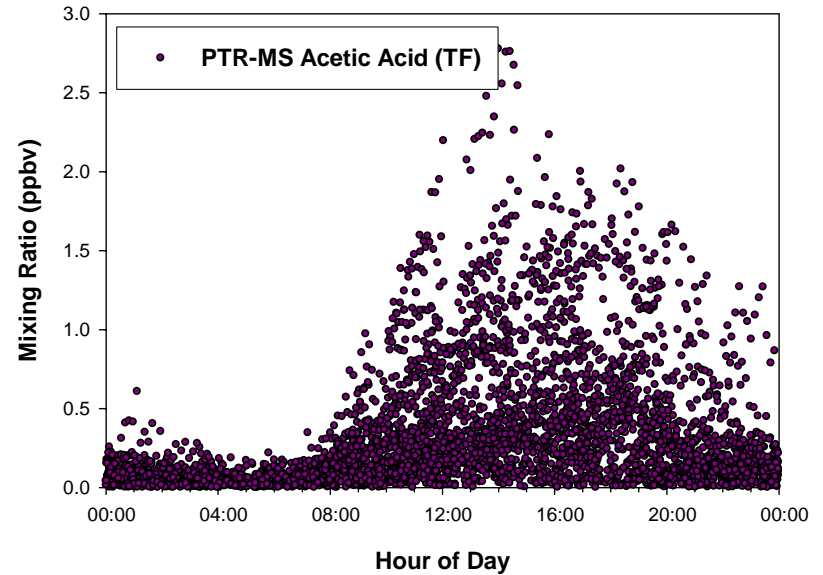
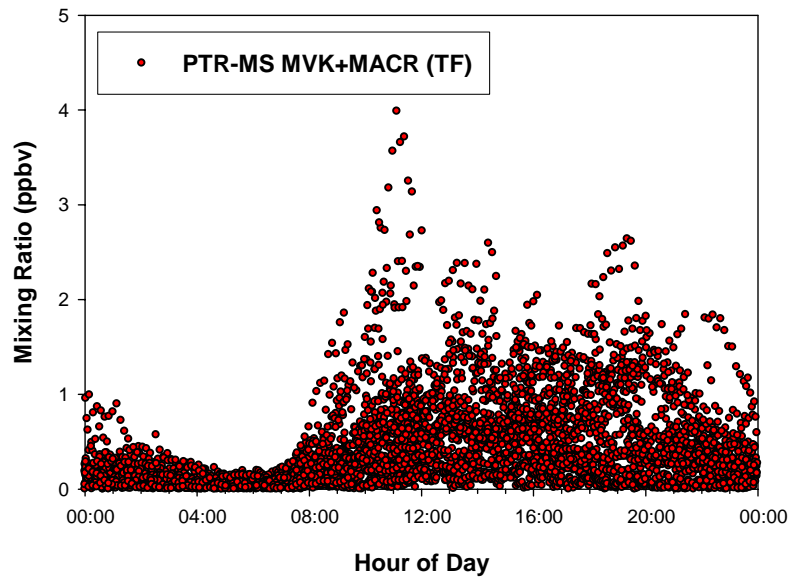
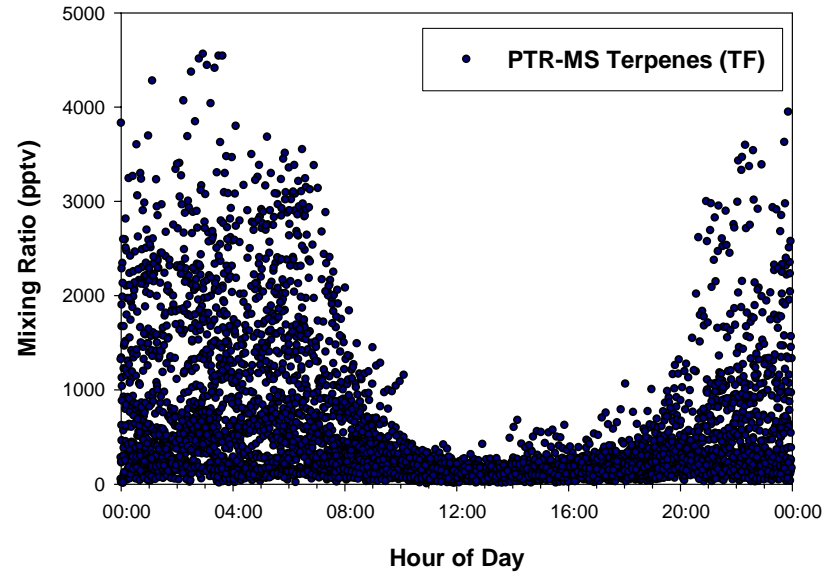
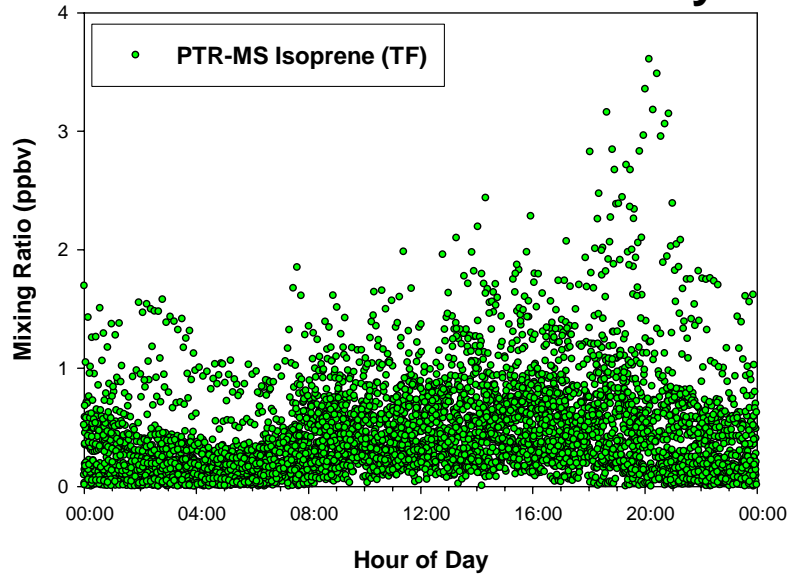
Diurnal Cycles at Thompson Farm

July-August, 2004

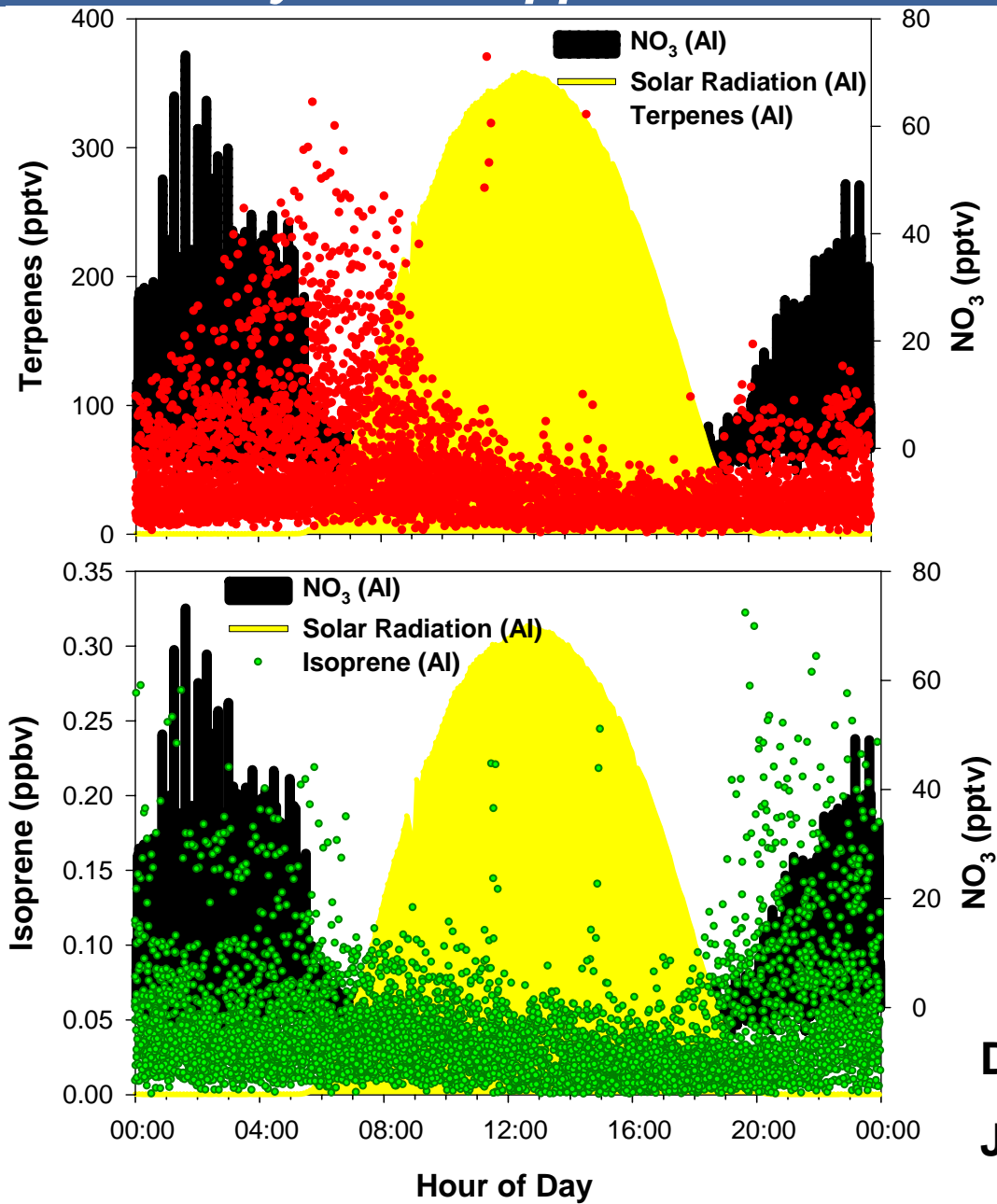


Diurnal Cycles at Thompson Farm

July-August, 2004



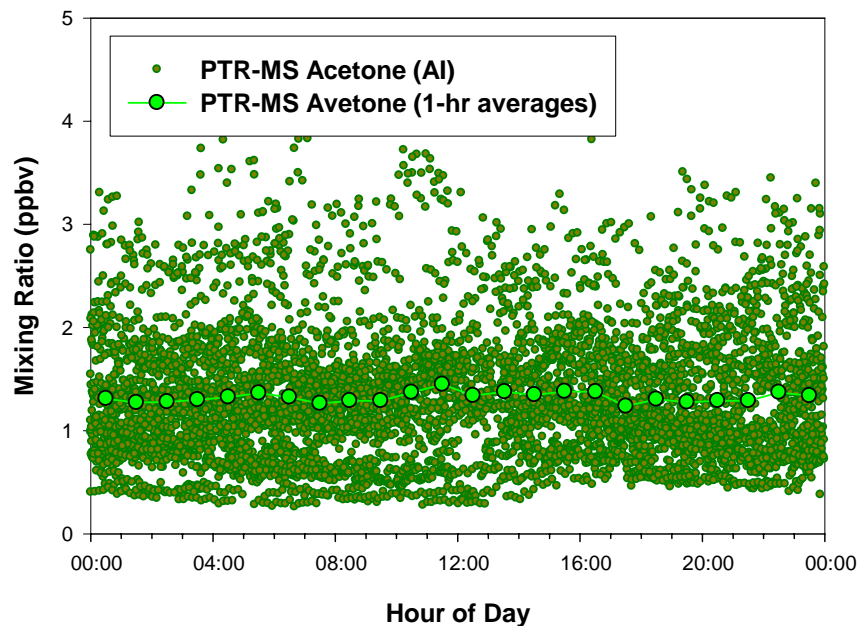
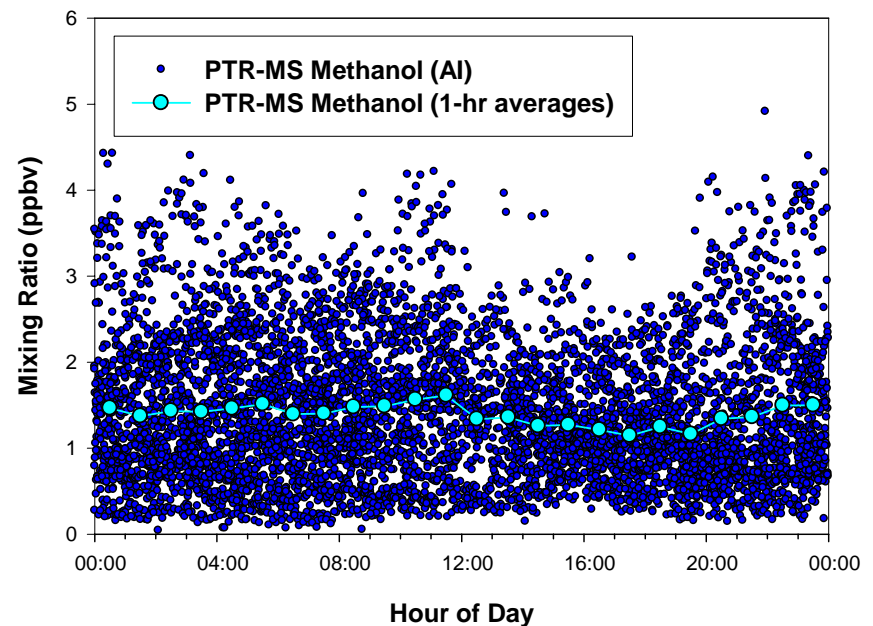
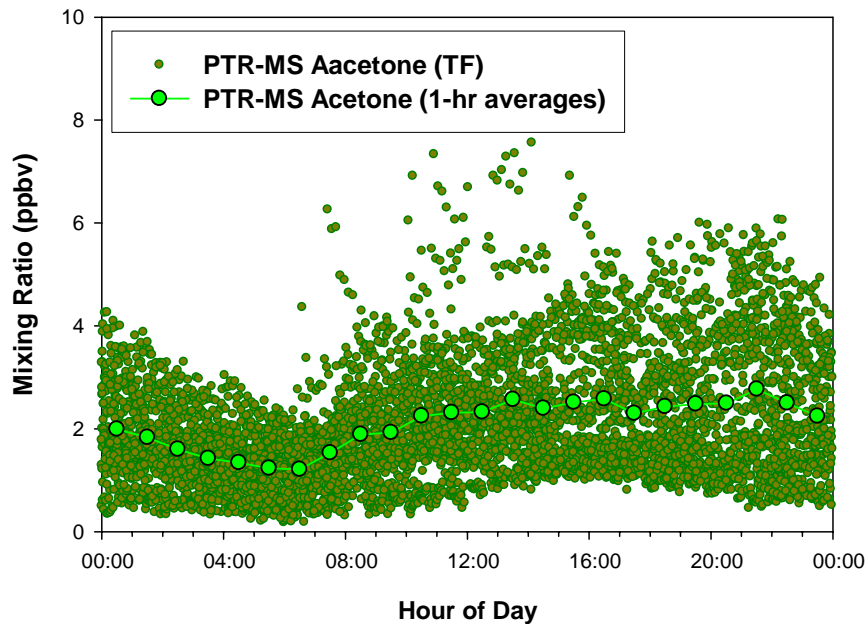
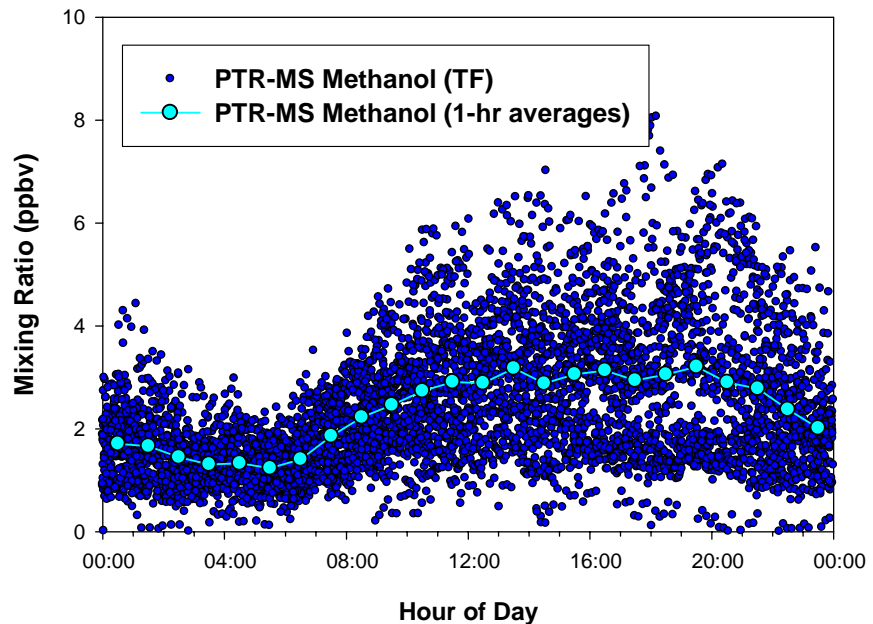
Diurnal Cycles at Appledore Island



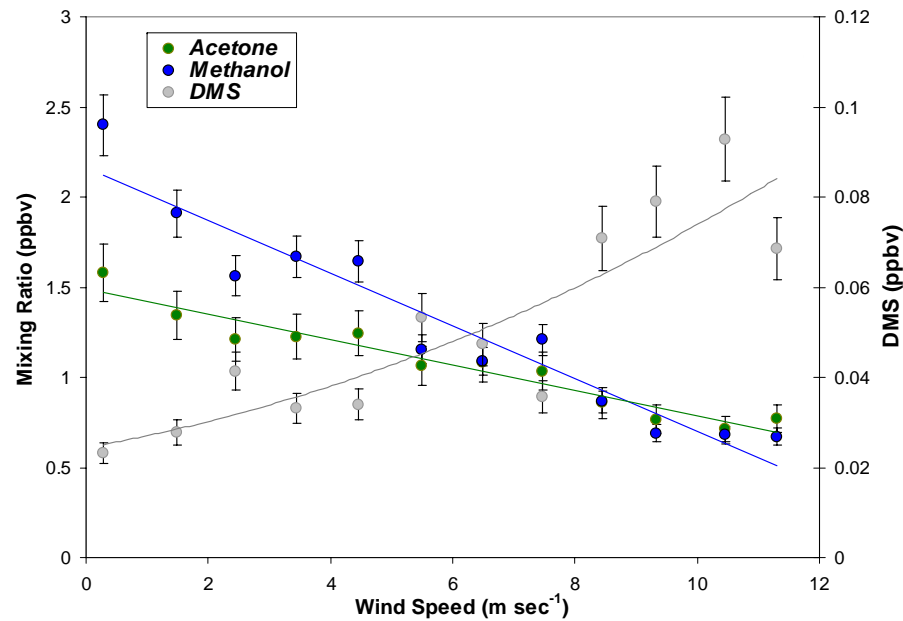
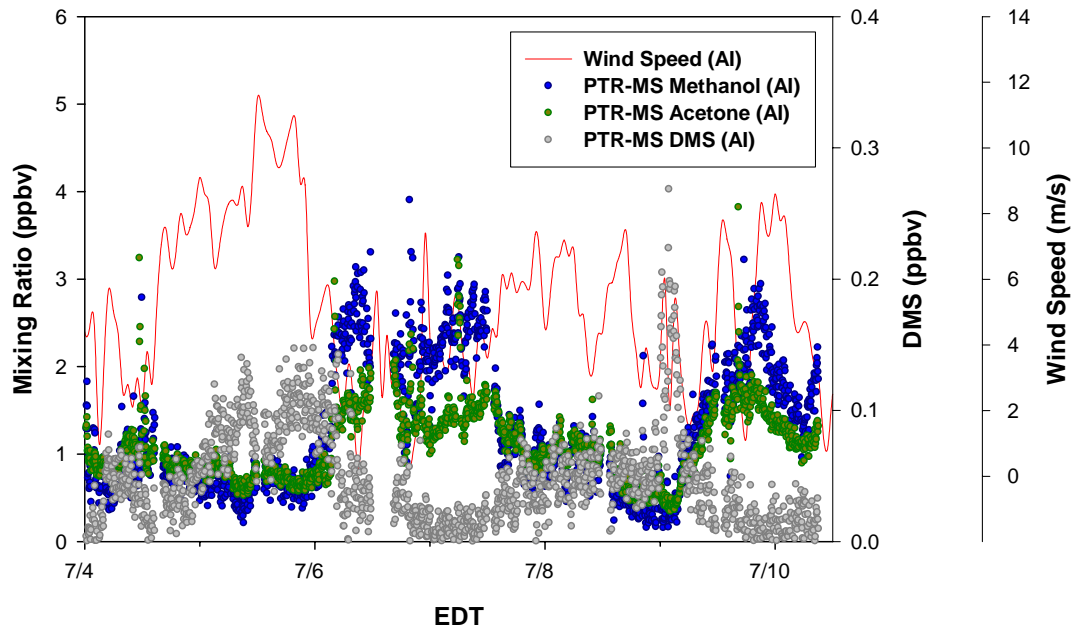
DOAS NO₃ data

J. Stutz - UCLA

Diurnal Cycles at Thompson Farm and Appledore Island



Ocean Uptake at Appledore Island



Acknowledgements

AIRMAP Investigators

Robert Talbot – Director

Ruth Varner

Rob Griffin

Alex Pszenny

Huiting Mao

Graduate Students

Yong Zhou – UNH

Rachel Russo – UNH

Carsten Neilsen – UNH

Asako Enomoto – UNH

Justine Kombarakkaran – NMT

Marguerite White – UNH

Pieter Beckman, Kevan Carpenter – Technician

Laura Cottrell – Research Scientist

Don Troop, Yuanli Wang – Engineering

Undergraduates

Jesse Ambrose – UNH

Karl Haase – NMT

Patrick Veres – OSU

Lissa C.M. Ducharme – Data Reduction

Hilary Graves – High School (MA)

Kate Petzak – High School (ME)



Appledore Island Crew

Jochen Stutz – UCLA

Bill Keene – UVA

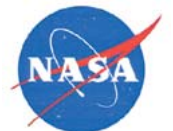
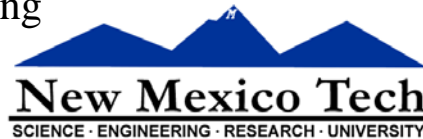
Lynn Russell – UCSD

Roland von Glasow - Heidelberg

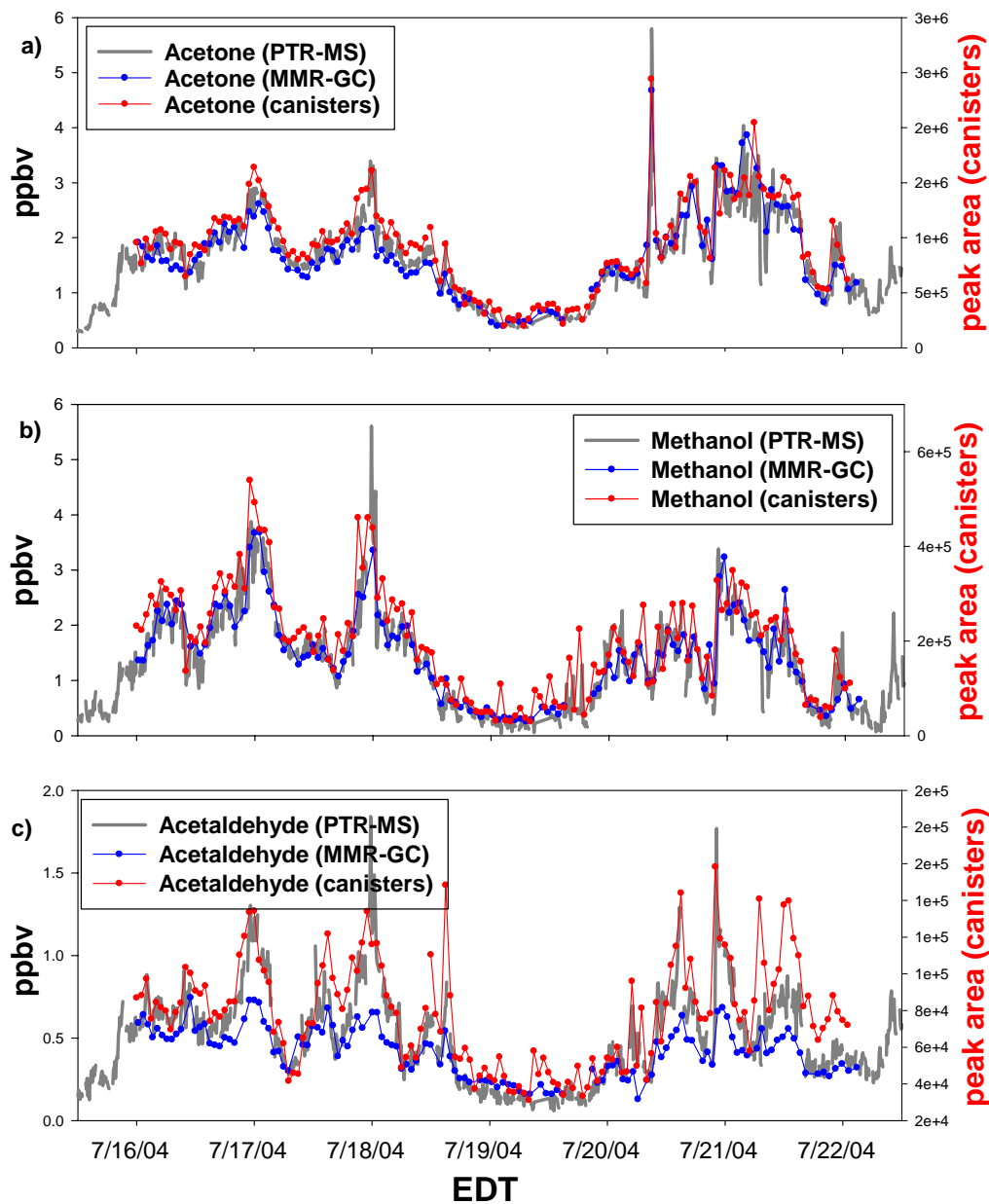
Oliver Wingenter – NMT

Don Blake – UCI

Kevin Gervais – UCI



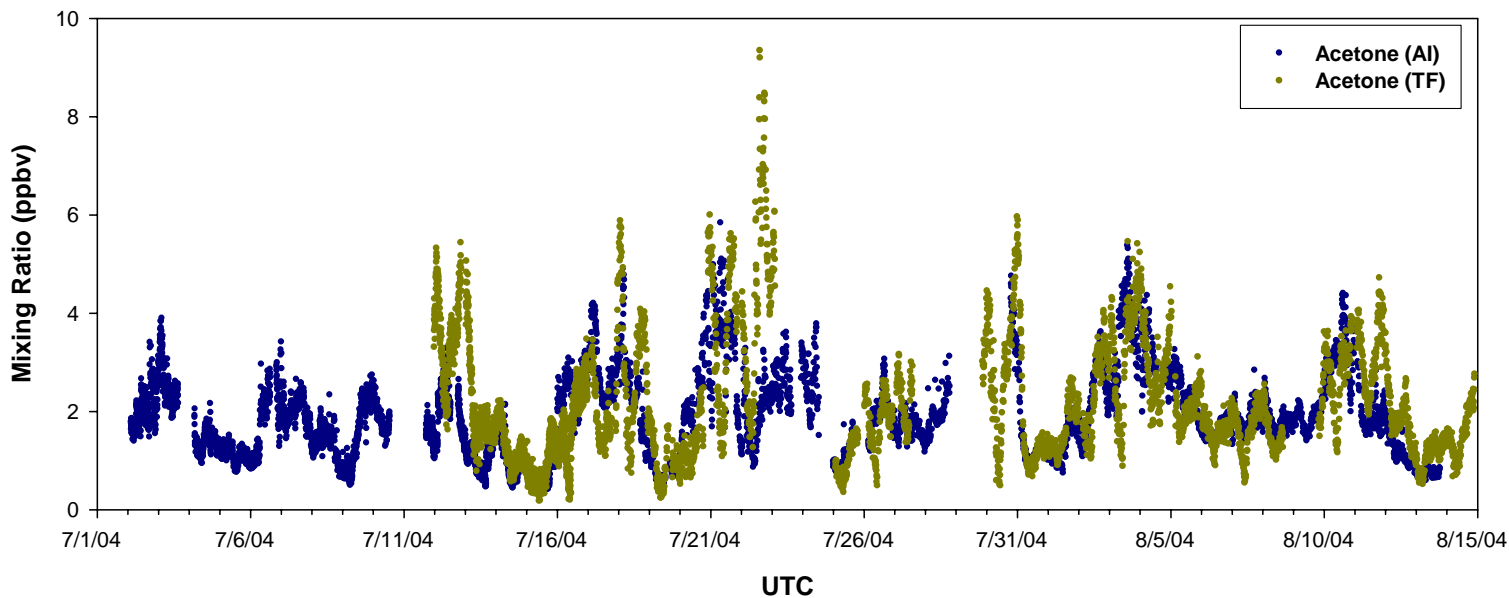
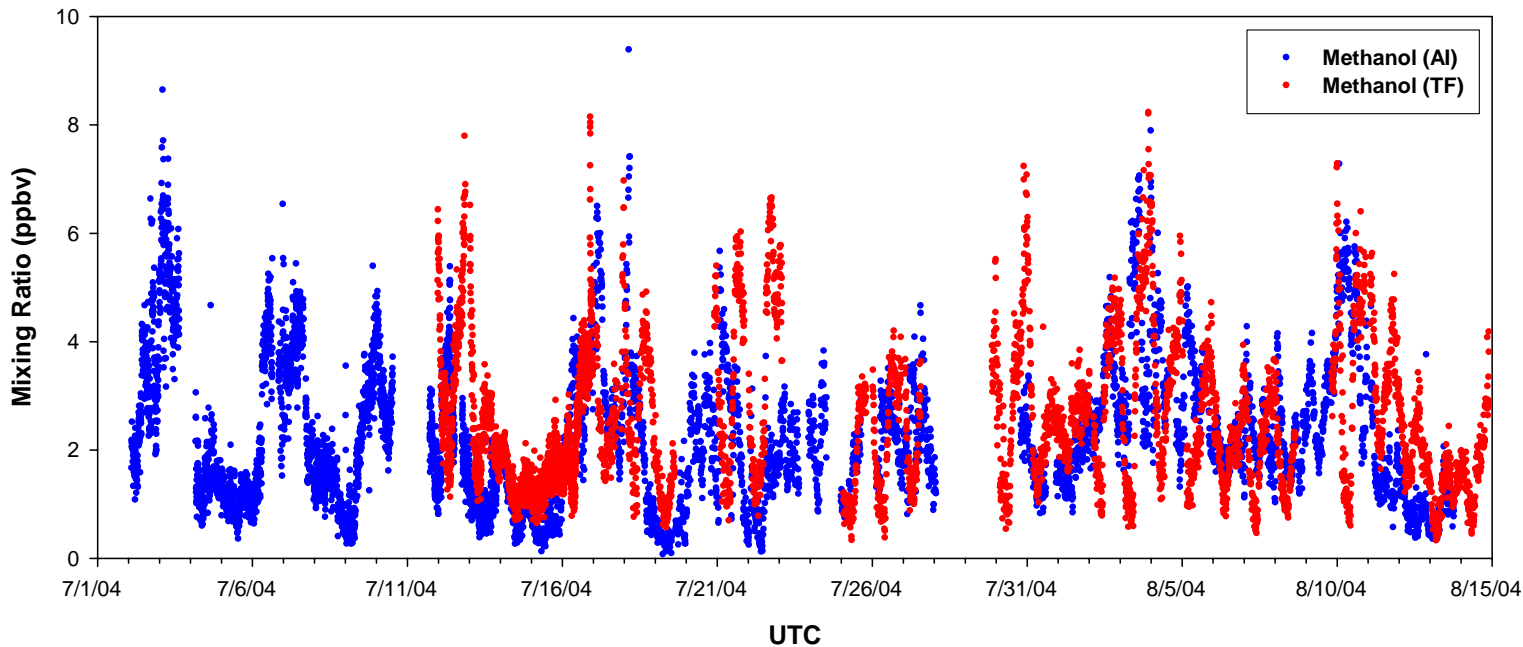
Appledore Island Measurement Comparison



Extras

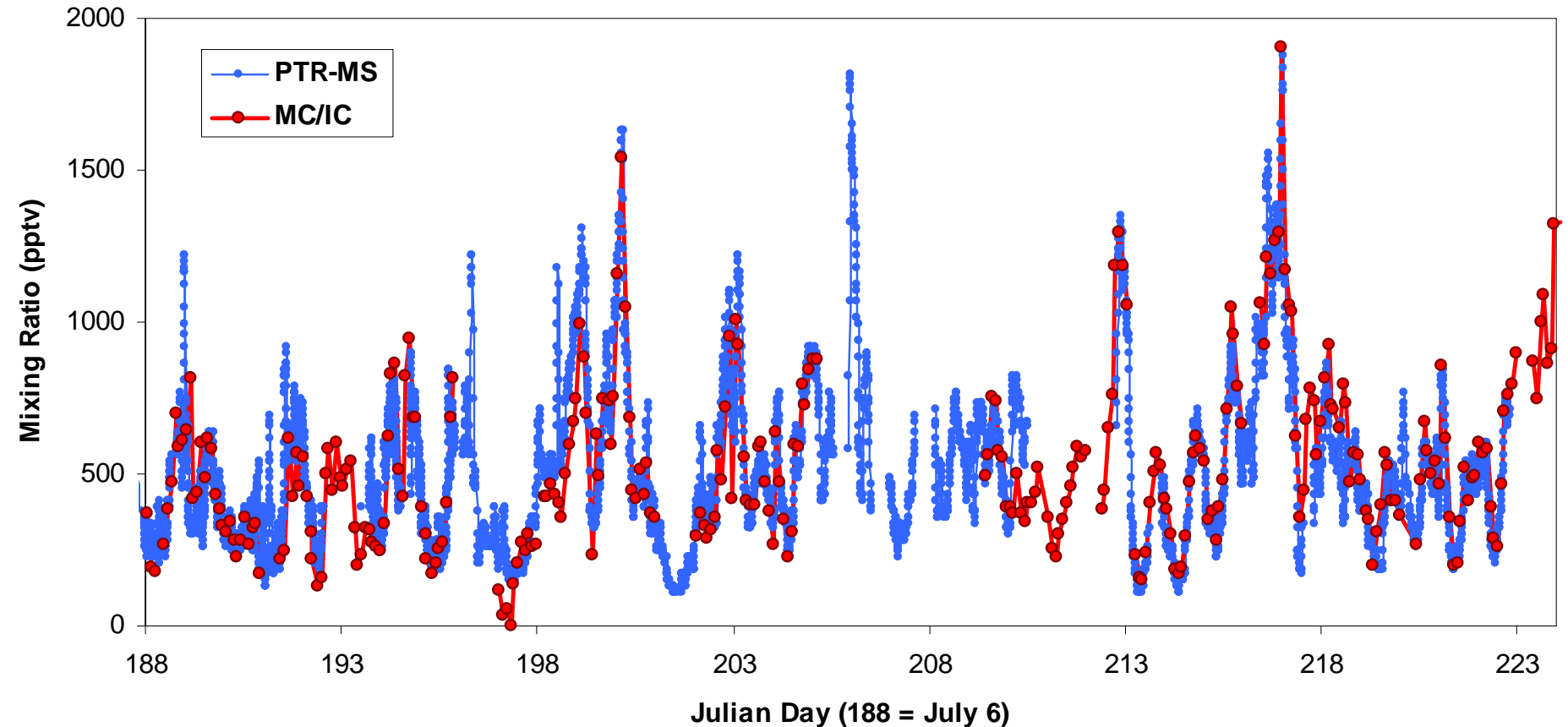


General Distributions at Thompson Farm and Appledore Island



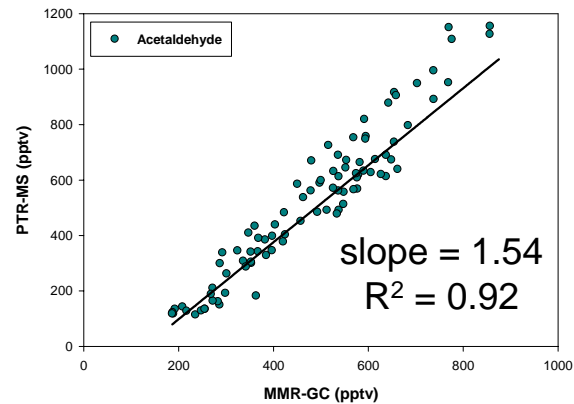
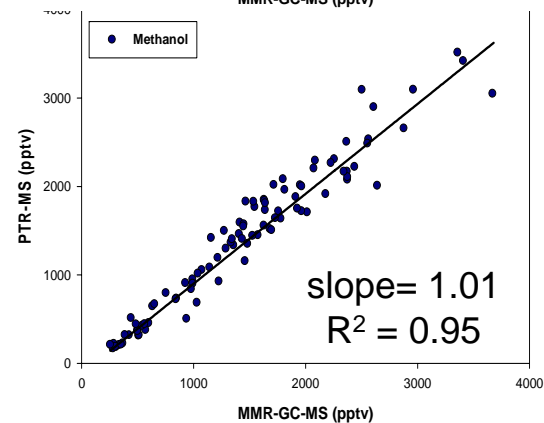
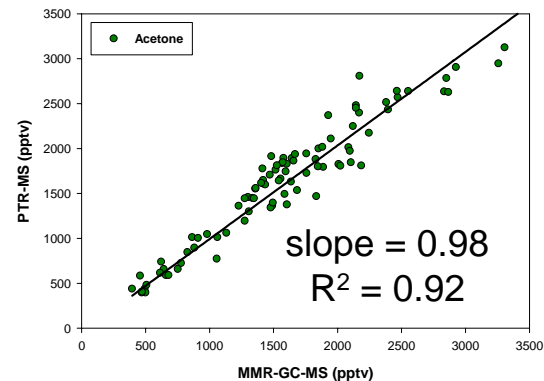
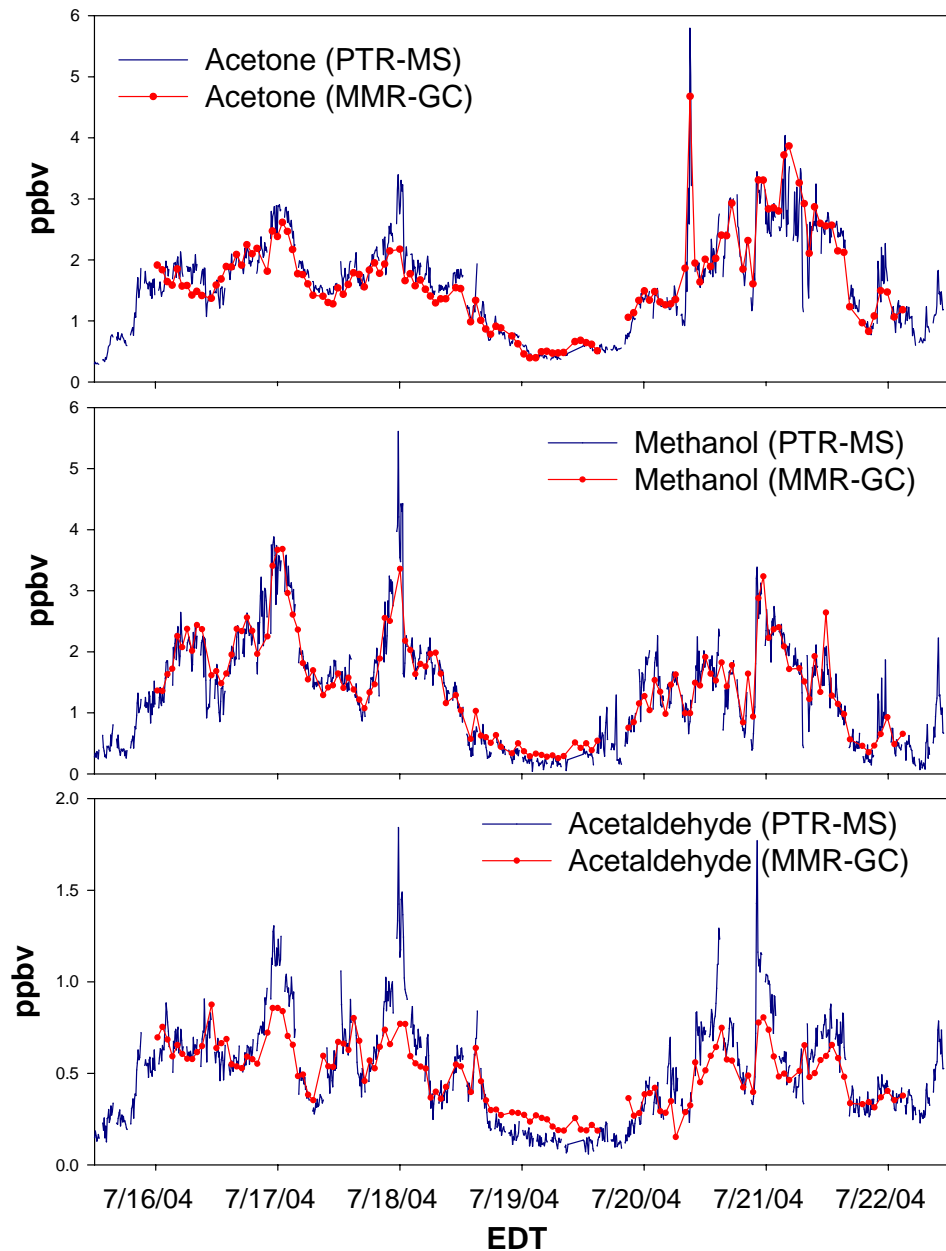
Acetic Acid

Comparison of PTR-MS and mist chamber data from Keene and Pszenny

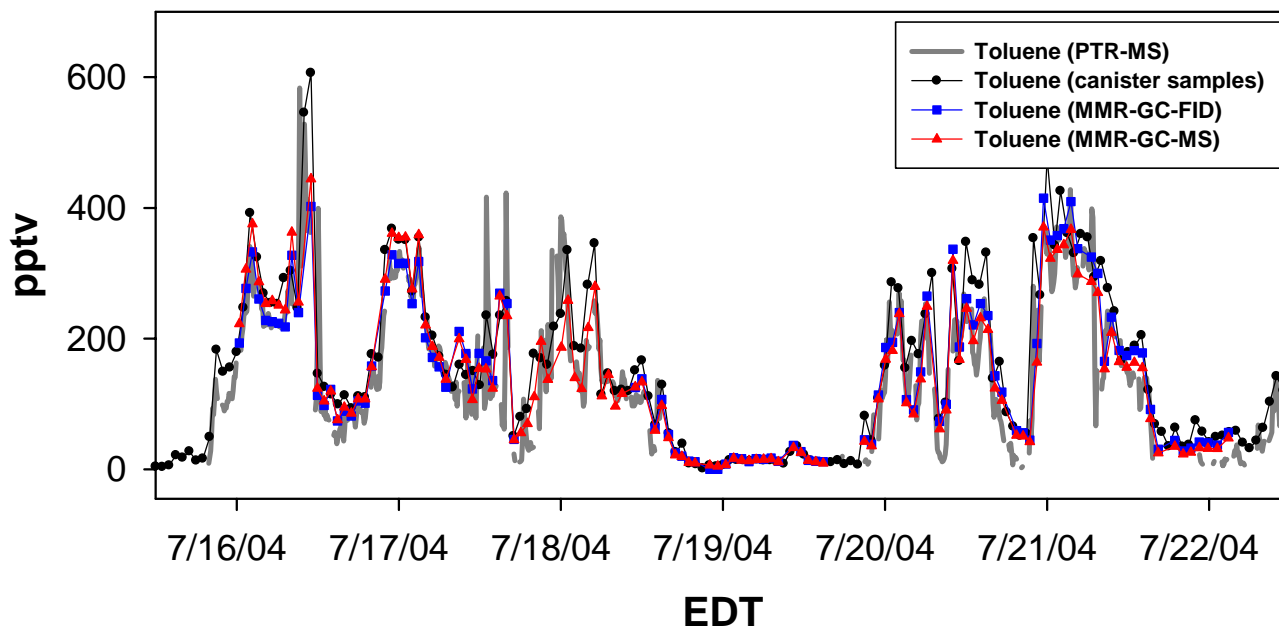
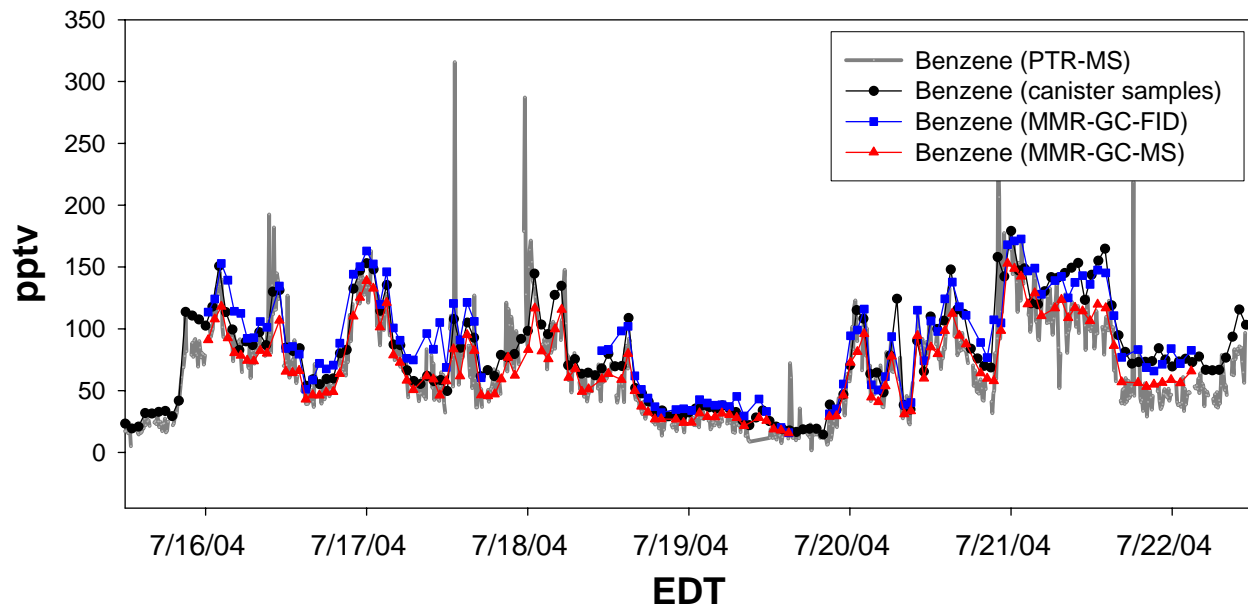


Note: The PTR-MS was sampling from a 100 ft x 3/8 in. O.D. PFA Teflon line with a residence time of 2 seconds. The MC/IC was sampling from the roof.

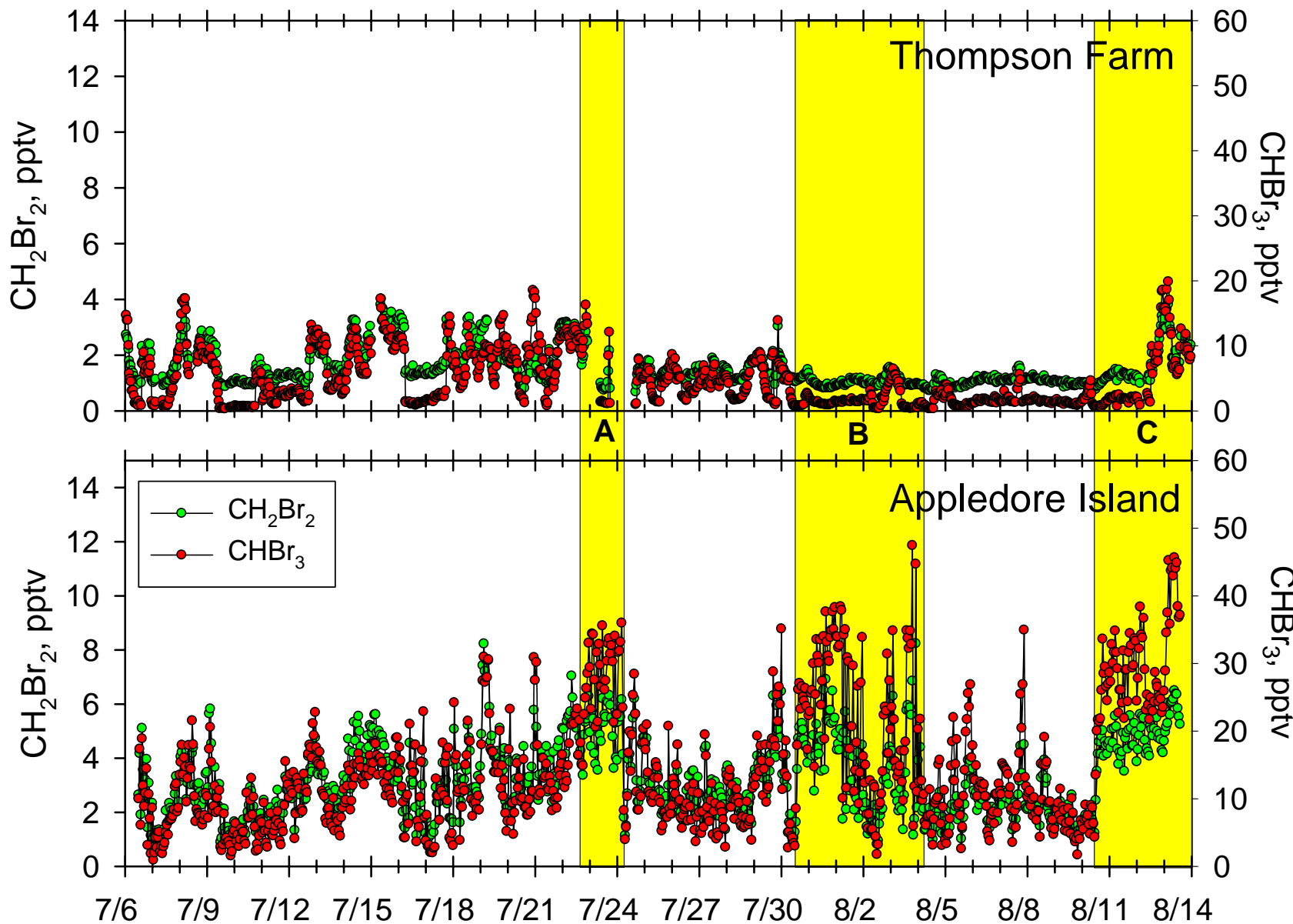
Appledore Island Measurement Comparison

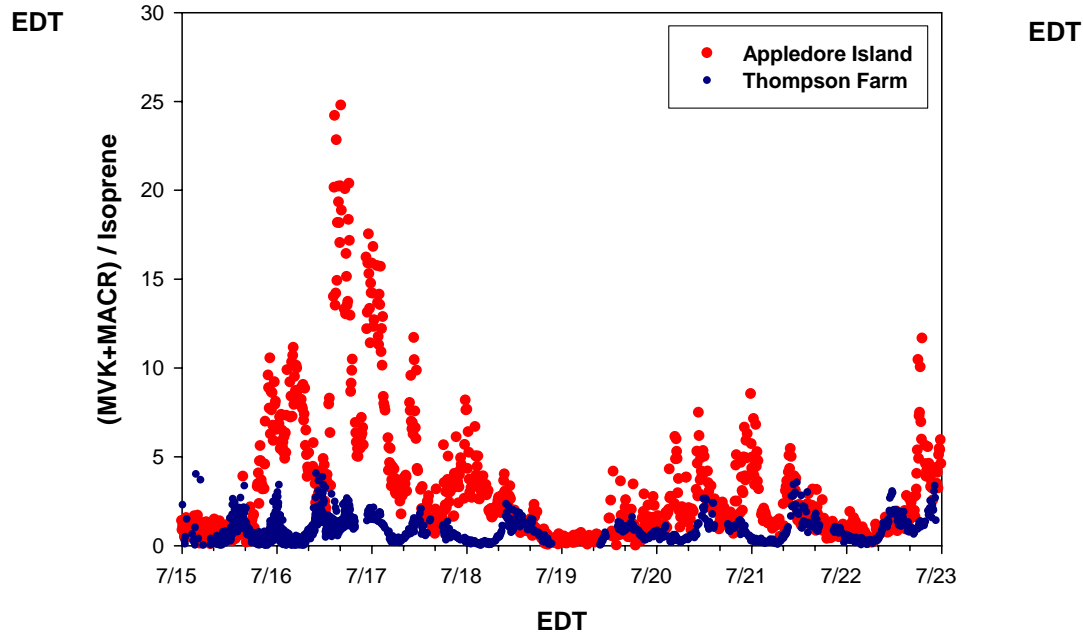
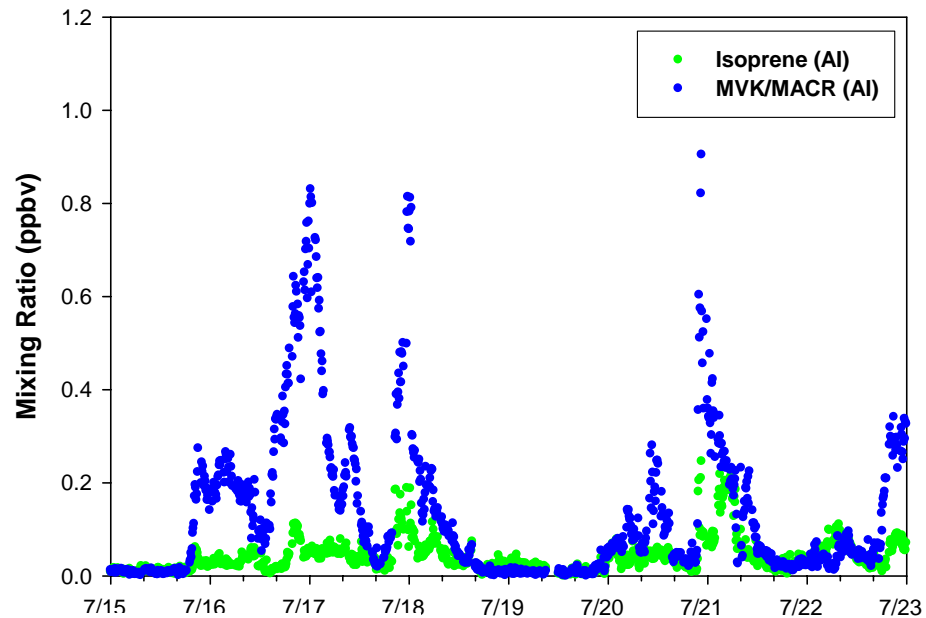
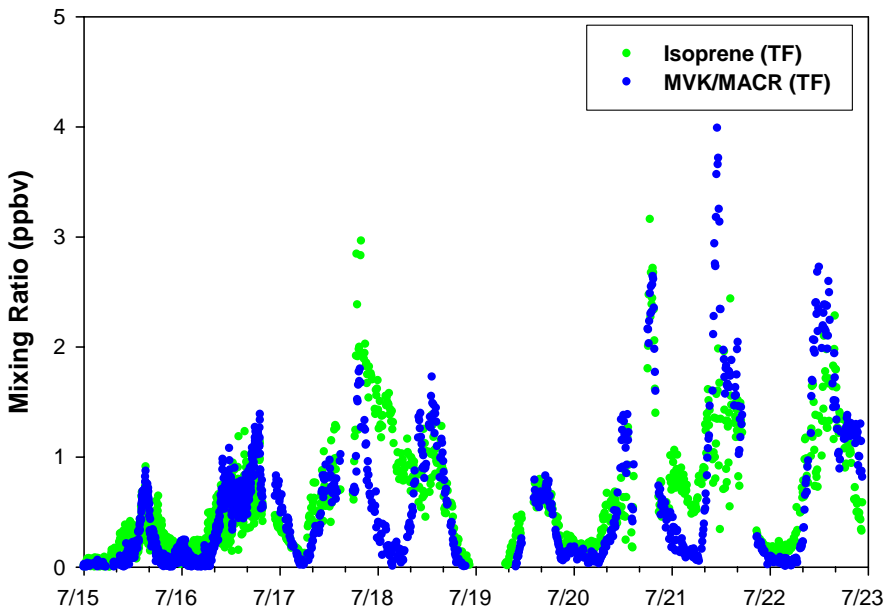


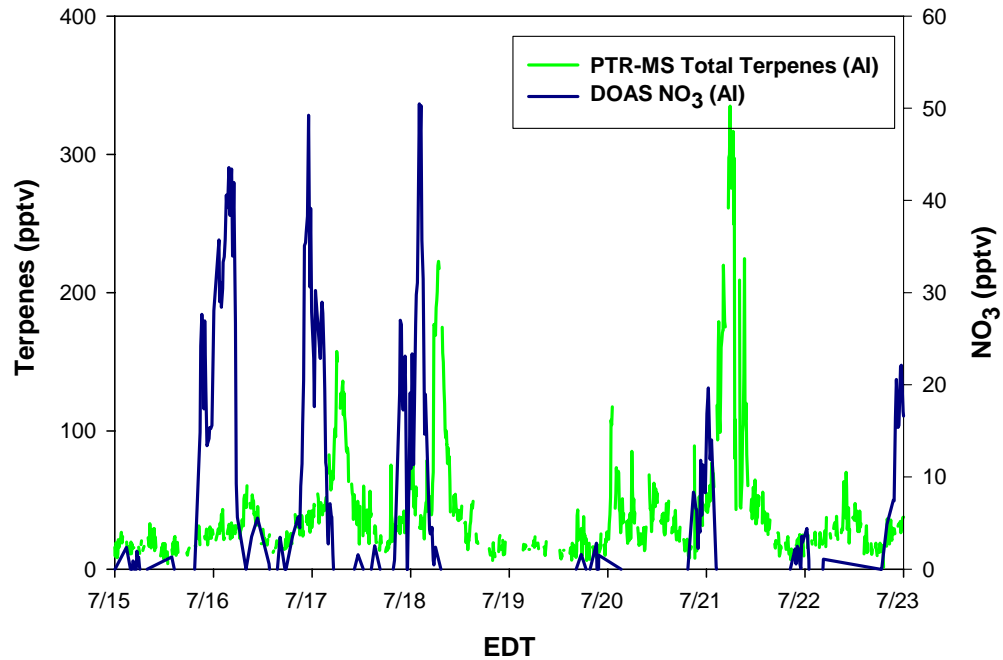
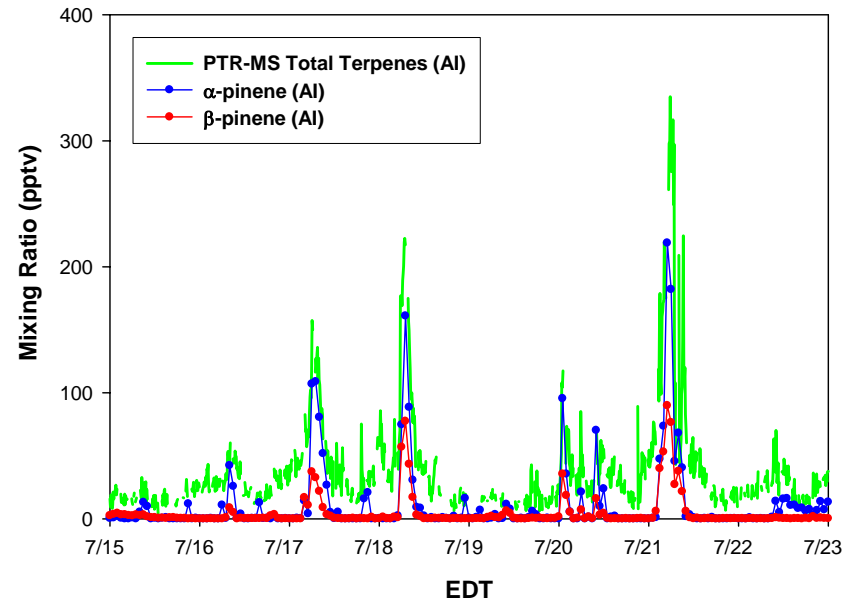
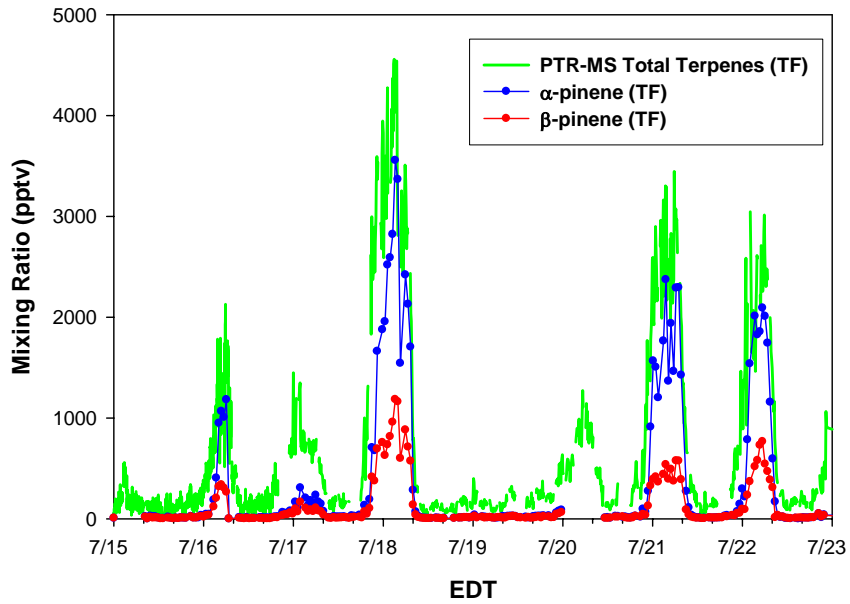
Appledore Island Measurement Comparison

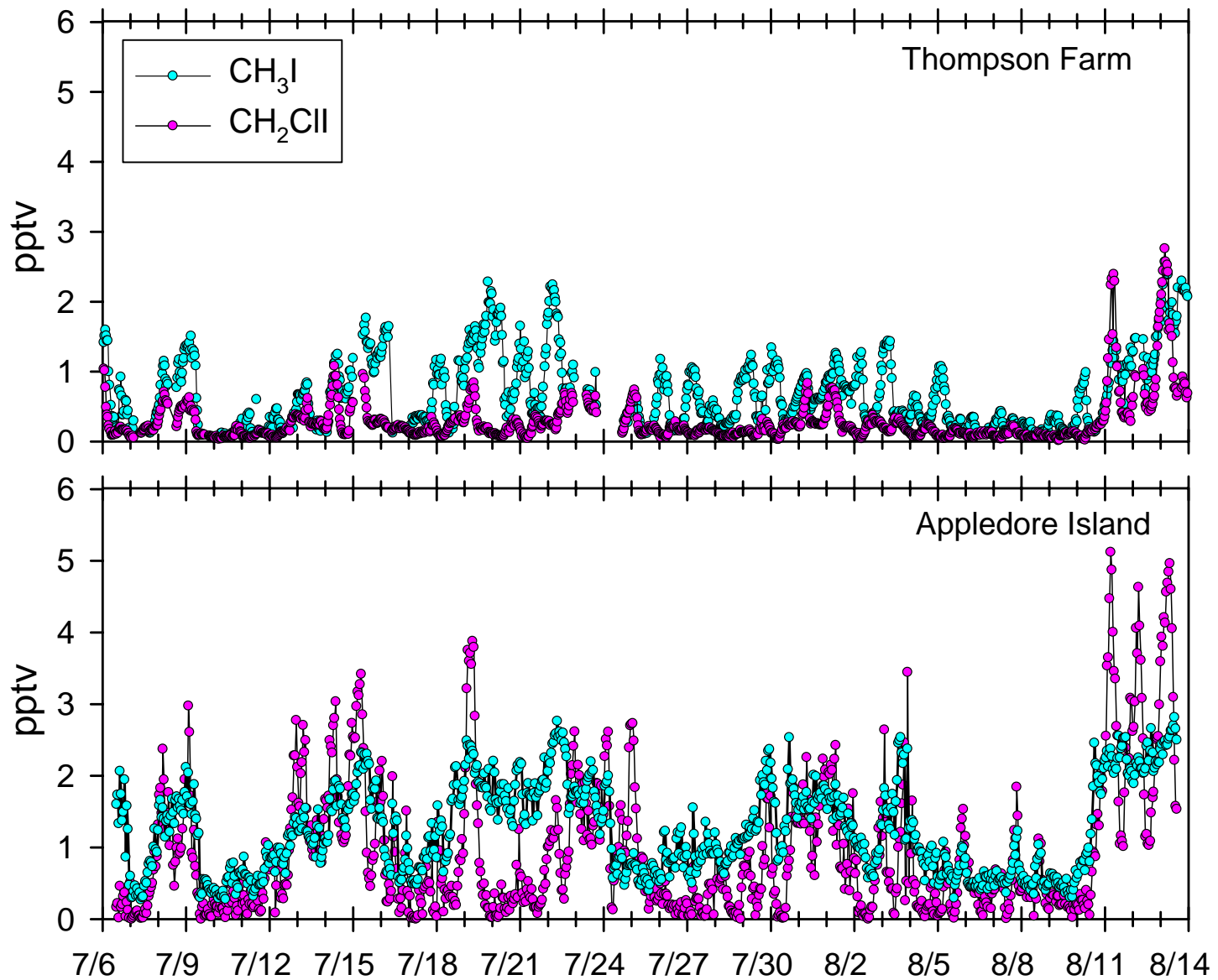


General Distributions at Thompson Farm and Appledore Island

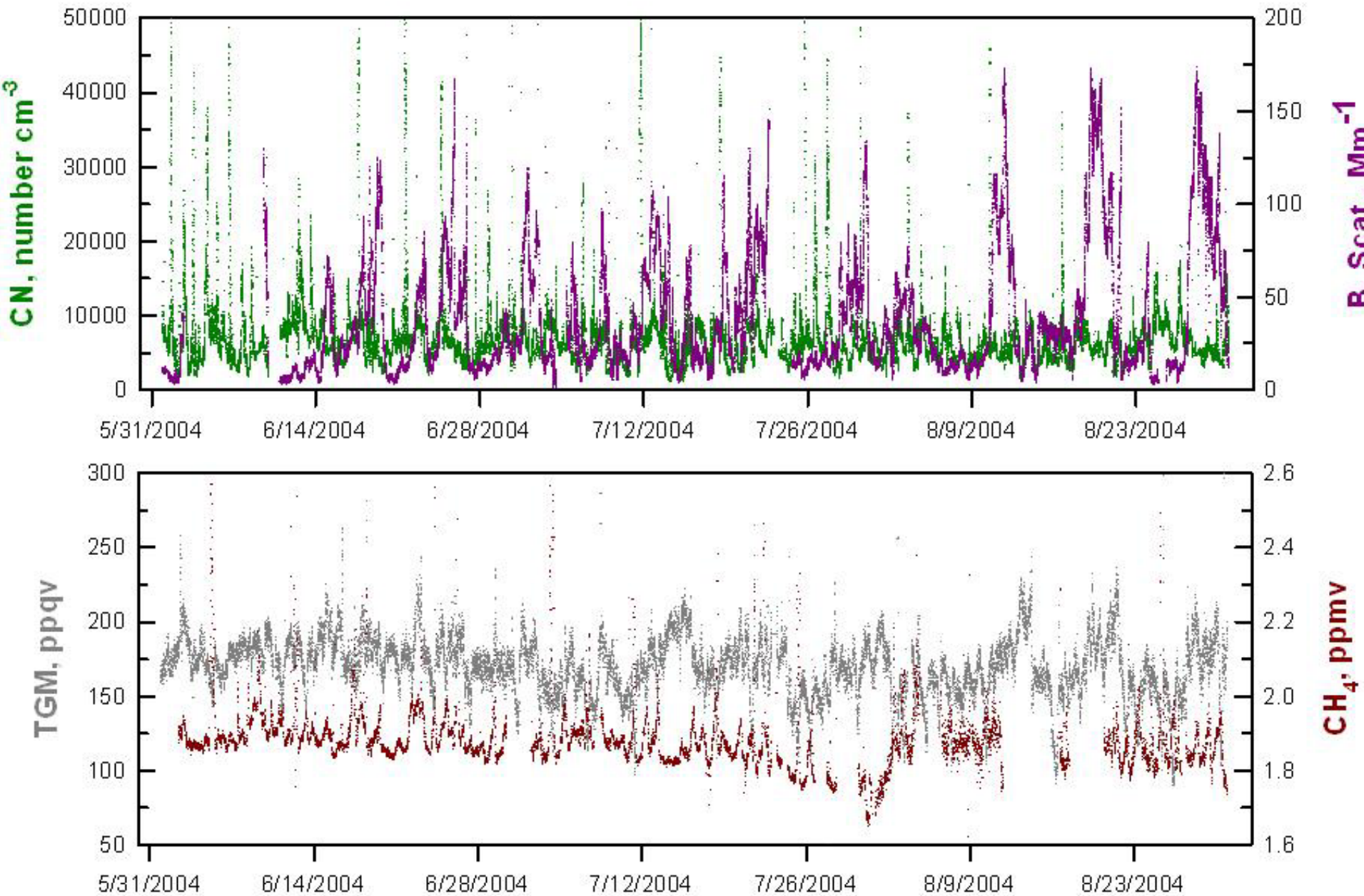








General Distributions at Thompson Farm



General Distributions at Appledore Island

