

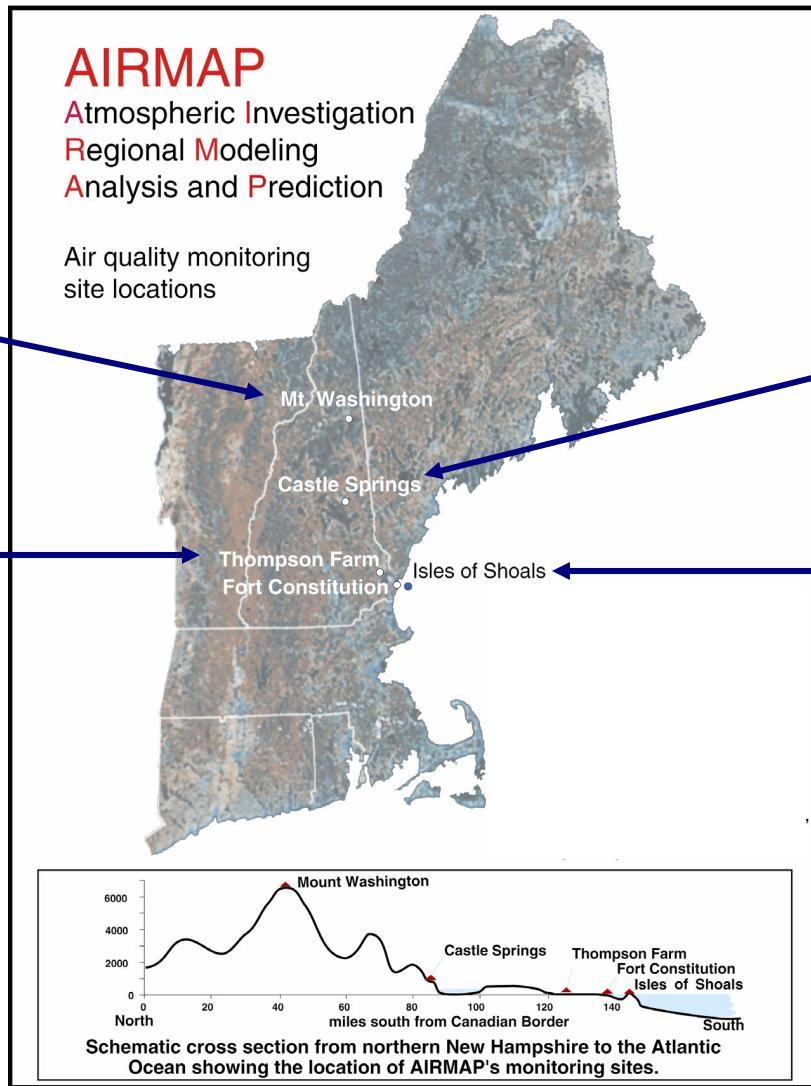
# AIRMAP-New England Air Quality Study 2002

## Diurnal Characteristics of Surface-Level O<sub>3</sub> and Other Trace Gases in New England

Robert Talbot, Huiting Mao, Barkley Sive

Institute for the Study of Earth, Oceans, and Space  
University of New Hampshire

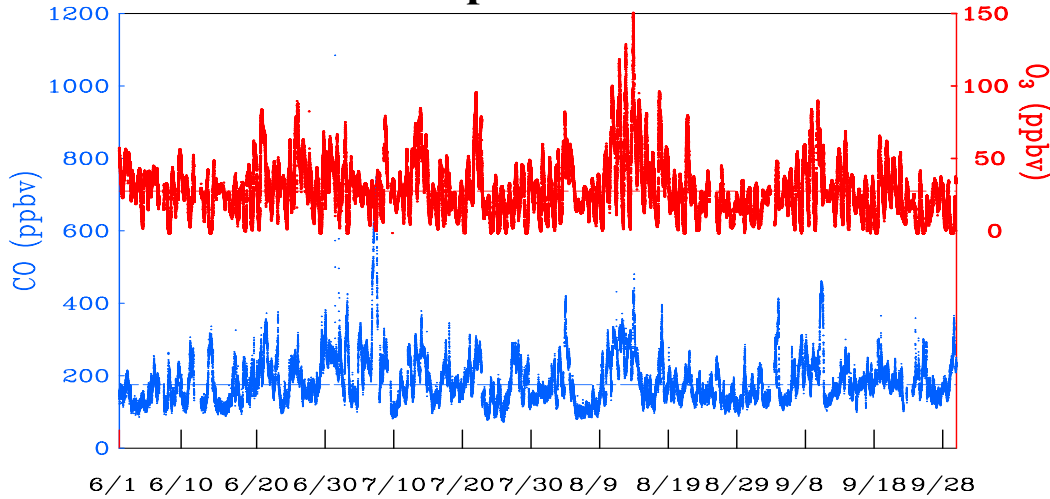




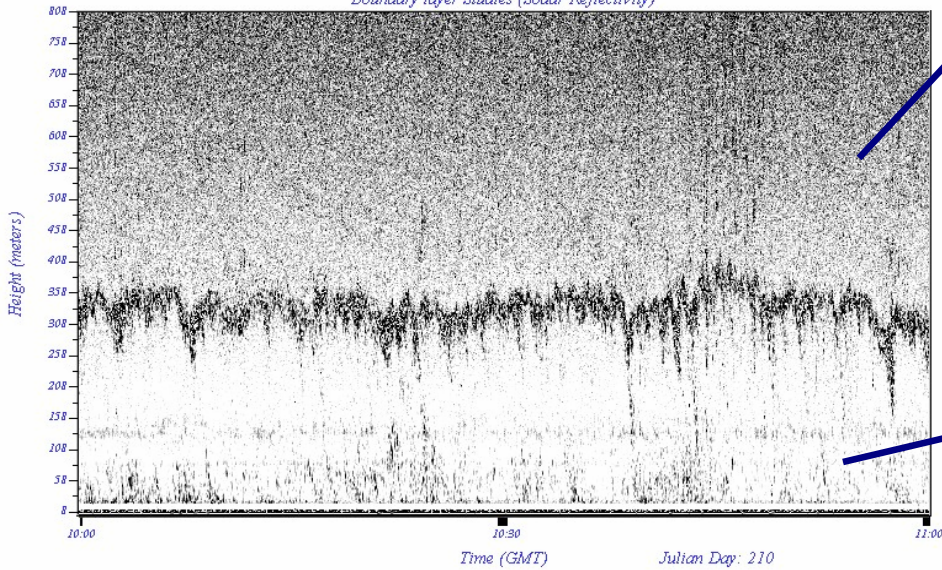
## Characteristics of the Diurnal Cycle are:

- indicative of removal processes for O<sub>3</sub> and other trace gases
- driven by synoptic transport, in situ production and destruction, and nocturnal transport into New England
- related closely to vertical mixing processes
- an important influence on the O<sub>3</sub>/CO and other species inter-relationships
- an influence on net export of O<sub>3</sub> and other species from North America (ITCT)

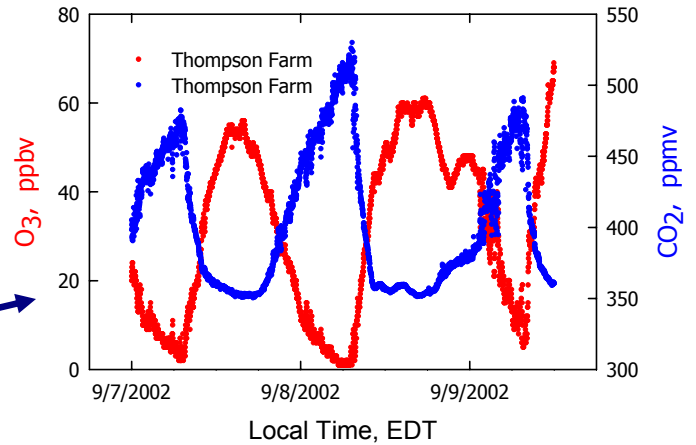
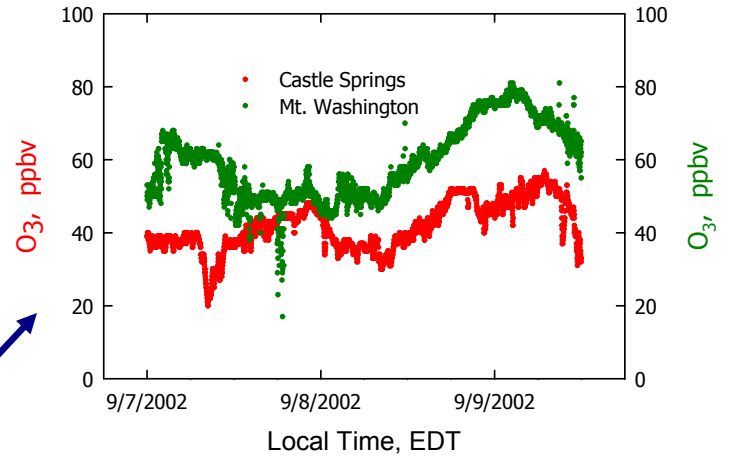
# Thompson Farm

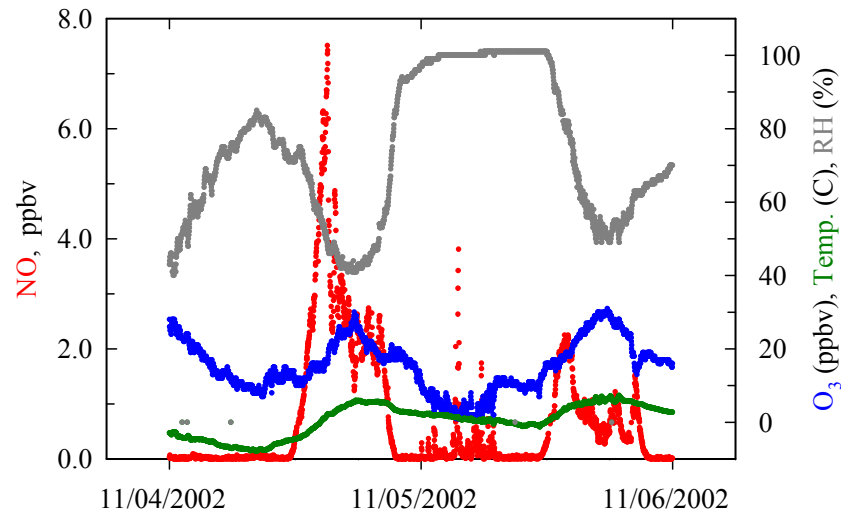
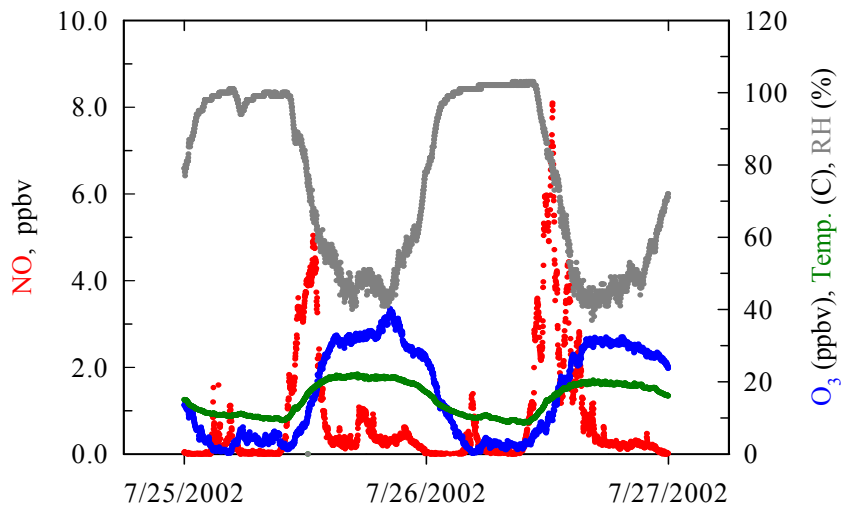
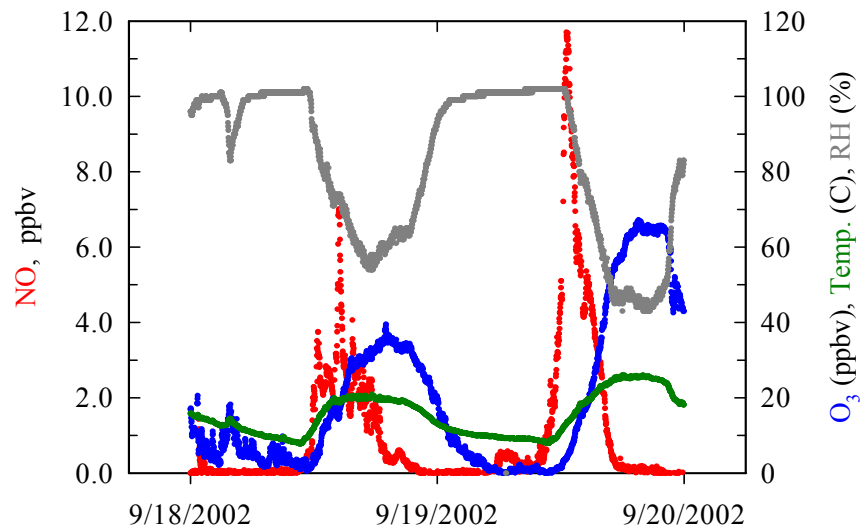
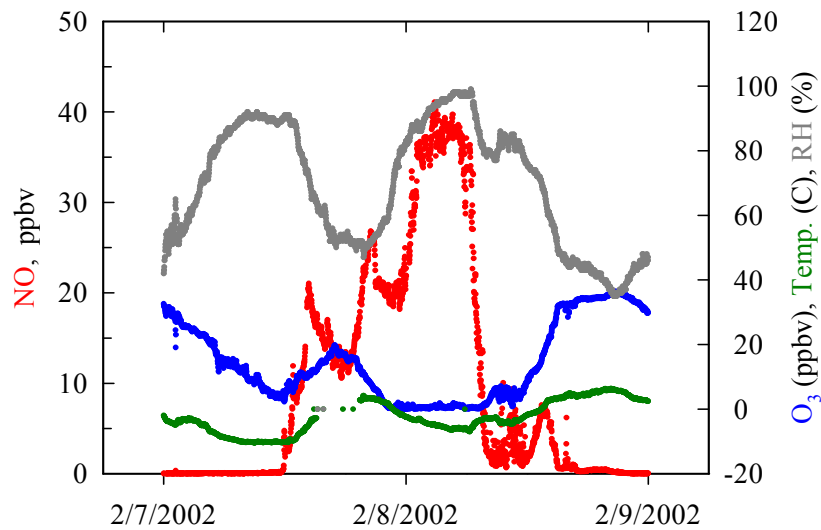


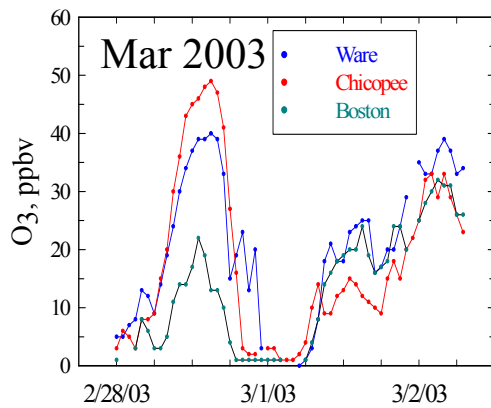
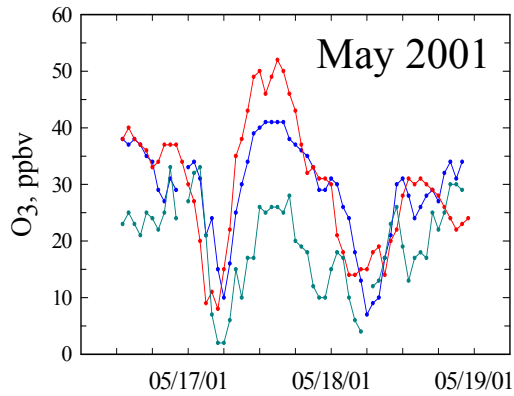
NOAA/ETL  
 Meteorological Applications and Assessment Division  
 Boundary layer Studies (Sodar Reflectivity)



# Nocturnal Inversion

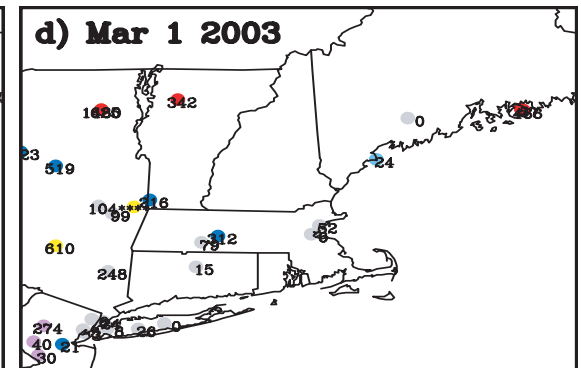
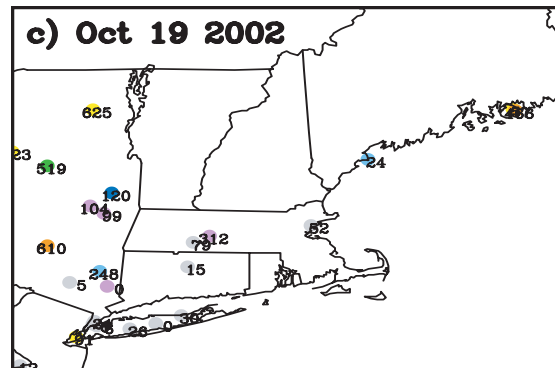
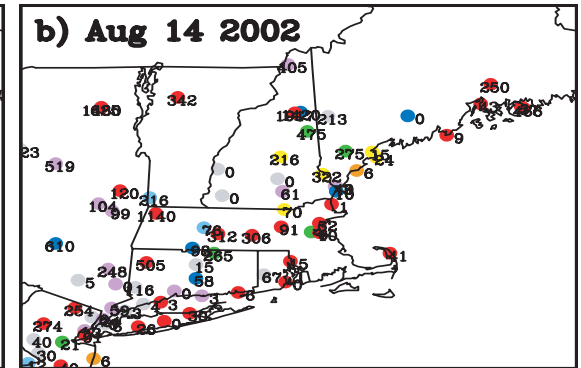
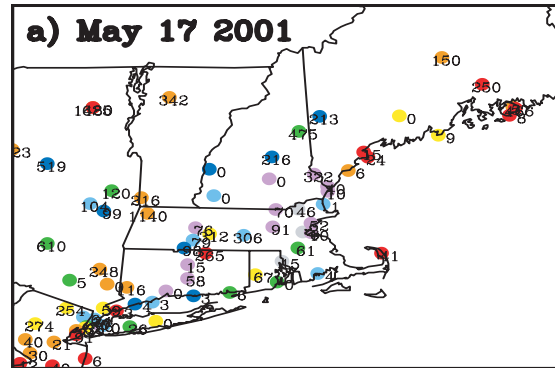
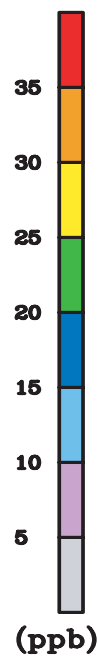
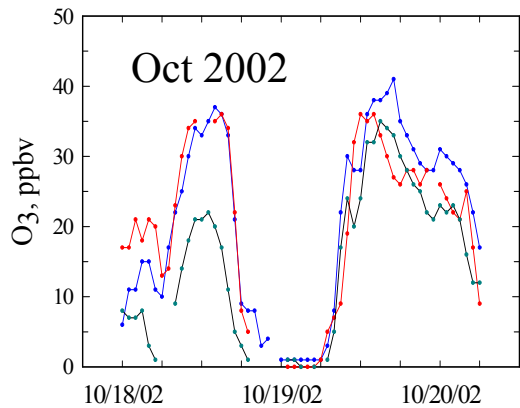
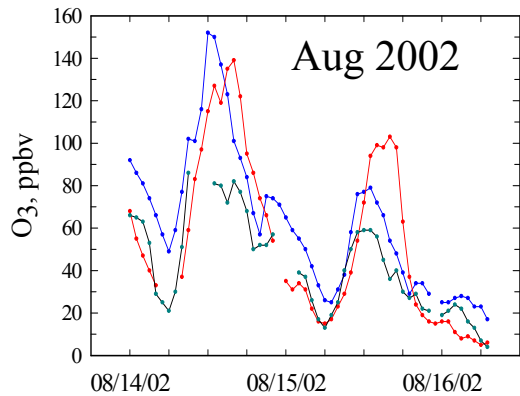




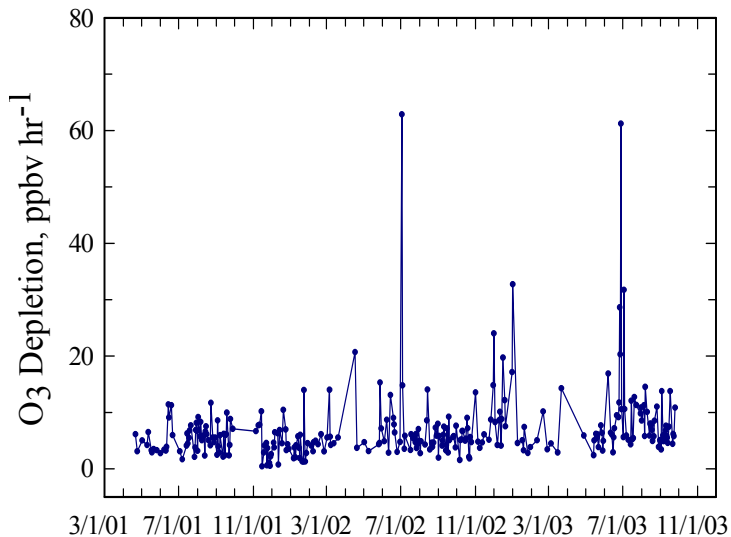
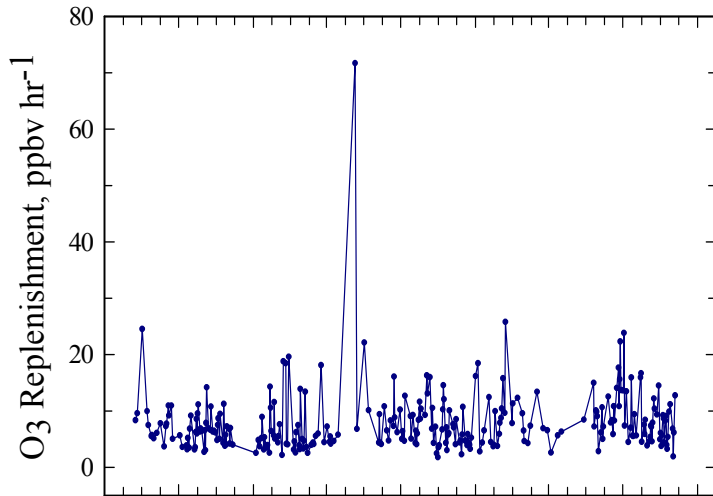


### Depletion and Replenishment Rates of O<sub>3</sub> in New England

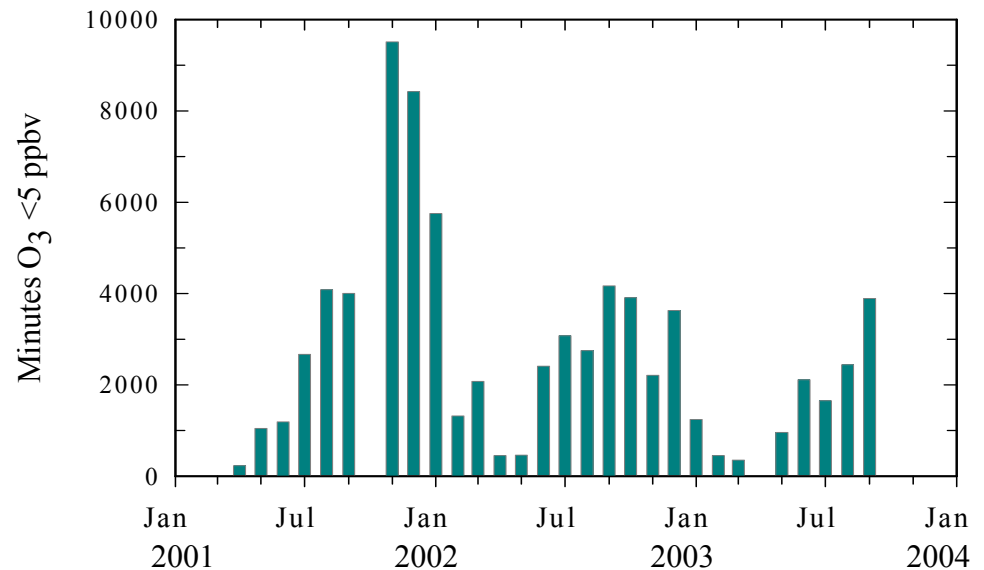
	Chicopee	Ware	Boston	Thompson Farm
	----- ppbv hr <sup>-1</sup> -----			
May 17, 2001				
Depletion	-3.2	-2.4	-2.0	-3.3
Replenishment	+4.4	+4.4	+2.4	+5.6
August 14, 2002				
Depletion	-8.9	-6.7	-4.9	-14.1
Replenishment	+11.4	+17.2	+21.7	+13.1
October 18, 2003				
Depletion	-7.2	-4.0	-3.5	-9.0
Replenishment	+5.1	+3.6	+3.9	+3.9
February 28, 2003				
Depletion	-7.8	-4.0	-3.5	-3.4
Replenishment	+3.8	+2.8	+3.2	+6.6



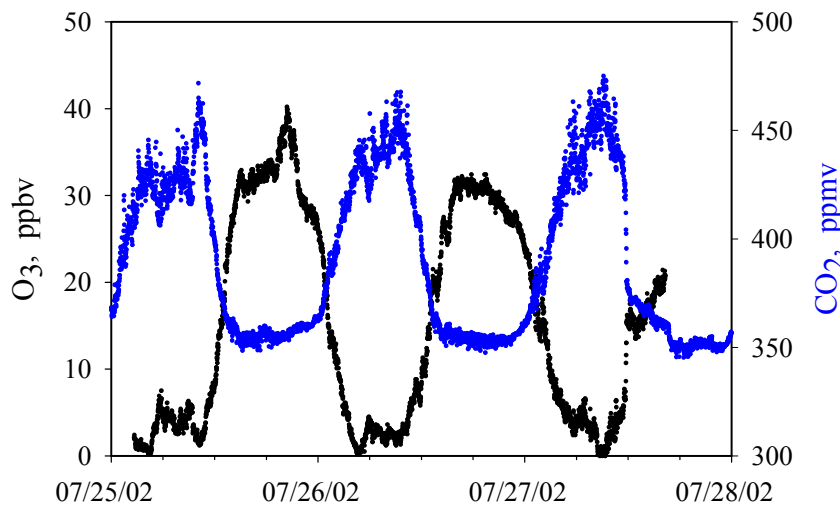
# Rates of Depletion and Replenishment of O<sub>3</sub> at Thompson Farm



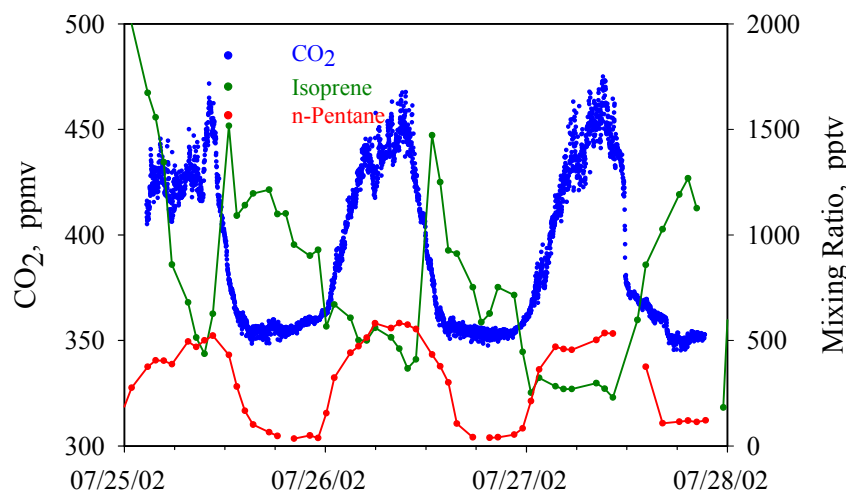
	MEAN	STDEV	MEDIAN	MAX	MIN	N
<i>Replenishment (ppbv/hr)</i>						
<b>Spring</b>	<b>10.5</b>	<b>9.4</b>	<b>8.4</b>	<b>72</b>	<b>2.9</b>	<b>58</b>
<b>Summer</b>	<b>7.5</b>	<b>3.7</b>	<b>6.7</b>	<b>24</b>	<b>1.8</b>	<b>131</b>
<b>Fall</b>	<b>7.4</b>	<b>5.2</b>	<b>5.2</b>	<b>26</b>	<b>2.2</b>	<b>58</b>
<b>Winter</b>	<b>6.4</b>	<b>3.6</b>	<b>5.2</b>	<b>18</b>	<b>2.6</b>	<b>40</b>
<b>Overall</b>	<b>7.9</b>	<b>5.7</b>	<b>6.5</b>	<b>72</b>	<b>1.8</b>	<b>287</b>
<i>Depletion (ppbv/hr)</i>						
<b>Spring</b>	<b>8.0</b>	<b>8.7</b>	<b>5.9</b>	<b>61</b>	<b>2.40</b>	<b>58</b>
<b>Summer</b>	<b>6.9</b>	<b>6.1</b>	<b>5.8</b>	<b>63</b>	<b>1.67</b>	<b>131</b>
<b>Fall</b>	<b>6.4</b>	<b>4.6</b>	<b>5.2</b>	<b>24</b>	<b>0.42</b>	<b>58</b>
<b>Winter</b>	<b>5.6</b>	<b>5.4</b>	<b>4.4</b>	<b>33</b>	<b>1.26</b>	<b>40</b>
<b>Overall</b>	<b>6.8</b>	<b>6.4</b>	<b>5.5</b>	<b>63</b>	<b>0.42</b>	<b>287</b>



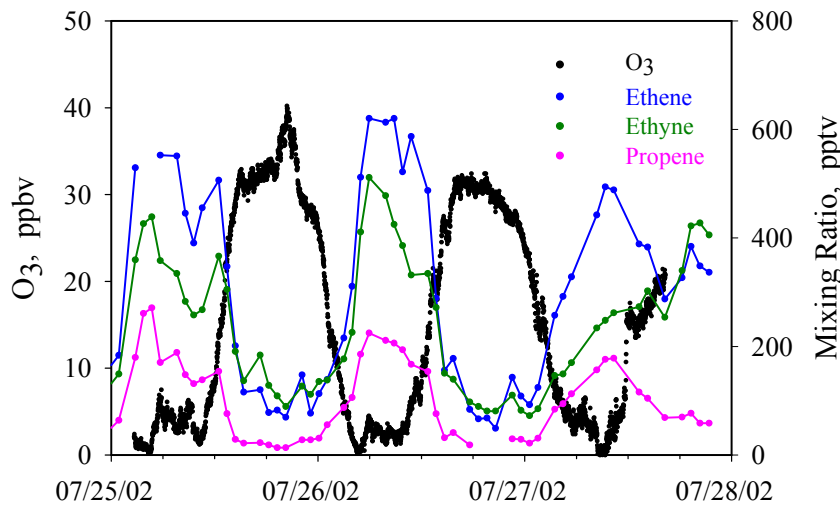
# Nighttime Enhancement of Selected Trace Gases



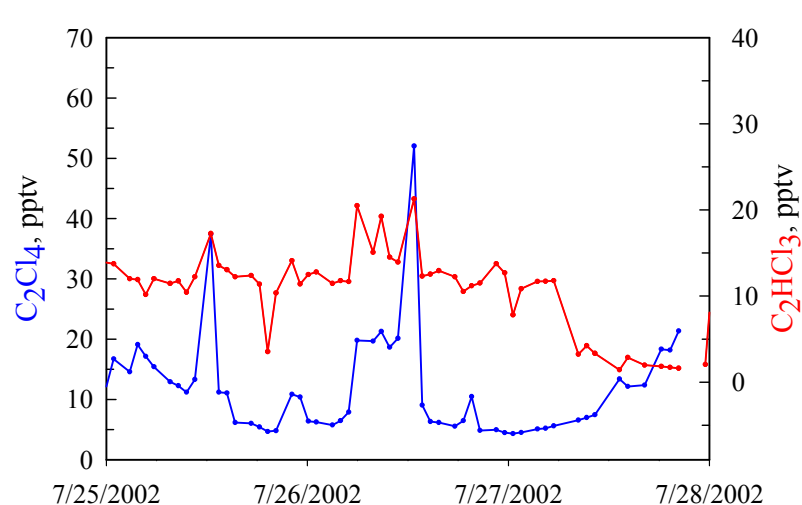
Thompson Farm



Thompson Farm

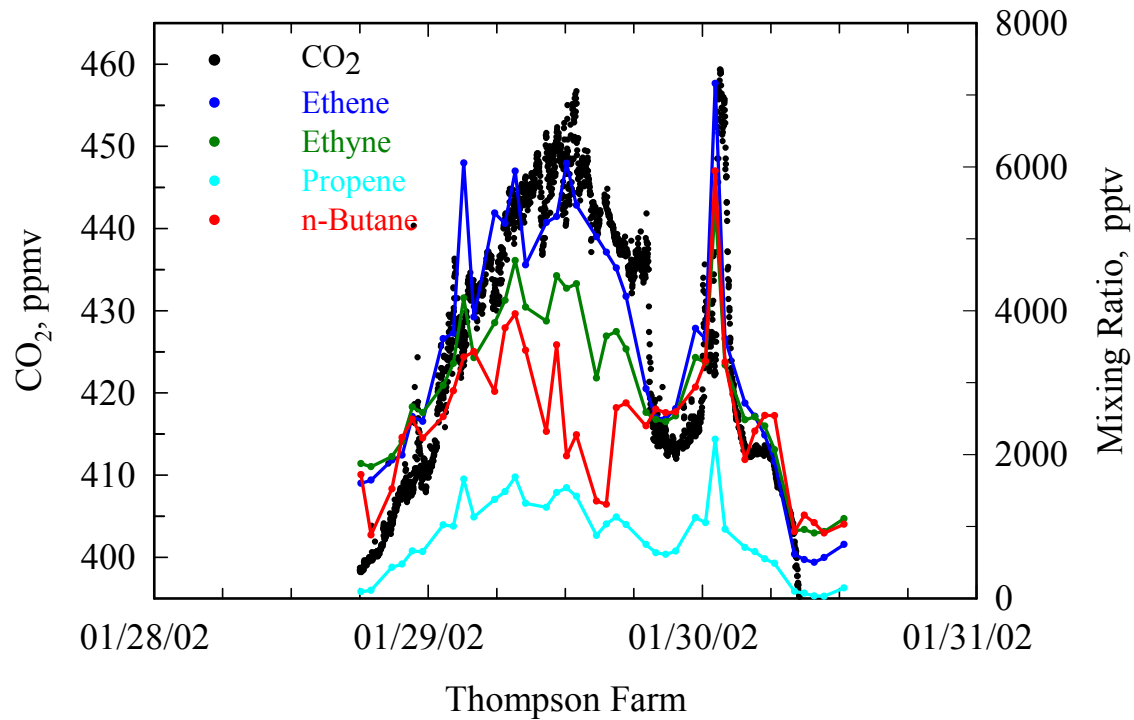


Thompson Farm



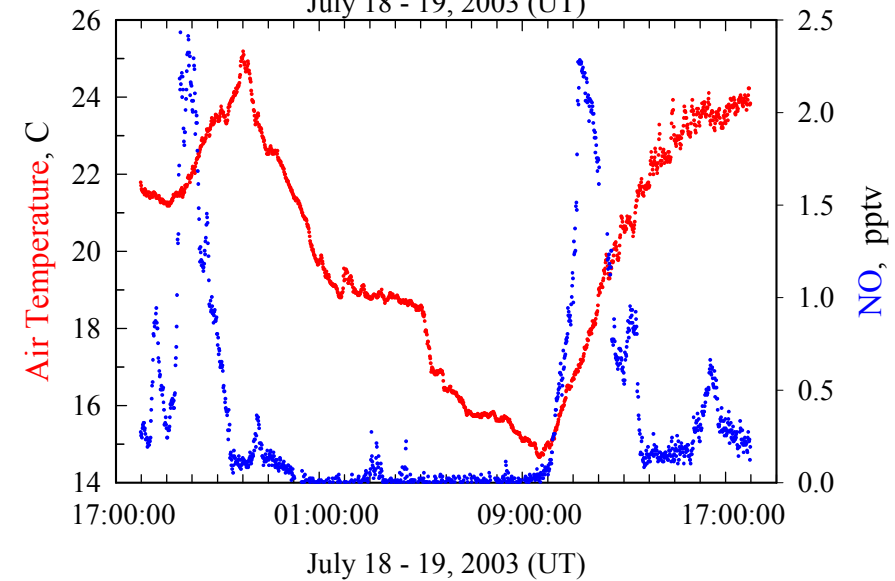
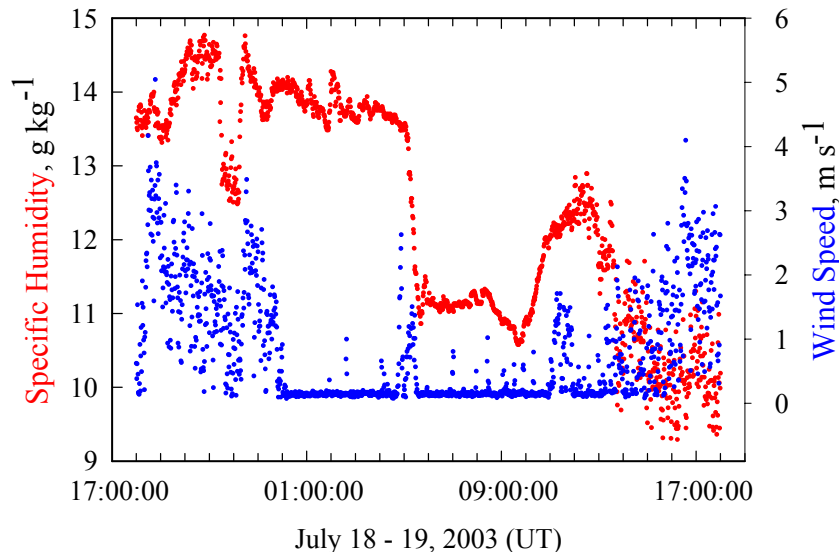
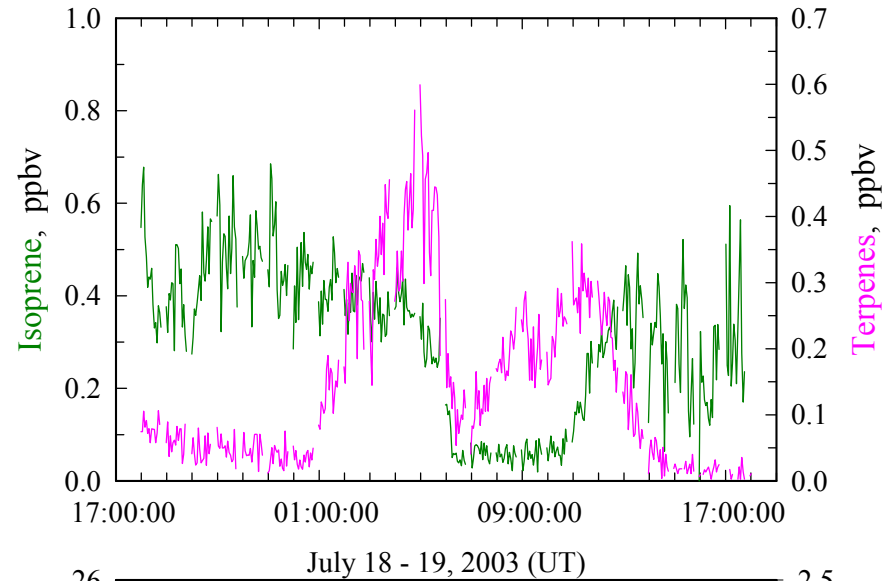
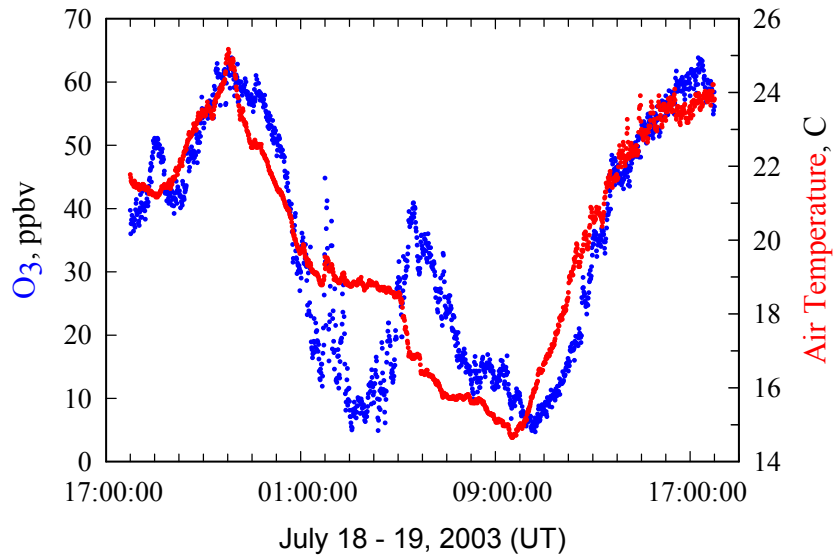
Thompson Farm



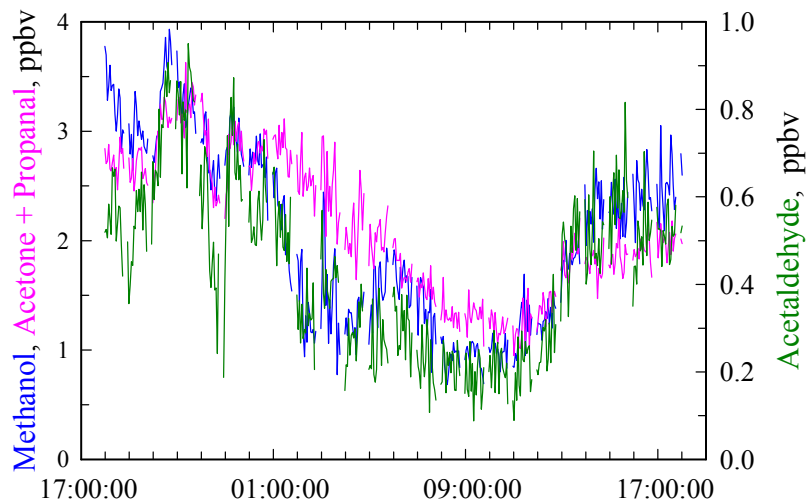


	$\Delta X/\Delta CO_2$		$\Delta X/\Delta CO$	
	----- (pptv/ppbv) -----			
	Narrow Plume	Broad Plume	Narrow Plume	Broad Plume
Ethene	0.099	0.088	8.5	11.9
Ethyne	0.067	0.060	5.7	8.1
Propene	0.049	0.029	4.2	3.9
n-Butane	0.073	0.049	6.2	6.6

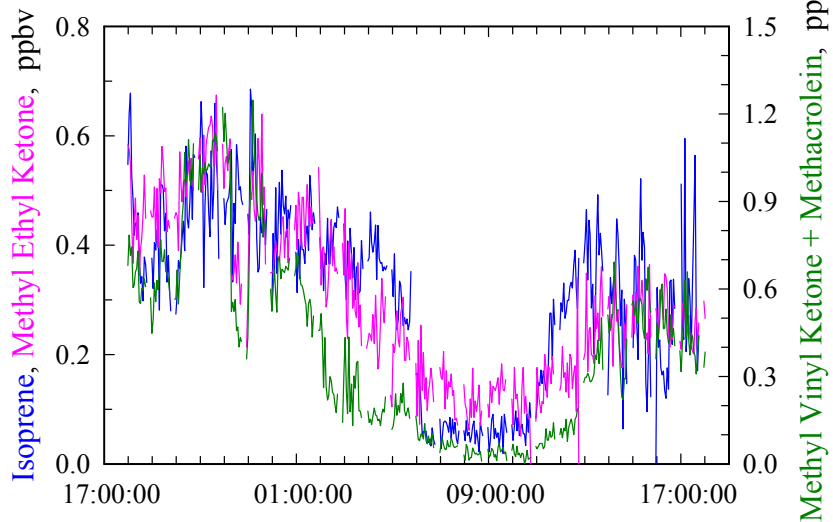
# A "Leaky" Nocturnal Inversion



## PTR-MS Results



July 18 - 19, 2003 (UT)



July 18 - 19, 2003 (UT)

## Diurnal Characteristics of Selected Oxygenates

Compounds	Depletion	Replenishment
	----- pptv hr <sup>-1</sup> -----	
<b>Methanol</b>	<b>310</b>	<b>375</b>
<b>Acetone &amp; Propanal</b>	<b>220</b>	<b>190</b>
<b>Acetaldehyde</b>	<b>75</b>	<b>90</b>
<b>Methyl Ethyl Ketone</b>	<b>50</b>	<b>40</b>
<b>Methyl Vinyl Ketone &amp; Methacrolein</b>	<b>115</b>	<b>105</b>