A51D MCC: Level 2 Friday 0830h

2002 New England Air Quality Study III Posters

Presiding: **B Talbot,** Institute for the Study of Earth, Oceans, and Space, University of New Hampshire**; T Bates,** NOAA Pacific Marine Environmental Laboratory

A51D-0701 0830h POSTER

Ozone Climatology for Portsmouth, NH 1978-2002

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Hourly ozone mixing ratios have been monitored in Portsmouth, NH since 1978 for the typical "summer" ozone season (April to October) by the New Hampshire Department of Environmental Services. This 25 year record provides the basis to investigate seasonal variability in daily summertime ozone levels in Portsmouth NH and evaluate the relationship between ozone mixing ratios, temperature, precipitation, and the state of El Niño/Southern Oscillation. The overall goal of this research is to identify significant relationships between high ozone days and a suite of climate variables. The mean daily ozone mixing ratio in Portsmouth from 1977 through 2002 was 40 ppbv (sd 17 ppbv) with a mean of 6 days per summer when maxiumum 8 hour ozone levels exceed the 80 ppbv level. The highest ozone levels usually occur during June, July and August (with a peak in July), but high ozone days also occur May and September. April and October rarely experience high ozone. High ozone in coastal New Hampshire (and for most of New England) occurs predominantly on days when maximum temperatures are above 85 oF, although there are also may hot days when ozone levels do not reach elevated levels. Analysis of the relationship between number of days per year when 8 hour ozone is greater than 80 ppbv and maximum temperatures are greater than 85 oF indicates that there is a positive correlation (r = 0.60). Surprisingly, there is not a strong inverse relationship between ozone days and precipitation. For example, over the last 25 years, 1988 clearly stands out with 20 days with maximum 8 hour ozone above 80 ppbv. However, 1988 also experienced considerable precipitation in July and August (14.1 inches compared to the climatological mean of 6.7 inches) and relatively few days without precipitation (38 compared to the climatological mean of 44). There are differences in temperature, precipitation, and ozone levels in Portsmouth during years that are classified as El Niño and neutral, compared to La Nina years. However, we have only experienced one strong La Nina year in the past 25 years, so the results must be viewed with caution. The La Nina year (1988) experience high ozone and more frequent hot days, as well as double the average precipitation. El Niño years experience slightly warmer, dryer and experience more frequent ozone days, although they are not significantly different from neutral years. Our results indicate that hot summers are indeed related to higher than average ozone levels, although there is considerable variability in this relationship. There does not appear to be a consistent ozone - precipitation relationship. Further work is needed to define these relationships for a larger number of stations throughout New England and also for comparison to broader synoptic to hemispheric circulation patterns and sea surface temperatures.

A51D-0702 0830h POSTER

Comparing Summer 2002 to the Decade-Long Air Quality Record at Harvard Forest: Patterns, Trends, and Anomalies.

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The Harvard Forest Environmental Measurement Site (EMS) was established in 1990 to quantify deposition of air pollutants to a forest canopy, to examine regional-scale rural air quality, and determine net carbon exchange by a typical New England forest. The measurement site is situated over a mile from the nearest paved road or building and major urban areas are over 100 km away. The observations from this site provide one of the best available records for establishing air quality patterns and trends in eastern North America. The focus of this talk will be NO_x, NO_y, O_3, and CO concentrations. Transport patterns and vertical mixing account for the dominant patterns observed in pollutant concentrations. Southwesterly winds at HF bring elevated concentrations of primary and secondary pollutants while northwesterly winds bring relatively clean background continental air. Emissions of NO_x and CO accumulate beneath the nocturnal inversion and reactive species such as O_3 are depleted at the surface overnight. Variations in meteorological patterns from year to year complicate comparison of pollutant concentrations. We will make use of Stochastic Time-Inverted Lagrangian Trajectories to define periods that should be meteorologically similar. To establish the air quality context for observations during the NEAQS 2002 observation period we compare the probability distributions for pollutant concentration and mean diel cycles in the summer of 2002 with those from 1990-2001. The peak O_3 events during June-August 2002 were among the highest recorded at Harvard Forest, but clean air periods had some of the lowest O_3 concentrations. NO_y concentrations at Harvard Forest tended to be lower across the entire concentration range and for both polluted and clean sector winds. CO concentrations during southwesterly winds were lower in 2002 relative to the typical range, but background concentrations were unchanged. A single event with forest-fire smoke from Quebec had maximum hourly CO concentrations exceeding 600 ppb. These concentrations exceed the peak values for the prior 11 years by over 50%.

A51D-0703 0830h POSTER

Surface Ozone Differences Between Appledore Island and Thompson Farm: Local-Scale vs. Synoptic Scale Meteorology

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At NEAQS 2002, the surface O_3 observation network included stations at Thompson Farm (TF), near Durham, NH, and Appledore Island (AI), just off the coast of NH. The stations were only 30 km apart, yet the differences in the O_3 measured at the two sites could be as high as 50 ppbv. This study focuses on meteorological processes contributing to the differences in O_3 at the two sites. During the first 6 days of Aug. 2002, the differences in surface O_3 measured at AI and TF ranged from $<$ 5 ppbv to $>$ than 50 ppbv, with AI typically having higher O_3 than TF. Meteorology played a role in these differences. For instance, on 6 Aug., a day when the ozone differences between the two sites were very small throughout the day ($<$10 ppbv), there were no local-scale circulations such as a sea breeze, and both TF and AI were in the same post-frontal northwesterly, clean' (low-O_3) air. In contrast, on two of the days with large differences in surface ozone between the stations, there was a synoptic stationary front hugging the New England coast, separating the marine air mass (sampled at AI) from the continental air mass (sampled at TF). Differences in large-scale ozone transport within these two air masses led to much higher ozone values at AI than at TF, with differences as large as 50 ppbv. The formation and inland propagation of a sea breeze, measured by the ETL Doppler lidar, acted to lessen the effect of the stationary front on a local scale, bringing higher-ozone air to TF, reducing the difference in ozone between the two sites. Other features receiving further investigation will include the Appalachian Trough and the few times during which TF ozone measurements exceeded those at AI. The Appalachian Trough enhances the southwest transport of pollutants from the New York and Boston areas to the NH and ME coasts. This feature was in place from late in the day on 4 Aug. and continued through 5 Aug. During this period, ozone measurements at both sites were elevated relative to the other days investigated. TF had ozone measurements that exceeded those at AI only during brief periods on five of the six days analyzed. These periods tended to be, but were not exclusive to, the hours between 1200 and 1500 LST.

A51D-0704 0830h POSTER

Surface-Level Ozone Variability in the Coastal Marine Boundary Layer Measured in the Gulf of Maine on a Commercial Ferry During NEAQS 2002

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As part of the New England Air Quality Study in July-August 2002, we deployed the PSI UV Ozone Photometer on a commercial cruise ferry to measure temporal and spatial variations in ozone off the New Hampshire coast. The MV Thomas Laighton, operated by the Isles of Shoals Steamship Company in Portsmouth, NH, provided a mobile platform from which to conduct twice-daily measurement transects between the coastline and the Isles of Shoals area some 8 km offshore. Ozone mixing ratios, ambient air temperature, and GPS latitude and longitude were sampled at a 1 Hz data rate (5 to 10 m spatial resolution) via a mast and forward-facing air sampling inlet extending into the free stream above the wheelhouse of the vessel. The measurements provide detailed views of offshore ozone buildup in two different high-ozone events (>100 ppbv). The data exhibit extensive spatial variability in ozone mixing ratios for a given transect. These include frequent small-scale depletions in ozone on the scale of tens of meters, due to titration of ozone by localized NOx emissions, and large scale ozone depletions on the order of km, associated with the high-ozone events. In general, the off-shore ozone concentrations are greatly elevated during periods of southwesterly winds from the polluted urban corridor, and are modulated near the coastline by a complex sea breeze/land breeze effect. This research was supported by the National Oceanic and Atmospheric Administration.

A51D-0705 0830h POSTER

Ozone Over the Coastal Ocean of Chesapeake Bay and New England

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We have successfully deployed a new autonomous ozone measurement system for time-series measurements over the coastal ocean. Data were obtained at the Chesapeake Bay Lighthouse Tower (36.91 N, 75.71 W) for over a month in June-July 2003, and at an offshore tower at the Martha's Vineyard Coastal Observatory (41.32 N, 70.57 W) in late summer 2003. The data are compared with ozone and other data from nearby land stations. There is a strong correlation between ozone measurements at the coastal ocean towers and the land stations. However, the diurnal cycle is different over water, reflecting titration by NO emissions at night and increased dry deposition on land as well as differences in the atmospheric boundary layer structure over land and water. Back trajectories were calculated to determine the source regions of the air masses observed, and to examine differences in chemistry and transport between the land and ocean sites. A high-ozone pollution event in late June over the Chesapeake Bay region is analyzed in detail. These measurements are the beginning of a time series of ozone over the coastal ocean, and will be valuable in providing context to studies of air quality in coastal regions.

A51D-0706 0830h POSTER

Meteorological Controls on Ozone at Two High-Elevation Monitoring Sites in New Hampshire

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This study is examining the synoptic and regional scale meteorological controls on ozone mixing ratios at two sites in the Atmospheric, Investigation, Regional Modeling, Analysis and Prediction (AIRMAP) network located in New Hampshire, USA. Summertime ozone data is being analyzed from the summit of Mount Washington, the highest peak in the northeastern United States (1910m), and from Castle Springs, a forested site on the southwest flank of the Ossipee Mountains (400m). A five-summer data set (1998-2002) from Mount Washington is being used along with a two-summer data set (2001 and 2002) from Castle Springs in our analysis of extreme ozone at these two sites. Enhanced ozone events, defined as hourly averages above the 90th percentile (∼65 ppbv), and depleted ozone events, defined as hourly averages below the 10th percentile (∼30 ppbv) were identified and are being examined in detail. Due to the high elevation of these two sites and the associated diurnal dynamics, afternoon and nighttime ozone events are being studied separately. Transport analysis is being conducted using HYSPLIT backward trajectories initialized from both sites. We are using coincident meteorological observations and synoptic conditions to understand and interpret both depleted and enhanced ozone events. Trajectory analysis has revealed distinct patterns in transport and air mass history that help explain the variations in ozone extremes. Enhanced ozone events at Mount Washington and Castle Springs are generally associated with descending westerly transport, while depleted ozone events correspond to northerly transport. Our initial analysis of backward trajectories and meteorological conditions suggests an influence of both anthropogenic and stratospheric sources on afternoon and nighttime enhanced ozone events.

A51D-0707 0830h POSTER

Evaluating NOx/NOy Ratio as a method for Determining Long Range Vs. Short Range Pollution Events in New England.

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The NOx/NOy ratio has been used in past studies to determine the relative age of an air mass. Here we evaluate the use of this ratio with data collected from air quality monitoring sites operated by the Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIRMAP) program as a method for determining long versus short range pollution events in New England. Pollution events were identified using multiple gas phase species (O3, CO, NO, NOy) over a six-month period from July 2002 through December 2002. A total of 46 individual events were identified which lasted longer than 30 minuets at or above the 95% level of the selected species. The 95% level of CO, O3, NO and NOy for each species was 346 ppbv, 65 ppbv, 5.46 ppbv and 19.0 ppbv respectively. Backward trajectories and selected volatile organic compounds (VOC's) are being used to verify source regions. The frequency of short and long range pollution events using this method is being quantified and their seasonal variability assessed.

A51D-0708 0830h POSTER

Aerosol mass spectrometer measurements at Harvard Forest during NEAQS 2002

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An Aerosol Mass Spectrometer (AMS) was installed on a 30 m high platform at Harvard Forest during the New England Air Quality Study (NEAQS) 2002, a multi agency campaign designed to characterize gas and aerosol pollutants passing through the northeastern U.S. and the outflow over the Atlantic Ocean. The AMS provided size and chemically speciated aerosol mass loadings for nitrates, sulfates, ammonium, chloride and organic carbon. The Harvard Forest site is situated in a rural setting in central Massachusetts, with few known local sources of particulate sulfates and nitrates. Despite the location, Harvard Forest was subjected to several large particulate mass pollution events during July and August 2002. A detailed back trajectory analysis correlates the large, sulfate dominated particle events with source emitters (cities, power plants, etc.) in the region, mainly west of Harvard Forest. Comparisons with G1 aircraft data support the hypothesis that much of the boundary layer particulate matter is generated and transported within the North Eastern region and not transported long distances from outside regions within the US. A well defined example of long distance transport was observed on July 9th when mass spectral markers for biomass burning correlated with high CO levels identifying a Quebec fire plume. Results from a comprehensive study to apportion the sulfate and organics loadings with respect to sources will be presented.

A51D-0709 0830h POSTER

A major regional air pollution event in the northeastern U.S. caused by extensive forest fires in Quebec, Canada

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During early July 2002, wildfires in Quebec burned 1.1×10^6 ha of forest. The resultant smoke plume was seen in satellite images blanketing the U.S. east coast. At the same time extremely high CO mixing ratios were observed at the Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIRMAP) network sites in NH, USA and the Harvard Forest Ecological Monitoring Station (EMS) in MA, USA, representing enhancements of 525-1025 ppbv above background conditions. A biomass burning source for the event was confirmed by extremely elevated aerosol K^+, NH_4^+, NO_3^-, and oxalate mixing ratios at the AIRMAP sites. Additional data for aerosol K, OC and EC from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network and CO data from EPA sites indicated that the smoke plume impacted much of the U.S. east coast, from Maine to Virginia. CO mixing ratios and K concentrations at stations with 10+ year records suggested that this was the largest biomass burning plume to impact the U.S. east coast in over a decade. Furthermore, CO mixing ratios and aerosol $PM_{2.5}$ mass and scattering coefficients from the AIRMAP network and EMS indicate that this event was comparable to the large anthropogenic combustion and haze events which intermittently impact rural New England. We also present evidence that the biomass plume was superimposed on U.S. anthropogenic pollution, particularly in urban areas. The degree of enhancement of O_3, NO_y, NO_3^-, NH_4^+ and SO_4^{2-} in the biomass plume showed significant variation with elevation and latitude, with all species except SO_4^{2-} having reduced mixing ratios at lower elevation and more southern sites. The smoke plume reaching lower elevation sites clearly experienced enhanced interaction with the surface layer compared to higher sites due to subsiding transport along isentropic surfaces. Transport in the boundary layer resulted in increased depositional loss (e.g., O_3 and NO_y) and increased incorporation of polluted air masses (e.g., SO_4^{2-}) compared to transport in the free troposphere. The decreases with latitude likely also reflected increased dilution of the smoke plume as it traveled further south.

A51D-0710 0830h POSTER

Occurrences and Implications of Marine Air Tracers at Thompson Farm

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Enhancements of naturally emitted oceanic halocarbons, such as bromoform and methyl iodide, have been observed inland at the Thompson Farm sampling site in Durham, NH as part of the AIRMAP program. Measurements of these and other oceanic halocarbons are important for understanding the marine influences on New England air quality. Elevated levels of bromoform and methyl iodide were frequently measured during the NEAQS study period (June-August, 2002). Typical enhancements for bromoform were on the order of 150% while methyl iodide enhancements were approximately 25% above background. The observed enhancements of these two gases suggest a local source and that Thompson Farm can be impacted by marine sources. The diurnal and seasonal variations of these and other marine tracers will be examined in addition to the frequency of enhancement events using local sea-breeze data. Although these enhancements are believed to be primarily associated with sea breeze events, tidal cycle influences will also be examined.

A51D-0711 0830h POSTER

Nonmethane Hydrocarbon and Alkyl Nitrate Distributions at a Rural Site in New Hampshire

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Measurements of C_2-C_8 nonmethane hydrocarbons (NMHCs) and C_1-C_5 alkyl nitrates were made at Thompson Farm in Durham, New Hampshire as part of the Atmospheric Investigation, Regional Modeling, Analysis, and Prediction (AIRMAP) program. Distributions of NMHCs and alkyl nitrates, as well as their evolution, are analyzed to identify pollution events and their sources. The dominant NMHCs throughout the summer were ethane, propane, and isoprene while ethene, ethyne, and the C_4 and C_5 alkanes also made significant contributions to the total NMHC levels observed. The most abundant alkyl nitrates were isopropyl nitrate and 2-butyl nitrate, suggesting anthropogenic sources. Alkyl nitrate/parent alkane versus 2-butyl nitrate/n-butane ratios were used to examine the aging, production, and sources of alkyl nitrates. NMHCs, total $RONO_2$, and O_3 tracked each other well during pollution events for the June-August 2002 sampling period. The concurrent enhancements in $RONO_2$ and O_3 during the events suggests that the air masses were composed of photochemically aged anthropogenic emissions.

A51D-0712 0830h POSTER

Halocarbons, alkyl nitrates, and nonmethane hydrocarbons quantified from surface air and water samples in the Gulf of Maine during NEAQS

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During the New England Air Quality Study (NEAQS) campaign, July-August 2002, natural and anthropogenic halocarbons, alkyl nitrates, and nonmethane hydrocarbons (NMHCs) in surface air and water samples were quantified in situ using gas chromatography with flame ionization and electron capture detection aboard the NOAA R/V Ronald H. Brown. The cruise focused on an area in the Gulf of Maine,

south of Portsmouth Harbor, near the Isle of Shoals, and in the Boston Harbor area. Between Cape Ann and Newburyport, saturation anomalies for anthropogenic halocarbons of 100% for CFC-113, 140% for H-1211, 40% for methyl chloroform, and 15% for carbon tetrachloride were observed. Throughout the cruise, subsequent high levels of these compounds were found in the area. The findings suggest that there are local anthropogenic sources of these gases, which are draining into the Gulf of Maine from local rivers, harbors, or estuaries. Elevated level of methyl bromide, methyl iodide, bromoform, and chloroform were measured near the coast, and decreased with increasing distance. The distributions of the NMHCs were similar to the naturally produced marine halocarbons, suggesting similar sources. Supersaturation of alkyl nitrates were observed indicating an oceanic source of methyl nitrate, i-propyl nitrate, n-propyl nitrate, and 2-butyl nitrate, with the later three compounds reported here in ocean water samples for the first time.

A51D-0713 0830h POSTER

Non-Methane Hydrocarbon Measurements Aboard the NOAA Research Vessel Ronald H. Brown during the 2002 New England Air Quality Study (NEAQS 2002)

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During the NEAQS 2002 study, in-situ NMHC measurements were made aboard the NOAA research vessel Ronald H. Brown by a two channel automated gas chromatograph using both flame ionization and mass-spectrometric detection techniques. Five minute average samples were cryogenically trapped each 1/2 hour and analyzed immediately for C2 through C10 alkanes, C2 through C5 alkenes, C6 through C9 aromatics, C2 through C8 aldehydes and ketones, C1 through C5 alcohols and a variety of compounds of biogenic origin including 6 monoterpenes, isoprene and its primary oxidation products methacrolein and methylvinyl ketone. The relative contributions of these classes of compounds to OH photochemistry has been determined for air masses ranging from those showing significant anthropogenic influence to clean marine air. For the most anthropogenically influenced air masses, alkenes were observed to play a dominant role whereas oxyhydrocarbons, principally acetaldehyde, were observed to dominate under clean marine conditions. Both the NMHC measurements and back trajectory analyses indicated periods of significant influx into the New England coastal region of urban air masses showing elevated ozone levels from the Boston/Providence urban corridor. About as frequently, less photochemically mature air masses, depleted in ozone but laden with light reactive alkenes, were observed coming from the Portsmouth NH/Kittery ME coastal urban complex. Even in the presence of these anthropogenic plumes, biogenic hydrocarbons appear to dominate OH photochemistry in the New England region much of the time. Data demonstrating all of these conclusions will be shown.

A51D-0714 0830h POSTER

PAN-Type Compounds and Photochemistry in the NEAQS Environment

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Peroxyacyl Nitrates (PANs) were measured by capillary GC/ECD aboard the NOAA research ship, Ronald H. Brown, as part of the 2002 New England Air Quality Study (NEAQS). Peroxyacetyl nitrate (PAN), Peroxypropionyl nitrate (PPN), Peroxy-iso-butyryl nitrate (PiBN), and Peroxymethacryloyl nitrate (MPAN) were all measured simultaneously once every 10 minutes from July 12 through August 10, 2002. Calibration of the PANs was performed via acetone photolysis (PAN) and diffusion source (PPN and PAN) allowing for detection limits ranging between 5-10 pptv. Significant amounts of all the PANs were observed off of the coast of New England. These values are comparable to those obtained from past terrestrial ground site measurements. PAN mixing ratio was observed to be as high as 2.5 ppbv, while PPN and MPAN were seen to reach mixing ratios over 300 pptv. PANs thereby represent a significant NOx source to the New England marine boundary layer. The relative amounts of the PANs observed also indicate that the chemistry of the NEAQS sampling environment is impacted by the oxidation of both anthropogenic and biogenic hydrocarbons. The results from this investigation possibly indicate the in-situ production/destruction of PANs within the marine boundary layer.

A51D-0715 0830h POSTER

Measurements of HNO_3 on the NOAA Research Vessel Ronald H. Brown During NEAQS 2002

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Nitric acid was measured at 5 minute resolution with an automated mist chamber/ion chromatograph sampling/analysis system. More than 3000 measurements were made from 29 July through 10 August, 2002, mainly in the Gulf of Maine but also during the transect to South Carolina at the end of the cruise. Mixing ratios of HNO_3 varied over a wide range from day to day in response to synoptic conditions, with southeasterly flow bringing much cleaner air to the sampling region on several days. The maximum mixing ratio (7.1 ppbv) was observed in Boston Harbor, but the prevailing westerly flow carried regionally polluted air masses to the ship for most of the study, resulting in an overall mean HNO_3 mixing ratio of 1.1 ppbv. Pronounced diurnal variability was superimposed on these synoptic changes. Peak mixing ratios were observed each day around solar noon (mean for the interval 11:00 - 15:00 local time was 2.01 ppbv), with minima near sunrise and sunset. The morning hours between 6:00 - 8:00 almost always had the lowest HNO_3 mixing ratios each day, overall the mean during this period was 0.57 ppb. Interestingly, nitric acid increased after dark to a secondary maximum, averaging 0.98 ppbv for the 4 hours centered around midnight. The nighttime peak of HNO_3 was generally much broader than the daily maximum in the early afternoon, suggesting sustained production of HNO_3 in the dark (see Brown et al., this session).

A51D-0716 0830h POSTER

In-situ Measurements of NO_3 and N_2O_5 During NEAQS 2002

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During the New England Air Quality Study (NEAQS) 2002 campaign, nighttime chemistry of nitrogen oxides was studied through direct, in-situ measurements of NO_3 and N_2O_5 via cavity ring-down spectroscopy. The measurements were taken off the coast of the Northeast U.S. aboard the NOAA research vessel Ronald H. Brown. The marine boundary layer is a unique environment in which to observe chemical transformations occurring in polluted air masses advected from land over the ocean. Data are available for 17 nights of observations of these two compounds; their mixing ratios varied from the instrumental detection limit of 0.5 pptv (5 s average) to maximum values of 140 pptv for NO_3 and 1.5 ppbv for N_2O_5. Respective average mixing ratios were 17 and 84 pptv during nighttime hours for these two compounds. The combination of these observations with measurements of mixing ratios of other important trace gases, aerosols properties and composition, and meteorological data allowed for detailed analysis of NO_3 and N_2O_5 lifetimes and relevant sink chemistry for these compounds. Model calculations are used to illustrate the interconversion of nitrogen oxide compounds near sunset and sunrise.

A51D-0717 0830h POSTER

Field and Laboratory Measurements of Carbon Dioxide Mixing Ratios in Air Using the LI-COR LI-7000 CO_2/H_2O Analyzer

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Air measurements of CO_2 were made with a LI-COR LI-7000 CO_2/H_2O analyzer on the NOAA ship Ronald H. Brown during the New England Air Quality Study (NEAQS 2002) field campaign. This instrument is an improved version of the older model LI-6262 CO_2/H_2O analyzer, which uses a non-dispersive IR radiation absorption technique. During NEAQS, we operated the LI-7000 without temperature regulation, using a simple 2-point calibration scheme. An intercomparison between our measurements of atmospheric CO_2 mixing ratios and those measured by a more sophisticated method, using temperature-regulation and a multipoint calibration with a LI-6252 CO_2 analyzer (operated by AOML) shows generally good results ($[CO_2]AL = [CO_2]AOML \times 1.015\ (0.010) - 5.7\ (3.8)$ ppmv; $R^2 = 0.9889$) in highly variable air masses. During subsequent laboratory studies, we evaluated the instrument for the manufacturer's claims of improvement in signal noise, sample gas temperature equilibration and zero drift with temperature. Further work examined the instrument's susceptibility to rapid temperature changes, which has been previously demonstrated to introduce error of several ppmv $^{\circ}C^{-1}$ in the LI-6252. A change in the LI-7000 optical bench temperature of 12 $^{\circ}$C in 1 hour caused a sampling error of $\sim$3 ppmv CO_2. Therefore, our lab investigations indicate that the LI-7000 would benefit from a temperature-controlled enclosure, as is used by the AOML group.

A51E MCC: Level 2 Friday 0830h

2002 New England Air Quality Study IV Posters

Presiding: **B Talbot,** Institute for the Study of Earth, Oceans, and Space, University of New Hampshire**; T Bates,** NOAA Pacific Marine Environmental Laboratory

A51E-0718 0830h POSTER

Measurements of Marine Vessel Emissions

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