Nocturnal Measurements of HONO in a Polluted Urban Atmosphere

Patryk Wojtal and Robert McLaren, York University, Centre for Atmospheric Chemistry

Differential optical absorption spectroscopy (DOAS) was used to quantify the concentration of nitrous acid (HONO) and NO2 in the nocturnal urban environment at York University, Toronto over a one year period. HONO accumulates over night and rapidly photolyzes in the early morning to produce a daytime source of hydroxyl radicals (OH) and nitrogen oxides (NO). Laboratory studies and observations within the nocturnal boundary layer reported in the literature suggest heterogeneous conversion of NO2 on surface adsorbed water as the major nighttime source of HONO. Recently, we reported nocturnal pseudo steady states (PSS) of HONO in a marine environment where the HONO concentration was constant with time and independent of the air mass source and NO2 concentration. This led us to propose a formation mechanism in which an aqueous surface, saturated with nitrogen containing precursors, is established to support reversible partitioning of HONO to the gas phase through vaporization and deposition of HONO to the surface. Similar steady states of HONO along with other types of HONO behaviors have been observed at York University for a variety of surface conditions (snow, water, dry, etc.), temperatures and relative humidity. The dataset collected at York University will be presented with a focus on the causes and implications of the observed nighttime HONO behaviors. The effects of a surface reservoir of nitrogen oxides and their link to daytime and nighttime HONO will be discussed. Various HONO correlations and conversion efficiencies of NO2 to HONO will also be examined, providing further insight into the nighttime HONO chemistry.

Using Wind Profiler Data for Real-Time Severe Weather Analysis

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[1] York University and Zephyr North Canada; [2] York University

Numerous severe storm cells, some producing tornados pass through southern Ontario every year and put human lives at risk. As intense storms appear to be occurring more frequently, it will be useful to provide meteorologists with real-time tools to help predict storm developments and provide warnings to the public in a timely manner. Wind measurements from 9 VHF wind profilers located in southern Ontario and western Quebec (locations are shown in Fig.1) are used to produce a variety of plots, including streamlines of wind velocity, plus divergence, vorticity and speed contours at various heights from 0.5km to 15km. In addition, hodographs are produced to represent the vertical wind profiles up to 15 km for all 9 wind profiler sites. This is one of the first times that a network of wind profilers has been used in this way. From these plots, we anticipate that forecasters will be able to better analysis and locate storm development in real time. The hodographs and streamlines can

Fig 1. The locations of the 9 Wind Profilers throughout Southern Ontario and Western Quebec.

show wind shear, which is essential to determine the development of thunderstorms. An automated real time system is being developed and will become operational soon, providing all these products on the web for meteorologists to reference. With feedback from meteorologists at Environment Canada, CBC and The Weather Network, we hope to develop additional products to aid in the prediction of severe weather.

Hydroxyhydroperoxide (HHP) Formation from H_2O_2 Addition to Carbonyls in the Aqueous Phase and Its Environmental Implications

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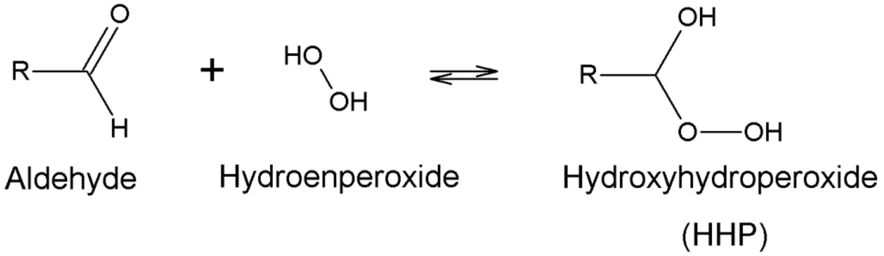
Organic peroxides are major components of secondary organic aerosol (SOA), affecting the toxicity of SOA and its oxidative capacity. Hydroxyhydroperoxide (HHP) is a class of organic peroxide observed in ambient air, rain water, and cloud water. However, the formation pathway of HHPs remains under debate, with one potential path via reaction of water with Criegee Intermediates. The current study focuses on a formation mechanism involving reversible nucleophilic addition of H_2O_2 to aldehydes. This formation pathway of HHPs has been known for decades, but has long been considered as a minor reaction. This is because HHPs were observed to decompose rapidly into H_2O_2 and the corresponding aldehydes in dilute aqueous solutions. In the current study, proton transfer reaction mass spectrometry (PTR-MS) coupled to a bubbler was employed to determine the equilibrium constants (K_{eq}) of H_2O_2 addition to a variety of atmospherically relevant carbonyls in the aqueous phase. HHP formation was insignificant from ketones and methacrolein, but was significant from acetaldehyde and propionaldehyde, with K_{eq} values determined to be 131 ± 14.6 and 83.8 ± 12.3 M^{-1} at 25 °C. The temperature dependence of the acetaldehyde reaction was also explored. Based on these values, the environmental implications of HHP formation via this pathway suggest that HHP formation is unlikely to be significant in cloud water. However, in aerosol liquid water, where the concentrations of aldehydes and H_2O_2 can be at the mM level, this pathway may be significant.



Investigation of Low Altitude Water Ice Cloud Formation in Mars using a Laboratory Based Cloud Chamber

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The ice nuclei abilities of the two available Martian regolith analogs (the Mojave Mars simulant and Johnson Space Center Mars-1) to form low altitude water ice clouds in the Martian atmosphere were investigated with the help of the University of Toronto continuous flow diffusion chamber (UT-CFDC). Polydisperse aerosol particles (below 1 μm) generated using a dry disperser and monodisperse aerosol particles (100 nm and 240 nm) generated with an atomizer were exposed to different supersaturations with respect to ice as a function of temperature. Experiments using 100 nm size selected sulfuric acid particles defined the homogeneous freezing threshold in the chamber. Both simulants were found to be active ice nuclei in the deposition nucleation mode between 223 K and 203 K. The Mojave Mars simulant particles were found to be slightly better ice nuclei than the Johnson Space Center Mars-1 particles since they require lower supersaturations to nucleate ice at the different tested temperatures. It was observed that the critical supersaturation (S_{crit}) to activate 1 % of the aerosol particles increased with decreasing temperature. It was also found that S_{crit} decreased when the particle size was increased from 100 nm to 240 nm. The Johnson Space Center Mars-1 analog behaves similarly to the well known terrestrial ice nuclei such as kaolinite and Arizona test dust particles, whereas, the Mojave Mars simulant behaves closer to another clay, montmorillonite. The *m* parameter values and the contact angles were calculated from the experimental S_{crit}. Those values follow the literature trends; however, our values are larger than in previous studies perhaps due to the use of submicron aerosol particles and the lower sensitivity of our system for determining the S_{crit} values. A general finding is that the barrier to ice nucleation becomes larger at lower temperatures. This behaviour is typically neglected in most of the microphysical models since the nucleation rates at this temperature range are assumed as non temperature dependent. This should be re-evaluated based in the literature data and present results.

Development of a Raman LIDAR for Mars Water Cycle Studies

George Nikolakakos
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The LIDAR (LIght Detection and Ranging) instrument aboard the Phoenix Mars lander provided crucial new insight into the Martian atmosphere. Chief among the LIDAR discoveries was the observation of ice crystals precipitating from clouds. Other key Phoenix mission findings included the confirmation that a water ice table exists below the surface, the observation of adsorbed water on regolith grains, and the detection of perchlorate, a highly deliquescent salt. The addition of Raman spectroscopy capabilities to the next generation of Mars LIDAR would greatly enhance the understanding of these Mars water cycle processes while maintaining the compactness of using a single emitted laser wavelength. In order to assess the feasibility of such an instrument, a Raman LIDAR has been developed and operated at York University. The

vertical viewing capabilities of the LIDAR were first demonstrated using the Earth's atmosphere to detect molecular atmospheric constituents as well as to derive range-resolved tropospheric ozone profiles by utilizing the differential absorption method. The instrument was then converted to a horizontal near-range viewing configuration and Raman measurements were conducted on bulk ice and liquid water. Early measurements demonstrate great promise for discriminating between the two states using their Raman signature.

Atmosphere-Surface Exchange of Reactive Nitrogen and its Implications for PM2.5

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Recently it has been suggested that the surface-atmosphere exchange of ammonia (NH3) and nitrous acid (HONO) can occur in a bidirectional fashion governed by a compensation point (i.e. the atmospheric mixing ratio where the flux changes direction). Direct calculation of compensation point values is not trivial, because of the dependence on soil temperature, moisture, pH and the nitrogen distribution in the system. The presence of atmospheric particulate matter can further influence surface flux by providing a reactive sink for trace gases in the atmosphere. An accurate understanding of the factors governing bidirectional flux is required for air quality models to accurately predict trace gas mixing ratios, aerosol composition and spatial patterns of nitrogen deposition.

A field study is currently being conducted in southwestern Ontario to measure the atmospheric and surface components of the system to provide observational constraints to test our understanding of the bi-directional exchange of reactive nitrogen. An Ambient Ion Monitor Ion Chromatograph (AIM-IC) was used to quantify the water-soluble trace gases as well as water-soluble ions in PM2.5 with hourly time resolution. Similar IC methods were used in an offline fashion to monitor soil ammonium, nitrite and nitrate. Instrumental optimization and method validation experiments were performed prior to the start of the field campaign. Challenges in selecting sampling and extraction protocols that can provide representative soil pH and nitrogen content are also discussed.

Study of Overdense Meteors and the Secondary Ozone Layer Using VHF Meteor Radars

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An estimated 200,000 tonnes of interplanetary dust and debris enter Earth's atmosphere each year, with speeds ranging from 11 km/h to 72 km/h. Collisions with atmospheric gases cause frictional heating and ablation which result in an ionized meteor trail containing electrons and positive ions. Radar has the capability to detect electrons in the meteor trail, and distinguish two distinct trail types; underdense with low electron density ($q<10^{14}$ el/m) and overdense meteor trails where $q>10^{14}$ el/m. Overdense meteors and their radio echo durations are valuable tools for study of the upper atmosphere, especially of the secondary ozone layer between 80-100 km, where gradual and alarming ozone depletion had been observed in the past. The duration of overdense meteor echoes is directly related to the ozone concentration. The importance of chemistry (initial oxidation and dissociative recombination) in the process of meteor trail deionization which has been somewhat ignored during the sixties, will be discussed here in more detail. Additionally, some aspects of meteor ablation and numerical modeling of that process will be discussed.

Illuminating Urban Grime

Alyson Baergen and D. J. Donaldson, University of Toronto

In recent years there has been increasing interest in understanding the formation of pollutant films on impervious surfaces exposed to the atmosphere and their role in influencing atmospheric processes. Often referred to as urban grime, these films sequester compounds such as polycyclic aromatic hydrocarbons (PAHs), halogenated aromatics (ie. PCBSs), as well as inorganic compounds such as nitrates and sulfates from the gas phase. On the film, photochemical reactions are thought to take place, producing gas phase products such as NOx suggesting that these films may play a role in altering atmospheric composition especially in urban environments. In order to explore photochemistry on the films, we are using Attenuated Total Reflectance Fourier Transform Infrared spectroscopy (ATR-FTIR) to track changes in chemical composition following illumination. Using proxy films, we have observed film oxidation due to reaction with ambient oxygen during illumination with a solar simulator. These results suggest that the films could act as more than just an inert surface on which heterogeneous reactions can occur. The effects of various photosensitizers, thought to be present in real films, have also been examined. Both nitrate anions and anthraquinone enhance the film photooxidation. As an extension of these studies we have grown true films on the ATR crystals by exposing them to the atmosphere in downtown Toronto, allowing for films to be directly studied without the necessity of extraction techniques used in previous studies. We will present results comparing the photochemistry on such "real" films with what we have observed on the film proxies.

Gas-particle partitioning of an ad hoc division of accumulation and coarse modes at the CalNex-LA ground site and the consequences for aerosol acidity

Gregoire, P.K. and Murphy, J.G.

The CalNex 2010 field campaign was a broad collaborative field study that investigated the atmospheric processes that contribute to air pollution and climate change. Data from this study are being used to explore the thermodynamic partitioning of the gas and particle phase inorganics. Gas phase HNO_3 and HCl measurements were obtained by negative-ion proton-transfer chemical-ionization mass spectrometry (NI-PT-CIMS), while gas-phase ammonia measurements of NH_3 were collected via quantum cascade tunable infrared laser differential absorption spectroscopy (QC-TILDAS). Particulate Na^+, NH_4^+, SO_4^{2-}, NO_3^-, and Cl^- in fine particles (diameter < 2.5 microns) were measured hourly with particle into liquid sampler ion chromatography (PILS-IC). These measurements were analyzed in conjunction with the extended aerosol inorganic model (E-AIM).

The goal of this study is to evaluate the plausibility of creating an ad hoc division in the concentrations of the particulate species to attempt to replicate real, size-dependent differences in aerosol composition. The accumulation mode (generally submicron) is dominated by partitioning of SO_4^{2-} and NH_4^+ while the supermicron mode can be formed by mechanical action such as sea spray and may be dominated by Na^+ and Cl^-. If the system is at equilibrium, the two modes should produce equivalent gas phase NH_3, HCl, and HNO_3 concentrations. Analysis using E-AIM suggests that separating these two modes may improve the thermodynamic predictions of the model. Furthermore, the results show that the pH of the fine mode aerosols tends to be on average 0.25 pH units lower than the coarse mode aerosols. Disparities between the fine system, coarse system, and measured gas concentrations are greatest at times of reduced relative humidity.

Atmospheric Detection of Perfluorotributyl Amine, an Uncharacterized Long-Lived Greenhouse Gas

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Poly- and perfluoroalkyl substances (PFASs) are trace atmospheric constituents of radiative significance. Upon release to the environment, PFASs partition into the atmosphere due to unique physico-chemical properties such as high partial pressures and insolubility in aqueous media imparted by the presence of multiple C—F bonds. In the atmosphere, PFASs may represent a class of potent long-lived greenhouse gases (LLGHGs) because they possess long lifetimes and exceptionally strong absorption bands in the infrared (IR) spectral region where other naturally occurring greenhouse gases (GHGs) do not absorb. The Intergovernmental Panel on Climate Change determined the radiative forcing (RF) of halocarbons to be +0.337 [± 0.03] W m-2, accounting for 13 % of the total RF attributed to LLGHGs. Although this value claims high certainty, it does not represent the actual perturbation from all environmentally relevant PFASs. Here we present the initial detection of perfluorotributyl amine (PFBAm), an unreported PFAS, in the atmosphere. Previous work from our group has shown that PFBAm interacts strongly with IR radiation and is a potent GHG; its radiative efficiency (RE) is calculated to be 0.86 W m-2 ppb-1. To evaluate the contribution of PFBAm atmospheric loadings as an agent of radiative imbalance, a highly sensitive and selective method for detection was developed and validated. PFBAm was cryogenically extracted and pre-concentrated from bulk air samples for the offline detection by a custom-designed manifold coupled to a gas chromatograph-mass spectrometer. Quantitation was achieved by external calibration with a gravimetrically prepared, matrix-matched, authentic gaseous standard. Validation of the sampling method was performed by simultaneous measurement of several legacy chlorofluorocarbons and hydrochlorofluorocarbons. Preliminary results indicate that PFBAm is present in the atmosphere at concentrations of 0.081 [± 0.006] pptv ($n=27$, $p<0.05$, $t=1.706$). The potential for PFBAm to impact the Earth's energy balance will be discussed in light of its concentration and RE. The detection of PFBAm sets a precedent for the discovery of other unaccounted PFASs.

Development of a Fluorescence Technique for Organic Hydroperoxides (ROOH) Detection: Application to the Study of SOA Aging

Dana Aljawhary, Appana Lok, Jon Abbatt, University of Toronto

Atmospheric particulate matter provides a medium into which gaseous organics can condense and further oxidize. While much is known about gas phase oxidation of organics in the atmosphere, there remains a large uncertainty associated with understanding the chemical processing of organics in the condensed phase. It is reported that organic peroxides, which are a class of Reactive Oxygen Species (ROS), can contribute to a large fraction (47-85%) of SOA mass [1]. Due to their high abundance and reactivity, organic peroxides may contribute to the chemical processing of organics in SOA. As a result, measuring the concentration of organic peroxides in SOA is essential to enable full understanding of their reactivity in SOA. The majority of the detection techniques used nowadays are general, and detect peroxides in all forms ($ROOR+ROOH+H_2O_2$). A more specific detection technique that allows for measuring one class of peroxides is crucial as it helps in understanding the role each class plays in SOA chemical processing. As a result, a fluorescence detection technique using 2′7′-dichlorofluorescin (DCFH) has been optimized to allow for separate measurements of H_2O_2 and total ROOH in SOA. Results from the optimization experiments will be presented. The experimental conditions were then used to measure the total ROOH and H_2O_2 content in the aqueous extract of lab generated SOA. This was followed by photolysis experiments of the SOA extract, where the ROOH and H_2O_2 concentrations were determined at different photolysis time. In addition, the stability of the ROOH and H_2O_2 in SOA aqueous solutions and on SOA filters was determined.

(1) Docherty, K. S.; Wu, W.; Lim, Y. B.; Ziemann, P. J. *Environ.Sci.Technol.* **2005**, *39*, 4049-4059.

Arctic weather, climate, and air quality: A quasi-geostationary view of the Arctic and environs with PCW/PHEOS

J. C. McConnell and the PHEOS Science team

Arctic climate is changing and the multi-year sea-ice cover is disappearing more rapidly than most climate models estimate. With declining ice cover, the Arctic Ocean will likely be subject to increased shipping traffic in addition to exploration activity for natural resources with a concomitant increase in air pollution. Thus there is a need to monitor the polar region. An important method that can address many of the atmospheric issues is by quasi-geostationary viewing at high temporal resolution. The Canadian Space Agency (CSA) is proposing the PCW (Polar Communications and Weather) mission to provide improved communications and an operational meteorological imager similar to MODIS. Two satellites are planned to be in a highly eccentric orbit (HEO) with apogee at ~ 40,000 km over the Arctic in order to have both quasi-geostationary viewing over the Arctic and environs with 24x7 coverage in the MIR and solar reflected light (UV-Vis-NIR) in the summer period.

This presentation will focus on PHEOS WCA (Polar Highly Elliptical Orbital Science Weather, Climate and Air quality) mission, which is an atmospheric science complement to the operational PCW mission. The PHEOS WCA instrument package consists of FTS and UVS imaging sounders with viewing range of ~4.5 degrees or a FoR ~ 3400x3400 km2 from near apogee. The spatial resolution at apogee of each imaging sounder is targeted to be 10x10 km2 with an image repeat time of ~ 1-2 hours. The FTS has 4 bands that span the MIR and NIR while the UVS has one band spanning the UV-Vis spectral region. The instruments should provide vertical tropospheric profiles of temperature and water vapour in addition to partial columns of other gases of interest for air quality such as O3, CO, NO2, BrO, HCHO, HCN, CH3OH, etc as well as total columns of CO2 and CH4 and AOD. In this presentation we will outline the scientific objectives, status of retrieval algorithms and also the viewing geometry necessary with 2 satellites and the outcome of the PHEOS WCA Phase A study, funded by the CSA, which was completed in the spring of 2012.

Posters

P1. Stable carbon isotope ratios and the photochemical age of atmospheric volatile organic compounds

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There are several approaches that allow estimates of the extent of photochemical processing of VOC, often referred to as photochemical age. Most of them are based on the change of ratios of precursor concentrations (hydrocarbon clock) or ratios of precursor concentrations over reaction product concentrations. Recently our group developed a methodology to determine the extent of photochemical processing for individual VOC from change in their stable carbon isotope composition. During the last years we conducted measurements of VOC concentrations and their carbon isotopic composition at urban and remote locations in southern Ontario. In this presentation photochemical ages derived from VOC ratios will be compared with the photochemical age of individual VOC derived from their stable carbon isotopic composition. One of the most important findings is that in many cases photochemical ages of VOC with different reactivity differ. Generally the photochemical age of VOC increases with decreasing reactivity. One of the consequences is that the concept of a uniform photochemical age of an air mass may sometimes be misleading and photochemical age will depend on timescales determined by the photochemical life time of the studied compound. The use of VOC with different atmospheric lifetimes to determine photochemical aging at different timescales will be discussed.

P2. Stable Carbon Isotope Ratios and Concentrations of Gas Phase and Particulate Nitrophenols and their Dependence on Ozone and NO_x Levels

Marina Saccon[1], Sophie Moukhtar[1], Satoshi Irei[1], Lin Huang[2], Jochen Rudolph[1]
[1] Centre for Atmospheric Chemistry, York University; [2] Environment Canada

The chemical processing of atmospheric trace gases over or close to urban and industrialized areas often results in significant correlations between concentrations of various pollutants, including ozone. There are several reasons for the existence of these correlations ranging from atmospheric dispersion to photochemical processing and co-location of trace gas sources. Correlations between ozone and secondary organic pollutants such as peroxyacyl nitrates and other organic nitrates have been used to understand the processes determining atmospheric levels of photo-oxidants, including ozone. Similar to many organic nitrates in the atmosphere, nitrophenols are formed by the atmospheric oxidation of non-methane hydrocarbons (NMHC), specifically aromatic NMHC, in the presence of oxides of nitrogen. Therefore their concentrations should show a positive correlation with ozone concentration similar to many other organic nitrogen species. Due to the semivolatile nature of nitrophenols determining their atmospheric concentrations is demanding and requires measurements of gas phase and particle phase concentrations. In this presentation we describe methodology to determine gas phase and particle phase concentrations and isotope ratios of nitrophenols. Results of measurements conducted in a mixed industrial and residential area at the outskirts of metropolitan Toronto (ON, Canada) will be presented. Preliminary results unexpectedly indicate a negative correlation between nitrophenol and ozone levels. Possible reasons for this will be discussed and it will be shown that isotope ratio measurements provide new insight into the origin and atmospheric chemistry of semi-volatile secondary organic pollutants.

P3. Identification and Aging of Secondary Organic Aerosol Formed from the Photo-oxidation of β-pinene

Mehrnaz Sarrafzadeh, Donald Hastie, York University

Monoterpenes such as β-pinene are a prominent class of volatile organic compounds (VOCs) that can be oxidized to result in significant secondary organic aerosol (SOA) formation. The lack of knowledge of SOA composition and formation mechanisms lead to uncertainties in its true impact on climate and health. The main objective of this study was to investigate the chemical composition and formation mechanisms of SOA generated from hydroxyl radical (OH) initiated oxidation of β-pinene. The experiments were carried out in an indoor $8m^3$ smog chamber and oxidation products were analyzed online using an atmospheric pressure chemical ionization tandem mass spectrometer (APCI-MS/MS). For investigating particle phase products, an online counter flow membrane denuder (CFMD) was successfully integrated with the smog chamber and APCI-MS/MS instrument. Collision induced dissociation was used to identify product composition as well as generate product reaction time profiles which aided in providing valuable mechanistic information. The other aim of this work was to focus on the chemical aging process of SOA formed from β-pinene photo-oxidation in order to investigate if the SOA produced can undergo further oxidation with OH and ozone (O_3) in both gas and particle phases. Further oxidation can alter the chemical composition of products resulting in less volatile products which contribute to SOA mass. The results of this study suggested that OH induced aging may play an important role in the SOA aging process, whereas aging with O_3 did not show any detectable impact.

P4. Air-snowpack exchange of bromine, ozone and mercury in the springtime Arctic as simulated by the 1-D model PHANTAS

Kenjiro Toyota[1,2], Ashu P. Dastoor[2], Ralf M. Staebler[2], John C. McConnell[1]

[1] York University, [2] Environment Canada

PHANTAS (PHotochemistry ANd Transport in Air and Snowpack) is a one-dimensional model that represents the multiphase chemistry and transport of reactive bromine and chlorine species from the bottom of saline snowpack and to beyond the turbulent atmospheric boundary layer mainly to simulate their impacts on ozone and atmospheric mercury depletion events in the polar region. The chemical mechanism has been adapted from that used for the simulation of multiphase halogen chemistry involving deliquesced sea-salt aerosols in the marine boundary layer. The formulation of a vertical diffusion equation and the configuration of grid spacing are designed so that the model can realistically capture chemical interactions occurring across the interface of snowpack and overlying ambient air. The profile of turbulent diffusivity in the atmosphere is diagnosed by solving a set of micro-meteorological equations applicable to the stable boundary layer from several external inputs such as surface wind speed and sensible heat flux. The effect of wind pumping in the snowpack interstitial air is superimposed on molecular diffusivity in a simplified fashion. Model runs by PHANTAS illustrate how the top millimeter layer of snowpack actively interact with the overlying atmosphere to release reactive halogens and to take up oxidized mercury entering from the atmosphere. Also shown is that bromide starts to accumulate into haze aerosols when ozone is depleted in the air and then mediates the retention of oxidized mercury in the aerosols.

P5. Concentration Measurements of Atmospheric Nitrophenols in Particulate Matter and Gas Phase

C. Facca, M. Huroy, J. Kharboutly, D. Lane and J. Rudolph, York University

Nitrophenols are toxic, semi-volatile compounds which are formed in the atmosphere by the OH-radical initiated photo-oxidation of aromatic hydrocarbons, such as toluene. Due to their semi-volatile nature, nitrophenols can exist in the atmosphere in both the gas phase and in particulate matter, thus the understanding of their partitioning is important for studies of the formation and processing of secondary organic matter.

In recent years high-volume air sampling using filter-based techniques have been employed to collect nitrophenols from both phases. However, the results from these filter-based techniques tend to be biased towards the vapor phase due to sampling artifacts, and therefore do not give a completely accurate depiction of the partitioning. More recently, a sampling method using the IOGAPS (Integrated Organic Gas and Particle Sampler) system which employs an eight-channel annular diffusion denuder and quartz fibre filters, has been developed to allow separate collection of gas and particle phase nitrophenols. This sampling techniques can eliminate some of the sampling artifacts normally observed in filter sampling techniques and therefore may be able to give a more accurate depiction of nitrophenol partitioning. In this poster, results for a denuder sampling efficiency test, as well as some preliminary ambient measurements results obtained over the last few months using the IOGAPS in parallel to high-volume filter samples are presented.

P6. Water uptake properties of pure organic and mixed aerosols produced by oxidation of isoprene and selected terpenes, Naeem Lodhi, York University

P7. Development of an FTS for thermal and near-infrared sounding of weather, air quality and greenhouse gases in the Arctic, McConnell et al.

P8. PCW/PHEOS-WCA Quasi-geostationary viewing of the Arctic and environs for weather, climate and air quality, McConnell et al.

P9. Optical depth measurements from MAESTRO on the ACE satellite, McElroy et al.

P10. National Instruments provides a variety of solutions that help educators and researchers solve their teaching and application challenges. Visit with NI to explore hardware and software products that bring hands-on, project-based learning to the classroom, take research to the next level, and foster the next generation of innovators. Come see how educators and researchers around the world are using NI tools such as NI LabVIEW graphical system design to create a dynamic environment in the lab and in the classroom.

P11. Measurements of Gaseous Carbonyls Using an Automated HPLC system during the BAQS-MET Field Study

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Measurements of gaseous carbonyls were made using an automated HPLC system, which utilizes the DNPH derivitization method, during the Border Air Quality and Meteorology Study (BAQS-MET). The BAQS-MET field campaign was conducted to investigate the effects of transport and lake breezes on pollutant levels in southwestern Ontario, as well as to determine the sources of these pollutants. The measurements took place in Ridgetown, ON from Jun 21st to July 10, 2007. Ridgetown is a rural area in close proximity to the United States, as well as Lake Erie and Lake St. Clair, rendering it an ideal location for the objectives of this field campaign. The levels of nine carbonyls (C1-C7) including methylglyoxal and o-tolualdehyde were measured on a 2-hour cycle time throughout the study. The median levels of the most abundant carbonyls were: 1.8 ppb for acetone, 1.7 ppb for formaldehyde and 0.92 ppb for acetaldehyde. These levels were significantly elevated during enhanced smog events. Long range transport was observed for the carbonyls, which are important products of photochemistry, as well as, important precursors of ozone and secondary organic aerosols. The highest levels of carbonyls were observed with a general southerly flow. The non methane hydrocarbons (NMHCs) contributing to the production of carbonyls were mostly anthropogenic in nature. Furthermore, the carbonyl data has been analyzed in conjunction with NMHC, NO_2 and O_3 data collected at the same site. The NMHC were measured via Suma canisters and GC-FID analysis, while the NO_2 and O_3 were measured with TECO instruments. From the analysis with NMHCs, it was found that the carbonyls represent a significant fraction of the total volatile organic compounds

(VOCs) burden and a valid measure of relative photochemical processing is proposed to be ppbO/ppbC.

P12. Measurement of refractory and non refractory particulate chloride using a HR-TOF-AMS: Observation of "non" sea salt chloride and its correlation with nitryl chloride and chlorine gases

Ibraheem Nuaaman, Shao-Meng Li, Katherine Hayden, Timothy Onasch, Paola Massoli, Douglas Worsnop, Tim Bates, Patricia Quinn, Joel Thornton, Theran Riedel and Robert McLaren

Atmospheric aerosols have an impact on human health, climate change and visibility. A high resolution Aerodyne aerosol mass spectrometer (HR-TOF-AMS) was deployed onboard the research vessel Atlantis during the CalNex campaign in Southern California in the summer of 2010. Ambient submicron aerosol concentrations and composition were established for p-SO4, p-Org, p-NO3 and p-Cl p-Na (m/z 23). Measurements were also made during "sea sweep" experiments where in situ bubbling of sea water created sea salt aerosol. In this presentation we will discuss aerosol concentration and composition during the study. We will also discuss the distinction between sea salt chloride and non sea salt chloride, in ambient air, using the AMS measurements. In addition, the effect of chlorine atom production on non sea salt chloride will also be discussed.

P13. **Airborne LIDAR Measurements for Investigation of Aerosol Transport from Pyro-convection and Volcanic Eruptions**, M. Aggarwal, J. Whiteway, J. Seabrook, C. Dickinson

P14. **Lidar Measurements of Boundary Layer Ozone Depletion Events in the Canadian Arctic during Polar Sunrise**, Jeff Seabrook

A differential absorption lidar (DIAL) developed at York University has been used to measure vertical profiles of boundary layer ozone. This ground based lidar uses wavelengths generated via stimulated Raman scattering (SRS) of 266 nm laser energy in carbon dioxide to generate three closely spaced wavelengths in the UV. The molecular backscatter from these three wavelengths is used to generate a range resolved profile of ozone.

In March of 2008 a DIAL was installed aboard the CCGS Amundsen icebreaker during Polar Sunrise. During this time of year, unique photochemistry results in sudden and near complete depletion of ozone over the sea ice. A near continuous record of ozone from the ground to 1 km was obtained and a number of depletion events were observed throughout this period. Results and analysis from this measurement campaign will be presented.