

of these phenomena. In particular, it is inappropriate to estimate certain common verification statistics that normally are of interest in forecast evaluations. For example, estimates of the false alarm ratio and critical success index are incorrect, due to the unrepresentativeness of the observations. Analytical explanations for this result have been developed, and the magnitudes of the errors associated with estimating these statistics have been estimated through Monte Carlo simulations. In addition, several approaches have been developed to compensate for these characteristics of PIREPs in verification studies, including methods for estimating confidence intervals for the verification statistics, which take into account their sampling variability. These approaches also have implications for verification of forecasts of other types of phenomena where the observations are non-systematic, such as severe weather.

#### A52C-11 1640h

##### Sampling-Related Variability in Raingage Network Products

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The representation of precipitation using sparse gage measurements presents formidable challenges due to incomplete and nonhomogeneous sampling. With feasible density and frequency of observations, gage networks cannot capture the full spectrum of space and time scales at which precipitation may fall. If unrecognized or unadjusted, this sampling inadequacy can lead to a biased or distorted characterization of precipitation.

We examine the magnitude of this sampling effect on two products: gridded fields of precipitation analyzed from point observations, and verification scores for model-generated precipitation computed using these observed fields. To do so, we first directly compare analyses and frequency statistics produced using several independent U.S. raingage datasets, including measurements made by the operational array of near-real-time daily and hourly reporting rain gages acquired from the National Centers for Environmental Prediction, and two sets of high-quality raingage measurements made by volunteer observers and archived at the National Climatic Data Center. Next, to assess intra-network sampling differences, we employ resampling techniques (including bootstrapping) to estimate the variability of gridpoint precipitation values and model verification scores that must be assumed when the analyses or scores are used. We also discuss the implications of combining precipitation observations from platforms with vastly different sampling characteristics (e.g., radar and gages).

#### A52D MC: 133 Friday 1330h

##### Tropospheric Chemistry and Constituents III

**Presiding:** L Avallone, Laboratory for Atmospheric and Space Physics; R Anderson, Centre for Atmospheric Chemistry

#### A52D-01 1330h

##### Measurements of Active Chlorine in the High Latitude Boundary Layer During Springtime

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Studies of the sudden boundary-layer ozone loss phenomenon in the springtime high latitudes have concluded that catalytic reactions involving bromine species are the dominant ozone destroyers. However, calculations show that even small amounts of active chlorine and iodine can make significant contributions to the ozone loss rates during these events. In this presentation, I will describe the first in situ measurements of the halogen radical chlorine oxide (ClO) in the high-latitude boundary layer. These observations were made as part of ARCTOC '96 in Ny Alesund, Spitsbergen and Alert 2000 Polar Sunrise Experiment at Alert, Nunavut, Canada during low ozone events in the months of April and May. I will compare these observations to estimates of active chlorine abundances derived from a chemical amplification technique (Perner et al., 1999) and to published model calculations. Finally, I will explore the extent to which the observed ClO can contribute to ozone loss rates under typical high Arctic conditions.

#### A52D-02 1345h

##### Isotopic and Chemical Characterization of Particulate Nitrogen in Marine Air at Bermuda during Spring

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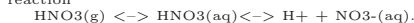
Stephan Macko<sup>2</sup> (804-982-2967; sam8f@virginia.edu)

William Keene<sup>2</sup> (wck@virginia.edu)

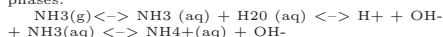
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<sup>2</sup>The University of Virginia, Department of Environmental Sciences Clark Hall, Charlottesville, VA 22903, United States

Size resolved particulate nitrogen species were measured on Bermuda during spring, 1998. NO<sub>3</sub><sup>-</sup> was primarily associated with super-m radius aerosol and NH<sub>4</sub><sup>+</sup> with sub-m radius aerosol, which is consistent with thermodynamic properties of the gaseous precursors and the size distribution of aerosol acidity. The average d15N for the super-m aerosol (-2.1 ± 0.5‰) was depleted in <sup>15</sup>N relative to submicron aerosol (d15N = 5.3 ± 1.5 ‰). The d15N range between super-μm and sub-m aerosol is consistent with the different sources for NO<sub>3</sub><sup>-</sup> and NH<sub>4</sub><sup>+</sup>. The d15N values indicate that high temperature combustion was the dominant source for the NO<sub>3</sub><sup>-</sup>. The strong correlation between the d15N for paired aerosols with geometric mean radii (GMR) 5.4 and 2.3 μm suggests that incorporation of NO<sub>3</sub><sup>-</sup> into the aerosol was unidirectional following the reaction



There was no significant correlation between the d15N values for paired aerosols with GMR 0.34 and 0.18 μm, suggesting that NH<sub>3</sub> actively recycles between phases:



The dry deposition of super-m aerosol accounted for over 99

#### A52D-03 1400h

##### In Situ Measurements of Halocarbons and Greenhouse Gases from the Trans-Siberian Railway During Summer 2001

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During June 27 July 10, 2001, over 11,000 in situ measurements of CFC-12, halon-1211, N<sub>2</sub>O, SF<sub>6</sub>, and 5000 measurements of CFC-11, CFC-113, CHCl<sub>3</sub>, CH<sub>3</sub>CCl<sub>3</sub>, CCl<sub>4</sub>, CH<sub>4</sub> and H<sub>2</sub> were made along 17,000 km of the trans-Siberian railway between Moscow and Khabarovsk, Russia. Also measured by in situ analyzers were CO, CO<sub>2</sub>, O<sub>3</sub>, NO<sub>x</sub>, and standard meteorological parameters. These measurements were part of the seventh Trans-Siberian Observations in the Chemistry of the Atmosphere (TROICA-7) scientific expedition, a collaboration between U.S., Russian, and German scientists.

Most of these gases were detected at elevated concentrations along some sections of the fully-electrified railway, typically in proximity to the larger cities. Specifically, spikes of CFC-12, halon-1211, CHCl<sub>3</sub> and CH<sub>4</sub> were frequently encountered during both the eastward and westward transects of the expedition. Attempts to identify the sources of these emissions are based on analyses of their correlations with the other measured gases. Chloroform emissions are generally uncorrelated with anthropogenic tracers, and are believed to be associated with the bleaching of wood pulp from Siberian forests. CFC-12 and halon-1211 emissions are mostly uncorrelated with one another, and accurate identification of their sources is difficult but extremely important in view of the Montreal Protocol. CH<sub>4</sub> emissions were detected as short-term spikes and, in some regions, broader increases in the background CH<sub>4</sub> concentration. Possible sources for CH<sub>4</sub> emissions include biomass burning, leaks from natural gas transmission lines, and wetlands.

#### A52D-04 1415h

##### Nonmethane Hydrocarbons and Ozone in the Rural Southeast United States National Parks: A Model Sensitivity Analysis and Its Comparison with Measurement

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A comprehensive modeling analysis is conducted using the Multiscale Air Quality Simulation Platform (MAQSP) focusing on nonmethane hydrocarbons and ozone in three southeast United States national parks for a 15-day time period (July 14th to July 29th, 1995) characterized by high O<sub>3</sub> surface concentrations. Nine emission scenarios including the base scenario are analyzed. Model predictions are compared with and contrasted against observed data at the three locations for the same time period. Model predictions (base scenario) tend to give lower daily maximum O<sub>3</sub> concentrations than observation by 10.8% at Cove Mountain, Great Smokey Mountains National Park (GRSM), 26.8% at Mammoth Cave National Park (MACA), and 17.6% at Big Meadows, Shenandoah National Park (SHEN). Overall mean ozone concentrations are very similar at GRSM and SHEN (observed data at MACA are not available). Model predicted concentrations of lumped paraffin compounds match the observed values on the same order, while the observed concentrations for other species (isoprene, ethene, surrogate olefin, surrogate toluene, and surrogate xylene) are usually an order of magnitude higher than the predictions. Sensitivity analyses indicate each location has its own characteristics in terms of the capacity of volatile organic compounds (VOCs) to produce O<sub>3</sub>, but a maximum VOC capacity point (MVCP) exists at all locations that changes the influence of VOCs on O<sub>3</sub> from production to destruction. Analysis of individual model process budgets shows that more than 50% of daytime O<sub>3</sub> concentrations at these rural locations are transported from other areas, local chemistry is the second largest contributor (13% to 42%), all other processes combined contribute less than 10% of the daytime O<sub>3</sub> concentrations. Local emissions (>99%) are predominantly responsible for VOCs at all locations, while vertical diffusion (>70%) is the predominant process to move VOCs away from the modeling grid. Dry deposition (~10%) and chemistry (2 to 13%) processes are also responsible for the removal of VOCs. Metrics such as O<sub>3</sub> production efficiency of VOC emissions (VOPE), VOC potential for O<sub>3</sub> production (VPOP), and MVCP are devised to quantitatively measure the different characteristics of O<sub>3</sub> production and VOCs in these rural environments. Implications of this model exercise in understanding O<sub>3</sub> production in rural atmospheres are analyzed and discussed. Even though this study is focusing on three United States National Parks, the research results and conclusions may be applicable to other rural atmospheres.

#### A52D-05 1430h

##### Seasonal VOC measurements at a rural site in the Sierra Nevada Mountains, California: A focus on acetone and methanol

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Methanol and acetone significantly influence the odd hydrogen budget of the upper troposphere. We have measured the seasonal cycle of these oxygenated volatile organic compounds (VOCs) and several other biogenic and anthropogenic VOCs along with carbon monoxide (CO) at Blodgett Forest Research Station, elevation 1300 m, on the western slope of the Sierra

Nevada mountains continuously since spring 2000. Owing to their long atmospheric lifetimes and local emissions, methanol and acetone are the most abundant VOCs throughout the seasons, with highest levels in summer (methanol ~40 ppb, acetone ~8 ppb) and lowest levels in winter (methanol ~0.3 ppb, acetone ~0.1 ppb). Their mixing ratios were always highly correlated, and were influenced by air mass origin, direct emissions, and, mostly for acetone, photochemical production from anthropogenic and biogenic precursors. Factor analysis associates acetone with 2-methyl-3-buten-2-ol (MBO, biogenic emissions), toluene (anthropogenic emissions), and a local, temperature-driven emission factor. Using air temperature as proxy for direct emissions, and mixing ratios of MBO and toluene or CO as proxies for photochemical production from biogenic and anthropogenic precursors, respectively, two thirds of acetone's variability can be explained in summer, and one half in winter. The remaining factor, air mass origin, plays a larger role in winter because of less stable synoptic meteorological conditions compared to the more regular summer up-slope transport scheme. Nevertheless, surprisingly little differences were found for the relative contributions to acetone's mixing ratio: In both summer and winter, local emissions were the dominant source, as inferred from the temperature correlation and MBO mixing ratios. However, both the acetone "background" was much higher in summer (~1 ppb) compared to the winter (~0.3 ppb), and the contribution from anthropogenic hydrocarbon photooxidation was higher in summer. Similar arguments hold for methanol.

## A52D-06 1445h

### Spring and Summer Observations of Carbon Monoxide, Ozone, Non-Methane Hydrocarbons and Total Gaseous Mercury at Cheeka Peak, Washington During the PHOBEA II Campaign

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During spring (March-May) and summer (June-August) of 2001 we made measurements of carbon monoxide (CO), ozone (O<sub>3</sub>), non-methane hydrocarbons (NMHC), and total gaseous mercury (TGM) as part of the ongoing Photochemical Ozone Budget of the Eastern North Pacific Atmosphere (PHOBEA II) project at Cheeka Peak Observatory on the northwestern tip of Washington State. The data were segregated by wind direction (SSE to WNW) to examine the mixing ratios for these compounds in the Pacific marine atmosphere. CO, O<sub>3</sub> and TGM exhibited spring maxima, with CO and O<sub>3</sub> having the most pronounced seasonal cycles. CO varied from 161 ppbv (April 7-17) to 76 ppbv (July 22 August 1), O<sub>3</sub> varied from 47 ppbv (April 26 May 6) to 27 ppbv (July 23 August 2), and TGM varied from 1.69 ngm<sup>3</sup> (May 10-20) to 1.57 ngm<sup>3</sup> (March 6-16 and August 1 10). CO and ozone mixing ratios showed a positive correlation 13 out of 21 weeks during our study ( $R > 0.3$ ). Anticorrelations occurred only during 2 out of 21 weeks. During one week in late April, CO-O<sub>3</sub> correlation coefficient was 0.8. This is in stark contrast with the spring 1997 and 1998 data from PHOBEA I which showed few (1997) or no (1998) positive correlations ( $R > 0.3$ ) between CO and O<sub>3</sub>. Diurnal variability was significant for TGM and O<sub>3</sub>, but not for CO. TGM had spring and summer maxima at 2200 and 0500 local time, respectively. Summer variation was much greater (7.5% around the mean) than spring (2% around the mean). O<sub>3</sub> had spring and summer maxima at 0200 and 2200 local time, respectively, and also showed much greater variability in the summer (11%) compared to the spring (4%). During April 23rd through 29th we observed two air masses with distinctly different photochemical ages. 10-day back trajectories from the 23rd to the 28th show air originating from swirling low-pressure systems around 40°N, apparently uninfluenced by continents. At CPO we observed very low levels of CO, O<sub>3</sub>, TGM and ethane (18%, 43%, 6%, and 38% below April monthly averages). Back trajectories for April 29th show a transition to rapid trans-Pacific flow (crossing time=5-8 days), which corresponded to restored mixing ratios of all four species to near April monthly average values.

## A52D-07 1500h

### Quantification of carbon dioxide, methane, nitrous oxide, and chloroform emissions from atmospheric observations at Mace Head and Radon efflux measurement over Ireland

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Flux estimates of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and CHCl<sub>3</sub> over Ireland are inferred from continuous atmospheric records of these species. We use radon-222 (222Rn) as a reference compound to estimate unknown sources of other species. In order to better quantify 222Rn exhalation from the soil and its seasonal variability, two field campaigns have been conducted during wintertime (October 2000) and summertime (July 2001). The correlation between each species and 222Rn is calculated for a suite of diurnal events that have been selected in the Mace Head record over the period 1995-1997 to represent air masses exposed to sources over Ireland. We established data selection based on criteria using 222Rn and 212Pb thresholds. We estimated flux densities of 12-15 103 kg CH<sub>4</sub> km<sup>-2</sup> yr<sup>-1</sup>, 680-830 kg N<sub>2</sub>O km<sup>-2</sup> yr<sup>-1</sup>, and 20-30 kg CHCl<sub>3</sub> km<sup>-2</sup> yr<sup>-1</sup> for CH<sub>4</sub>, N<sub>2</sub>O, and CHCl<sub>3</sub>, respectively. We also inferred flux densities of 250-310 103 kg C km<sup>-2</sup> yr<sup>-1</sup> for CO<sub>2</sub> during wintertime, of 760-950 103 kg C km<sup>-2</sup> yr<sup>-1</sup> for CO<sub>2</sub> during summer nighttime.

## A52D-08 1535h

### Heterogeneous and Unradiogenic Isotopic Composition of Atmospheric Lead in San Francisco Recorded by Epiphytic Lichens

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In 1989, Flegal et al. reported high gradient isotopic composition of Pb dissolved in the Pacific Ocean offshore San Francisco. Unradiogenic <sup>206</sup>Pb/<sup>207</sup>Pb ratios of 1.16 were measured in different filaments of an upwelling current. This was interpreted by Flegal et al. as a significant contribution of anthropogenic Pb coming from Asia which mixed with Pb from the U.S., having typical <sup>206</sup>Pb/<sup>207</sup>Pb of 1.20 to 1.22. From 1995 to 1998, epiphytic lichens hanging in tree branches were collected along the coast of California from Los Angeles to Eureka and inland towards the Yosemite National Park. Based on the fact that lichens take their nutrients exclusively from air, these are efficient natural filters of atmospheric particles and their chemical and isotopic compositions reflect that of the atmosphere. A high gradient Pb isotopic composition was also measured in these lichens and the range matches exactly the one found for the Pacific Ocean. As for Pb in the Pacific Ocean, the <sup>206</sup>Pb/<sup>207</sup>Pb in lichens was correlated to the Pb concentration, suggesting that samples having the highest Pb excess (relative to Al) was mostly originating from the US and the lowest Pb excess, mostly from Asia. This was interpreted as the possible direct transport of atmospheric Asian Pb to the coast of California. However, 3 samples (out of 30) showed high Pb excess but low <sup>206</sup>Pb/<sup>207</sup>Pb, one of which was sampled in the Golden Gate Park of San Francisco. In order to confirm and to document more extensively this anomaly, seven lichen samples were collected (December 1999) along a West-East section in the Golden Gate Park and the Alamo Park. From the Pacific coast towards the city center, the Pb concentration increase with Pb enrichment factors (normalized to Al and relative to the average upper crust) of 5 to 105. Other metals like Cu and Zn follow this pattern to a lesser extent. The Pb isotopic composition also varies systematically along the section, with <sup>206</sup>Pb/<sup>207</sup>Pb varying between 1.159 and 1.178. The isotopic ratios measured fall into the observed trend defined by the other lichens in a <sup>206</sup>Pb/<sup>207</sup>Pb vs <sup>208</sup>Pb/<sup>208</sup>Pb diagram. However, <sup>206</sup>Pb/<sup>207</sup>Pb ratios are inversely correlated with the Pb concentrations, suggesting an important non-radiogenic source of anthropogenic Pb to the atmosphere in San Francisco. This suggests that a variation towards low <sup>206</sup>Pb/<sup>207</sup>Pb of atmospheric Pb in California during the last decade may in part reflect heterogeneity of the US industrial Pb emitted to the atmosphere and not only the presence of Asian Pb.

## A52D-09 1550h

### Five or Fifty: How Many DMS Oxidation Reactions Do You Need?

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The oxidation of dimethylsulfide (DMS, CH<sub>3</sub>SCH<sub>3</sub>) plays a critical role in the global sulfur cycle because DMS is the largest source of natural atmospheric sulfur and because the products of DMS oxidation may significantly influence Earth's radiative budget. For these reasons it is important for global sulfur models to use a DMS oxidation mechanism that correctly produces oxidized sulfur products under a variety of conditions. However, given the large number of reactions, species, and branches in the DMS oxidation chain, previous global sulfur studies have used highly parameterized versions of the DMS mechanism. We test the capability of these parameterized versions by adding a detailed DMS cycling package to the global 3-D Model of Atmospheric Transport and Chemistry (MATCH). We use MATCH to calculate the sensitivity of oxidized sulfur products to the choice of DMS oxidation mechanism. Two parameterized mechanisms, taken from previous global sulfur studies, and two comprehensive mechanisms based on the Yin et al. mechanism [Lucas and Prinn, 2001, *JGR*, under revision], are run in MATCH under identical conditions. We present results showing that DMS and SO<sub>2</sub> are relatively insensitive to the mechanism choice, while other species such as H<sub>2</sub>SO<sub>4</sub> and methanesulfonic acid are more dependent on the type of mechanism. We also show the differences in the budgets of the major species in the DMS cycle for two distinct remote marine regions (equatorial and mid-latitude Pacific).

## A52D-10 1605h

### Theoretical Investigation of the Vertically Averaged Balance Equations for Chemically Reactive Trace Constituents

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The vertically averaged balance equation of chemically reactive atmospheric trace constituents as customarily served as a basis for so-called box models is derived and discussed. It is shown that this kind of balance equation has several prominent shortcomings so that the capability of box models to predict real situations of photochemical smog formation and depletion is strongly limited. Two of these prominent shortcomings are theoretically elucidated in more detail, namely (1) the vertically averaged source and sink terms owing to chemical reactions, and (2) the parameterization of the dry deposition and exhalation fluxes at the earth's surface. Based on our theoretical results, we suggest that such box models should be refused. Even though the consumption of computing time is much smaller than those of sophisticated Eulerian air pollution models like ADOM, DRAIS, EURAD or RADM, box models should not be considered as a true alternative to such air pollution models. It is also shown that before introducing vertically averaged balance equation of atmospheric trace constituents into general circulation models (GCMs) to investigate the interrelation between air pollution and climate change on the basis of long-term simulations the influence of these shortcomings has to be estimated in a reliable manner.

## A52D-11 1620h

### Gaseous and Particulate Oxidation Products Analysis of a Mixture of a-pinene + b-pinene/O<sub>3</sub>/Air in the Absence of Light and a-pinene + b-pinene/NO<sub>x</sub>/Air in the Presence of Natural Sunlight

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The gas and particle phase reaction products of a mixture of the atmospherically important terpenes a-pinene and b-pinene with the atmospheric oxidants O<sub>3</sub> and OHNO<sub>x</sub> were investigated using both gas

chromatography-mass spectrometry (GC-MS) and high performance liquid chromatography (HPLC) for identification and quantification of reaction products. The nighttime oxidation of a mixture of  $\alpha$ -pinene and  $\beta$ -pinene in the presence of O<sub>3</sub> and the daytime oxidation of a mixture of  $\alpha$ -pinene +  $\beta$ -pinene with NO<sub>x</sub>/air in the presence of natural sunlight were carried out in the University of North Carolina's large outdoor smog chamber (190 m<sup>3</sup>) located in Chatham County, North Carolina. Mass balances for gaseous and aerosol reaction products are reported over the course of the reaction. More than twenty-nine products were identified and/or quantified in this study. On average, measured gas and particle phase products accounted for 74 to 80% of the reacted  $\alpha$ -pinene- $\beta$ -pinene mixture carbon. Measurements show that a number of reaction products were found in both O<sub>3</sub> and NO<sub>x</sub> system [pinonaldehyde, pinic acid, pinonic acid, pinalic-3-acid, 4-hydroxypinalic-3-acid, 4-oxonopinone, 1-hydroxynopinone, 3-hydroxynopinone, and nopinone]. Pinonic acid, pinic acid, pinalic-3-acid, 4-hydroxypinalic-3-acid, and 10-hydroxypinonic acid were observed in the early stage in the aerosol phase and may play an important role in the early formation of secondary aerosols.

#### A52D-12 1635h

##### Carbon Kinetic Isotope Effects in the Oxidation of Atmospheric Alkane and Aromatic Hydrocarbons by Hydroxyl Radicals

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To interpret measurements of stable carbon isotope ratios of ambient NMHC, we need to understand the isotopic composition of the emissions, and the isotope fractionation associated with the removal of NMHC from the atmosphere. Oxidation by OH-radicals is by far the most important atmospheric process for removal of NMHC. In this presentation measurements of the kinetic isotope effects (KIEs) for the reactions of hydroxyl radicals with several C<sub>5</sub>-C<sub>8</sub> alkanes, including cyclic, branched and straight-chain alkanes, as well as C<sub>6</sub>-C<sub>9</sub> aromatics are presented. All KIEs are positive: compounds containing only <sup>12</sup>C atoms react faster than <sup>13</sup>C labelled compounds.

KIEs for light n-alkanes are typically between 1.5-4<sup>o</sup>/<sub>oo</sub> and are larger than mass dependent collision frequencies, deviating from the collision frequency as carbon number increases. For n-alkanes there is no statistically significant difference between the KIEs of structural isomers. KIEs for the reactions of light alkenes and aromatics with OH-radicals are considerably higher than for alkane reactions, ranging from 3-18<sup>o</sup>/<sub>oo</sub>. The KIEs for the aromatic reactions can be described by a 33.3±2.0<sup>o</sup>/<sub>oo</sub> fractionation for the addition of an OH-radical to the aromatic ring and an inverse dependency on the number of carbon atoms, added to the mass dependent collision frequency. There are indications for minor structure specific effects, however the deviations from the idealised inverse carbon number dependence is relatively small and the limited number of studied alkyl benzenes does not yet allow the identification of systematic dependencies.

#### A52D-13 1650h

##### Atmospheric Chemistry of Nonanal and Other Long Chain Aldehydes

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During the SOS99 field campaign at Dickson, Tennessee, we conducted measurements of a series of n-aldehydes, including propanal, pentanal, hexanal, heptanal, octanal, and nonanal. Propanal and nonanal tended to have the largest concentrations, with afternoon maxima of typically 0.3 ppb. These aldehydes typically represented a significant fraction of the VOC reactivity defined as  $k_{OH}[VOC]$ . However, this information is misleading with regard to the impact of these aldehydes on ozone formation, as their oxidation can represent a significant NO<sub>x</sub> sink. Motivated by the relatively large nonanal concentrations, we conducted a laboratory study of the products of the nonanal + OH reaction. The OH + nonanal reaction rate constant was determined via the relative rate technique, and found to be 3.6(+/-0.6)x10<sup>-11</sup> cm<sup>3</sup>molecule<sup>-1</sup>s<sup>-1</sup>. Under conditions of high [NO<sub>2</sub>]/[NO], we determined that 55(+/-9)% of OH-nonanal reactions occur via abstraction of the aldehydic H-atom, through measurement of the peroxy-nonanal nitrate yield. We also studied the production of organic nitrates from OH reaction with nonanal in the presence of NO. As expected, a major product (21% at large [NO]/[NO<sub>2</sub>]) of this reaction was octyl nitrate. We calculate that the branching ratio for octyl nitrate formation from peroxyoctyl radicals is 0.39. Based on these measurements we find that more than 50% of the time that OH reacts with nonanal (for mid-day summer conditions), an organic nitrate or PAN compound is formed, making this compound an effective NO<sub>x</sub> sink.

## Reference Style for Abstracts

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Pan, C., The rotation of non-rigid Earth., *Eos Trans. AGU*, 82(47), Fall Meet. Suppl., Abstract U41A-00005, 2001.