

**A51A MCC: Hall D Friday 0830h  
 Program for Research on Oxidants:  
 Photochemistry, Emissions, and  
 Transport (PROPHET) Summer 2000  
 and Summer 2001 Measurements  
 Intensives Posters**

**Presiding:** M Carroll, University of Michigan; S Bertman, Western Michigan University; P Shepson, Purdue University

**A51A-0027 0830h POSTER**

**The Influence of Synoptic Meteorology on Convective Boundary Layer Characteristics and the Observed Chemical Response During PROPHET 2000 & 2001 Summer Intensives**

Mark A.R. Lilly<sup>1</sup> (434-977-3244; ml3x@virginia.edu)

Jennie L. Moody<sup>1</sup> (434-924-0592; jlm8h@windfall.evsc.virginia.edu)

Mary Anne Carroll<sup>2</sup> (734-763-4066; mcarroll@umich.edu)

William O.J. Brown<sup>3</sup> (303-497-8774; brown@atd.ucar.edu)

Stephen A. Cohn<sup>3</sup> (303-497-8826; cohn@ncar.ucar.edu)

<sup>1</sup>Department of Environmental Sciences, University of Virginia, Charlottesville, VA 22904-4123, United States

<sup>2</sup>Department of Atmospheric Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI 48109, United States

<sup>3</sup>Atmospheric Technology Division, National Center for Atmospheric Research, Boulder, CO 80301, United States

PROPHET conducted atmospheric chemistry intensives that were coordinated with continuous measurements of the atmospheric boundary layer at the University of Michigan Biological Station (UMBS) during July and August of 2000 and 2001. Observations of ozone and trace gas precursors were made on a 31-meter tower within a mixed hardwood forest. A National Center for Atmospheric Research (NCAR) integrated sounding system (915-MHz Doppler wind profiler, radio acoustic sounder, surface meteorological tower, and rawinsonde system) was deployed in a nearby clearing. This facility provided detailed measurements of atmospheric boundary layer structure. The site is located at the northern tip of the Michigan lower peninsula. Typically, a contaminated maritime-subtropical air mass lies to the south, while a relatively clean continental-polar air mass lies to the north, resulting in two distinct synoptic transport regimes. Published work, based on analyses of back trajectories and 1998 chemical data, has shown the influence of air mass origin on trace gas mixing ratios and the same trends are observed in 2000 and 2001 chemical data. Besides directly affecting the chemistry observed at the site, the large-scale synoptic meteorology has a major influence on convective boundary layer (CBL) characteristics. CBL data were obtained from the range corrected signal-to-noise ratio, derived from the Doppler spectra measured by the wind profiler. Distinct differences between CBL characteristics, such as growth rates, time period of maximum growth, average height throughout evolution, and maximum height, are illustrated for differing synoptic patterns. Typically, dry northerly flow results when UMBS is positioned on the leading edge of surface anticyclones moving out of Canada after frontal passages. The dry air mass accompanied with relatively clear skies allows intense solar radiation to go directly into surface heating; the result is rapid CBL development. By contrast, warm, moist air from the south is advected toward the region when the UMBS sits on the back of surface anticyclones ahead of approaching frontal boundaries. This transport regime characteristically consists of air with high moisture content and an early morning low stratus deck giving way to hazy afternoon skies. Surface values of specific humidity throughout 2001 were nearly 4 g/kg higher under southerly flow. Solar radiation is partitioned into evaporating moisture and surface heating, which results in slower CBL growth. During PROPHET 2001 mean CBL heights were 200 meters lower under southerly flow when the site was located on the back of a surface anticyclone. This analysis quantifies the influence of variation in boundary layer characteristics on PROPHET chemical observations.

**A51A-0028 0830h POSTER**

**Hydrocarbon Observations as a Function of Meteorological Regime**

Valerie L. Young<sup>1</sup> (740-593-1496; youngv@ohio.edu); Brian Nucifora<sup>2</sup>; Mary Kathryn Bartek<sup>3</sup>; Caitlin Day<sup>3</sup>; Fani Visharia<sup>1</sup>; Mark Lilly<sup>4</sup>; Jennie L. Moody<sup>4</sup>; Troy Thornberry<sup>5</sup>; Mary Anne Carroll<sup>6</sup>; Colleen Campbell<sup>6</sup>; Grover Yip<sup>6</sup>; Edward Fortner<sup>7</sup>; Shawna Hengel<sup>8</sup>

<sup>1</sup>Ohio University, Dept of Chemical Engineering, Athens, OH 45701

<sup>2</sup>Eastern University, Dept of Mathematics, St Davids, PA 19087

<sup>3</sup>Haverford College, Dept of Chemistry, Haverford, PA 19041

<sup>4</sup>University of Virginia, Dept of Environmental Sciences, Charlottesville, VA 22904

<sup>5</sup>University of Toronto, Dept of Chemistry, Toronto, ON M5S 1A1, Canada

<sup>6</sup>University of Michigan, AOSS, Ann Arbor, MI 48109

<sup>7</sup>Texas AM, Dept of Meteorology, College Station, TX 77840

<sup>8</sup>Santa Clara University, Dept of Chemistry, Santa Clara, CA 95053

The PROPHET (Program for Research on Oxidants: Photochemistry, Emissions, and Transport) research site experiences substantial local emissions of the biogenic hydrocarbon isoprene, whereas local anthropogenic sources are small. Thus the loading of isoprene is expected to depend primarily on local meteorological conditions. The loading and distribution of anthropogenic hydrocarbons is expected to depend primarily on long-range transport, which may carry influence ranging from urban-industrial centers in the U.S. Midwest to remote regions of northern Canada. Using on-site hydrocarbon analyses from summers 2000 and 2001, supplemented by analysis of a limited number of grab samples from 1997 and 1998, we show the dependence of biogenic and anthropogenic hydrocarbon reactivity (potential for reaction with OH) on transport regime and on locally-measured meteorological parameters. Biogenic reactivity was influenced by transport regime and local temperature. Both anthropogenic and biogenic reactivity were lowest under northerly transport and highest under southerly transport. Although total hydrocarbon reactivity changed, isoprene consistently accounted for more than 90 % of the measured nonmethane hydrocarbon reactivity at the site. Even at the maximum anthropogenic hydrocarbon loading, air masses reaching the site were sufficiently aged to deplete the most reactive anthropogenic species. In addition, predictions of low anthropogenic loading based on northerly transport are typically accurate, but predictions of high anthropogenic loading based on southerly transport regime have low reliability. This is in agreement with previous work showing a wide range of ozone and NO<sub>x</sub> concentrations under southerly flow, and probably related to the short duration of most southerly flow periods.

**A51A-0029 0830h POSTER**

**Comparison of Models, Theory, Experiment, and Field Observations of Isoprene Nitrates**

Paul B. Shepson<sup>1</sup> (765-494-7441; pshpson@purdue.edu)

Kevin Ford<sup>1</sup> (socrates469@yahoo.com)

John W Grossenbacher<sup>1</sup> (grossenbacher@griffanalytical.com)

Cynthia Espada<sup>1</sup> (cespada1@purdue.edu)

Pete Giacomelli<sup>1</sup> (giacopel@purdue.edu)

<sup>1</sup>Purdue University, Departments of Chemistry, and Earth and Atmospheric Sciences 1393 Brown Building, West Lafayette, IN 47907-1393, United States

We have conducted chromatographic separation and quantitative determination of isoprene nitrates from laboratory irradiations of isoprene/NO<sub>x</sub>/air mixtures, in ambient air at the PROPHET site in Pellston, MI, and at the SOS99 Dickson, TN field site. In 1998 and 2000 isoprene nitrates were determined at the PROPHET site, using independent methods, with similar results. In each case, only three isomers represented the majority of the total isoprene nitrate concentration, although there are 8 different isomers possible. In this paper we compare the results of laboratory studies and field observations with published computational studies of the distribution of isoprene peroxy radicals. We will also discuss the results of a zero-D modeling study of explicit isoprene chemistry applied to the PROPHET data sets, to enable comparison of the individual isoprene nitrate isomer concentrations with model simulation results. The results of the modeling study will be

examined with respect to the distribution of biogenic organic nitrates at the PROPHET site, and the impact that deposition of these nitrogen species may have on forest nitrogen cycling.

URL: <http://aoss.engin.umich.edu/PROPHET/>

**A51A-0030 0830h POSTER**

**Sensitivity of MPAN at the PROPHET Site**

Margaret Pippin<sup>1</sup> (m.r.pippin@larc.nasa.gov); Steve Bertman<sup>2</sup> (bertman@wmich.edu); James Crawford<sup>1</sup> (j.h.crawford@larc.nasa.gov); Amy Hamlin<sup>1</sup> (a.j.hamlin@larc.nasa.gov); Troy Thornberry<sup>3</sup>; Mary Anne Carroll<sup>4</sup> (mcarroll@umich.edu); Greg Huey<sup>5</sup>; David Tanner<sup>5</sup>; Hartwig Harder<sup>6</sup> (harder@mpch-mainz.mpg.de); Monica Martinez<sup>6</sup> (martinez@mpch-mainz.mpg.de); William Brune<sup>6</sup> (brune@essc.psu.edu); Valerie Young<sup>7</sup> (valy@bobcat.ent.ohio.edu); Shelley Pressley<sup>8</sup>; Hal Westberg<sup>8</sup>; Brian Lamb<sup>8</sup> (blamb@wsu.edu); Barry Langer (lefer@ucar.edu); Sanford Sillman<sup>4</sup>

<sup>1</sup>NASA Langley Research Center, MS 483, Hampton, VA 23681

<sup>2</sup>Western Michigan University, Department of Chemistry, Kalamazoo, MI 49008

<sup>3</sup>University of Toronto, Department of Chemistry, Toronto, ONT M5S 3H6, Canada

<sup>4</sup>University of Michigan, Atmospheric, Oceanic, and Space Sciences, Ann Arbor, MI 48109

<sup>5</sup>Georgia Institute of Technology, Department of Earth and Atmospheric Sciences, Atlanta, GA 30332

<sup>6</sup>Pennsylvania State University, Department of Meteorology, University Park, PA 16802

<sup>7</sup>Ohio University, Chemical Engineering, Athens, OH 45701

<sup>8</sup>Washington State University, Civil and Environmental Engineering, Pullman, WA 99164

Peroxyacetylnitrate (MPAN) is a secondary product of isoprene oxidation and is an indicator of active local biogenic photochemistry. In the past, the biogenic contribution to peroxyacetyl nitrate (PAN) production has been determined using the PAN-MPAN-PPN (peroxypropionyl nitrate) multivariate correlation, which assumes equivalent lifetimes dominated by thermal loss. The new measurement of the MPAN+OH rate constant indicates this MPAN loss pathway can no longer be considered insignificant. MPAN was measured at the PROPHET (Program for Research on Oxidants: Photochemistry, Emissions and Transport) site during the 2000 and 2001 Summer intensives. The average daytime MPAN for 2001 was about 80 percent higher than measured in 2000. A sensitivity study of MPAN in different photochemical environments is presented to investigate the difference in MPAN observation and persistence between the two summers.

**A51A-0031 0830h POSTER**

**Measurement of Nitrous Acid (HONO) During PROPHET 2000 Summer Intensive**

Yi He<sup>1</sup>; Xianliang Zhou<sup>1,2</sup>; Gu Huang<sup>1</sup>; Steven B. Bertman<sup>3</sup>; Troy D. Thornberry<sup>4,5</sup>; Mary Anne Carroll<sup>4</sup>

<sup>1</sup>Department of Environmental Health and Toxicology, School of Public Health, State University of New York at Albany, Albany, NY 12222, United States

<sup>2</sup>Wadsworth Center, New York State Department of Health, Albany, NY 12201, United States

<sup>3</sup>Department of Chemistry, Western Michigan University, Kalamazoo, MI 49008, United States

<sup>4</sup>Departments of Atmospheric, Oceanic and Space Science and Chemistry, University of Michigan, Ann Arbor, MI 48109, United States

<sup>5</sup>now at Department of Chemistry, University of Toronto, Toronto M5S 1A1, Canada

Ambient nitrous acid (HONO) was measured during the PROPHET (Program for Research on Oxidants: Photochemistry, Emission and Transport) 2000 Summer Intensive at Pellston, Michigan from July 22 to August 15, 2000. Mixing ratios of HONO were in the range of < 5 - 740 pptv with a median of 51 pptv and a mean of 77 pptv within the forest canopy, and in the range of 12 - 390 pptv with a median of 65 pptv and a mean of 80 pptv above the canopy. Diurnal patterns of HONO concentration and relative humidity within

canopy indicate that dew droplets on leaf surfaces may play an important role in controlling ambient HONO levels. The data of gradient measurement suggest that heterogeneous reactions occurring on the leaf surfaces were a source of HONO for most of the time when they were free of excess moisture. However, deposition of HONO on the leaf surfaces occurred around and after midnight as the dew droplets formed. High level of morning HONO indicates that the trapped nitrous acid/nitrite was then released to the atmosphere when dew droplets were evaporated after sunrise. As the solar radiation increased, photolysis of ambient HONO overcame its formation, therefore, its observed concentration decreased throughout the day. The observed daytime HONO concentration was significantly higher than that expected from photo-steady state with OH and NO and from its production based on its nighttime accumulation rate, indicating a strong daytime source for HONO. Photolysis of HNO<sub>3</sub> accumulated on leaf surfaces via dry deposition may be this 'missing' source. Our observation has significant implications in the atmospheric chemistry of the boundary layer in terms of radical dynamics and of 're-NOx-ification' of nitric acid. Calculated photolysis rate of HONO at 3.0 ppbv/day contributed about 30% of the daily total radical production.

#### A51A-0032 0830h POSTER

##### Reactive Oxidized Nitrogen Partitioning and Ozone Production Efficiencies during the PROPHET Summer 2000 and Summer 2001 Measurements Intensives

Mary Anne Carroll<sup>1</sup> (734-763-4066;

mcarroll@umich.edu); Troy D. Thornberry<sup>1,15</sup> (tthornbe@chem.utoronto.ca); Coleen C. Campbell<sup>1</sup> (cccampbe@umich.edu); Shawna Hengel<sup>10</sup> (legnehms@hotmail.com); Alan J. Hogg<sup>1</sup> (alanhogg@umich.edu); Paul B. Shepson<sup>2</sup> (pshepson@purdue.edu); Kevin Ford<sup>2</sup> (socrates469@yahoo.com); Pete Giacomelli<sup>2</sup> (giacopel@purdue.edu); Steven B. Bertman<sup>3</sup> (bertman@wmich.edu); Margaret R. Pippin<sup>3,14</sup> (m.r.pippin@larc.nasa.gov); Matthew Marchewka<sup>3</sup> (marchewka7@yahoo.com); L. Gregory Huey<sup>4</sup> (greg.huey@eas.gatech.edu); David J. Tanner<sup>4</sup> (tanner@eas.gatech.edu); Steven Sjostedt<sup>4</sup> (ssjostedt@eas.gatech.edu); Dorene B. Slusher<sup>4</sup> (hivesunshine@yahoo.com); Yi He<sup>5</sup> (yihe@wadsworth.org); Xianliang Zhou<sup>5,6</sup> (zhoux@wadsworth.org); Gu Huang<sup>5</sup> (ghuang@wadsworth.org); Jonathan O. Allen<sup>7</sup> (joallen@asu.edu); Alice E. Delia<sup>8</sup> (Alice.Delia@Colorado.EDU); Darin Toohey<sup>8</sup> (toohey@Colorado.EDU); Doug Worsnop<sup>9</sup> (worsnop@aerodyne.com); Jennie Moody<sup>13</sup> (moody@virginia.edu); Mark Lilly<sup>13</sup> (ml3x@virginia.edu); Leah Yageman<sup>1</sup> (lyageman@umich.edu); Edward Fortner<sup>11</sup> (edfortner@tamu.edu); Joshua Abrams<sup>12</sup> (jabrams@knox.edu)

<sup>1</sup>Departments of Atmospheric, Oceanic, and Space Sciences and Chemistry, University of Michigan, 2455 Hayward Street, Ann Arbor, MI 48109-2143, United States

<sup>2</sup>Departments of Chemistry and Earth and Atmospheric Sciences, Purdue University, 1393 Brown Building, West Lafayette, IN 47907-1393, United States

<sup>3</sup>Department of Chemistry, Western Michigan University, 3440 Wood Hall, Kalamazoo, MI 49008-3842, United States

<sup>4</sup>School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Baker Building, Rm. 332, Atlanta, GA 30332-0340, United States

<sup>5</sup>Department of Environmental Health and Toxicology, School of Public Health, SUNY Albany, 1400 Washington Avenue, Albany, NY 12222, United States

<sup>6</sup>Wadsworth Center, New York State Department of Health, Empire State Plaza, Albany, NY 12201-0509, United States

<sup>7</sup>Departments of Chemical and Materials Engineering and Civil and Environmental Engineering, Arizona State University, Mail Stop 876006, Tempe, AZ 85287-6006, United States

<sup>8</sup>Program in Atmospheric and Oceanic Sciences, University of Colorado, Campus Box 311-UCB, Boulder, CO 80309-0311, United States

<sup>9</sup>Aerodyne Research, Inc., 45 Manning Road, Billerica, MA 01821, United States

<sup>10</sup>Department of Chemistry, Santa Clara University, 500 El Camino Real, Santa Clara, CA 95053, United States

<sup>11</sup>Department of Atmospheric Sciences, Texas A&M University, 3150 TAMU, College Station, TX 77843-3150, United States

<sup>12</sup>Department of Physics, Knox College, 2 E. South Street, Galesburg, IL 61401-4999, United States

<sup>13</sup>Department of Environmental Sciences, University of Virginia, Clark Hall, Room 351b, Charlottesville, VA 22904-4123, United States

<sup>14</sup>NASA Langley Research Center MS 483, MS 483, Hampton, VA 23681, United States

<sup>15</sup>Department of Chemistry, University of Toronto, 80 St. George Street, Toronto, Ont M5S 3H6, Canada

Using measurements obtained during the Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET) Summer 2000 (NO, NO<sub>2</sub>, NO<sub>y</sub>, PAN, PPN, MPAN, HONO, isoprene nitrates, O<sub>3</sub>, and meteorological parameters) and Summer 2001 (NO, NO<sub>2</sub>, PAN, PPN, MPAN, HNO<sub>3</sub>, HONO, isoprene nitrates, O<sub>3</sub>, and meteorological parameters), we examine the partitioning among reactive nitrogen species and ozone production under the different meteorological conditions associated with the dominant flow regimes (north-northwesterly and southwesterly). Using calculated total oxidized reactive nitrogen (sum of individually measured compounds) and/or measured NO<sub>y</sub> and measured NO<sub>x</sub>, we determine ozone production efficiencies and background ozone for different flow regimes (on the order of 25 ppbv under northerly flow and 40-60 ppbv under southerly flow). We discuss evidence for NO<sub>y</sub> loss during northerly flow and evidence of photochemical processing of NO<sub>x</sub> during southwesterly and southerly flow. An assessment of year to year variability is also provided through comparisons of results from the Summer 2000 and Summer 2001 intensives with previously published results from the PROPHET Summer 1998 intensive.

#### A51A-0033 0830h POSTER

##### Understanding the Sunrise Peak in Rural NO<sub>x</sub>: Physical and Chemical Factors Observed during PROPHET Summer Intensives

Jennie L. Moody<sup>1</sup> (434-924-0569;

moody@virginia.edu); Mary Anne Carroll<sup>2</sup>; Mark A. Lilly<sup>1</sup>; Troy Thornberry<sup>2</sup>; Anthony Wimmers<sup>1</sup>; Michael Mitchell<sup>2</sup>; Curtis Seaman<sup>2</sup>; Michelle L'Heureux<sup>1</sup>; Leah Yageman<sup>2</sup>; Colleen Campbell<sup>2</sup>; Grover Yip<sup>2</sup>; Shawna Hengel<sup>3,4</sup>; Edward Fortner<sup>3,4</sup>

<sup>1</sup>Department of Environmental Sciences, University of Virginia Box 400123, Charlottesville, VA 22903, United States

<sup>2</sup>Department of Atmospheric Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI 48109, United States

<sup>3</sup>Atmospheric Sciences Department, Texas A&M University, College Station, TX 77843, United States

<sup>4</sup>Department of Chemistry, Santa Clara University, Santa Clara, CA 95053, United States

The PROPHET tower provides measurements of rural air chemistry at the top of a mixed deciduous forest canopy in Northern Lower Michigan. Using data from summer intensives in 2000 and 2001, we have identified a number of mornings with significant peaks (~3000 ppt or greater) in NO<sub>x</sub>. This analysis describes the temporal evolution of these features, and evaluates a number of mechanisms that may explain this behavior. An NCAR Integrated Sounding System (ISS) with a Doppler Wind Profiler and Radio Acoustic Sounding provided measurements of boundary layer behavior from ~200 meters and above. However, during the night, the NBL was typically below the height of the lowest range gates of the ISS. To observe characteristics of the NBL a tether system was used to raise/lower standard rawinsondes throughout several nights. Ultimately, the transition from the stable nocturnal boundary layer (NBL) to the daytime convective mixed layer is shown to determine the erosion of the morning chemical maxima. This occurs as the mixed layer deepens and entrains an increasing volume of air from aloft, the concentrations drop significantly, and corresponding changes are observed in the concentrations of other trace gases. Multiple mechanisms may explain the initial chemical increase that typically begins at first light, when net solar radiation becomes positive. On nights with tethersonde data, we have observed that the initial erosion of the NBL at sunrise corresponds with the timing of significant increase in NO<sub>x</sub> at the tower. However, observations indicate that a number of these peaks occur on saturated mornings. Therefore, we also consider the role of fog and dew formation as a reservoir that potentially liberates NO<sub>x</sub> in the early morning as moist air in the NBL begins to evaporate.

#### A51A-0034 0830h POSTER

##### Significant Atmospheric Implications of Nitric Acid Photolysis on Surfaces in Low-NO<sub>x</sub> Environments

Xianliang Zhou<sup>1,2</sup> (zhoux@wadsworth.org);

Honglian Gao<sup>1</sup> (hlgao@yahoo.com); Yi He<sup>2</sup>

(Yihe@Wadsworth.Org); Gu Huang<sup>2</sup>

(Gu.Huang@Organichem.com); Steven Bertman<sup>3</sup>

(bertman@wmich.edu); Kevin Civerolo<sup>4</sup>

(kxcivero@gw.dec.state.ny.us)

<sup>1</sup>Wadsworth Center/NYSDOH, ESP/D524, Albany, NY 12201

<sup>2</sup>School of Public Health/SYNY at Albany, ESP/D524, Albany, NY 12201

<sup>3</sup>Department of Chemistry, Western Michigan University, Kalamazoo, MI 49008

<sup>4</sup>NYSDEC/Bureau of Air Research, 625 Broadway, Albany, NY 12233

Several field measurements at low-NO<sub>x</sub> rural sites have shown unexpectedly high daytime HONO concentrations, with noontime means of 60 pptv at Pinnacle State Park, NY, 55 pptv at the summit of Whiteface Mountain, NY, and 53 pptv at the University of Michigan Biological Station in Pellston, MI. To maintain the observed concentrations against its effective photolysis, a strong HONO source is needed, about one order of magnitude greater than that from the formation mechanism under dark conditions alone. We hypothesize that HNO<sub>3</sub> photolysis on ground surfaces is the missing HONO source. The proposed daytime HONO formation mechanism is supported by the observation of significant photochemical production of HONO in a sunlight-exposed glass sampling manifold during the PROPHET 2000 summer intensive in Pellston. Results from a series of laboratory experiments have confirmed that HONO is produced from adsorbed HNO<sub>3</sub> photolysis on glass surfaces. Humidity is required for the HONO production, suggesting that the majority of the HONO produced is from the reaction of adsorbed NO<sub>2</sub>, the major primary product of HNO<sub>3</sub> photolysis, with H<sub>2</sub>O on surface. Based on the production rate of HONO, the surface HNO<sub>3</sub> photolysis rate, J(HNO<sub>3</sub>-HONO), is (1.20-4.10) × 10<sup>-5</sup> /s under the irradiation equivalent to the noontime sun at low latitudes. It is 1-2 orders of magnitude greater than the photolysis rates for gas-phase HNO<sub>3</sub> and aqueous nitrate. The overall surface HNO<sub>3</sub> photolysis rate, considering both HONO and NO<sub>2</sub> as products, may still be higher than the observed rate. With this enhanced rate, HNO<sub>3</sub> photolysis on surfaces may significantly impact the chemistry of the remote low-NO<sub>x</sub> atmospheric boundary layer via emitting HONO as a radical precursor and via recycling HNO<sub>3</sub> deposited on ground surfaces back to NO<sub>x</sub> in the overlying atmosphere.

#### A51A-0035 0830h POSTER

##### The Behavior of the Hydroxyl and Hydroperoxyl Radicals During PROPHET2000

Piero Di Carlo<sup>1</sup>; M. Martinez<sup>2</sup>; H. Harder<sup>2</sup>; R. Leshar<sup>2</sup>; J.B. Simpas<sup>2</sup>; J. Bassis<sup>2</sup>; W. Brune<sup>2</sup> (brune@essc.psu.edu)

<sup>1</sup>Universita' di L'Aquila, Dipartimento di Fisica, Coppito, L'Aquila 67010, Italy

<sup>2</sup>Pennsylvania State University, Department of Meteorology 503 Walker Building, University Park, PA 16802, United States

Biogenic emissions strongly influence the behavior of the hydroxyl radical (OH) and the hydroperoxyl radical (HO<sub>2</sub>) in a forest that is distant from urban areas. The mixing ratios of OH and HO<sub>2</sub> and the OH reactivity were measured as part of the multi-investigator study, PROPHET2000, which took place on a tower above a forest at the University of Michigan Biological Station near Pellston Michigan in June and July 2000. Both OH and HO<sub>2</sub> showed strong diurnal variations, although observed HO<sub>2</sub> and especially observed OH were greater than expected at night. The observed OH reactivity was highly variable from day to day, with values ranging from greater than 20 s<sup>-1</sup> during some more polluted days to less than 2 s<sup>-1</sup> on some nights. This diurnal variation, where observed OH reactivity was greater during the day, was not seen in Nashville in summer 1999, where observed OH reactivity tended to be slightly greater during the night. The observed OH, HO<sub>2</sub>, and OH reactivity all appear to correlate with O<sub>3</sub> and temperature, both day and night. The implications of these observations will be discussed.

## A51A-0036 0830h POSTER

## Measurements of Hydroperoxides during the PROPHET 2001 Summer Intensive in Pellston, MI

Judith B Weinstein-Lloyd<sup>1</sup> (631-344-6199; jlloyd@bnl.gov); Ali M Alaouie<sup>1</sup> (amalaouie@unity.ncsu.edu); Neiza Hernandez<sup>1</sup> (neiza.h@hotmail.com); Lawrence I Kleinman<sup>2</sup> (kleinman@bnl.gov); Mary Anne Carroll<sup>3</sup> (mcarroll@umich.edu); Edward Fortner<sup>5</sup>; Shawna Hengel<sup>4</sup>; Valerie Young<sup>6</sup> (valy@bobcat.ent.ohio.edu); Barry Lefer<sup>7</sup> (lefer@ucar.edu); Brian Lamb<sup>8</sup> (blamb@wsu.edu); Hal Westberg<sup>8</sup> (westberg@mail.wsu.edu); Shelley Pressley<sup>8</sup> (spresle@wsunix.wsu.edu)

<sup>1</sup>State University of New York College at Old Westbury, Chemistry / Physics Department PO Box 210, Old Westbury, NY 11568, United States

<sup>2</sup>Brookhaven National Laboratory, Atmospheric Sciences Division Building 815E, Upton, NY 11973, United States

<sup>3</sup>University of Michigan, Departments of Atmospheric, Oceanic and Space Sciences and Chemistry 2455 Hayward, Ann Arbor, MI 48109, United States

<sup>4</sup>Santa Clara University, Chemistry Department 500 El Camino Real, Santa Clara, CA 95053, United States

<sup>5</sup>Texas A M University, Atmospheric Sciences Department 3150 TAMU, College Station, TX 77843, United States

<sup>6</sup>Ohio University, Department of Chemical Engineering, Athens, OH 45701, United States

<sup>7</sup>NCAR / UCAR, Atmospheric Chemistry Division 1850 Table Mesa Drive, Boulder, CO 80305, United States

<sup>8</sup>Washington State University, Department of Civil and Environmental Engineering, Pullman, WA 99164, United States

Semicontinuous measurements of gaseous hydrogen peroxide and methyl hydroperoxide were obtained above the forest canopy during the 2001 summer intensive of the PROPHET program at the University of Michigan Biological Station in Pellston, MI. Peroxides were determined by fluorescence spectroscopy after derivatizing with p-hydroxyphenylacetic acid or a Fenton reagent consisting of Fe(II) and benzoic acid. To guard against losses of these reactive species in the sampling manifold, peroxides were collected using a glass coil scrubber without inlet tubing and delivered to vials containing derivatizing reagent at a height of 30 m sampling site on the tower. An autosampler on the tower was set for 15-minute collection of sample into 4 mL vials, which were removed twice daily for analysis in the laboratory.

Total hydroperoxide mixing ratio varied from the detection limit of 100 pptv to maximum values between 1.2 and 5.2 ppbv in the late afternoons. Hydrogen peroxide accounts for approximately 75% of the total at this site. Diurnal profiles appeared to follow measured values of UV, temperature and isoprene, consistent with local production. Nighttime peroxide concentrations remained near 1 ppbv when temperatures remained above 16°C, but otherwise decreased to the detection limit. Peroxide concentrations peaked 1-2 hours later than maximum isoprene and 2-3 hours later than maximum UV.

A constrained steady state box model was used to estimate net instantaneous peroxide production rates and steady state concentrations.

We acknowledge funding from the DOE Atmospheric Chemistry Program under Grant DE-FG02-98ER62586.

## A51A-0037 0830h POSTER

Measurement and model results for gas phase OH and H<sub>2</sub>SO<sub>4</sub> during PROPHET 2001.

David Tanner<sup>1</sup> (404-894-0153; tanner@eas.gatech.edu); Steve Sjostedt<sup>1</sup> (ssjostedt@eas.gatech.edu); Greg Huey<sup>1</sup> (greg.huey@eas.gatech.edu); Darlene Slusher<sup>1</sup> (darlene.slusher@eas.gatech.edu); Gao Chen<sup>1</sup> (Gao.chen@eas.gatech.edu); Barry Lefer<sup>2</sup> (lefer@ucar.edu); Richard Shetter<sup>2</sup> (shetter@ucar.edu); Mary Ann Carroll<sup>3</sup>; Shawna Hengel<sup>4</sup>; Edward Fortner<sup>5</sup>; Valerie Young<sup>6</sup>

<sup>1</sup>Georgia Tech / EAS, 221 Bobby Dodd Way, Atlanta, GA 30332

<sup>2</sup>NCAR / ACD, PO Box 3000, Boulder, CO 80303

<sup>3</sup>University of Michigan, Atmospheric Oceanic and Space Sciences and Chemistry Departments, Ann Arbor, MI 48109

<sup>4</sup>Santa Clara University, Chemistry Department, Santa Clara, CA 95053

<sup>5</sup>Texas A M, Atmospheric Sciences Department, College Station, TX 77843

<sup>6</sup>Ohio University, Chemical Engineering, Athens, OH 45701

During the summer of 2001 a Chemical Ionization Mass Spectrometer (CIMS) was installed on top of the PROPHET tower to measure OH and H<sub>2</sub>SO<sub>4</sub>. Both OH and H<sub>2</sub>SO<sub>4</sub> have a strong diurnal variation and correlate well with the measured ozone photolysis rate. Typical OH nighttime values are below the detection limit of 3e5 molecules cm<sup>-3</sup>. The maximum daytime value varied from 1-5 e6 molecules cm<sup>-3</sup> with the highest OH levels corresponding to the lowest isoprene mixing ratios. The nighttime results are inconsistent with previous LIF measurements of high nighttime OH levels at this site and may indicate a systematic difference between the two techniques. However, the midday measured OH data is approximately 50% higher than the preliminary midday model values and is in accord with the previous LIF observations. A more detailed comparison of constrained photochemical models predictions to the observed OH levels will be presented. The daytime H<sub>2</sub>SO<sub>4</sub> concentrations were highly variable and exceeded 5e7 molecules cm<sup>-3</sup> on two days under clean northerly flow conditions. Evidence will be presented that suggest the source of the relatively high sulfuric acid concentrations is a large nickel smelting operation in Sudbury, Ontario. The nighttime levels of sulfuric acid were typically below the detection limit of the instrument of approximately 1e5 molecules cm<sup>-3</sup>. This data is consistent with the measured OH and suggests that large nighttime sources of radicals are not present in this environment.

## A51A-0038 0830h POSTER

## Analysis of Ambient Aerosol Measurements During PROPHET 2001

Alice E Delia<sup>1</sup> (303-735-3591; delia@colorado.edu); Rebecca Garland<sup>2</sup> (garland@colorado.edu); Darin W Toohey<sup>1</sup> (toohey@colorado.edu); Douglas R Worsnop<sup>3</sup> (worsnop@aerodyne.com); Jonathan O Allen<sup>4</sup> (joallen@asu.edu); Mary Anne Carroll<sup>5</sup> (mcarroll@umich.edu); Edward Fortner<sup>6</sup> (edfortner@tam.u.edu); Shawna Hengel<sup>7</sup> (legnehms@hotmail.com); Mark Lilly<sup>8</sup> (ml3x@unix.mail.virginia.edu); Jennie Moody<sup>8</sup> (moody@virginia.edu); Greg Huey<sup>9</sup> (greg.huey@eas.gatech.edu); David Tanner<sup>9</sup> (david.tanner@eas.gatech.edu)

<sup>1</sup>Program in Atmospheric and Oceanic Sciences, Campus Box 311-UCB University of Colorado, Boulder, CO 80309-0311, United States

<sup>2</sup>Department of Chemistry, Campus Box 215 University of Colorado, Boulder, CO 80309-0215, United States

<sup>3</sup>Aerodyne Research, Inc., 45 Manning Rd, Billerica, MA 01821-3976, United States

<sup>4</sup>Chemical Materials Engineering and Civil Environmental Engineering, Mail Stop 876006 Arizona State University, Tempe, AZ 85287-6006, United States

<sup>5</sup>Departments of Atmospheric, Oceanic, and Space Sciences and Chemistry, 2455 Hayward, Rm. 1518 SRB University of Michigan, Ann Arbor, MI 48109-2143, United States

<sup>6</sup>Department of Atmospheric Science, 3150 TAMU Texas A M University, College Station, TX 77843-3150, United States

<sup>7</sup>Department of Chemistry, Santa Clara University, Santa Clara, CA 95053, United States

<sup>8</sup>Department of Environmental Sciences, Clark Hall 291 McCormick Rd University of Virginia PO Box 400123, Charlottesville, VA 22904-4123, United States

<sup>9</sup>School of Earth and Atmospheric Sciences, Baker Building, Rm. 332 Georgia Institute of Technology, Atlanta, GA 30332-0340, United States

Aerosol size and composition were measured using an aerosol mass spectrometer, developed by Aerodyne Research, Inc., during PROPHET 2001 (Program for Research on Oxidants: Photochemistry, Emissions and Transport). Our purpose in this study was to characterize chemical composition and size of ambient aerosols, investigate the effects of transport, and study aerosol microphysics. The site is located in a remote forested area of northern Michigan at the University of Michigan Biological Station, far from any large urban areas and surrounded primarily by deciduous forests. The aerosols at this site can be cataloged into four classes. The two principal classes are distinguished by meteorological conditions. Clean, northerly airflow produced low aerosol mass loadings dominated by organic species. More polluted southerly airflow brought higher aerosol mass loadings dominated by sulfate with

an organic contribution. Under both of these conditions, aerosol existed almost entirely in the accumulation size mode of 300-600 nm. In addition to these principal aerosol types, small particle growth was observed on several occasions. It appears that these events occurred primarily during periods of low aerosol mass loading (i.e., northerly airflow) when the low aerosol number provided an opportunity for new particle formation and rapid growth. On at least one occasion, it appears that a large plume of sulfur dioxide that was converted to sulfuric acid near the site may be responsible for new particle formation. The fourth type of aerosol consisted of short events dominated by organic species, apparently diesel exhaust caused by local truck traffic. In addition to the overall aerosol characterization, comparisons with other measurements that affected the aerosol composition or characterized the air masses will be presented and the implications of these results for regional transport of aerosols will be discussed.

## A51A-0039 0830h POSTER

## Speciated Fine Particle Deposition to a Forest Canopy Measured by Eddy-Correlation Mass Spectrometry

Jonathan O Allen<sup>1</sup> (480 965 4112; joallen@asu.edu); Daniel A Gonzales<sup>1</sup> (480 965 8397; daniel.gonzales@asu.edu); Alice E Delia<sup>2</sup> (303 735 3591; alicedel@colorado.edu); Jose L Jimenez<sup>2</sup> (jose.jimenez@cires.colorado.edu); Kenneth A Smith<sup>3</sup> (617 253 1973; kas@mit.edu); Manjula Canagaratna<sup>4</sup> (978 663 9500 x285; mrcana@aerodyne.com); John T Jayne<sup>4</sup> (978 663 9500 x233; jayne@aerodyne.com); Douglas R Worsnop<sup>4</sup> (978 663 9500 x225; worsnop@aerodyne.com)

<sup>1</sup>Chemical Materials Engineering, Arizona State University, Mail Stop 876006, Tempe, AZ 85287-6006, United States

<sup>2</sup>University of Colorado, Boulder, Campus Box 311-UCB, Boulder, CO 80309-0311, United States

<sup>3</sup>Chemical Engineering, Massachusetts Institute of Technology, Room 66-540, Cambridge, MA 02139, United States

<sup>4</sup>Aerodyne Research, Inc., 45 Manning Rd., Billerica, MA 01821, United States

Dry deposition serves as an important mechanism for the removal of particles from the atmosphere and for the addition of material to ecosystems. Here we report on measurements of aerosol particle deposition using eddy-correlation mass spectrometry data collected during the PROPHET 2001 study which was conducted at the University of Michigan Biological Station in a north Michigan forest. Aerosol composition was measured with fast time response using the recently-developed Aerodyne Aerosol Mass Spectrometer (AMS) (Jayne et al., 2000). In the AMS, particles were focused using an aerodynamic lens. The aerosol was then expanded into a vacuum where aerodynamic particle size is determined by particle time-of-flight. The particles were then directed to an oven where semi-volatile components were flash vaporized. Vaporized components were ionized by electron impact and detected using a quadrupole mass spectrometer. Thus the response of characteristic ions from fine aerosol particles (particle diameter,  $D_p$ , = 0.04 - 1.5  $\mu$ m) were measured with a frequency of 10 Hz. A sonic anemometer was also deployed to measure wind velocity with a frequency of 10 Hz. Fluxes of aerosol species were then calculated using the well-known eddy-correlation method as the covariance of the vertical wind speed and the species concentration. These results demonstrate the new eddy-correlation mass spectrometry technique for measuring directly speciated fine particle deposition rates.

## A51A-0040 0830h POSTER

## Long Term Isoprene Flux Measurements Above a Northern Hardwood Forest

Shelley N Pressley<sup>1</sup> (509-335-5738; spresle@wsunix.wsu.edu)

Brian Lamb<sup>1</sup> (509-335-5702; blamb@wsu.edu)

Hal Westberg<sup>1</sup> (509-335-1529; westberg@wsu.edu)

Grant Hatten<sup>1</sup> (hatten@mail.wsu.edu)

Julia Flaherty<sup>1</sup> (punx.1981@yahoo.com)

<sup>1</sup>Washington State University, Department of Civil and Environmental Engineering, Pullman, WA 99164-2910, United States

Canopy scale emissions of isoprene from a northern hardwood forest in Michigan were measured using the eddy covariance technique during the summer growing periods from 1999 through 2001. The goal of this work was to improve our understanding of isoprene emissions

from forest ecosystems to better describe the role of isoprene in local and regional atmospheric chemical cycles. A second objective of this work was to contribute to the Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET) goal of characterizing the role of biogenic emissions in processing atmospheric nitrogen. Isoprene is one of the most abundant hydrocarbons in the atmosphere, and it is very reactive in the atmosphere. Long-term flux measurements are important for investigating the interannual variability in emissions due to interannual variability in climate. In addition, continuous flux data are useful for verifying canopy scale models that are used to generate emission inventories for regional photochemical models.

Measurements were made in collaboration with the AmeriFlux site located at the University of Michigan Biological Station (UMBS) and the (PROPHET) site located within 100 m of the AmeriFlux Tower. The site is a 90-year old stand classified as mid-aged conifer and deciduous, with aspen and oak two of the dominant species. Fluxes of isoprene, CO<sub>2</sub>, H<sub>2</sub>O, and sensible heat were measured using a fast response isoprene sensor (FIS), an open-path infrared gas analyzer, and a 3-D sonic anemometer. Concurrent measurements of these canopy scale fluxes are useful for understanding the physiological controls on isoprene emissions and potential links between isoprene emissions and other forest ecosystem dynamics. The multi-year data set will be presented and year-to-year variations in isoprene emissions will be explored in the context of interannual variations among the other canopy scale parameters.

#### A51A-0041 0830h POSTER

##### RELATING ISOPRENE CONCENTRATION PROFILES TO SOURCES AND SINKS IN A NORTHERN HARDWOOD FOREST

Jennifer L. Hutton<sup>1</sup> (812-855-2237; jehutton@indiana.edu); Hans Peter Schmid<sup>1</sup> (812-855-6303; hschmid@indiana.edu); Maria G. Villani<sup>1</sup> (812-855-2237; gvillani@indiana.edu); Hong-Bing Su<sup>1</sup> (812-855-6303; hsu@indiana.edu); Shelley N Pressley<sup>2</sup> (spressle@wsu.wsu.edu); Cheryl A Gilbert<sup>3</sup> (cheylagilbert@hotmail.com)

<sup>1</sup>Indiana University, 701 E. Kirkwood Rd, Bloomington, IN 47408, United States

<sup>2</sup>Dept. of Civil and Environmental Engineering, Washington State University P.O. 642910, Pullman, WA 99164

<sup>3</sup>Department of Chemistry, Central Michigan University Dow Science 268, Mt. Pleasant, MI 48859, United States

Due to the failure of gradient-diffusion theory to account for observations of turbulent transport in forest canopies, the relationship between a distributed source and its concentration profile has been an interesting challenge for micrometeorologists over the last 10 years. In this context Lagrangian models of trace gas exchange have emerged as useful tools for the prediction of transport processes in and over complex canopies. This research presents an analysis of M.R. Raupach's localized near-field theory (LNF) and an alternative spatially explicit approach proposed by Warland and Thurtell, (Boundary Layer Meteorology, 2000, Vol. 96, pp. 453-471). Measurement intensives from two summers at an AmeriFlux site in Pellston, Michigan provide high-resolution turbulence information and profiles of isoprene concentration for model implementation. In both forward Lagrangian analysis and the spatial Lagrangian model (WT2000), turbulence statistics and source distribution estimates derived from enclosure measurements of isoprene emissions are used as model input to predict concentration profiles for comparison with measured concentration profiles. Inverse Lagrangian dispersion analysis is used to infer to sources and sinks of isoprene in a mixed hardwood forest for comparison with measured emission factors within the canopy. The quantitative agreement between modeled and measured profiles of isoprene and isoprene emission factors with respect to plausible chemical dynamics for the time period of interest will be discussed.

#### A51A-0042 0830h POSTER

##### Biogenic Emission Inventories: Scaling Local Biogenic Measurements to Regions

Brian Lamb<sup>1</sup> (509-335-5702; blamb@wsu.edu)

Shelley Pressley<sup>1</sup> (509-335-5738; spressle@wsu.wsu.edu)

Hal Westberg<sup>1</sup> (509-335-1529; westberg@wsu.edu)

Alex Guenther<sup>2</sup> (303-497-1447; guenther@ucar.edu)

<sup>1</sup>Washington State University, Department of Civil and Environmental Engineering, Pullman, WA 99164-2910, United States

<sup>2</sup>UCAR/NCAR, Atmospheric Chemistry Division PO Box 3000, Boulder, CO 80307-3000, United States

Biogenic Hydrocarbons, such as isoprene, are important trace gas species that are naturally emitted by vegetation and that affect the oxidative capacity of the atmosphere. Biogenic emissions are regulated by many environmental variables; the most important variables are thought to be temperature and light. Long-term isoprene flux measurements are useful for verifying existing canopy models and exploring other correlations between isoprene fluxes and environmental parameters.

Biogenic Emission Models, such as BEIS (Biogenic Emission Inventory System) rely on above canopy environmental parameters and below canopy scaling factors to estimate canopy scale biogenic hydrocarbon fluxes. Other models, which are more complex, are coupled micrometeorological and physiological modules that provide feedback mechanisms present in a canopy environment. These types of models can predict biogenic emissions well, however, the required input is extensive, and for regional applications, they can be cumbersome.

This paper presents analyses based on long-term isoprene flux measurements that have been collected since 1999 at the AmeriFlux site located at the University of Michigan Biological Station (UMBS) as part of the Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET). The goals of this research were to explore a potential relationship between the surface energy budget (primarily sensible heat flux) and isoprene emissions. Our hypothesis is that the surface energy flux is a better model parameter for isoprene emissions at the canopy scale than temperature and light levels, and the link to the surface energy budget will provide a significant improvement in isoprene emission models. Preliminary results indicate a significant correlation between daily isoprene emissions and sensible heat fluxes for a predominantly aspen/oak stand located in northern Michigan. Since surface energy budgets are an integral part of mesoscale meteorological models, this could potentially be a useful tool for including biogenic emissions into regional atmospheric models. Comparison of measured isoprene fluxes with current BEIS estimates will also be shown as an example of where emission inventories currently stand.

#### A51A-0043 0830h INVITED POSTER

##### Atmosphere-Forest Exchange: Important Questions Regarding the Atmosphere's Role in the Delivery of Nutrient Nitrogen and Impacts on Nitrogen and Carbon Cycling

Mary Anne Carroll<sup>1</sup> (734-763-4066; mcarroll@umich.edu)

Paul B. Shepson<sup>2</sup> (pshepson@purdue.edu)

Steven B. Bertman<sup>3</sup> (bertman@wmich.edu)

Jed P. Sparks<sup>4</sup> (jps66@cornell.edu)

Elisabeth A. Holland<sup>5</sup> (eholland@ucar.edu)

<sup>1</sup>Departments of Atmospheric, Oceanic, and Space Sciences and Chemistry, University of Michigan, 2455 Hayward St., Ann Arbor, MI 48109-2143, United States

<sup>2</sup>Departments of Chemistry and Earth and Atmospheric Sciences, Purdue University, 1393 Brown Building, West Lafayette, IN 47907-1393, United States

<sup>3</sup>Department of Chemistry, Western Michigan University, 3440 Wood Hall, Kalamazoo, MI 49008-3842, United States

<sup>4</sup>Department of Ecology and Evolutionary Biology, Cornell University, E409 Corson Hall, Ithaca, NY 14853, United States

<sup>5</sup>Atmospheric Chemistry Division, National Center for Atmospheric Research, 1850 Table Mesa Drive, Boulder, CO 80305, United States

Atmosphere-Forest Exchange: Important Questions Regarding the Atmosphere's Role in the Delivery of Nutrient Nitrogen and Impacts on Nitrogen and Carbon Cycling

Atmospheric composition and chemistry directly affect ecosystem nitrogen cycling and indirectly affect ecosystem carbon cycling and storage. Current understanding of atmosphere-forest nitrogen exchange and subsequent impacts is based almost exclusively on nitrogen deposition data obtained from networks using buckets placed in open areas, studies involving inorganic nitrogen, frequently with enhanced N deposition inputs applied only to soils, and that ignore multiple stresses (e.g., the combined effects of aerosols, ozone exposure, elevated CO<sub>2</sub>, and drought). Current models of nitrogen cycling treat deposited nitrogen (e.g., HNO<sub>3</sub> and NO<sub>3</sub><sup>-</sup>) as a permanent sink whereas data appear to indicate that photolytic and heterogeneous chemical processes occurring on surfaces and in dew can result in the re-evolution of gaseous species such as NO and HONO. Similarly, the direct uptake of gaseous nitrogen compounds by foliage has been neglected, compromising conclusions drawn from deposition experiments and ignoring a mechanism that may significantly

affect nitrogen cycling and carbon storage, one that may become more significant with future atmospheric and climate change.

We hypothesize that the atmosphere plays a significant role in the delivery of nutrient nitrogen to the N-limited mixed hardwood forest at the PROPHET research site at the University of Michigan Biological Station. We assert that a complete understanding of atmosphere-biosphere interactions and feedbacks is required to develop a predictive capability regarding forest response to increasing atmospheric CO<sub>2</sub>, reactive nitrogen, oxidants, and aerosols, increasing nitrogen and acidic deposition, and anticipated climate change. We further assert that conclusions drawn from studies that are limited to inorganic nitrogen, fertilization of soils, and/or that neglect the role of the canopy (in N uptake and/or remobilization) may not produce a complete understanding of N and C cycling in terrestrial ecosystems, including atmosphere-biosphere interactions and feedbacks. Here, as part of a new PROPHET focus on Biosphere Exchange of Atmospheric Carbon and Odd Nitrogen (BEACON), we identify a number of issues associated with nitrogen limited forest ecosystems and nitrogen saturation and important science questions that require collaborative studies involving the atmospheric and biosphere science communities.

URL: <http://aoss.engin.umich.edu/PROPHET/Vision/BEACON%20Vision.htm>

#### A51B MCC: Hall D Friday 0830h

##### Atmospheric Chemistry: Ozone and Precursors Posters (joint with GC)

Presiding: P C Novelli, NOAA Climate Monitoring and Diagnostics Laboratory; D Jaffe, University of Washington, Bothell

#### A51B-0044 0830h POSTER

##### The 2002 Antarctic Ozone Hole

Paul A Newman<sup>1</sup> (301 614 5985; newman@code916.gsfc.nasa.gov)

Eric R. Nash<sup>2</sup> (301 614 5988; nash@code916.gsfc.nasa.gov)

Anne R. Douglass<sup>1</sup> (301-614-6028; douglass@code916.gsfc.nasa.gov)

S. Randolph Kawa<sup>1</sup> (301-614-6004; kawa@code916.gsfc.nasa.gov)

<sup>1</sup>NASA's Goddard Space Flight Center, Code 916 NASA/GSFC, Greenbelt, MD 20771, United States

<sup>2</sup>Science Systems and Applications, Inc., 10210 Greenbelt Rd. Suite 600, Lanham, MD 20706, United States

Since 1979, the ozone hole has grown from near zero size to over 24 Million square kilometers. This area is most strongly controlled by levels of inorganic chlorine and bromine concentrations. In addition, dynamical variations modulate the size of the ozone hole by either cooling or warming the polar vortex collar region. We will review the size observations, the size trends, and the interannual variability of the size. Using a simple trajectory model, we will demonstrate the sensitivity of the ozone hole to dynamical forcing, and we will use these observations to discuss the size of the ozone hole during the 2002 Austral spring. We will further show how the Cly decreases in the stratosphere will cause the ozone hole to decrease by 1-1.5 per cent per year. We will also show results from a 3-D chemical transport model (CTM) that has been continuously run since 1999. These CTM results directly show how strung dynamics acts to reduce the size of the ozone hole.

#### A51B-0045 0830h POSTER

##### An examination of anomalously low column ozone in the Southern Hemisphere midlatitudes during 1997

Eugene C Cordero<sup>1</sup> (408 924-5188; cordero@met.sjsu.edu)

Terrence R Nathan<sup>2</sup> (530 752-1609; trnathan@ucdavis.edu)

<sup>1</sup>Department of Meteorology, San Jose State University, San Jose, CA 95192-0104, United States

<sup>2</sup>Atmospheric Science Program, University of California, Davis, Davis, CA 95616, United States

Observations from both ground-based and satellite instruments show record low column ozone abundance between 20°S and 40°S during 1997. The 1997 monthly