

model-data bias and unknown error covariances must be addressed as they are actually a strong limitation in assimilation performance when assimilating any real data set.

#### A41A-0019 0830h POSTER

##### High Frequency Polar Waves in the Middle Atmosphere as seen in a Data Assimilation System

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High frequency waves in the polar vortex have been observed since the 1980's and are believed to be created by instabilities in the vortex winds. These eastward propagating waves consist of zonal waves 1 through at least 4 all moving at approximately the same phase speed, so that when wave 1 has a four day period, wave 2 will have a 2 day period, and so on. These waves are generally referred to as the 4-day wave because the wave 1 component is often dominant and is easily resolved by daily observations. However, past studies have shown that the 2-day, wave 2 component can be larger than the 4-day, wave 1 component at certain times and locations. This study examines the winter southern hemisphere vortex of 1998 using four times daily output from a data assimilation system to focus on the polar 2-day wave and its relation to the 4-day wave.

The data assimilation system products are from a test version of the finite volume data assimilation system (fvDAS) being developed at Goddard Space Flight Center (GSFC). The fvDAS has many new features and improvements that help in polar wave analysis, including a general circulation model with accurate advection near the poles and an analysis system that interactively assimilates satellite radiance observations. Ozone products are also available from the GSFC ozone assimilation system.

Results show that the polar 2-day wave dominates during July 1998 at 65S. The vertical structure of the 2-day wave shows only one peak with westward phase tilt with height above the peak and eastward phase tilt with height below the peak. This differs from the more poleward 4-day wave that tends to have two out of phase peaks in the vertical. The 2-day wave is somewhat faster than 2 days during July 1998 with a period closer to 1.6 days and an average amplitude for the month of over 2.5 K. Results for potential vorticity and ozone also show the 2-day wave consistent with the temperature signal. The 2-day wave represents a major source of ozone variation in this region.

#### A41A-0020 0830h POSTER

##### An Analysis of Various Kalman Filtering Techniques for Thermospheric Species Data Assimilation

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To determine the propagation parameters of high-frequency radio, an accurate forecast of the ionosphere is desirable. Until recently, obtaining a real-time and precise description of neutral atmospheric composition has acquired less consideration in comparison to other parameters such as ionospheric and neutral density. However, forecasting the ionosphere, especially during geomagnetic storm times, is strongly dependent on perturbations in the neutral composition. Because of this coupling between the ionosphere and neutral atmospheric chemistry, accurate knowledge of the neutral composition is critical in forecasting the ionosphere. The more accurate description of the neutral atmospheric composition is then used to supplement input parameters for ionospheric modeling.

In the research presented here, data assimilation techniques are applied to more accurately determine the neutral atmospheric species. The neutral atmospheric species are measured using remote sensing air-glow data from polar orbiting spacecraft. Data is assimilated and noise from this data is reduced using fil-

tering techniques in combination with a state propagation model. Methods for ingesting satellite data, predicting the state of the neutral atmosphere in the future, and filtering the data are investigated and then used simultaneously, utilizing the benefits of each, to reproduce the neutral atmospheric composition.

Since data assimilation techniques have enormous computational requirements for global forecasting, a significant amount of study is required to decrease the computation time while not decreasing accuracy. In this presentation, various methods are tested and compared in speed and accuracy in recreating a simulated data set and are documented as a benchmark for data assimilation of the neutral atmospheric composition as well as for other similar global systems.

#### A41A-0021 0830h POSTER

##### Data Assimilation with the Canadian Middle Atmosphere Model

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A three-dimensional variational (3D-var) data assimilation scheme has been developed for the Canadian Middle Atmosphere Model (CMAM) in order to provide further insight into the model's errors and to provide a platform for the design and testing of satellite instruments targeting the middle atmosphere. CMAM is a 65-level (90 km) General Circulation Model of the troposphere-stratosphere-mesosphere capable of producing a realistic ozone climatology and QBO-like oscillations. Because CMAM has fully interactive chemistry, radiation and dynamics, the assimilation of ozone and other species is planned and may help to diagnose the interplay between these three processes. The 3D-var scheme has been adapted from the Canadian Meteorological Centre's operational weather forecasting system primarily by raising the lid, changing the vertical coordinate, adding analysis variables and developing new statistics. A preliminary set of background-error statistics have been estimated from CMAM climatology and are compared to statistics used by the operational Canadian weather forecast model. Results of the initial validation of the CMAM/3D-var system involving conventional meteorological observations from the troposphere and lower stratosphere, supplemented by middle atmosphere ozone and temperature data from satellite instruments such as TOMS and MLS, are also presented. Future plans include the assimilation of other chemicals and other sources of satellite data.

#### A41A-0022 0830h POSTER

##### Model Simulations of CO<sub>2</sub> Transport Using Assimilated Meteorological Fields

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The numerical simulation of CO<sub>2</sub> transport (and other tracers such as CO, CH<sub>4</sub>, and biomass burning tracers) in the atmosphere is required to determine the fate of anthropogenic source gases. Estimation of the CO<sub>2</sub> exchange between the ocean surface, the terrestrial biosphere, and the atmosphere is of first-order importance to understanding the global carbon cycle and the processes that are most crucial in determining the atmospheric CO<sub>2</sub> concentration. Forward transport simulations have been conducted using two-dimensional, time-dependent grids of average surface fluxes (from TRANSCOM) and three-dimensional wind data from a prototype data assimilation system

(FV-DAS) run by the Goddard Data Assimilation Office. The objective is to better understand the contribution of meteorological variability to changes in CO<sub>2</sub> and other constituents. By accurately accounting for meteorological variability, through use of assimilated winds, we hope to better characterize the distribution of surface sources and sinks (and chemistry where applicable). With assimilated meteorology such chemistry/transport runs provide the basic framework to analyze existing (and proposed) measurement data on a point-by-point, real-time basis. We compare with measured CO<sub>2</sub> concentration gradients on a daily, seasonal, regional, and interhemispheric basis to examine the consistency of sources, sinks, and transport formulation. We will also examine the inter-annual variability of atmospheric CO<sub>2</sub> due to atmospheric circulation changes using longer runs with assimilated winds.

#### A41B MC: Hall D Thursday 0830h Advances in Aerosol Science and Technology III

**Presiding: T A Cahill, DELTA**  
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#### A41B-0023 0830h POSTER

##### The Center for Aerosol Research (AEROCENTER)

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The newly established Center for Aerosol Research (AEROCENTER) located at the NASA/Goddard Space Flight Center in Greenbelt MD is dedicated to fostering interdisciplinary research in all aspects of aerosol science. AEROCENTER will be an incubator for innovative new analysis of existing data and ideas for new space missions. The plan is to tap and harvest ideas from a broad international and interdisciplinary science community and to incorporate these ideas into NASA's aerosol research effort for understanding and predicting the aerosol effect on climate and the environment. In order to achieve this goal the center aims to host several established and developing scientists for a period of 3-6 months each year. AEROCENTER will also develop a new technical infrastructure that will integrate the present aerosol research activities and data resources of GSFC/Greenbelt and GSFC/GISS, increase efficiency in the use of NASA remote sensing data, and increase the involvement of a larger national and international scientific community. The center aims to institutionalize and extend the present knowledge base within NASA into a national resource for the education and research communities.

URL: <http://aerocenter.gsfc.nasa.gov>

#### A41B-0024 0830h POSTER

##### AERONET POLARIZATION MEASUREMENTS

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Since 1995, a polarized version of the CIMEL sunphotometer is operated on a number of AERONET sites. Those polarized AERONET sunphotometers provide daily measurements of the linear polarization in the principal plane, in addition to the standard solar transmission and total radiance measurements. The polarized version of the instrument is equipped with

three polarizers at the same wavelength (870nm), scanning the principle plane horizon to horizon in 5 degree intervals on scattering angle. The polarized network is designed to investigate the feasibility of retrieving aerosol properties from ground-based polarization data and to prepare the validation of remote sensing polarimetric experiments. Theoretical computations clearly show the sensitivity of polarization to particle properties, especially to their size and refractive index. Field measurements confirm that sensitivity. Adding polarization measurements to radiance measurements in retrieval algorithms provide a better assessment of aerosol properties.

We present the AERONET network of polarized instruments and describe the polarization calibration method and accuracy. We show typical polarization measurements collected in various geographical regions and atmospheric conditions. We describe the method used to correct the measurements for the effects of multiple scattering, Rayleigh scattering, and ground influence and we consider aerosol properties retrieved from the angular distribution of the sky radiance and its polarization. Advantages of radiance and polarization measurement in the principal plane to retrieve aerosol properties are demonstrated. Specific issues associated with that retrieval technique are discussed.

#### A41B-0025 0830h POSTER

##### Application of Synchrotron-XRF to Quantitative Elemental Aerosol Analysis

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Recent advances in synchrotron x-ray fluorescence (s-XRF) analysis of atmospheric particulate matter have improved elemental sensitivity, quantification and time-resolution. Analysis of both filter and impactor based aerosol samples have yielded quantitative data for elements Na-U, if present, in ambient aerosols. The increased sensitivity allows higher time resolution through either smaller spatial analysis of time-resolved impactor samples or shorter sample time-integration using filter-based samplers. Of particular interest is the application of s-XRF to aerodynamically sized rotating substrate impactor samples. These samplers, 8- and 3-stage DRUMs, have the ability to aerodynamically size-classify particles in either 8 or 3 categories, respectively. In addition, the rotating substrate allows time-resolved analysis of samples with little or no loss in elemental sensitivity.

The s-XRF analyses are performed on Beamline 10.3.1 at the Advanced Light Source-Lawrence Berkeley Laboratory (ALS-LBL). Beamline 10.3.1, originally designed for materials analysis, has been supplemented with aerosol analysis capability from several substrate options. Typical analysis involves Teflon filters or Mylar impaction substrates. The newly formed Participating Research Team (PRT) for beamline 10.3.1 encompasses both global climate and material science research. The s-XRF capabilities of beamline 10.3.1 are now available for PRT researchers and independent investigators through a proposal process to the ALS. The technology, application to aerosol research and monitoring, and availability of the facility to the aerosol research community will be presented.

#### A41B-0026 0830h POSTER

##### The partitioning of Nitric Acid between the gas phase and condensed phase of aqueous sulfate aerosols.

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The heterogeneous hydrolysis of  $N_2O_5$  on aqueous aerosol surfaces is an important source of atmospheric  $HNO_3$ . We generated  $HNO_3$  by heterogeneous hydrolysis of  $N_2O_5$  on aqueous ammonium and sodium sulfate aerosols and studied its partitioning between the gas phase and the aerosol phase. The experiments were performed in the large aerosol chamber at the FZ-Jülich

at several relative humidities. Gas phase processes and the composition of the aerosols were monitored on-line simultaneously by FTIR spectroscopy and by Steam Jet Aerosol Collection/Ion Chromatography. The aerosol size distributions in the range of 20 nm to 5  $\mu$ m were measured by differential electromobility classification and by aerodynamic particle sizing.

In the presence of aqueous bisulfate and sulfate aerosols a fast heterogeneous formation  $HNO_3$  is observed. (The reaction probability of  $N_2O_5$  is about 0.02.) In the case of the acidic bisulfate aerosols the major fraction of heterogeneously formed  $HNO_3$  resides in the gas phase. For neutral sulfate aerosols a significant fraction of  $HNO_3$  is taken up by the condensed phase of the aerosols. This leads to a distinctive growth of the aerosol population during the heterogeneous hydrolysis of  $N_2O_5$ , which is observable in the number size distribution as well as in IR extinction measurements.

The observed partitioning of  $HNO_3$  between gas phase and aqueous aerosol phase can be quantitatively understood by a Pitzer based thermodynamic model for salt solutions of high ionic strength. The model calculations and low resolution FTIR spectroscopy demonstrate that protonation of sulfate to bisulfate is the driving force for the uptake of  $HNO_3$  in neutral sulfate aerosols.

#### A41B-0027 0830h POSTER

##### A Prototype Field Instrument for Detection of the Nitrate Radical by Laser-Induced Fluorescence

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The nitrate radical,  $NO_3$ , is an important nighttime oxidant and is an intermediate in the removal of  $NO_x$  ( $NO + NO_2$ ) from the atmosphere. Measurements of  $NO_3$  concentrations with high spatial and temporal resolution are prerequisite for a more complete understanding of night-time chemistry. We have developed a prototype of an instrument for *in situ* detection of  $NO_3$  by laser-induced fluorescence (LIF). A 400 mW, multi-mode InAlGaP diode laser is used to excite the 0-0 transition of  $NO_3$  at 662 nm. Red-shifted fluorescent photons longer than 700 nm are detected at a right angle to the laser beam and gas-flow axes using a cooled GaAs Hamamatsu H7421-50 photo-multiplier tube. Our calibration source consists of thermal dissociation of gas-phase  $N_2O_5$  in a flow tube followed by simultaneous detection of  $NO_2$  and  $NO_3$  using a 5 mW, 638 nm tunable diode laser. Titration of  $NO_3$  with  $NO$  followed by  $NO_2$  LIF detection provides a check on the  $NO_3$  concentration. Improvements will be described that should result in a portable instrument with a detection sensitivity of 1 ppt after 10 s averaging.

#### A41B-0028 0830h POSTER

##### Ozone Modulation/Membrane Introduction Mass Spectrometry for Analysis of Hydrocarbon Pollutants in Air

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Modulation of volatile hydrocarbons in two-component mixtures is demonstrated using an ozonolysis pretreatment with membrane introduction mass spectrometry (MIMS). The MIMS technique allows selective introduction of volatile and semivolatile analytes into a mass spectrometer via processes known collectively as pervaporation [Kotiaho and Cooks, 1992]. A semipermeable polymer membrane acts as an interface between the sample (vapor or solution) and the

vacuum of the mass spectrometer. This technique has been demonstrated to allow for sensitive analysis of hydrocarbons and other non-polar volatile organic compounds (VOC's) in air samples [Cisper et al., 1995]. The methodology has the advantages of no sample pretreatment and short analysis time, which are promising for online monitoring applications but the chief disadvantage of lack of a separation step for the different analytes in a mixture. Several approaches have been investigated to overcome this problem including use of selective chemical ionization [Bier and Cooks, 1987] and multivariate calibration techniques [Ketola et al., 1999].

A new approach is reported for the quantitative measurement of VOCs in complex matrices. The method seeks to reduce the complexity of mass spectra observed in hydrocarbon mixture analysis by selective pretreatment of the analyte mixture. In the current investigation, the rapid reaction of ozone with alkenes is used, producing oxygenated compounds which are suppressed by the MIMS system. This has the effect of removing signals due to unsaturated analytes from the compound mass spectra, and comparison of the spectra before and after the ozone treatment reveals the nature of the parent compounds. In preliminary investigations, ozone reacted completely with cyclohexene from a mixture of cyclohexene and cyclohexane, and with  $\beta$ -pinene from a mixture of toluene and  $\beta$ -pinene, suppressing the ion signals from the olefins. A slight attenuation of the cyclohexane and toluene in those mixtures was also observed. Despite this problem, the hydrocarbon signal response can be calibrated and the method can be used for quantitative analysis of volatile hydrocarbon compounds in air samples. This methodology should augment the efficiency of the MIMS approach in online and onsite monitoring of VOC emissions.

Bier, M.R., and R.G. Cooks, Membrane Interface for Selective Introduction of Volatile Compounds Directly into The Ionization Chamber of a Mass Spectrometer, *Anal. Chem.*, 59 (4), 597, 1987.

Cisper, M.E., C.G. Gill, L.E. Townsend, and P.H. Hemberger, On-Line Detection of Volatile Organic Compounds in Air at Parts-per-Trillion Levels by Membrane Introduction Mass Spectrometry, *Anal. Chem.*, 67 (8), 1413-1417, 1995.

Ketola, R.A., M. Ojala, and J. Heikkonen, A Non-linear Asymmetric Error Function-based Least Mean Square Approach for the Analysis of Multicomponent Mass Spectra Measured by Membrane Inlet Mass Spectrometry, *Rapid Commun. Mass Spectrom.*, 13 (8), 654, 1999.

Kotiaho, T., and R.G. Cooks, Membrane Introduction Mass Spectrometry in Environmental Analysis, in: J.J. Breen, M. J. Dellarco, (Eds), *Pollution in Industrial processes*, 126 pp., ACS Symp. Ser., Washington, D.C. 508, 1992.

#### A41B-0029 0830h POSTER

##### Characterization of Source Signatures of Fine Roadway Particles by Pyrolysis-GC-MS

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Fine particulate matter, defined as particles with an aerodynamic diameter less than 2.5  $\mu$ m ( $PM_{2.5}$ ), is of growing concern due to its detrimental effects on human health and the environment. Roadway traffic generates a significant fraction of  $PM_{2.5}$  in urban areas. Since exposure to fine particles derived from mobile sources commonly occurs, understanding the physicochemical processes that contribute to the generation, transport and atmospheric reactivity of roadway PM is important. Factors that influence the properties of roadway PM include: the mass, number and size distribution of the particles as well as their chemical composition. These factors are partially determined by the sources of the roadway particles.

The focus of this effort is to identify unique organic chemical profiles of known roadway sources of PM using a new rapid characterization technique. A pyrolysis GC-MS analytical method is being developed to uniquely characterize the sources of roadway  $PM_{2.5}$  such as brake dust, tire wear, and direct emissions from diesel and gasoline engines. The source profiles will be used in conjunction with measurements of the composition of ambient roadway PM to determine the importance of the various roadway sources. The advantages of this technique over conventional solvent extractions include: smaller (mg) sample mass requirements, short extraction times and minimal sample handling. Preliminary two-step pyrolysis results will be presented for PM samples from individual sources and an ambient roadway. Specific analytical issues that will be discussed include: modifications of commercial pyrolysis hardware to improve reproducibility; desorption versus pyrolysis; developing appropriate pyrolysis programs for

heterogeneous sample materials; and method detection limits.

#### A41B-0030 0830h POSTER

##### Eddy Correlation Flux Measurements of Volatile Organic Compounds by Disjunct Eddy Sampling and Ion Trap Mass Spectrometry Analysis

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The present technical capability to accurately measure the fluxes of volatile organic compounds (VOC) is one of the major limitations towards advancing our understanding of photochemical generation of tropospheric ozone and aerosols and strategies for their controls. We demonstrate a new analytical technique for the detection and direct flux measurement of VOC from both biogenic and anthropogenic sources. Air is collected instantaneously and subsequently analyzed in situ with an ion trap mass spectrometer (ITMS). Samples are taken periodically rather than continuously, and correlated with the corresponding wind speed and direction at the time of sampling (disjunct eddy sampling). In order to calculate flux values with this technique, the deviations from the temporal means of the vertical wind speed and the VOC mixing ratio are correlated (Rinne et al., 2000).

A volume of atmospheric air containing target VOC among a mixture is quickly sampled into an evacuated 0.5 l sample reservoir in approx. 0.2 s. Wind speed and direction at the sampling time are recorded with a 3-D sonic anemometer. From the sample reservoir, a 25 ml aliquot is directed through a short section of a Porous Layer Open Tubular (PLOT) column for enrichment of VOC and separation from air. The choices of PLOT column material and adsorption parameters determine the focusing efficiency of the enrichment trap with respect to the species of interest. The PLOT column is subsequently flash-heated, VOC are backflushed with helium and injected into the ITMS for analysis. Qualitative and quantitative analysis of target VOC from the mixture is accomplished by applying selective ionization, ion storage and fragmentation techniques (MS/MS) with the ITMS. The entire process of sample collection, focusing, desorption and analysis can be repeated every 20-30 seconds, and is automated and software driven. Compared to continuous eddy correlation measurements, this method increases the uncertainty of the flux measurement by reducing the sampling frequency, but allows enough time for enrichment and analysis by ITMS in order to achieve required detection limits. Up to 180 samples can be analyzed every hour, which has been demonstrated to be sufficient for surface-atmosphere VOC flux measurements (Rinne et al., 2000). This presentation describes the analytical approach and results of experiments towards applying this technique for ambient VOC flux measurements. References: Rinne H.J.L., Delany A.C., Greenberg J.P. and Guenther A.B. (2000), A true eddy accumulation system for trace gas fluxes using disjunct eddy sampling method. *J. Geophys. Res.* 105, 24791-24798.

#### A41B-0031 0830h POSTER

##### Measurements of the Surface Flux Density of Nanometer-Size Particles Over the High Desert Terrain of New Mexico

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Measurements of the surface flux density and dry deposition velocity of nanometer-size ( $10^{-9}$  m) particles were made in the outdoor environment in the high desert terrain (characterized by uncut grass and scattered shrubs) of central New Mexico, utilizing three different methods: relaxed eddy accumulation, modified Bowen ratio, and surface collection. The modified Bowen ratio and surface collection methods were

conducted primarily for comparative purposes and validation of the relaxed eddy accumulation methodology. Using unattached-to-aerosol radon progeny (median diameter of  $1.5 \times 10^{-9}$  m) as a naturally existing tracer, dry deposition velocities up to  $31 \text{ cm s}^{-1}$  were calculated with the relaxed eddy accumulation method. Additionally, a noted correlation between the dry deposition velocity and horizontal wind speed was observed. Similar magnitude dry deposition velocities were observed utilizing the modified Bowen ratio method. In contrast, the surface collection method, using approximately  $80 \text{ cm}^2$  size artificial materials and simultaneously taken with the relaxed eddy accumulation or modified Bowen ratio measurements, yielded about one order of magnitude smaller values for the deposition velocities. This large difference is believed to be due to the fact that the relaxed eddy accumulation and modified Bowen ratio methods can respond to the effects of the surface roughness at the measurement sites, which are impossible to simulate with the relatively smooth, flat surface-collection materials. Notably, about the same deposition velocity was obtained with the surface collection technique whether the materials were mounted horizontally or vertically. Though insufficient data were obtained to statistically evaluate the correlation between the modified Bowen ratio dry deposition velocities and horizontal wind speed, the surface collection method showed an even stronger correlation with wind speed than observed with the relaxed eddy accumulation method. In combination, the results of the three methods indicate much higher dry deposition velocities than predicted or measured in wind tunnel studies and support some previously reported outdoor observations. The results also suggest a nonlinear correlation between the dry deposition velocity and horizontal wind speed.

#### A41B-0032 0830h POSTER

##### Particle Characterization of European and Indo-Asian Pollution Plumes With Six-Wavelength Lidar

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The institute's scanning six-wavelength aerosol lidar allows a comprehensive characterization of atmospheric particles on a vertical scale. The system provides highly accurate profiles of the spectrum of the particle backscatter coefficient between 355 and 1064 nm, and of extinction coefficients and extinction-to-backscatter (lidar) ratios at 355 and 532 nm. Effective radius, volume and surface-area concentration, and complex refractive index of the particle ensembles are retrieved from the optical properties with an inversion scheme. The profile of the single-scattering albedo may be calculated with high accuracy.

European pollution plumes were observed during the Aerosol Characterization Experiment 2 (ACE 2; North Atlantic/Portugal) in June/July 1997. Indo-Asian pollution was observed in the framework of the Indian Ocean Experiment (INDOEX; Indian Ocean/Maldives) in February/March 1999 and March 2000. In both cases a great share of columnar optical depth was contributed by particles above 1000 m height. In the first case it was approximately 59% for the monthly-mean values. In the second it ranged from 30% to 55% for the different months.

During ACE 2 the lidar ratio at 532 nm mostly ranged from 30 to 50 sr, with peak values of 80 sr. During INDOEX the lidar ratio mostly was 50-80 sr, with peak values of 110 sr. The mean Angstrom exponent in the wavelength range from 400 to 532 nm was  $\sim 1.34$  for ACE 2 and for INDOEX. In contrast, in the wavelength-range from 532 to 800 nm the mean value of 1.41 for ACE 2 was larger than the INDOEX value of 1.17, which indicates a higher contribution from large particles.

Effective radii in both cases mostly were below  $0.2 \mu\text{m}$ . Significant differences were found for the complex refractive index. For ACE 2 real parts were  $\sim 1.55$ , and imaginary parts were  $< 0.03i$ . INDOEX showed considerably larger values above  $1.6$  in real part and maximum values of  $0.07i$  in imaginary part. Accordingly the single-scattering albedo at 532 nm was  $0.9-1$  for ACE 2. For INDOEX values were between 0.8 and 0.93.

In summary the parameters for ACE 2 indicate non-absorbing ammonium-sulfate-like material as the main contributor to the observed pollution. In contrast, highly absorbing carbon-like material from coal and

diesel combustion, and from biomass burning was responsible for the particle properties observed during INDOEX.

#### A41B-0033 0830h POSTER

##### The Seasonal Cycle of NO<sub>2</sub>, Total Peroxy Nitrates, Total Alkyl Nitrates, and HNO<sub>3</sub> at the U.C. Blogett Forest Research Station

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Measurements of NO, NO<sub>2</sub>, total peroxy nitrates, total alkyl nitrates, HNO<sub>3</sub>, NO<sub>y</sub>, O<sub>3</sub>, and CO from the fall of 2000 to the fall of 2001 were made at U.C. Blogett Forest Research Station. NO<sub>2</sub>, total peroxy nitrates, total alkyl nitrates, and HNO<sub>3</sub> were measured using thermal dissociation laser induced fluorescence (TD-LIF), a new technique developed at Berkeley. We describe the seasonal cycle of the speciation of NO<sub>y</sub> and the seasonal variations in their relationships with CO and O<sub>3</sub>.

#### A41B-0034 0830h POSTER

##### Sesquiterpene Emissions from Vegetation - Chemical Analysis Technique for Ambient Measurements of the Contribution to the Formation of Ozone and Aerosols

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An analytical technique for the measurement of sesquiterpenoid compounds (SQT; C<sub>15</sub>H<sub>24</sub> and oxygenated isomers) emitted from vegetation is developed. SQT are suspected to contribute in aerosol-forming processes and heterogeneous reactions in the lower troposphere. SQT have been identified in plant emissions in numerous studies. However, their role in atmospheric processes remains uncertain. This uncertainty is mainly due to the lack of analytical capabilities for research of their ambient concentrations, surface-atmosphere fluxes and atmospheric reactions. SQT pose a challenge to the analytical chemist, and many questions regarding their reliable analysis remain unresolved.

In this project, several analytical methodologies for the measurement of SQT such as whole air sampling techniques into bags and canisters and analysis by solid adsorption methods are being investigated and characterized. A calibration system has been built to generate well-defined gas-phase concentrations of individual SQT and SQT mixtures. This system is based on capillary diffusion and delivers steady output concentrations of SQT. A gas chromatography/flame ionization detection instrument provides automated and continuous online monitoring of the output concentrations. Potential analytical interferences, such as water and ozone, can be added to the analytes in order to study their effects on the SQT recovery rate and the analytical precision and accuracy.

This research contributes towards improving the quality of SQT data from 1) measurements in experimental enclosure systems such as cuvettes, branch enclosures and chamber experiments, 2) monitoring at the ambient level and 3) studies of surface-atmosphere fluxes by tower gradient or relaxed eddy correlation methods. Furthermore, this project delivers a platform to research the non-isoprene portion of BVOC fluxes and it provides further insight how BVOC participate in the atmospheric formation of oxidants and aerosols.

## A41B-0035 0830h POSTER

### Absolute Quantum Yields for HCO Production in the Photolysis of Aldehydes Measured by Cavity Ringdown Spectroscopy

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Generation of most radicals in the atmosphere is initiated by photolytic processes. It is therefore important to know the efficiencies of the photolytic processes. The high sensitivity of cavity ringdown spectroscopy (CRDS) to detect certain free radicals with suitable absorption features offers a quantitative detection method for quantum yield measurements, especially for small quantum yields, say just a few percent. Because CRDS works at any pressure and temperature, it enables quantum yield measurements over the entire range of atmospheric conditions.

Here we describe the first photolysis experiments carried out in our laboratory using a CRDS setup. We detected HCO radicals at 613.85 nm with a tunable dye laser and photolyzed aldehydes from 310-350 nm using a frequency doubled tunable dye laser. To derive absolute quantum yields,  $\Phi$ , we used the photolysis of chlorine in the presence of chlorine nitrate as an actinometer by measuring the NO<sub>3</sub> produced from the very fast reaction of chlorine atoms with chlorine nitrate. Using the derived laser fluence we could calculate  $\Phi$ . In a different set of experiments we measured the absolute HCO cross section by comparing the absorption due to NO<sub>3</sub> produced from the Cl + ClONO<sub>2</sub> reaction with the HCO absorbance from the Cl + H<sub>2</sub>CO reaction under the same conditions. The NO<sub>3</sub> cross section at the detection wavelength of 613.85 nm (<sup>2</sup>A' (09<sup>0</sup>0) ← <sup>2</sup>A' (00<sup>1</sup>0) transition in HCO) is well known.

Here we report our preliminary data on the wavelength dependence (315 - 340 nm) of quantum yields of the formyl radical, HCO, from propionaldehyde. Some preliminary data on HCO yield in chloral (Cl<sub>3</sub>CCHO) photolysis at 325 nm will also be presented.

## A41B-0036 0830h POSTER

### Comparison of Cavity Ringdown and Laser-Induced Fluorescence Spectroscopy for Trace Gas Detection: NO<sub>2</sub>

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In the last decade, Cavity Ringdown Spectroscopy (CRDS) has established itself as a new highly sensitive direct absorption spectroscopic technique. Present applications of CRDS in atmospheric sciences are mainly in the detection of tracer species. However, new technological advances should expand the applicability of CRDS to include other species, such as reactive intermediates and free radicals. For example, Laser-Induced Fluorescence is one of the prevalent methods for detection of NO<sub>2</sub> in the atmosphere and has achieved detection limits as low as 1 ppt. Comparison of CRDS with LIF detection of NO<sub>2</sub> demonstrates that, even though the sensitivity of the LIF method is superior by approximately one order of magnitude, the CRDS approach is significantly less complex. In many cases, the superior LIF detection limit is not necessary, and CRDS has the advantage of a direct absorption technique with no spectroscopic interferences and a greatly simplified calibration methodology. Furthermore, CRDS should be applicable to various other atmospheric trace species, most significantly those that do not fluoresce. Results and implications of the comparison of the two methods will be discussed.

## A41B-0037 0830h POSTER

### Spectroscopy and Kinetics of Organic Peroxy Radicals Measured Using a Laser Photolysis / CW Cavity Ring-down Reactor

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A new type of reactor system is used to examine the spectra and gas phase reaction kinetics of atmospherically relevant organic peroxy radicals (RO<sub>2</sub>). The reactor uses the recently developed continuous wave laser excitation cavity ring-down (CWCRD) spectroscopic technique to detect the near-infrared (NIR) absorptions of peroxy radicals produced by laser photolysis. Preliminary spectroscopic and kinetic results for the methyl peroxy (CH<sub>3</sub>O<sub>2</sub>) and ethyl peroxy (C<sub>2</sub>H<sub>5</sub>O<sub>2</sub>) radicals are presented. Organic peroxy radicals are formed as reaction intermediates in the atmospheric oxidation of biogenic and anthropogenic volatile organic compounds (VOCs). Peroxy radicals react with NO, NO<sub>2</sub>, HO<sub>2</sub>, or other organic peroxy radicals in the troposphere to produce a variety of atmospherically important products, including ozone.

The reactor uses the conventional slow flow/photolysis approach and is capable of accessing pressures between 5 and 1000 torr and temperatures between 275 and 400 K. Methyl or ethyl radicals are generated from suitable precursors via 193nm laser photolysis, and are reacted with excess oxygen to form methyl peroxy or ethyl peroxy radicals respectively. The peroxy radical concentrations are then monitored by their NIR absorptions near 1.3μm using CWCRD spectroscopy. The spectra are consistent with those originally published [Hunziker and Wendt, 1976] and with the more recently reported results implementing the pulsed cavity ring-down technique [Pushkarsky et al., 2000]. The kinetics of the radicals self-reactions, the oxidation reaction with nitric oxide, and the prototypical cross-reaction between methyl peroxy and ethyl peroxy will be presented. All rate coefficients obtained to date are in good agreement with recommended values, lending credence to the new methodology.

Hunziker, H.E., and Wendt, H.R., Electronic Absorption Spectra of Organic Peroxy Radical in the Near-Infrared, *J. Chem. Phys.*, 64, 3488-3490, 1976.

Pushkarsky, M.B., Zalyubovsky, S.J., and Miller, T.A., Detection and Characterization of Alkyl Peroxy Radicals Using Cavity Ringdown Spectroscopy, *J. Chem. Phys.*, 112, 10695-10698, 2000.

## A41B-0038 0830h POSTER

### Time-of-Flight Neutral Mass and Velocity Spectrometer for Atmospheric Research

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The information of the velocity distribution of the neutral gas in the Earth's upper atmosphere is important to understand the non-thermal escape processes and dynamics of tenuous gas in the thermosphere. We have developed a prototype time-of-flight (TOF) neutral gas mass spectrometer (NMS) that simultaneously measures the density and the velocity distribution function of each mass species, using the time-of-flight and the 2D spatial distribution of the ionized particles on a micro channel plate (MCP) detector. The neutral gas is ionized by an electron pulse and then accelerated toward the detector by an electric field that is applied shortly after the ionization pulse. The TOF of the detected particle defines the mass selection and the 2D spatial distribution on the detector yields the velocity distribution, temperature, and bulk velocity of the selected neutral species. In order to preserve the initial velocity of the neutral gas, the acceleration electric field is applied in the direction perpendicular to the incident gas velocity. We confirmed the feasibility of measuring the velocity distribution of room-temperature Ar (300 K) in a vacuum chamber using our prototype instrument. We will discuss the limitation of these measurements and strategies to mitigate the limitations.

## A41B-0039 0830h POSTER

### The Role of Hydrocarbon and Halocarbon Species in the Polluted Urban Atmosphere of Bristol, England.

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The urban environment is a complex mixture of chemicals, however, due to the high levels of NO<sub>x</sub> that are generally present, ozone formation is VOC (volatile organic compound) limited. Therefore, it is of great importance to determine the type of VOC that is present in the urban environment, its concentration and how this varies both spatially and temporally.

The results of a field campaign carried out from early spring through to the late summer of 2000, in Bristol, England, are presented. Continuous measurements of over 40 hydrocarbons have been made at an urban background site, located at Bristol University, for approximately nine months using a GC-FID system and for a selection of hydrocarbons for approximately one month using a GC-ECD system. Measurements of a smaller set of hydrocarbons were made simultaneously at a roadside site in the centre of Bristol, as part of the U.K. national monitoring network.

In this paper the form of the halocarbon time-series is investigated by comparison with the hydrocarbon time-series, air-mass back trajectories and also local weather conditions. The variability of hydrocarbon concentrations within the urban environment are also investigated and reasons for discrepancies are discussed. Using principal component analysis sources for these hydrocarbons have been apportioned. In addition, ozone levels recorded in Bristol have been compared with hydrocarbon levels and in conjunction with trajectory modelling the role played by certain VOCs in the formation of ozone and radicals such as OH is assessed. A simple approximation of radical fluxes is also presented based on the variations of the measured hydrocarbons and the role of biogenically produced compounds such as isoprene in the urban environment is also considered.

This study has investigated both local and remote effects on levels of pollutants in the Bristol conurbation. Like any other town or city, Bristol has its own distinctive atmospheric characteristics. A detailed understanding of the different influences on local air quality is important to inform relevant policy decisions such as transport planning and healthcare provision and this type of research provides such information.

## A41B-0040 0830h POSTER

### Evaluation of AERONET Aerosol Retrievals

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The aerosol robotic network (AERONET) program provides aerosol retrievals at ground-based sunphotometer sites throughout the world. The aerosol size distributions and refractive index retrievals at two locations have been converted to phase functions and single-scattering albedo using Mie theory. These optical properties are incorporated into a discrete-ordinates radiative transfer model and calculations are compared to independent measurements obtained at the surface. The independent measurements include principle plane radiances from sunphotometer data and narrowband irradiances from multi-filter rotating shadowband radiometer (MFRSR) and rotating shadowband spectroradiometer (RSS) data.

The two locations represent radically different environments. The Atmospheric Radiation Measurement (ARM) program Central Facility (CF) represents a rural continental environment, while the CERES (Clouds and the Earth's Radiant Energy System) Ocean Validation Experiment (COVE) site represents a coastal marine environment. Both sites exhibit good agreement between the model calculations and the principle plane radiances for the year 2000 (generally better than 15 percent at optical depths greater than 0.1). A comparison with RSS measurements in July 2000 at the

ARM Central Facility shows an irradiance error of 12 percent or better at tested wavelengths longer than 500 nm. Comparisons with MFRSR data fared less well, however, indicating a discrepancy between the instruments. Inspection of 28 whole-sky imager (WSI) files coincidental with all AERONET quality-controlled retrievals during 7 days reveals that no clouds were obstructing the almucantar field of view and that indeed the whole sky was clear during this period, indicating a degree of robustness in the AERONET cloud screening.

Additionally, the size distributions were evaluated at COVE with hourly-averaged wind speed and direction. Linear regression indicates that the coarse mode column-integrated surface area increases from 0.015 to 0.04 as maritime wind speeds increase from 0 to 10 m/s, while the fine mode column-integrated surface area remains relatively constant at 0.62 to 0.66. When winds originate from the continent (25 km away), however, both modes maintain a relatively constant column-integrated surface area. This behavior is consistent with the creation of new large sea-spray particles at high wind speeds over a long fetch. Winds originating from the continent are unable to create many large particles in the short, 25-km fetch.

#### A41B-0041 0830h POSTER

##### A New Multifunctional GES DAAC Data Processing and Visualization Tool for Land, Ocean and Atmosphere MODIS Data

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The unique position of the NASA Goddard Earth Sciences Distributed Active Archive Center (GES DAAC) as an intermediary between users and MODIS data led us to explore and develop tools that could help users access and manipulate data. Currently all available tools are not able to meet the MODIS data processing requirements, which are critical at the GES DAAC. Our goal was to unify the strengths of the current tools and add new features in a new tool intended to visualize, validate, and analyze MODIS data. HDFLook-MODIS is a result of joint collaboration between LOA USTL, France, and GES DAAC and is based on the very popular MSPHINX (<http://www-loa.univ-lille1.fr/informatique/anim.html>) tool philosophy. Created as a flexible modular tool, it is easy to update, add new features, and is free to users obtaining it from the GES DAAC. HDFLook-MODIS helps MODIS Data Support Team significantly to visualize, validate and analyze MODIS data, and also is to be used for batch-mode local processing. Main features of HDFLook-MODIS are: 1) Accessing and visualization of all swath (level-1, and 2) and gridded (level-3 and 4) MODIS radiometric and geolocation, atmosphere, land, and ocean products; 2) Re-mapping of swath data to world map. Geo-projection conversion. Reprojection the initial projection into several pre defined selection; 3) Interactive and batch mode capabilities; 4) Subsetting features - availability of parameter, band, and spatial subsetting; 5) Multi-granule processing - Mosaic and stitch capabilities; 6) Displays ancillary/data attributes; 7) Data conversion- from scaled quantities to physical units. Format conversion- HDF-EOS to ASCII, Binary, JPEG, GIS (Geo Tiff shape files); 8) Aerosol and other ancillary data available from the ground based sun photometer measurements (AERONET data bank) for the atmospheric correction and validation of some atmospheric products. HDFLook-MODIS is developed for XWindows computer environment and has been tested on SGI and Linux systems. This presentation will describe HDFLook-MODIS tool that is intended to optimize MODIS data use for the Earth Science community. The options for data formats, data projections, subsetting functions, and data visualization are described and user feedback is encouraged.

#### A41B-0042 0830h POSTER

##### Field Experiment Data Support at the Goddard DAAC

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Historically, field experiment data support at the data center level has been sketchy, but in the last decade, because of rapid growth of electronic capabilities throughout the science community, the data center has become the resolution of choice to the problems of campaign data distribution and archival. Even so, field campaign data, being inherently non-uniform, require significant adaptation on the part of the archive.

The participant complement for a campaign ranges widely from one to three dozen investigators. Each has his/her own instrument, organizational affiliation, and funding. Many are academics with class schedules to consider, an office staff composed of graduate students and a correspondingly high turnover rate. Some are operating with very limited resources and lack the programming staff to tailor their data to archive specifications. Data delivery schedules, formatting and documentation are all driven by these factors.

Planning for data volume also requires flexibility. Campaign data acquisition is sensitive to weather and a variety of logistical problems. Planning for campaign data volume is therefore a matter of determining thresholds. Since most campaign data sets tend to be small by data center standards, distribution is mainly from anonymous ftp sites front-ended by web sites.

The Goddard DAAC opened its campaign archive in 1994 with data from the TRMM oriented TOGA-COARE campaign of 1992-93, and has most recently archived the TRMM global validation campaigns, designed to evaluate the physical assumptions made by TRMM rainfall algorithms, initialize and validate the cloud resolving models, test latent heating retrievals from TRMM measurements, and evaluate methods to estimate rainfall and latent heating from ground based radars. Launched by the TRMM Office in 1998, the TRMM campaigns were designed as a group so that specific measurements could be compared between experiments in order to gain insight into the regional dependence of any findings.

The Goddard DAAC's campaign complement now stands at nine and includes the five TRMM campaigns, an instrument archive for the MODIS Airborne Simulator (MAS), and the Southern Great Plains Soil Hydrology campaigns of 1997 and 1999.

URL: [http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/field\\_experiments/field\\_main.html](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/field_experiments/field_main.html)

#### A41B-0043 0830h POSTER

##### Anatomy of TRMM Science Data Support at the Goddard DAAC

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Successful science data support for Earth observing satellite missions and their data systems requires a large, well-coordinated set of activities that spans more than the lifetime of the missions. The Distributed Active Archive Center (DAAC) at the GSFC Earth Sciences Data and Information Services Center has been providing such science data support for numerous satellite missions since 1993 (e.g., TOMS, SeaWiFS, TRMM, MODIS). These cradle-to-grave data support activities include user surveys, profiling, and requirements gathering; data ingest, validation, and archive; documentation and informational Web sites; search and order and visualization; read software and other tools; user support; value-added or customized products and services; and outreach. Support activities for MODIS and other Earth Observing System (EOS) data sets also

include science software integration and testing (SSI&T support) and troubleshooting user problems related to data production systems. The goal is to enable users to fully realize the scientific, educational, and application potential of DAAC data.

The DAAC's Hydrology Data Support Team has been helping users of Tropical Rainfall Measuring Mission (TRMM) data in achieving this goal since before the launch of TRMM on November 28, 1997. TRMM is a joint mission of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency (NASDA) of Japan to monitor and study tropical and subtropical rainfall systems. TRMM data and information are accessible via [http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/hydrology/hd\\_main.html](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/hydrology/hd_main.html). This paper summarizes the main components-the anatomy-of TRMM science data support provided by the DAAC, which include (1) pre-launch preparation; (2) first public data release of TRMM standard products, via the TRMM Web Search and Order System; (3) support for two major reprocessings; (4) support for five field validation experiments; (5) a suite of derived subsets; (6) a collection of ancillary and related hydrological data sets; (7) data product readiness and other documentation; (8) read software, Web GIS, data mining, and other tools; and (9) outreach and the continual gathering of user requirements, via usage statistics, conferences, and other means. At all times, the DAAC's TRMM support remains responsive to user needs, accommodating to unanticipated demands, and innovative in availing the users of the latest appropriate technology. Through this support, in the four years of TRMM thus far, the DAAC has largely achieved the goal of enabling an increasing number and variety of users to fully benefit from the use of TRMM data in solving problems. The August 2001 boost of the TRMM satellite operating altitude from 350 to 403 km, which has significantly extended the projected mission lifetime of TRMM, will allow the DAAC to provide an even greater range of data services for TRMM users.

#### A41B-0044 0830h POSTER

##### Thermal Discrimination Technique for Airborne Measurement of Sulfuric Acid on Atmospheric Aerosol: Calibration and Performance

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The thermal discrimination or volatility technique has been widely used to determine the number fraction of volatile atmospheric aerosol (e.g. Hagen *et al.*, 1998). Here we extend this method to measure both number and volume fraction of upper-tropospheric/lower-stratospheric aerosol with particular concern for the conditions in aircraft and rocket plumes.

The volatility method infers the amount of volatile aerosol material from the change in aerosol volume under heated conditions. Accurate measurements require size resolved volatility data, corrected for possible systematic effects due to particle wall losses, incomplete evaporation, and recondensation of evaporated material. A tandem differential mobility analyzer was employed to investigate these effects for mixed H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O aerosol conditioned by a thermal discriminator that had been used by the University of Missouri-Rolla for several field studies in the past including the recent ACCENT mission.

For an operating temperature of 300 °C and an aerosol residence time of 0.25 s, we found that complete evaporation of H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O aerosol occurred up to diameters of at least 2 micron. This is consistent with the theoretically estimated upper diameter limit for complete evaporation of about 10 micron. No evidence for recondensation was found for H<sub>2</sub>SO<sub>4</sub> abundances occurring in the atmosphere. We also showed that for a given set of discriminator parameters, wall losses depend only on charge state and particle diameter downstream of the discriminator. Based on these findings an improved volatility method with analytical correction for wall losses is described and its accuracy is tested with mixed H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O-NaCl aerosol of known composition. The observed accuracy is consistent with the estimated accuracy of the system parameters. Finally, some results from atmospheric measurements are presented.

Hagen, D., Whitefield, P., Paladino, J., Trueblood, M., and Lilienfeld, H. Particulate Sizing and Emission Indices for a Jet Engine Exhaust Sampled at Cruise, *Geophys. Res. Lett.*, 25, 1681-1684, 1998.

## A41B-0045 0830h POSTER

In-situ Detection of Atmospheric NO<sub>3</sub> and N<sub>2</sub>O<sub>5</sub> via Cavity Ring-Down SpectroscopySteven S Brown<sup>1,2</sup> (sbrown@al.noaa.gov)Harald Stark<sup>1,2</sup> (hstark@al.noaa.gov)A.R. Ravishankara<sup>1,2</sup> (ravi@al.noaa.gov)<sup>1</sup>National Oceanic and Atmospheric Administration, Aeronomy Laboratory, R/AL-2 325 Broadway, Boulder, CO 80305, United States<sup>2</sup>Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder, Campus Box 216, Boulder, CO 80309, United States

The nitrate radical is an important chemical constituent throughout the atmosphere, serving as a nocturnal oxidant in the troposphere and playing a role in the conversion of NO<sub>x</sub> to nitric acid in the stratosphere through the heterogeneous hydrolysis of N<sub>2</sub>O<sub>5</sub>. Despite its significance, instrumentation for fast-response, in-situ detection of NO<sub>3</sub> has not previously been available. We report the application of cavity ring-down spectroscopy (CaRDS), a high sensitivity absorption technique, to the in-situ detection of NO<sub>3</sub> in ambient air. The instrument simultaneously detects N<sub>2</sub>O<sub>5</sub> on a second channel through thermal dissociation and detection of the resulting NO<sub>3</sub>. The detection sensitivity is 0.3 pptv at STP for a 5 second integration time. We report observation of these two species at several locations in the boundary layer near Boulder, CO. Both NO<sub>3</sub> and N<sub>2</sub>O<sub>5</sub> show considerable temporal variability, highlighting the advantage of in-situ detection.

## A41B-0046 0830h POSTER

## GEOS-Terra Data Assimilation System Data Support at the Goddard Earth Sciences DISC/DAAC

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The Distributed Active Archive Center (DAAC) located within the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) is scheduled to distribute the Globally-gridded atmospheric research-quality time series data from the Goddard Earth Observing System - Data Assimilation System (GEOS-Terra DAS) in early 2002. This near real-time dataset is produced by the Data Assimilation Office (DAO) at the Goddard Space Flight Center in direct support of the operational EOS instrument product generation for the Terra (12/1999 launch), Aqua (01/2002 launch) and Aura (01/2003 launch) spacecrafts. The GEOS-Terra DAS data set provides 136 physical quantities including wind, temperature, humidity, cloud parameters, total ozone and other important surface parameters. The data have horizontal resolution of 1 degree latitude by 1 degree longitude and 36 vertical pressure levels (except ozone which have a horizontal resolution of 2 degree latitude by 2.5 degree longitude and 42 vertical pressure levels). Time-averaged products are averaged over a 3hour period for single level files or a 6hour period for pressure level files. The data are in HDF-EOS (Hierarchical Data Format Earth Observing System) format. The Atmospheric Dynamics Data Support Team (ADDST: [http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/atmospheric\\_dynamics/](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/atmospheric_dynamics/)) at the GES DISC/DAAC provides support for data distribution, documentation, web-enabled visualization and analysis, read software and other related user services for the GEOS-Terra DAS data products. These services will help the users on data access, application, educational material and information for research activities. This paper presents the overview of the data product, major features of the latest GEOS-DAS, tools for online quality analysis, the various mechanisms for data search and ordering and subscription services.

## A41B-0047 0830h POSTER

## Meteorological Quantities Measured by a Small Robotic Aircraft

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A robotic aircraft (Aerosonde) is proving its capability to make useful measurements in a range of

conditions. Aerosonde is a small aircraft (15kg, 3m wingspan), developed for meteorological reconnaissance but is also adaptable for a range of compact payloads. This paper focuses on the meteorological parameters which are available from the Aerosonde sensors. As with any new monitoring platform, the quality of observations must be assessed. Programs to make inter-comparisons with radiosonde ascents are an active component of this research program and as larger datasets become available, an accurate assessment of the performance of the Aerosonde platform can be made. The Aerosonde meteorological package consists of a combination of established technology for measurement of pressure temperature and humidity (Vaisala RS90), and GPS navigation, meaning that the aircraft can provide a range of meteorological information over remote regions. This paper shows some of the results of inter-comparison experiments and examines the likely accuracy of some of the computed meteorological parameters.

## A41B-0048 0830h POSTER

## MC2AQ: Preliminary Results With the Addition of a Bulk Model of Particulate Matter

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MC2 (Mesoscale Compressible Community model) is a mesoscale model developed by collaborators at the University of Quebec at Montreal and the Meteorological Service of Canada. MC2AQ is an on-line air quality version of MC2 that was developed at York University. The AQ part of the model includes complex oxidant gas-phase chemistry, deposition, anthropogenic and on-line biogenic emissions. MC2AQ has been used successfully to calculate ozone concentrations in Eastern Canada and the United States and also for Europe. The model can be run down to urban scales of a kilometer or less. The long-term goal of this project is to modify MC2AQ to include aerosol and aqueous chemistry, and the detailed microphysics of the formation and evolution of size distributed particles in an on-line fashion. As a first step, the model has recently been updated to include a new Canadian emissions inventory that includes bulk primary sources of PM<sub>2.5</sub> and PM<sub>10</sub>. Secondary sulphate and nitrate chemical production mechanisms have also been included. In this first phase of the work bulk aerosols were included along with dry deposition for aerosols and rain out in MC2AQ. Results of this first phase showing ozone and PM concentrations and 24 hour accumulated depositions of total PM will be presented, and compared to some field observations in Southern Ontario.

## A41B-0049 0830h POSTER

## Aerosol profile retrievals from integrated dual wavelength space lidar ESSP3-CENA and spectral radiance MODIS data

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The ESSP3-CENA space mission (formally PICASSO-CENA) will provide continuous global observations with a two wavelength lidar. The attenuated backscattering coefficients measured by the lidar, have valuable information about the vertical distribution of aerosol particles and their sizes. However the information cannot be mapped into unique aerosol physical properties. Infinite number of physical solutions with different attenuations through the atmosphere can reconstruct the same two wavelength backscattered profile measured from space. Spectral radiance measured by MODIS simultaneously with the ESSP3 data can constrain the problem and resolve this ambiguity to a large extent. Sensitivity study shows that inversion of the integrated MODIS+ESSP3 data can derive

the vertical profiles of the fine and coarse modes mixed in the same atmospheric column in the presence of moderate calibration uncertainties and electronic noise (10%). We shall present the sensitivity study and results from application of the technique to measurements in the SAFARI-2000 and SHADE experiments.

## A41B-0050 0830h POSTER

## Molecular and Stable Carbon Isotope Composition of Organic Compounds from Particles Sampled from the Lower Fraser Valley, BC Urban and Regional Air Shed

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This study examines the character of specific non-volatile organic compounds (N-VOCs) extracted from total suspended particulates. Aerosols are collected on filters by HiVol samplers on monthly intervals, at well-characterized meteorological sites throughout the Lower Fraser Valley. Filters are solvent-extracted, then separated into different compound classes by Silica-gel Chromatography. Selected fractions are analysed for their individual compound molecular compositions by Gas Chromatography-Mass Spectrometry (GC/MS) and by Continuous Flow-Isotope Ratio Mass Spectrometry (CF-IRMS) for their stable carbon isotope ratio.

The purpose is to identify spatial and temporal variations in N-VOCs, with the long-term goal of understanding their sources, transport processes and atmospheric chemistry. This Health Canada, Toxic Substance Research Initiative offers insights into the levels and signatures of N-VOCs exposed to humans in congested urban settings. The program is also part of the Pacific 2001 field study. This paper presents the initial year's results on our N-VOCs, including alkanes, organic acids, in comparison with bulk isotope analyses.

URL: <http://ceor.seos.uvic.ca/biogeochem/>

## A41B-0051 0830h POSTER

## Fractal Dimension of Combustion Particles by in-situ Atomic Force Microscopy

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The environmental fate of road run-off particles is still poorly understood. While many studies have analysed and characterised airborne particles, none of them has focussed on their behaviour once in runoff-waters.

In this context, we have analysed airborne particles originating from combustion, by means of Atomic Force Microscopy. This technique allows us to determine the morphological characteristics of the particles and of their aggregates at the nanometer scale. In addition, particles can be analysed either in air or in water, under their native, undisturbed state. In the case of our combustion particles, these two different environments were investigated.

It is possible to characterise the reactions which individual particles undergo during aggregation, by means of the fractal dimension *f* of the aggregates. This parameter is a very sensitive indication on the surface roughness and the compacity of the aggregates.

The analysed airborne particles (*n* = 20) showed a very smooth surface (*f* = 1.15 +/- 0.05), either in air samples or in water samples. For the latter, pure water (pH = 7) was used to perform the measurements. On the other hand, aggregates of individual particles showed a high compacity (*f* = 2.5 +/- 0.2), and they did not exhibit morphological changes under the experimental conditions of analysis. The fractal dimension of these aggregates suggests that they are formed under conditions of reaction-limited colloid aggregation (RLCA), which are mainly controlled by repulsive electrostatic forces.

Further studies will be performed on in-situ samples in the near future. Physico-chemical conditions such as pH and ionic strength will be varied, to determine their influence on the behaviour and fate of these entities.

## A41B-0052 0830h POSTER

## CFORS - Regional Chemical and Weather Forecast System in Support of Field Experiments

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In this paper we will present the development, evaluation, and use of improved modeling techniques and methodologies for the integration of meteorological forecasts with air pollution forecasts in support of field operations during the TRACE-P and Ace-Asia experiments in East Asia. During the campaign period we provided a variety of forecast products using our regional modeling system built upon the dynamic meteorological model RAMS and the 3-D regional chemical transport models STEM-III. These models were run in both on-line and off-line modes, and the results integrated into an interactive web-based data mining and analysis framework. This resulting Chemical Weather Forecasting System CFORS, was run operationally for the period February through May 2001, and provided 72-hr forecasts of a variety of aerosol, chemical and air mass and emission marker quantities. These included aerosol mass distribution and optical depth by major component (e.g., dust, sea salt, black carbon, organic carbon, and sulfate), photochemical quantities including ozone and OH/HO<sub>2</sub>, and air mass & emissions markers including lightning, volcanic, mega-cities, and biomass burning. These model products were presented along with meteorological forecasts and satellite products, and used to help determine the flight plans, the positioning of the ship, and to alert surface stations of upcoming events (such as dust storms). The use of CFORS forecasts (along with other model results) models were shown to provide important new information and level of detail into mission planning. For example many of the mission objectives required designing flight paths that sampled across gradients of optical depth, or flew above, below and through vertical layers of aerosol, intercepted biomass emission plumes, or sampled dust storms. CFORS, forecasts of dust outbreaks and plume locations, etc., proved to be very useful in designing missions that meet these objective. In this paper we will present an overview of CFORS and demonstrate how it was used in the field (via computer demonstration). We will present a few case studies from the experiment including some interesting events that the model predicted as well as some that the models missed. We will also show results from an application of the model to track trans-Pacific transport.

## A41B-0053 0830h POSTER

## Photochemical Application of Aerosol Climatologies

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Aerosols affect the global budgets of O<sub>3</sub>, CO, OH and CH<sub>4</sub> in part through their alteration of photolysis rates and in part through their direct interactions with chemical species (i.e., "heterogeneous chemistry"). The first effect is evaluated here with a global tropospheric chemistry transport model (CTM) using recently developed global climatologies of aerosols: the aerosol climatology over the ocean retrieved from channel 1 and 2 AVHRR satellite radiance data (Mishchenko et al., 1999) and a model-generated climatology for land-plus-ocean by CCSR (Center for Climate System Research) (Takemura et al., 2000)

Globally integrated, most tracer's global budgets are impacted at most several percent by the direct impact of aerosols on photolysis rates within the uncertainties considered. Regional changes, however, are often more than 10%, especially over west African where biomass burning and desert dust provide a large absorbing aerosol loading. The predominant impact is due to the aerosols over land, oceanic aerosols contribute less than a third of the total aerosol-driven

to changes in key tropospheric constituents (e.g., OH, NO<sub>2</sub>, CO, CH<sub>4</sub>). On a global scale, the influence of aerosols is greater in July than in January, greater in the Northern Hemisphere than in the Southern Hemisphere, as would be expected since the aerosols are generally co-located with the major pollution sources in the Northern Hemisphere. Sensitivity experiments illustrate that lack of more precise data on aerosol refractive index is these largest uncertainties in these calculations.

## A41B-0054 0830h POSTER

## The Investigation of Influence of Artificial and Anthropogenic Formations on Propagation of Electromagnetic Waves in Atmosphere

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The purpose of the scientific work is to investigate the influence of artificial and anthropogenic formations on propagation of electromagnetic waves in atmosphere in wavelength range of 10 mm - 2 m.

Containers were exploded at various heights with different concentrations and different chemical characteristics. The resulting artificial aerosol cloud formation, with d=1km, was observed with MRL-2 or MRL-5 Radars on different climatic conditions. In particular, the effects of this artificial formation on the absorption, the refraction and the reflection of radio waves in the range of 10mm - 2m was observed. The electromagnetic waves, sending through the aerosol cloud formation, was observed subsequently with MRL-2 or MRL-5 Radars.

Given work made possibility:

1. Studying experimentally the influence of physical properties of aerosols under various climatic conditions on the propagation of radio waves and defining the influence of atmospheric characteristics on physical properties of aerosol particles and reflecting characteristics of aerosol formations.
2. Studying the possibility of regulating atmospheric radio transparency by the modification of aerosol components on the path of radio waves and investigating the influence of the electrical characteristics of the atmosphere on the absorption and propagation of radio waves in the wavelength range of 10 mm to 2m.
3. Creating the measurement devices and recording means of absorption features of radio waves in the atmosphere.

## A41B-0055 0830h POSTER

## Climatology of the Stratospheric Aerosol Angstrom Parameter : Anti-correlation to the Extinction and Latitudinal Variation

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SAGE II version 6.0 extinction data from 1985 through 1999 were analyzed, focusing on the Angstrom parameter, which is a good indicator of particle size. The time variation of the extinction coefficients was compared with the Angstrom parameter. The level of extinction in 1999 was the lowest in the history of systematic measurement of the stratospheric aerosol layer, while the Angstrom parameter was the highest. A clear anti-correlation between extinction and the Angstrom parameter was observed during the decay after the Pinatubo eruption [Hayashida and Horikawa, 2001].

Although a negative correlation is a distinguishing feature of a decay period after volcanic eruptions, the Angstrom parameter shows a latitudinal gradient even in the background period. They are higher at higher latitudes, suggesting smaller particles. Although the classic theory of aerosol microphysics depicts growth to 'mature particles' in a poleward meridional circulation, this study suggests that particles diminish in size.

References: Hayashida, S., and M. Horikawa, Anti-correlation between stratospheric aerosol extinction and the Angstrom parameter from multiple wavelength measurements with SAGE II - a characteristic of the decay period following major volcanic eruptions -, Geophys. Res. Lett., 2001 (in press).

## A41B-0056 0830h POSTER

## The Impact of Transportation on the Chemical Composition of the Troposphere

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A large amount of chemical compounds is released in the atmosphere as a result of road, train, aircraft and ship transportation. A three-dimensional chemistry transport model has been used to assess the importance of the emissions related to traffic on the global distribution of ozone and its precursors in the troposphere. Emissions related to road transportation are for example found to be responsible for up to 10% of surface ozone at mid-latitudes of the northern hemisphere. The impact of different transportation means will be evaluated and the results of a few sensitivity studies will be discussed.

## A41B-0057 0830h POSTER

Airborne Measurements of NMHCs, O<sub>3</sub>, CO and Aerosol Scatter in the Northeastern Pacific During the Spring of 2001 PHOBEA-II Campaign

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In spring of 2001 airborne observations of NMHCs, O<sub>3</sub>, CO and aerosol scatter were made off the coast of Washington State as part of the Photochemical Ozone Budget of the Eastern North Pacific-II (PHOBEA-II) experiment. In this presentation, observations of long-range transport and the springtime background from PHOBEA-II will be evaluated alongside observations from our previous airborne experiment in spring of 1999, PHOBEA-I. Polluted air masses originating from the Eurasian region have been identified in both the 1999 and 2001 PHOBEA experiments. A spring of 2001 event observed on 14 April contained substantial aerosol loadings and was identified by TOMS satellite, and airborne and surface measurements throughout North America. Discussion of the spring 2001 event has concentrated on the transport of dust from the desert regions of Asia, but our observations suggest a considerable air pollution component. We observed elevated levels of CO, O<sub>3</sub> and NMHCs with maximums between 4-6 km. Aerosol scatter and CO show a 554% and 45% enhancement respectively over the observed spring 2001 background at 5.5km.

## A41B-0058 0830h POSTER

## Statistics of TRMM Data Archive and Distribution at the Goddard DAAC

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The Tropical Rainfall Measuring Mission (TRMM) is a joint mission of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency (NASDA) of Japan to monitor and study tropical and subtropical rainfall systems. TRMM has been acquiring data from shortly after its launch on November 28, 1997 to the present. All TRMM standard products are processed by the TRMM Science Data and Information System (TS-DIS) and archived and distributed by the Goddard Distributed Active Archive Center (GDAAC). In addition to the standard products (accessible via <http://lake.nascom.nasa.gov/data/dataset/TRMM/index.html>), the GDAAC generates and/or maintains a set of derived TRMM products (e.g., satellite coincidence subsets, parameter subsets, resampled gridded subsets, GIS-compatible files) to facilitate use of TRMM data by the general public. TRMM data are reprocessed with improved science algorithms approximately once per year, currently at version 5. The average operating altitude for TRMM was moved from 350 kilometers to 403 kilometers during the period from August 7 to 24, 2001, which will significantly extend the mission lifetime for TRMM.

The GDAAC stores archive and distribution information on TRMM standard and derived products in a database. In order to better understand the data usage patterns and requirements of TRMM users, statistics are routinely derived from the database for the entire TRMM data set or for specific groups of data products. For example, the total cumulative distribution and archive of TRMM satellite standard products (as of August 2001) are 2,722,479 and 420,573, respectively, in terms of file numbers; and 64.5 TB and 11.4 TB, respectively, in terms of file volumes. The Utilization Rate (UR), defined as the ratio of the number of distributed files to the number of archived files, of these satellite products is 6.5 (not including anonymous ftp distribution). Overall, the UR has increased steadily as TRMM progressed, and the trend is continuing. As measured by the UR, the most frequently requested satellite orbital data products are TMI brightness temperature, and PR and TMI rain profiles, with UR above 12. Most of the satellite gridded data products have a UR above 10, with a few above 20. Because some of the gridded products can also be accessed via anonymous ftp, the statistics of which are not included here, their UR is actually even higher. The complete, detailed statistics and their analysis will be presented. These statistics not only help the GDAAC to better serve its TRMM users, but also are useful inputs to the design of future satellite data support systems, such as those of the TRMM follow-on mission, the Global Precipitation Mission (GPM).

#### A41B-0059 0830h POSTER

##### Application of ensemble back trajectory and factor analysis methods to aerosol data from Fort Meade, MD: Implications for sources

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As the primary field experiment for Maryland Aerosol Research and Characterization (MARCH-Atlantic) study, chemically speciated  $PM_{2.5}$  has been sampled at Fort Meade (FME, 39.10°N 76.74°W) since July 1999. FME is suburban, located in the middle of the bustling Baltimore-Washington corridor, which is generally downwind of the highly industrialized Midwest. Due to this unique sampling location, the  $PM_{2.5}$  observed at FME is expected to be of both local and regional sources, with relative contributions varying temporally. This variation, believed to be largely controlled by the meteorology, influences day-to-day or seasonal profiles of  $PM_{2.5}$  mass concentration and chemical composition. Air parcel back trajectories, which describe the path of air parcels traveling backward in time from site (receptor), reflect changes in the synoptic meteorological conditions. In this paper, an ensemble back trajectory method is employed to study the meteorology associated with each high/low  $PM_{2.5}$  episode in different seasons. For every sampling day, the residence time of air parcels within the eastern US at a  $1^\circ \times 1^\circ \times 500$  m geographic resolution can be estimated in order to resolve areas likely dominating the production of various  $PM_{2.5}$  components. Local sources are found to be more dominant in winter than in summer. "Factor analysis" is based on mass balance approach, providing useful insights on air pollution data. Here, a newly developed factor analysis model (UNMIX) is used to extract source profiles and contributions from the speciated  $PM_{2.5}$  data. Combining the model results with ensemble back trajectory method improves the understanding of the source re-

gions and helps partition the contributions from local or more distant areas.

URL: <http://www.meto.umd.edu/~bruce/MARCH-Atl.html>

#### A41B-0060 0830h POSTER

##### Climate Variability of the Atmosphere and Seas Adjacent to the Korean Peninsula

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The main purpose of the research is to provide the basic description of the nature of interannual variations to secular trends in the local climate system of the area surrounding the Korean Peninsula. This is based on the systematic analysis of selected atmospheric and oceanic climate data that have been collected over the last century. Note that climate-related research activities of the area are still in the stage of infancy in Korea and only a few recent studies have addressed the issue through analyses of particular atmospheric variables such as air temperature and/or rainfall data or an oceanic variable such as SST. These studies have focused mainly on the relationship between the regional interannual variability and ENSO. In the present study both the atmospheric and oceanic variables have been analyzed without any prejudice to the connection with ENSO, complementing previous work but with a more complete and comprehensive manner. Such a basic empirical study should lay the foundations for the understanding of the mechanisms that determine the nature of the local climate variability, leading eventually to its better predictability.

URL: <http://www.metri.re.kr/kgawo>

#### A41B-0061 0830h POSTER

##### Jet Stream Migration Characteristics Associated with the Onset of the East Asian Summer Monsoon

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It was pointed out some decades ago that the jet stream migration was a prominent phenomenon associated with the seasonal change of the general circulation. It was also noted that there have two stages of the jet stream migration within the system of the Asian monsoon. However, the relationship of jet stream migration and the onset of the Asian summer monsoon are not that clear. Thus the goal of present study is to identify the jet stream migration characteristics associated with the East Asian summer monsoon, and examine its relationship with the onset of the Asian summer monsoon. NCEP/NCAR reanalysis data was used in this study. The results indicated that the climatological mean of the first jet stream northward migration (jet stream moves into the 30°N) occurred around May 8th, which is 6 days ahead of the onset of the East Asian summer monsoon in the South China Sea (SCS) region. The northward migration of the jet stream implies the retreat of the mid- and high latitude system, and the advancement of the tropical system. Thus it is favorable for the tropical and convective system prevails in the SCS area and thus the onset. The second stage of the jet stream migrates into the 35°N is around June 10th, and it is about 8 days earlier than the onset of the Asian monsoon in the Yangze-Hui river area. It was also associated with the further advancement of the tropical system. Thus the tendency of the jet migration occurred several days earlier than the onset can be established. It can also be understood that after the large scale favorable situation is set up, it will be followed by a sequence of events that trigger the onset of the Asian summer monsoon at that region. The study also found that for individual year, if the jet stream northward migration is continuous, and move further northward. This situation is normally associated with a shorter monsoon (or rain) period. On the other hand, if the jet stream northward migration is not that clear and sometimes its movement is back and forth, it normally is associated with a heavy rainfall monsoon year. This abnormal migration is related to the movement of the subtropical high and it deserves more study in near future.

#### A41B-0062 0830h POSTER

##### Spatial Assessment of Asian Outflow: Aerosol Microphysics and Optics During ACE-Asia and TRACE-P Intercomparison Flights

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During March and April of 2001 NASA conducted the Transport and Chemical Evolution over the Pacific experiment (TRACE-P) and the NSF conducted the Asian Pacific Regional Aerosol Characterization Experiment (ACE-Asia). On March 30th and April 1st both the NASA P3-B and the NSF/NCAR C-130 aircraft completed intercomparison flights near Japan. Although the science objectives of the missions were different a few researchers had identical instrumentation aboard the two platforms. Establishing quantitative links between these instruments and data sets not only provides confirmation of instrument performance but, more significantly, allows the combination of large data sets that span different sampling regimes and sampling periods.

The University of Hawaii (McNaughton, Clarke, Howell) operated aerosol instrumentation aboard both the P3-B and the C-130. Differential Mobility Analyzers (DMAs), Aerodynamic Particle Sizers (APSs), and thermally resolved laser Optical Particle Counters (OPCs) cumulatively sized aerosol species between 0.007 $\mu$ m and 20 $\mu$ m. Aboard the NASA P3-B the UH team operated a single three-wavelength TSI nephelometer measuring total aerosol but also equipped with a sub-micron impactor. The University of Washington (Anderson, Masonis) operated total and sub-micron three-wavelength TSI nephelometers aboard the NSF/NCAR C-130.

The poster presentation evaluates the results from identical instrumentation aboard the two aircraft during the intercomparison flights. The presentation will focus on the size distributions and optical properties of aerosols observed in Asian outflow and derived from both natural (dust) and anthropogenic (pollution) sources.

#### A41B-0063 0830h POSTER

##### Low Molecular-Weight Dicarboxylic and Fatty Acids Over the Northwestern Pacific and the Sea off East Asia During the ACE-Asia Campaign

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Sampling of dicarboxylic and fatty acids was conducted from March 15 to April 20, 2001 on R/V NOAA Ronald H. Brown over the Northwestern Pacific, East China Sea and the Sea of Japan, as part of the ACE-Asia campaign. During the cruise, aerosol particles were collected on pre-combusted quartz fiber filters using a high volume air sampler, and organic acids in gas and particles were collected separately using an annular denuder with a backup quartz filter. In addition, MOUDI impactor was used for size-segregated aerosols. The collected samples were analyzed for water and ethyl-acetate extractable organic compounds such as low molecular-weight dicarboxylic acids and fatty acids using capillary GC and GC/MS. Throughout the cruise, oxalic acid, followed by malonic and succinic acids, was found to be the most dominant species.

For oxalic acid, concentrations as high as  $1 \mu\text{g m}^{-3}$  was observed occasionally at sea off East Asia. Chemical transport model calculations predicted high sulfate concentrations in the regions where oxalic acid concentrations were high, suggesting that oxalic acid should have been strongly influenced by anthropogenic emissions from the Asian continent. This is consistent with our hypothesis that the main source of oxalic and some other dicarboxylic acids are anthropogenic in the East Asia region. The relative abundances of dicarboxylic acids and fatty acids between gas and particles were obtained by analyses of denuder samples. For oxalic acid, 65-90 % were present in particles, whereas some fatty acids were detected only in particles. Molecular compositions, gas to particle ratios, and size distributions of the organic aerosol particles obtained by this study would provide information of sources, chemical processes and transport, which will be discussed in this presentation.

#### A41B-0064 0830h POSTER

##### Hygroscopic Properties of Aerosol Particles Measured at Kosan Super-Site During the ACE-Asia Study

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The chemical and physical properties of ambient aerosols were measured during the yellow dust and non-dust events at Cheju Island off the tip of South Korea in April 2001. Here we report measurements of aerosols hygroscopic properties observed with Humidified Tandem Differential Mobility Analyzer (HTDMA). Simultaneously aerosol size distributions were measured with aerosol mobility analyzers. During particle water uptake studies dry aerosols with almost monodisperse sizes in the range of 20-250 nm were selected and humidified to elevate relative humidity (60-95%). Results showed unimodal or bimodal response of humidified particles. In some cases, number of modes observed after the humidification was dependent upon the initial dry particle size selected while measurements were done within an hour and non significant changes in air masses were observed within the time period. On several days new particle formation events were observed. During the event nucleation mode particles grew into Aitken mode sizes. Water uptake measurements demonstrated that 25 nm size dry ambient particles grew to about 55 nm in HTDMA when RH was elevated to 92%.

#### A41B-0065 0830h POSTER

##### Variations of Atmospheric Trace Substances According to the Transport Scales at Tokchok Island in Korea

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Tokchok Island is located in the Yellow Sea, a semi-enclosed, shelf-type shallow basin between Korea and China. On the Korean side, the island is 50 km west of the greater Seoul area where around 20 million people reside; on the Chinese side, it is 250 km east of the greater Qindao area where more than 8 million people reside. Prevailing wind directions over the Yellow Sea are westerlies especially in winter. However, in summer with strong insolation, the island could be affected by the sea-land breeze from the Korean Peninsula. Although the emission amount of air pollutants is quite low in this small island of 20 km<sup>2</sup> with 20 thousand inhabitants, there are an oil-firing power plant and a wharf for ferryboat.

Gaseous pollutants including ozone and SO<sub>2</sub> and fine particles such as TSP and PM<sub>2.5</sub> were measured from April 1999 to June 2000. While ozone and SO<sub>2</sub> were constantly measured during the period, other pollutants were intermittently measured during four intensive measurement periods. First, the measurement periods were classified into three groups on the basis of the correlation between ozone and SO<sub>2</sub>. They included the period more affected by the long-range transport, the period more affected by local emissions, and the

remaining period. Characteristics of mass and ion concentrations of TSP and PM<sub>2.5</sub> in each group were investigated in order to further study the variations of atmospheric trace substances according to the transport scales. The transport paths of trace substances were estimated by using the back trajectory analysis over the refined meteorological fields. Seasonal and meteorological influences revealed on the variations of trace substances were also discussed.

#### A41B-0066 0830h POSTER

##### Source Apportionment of PM<sub>2.5</sub> in Beijing, China Using Organic Tracers

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In 2000, the annual average concentration of PM<sub>2.5</sub> measured at five air quality monitoring sites in Beijing, China was found to be 101 micrograms per cubic meter, which is significantly higher than the annual average fine particle concentrations in many North American and European urban locations. Such high concentrations of airborne fine particulate matter lead to a variety of air quality problems including severe visibility reduction. Development of an effective strategy for reducing the air pollution emissions in Beijing requires a clear understanding of the composition, concentration, and sources of these fine particles in the atmosphere.

Daily average PM<sub>2.5</sub> samples were collected simultaneously once every 6th day at five air quality monitoring stations in Beijing, China during January, April, July, and October 2000. The samples obtained each month at each site were combined as a monthly composite sample for detailed organic tracer analysis by GC/MS (gas chromatography/mass spectrometry). The concentrations of one hundred organic compounds were quantified in each composite sample, including n-alkanes, branched alkanes, cycloalkanes, n-alkenoic acids, n-alkenoic acids, PAHs (polycyclic aromatic hydrocarbons), oxy-PAHs, hopanes, steranes, alkanedioic acids, resin acids, aromatic acids as well as key molecular marker compounds. The identified organic tracers along with elemental carbon, organic carbon, Al and Si which have been previously quantified were applied in a chemical mass balance model to apportion the sources contributing to PM<sub>2.5</sub> mass. The major sources include coal combustion, wood burning, gasoline-power vehicle exhaust, diesel exhaust, crustal material, meat cooking, vegetative detritus, as well as secondary aerosol formation. Significant seasonal variations in the source contributions to PM<sub>2.5</sub> were observed, e.g., higher contribution from crustal material in April and higher concentration from coal combustion in January. The highest concentration of residual organic matter, which cannot be explained by the identified primary fine particulate matter sources, occurred in July. The characterization of solvent-extractable organic compounds at rural and urban sites in Beijing will be presented and discussed.

#### A41B-0067 0830h POSTER

##### Stable Carbon Isotopic Compositions of Nonmethane Hydrocarbons Collected during ACE-Asia Aircraft Campaign

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Canister sampling of NMHC for the measurements of stable carbon isotopic compositions ( $\delta^{13}\text{C}$ ) was conducted aboard NCAR C-130 aircraft over East Asian region as part of ACE-Asia experiment during April and May 2001. Mixing ratios of ethane, acetylene, propane, n-butane, and n-pentane showed a decrease from the surface to 6 km in altitude.  $\delta^{13}\text{C}$  values of ethane become heavier from around  $-26.5 \text{ ‰}$  in the marine boundary layer to around  $-24.5 \text{ ‰}$  at 6 km in altitude. Vertical trend of isotopic composition for acetylene is somewhat similar to that for ethane, but its vertical gradient is more pronounced than that of ethane. Particularly, very high isotopic ratios of acetylene up to  $+20 \text{ ‰}$  were observed in the free troposphere, being consistent with the previously published results on the largest kinetic isotope effect of acetylene and its highly  $^{13}\text{C}$ -enriched emission sources. On the contrary, more reactive NMHC, such as propane, n-butane, and n-pentane, did not show a significant vertical change. In general, changes in  $\delta^{13}\text{C}$  values of less reactive NMHC due to the mixing of air masses are larger than those of more reactive NMHC, because the accumulation of the former NMHC should be relatively more enhanced in the atmosphere. Thus, the weaker isotopic gradient of more reactive NMHC with altitude suggest that the photochemical removal of NMHC during the atmospheric transport plays a minor role in determining vertical profile of the mixing ratios. Alternatively, the strong isotopic gradients found for less reactive NMHC (such as ethane and acetylene) suggest that the systematic decreases of the mixing ratios with altitude are predominantly caused by the vertical mixing (i.e. dilution) of air masses with different photochemical ages

#### A41B-0068 0830h POSTER

##### Carbon Dioxide, Carbon Monoxide and Ozone Measurements on the NCAR C-130 During ACE-Asia

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Several in situ trace gases were measured from the NCAR C-130 to provide indications of air mass origin during the ACE-Asia intensive field campaign. Carbon dioxide was measured using a dual cell, non-dispersive infrared absorption instrument, modified to provide temperature and pressure control. This instrument was developed to be highly precise and accurate, having a 0.1 ppmv precision and +/- 0.4 ppmv accuracy. A high data rate vacuum UV resonance fluorescence instrument was deployed to quantify carbon monoxide. The commercially available instrument was based upon that developed by Gerbig et al. (JGR, 1999). The instrument has a 3 ppbv detection limit and a useful time response of 0.3 Hz. Recent intercomparison with NOAA CMDL canister samples indicate an accuracy limit of 3 ppbv over the course of a research flight. Ozone mixing ratios and fluxes were measured by chemiluminescent reaction with NO. The time response for turbulent flux measurements was approximately 3 Hz, and the ozone mixing ratio observations had a sub-ppbv detection limit.

Summary statistics of tracer mixing ratios over the entire mission will be presented. Cases of highly polluted plume samplings will be discussed in greater detail.

#### A41B-0069 0830h POSTER

##### Observations of Ozone and its Deposition to the Sea Surface During ACE-Asia

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A fast-response chemiluminescence ozone analyzer was deployed onboard the NCAR C-130 during the ACE-Asia intensive observation period. Direct measurements of ozone deposition to the ocean surface were made using eddy-correlation throughout the target area in the Western Pacific, allowing for a large scale study of the statistics and spatial distribution of this globally important ozone loss mechanism. The deposition velocities observed ranged from below the detection limits of the method to nearly 0.1 cm/s. Possible causes, both meteorological and oceanic, of the observed variability in ozone deposition will be explored.

#### A41B-0070 0830h POSTER

##### Observations of Hydrocarbons and Halocarbons during ACE-Asia

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Sixty hydrocarbons (HCs), 21 halocarbons and 7 alkyl nitrates were measured in 1322 whole air samples collected aboard the National Center for Atmospheric Research (NCAR) C-130 aircraft as part of NSF's Asian Pacific Regional Aerosol Characterization Experiment (ACE-Asia). Thirty flights were flown from March to May, 2001, 19 of which were deployed from the Iwakuni airbase in southern Japan. These flights over the Yellow Sea, Sea of Japan, and the East China Sea, at a time when continental outflow was at its strongest, offered excellent opportunity to study the impact of Asian aerosol on the chemical and radiative properties of the Earth's atmosphere. In addition, samples were collected at the two Taiwanese ground stations. Seventy four nearly daily samples were collected at Lan-Yu (2/28-5/15), and another 57 collected at Wen-Li (3/20-5/15). These additional data allows assessment of the impact of continental aerosol upon Pacific rim countries.

Very high levels of aerosol were encountered on a number of flights, some dominated by dust, some by pollutants, and others a mixture of both. Elevated levels of hydrocarbons and halocarbons were observed in some of these plumes, suggesting inputs from urban industrial regions, and carried these anthropogenic pollutants out to the western Pacific basin. Many urban plumes were intercepted near their sources and the chemical signatures of these emitted anthropogenic pollutants varied greatly. These unique source signatures enable characterization of these high aerosol plumes and suggest possible paths of the outflow. In one particular example, a large dust storm was intercepted by the C-130 over the Yellow Sea on April 11, and on April 12, the same system reached Taiwan. Our data collected from the C-130 and the two Taiwanese ground stations allows comparison between these two air masses and assess its impact on the local air quality.

#### A41B-0071 0830h POSTER

##### Total Column Radiative Forcing by Aerosols During the ACE-ASIA Campaign

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Comprehensive measurements including the solar insolation at the surface as well as the aerosol optical depth were made during the intensive field phase of the ACE-ASIA field project. These measurements, in conjunction with aerosol-free model simulations are used to determine the radiative forcing at the surface for the visible, near-infrared, and total solar spectral bandpasses. The predominant sources and compositions of the aerosols present in the measurement region located at Cheju Island, Republic of South Korea, ranged from anthropogenic "pollution" from large cities in China, Korea, and Japan as well as

natural "yellow dust" transported from the Gobi desert area. The surface radiation measurements are used to characterize the overall climatic response to the combination and variability of the magnitude of the atmospheric aerosols. Analyses show that the diurnally averaged surface radiative forcing due to the aerosols is approximately -82.6 W/m<sup>2</sup> per unit optical depth at 500 nm for the total solar broadband spectrum with a roughly equal contribution from the visible (-41.7 W/m<sup>2</sup>) and near-infrared (-44.0 W/m<sup>2</sup>) portions.

#### A41B-0072 0830h POSTER

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Sulfur dioxide was determined on ACE-Asia using isotope dilution atmospheric pressure ionization mass spectrometry. We achieved a lower limit of detection of at least 5 pptv with an integration time of 1 second. Sulfur dioxide was sampled at a rate of 2 hertz that enabled us to observe variations in sulfur dioxide that was not possible with slower instrumentation. We observed sulfur dioxide concentrations from 10 pptv to 40 ppbv. Extensive layering was observed which was related to complicated horizontal and vertical transport especially in the vicinity of cloud. On several occasions we observed the interaction of sulfur dioxide with Gobi desert dust.

#### A41B-0073 0830h POSTER

##### Multi Channel Lidar Observation of Aerosol Backscatter Ratio at Kosan, Jeju, Korea during the Spring of 2001

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Vertical profiles of atmospheric aerosol backscattering and the depolarization ratio (particle nonsphericity) were measured with multi channel lidar at Kosan (33.17°N, 126.10°E, 50m) from 11 March to 4 May, 2001, ACE-Asia intensive measurement period to investigate the characteristic of aerosol optical properties with altitude during yellow sand event. Our lidar system used a Nd:YAG laser whose wavelength are 355nm, 532nm, and 1064nm. Pulse duration of laser do not exceed 10ns at 1064nm, repetition rate is 20Hz, and detection range is below 60km. Additionally, the detector is PMTs which counts the number of photons. Lidar consists of three telescopes and receives data of aerosols at the eight channels. Two channels are used not only to measure aerosols but also to analyze boundary layer. The six channels which detect aerosols are produced by polarizing 532nm laser and 1064nm laser vertically and horizontally respectively. During April 13, yellow sand layers existed at 6km and 4km, respectively. The upper layer had a scattering ratio of 5.0 which the lower layer had a scattering ratio of 6.7. Much more lower layers appeared at about 2km to be mixed with background aerosol and scattering ratio of 1.4. At April 23, yellow sand layers existed at 4-5km, and the maximum scattering ratio of 54.1 was recorded. Also, at April 24, yellow sand layers existed at 5.5km and 4km. The upper layer had a scattering ratio of 55.1, and the lower layer had a scattering of 17.6. At April 26, yellow sand layers separated low and high altitude between 3-5 km and 10-11 km respectively. At the lower altitude, yellow sand layers existed at 3-5km with maximum scattering ratio of 4.7. However, at high altitude, yellow sand layers existed at 10-11km, and the maximum scattering ratio of 9.0 was observed. Keyword : ACE-Asia, Multi Channel Lidar, Yellow Sand, Scattering ratio

URL: <http://www.kjst.ac.kr>

#### A41B-0074 0830h POSTER

##### Quantifying the Effect of the COVE Ocean Platform Structure on Measurements of Albedo by Comparison with Aircraft Observations During the CLAMS Field Campaign

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To complement the CERES Ocean Validation Experiment (COVE), the Chesapeake Lighthouse and Aircraft Measurements for Satellites (CLAMS) field was conducted from July 10 to August 3, 2001. COVE has long term radiation measurements, including up and down broadband fluxes, spectral and directional radiances, on a stable sea platform 25km east of the coast at Virginia Beach, VA. The several CLAMS aircraft measured the optical properties of the ocean surface, including the Bidirectional Reflectance Distribution Function (BRDF), under various solar zenith angles and aerosol loads on clear days. CLAMS data make it possible to determine the extraneous effect of the platform structure on the upwelling broadband measurements at the COVE site; to interpret point observations at COVE in terms of the broader ocean; and to validate satellite-retrieved aerosol properties.

During the period of CLAMS, the NASA Langley OV-10 aircraft measured spectral SW fluxes (ASD Field Spectrometer) and broadband LW and SW and fluxes (Eppley), both upwelling and downwelling. The altitudes of these flights ranged from 30 m to 3000 m above the sea level.

To separate the signal from noise and from the optical effect of the platform, statistical analyses were made of the acquired data. This paper focuses on the effect of the platform under various solar angles. In addition, broadband and spectral albedos were derived, and the moderate-resolution atmospheric radiation and transmittance model (MODTRAN) was applied to the weather condition of CLAMS to corroborate the measurements.

URL: <http://sundog.larc.nasa.gov/~Ceres/>

#### A41B-0075 0830h POSTER

##### Application of Observations from the COVE Sea Platform, CLAMS Aircraft Campaign, and CERES on Terra to Determine an Accurate Shortwave Budget for the Atmosphere in Cloud-free Conditions

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We compute the Surface and Atmospheric Radiation Budget (SARB or vertical profile of fluxes) for shortwave (SW) under clear skies using photometer-based observations of aerosol optical thickness (AOT) and validate with observed fluxes at both the top and bottom of the column. Because of the inherently large noise in converting instantaneous satellite-observed radiances (Wm<sup>-2sr-1</sup>) to flux (Wm<sup>-2</sup>), closure at TOA requires a time series of significant length. And validating such a result at the column bottom would be problematic over land, where surface inhomogeneity solely

limits the spatial representativeness of any ground-based, point measurement of the upwelling and net SW. Hence at the surface we focus on the CERES Ocean Validation Experiment (COVE) sea platform (25km due east of Virginia Beach), which has continuous measurements of upwelling and downwelling fluxes, AOT, meteorology, and ocean waves. The Chesapeake Lighthouse and Aircraft Measurement for Satellites (CLAMS 10 July to 3 August 2001) field campaign specifically targeted the COVE sea platform to establish minor adjustments that must be made to account for local obstructions.

Surface spectral albedos were generated by the Jin-Stammes coupled air-sea radiative transfer model, which accounts for scattering and absorption in both media explicitly; inputs include AOT, surface wind and precipitable water (measured at COVE), and chlorophyll concentration (estimated using both in situ data from the Chesapeake Bay and SeaWiFS). Simulated broadband albedos were compared with COVE observations for the afternoon clear sky conditions obtained during an entire year (3/1, 2000 to 3/1, 2001); mean differences are within 0.01; but observations are higher, suggesting that additional sediments or bubbles should be included in the code. We report further calculations using the Jin-Stammes albedo and the Fu-Liou radiation code for the CLAMS period, comparing with fluxes observed at the surface by COVE, at altitude by aircraft, and at TOA by a CERES scanner specially programmed to target COVE; and close on the elusive aerosol forcing to atmospheric absorption.

URL: <http://www.cave.larc.nasa.gov/cave/>

#### A41B-0076 0830h POSTER

##### The Chesapeake Lighthouse and Aircraft Measurements for Satellite (CLAMS) Campaign: Experiment Overview

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The Chesapeake Lighthouse and Aircraft Measurements for Satellites (CLAMS) field campaign was conducted from NASA Wallops Flight Facility and successfully executed over the middle Atlantic eastern seaboard from July 10 - August 2, 2001. CLAMS is primarily a shortwave closure experiment designed to validate and improve EOS TERRA satellite data products being derived from three sensors: CERES (Clouds and Earth's Radiant Energy System), MISR (Multi-angle Imaging Spectro-Radiometer) and MODIS (MODerate Resolution Imaging Spectroradiometer). CLAMS is jointly sponsored by the CERES, MISR and MODIS instrument teams and the NASA GEWEX Global Aerosol Climatology Project (GACP). CLAMS primary objectives are to validate satellite-based retrievals of aerosol properties and vertical profiles of radiative flux, temperature and water vapor. Central to CLAMS measurement strategy is the Chesapeake Lighthouse, a stable sea platform located in the Atlantic Ocean, 13 miles east of Virginia Beach near the mouth of the Chesapeake Bay and the site of an ongoing CERES Ocean Validation Experiment (COVE). Six research aircraft including NASA's ER-2 and OV-10, the University of Washington CV-580, the Proteus, a Cessna 210 and a Lear Jet were deployed to make detailed measurements of the atmosphere and ocean surface in the vicinity of COVE, over the surrounding ocean, over nearby NOAA buoys and over a few land sites. The measurements are

used to validate and provide "ground truth" for simultaneous products being derived from TERRA data, a key step toward an improved understanding and ability to predict changes in the Earth's climate. One of the two CERES instruments on-board TERRA was programmed for Rotating Azimuth Plane Scans (RAPs) during CLAMS, increasing the CERES coverage over COVE by a factor of 10. Nine coordinated aircraft missions and numerous additional sorties were flown under a variety of atmospheric conditions and aerosol loadings. On one "golden day", July 17, all six aircraft flew coordinated patterns, vertically stacked between 100 ft and 65,000 ft over the COVE site as the TERRA satellite orbited overhead. A summary of CLAMS measurement campaign, a description of the platforms, measurements and anticipated data products will be presented.

URL: <http://www-clams.larc.nasa.gov/clams>

#### A41B-0077 0830h POSTER

##### Description of the CERES Ocean Validation Experiment (COVE), A Dedicated EOS Validation Test Site

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A unique test site located in the mid-Atlantic coastal marine waters has been used by several EOS projects for validation measurements. A common theme across these projects is the need for a stable measurement site within the marine environment for long-term, high quality radiation measurements. The site was initiated by NASA's Clouds and the Earth's Radiant Energy System (CERES) project. One of CERES's challenging goals is to provide upwelling and downwelling shortwave fluxes at several pressure altitudes within the atmosphere and at the surface. Operationally the radiative transfer model of Fu and Liou (1996, 1998), the CERES instrument measured radiances and various other EOS platform data are being used to accomplish this goal. We present here, a component of the CERES/EOS validation effort that is focused to verify and optimize the prediction algorithms for radiation parameters associated with the marine coastal and oceanic surface types of the planet. For this validation work, the CERES Ocean Validation Experiment (COVE) was developed to provide detailed high-frequency and long-duration measurements for radiation and their associated dependent variables. The CERES validations also include analytical efforts which will not be described here (but see Charlock et al., Su et al., Smith et al. Fall 2001 AGU Meeting). The COVE activity is based on a rigid ocean platform which is located approximately twenty kilometers off of the coast of Virginia Beach, Virginia. The once-manned US Coast Guard facility rises 35 meters from the ocean surface allowing the radiation instruments to be well above the splash zone. The depth of the sea is eleven meters at the site. A power and communications system has been installed for present and future requirements.

Scientific measurements at the site have primarily been developed within the framework of established national and international monitoring programs. These include the Baseline Surface Radiation Network of the World Meteorological Organization, NASA's robotic aerosol measurement program - AERONET, NOAA's GPS Water Vapor Demonstration Network, NOAA's National Buoy Data Center and GEWEX's Global Aerosol Climate Program. Other EOS projects have utilized the COVE platform for validation measurements (short term: MODIS, MISR intermediate term: SEAWIFS). A longer term measurement program for the AIRS instrument to be deployed on the AQUA satellite is underway.

The poster will detail the unique measurement and infrastructure assets of the COVE site and present example 1.5 year time series of the major radiometric parameters. Lastly, the near term measurement augmentations that are anticipated at COVE will be discussed.

URL: <http://www-svg.larc.nasa.gov/>

#### A41B-0078 0830h POSTER

##### Activation of Aqueous Aerosol Particles Containing NaCl and Water Soluble Surfactant: Comparison of Measured to Modeled Results

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Atmospheric aerosol particles with diameter less than 2.5 um are composed of significant amounts of organic materials many of which can be water soluble and surface active. The role of water-soluble surface-active organic compounds in droplet formation is not well understood. This study utilizes a differential mobility analyzer and a continuous flow thermal diffusion cloud chamber to study aqueous droplet activation of particles containing sodium chloride (NaCl) and sodium-dodecyl-sulfate (SDS). SDS is used as a surrogate for atmospheric water-soluble surfactants in order to investigate the possible role of surfactants in droplet activation. Interpretation of the experimental results draws on a model developed by Li et al. (1998) describing the influence of surfactants on droplet activation. Analysis of the experimental results confirm that droplet activation of particles composed of pure (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> is well described by Kohler theory, and activation of pure NaCl particles also follows theoretical predictions after a correction is made for the non-spherical shape of the dry NaCl particles. Good agreement between theory and experiment was also obtained for different SDS - NaCl mixtures when the Raoult term in the Kohler equation was generalized to take into account multiple ionic species, the variation of surface tension with surfactant concentration, and the non-spherical shape of the dry particles. Critical supersaturations increased with increasing mass ratios of SDS to NaCl. Slight departures from the theoretical description were found for some situations involving SDS - NaCl mixtures. These results suggest the predominate role of soluble organic surfactants with properties similar to SDS is to inhibit activation of inorganic salt particles that have similar properties as NaCl.

#### A41C MC: 123 Thursday 0830h

##### SAFARI 2000: The Southern African Regional Science Initiative I

Presiding: J T Suttles, NASA Earth Observing System; R J Swap, University of Virginia

#### A41C-01 0830h INVITED

##### Validation of NASA's Earth Observing System in SAFARI 2000: Southern Africa Validation of EOS (SAVE)

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