## A21B-08 0945h

### Constraints on the Sources of Tropospheric Ozone From $^{210}$Pb-$^{7}$Be-$O_3$ Correlations

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The $^{210}$Pb-$^{7}$Be-$O_3$ relationships observed in three aircraft missions over the western Pacific (PEM-West A and B, TRACE-P) are simulated with a global 3-D chemical tracer model (GEOS-CHEM) driven by assimilated meteorological observations. Results are interpreted in terms of the constraints that they offer on sources of tropospheric ozone ($O_3$). Aircraft observations of Asian outflow along the Asian coast show strong $^{210}$Pb-$O_3$ correlations in Sep-Oct (PEMWest A) but such correlations are only seen at low latitudes in Feb-Mar (PEM-West B and TRACE-P). Observations further downwind over the Pacific show stronger $^{210}$Pb-$O_3$ correlations in Feb-Mar than Sep-Oct. The model reproduces these results and attributes the seasonal contrast to strong $O_3$ production and vertical mixing in Sep-Oct, seasonal shift of convection from China in Sep-Oct to Southeast Asia in Feb-Mar, and slow but sustained net $O_3$ production in Asian outflow over the western Pacific in Feb-Mar. Seasonal biomass burning over Southeast Asia in Feb- Mar is also responsible for the positive $^{210}$Pb-$O_3$ correlations observed in the middle and upper troposphere at low latitudes near Asia and over the remote Pacific. The model reproduces the observed absence of $^{7}$Be-$O_3$ correlations over the western Pacific during Sep-Oct, implying strong convective and weak stratospheric influence on $O_3$. The model shows stronger $^{7}$Be-$O_3$ correlations than the observations during PEM-West B and TRACE-P, suggesting it does not underestimate the stratospheric source of $O_3$. We conclude that less than 20-30% of model $O_3$ in the mid-latitude middle troposphere originates from the stratosphere in spring.

URL: http://research.nianet.org/~hyl/publications/liu2003_pbbeo3.pdf

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# A21C MCC: Level 2 Tuesday 0830h

## The Aura Mission to Study Chemistry and Climate III Posters

*(joint with SA)*

***Presiding:*** **A Douglass,** NASA Goddard Space Flight Center**; E Hilsenrath,** NASA Goddard Space Flight Center

## A21C-0969 0830h POSTER

### Characterization of Aura-TES (Tropospheric Emission Spectrometer) Nadir and Limb Retrievals

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The TES Level 2 algorithm retrieves vertical profiles of atmospheric temperature and trace gases from radiometrically calibrated measured spectra. The retrieval is based on minimizing the difference between a measured spectrum and a model spectrum, which is calculated for an estimated atmospheric state. This minimization is subject to smoothness constraints imposed on the atmospheric profiles being retrieved and is applied iteratively using a non-linear least squares solver. Algorithm descriptions and simulation results are presented. Simulations of the data acquired by TES along different orbit tracks were generated in order to test the TES nadir and limb retrieval algorithms for different spatial and temporal (seasonal and day/night) regimes. Noise added to simulated radiances is representative of the noise measured during TES instrument calibration. Retrieval results, including error analysis and expected vertical resolution, are shown for both the nadir and limb viewing modes of TES.

## A21C-0970 0830h POSTER

### Spectral-Windows and Retrieval Characterization for Tropospheric Emission Spectrometer Nadir Retrievals

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Spectral windows are reported for TES nadir retrievals of surface temperature, atmospheric temperature, H2O, O3, CO, and CH4. Spectral windows are selected if they increase the information content, which is a function of an a priori covariance matrix and an a posteriori covariance matrix. The a posteriori covariance depends on an estimated smoothing error, measurement error, and systematic errors from interfering species and line parameter uncertainties. In order to ensure that spectral windows are robust over a variety of climatological conditions, the information content is computed for four regions representative of northern mid-latitude, southern mid-latitude, tropical, and polar climates. Characterization of TES retrievals are a consequence of the spectral window selection; therefore, we also report the expected errors and vertical resolution for TES nadir retrievals for these four climatologically representative profiles.

## A21C-0971 0830h POSTER

### Calibration and Characterization of the Tropospheric Emission Spectrometer

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Prior to shipment of the Tropospheric Emission Spectrometer (TES) to the AURA spacecraft in late April, 2003, the instrument was put through an extensive series of thermal vacuum tests, over an 8-month period, to characterize and calibrate the instrument performance. During these tests, measurements were made to characterize the field-of-view, radiometric and spectral performance of the instrument. The measurements were highly successful in for quantifying key instrument parameters and also permitted the characterization of many unexpected, but important instrument features. This presentation will describe the measurements and results of the TES pre-flight calibration.

## A21C-0972 0830h POSTER

### Tropospheric Emissions Spectrometer (TES) One Day Test Objectives And Status

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The TES instrument will be launched as part of the EOS Aura spacecraft. The goal of the instrument is to observe important chemical species in the atmosphere, O3, CH4, CO, and others. The TES One Day Test processes 16 orbits ( 1day which is defined as a global survey) worth of instrument observations: 1168 nadir target scenes (averages of 2 nadir observations pointing at the same geolocation) and 3504 limb target scenes. There are four science objectives for the ODT. First, to determine whether the “production mode” implementation of the species retrieval algorithm provides the required accuracy, robustness, and performance needed to be able to successfully process global survey data. Robustness refers to the ability to apply constraints, allow selection of retrieval algorithms and/or cost functions, and include enough detail in the forward model to account for the true variation of the atmosphere so that the majority of target scenes can complete successfully. Second, to determine what information out of the target scene retrievals will be most useful in enabling monitoring of science data quality, instrument performance, and compilation of relevant statistics. Third, to evaluate error analysis techniques for both single target retrievals and aggregations of retrievals, with emphasis on an entire global survey. Fourth, to determine whether ordering target scenes would allow additional improvements in performance. Status of the ongoing One Day Test will be presented including results of retrievals and corresponding error analysis. The degree to which the above objectives have been satisfied will be discussed.

## A21C-0973 0830h POSTER

### Calibration of the EOS Microwave Limb Sounder on the Aura Spacecraft

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The Microwave Limb Sounder experiment on the Aura Spacecraft (EOS MLS) is a direct descendant of the MLS experiment on the Upper Atmosphere Research Satellite (UARS MLS), with greater spectral coverage and increased measurement precision and bandwidth. Comprehensive pre-launch Radiometric, Spectral and Field-of-View calibrations were performed on the instrument prior to delivery. Experience gained with UARS MLS was used to improve calibration accuracy in all categories. Calibration results from EOS MLS will be presented, with descriptions of the enhancements applied to the techniques used on the earlier instrument.

URL: http://mls.jpl.nasa.gov/joe/eos_mls.html



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## A21C-0974 0830h POSTER

### $HNO_3$ From MLS: Building on the UARS Legacy With Aura Measurements

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The Microwave Limb Sounder (MLS) onboard the Upper Atmosphere Research Satellite (UARS) measured the global distribution of stratospheric $HNO_3$ over annual cycles for much of the 1990s, albeit with reduced sampling frequency in the latter half of the decade. The UARS MLS $HNO_3$ dataset, unique in its scope, has previously been studied to explore the seasonal, interhemispheric, and interannual variations in the distribution of $HNO_3$. This work, however, suffered from a number of limitations: It was confined to a single level in the lower stratosphere (465 K potential temperature), it was based on version 4 MLS data, and it relied heavily on zonal-mean comparisons of the evolution of $HNO_3$ in the northern and southern hemispheres. Here we update and significantly expand the previous work by examining the distribution of $HNO_3$ throughout the lower and middle stratosphere from 420 to 960 K. We use version 6 MLS $HNO_3$ data, which, in addition to having much better precision, a larger vertical range, and better definition of the $HNO_3$ profile, have also been corrected to account for the neglect of some excited vibrational state lines that caused the version 4 (and version 5) retrievals to substantially overestimate $HNO_3$ peak values. In addition, we calculate averages over equivalent latitude, which are more representative of vortex behavior than zonal means, especially in the Arctic. This work provides a comprehensive picture of the behavior of stratospheric $HNO_3$ during the UARS timeframe and establishes an important baseline for upcoming measurements from the EOS Aura mission, which will include a second-generation MLS experiment. The capability of EOS MLS is greatly enhanced over that of UARS MLS. We review the anticipated improvements in the EOS MLS $HNO_3$ measurements (e.g., better spatial and temporal coverage, better horizontal and vertical resolution, larger vertical range), show some results from retrieval simulations, and discuss a few specific polar process studies that are planned with the EOS MLS $HNO_3$ data.

URL: http://mls.jpl.nasa.gov

## A21C-0975 0830h POSTER

### Dynamics of the Upper Reaches of the Polar Vortex, Using EOS MLS Data.

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The lower part of polar vortex has been studied in enormous detail and many aspects of it are well understood. This is less true of the upper reaches of the vortex, roughly from the stratopause upwards. The main reasons for this are the relative lack of measurements at these altitudes. In particular, most of the popular meteorological analysis products used for studying the dynamics of the stratosphere do not cover the mesosphere and very little data are assimilated into the upper layers of these analyses. The UARS mission provided measurements of a number of chemical species which are useful as dynamical tracers at these altitudes: $H_2O$ from MLS and CO from ISAMS are examples. These data are immensely valuable, but they all suffer from sparseness caused by a variety of factors such as the UARS yaw cycle, instrument failures and the use of solar occultation as a measurement technique. The EOS MLS instrument will make daily global measurements of CO, $H_2O$ and HCN throughout the stratosphere and mesosphere. In addition, its measurements of temperature and geopotential height will be of sufficient quality to provide a dynamical context for the tracer measurements at altitudes where few meteorological assimilation datasets are available. In this poster we use UARS measurements of CO, $H_2O$ and ATMOS measurements of HCN, together with precision estimates for EOS MLS, to examine the usefulness of the EOS MLS measurements for studying the upper vortex.

## A21C-0976 0830h POSTER

### Ozone Monitoring Instrument flight-model on-ground calibration from a scientific point of view

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In 2002 the on-ground calibration of the flight-model of the Ozone Monitoring Instrument (OMI), scheduled for launch in January 2004 on the EOS-AURA satellite, was performed by the industrial contractor in close cooperation with the Principal Investigator team from the Royal Netherlands Meteorological Institute (KNMI) and the scientific Calibration Working Group with members from The Netherlands, Finland, and the United States. OMI will observe the Earth in nadir with a field of view of 114 degrees, providing a daily Earth coverage. This presentation will focus on the measurements, analyses and preliminary results of the on-ground calibration from a scientific perspective, which are particularly important for meeting the scientific objectives of the OMI instrument. The OMI instrument is operated in flight at close to vacuum pressure and at temperatures of the CCD detectors and the instrument optical bench of 266 K and 265 K, respectively. Special attention is therefor given to the methods for obtaining a flight-representative on-ground calibration of the instrument. The OMI instrument has a large observational swath field of view of 114 degrees and a high spectral resolution. For this reason the on-ground calibration of the swath angle dependence of the radiometric calibration and the calibration description of spectral instrument features are discussed in the presentation.

## A21C-0977 0830h POSTER

### EOS-Aura's Ozone Monitoring Instrument (OMI) Validation

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OMI is a nadir-pointing imaging spectrometer that will measure Earth reflectance and solar irradiance in the 270-500 nm spectral range with a unique spatial resolution of 13 × 24 km (nadir). OMI will fly on EOS-Aura, which is launched in 2004 into a 1:38 PM near-polar ascending orbit. OMI will contribute to the EOS-Aura mission objectives for climate monitoring and atmospheric research by measuring columns of $O_3$, $NO_2$, HCHO, BrO, OClO, and volcanic $SO_2$, $O_3$ profiles, aerosol optical depth and single scattering albedo, surface UV irradiance, cloud fraction and cloud pressure. These products are retrieved with daily global coverage. The most important objective of OMI is to provide the continuation of the TOMS and GOME total ozone data record.

Four major environmental questions will be addressed by the OMI measurements:
1. Is the ozone layer recovering as expected?
2. What are the sources of aerosols and trace gases that affect global air quality and how are they transported?
3. What are the roles of tropospheric ozone and aerosols in climate change?
4. What are the causes of surface UV-B change?

Extensive validation of OMI is foreseen, based in part on routine ground-based data. However, in view of the high spatial resolution of OMI in combination with the broad spectral range covered and the major environmental questions posed, additional measurements are needed. Existing routine measurements predominantly take place in pristine areas. Therefore, strong needs for additional ground-based and airborne measurements exist (see environmental questions 2 and 3). Examples are measurements of tropospheric ozone and $NO_2$ profiles, to verify the assumptions made in calculating airmass factors for the respective DOAS retrievals, and measurements of aerosol optical properties and scattering behavior in the 340-500 nm spectral range.

We invite the scientific community to submit proposals for validation projects in response to two upcoming simultaneous calls (winter 2003/2004):
1. NASA National Research Announcement for Aura validation (NRA-Aura)
2. International Announcement of Opportunity for OMI validation (AO-OMI)
In the NRA-Aura, US scientists can apply for funding to contribute to Aura validation. The AO-OMI invites the world-wide scientific community (Europe specifically) to participate in the validation of OMI data. Early Aura or OMI data access will be provided to investigators contributing to Aura or OMI validation, respectively. Contacts are Anne Douglass (NRA-Aura: Anne.R.Douglass@nasa.gov) and Mark Kroon (AO-OMI: Mark.Kroon@knmi.nl).

## A21C-0978 0830h POSTER

### Improvements in the DOAS Based Total Ozone Column Algorithm for OMI

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The Ozone Monitoring Instrument is a nadir pointing imaging spectrometer with a wide swath (about 2600 km) that records reflected radiance spectra in the wavelength range 270-500 nm with a spectral resolution of about 0.5 nm. The high spatial resolution (13x24 km at nadir) makes it possible to obtain information on tropospheric ozone as problems due to (partly) cloudy pixels are reduced compared with instruments like GOME and SCIAMACHY. OMI is scheduled for launch early 2004 as part of the NASA EOS-Aura mission. To obtain accurate total ozone columns from OMI spectra an improved DOAS based algorithm is used as compared to the algorithm used in the operational processor for GOME and SCIAMACHY data. The following improvements have been implemented. First, the DOAS fit window is changed from 325-335 nm to 331.6 - 336.6 nm, making the retrieved columns less sensitive to the temperature and ozone profile. To further improve the accuracy we adopt a so-called empirical procedure to calculate air mass factors. In this procedure the DOAS method is applied to simulated spectra. These air mass factors are exact if the atmospheric model used in the calculations corresponds to the actual atmosphere. The third improvement is that the air mass factor is regarded as a function of the slant column density that results from the DOAS fit of a measured spectrum. These improvements have been implemented in the operational algorithm for OMI. We are currently investigating further improvements by handling rotational Raman scattering in a more advanced manner. In this poster presentation the improvements are discussed and some results based on GOME spectra will be presented.

## A21C-0979 0830h POSTER

### Cloud Retrieval Using the O2-O2 477 nm Absorption Band as Observed by the Ozone Monitoring Instrument

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The Ozone Monitoring Instrument (OMI) is a nadir pointing imaging spectrometer with a wide swath (about 2600 km) that records reflected radiance spectra in the wavelength range 270-500 nm with a spectral resolution of about 0.5 nm. The high spatial resolution (13x24 km at nadir) makes it possible to obtain information on tropospheric pollution provided one can accurately account for problems associated with (partly) cloud covered pixels. OMI is scheduled for launch early 2004 as part of the NASA EOS-Aura mission. Currently operational spectrometers such as GOME and SCIAMACHY use the oxygen A band to obtain information on the effective cloud fraction and effective cloud altitude for a ground pixel. This information is essential to correct vertical column densities of trace gases for cloud contaminated pixels. As OMI does not record spectra beyond 500 nm, an alternative method has to be used to obtain information on cloud properties. A simple and robust method based on absorption by the O2-O2 collision complex at 477 nm has been developed for OMI. The method has been applied to GOME data and its results have been compared with those obtained from the O2-A band algorithm. In this poster presentation the method used will be briefly described and the comparisons with cloud information obtained form the oxygen A band will be presented.

## A21C-0980 0830h POSTER

### Satellite Ozone Profiles From OMI: Information for Potential Users

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In January 2004, the NASA EOS-Aura satellite is scheduled for launch, as part of the successful Earth Observing Satellite series, with onboard the Ozone Monitoring Instrument. OMI is a nadir-viewing UV-VIS spectrometer, with a 2600 km wide swath, and a 13x24 km2 footprint, guaranteeing daily global coverage. This combination of daily global coverage and excellent spatial resolution is unprecedented and is expected to provide an enhanced view of processes involving ozone on a global scale. This paper gives an overview of the OMI ozone profile product for potential users. We identify six different groups of users: tropospheric ozone, data assimilation, ozone trend analysis, total ozone column, SO2 column and other EOS-Aura ozone products. We indicate benefits as well as potential hazards when using the OMI ozone profile product.

## A21C-0981 0830h POSTER

### Global Retrieval of BrO, HCHO, and OClO for the EOS–Aura Ozone Monitoring Instrument

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The Ozone Monitoring Instrument (OMI) is scheduled for launch on the EOS–Aura platform in March 2004. OMI is a nadir viewing UV/Vis instrument observing continuously from 270 to 500 nm, and thus similar to the European Space Agency's Global Ozone Monitoring Experiment (GOME), from which it derives much of its heritage. Compared to GOME, OMI has about 3–5 times coarser spectral resolution but a more than 40 times smaller ground footprint of 13×24 $km^2$, and it achieves global coverage within one day. Stratospheric bromine oxide (BrO) and chlorine dioxide (OClO) are key elements in the destruction of stratospheric ozone and the formation of the Antarctic ozone hole; in the troposphere, BrO is released from the snow and ice-pack during high-latitude Spring. Tropospheric formaldehyde (HCHO), a volatile organic compound (VOC), is an indicator of isoprene emissions and a byproduct of forest fires; it is a key measure for air quality determination from space. We present results from the operational algorithms for BrO, HCHO, and OClO, as well as auxiliary retrievals of ozone, which we are currently developing for OMI. Global retrievals of BrO and HCHO, and OClO within the polar vortex, have been performed by applying the OMI algorithms to existing GOME data. The trace gas algorithms developed for OMI are scientifically mature since they are able to fully exploit their heritage from GOME. Key elements in the retrieval are the non-linear least squares minimization procedure to derive trace gas slant columns and the conversion from slant to vertical columns using cloud information and a shape factor analysis. This poster demonstrates the capabilities of atmospheric chemistry monitoring with the OMI instrument.

## A21C-0982 0830h POSTER

### The OMI Atmospheric Science Data Products

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The Ozone Monitoring Instrument (OMI), will provide measurements in the UV and Visible spectral regions (1560 wavelength bands between 270 and 500 nm with approximately 0.5 nm spectral resolution). OMI will continue the long-term Total Ozone Mapping Spectrometer (TOMS) column ozone record and will focus on monitoring the ozone layer, ozone depleting trace gases (BrO and OClO), atmospheric pollutants (tropospheric ozone, NO2, SO2, and HCHO), clouds and aerosols characteristics, and surface spectral UV irradiance and erythemal surface UV-B flux. OMI is a contribution of the Netherlands Agency for Aerospace Programs (NIVR) in collaboration with the Finnish Meteorological Institute (FMI), to NASA's Aura mission. It will be flown on the Aura spacecraft (early 2004) in a sun-synchronous polar orbit with equator crossing time approximately at 1:38 p.m in the ascending mode. The standard atmospheric chemistry and dynamics products derived from OMI, and from the other two Aura sensors, the High Resolution Dynamics Limb Sounder (HIRDLS) and the Microwave Limb Sounder (MLS), will be archived at the NASA GES DAAC. OMI atmospheric data products will provide continuity to the over 30 year long-term ozone data records obtained from the heritage atmospheric data missions including Nimbus-4 BUV and Nimbus-7 SBUV, and a series of TOMS instruments, also archived at the NASA GES DAAC. The standard satellite data sets, as well as regional subsets, related ancillary data sets, and data analysis tools are freely available to the public for the Earth System Science studies, environmental applications, and educational use. This presentation will provide an overview of the OMI instrument, data processing, data products, and the data services provided by the NASA GES DAAC's Upper Atmosphere Data Support team to the user in the areas of accessing data products, documentation, browse, and data analysis software.

URL: http://daac.gsfc.nasa.gov

## A21C-0983 0830h POSTER

### $NO_2$ Vertical Column Retrievals With the Ozone Monitoring Instrument (OMI)

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The retrieval of $NO_2$ vertical column densities from satellite measurements presents a challenge because of the difficulty in determining the air mass factor (AMF). This quantity, which relates the measured slant column to the vertical column, is particularly sensitive to the $NO_2$ profile when tropospheric $NO_2$ amounts are large. We describe the algorithm that will be used to obtain vertical column densities from the $NO_2$ slant column densities measured by OMI on the upcoming EOS AURA mission. Our method relies on a tropospheric separation scheme that identifies polluted regions (containing significant tropospheric $NO_2$) and applies different AMFs in polluted and unpolluted regions. We test the method on synthetic $NO_2$ fields and on data from the Global Ozone Monitoring Instrument (GOME). Results from the OMI algorithm are compared to retrievals used in previous studies to analyze GOME data.

## A21C-0984 0830h POSTER

### The OMI Cloud Pressure Algorithm Based on UV Measurements

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The OMI cloud pressure product is deemed "mission-essential" for OMI because the product is necessary for correction of the mission-critical total ozone product. Cloud pressure can be derived from the high frequency structure of top-of-atmosphere reflectance in the UV caused by rotational Raman scattering (RRS) in the atmosphere. RRS results in filling-in of Fraunhofer lines in the backscatter UV spectra (also known as the Ring effect). The magnitude of filling-in of the Fraunhofer lines is roughly proportional to the average number of solar photon scatterings in the atmosphere above the clouds. This property of RRS is used to deduce an effective cloud pressure. The cloud pressure algorithm retrieves the effective cloud pressure and cloud fraction using a concept of the Modified Lambert Equivalent Reflectivity (MLER). The MLER concept is used for several of the OMI algorithms including the retrieval of ozone and other trace gases. Therefore, the cloud pressure algorithm is consistent with other OMI algorithms. Details of the cloud pressure algorithm are discussed including the correction for vibrational Raman scattering in the ocean that also significantly contributes to filling-in of Fraunhofer lines in the backscatter UV spectra over pixels with thin or broken clouds. Examples of retrieving cloud pressure from GOME data are presented.

## A21C-0985 0830h POSTER

### Measuring Sulfur Dioxide From Space: The Promise of Ozone Monitoring Instrument (OMI) on EOS-AURA Platform

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Ozone Monitoring Instrument (OMI) is a wide field of view hyper-spectral imaging spectrometer to be launched on Earth Observing System's (EOS) AURA platform in 2004. OMI is a contribution of the Netherlands' Agency for Aerospace Programs (NIVR) in collaboration with the Finish Meteorological Institute (FMI) to the EOS Aura mission. The footprint size for OMI at nadir is 13 km x 24 km and it makes observation in one visible (350 - 500 nm) and two UV (UV1: 270 to 314nm and UV2: 306 to 380 nm) bands. The hyper-spectral capability of OMI along with its smaller foot print size, presents us an opportunity to monitor anthropogenic sulfur dioxide from space with better sensitivity (about 0.5 DU) and an attempt to build a satellite based global inventory of these sources. The optimum spectral region for sulfur dioxide retrievals is determined from the differential radiance due to added sulfur dioxide compared with the noise radiance of the instrument. The sulfur dioxide inversion strategy is

based on a flexible inversion approach and uses maximum likelihood estimation. In this paper we will present the performance of the OMI sulfur dioxide retrieval algorithm on simulated OMI radiances. Sensitivity of the retrieval on random noise and other systematic error sources will also be discussed.

## A21C-0986 0830h POSTER

### Evaluation and Correction of Spectral Undersampling by the OMI Instrument on Aura

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Detector array-based spectrometers used in atmospheric remote sensing from space suffer from spectral undersampling: they do not sample high enough in spatial frequency to fully represent the information content of the instrument transfer function, as is required by the sampling theorem (Nyquist sampling). Thus they permit higher-frequency, aliased, information into the measured spectra. This is further complicated by the binning over the detector pixel response profiles that leads to the measured radiances and irradiances. Undersampling strongly impacts the comparison of radiances and irradiances, which is an integral step in the analysis of the spectra. This comparison requires resampling in wavelength due to Doppler shifts between radiance and irradiance measurements, plus smaller contributions from instrument changes in-orbit. Neglecting effects from undersampling can lead to substantial, often dominant, systematic residuals in the spectral fitting. Correction of undersampling for previous instruments (GOME and SCIAMACHY) has been handled in an *ad hoc* fashion, by resampling undersampled and correctly-sampled representations of a high-resolution Fraunhofer reference spectrum and differencing the results. We present a more systematic approach to undersampling characterization by frequency analysis of the instrument transfer function, sampling of a Fraunhofer reference spectrum, and convolution with the detector pixel response profile. This analysis is presented for the EOS-Aura Ozone Monitoring Instrument (OMI): We determine the extent of undersampling in the windows for fitting the atmospheric gases $O_3$, $NO_2$, $SO_2$, BrO, OClO, and HCHO, and provide corrections for inclusion in the data analysis algorithms.

## A21C-0987 0830h POSTER

### Two Dimensional Characterization of Atmospheric Profile Retrievals From Limb Sounding Observations

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Limb sounders measure atmospheric radiation that is dependent on atmospheric temperature and constituents that have a radial and angular distribution in Earth-centered coordinates. In order to evaluate the sensitivity of a limb retrieval to radial and angular distributions of trace gas concentrations, we perform and characterize one-dimensional (vertical) and two-dimensional (radial and angular) atmospheric profile retrievals. Our simulated atmosphere for these retrievals is a distribution of carbon monoxide (CO), which represents a plume off the coast of south-east Asia. Both the one dimensional (1D) and two dimensional (2D) limb retrievals are characterized by evaluating their averaging kernels and error covariances on a radial and angular grid that spans the plume. We apply this 2D characterization of a limb retrieval to a comparison of the 2D retrieval with the 1D (vertical) retrieval. By characterizing a limb retrieval in two dimensions the location of the air mass where the retrievals are most sensitive can be determined. For this test case the retrievals are most sensitive to the CO concentrations about 2 degrees latitude in front of the tangent point locations. We find the information content for the 2D retrieval is an order of magnitude larger and the degrees of freedom is about a factor of two larger than that of the 1D retrieval primarily because the 2D retrieval can estimate angular distributions of CO concentrations. This 2D characterization allows the radial and angular resolution as well as the degrees of freedom and information content to be computed for these limb retrievals. We also use the 2D averaging kernel to develop a strategy for validation of a limb retrieval with an in-situ measurement.

## A21C-0988 0830h POSTER

### Retrieval of Temperature, Trace Species and Aerosols From the High Resolution Dynamics Limb Sounder (HIRDLS).

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The retrieval algorithms developed for the High Resolution Dynamics Limb Sounder (HIRDLS) will be presented. The non-linear inversion technique is based on the Rodgers optimal estimation method (maximum a posteriori). An objective function, consisting of the sum of the cost function (departure of radiance measurements from forward model) and penalty function (departure of retrieved state from the a priori) is minimized using a modified Marquardt-Levenberg algorithm which combines the inverse Hessian and steepest descent approaches and uses a simplified trust-region scheme to control the step-size at each iteration. The diagnostic information obtained from the retrieval allows quantification of the effects of the a priori state on the retrieved state and decomposition of the various sources of error so that the effect of each on the retrieved state can be appreciated. A 3D 12-h global-mode set of simulated HIRDLS radiances were generated using atmospheric data fields at 20 minute intervals from the NCAR MOZART3 model which allows the effects of line of sight gradients and diurnally varying species on the retrieval to be investigated.

URL: http://www.eos.ucar.edu/hirdls/

## A21C-0989 0830h POSTER

### Detection of cirrus and determination of cloud top pressure by HIRDLS

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The infrared limb sounding measurements by the High Resolution Dynamics Limb Sounder (HIRDLS) allow detection of cirrus in the upper troposphere and near the tropopause. The HIRDLS detectors are in a focal plane arrangement of 7 rows by 3 columns. The detector size is 10 km horizontal by 1 km vertical and the horizontal across-track spacing between the three columns is 17 km and 8 km. Cloud detection is performed using the best selection from the 7 available detectors for each column. The characteristics of cirrus contaminated radiances detected by the HIRDLS channels have been analyzed by simulating radiances with varying cloud parameters. More than half a million radiance profiles with various combinations of cloud top pressure, thickness, effective radius, and number density were simulated for a wide latitude range. Several kinds of cloud detection methods are tested using the simulated radiances. Statisitical results from the simulated radiance analyses are used to improve cloud profile retrievals. The possibility of opaque cloud top temperature retrieval is investigated. The simulated radiances for the HIRDLS radiometer channels are compared with spectrally integrated observations of cirrus by ENVISAT/MIPAS.

## A21C-0990 0830h POSTER

### Potential applications of Aura data in determining the influences of convective type and Rossby wave breaking on tropical and subtropical upper tropospheric water vapor

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The relative climate scale influences of continental and maritime convection on upper tropospheric (UT) water vapor is not as clearly understood as the influence of convection type on stratospheric entry mixing ratio. In the last decade, our ability to characterize the global distribution of convective system types and the associated temporal variabilities has been greatly improved, especially through the use of Tropical Rainfall Measuring Mission (TRMM) precipitation radar (PR) and Lightning Imaging Sensor (LIS) retrievals. Such advancement offers us an unprecedented opportunity to examine the impact of convective system types on the UT water vapor distribution in conjunction with the observations of clouds and water vapor that Aura will provide, especially MLS measurements of water vapor in both cloudy and clear sky. As a prototype of such analyses, we have used TRMM data in conjunction with HALOE water vapor retrievals to explore the relationship between the distribution of convective types and the UT water vapor distribution. We will also examine the physical implications of the observed relationship, particularly, whether they represents the influence of different cloud microphysical properties between maritime-like and continental-like convection on UT water vapor, or merely represents the influence of the frequency of convection, by joint use with ISCCP and MODIS retrievals of cloud effective radius. Water vapor feedbacks are most sensitive to the driest UT, such as that observed in the subtropical eastern Pacific. Waugh and Polvani (2000) have shown that equatorward incursions of stratospheric air occur frequently over the central and eastern Pacific. The contributions of these stratospheric incursions to the dryness of the UT remains unclear, especially relative to those of the subsidence of air detrained from convective areas. We will use UARS MLS water vapor data to demonstrate the potential of Aura data for clarifying this question.

## A21C-0991 0830h POSTER

### Accessing the EOS Aura Atmospheric Data Products

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In early 2004 NASA will launch Aura, the EOS chemistry mission. The NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC) Distributed Active Archive Center (DAAC) will be the archive for data from three of the four Aura instruments (HIRDLS, MLS and OMI), while data from the fourth instrument (TES) will be available from the NASA Langley Research Center's DAAC. This presentation will focus on the standard science data products from Aura that will be made available to users from the NASA GES DAAC. The higher level data products from Aura will all share a standard format (HDF-EOS 5) and a common layout, thus allowing for simplified access for intercomparisons between the measurements from the different instruments. The GES DAAC will assist users in using the Aura data by providing access routines, and an easy to use data search mechanism for ordering and downloading the Aura data. All data products from the NASA GES DAAC are available free to the public.

URL: http://daac.gsfc.nasa.gov