A42B-0763 1330h POSTER

Testing the EDMF Parameterization in the ARM Convective Diurnal Cycle Case

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An integrated scheme for describing the dry and shallow cumulus boundary layer is here presented. The approach is based on the concept that in the convective boundary layer the main mechanisms of mixing are: local mixing that can be parameterised by an eddy-diffusivity scheme and non-local mixing performed by the mass-flux associated with thermals. This eddy-diffusivity/mass-flux scheme (EDMF) was implemented in the research model MesoNH (Lafore et al., 1996), taking advantage of the eddy-diffusivity closure based on the TKE budget equation to parameterise the local transport by smaller eddies. In the sub-cloud and in the cloud layers the mass-flux term represents the effect of strong updrafts. These are modelled by a simple entraining rising parcel, which determines the boundary layer height and, if present, the lifting condensation level and cloud top. The new scheme is tested against observations from the ARM dataset (Brown et al., 2002) corresponding to a diurnal cycle of a convective boundary layer with shallow cumulus development.

A42B-0764 1330h POSTER

Estimates of the Atmospheric Water Balance Over the Oceans

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With the availability of global re-analysis and global satellite observations, the study of the global water balance has received renewed interest. In this study, we have focused on calculating flux divergence and residual evaporation rates over the oceans using observed data sets where available. To calculate these terms, we are using 6-hourly global winds and pressure fields from NCEP/DOE Reanalysis II, moisture fields from NVAP (National Aeronautical and Space Administration Water Vapor Project), a satellite and in situ water vapor set, and precipitation from GPCP (Global Precipitation Climatology Project) and CMAP (Climate Prediction Center Merged Analysis of Precipitation), both a satellite and in situ precipitation data set. All data sets are from the time period 1988-1992 and the height dependent variables are vertically integrated for the first 18 sigma levels representing pressure levels over the oceans from the surface to approximately 200 mb. These data sets were used in various combinations to compute flux divergence, which is essentially equal to evaporation minus precipitation (E-P) since the storage term is small, and evaporation as a residual using the GPCP and CMAP precipitation data. We also calculated the water balance from the NCEP/DOE re-analysis for comparison. The evaporation minus precipitation fields are compared to other independent calculations, such as HOAPS (Hamburg Ocean-Atmosphere Parameters and Fluxes from Satellite Data), NODC (National Oceanographic Data Center), and SOC (Southampton Oceanographic Centre). Comparisons to these data sets show that our method produces similar patterns as those of the other data sets. The main differences are in the magnitude of the flux values and some regions of maxima and minima, but none of the four results agree completely in that regard. The evaporation was calculated as a residual by taking the flux divergence values and adding precipitation estimates to obtain evaporation values. Evaporation calculations were made using various combinations of input data; 1) NVAP water vapor, GPCP precipitation, and NCEP re-analysis II wind, 2) NVAP water vapor, CMAP precipitation, Re-analysis II winds, and 3) Re-analysis II water vapor, precipitation, and winds. These were compared to independent evaporation estimates from SOC, NODC, HOAPS, and Reanalysis II, and the results were evaluated.

A42B-0765 1330h POSTER

An Analysis and Model Evaluation of the Marine Boundary Layer Height in the Eastern Pacific

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The atmospheric boundary layer (ABL) couples ocean surface processes with clouds and convection over the eastern Pacific. The determination of the boundary layer height is therefore crucial in the parameterization of the ABL in numerical weather prediction and climate models. Here, a method to determine the boundary layer height h objectively for clear and cloudy conditions and for stable and unstable cases from sounding data is developed. Using this technique, h is thus determined from about 1000 radiosondes taken between 1995 and 2001 during 11 cruises in the eastern Pacific Ocean. An analysis of this data reveals seasonal, interannual, meridional, and zonal variations in h in the cold tongue region, the intertropical convergence zone, and the subtropical stratocumulus region off of the coasts of California and Mexico. Furthermore, it will be shown that this method can also be used in other regions such as the central and western Pacific and over land. Additionally, the marine boundary layer height in the eastern Pacific determined by the Community Climate System Model version 2 (CCSM2) is compared to the objective h determined from radiosondes. Both model results and output from an offline version of the model's parameterization are overall underestimated. It is thus found that a doubling of the model's resolution in approximately the lowest 2 km (from 5 to 10 layers) as well as the adjustment of h within clouds to cloud base or top would significantly improve the determination of h by the model.

A42C MCC: Level 2 Thursday 1330h

Contributions to Middle Atmosphere Science by Solar Occultation Instrumentation II Posters *(joint with SA)*

Presiding: **L W Thomason,** NASA Langley Research Center**; R Bevilacqua,** Naval Research Laboratory**; A Eldering,** Jet Propulsion Laboratory, California Institute of Technology

A42C-0766 1330h POSTER

Ground-based measurements of NO3 column abundance over Table Mtn, California

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The nitrate radical, NO3, which is being monitored by Meteosat/SAGE III, is an important intermediate in the transformation of NOx to NOy. Better characterization of the diurnal, seasonal and interannual variation of NO3 is important in characterizing the role of NOx-catalyzed ozone depletion in the stratosphere. In this work the nighttime variation of the NO3 column abundance has been studied over Table Mountain, California beginning in June 2002 We collected lunar occultation data around full moon with a grating spectrograph which utilized a CCD detector. NO3 column abundances were retrieved from lunar spectra using the differential optical absorption spectroscopy (DOAS) technique. A significant problem in the retrieval is the interference of water vapor and O2 in the NO3 visible absorption bands. To minimize these interferences, retrievals were carried out on both the 662 and 623 nm NO3 bands. Comparisons between the observed nighttime temporal profiles of NO3 and the predictions of a one-dimensional photochemical model will be discussed.

A42C-0767 1330h POSTER

Rocket sounding of stratospheric ozone density profile by UV radiometer onboard KSR-III

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The UV radiometer payload was launched from the west coastal area of Korea Peninsula on a KSR-III (Korea Sounding Rocket-III), third generation Korean sounding rocket launched at 14:52 LST on 28 Nov 2002. The ozone experiment payload consists of UV and visible radiometers to measure the direct attenuation of solar UV at four wavelengths centered at 255, 290, and 310nm, respectively. Visible channels centered at 450nm are used for rocket attitude correction. The filter transmission and phototube response characteristics of each channel were calibrated with the monochromator system at the optical laboratory in KARI (Korea Aerospace Research Institute). Measured solar UV attenuation is converted into ozone column density as a function of altitude and the vertical profile of ozone number density is obtained. This result was compared with other observations such as ozonesonde, Umkehr, and satellite measurements of POAM-III and HALOE. Reasonable agreements were found among the measurements. The sensitivity of the retrieval algorithm is investigated for errors in parameters where absorption cross section and wavelength bias are found to be significant error sources.

A42C-0768 1330h POSTER

Intercomparison of Simultaneous Laboratory Gas Absorption Measurements With ACE-FTS and MAESTRO

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ACE-FTS (Atmospheric Chemistry Experiment Fourier Transform Spectrometer) and MAESTRO (Measurements of Aerosol Extinction in the Stratosphere through Retrievals of Occultations) are the two spectrometers on board Canada's Scisat-1 satellite, which was launched in August 2003 in order to study polar stratospheric ozone chemistry and dynamics. The ACE-FTS is a high resolution Michelson Interferometer operating in the 750 to 4100 cm-1 spectral range, while MAESTRO is a dual holographic grating spectrometer operating in the 280-1000 nm range. A period of instrument testing and characterization took place at the University or Toronto's Instrument Characterization Facility during February and March of 2003. During this time a series of tests was performed where the two instruments, sitting inside a thermally controlled vacuum chamber, were simultaneously exposed to sources of blackbody radiation. Gas cells containing various concentrations and pressures of ozone and nitrogen dioxide were placed in between the sources and the instruments, and the resulting absorption spectra was simultaneously measured with both spectrometers. Since both instruments are looking at the same gas cell at the same time, discrepancies between the gas concentrations retrieved from ACE-FTS and MAESTRO spectra give insight into the validity of parameters used for spectral fitting. Results from these measurements will be presented along with a description of the experimental apparatus.

A42C-0769 1330h POSTER

Recent Improvements to the FTIR Chemical Profile Retrieval Algorithm SFit2

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A primary purpose of the ground-based remote sensing Network for the Detection of Stratospheric Change (NDSC) [Kurylo and Zander, 2001] is the validation of satellite measurements. Recently a thorough treatment of intercomparison methods for remotely sounded data has been derived [Rodgers and Connor, 2003]. A conclusion of that work is the usefulness of comparing the product of the total column operator on the retrieved profiles. However, comparisons of products of increasingly higher vertical resolution that were beyond the initial scope of the NDSC-FTIR charter and are attained by satellite-bourne instruments are being pursued. A limited version of the optimal estimation technique is implemented in the chemical constituent retrieval algorithm SFit2 that is in wide use among the NDSC-FTIR community and has been used in many profile retrieval studies. Recent improvements to the code including the accommodation of a broader selection of a priori covariances, the use of several observations at differing solar zenith angles and the ability to limit the retrieval by specie and micro-window are improving the precision of the retrievals. Application of these changes are shown using data from the inter-compared solar viewing 0.0035cm^{-1} resolution Fourier transform infrared interferometer installed at the NDSC primary site in Thule, Greenland (76.5N, 68.8W, 225masl).

A42C-0770 1330h POSTER

The validation of profiles of minor species derived from the Kiruna FTIR spectra using SFIT2 by comparison with satellite measurements (ILAS)

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The retrieval code SFIT2 has been jointly developed by NASA Langley Research Center and the National Institute for Water & Atmosphere, New Zealand. The code can retrieve the Volume Mixing Ratio (VMR) profiles of minor species from ground-based FTIR spectra. However, retrieved FTIR VMR profiles, with the exception of O_3, have yet to be well validated with other correlative data. We retrieved VMR profiles of N_2O and HNO_3 from ground-based FTIR spectra at Kiruna (67.8°N, 20.4°E), Sweden by using the SFIT2 version 3.8. As validation data, we used the already validated satellite data from the ILAS onboard the ADEOS from November, 1996 to July, 1997. The criteria for comparison between FTIR and ILAS were as follows; (1) distance between Kiruna and observed point by ILAS is less than 500 km, (2) difference in observation time is less than 12 hours, and (3) difference in potential vorticity (PV) is less than 2 PV-unit at potential temperature of 475 K. The numbers of spectra that we used for comparison of N_2O and HNO_3 were 32 (12 days) and 91 (18 days), respectively. The results showed that retrieved and ILAS VMR profiles agreed within $\pm$10% (altitude: 10–21 km) and within $\pm$20% (14–22 km) for N_2O and HNO_3, respectively.

A42C-0771 1330h POSTER

Recent Advances in SAGE II Data Processing: Version 6.2

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The Stratospheric Aerosol and Gas Experiment (SAGE II) has been operating aboard the Earth Radiation Budget Satellite since October 1984 and provided critical long term measurements of the profiles of ozone, aerosol extinction, and other trace constituents from the mid-troposphere to the lower mesosphere. A major revision, Version 6.0, of the SAGE II data processing was introduced in June 2000 and a minor revision, primarily affecting NO_2 retrievals, was released in October 2001. Recently, SAGE II version 6.2 was released. This version is primarily focused on improving water vapor and the correction of an altitude registration problem that initially appeared in 2000 data. The apparent altitude problem was identified as solely the result of faulty spacecraft ephemeris data, but it was particularly difficult to identify since it was subtle, episodic, began shortly after the change in millennia, and occurred in the same time frame as the instrument suffered a mechanical malfunction. Corrected ephemeris data has been obtained and is used in the new version. This presentation focuses on the identification and correction of the altitude errors and summarizes the other features of the latest release version.

A42C-0772 1330h POSTER

POAM III measurements of PSCs and water vapor in the Antarctic vortex: 1998-2003

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We present Polar Ozone and Aerosol Measurement (POAM) PSC and water vapor measurements obtained in the Antarctic stratosphere from 1998-2003. The temperatures at the POAM measurement locations were not exceptionally low during the July and August period, and the PSC statistics were not unusual. The amount of dehydration in the vortex is generally sensitive to the coldest temperatures in the vortex, and the coldest regions in 2003 Antarctic vortex during this period were unusually cold. POAM did observe unusually low water vapor mixing ratios, especially at the upper altitudes of the dehydration region. Water vapor mixing ratios at 22 km fell below 2 ppmv in early August, well outside the 4-6 ppmv range observed over the previous five years. We shall examine the interannual variation of water vapor and PSCs over the six Antarctic winters for which POAM data is available, and see how these are correlated with interannual variations in temperature.

A42C-0773 1330h POSTER

SAGE III and POAM III Observation of PSCs: Data Comparison and Analysis

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The winter of 2002-03 was unusual for the early onset of extremely cold temperatures in the Arctic favorable for polar stratospheric cloud (PSCs) formation and for the duration that these temperatures persisted. During the first half of the winter, sightings of PSCs were frequently observed by the Stratospheric Aerosol and Gas Experiment (SAGE) III and the Polar Ozone and Aerosol Measurement (POAM) III satellite experiments. Many PSCs were also observed during the southern hemispheric winter of 2003, when SAGE III took measurements inside the Antarctic vortex. The close proximity of satellite measurements in the northern hemisphere provides a valuable opportunity to compare PSC observations from the two instruments. Special consideration will be given to identifying optically thin PSCs in both polar. This study will utilize information on the spectral dependence of aerosol extinction together with temperature, potential vorticity, a proxy indicator for the edge of the vortex and backt rajectories to identify and analyze PSC properties.

A42C-0774 1330h POSTER

Polar Stratospheric Clouds Observed With ILAS-II Over Antarctica in 2003

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Improved Limb Atmospheric Spectrometer (ILAS) II was successfully launched on board ADEOS-II on December 14 in 2003, and started its continuous measurement on April 2. It measures aerosol extinction coefficients at eight window channels in the infrared. Only 780 nm extinction data were used in this study. Latitudinal coverage of ILAS-II is almost the same as that of POAM III. Sometimes coincident data can be obtained with SAGE III. ILAS-II level 2 data of aerosol extinction at 780 nm were compared with data observed with POAM III (780 nm) and SAGE III (755 nm) near ILAS-II measurement locations. In general, they showed good correspondence to each other, which validated ILAS-II 780 nm extinction data. In the Antarctic winter of 2003, ILAS-II started to observe PSCs around May 20. From June through September, collocated temperatures were often below 190 K, and many PSCs events were detected in ILAS-II data. Highest PSC sighting probability reached as much as 95 %. Some profiles were truncated at higher altitude levels because of their opacity, implying the existence of type II PSCs. Sometimes ILAS-II and POAM III observed PSCs at locations close to each other, which enabled to discuss the horizontal extent of the clouds.

A42C-0775 1330h POSTER

ILAS-II measurements of O_3: comparison with ozonesondes

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A solar occultation sensor, the Improved Limb Atmospheric Spectrometer (ILAS)-II, started to measure vertical profiles of several gas concentrations and aerosol extinction coefficients in the stratosphere from January 2003 (the operation phase from April 2003). The latitude coverage is similar to POAM II (October 1993 to November 1996), ILAS (November 1996 to June 1997) and POAM III (April 1998 to present) measurements, namely, in the high-latitude in the both hemispheres. One of the purposes of the ILAS-II measurement is to continue such high-latitude measurements of ozone and its related species in order to contribute to the derivation of their trends accurately. An early validation status of the ozone data through comparison with ozonesonde measurements will be presented. The ozonesonde data were obtained from the ILAS-II core validation measurements in Kiruna, Sweden in February and March, and in Syowa station, Antarctica in February, May, July, and August. Along with these data, data from the QUOBI campaign were used under the VINTERSOL data protocol and provided through a database of NILU. Initial results from these comparisons suggest that the ILAS-II ozone data in the lower stratosphere have a good quality and are suitable for scientific studies.

URL: http://www-ilas2.nies.go.jp

A42C-0776 1330h POSTER

ILAS-II measurements of trace gases, temperature and pressure: Comparison with solar occultation sensors

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The Improved Limb Atmospheric Spectrometer (ILAS)-II on the Advanced Earth Observing Satellite (ADEOS)-II was launched on 14 December, 2002. ILAS-II started to measure vertical profiles of several trace gas concentrations, aerosol extinction coefficients, temperature and pressure in the polar stratosphere from January 2003. In this study we will present initial validation results of the ILAS-II version 1.0 and 1.1 data through comparisons with multiple satellite-borne solar occultation sensors, the Halogen Occultation Experiment (HALOE), the Stratospheric Aerosol and Gas Experiment (SAGE) III and the Polar Ozone and Aerosol Measurement (POAM) III. The ILAS-II O_3, H_2O and NO_2 profiles were compared with the HALOE, SAGE III and POAM III measurements. The ILAS-II CH_4 profiles were compared with the HALOE. The ILAS-II measurements of temperature and pressure were compared with the HALOE and the SAGE III measurements. The results suggest that the ILAS-II O_3 data agree well with correlative measurements. The ILAS-II data on the other gases, temperature and pressure have some differences from correlative data.

A42C-0777 1330h POSTER

Measurements of $ClONO_2$ by Improved Limb Atmospheric Spectrometer (ILAS) in the high latitude stratosphere

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Improved Limb Atmospheric Spectrometer (ILAS) was a solar-occultation sensor onboard the ADEOS satellite. ILAS measured vertical profiles of O_3, HNO_3, NO_2, N_2O, CH_4, H_2O, and aerosol extinction coefficients at high latitude stratosphere from November 1996 to June 1997 [JGR, ILAS Special Section, Vol. 107, No. D24, 2002]. The latest retrieval algorithm of ILAS (Version 6.0) enabled us to retrieve vertical profiles of $ClONO_2$ and N_2O_5 with typical vertical resolution of 1.6-2.0 km in addition to these species. The advantage of ILAS $ClONO_2$ measurements is that it continuously measured this gas species at high latitude stratosphere with high vertical resolution. ILAS $ClONO_2$ profiles were compared with correlative balloon-borne measurements by MIPAS-B2 [Fischer and Oelhaf, 1996], FIRS-2 [Johnson et al., 1995], and MkIV [Toon, 1991]. In all comparisons, it was found that ILAS $ClONO_2$ values were systematically lower by around 30% between 15 and 32 km altitudes. Also, the precision and accuracy of ILAS $ClONO_2$ for altitude of 15-35 km were estimated to be around 20-40The Arctic winter/spring in 1996/1997 was characterized its relatively low temperature and its long lasting polar vortex. Many PSC activities were observed by ILAS in January-March 1997 [Hayashida et al., 2000]. ILAS succeeded to measure vertical profiles of $ClONO_2$ for whole period of this Arctic winter/spring. After the PSC activity in February, enhancement of $ClONO_2$ reaching 1.5 ppbv at around 20 km was observed for the data inside the polar vortex in March. In April 1997, enhanced $ClONO_2$ amount decreased towards 1.0 ppbv at more than 10 days prior to the polar vortex breakup. This suggest the change of partitioning of chlorine species from $ClONO_2$ into HCl at this period. Initial measurements of $ClONO_2$ resumed by ILAS-II onboard the ADEOS-II satellite from April 2003 will also be presented at the meeting.

URL: http://www-ilas2.nies.go.jp

A42C-0778 1330h POSTER

The Atmospheric Chemistry Experiment (ACE): Mission Overview

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The ACE mission goals are: (1) to measure and to understand the chemical and dynamical processes that control the distribution of ozone in the upper troposphere and stratosphere, with a particular emphasis on the Arctic region; (2) to explore the relationship between atmospheric chemistry and climate change; (3) to study the effects of biomass burning in the free troposphere; (4) to measure aerosol number density, size distribution and composition in order to reduce the uncertainties in their effects on the global energy balance. ACE will make a comprehensive set of simultaneous measurements of trace gases, thin clouds, aerosols, and temperature by solar occultation from a satellite in low earth orbit. A high inclination (74 degrees) low earth orbit (650 km) gives ACE coverage of tropical, mid-latitudes and polar regions. The solar occultation advantages are high sensitivity and self-calibration. A high-resolution (0.02 cm^{-1}) infrared Fourier Transform Spectrometer (FTS) operating from 2 to 13 microns (750-4100 cm^{-1}) will measure the vertical distribution of trace gases, and the meteorological variables of temperature and pressure. The ACE concept is derived from the now-retired ATMOS FTS instrument, which flew on the Space Shuttle in 1985, 1992, 1993, 1994. Climate-chemistry coupling may lead to the formation of an Arctic ozone hole. ACE will provide high quality data to confront these model predictions and will monitor polar chemistry as chlorine levels decline. The ACE-FTS can measure water vapor and HDO in the tropical tropopause region to study dehydration and strat-trop exchange. The molecular signatures of massive forest fires will evident in the ACE infrared spectra. The CO_2 in our spectra can be used to either retrieve atmospheric pressure or (if the instrument pointing knowledge proves to be satisfactory) for an independent retrieval of a CO_2 profile for carbon cycle science. Aerosols and clouds will be monitored using the extinction of solar radiation at 0.525 and 1.02 microns as measured by two filtered imagers as well as by their infrared spectra. A dual spectrograph called MAESTRO has been added to the mission to extend the wavelength coverage to the 280-1000 nm spectral region. The broad-band atmospheric extinction measured with high signal-to-noise ratio by MAESTRO is particularly useful for the derivation of aerosol and cloud physical properties. The PI for the MAESTRO instrument is T. McElroy from the Meteorological Service of Canada (MSC). ACE is unique in that MAESTRO, the ACE-FTS and the imagers all share the same suntracker and make simultaneous measurements of the same scene. The FTS and imagers have been built by ABB-Bomem in Quebec City, while the satellite bus has been made by Bristol Aerospace in Winnipeg. ACE was selected in the Canadian Space Agency's SCISAT-1 program, and was successfully launched by NASA on August 12, 2003 for a 2 year mission. The main international partners for ACE are NASA, for the launch and algorithm work at NASA-Langley, and Belgium/ESA, for the CMOS imaging arrays and scientific support.

A42C-0779 1330h POSTER

SAGE III Measurements of Tropospheric Ozone: Preliminary Results

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Tropospheric ozone is an important greenhouse gas; however, its global distribution and behavior is not well understood. Many satellite systems lack adequate vertical resolution or a significant signal-to-noise ratio to provide meaningful information on ozone in this region. Satellite experiments using the solar occultation technique, on the other hand, offer sufficient vertical resolution (1 km) and enhanced signal levels that permit a detailed view of the upper troposphere. The major shortcoming of this type of measurement set is its rather limited spatial coverage and the presence of clouds. This paper will report on the distribution of ozone in the upper troposphere observed by the Stratospheric Aerosol and Gas Experiment (SAGE III) satellite instrument, which was launched in December 2001. This instrument includes a number of advancements from its predecessor, SAGE II, such as a 16-bit digitizer and increased spectral range and resolution. These features provide added signal strength in the troposphere and offer better filtering of aerosol and cloud structures in the field of view. The presentation will focus on comparisons between SAGE III, other satellite experiments (e.g., SAGE II and POAM III), and balloon-borne sensors. The presentation will also show the distribution of ozone in the upper troposphere revealed from approximately 18 months of observations.

URL: http://www-sage3.larc.nasa.gov

A42C-0780 1330h POSTER

SAGE III Lunar Measurements

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The SAGE III instrument measures the vertical distribution of atmospheric gases and aerosols by measuring the attenuation of the sun or moon's rays observed through the limb of the earth's atmosphere. The lunar measurements increase the SAGE III/Meteor mission's geographic coverage and create the opportunity to detect the nocturnal species nitrogen trioxide and chlorine dioxide, in addition to ozone and nitrogen dioxide. This paper describes the techniques employed to perform the chemical species retrieval, altitude registration, and preliminary results of the first 15 months of data.

A42C-0781 1330h POSTER

Retrieval of atmospheric ozone and nitrogen dioxide vertical distribution from SAGE III limb scattering measurement

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SAGE III has been making a series of Earth limb radiance measurements over the past year. The paper will present an analysis and a discussion of the data. Since SAGE III was not designed to operate in this mode, instrument issues such as stray light and altitude registration, need special attention, and methods to deal with these issues will be first described. The methodology used to retrieve gas density profile will be explained. Two algorithms are used, the first one being based on Flitner's triplet method, and the second one relying on spectral fitting. Sample of retrieved ozone and nitrogen dioxide vertical profiles will be presented and discussed. Comparison of the retrieved profiles with measurements from other methods will be shown for validation: ozone sonde, lidar, other space borne instruments. The results will show the potential of SAGE III to operate in limb scattering mode and provide accurate determination of atmospheric ozone and nitrogen dioxide vertical distribution.

A42C-0782 1330h POSTER

Comparison of Limb Scattering Measurements Made by the Shuttle Ozone Limb Sounding Experiment (SOLSE), Limb Ozone Retrieval Experiment (LORE), and Stratospheric Aerosol and Gas Experiment (SAGE) III Instruments

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The reflight of the SOLSE (Shuttle Ozone Limb Sounding Experiment) and LORE (Limb Ozone Retrieval Experiment) instruments commenced with the launch of STS-107 on January 16, 2003. This 17-day mission yielded measurements of the radiance scattered by the limb of the atmosphere in the ultraviolet, visible, and near infrared portions of the spectrum. A subset of the measured radiance data was downlinked prior to the tragic destruction of STS-107 on February 1, 2003. A comparison of the limb scattered radiances measured by the SOLSE, LORE, and SAGE III instruments will be presented. Early results from the limb scattering ozone retrieval algorithm will also be analyzed. The ozone profiles derived from coincident measurements will be compared with each other, as well as with other correlative measurements.

A42C-0783 1330h POSTER

Analysis of SAGE III Spectral Survey Solar Occultation Events

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The Stratospheric Aerosol and Gas Experiment III (SAGE III) detector includes an 800-element CCD linear array that provides continuous spectral coverage between 290 and 1030 nm. During routine solar occultation measurements, SAGE III uses only 87 discrete spectral bands to retrieve gaseous species and aerosol parameters. SAGE III also has the capability to operate in a full spectral survey mode, sampling the entire spectral range of the detector, albeit at a decreased sampling rate. The spectral survey mode is primarily used to calibrate the instrument wavelength registration during exoatmospheric scans. On a few occasions, a full spectral survey of the atmosphere has been conducted. This spectral information serves as a useful SAGE III diagnostic tool: Does SAGE III use the optimal set of pixels for its gaseous species retrieval? Is the O_4 absorption signature a suitable method to improve altitude registration in the lower stratosphere and upper troposphere? Can SAGE III detect BrO? Is the etaloning behavior of the CCD at infrared wavelengths stable throughout an occultation event and is this information useful for the solar mode retrievals? Comparisons of coincident measurements taken by the Gas and Aerosol Monitoring Sensor (GAMS) during the SAGE III Ozone Loss Validation Experiment (SOLVE II) field campaign will also be presented. GAMS measures the same wavelength region as SAGE III but at a higher spectral resolution and a faster sampling rate. Two SAGE III spectral survey events were made coincident with GAMS measurements on SOLVE II DC-8 science flights, providing an opportunity for a comparison of spectral features and slant path transmittance through the same air mass.

A42D MCC: 3018 Thursday 1340h

Isotopic Constraints on Global Budgets of Atmospheric Gases I *(joint with B, H, OS, PP)*

Presiding: **J B Miller,** University of Colorado, Boulder**; M J Whiticar,** University of Victoria

A42D-01 1340h

Changes in Gross and Net CO2 Fluxes Over the Last two Decades Deduced from CO2, 13C, and 18O Atmospheric Measurements

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Year-to-year fluctuations in the growth rate of atmospheric CO2 are largely contributed by the effects of climate variability on terrestrial CO2 fluxes. High precision atmospheric 13C time series can be used in so called "double deconvolutions" to separate land from oceans fluxes. But 13C data alone provide almost no information on the interannual variability of the gross fluxes (Photosynthesis, Ecosystem Respiration, Combustion) controlling the carbon balance of terrestrial ecosystems. We used records of 18O in CO2 in addition to 13C and CO2 from the CMDL and CSIRO global air sampling networks, which span over the past two decades into a bayesian 'triple deconvolution". This method allows to infer year-to-year variations in photosynthesis and respiration at the hemispheric level, given additional a priori knowledge of the variability in isotopic fractionations and disequilibrium terms. The magnitude of the changes in gross CO2 fluxes that are required to explain the variability of the 18O signal will be compared to the magnitude of changes in the net fluxes.

A42D-02 1355h

Ten Years of Robust Sources and Sinks of Atmospheric CO2 inferred from 13CO2 and pCO2 Measurements in the NOAA/CMDL Network

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Prediction of future climate is dependent upon the trajectory of the rising concentration of carbon dioxide, which is, in turn, dependent upon the operation of both the terrestrial and oceanic components of the carbon cycle. Because the uptake of carbon in the oceans and land operates via different mechanisms, it is useful to calculate separately the uptake (or release) by each. Atmospheric measurements of CO2 concentrations and the relative carbon-13 content offer the possibility to resolve oceanic and terrestrial carbon fluxes at relatively high spatial and temporal resolution. Even though the global totals of oceanic and terrestrial uptake derived using d13C are somewhat uncertain, we will show that both the spatial and temporal patterns are robust. Since 1990, nearly 90,000 d13CO2 measurements have been made on air collected from more than 60 globally distributed sites in the NOAA/CMDL air sampling network. When combined with measurements of CO2 made on the same air, these data allow us to calculate the oceanic and terrestrial contributions to the total surface uptake of CO2 as a function of space and time. The most prominent result of our analysis is the large and sustained uptake of carbon in the temperate Northern Hemisphere (TNH), punctuated by periods of enhanced uptake centered around 1992 and 1997. The mean size of the uptake in the TNH is 3+/- 1 GTonC/yr, roughly half the size of the total fossil fuel flux to the atmosphere. The earlier period of enhanced uptake may be associated with the eruption of Mt. Pinatubo in 1991. The reasons for the enhanced terrestrial uptake in 1997 are less clear. The next result that stands out is the large release of carbon from the tropical biosphere that occurred during the 1997-1998 El Nino. The 1998 terrestrial flux in the tropics is about 2 to 3 GTon C more than the 1991-1997 mean. Coinciding with the SST transition typical of El Nino, we also estimate that tropical oceanic fluxes rose 2 by GtonC, sustained for two years. Perhaps the most interesting results derived from the atmospheric d13C data are the periods of enhanced terrestrial carbon uptake in the tropics in 1996 and the TNH in 1997. Whereas the other features of the record discussed so far have been previously addressed, these large signals have never been addressed and have no clear explanation.

A42D-03 1410h

Isotopic Signatures of net Carbon Fluxes and Pure Isotopic Exchange Fluxes as Determined From Atmospheric Data.

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For many years observed del-13C values of atmospheric CO2 have been used to partition net fluxes of carbon to the atmosphere into an oceanic and a terrestrial contribution. Additional information that is necessary is 1) an estimate of the isotopic "signature" (the difference from the atmosphere) of the fluxes, and 2) an estimate of the magnitude of pure isotopic exchange between all three reservoirs that is always taking place, also in the absence of net carbon fluxes. These estimates have traditionally been derived from other data or models. We are exploring a method to derive this information from the atmospheric CO2 and isotopic data themselves, which would be independent of earlier estimates and could help to uncover interannual variations of both the above quantities.

A42D-04 1425h

Towards A New Air-CO2 Isotopic Scale Based On Air Reference Material Generated From Carbonates

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Carbon and oxygen stable isotope ratios of atmospheric carbon dioxide provide important, independent information about carbon sources and sinks. Combined with CO2 mole fraction measurements, 13CO2 measurements can be used to quantitatively separate fluxes between atmosphere and terrestrial biosphere from fluxes between atmosphere and ocean. Highly precise and accurate isotopic data are needed for deriving accurate flux information using inverse modeling. For example, a change of just 0.02 $^{o}/_{oo}$ in 13C translates into an equivalent of 1.0 x 109 metric tons of carbon in models of surface fluxes. Such high degree of precision is possible, provided different laboratories agree on a common scale. Existing practice of using a carbonate reference material (NBS19) to unify scales has shown inadequate to this process in the past. Instead, CO2 admixture to CO2-free air where the CO2 is generated from a carbonate similar to NBS-19 in composition and texture has been proposed. We describe here an acid reaction and air mixing station (ARAMIX) setup at the Max Planck Institute for Biogeochemistry which is capable to introduce CO at ambient levels into an air mixture (without CO2) at the required precision level. This mixing station is used for generating CO2 by a conventional acid reaction (at 47 C the carbonate powder is reacted with pure ortho-phosphoric acid) and mixing the reaction gas with synthetic air. The mixture is distributed into several glass flasks (5l volume, 1.6 bar) attached to the system. Such flask air