modify the compositional structure of thermosphere at both E- and F-region altitudes. We have developed techniques for mapping the spatial distribution of wind-driven vertical displacement of the atmospheric column above 100-km altitude, based on compositional perturbations inferred from satellite ultraviolet auroral images. Displacements inferred from POLAR UVI images are shown to be consistent with vertical winds measured by the ground-based Fabry-Perot instruments. This same technique can be applied to TIMED-GUVI images using the "color" channels corresponding to ultraviolet emissions from oxygen at 135.6-nm and from nitrogen in the LBH-S and LBL-L bands. Although GUVI does not produce the long time-series of vertical displacement data that are available from POLAR-UVI, GUVI can instead yield maps of estimated thermospheric column displacement at much higher spatial resolution.

SA61A-11 1150h

Mesosphere and Lower-Thermosphere Wind Observations from a New South Pole Meteor Radar

Susan K Avery[1] (303-492-8773; susan.avery@colorado.edu)

Scott E Palo[2] (303-492-2489; palo@colorado.edu)

James P Avery[3] (303-492-6310; james.avery@colorado.edu)

Yun Yun Lu[1] (303-492-4625; sunnylu@cires.colorado.edu)

Nikolai Makarov (makarov@obninsk.org)

[1]University of Colorado, CIRES, Boulder, CO 80309

[2]University of Colorado, Department of Aerospace Engineering, Boulder, CO 80309

[3]University of Colorado, Department of Electrical and Computer Engineering, Boulder, CO 80309

A new meteor radar with altitude resolution was installed at the Amundsen-Scott South Pole station as part of the TIMED/CEDAR program. The radar has been operating almost continuously for 8 months. Preliminary results from late January through February 2002 have been obtained using various analysis techniques. During this period of time, the averaged hourly winds were projected onto 8 different longitude meridians in the height range spanning 80-105 km with a 5 km height resolution. Our results show the presence of waves with periods of 12, 24, and 72 hours that propagate westward and are consistent with a zonal wavenumber one longitudinal structure. A zonal wavenumber of 2 is also present at times for the semidiurnal wave period. During this period, a consistent divergent wind pattern where the wind vectors are northward (away from the pole) at all longitudes occurs from 1700-0200 UT while cross polar winds are present at all other times. This paper will present these preliminary features of the wind field and discuss future comparison with TIMED measurements and other Antarctica radar measurements.

SA62A MCC: Hall D Saturday 1330h

Mesosphere/Lower Thermosphere Posters

Presiding: **H G Mayr,** NASA Goddard Space Flight Center

SA62A-0375 1330h POSTER

Stable Reflecting Layers at Medium Frequencies in the Equatorial Mesosphere During Sunrise and Sunset Hours

THOKULUWA KRISHNAMOORTHY RAMKUMAR[1] (91-0462-573305; tkramkumar@rediffmail.com)

SUBRAMANIAN GURUBARAN[1] (91-0462-573305; gurubara@iig.iigm.res.in)

RAMASWAMY RAJARAM[2] (rrajaram@iig.iigm.res.in)

[1]EQUATORIAL GEOPHYSICAL RESEARCH LABORATORY, INDIAN INSTITUTE OF GEOMAGNETISM, MAHARAJANAGAR (P.O.), KRISHNAPURAM (B.O.), TIRUNELVELI, TN 627011, India

[2]INDIAN INSTITUTE OF GEOMAGNETISM, DR. NANABHAI MOOS MARG, COLABA, MUMBAI, MH 400005, India

The MF (1.98 MHz) partial reflection radar, operating at the Indian dip equatorial station Tirunelveli (8.7 deg. N, 77.8 deg. E, geographic; 0.4 deg. N dip), has been monitoring continuously the middle atmospheric dynamics (60-98 km) since 1992. At above about 90 km the ionospheric plasma irregularity is created mainly due to the gradient drift or cross-field instability and is called as type-II irregularity. Since this irregularity is associated with the fluctuations in the ambient electron density by a few percent, the received echoes from them are expected to be dynamic in nature. During the sunrise and sunset hours the EEJ electric field weakens and the plasma irregularity is created predominantly by the neutral turbulence. Since it is believed that the breaking of the gravity waves and certain modes of tides occurs at the mesopause region (∼85 km), a smooth stable reflecting irregularity layers are expected to be created at this height due to the anisotropic neutral turbulence. The MF echoes from them may be strong and static so that they can even saturate the receivers.

The two-minute scans, each comprising 256 data points, of the received radar echoes have revealed the same as expected. During the local sunrise and sunset hours the MF radar received echoes have shown the receiver saturation effects and the signals appear to be static in nature in the height range of about 84-94 km. The height profile of the signal power shows a sharp enchancement at about 88 km and then it remains as a constant up to 98 km. At these hours it is expected that the plasma instability induced irregularities loose their importance because of the weakening of the EEJ electric field. The neutral turbulence induced irregularities (Kolmogorov law) may play a dominant role even up to above 94 km at these times. However the exact mechanism of creating stable smooth layers at the mesopause heights during the sunrise and sunset hours is currently not known. Further analyses on other radar parameter changes during these hours are being carried out.

SA62A-0376 1330h POSTER

Characteristics of Meteor Echoes and Preliminary Winds Collected With a Narrow-Beam Radar at Piura, Peru

Elías M. Lau[1] (1-303-492-4625; Elias.Lau@Colorado.EDU)

Susan K. Avery[1] (1-303-492-8773; Susan.Avery@Colorado.EDU)

James P. Avery[2] (1-303-492-6310; James.Avery@Colorado.EDU)

[1]University of Colorado Cooperative Institute for Research in Environmental Sciences (CIRES), CIRES Bldg., Room 318, Boulder, CO 80309-0216, United States

[2]University of Colorado Department of Electrical and Computer Engineering, 425 UCB Engineering Center, ECEE 1B55A, Boulder, CO 80309-0425, United States

During the mid 1990's a MEDAC system was attached to the VHF wind profiler located in Piura, Peru to detect and collect meteor echoes and provide measurements of winds in the mesosphere-lower thermosphere. The collected data were different from those of similar systems operating at mid-latitudes and other equatorial sites. In particular, the echo rate was relatively low, the echoes were highly aspect sensitive, many of the meteor echoes were relatively weak suggesting the possibility that they were seen through a sidelobe instead of the main lobe of the antenna, and a great deal of activity was observed at nighttime when E-region echoes were also observed. A series of experiments have been designed to better understand the system and the resulting wind measurements. The first experiment was designed to increase the sensitivity of the radar and was conducted during one week in July 2002. Two transmitters were used instead of the single transmitter that normally feeds the transmit antenna on the wind profiler. Data was collected using three different systems: the wind profiler's own acquisition system, the MEDAC system, and a mode in which all data was collected and saved to the hard drive. This poster presents the results of the aforementioned experiment, compares the results provided by each data collection system, outlines the main features of the meteor echoes seen at Piura, and discusses the preliminary wind measurements.

SA62A-0377 1330h POSTER

Lidar Observation of Summer Mesopause Region Diurnal and Semi-diurnal Tides in Temerature, Zonal and Meridional Winds

Tao Yuan[1] (970-491-5424; titus@lamar.colostate.edu); James Sherman[1] (970-491-5880; jsherman@lamar.colostate.edu); Kam S Arnold[1] (970-491-5646; arnold@lamar.colostate.edu); David A Krueger[1] (krueger@lamar.colostate.edu); Chiao-Yao She[1] (970-491-6261; joeshe@lamar.colostate.edu); Maura E Hagan[2] (303-497-1537; hagan@ucar.edu)

[1]Colorado State University, Physics Department, Colorado State University, 200 West Lake Street, Fort Collins, CO 80523=1875, United States

[2]National Center for Atmospheric Research, NCAR/High Altitute Observatory, 3450 Mitchell Lane, Boulder, CO 80301, United States

The Colorado State Two-beam Na Lidar has been configured for simultaneous measurement of the profiles of temperature, zonal and meridional winds in the mesopause region over Fort Collins (41N, 105W). Observations on these dynamical variables covering full diurnal cycles have begun since April 2002. Two campaigns, one between the end of May and the beginning of June and the other between the end of July and the beginning of August were completed, yielding a total of 448 hours of summer data with 12 sets of full 24-hour continuous observation. Harmonic decomposition of these data into 24-, 12-, 8- and 6- hour periods are under way. The results of the diurnal and semi-diurnal tidal amplitudes and phases derived from this thus-far unique data set will be compared to the model output of GSWM00 migrating tidal model in summer months. They will be also compared to the new GSWM model under development, which includes nonmigrating tidal forcing due to latent heat release associated with raindrop formation in deep convective clouds in the tropical troposphere. Science implication on the middle atmosphere dynamics will be discussed in relation to the model-observation comparison.

SA62A-0378 1330h POSTER

Observations of Atmospheric Gravity Wave damping in the Mesosphere with lidar and airglow

Gary R Swenson[1] (217-333-4232; swenson1@uiuc.edu)

Feng Li[1] (217-265-0993; fengli@uiuc.edu)

Alan Liu[1] (217-333-6982; liuzr@uiuc.edu)

Purvesh Thakker[1] (217-333-4155; pbt003@yahoo.com)

[1]Electrical Engineering, U of Illinois, 1308 W. Main Street, Urbana, IL 61801, United States

Correlative measurements of temperature and winds by Na lidar and brightness in OH and O2 Atmospheric band airglow have been made at Albuquerque, NM and Maui, HI for a study of high frequency (Period less than 30 minutes) Atmospheric Gravity Waves (AGWs). Waves studies from four nights have been made and the correlative information describes the intrinsic wave properties with altitude, their damping characteristics, and resulting accelerations to the large scale dynamics in the 85-100 km altidude region. Generally, saturated to super-saturated conditions were observed below 95 km. Above this altitude, they became freely propagating.

SA62A-0379 1330h POSTER

Atmospheric Gravity Wave Properties for TOMEX as Observed With Na wind/temperature Lidar and Airglow Instrumentation From Albuquerque, NM

Feng Li[1] (fengli@uiuc.edu)

Jing Tang[2] (jingtang@uiuc.edu)

Alan Liu[2] (liuzr@uiuc.edu)

Gary Swenson[2] (swenson1@uiuc.edu)

Chet Gardner[2] (cgardner@uillinois.edu)

[1]Department of Atmospheric Sciences, University of Illinois at Urbana-Champaign, 105 Gregory Street, Urbana, IL 61801

[2]Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 1308 West Main, Urbana, IL 61801

On the night of October 26, 2000, the TOMEX sounding rocket was launched from White Sands rocket range 5 hours after sunset. Na lidar, airglow imagers, and a Michelson interferometer observed the perturbations in the mesosphere. In addition, the Na lidar measured the winds which were applied to the observed motion field from which intrinsic wave speeds were resolved. The extracted wave field from combined lidar and airglow observations included waves with periods of 5 hours, 1.5 hours, and 13 minutes present for the period leading to, and during the rocket launch. The vertical structures of the 13-minute and 1.5-hour period waves were determined primarily by the thermal structure, which was characterized by a small Brunt-Vaisala frequency between 90 km and 92 km with a strong gradient above and below. The 5-hour period waves exhibited a standing wave pattern, indicative of strong wave reflection in the mesopause region. In addition

to the intrinsic wave parameters, the vertical flux of horizontal momentum and acceleration rate as a function of altitude was calculated for each of the waves. Momentum fluxes and accelerations were dominated by contributions from the 13-minute period waves.

SA62A-0380 1330h POSTER

QBO Influences on Large-Scale Waves in the Equatorial MLT Region

Subramanian Gurubaran[1,2] (303-497-8329; sguru@ucar.edu)

Sundararajan Sridharan[2] (0091-462-579465; egrl@sancharnet.in)

Maura E Hagan[1] (hagan@ucar.edu)

[1]High Altitude Observatory / NCAR, P.O. Box 3000, Boulder, CO 80307-3000, United States

[2]Equatorial Geophysical Research Laboratory / IIG, Krishnapuram, Tirunelveli 627 011, India

The MLT wind data over the years 1993-2001 obtained from the MF radar operated at Tirunelveli (8.7 N, 77.8 E) were used to examine the possible association of the large-scale wind and wave fields at mesopause heights with the stratospheric QBO. The diurnal tide in the zonal wind over Tirunelveli shows enhanced activity when the stratospheric QBO is in the westerly phase. It has been shown earlier from the satellite and ground-based diagnostics that one of the westward phases of the mesopause SAO is enhanced during the QBO westerly phase. Earlier numerical experiments with the Global Scale Wave Model (GSWM) have indicated that the diurnal tidal response at MLT heights is largely insensitive to the QBO observed in the stratospheric ozone. The present work focuses on the non-migrating tides generated by the latent heat release in the troposphere that may show an interannual variability. With this forcing, the numerical experiments to be performed with the GSWM will examine whether the observed MLT tidal variability can be accounted for by the interannual variability in the tropospheric forcing.

The 6.5-day wave has been observed to be a dominant planetary wave component in the MLT region over Tirunelveli. The 6.5-day wave activity seems to be stronger during the stratospheric easterly phase. This wave has been identified to be a westward propagating disturbance arising from potential shear zones at stratopause levels. The interannual variability of this wave is intriguing. The sources of this variability are examined in the present work. The 3.5-day ultra-fast Kelvin wave, an equatorially trapped planetary wave mode, however, does not show any preference of activity during any of the QBO phases.

SA62A-0381 1330h POSTER

Modeling the Middle Atmosphere Dynamics With Gravity Waves: Influence of Tropospheric Processes

Hans G Mayr[1] (301 286-7505; hmayr@pop900.gsfc.nasa.gov)

John G Mengel[2] (301 286-4516; hmengel@pop900.gsfc.nasa.gov)

Douglas P Drob[3] (202 404-1292; drob@uap2.nrl.navy.mil)

Hayden S Porter[4] (864 294-3223; Hayden.Porter@furman.edu)

[1]Goddard Space Flight Center, Laboratory for Atmospheres, Greenbelt, MD 20771, United States

[2]Science Systems Applications, 5900 Pricess Garden Parkway, Lanham, MD 70706, United States

[3]Naval Research Laboratory, 455 Overlook Av., Washington, DC 20375, United States

[4]Furman University, Poinsett Highway, Greenville, SC 29613, United States

Our Numerical Spectral Model (NSM) extends from the ground up into the thermosphere and has a vertical grid point resolution of about 0.5 km to resolve the interactions of gravity waves (GWs) described with Hines' Doppler Spread Parameterization (DSP). This model produces in the stratosphere and mesosphere the major features of QBO, SAO, tides, and planetary waves. We discuss here results from an initial study with our 3D model that shows how certain tropospheric processes can affect the dynamics of the middle atmosphere. Under the influence of tropospheric heating and eddy viscosity, and augmented by GW interaction, two distinct but related processes can be identified. (1) A meridional circulation develops, which extends into the lower stratosphere with rising motions at low latitudes that are in magnitude comparable to the downward propagation of the QBO. As Dunkerton pointed out, a larger GW source is then required to reproduce the observed QBO, which tends to move us closer to the values recommended for the DSP. This has significant consequences for our ability to model the upper mesosphere, considering the central importance of GWs for the seasonal variations, planetary waves (e.g., 2-day wave) and tides in this region. (2) Tropospheric heating produces zonal jets near the tropopause that are related to latitudinal variations in pressure and reversing temperature (resembling the dynamical conditions near the mesopause), which in turn is conducive to generate baroclinic instability. Modeling results show that our ability to generate the QBO then critically depends on the magnitude of the temperature reversal that is a measure of this instability. Planetary waves are generated in this process, which can apparently interfere with or augment the GW interactions. Eastward propagating Kelvin waves and westward propagating Rossby gravity waves (generated by tropospheric convection) can generate the QBO in principle (Lindzen and Holton, 1968) and certainly influence it, and this process is reproduced with our 3D model.

SA62A-0382 1330h POSTER

A Reexamination of Evanescent Acoustic-Gravity Waves: Special Properties and Aeronomical Significance

Richard L. Walterscheid[1] (310-336-7352; richard.walterscheid@aero.org)

James H. Hecht[1] (310-336-7017; james.hecht@aero.org)

[1]The Aerospace Corporation Space Science Applications Laboratory, MS-260 P.O. Box 92957, Los Angeles, CA 90009, United States

Acoustic-gravity wave relations indicate that when wave frequency and horizontal wavenumber approach the characteristic curve delineating gravity and acoustic solutions, the horizontal group velocity and Eckart's characteristic impedance become infinite and wave energy E vanishes. It is shown that this behavior is equivalent to assuming incorrectly that wave energy is the same function of vertical wavenumber for internal and evanescent waves. When the correct expression for E for evanescent waves is used, the energy flow velocity U defined in terms of the energy flux F = EU is bounded by the sound speed, impedance is bounded by values near unity, and E does not vanish. The transient response is strongest for those waves that disperse least: waves with long horizontal wavelengths and waves not too far from the Lamb and Brunt-Vaisala curves in frequency-wavenumber space. Certain fundamental solutions merge at the common intersection of the characteristic,Lamb,and Brunt-Vaisala curves implying that waves should be able to transfer energy between the acoustic and gravity wave regimes in response to variations in the background state. Nonisothermal calculations show that even for fairly small lapse rates waves that are at least partially internal in nature can exist at all frequencies.

SA62A-0383 1330h POSTER

LTCS High Latitude Lower Thermospheric Wind Climatology

Roberta Johnson[1] (303 497 2591; rmjohnsn@ucar.edu)

S. M. Azeem[2]

Maura Hagan[1]

Satonori Nozowa[3]

[1]High Altitude Observatory National Center for Atmospheric Research, PO Box 3000, Boulder, CO 80307

[2]Aerospace Engineering Sciences Engineering Center, University of Colorado at Boulder, ECAE 1B23, Campus Box 429, Boulder, CO 80309

[3]STEL, Nagoya University, Nagoya 4648601, Japan

Ground-based instruments at numerous sites around the world have collected simultaneous lower thermospheric data during LTCS campaigns since 1987. Seasonally averaged climatological results from two high latitude incoherent scatter radars - EISCAT and Sondrestrom - have been analyzed and compared with results from GSWM 2000. Overall, mean winds and diurnal and semidiurnal tidal oscillations observed at the two stations shows very good agreement. Both radars detect a zonal jet peaking between 100 and 105 km at 50-60 m/s during summer months. Zonal flows shift from eastward (below) to westward (above) between 100 and 110 km during winter. Both radars detect a region of poleward flow (10 m/s) between 95 and 115 km, bounded above by a region of southward flow during summer. Semidiurnal and diurnal oscillations observed at the two radars are quite similar, although there are occasional offsets in phase. Agreement with GSWM00 is good in all seasons except summer, when the model amplitudes underestimate observed semidiurnal and diurnal amplitudes. However, model and observed phase profiles are in good agreement, particularly at lower altitudes. These observations indicate the dominance of migrating tidal components in the high latitude lower thermosphere.

SA62A-0384 1330h POSTER

Ozone retrieval and the Investigation of Structures in the Oxygen Infrared Atmospheric bands observed with the OSIRIS Imager on the Odin satellite

J. Truitt Wiensz[1] ((306) 966-6452; wiensz@osirus.usask.ca); Douglas A. Degenstein[1] ((306) 966-6447; degenstein@osirus.usask.ca); Edward J. Llewellyn[1] ((306) 966-6441; llewellyn@osirus.usask.ca); Nicholas D. Lloyd[1] ((306) 966-2201; lloyd@osirus.usask.ca); Adam E. Bourassa[1] ((306) 966-6516; bourassa@osirus.usask.ca); Richard L. Gattinger[1] (gattinger@osirus.usask.ca); Ian C. McDade[2] (mcdade@yorku.ca); Donal P. Murtagh[3] (donal@rss.chalmers.se)

[1]Institute of Space and Atmospheric Studies, University of Saskatchewan, 116 Science Place, Saskatoon, SK S7N 5E2

[2]Earth and Atmospheric Science, York University, 4700 Keele Street, Toronto, ON M3J 1P3

[3]Chalmers Institue of Technology, Radio and Space Science, Goteborg SE-412 96, Sweden

The OSIRIS imager on the Odin satellite has made extensive observations of the Oxygen Infrared Atmospheric bands during both the day and nighttime parts of the orbit. These observations can be inverted to determine the mesospheric ozone profile, even after sunset. This paper discusses the problem of ozone retrieval when the imager makes measurements across the terminator as well at other times. In addition some consistent features in the temporal/latitudinal variations of the airglow emission are described and the possible influence of either atmospheric dynamics or new mesospheric chemistry is discussed.

SA62A-0385 1330h POSTER

The Global Distribution of Limb Radiance Measured by the Midcourse Space Experiment (MSX)

Michael J. Kendra[1] (781-275-6767; kendra@radex.com)

James. M. Griffin[1] (781-275-6767; griffin@radex.com)

Robert R. O'Neil[2] (781-377-4775; robert.oneil@hanscom.af.mil)

James J. Gibson[2] (james.gibson@hanscom.af.mil)

[1]Radex Inc., 3 Preston Court, Bedford, MA 01730

[2]AFRL, Space Vehicles Directorate 29 Randolph Road, Hanscom AFB, MA 01731

The MSX SPIRIT III radiometer recorded infrared limb radiance simultaneously in five spectral bands in which the dominant signatures were due to 4.3 and 15 micron CO2, 9.6 micron O3 and 18 25 micron rotational water vapor emissions. In a vertical alignment, the detector columns covered a tangent altitude range of 60 km with 300 x 300 m resolution. The measurements were made in 153 episodic data collection events in the period from May 1996 to February 1997 over tangent heights from 25 to 150 km. They were recorded at all latitudes from a high inclination orbit and were made primarily in the eastern and northern hemispheres.

Global radiance databases were constructed for each radiometer band by combining all valid detector values into one-second time and one km tangent altitude bins. Each database contains nearly 1e7 mean radiance values, indexed by latitude, longitude, altitude, date, solar illumination, and geomagnetic index. Radiance measurements from this database were binned in a variety of ways: latitude and longitude; latitude and month; latitude and local time; geomagnetic latitude and geomagnetic time; altitude and latitude; altitude and solar zenith angle; and altitude and month. Bin parameters were adjusted to achieve adequate coverage for determining population statistics within the distribution space.

Global maps, seasonal summaries, and multidimensional plots of mean radiance, standard deviation of mean radiance, their ratio, minimum radiance, and maximum radiance will be presented. Special emphasis will be given to the 4.22-4.36 and 4.24-4.45 micron carbon dioxide bands and the 6.8-10.8 micron ozone band. Extreme values of limb radiance will be identified for each of the five spectral bands.

SA62A-0386 1330h POSTER

Midcourse Space Experiment (MSX): Analysis of Radiometric and Spectral Measurements of Infrared Limb Radiance

Robert R. ONeil[1] (781-377-4775; robert.oneil@hanscom.af.mil); James J. Gibson[1] (james.gibson@hanscom.af.mil); James H. Brown[1] (james.brown@hanscom.af.mil); James W. Duff[2] (duff@ssi.com); Alexander A. Zachor[2] (zachor@ssi.com); Edward Richards[3] (edward.richards@hanscom.af.mil); Carolyn Parsons[3] (parsonsc@bc.edu)

[1]AFRL, Space Vehicles Directorate 29 Randolph Road, Hanscom AFB, MA 01731

[2]Spectral Sciences Inc., 99 South Bedford Road, Burlington, MA 01803

[3]Boston College, Institute for Space Research, Chestnut Hill, MA 02467

The MSX SPIRIT III cryogenic infrared sensors measured atmospheric limb radiance at tangent heights between 25 and 100 km in the wavelength range 4-25 micron with a five-channel radiometer and a Michelson interferometer spectrometer. The radiometers 192 pixel linear arrays, which span 60 km in tangent altitude, observed approximately 150 atmospheric limb radiance profiles. The interferometers six filtered channels, which sample discrete tangent heights at spatial resolutions between 4 and 13 km, recorded limb signatures at selectable spectral resolutions of 2, 4 or 20 cm-1 in approximately 30 measurements. Simultaneous radiometer and interferometer data obtained in some of the MSX experiments provide a detailed description of limb emissions by the 4.3 and 15 micron CO2 bands, the 9.6 micron O3 band and rotational water over the 1825 micron region. The data show that the 9.6 micron O3 band radiance profile is characterized by a structured emission layer in the altitude 80-90 km with considerable variation in peak intensity and altitude in both day and night atmospheres. The MSX data has been analyzed to infer profiles of atmospheric temperature, density and composition, and to formulate partial corrections to predictive models for high-altitude composition and infrared spectral radiance.

SA62A-0387 1330h POSTER

Diurnal variability in the mesosphere during northern hemisphere winter

Ruth S. Lieberman[1] ((303) 415-9701 x212; ruth@co-ra.com)

Jens Oberheide[2] ((303) 497-1566; jenso@ucar.edu)

[1]Northwest Research Associates, Colorado Research Associates Division, 3380 Mitchell Lane, Boulder, CO 80301, United States

[2]NCAR, P. O. Box 3000, Boulder, CO 80307, United States

Theoretical studies indicate that nonlinear interactions between stationary waves and the migrating diurnal tide are a plausible source of nonmigrating diurnal tides in the middle atmosphere. The present study examines daily variations in stationary planetary waves and diurnal tides in the mesosphere during January-February 1979. Planetary wavenumber one is large and variable during this time, reaching peak amplitudes in the lower mesosphere between January 20-30, followed by rapid decay. This behavior is accompanied by rapid amplification of nonmigrating diurnal tides corresponding to wavenumbers zero and two, which are the sum and difference of the migrating tide and the planetary wavenumbers. Preliminary analyses indicate that the nonmigrating response is dominated by a westward traveling zonal wavenumber two at tropical latitudes, in accordance with numerical studies.

SA62A-0388 1330h POSTER

Diagnosis of Mesospheric Oxygen Chemistry Using Odin/OSIRIS Observations at 1.27 m and 762 nm

Nicholas Lloyd[1] ((306) 966-2201; lloyd@osirus.usask.ca); Douglas A Degenstein[1] ((306) 966-6447; degenstein@osirus.usask.ca); Edward J Llewellyn[1] ((306) 966-6441; llewellyn@skisas.usask.ca); J. Truitt Wiensz[1] ((306) 966-6452; wiensz@osirus.usask.ca); Adam E Bourassa[1] ((306) 966-6456; bourassa@osirus.usask.ca); Richard L Gattinger[1] ((306) 966-6441; gattinger@osirus.usask.ca); Ian C McDade[2] ((416) 736-2100; mcdade@yorku.ca)

[1]Institute of Space and Atmospheric Studies, 116 Science Place University of Saskatchewan, Saskatoon, SK S7N 5E2, Canada

[2]Earth and Atmospheric Science, York University 4700 Keele Street, Toronto, ON M3J 1P3, Canada

The OSIRIS instrument has made simultaneous observations of the mesospheric oxygen emissions at both 1.27 m and 762 nm. Both of these emissions are useful proxies for understanding odd oxygen chemistry in the mesosphere. The combined measurements allow us to constrain the role of O2 and O3 photolysis and to test the validity of current reaction chemistry and radiative transfer models. This paper presents our current understanding of these models.

SA62A-0389 1330h POSTER

Global and seasonal variations of O2 A-band airglow deduced from HALOE

J. B. Nee[1] (886-3-4227151; jbnee@phy.ncu.edu.tw)

V. Ratnam[1] (8865-3-4227151; ratnam@yahoo.com)

C. M. Shen (4227151; cms@yahoo.com)

W. N. Chen (wnchen@phy.ncu.edu.tw)

[1]National Central University, Department of Physics,, Chung-Li, Taiwan 32054, Taiwan

The 762 nm oxygen A-band emission with peak height at 95 km is the strongest airglow systems produced in the mesosphere. Emission rate of O2 airglow is closely related to the chemistry, dynamics and radiation in the mesopause region. The O2 A-band measured by HALOE instrument onboard UARS satellite shows a semiannual variation in the equatorial region with the strongest intensity measured during the spring and fall equinoxes. In 1997-98 irregular variations were observed. Seasonal variations are compared with HALOE ozone and temperature data, and strong correlations with both were found near the mesopause.

SA62A-0390 1330h POSTER

HDO in the Mesosphere: Observation and Modeling of [HDO]/[H_2O] Variability

Brad J Sandor[1] (303-735-5834; sandor@gemelli.colorado.edu)

R Todd Clancy[1] (910-457-6362; clancyr@colorado.edu)

[1]Space Science Institute, 3100 Marine Street, ste A353 Campus Box 564, Boulder, CO 80303-1058, United States

We present 1992-2002 measurements of HDO and H_2O at 50-70 km altitude, derived from ground-based μwave observations at 32°N, 112°W. Observed HDO/H_2O ratios show HDO depletions relative to Standard Mean Ocean Water (SMOW) of δD= −58% to −3%. Large variability of mesospheric δD is in surprising contrast to stratospheric observations of δD= −65% to −50% [Moyer et al., 1996], and indicates sensitivity to processes other than the CH_4 oxidation that pertains in the stratosphere. We observe anticorrelation of δD and H_2O abundance, contrary to the stratospheric pattern.

Observations are of the 225 GHz HDO and 203 GHz $H_2^{18}O$ lines, corresponding to rotational transitions of these molecules. The 12-meter radio telescope and T= 4°K receivers at Kitt Peak, AZ are used in frequency switching mode. HDO and H_2O altitude profiles are derived from sensitivity of the line shape to pressure. $H_2^{18}O$ is used as a proxy for $H_2^{16}O$ based on theory and available measurements [Kaye, 1987; Rinsland et al., 1991] of [$H_2^{18}O/H_2^{16}O$] = SMOW±5% in the upper stratosphere.

Standard theory holds that HDO is preferentially removed from water transported upward through the tropopause due to isotope-dependent freezing [Kaye, 1987], leading to lower stratosphere HDO depletions −65±10% [balloon- Rinsland et al., 1991; ATMOS-Moyer et al. 1996]. Depletion is less extreme in the upper stratosphere owing to conversion of CH_4 (D/H ∼ SMOW) to H_2O.

We model the photochemistry and conclude the observed mesospheric HDO behavior is driven by differing photolysis rates for HDO and H_2O at λ >175 nm.

SA62A-0391 1330h POSTER

New Observations of the Meinel OH Bands With the OSIRIS Imager on the Odin Satellite

Douglas A Degenstein[1] ((306) 966-6447; degenstein@osirus.usask.ca); Edward J. Llewellyn[1] ((306) 966-6441; llewellyn@skisas.usask.ca); Nicholas D Lloyd[1] ((306) 966-2201; lloyd@osirus.usask.ca); Adam E Bourassa[1] ((306) 966-6456; bourassa@osirus.usask.ca); Nathan Wiebe[1] ((306) 966-6452; nsw935@mail.usask.ca); Richard L Gattinger[1] ((306) 966-6441; gattinger@osirus.usask.ca); Ian C McDade[2] ((416) 736-2100; mcdade@yorku.ca)

[1]Institute of Space and Atmospheric Studies, 116 Science Place University of Saskatchewan, Saskatoon, SK S7N 5E2, Canada

[2]Earth and Atmospheric Science, York University 4700 Keele Street, Toronto, ON M3J 1P3, Canada

The OSIRIS imager on the Odin satellite has made extensive observations of the nighttime OH bands. These measurements show that the OH bands increase in brightness immediately after sunset and decay at sunrise. The brightness variations can be interpreted in terms of the variation of the mesospheric ozone profile during the nighttime. The tomographic analysis of these observations also allows the identification of structure in the emission that is related to mesospheric dynamics. This paper presents some of the latest observations of the OH emissions and the various wave structures that we have presently identified in the nightglow.

SA62A-0392 1330h POSTER

First Observations of the Mesospheric Thermal Structure at 78°N in Summer and its Connection to NLC and PMSE.

Franz-Josef Luebken[1] (-49-38293-680; luebken@iap-kborn.de); Josef Hoeffner[1]; Cord Fricke-Begemann[1]; Arno Muellemann[1]; Marius Zecha[1]; Juergen Roettger[2]

[1]Leibniz-Institue of Atmospheric Physics, Schloss-Str. 6, Kuehlungsborn 18225, Germany

[2]Max-Planck-Institute for Aeronomy, Max-Planck-Str. 2, Katlenburg-Lindau 37191, Germany

In summer 2001 a field campaign called ROMA ("Rocket borne Observations in the Middle Atmosphere") was conducted close to Longyearbyen (Spitsbergen) with temperature measurements by meteorological rockets and ground-based detection of noctilucent clouds (NLC) by lidar and polar mesosphere summer echoes (PMSE) by radar. In this paper we present a summary of the temperature measurements and first results from an analysis of NLC and PMSE, including their connection to the thermal structure. It is very cold in the upper mesosphere during the summer season (here from mid July until August 23), cold enough for water ice particles to exist (i. e., the degree of saturation is larger than unity assuming reasonable [H_2O] values). Generally, PMSE and NLC are found at altitudes with super-saturation. The lower ledge of PMSE and NLC coincide and are located at the lower height limit where ice particles can exist (appr. 82 km). PMSE extend to higher altitudes compared to NLC. NLC were found during approximately 70% of the observation period. The mean peak NLC altitude is ∼83.4 km with a RMS variability of ±1.1 km. We find a significant correlation between the upper ledge of the PMSE layer and potassium densities. The NLC layer is always located below or at the lower edge of the potassium layer.

SA62A-0393 1330h POSTER

PMC Particle Distributions from Inversion of MUV Spectra

James F Carbary[1] (443-778-8805; james.carbary@jhuaple.edu)

Danny Morrison[1] (danny.morrison@jhuapl.edu)

Gerald J Romick[1] (jerrymarcia@worldnet.att.net)

[1]Johns Hopkins University Applied Physics Laboaratory, 11100 Johns Hopkins Rd, Laural, MD 20723, United States

The spectrographic imagers on the MSX satellite have made the first observations of the middle ultraviolet spectra of polar mesospheric clouds (200-320 nm). After suitable averaging, the PMC spectra from the peak altitudes of the clouds are divided by the solar irradiance to produce a scattering ratio as a function of wavelength. The scattering ratio can be expanded in

terms of particle distribution weights and Mie scattering functions. This expansion can be cast in the form of a matrix equation in which one side is the vector of observed scattering ratios in wavelength and the opposite side is the product of a scattering function matrix and the particle distribution in size. Direct inversion of this equation determines the actual particle distribution without recourse to assumptions about its shape or amplitude. This method is applied to MSX data and the results compared to commonly-assumed PMC distributions such as Gaussian and lognormal.

SA62A-0394 1330h POSTER

Is the water vapor budget in the summer polar mesosphere understood?

Michael H. Stevens[1] (202-404-7226; stevens@uap2.nrl.navy.mil)

Markus Rapp[2] (rapp@iap-kborn.de)

Oleg A. Gusev[3] (oleg@wpos12.physik.uni-wuppertal.de)

Jorg Gumbel[4] (gumbel@misu.su.se)

[1]Code 7641, E.O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, DC 20375, United States

[2]Leibniz Institute of Atmospheric Physics, Schloss-Str. 6, Kuehlungsborn 18225, Germany

[3]Department of Physics, University of Wuppertal, Wuppertal 42097, Germany

[4]Department of Meteorology, Stockholm University, Stockholm S-106 91, Sweden

Recent observations and model results show that the vertical distribution of water vapor in the summer polar mesosphere is more complex than originally believed. Limb scanning observations of hydroxyl (OH), a product of water vapor photodissociation, have helped to yield new insight into water vapor in the summer polar mesosphere. Analysis of OH observations from the Middle Atmosphere High Resolution Spectrograph Investigation (MAHRSI) revealed a water vapor layer with average peak mixing ratios of 10-15 ppmv near 82 km, at the same altitude as polar mesospheric clouds (PMCs). Microphysical model results have also shown that a layer of water vapor about 1 km thick can build up near 82 km due to the freeze drying, sedimentation and sublimation of PMC ice particles from above. But the narrow vertical structure predicted by models is not easily resolved by MAHRSI. In this work, we will use a one-dimensional microphysical model to quantify the vertical distribution of water vapor near 82 km. By convolving the model results with the vertical resolution of MAHRSI and comparing to the data, we will rigorously test our understanding of the water vapor budget in the summer polar mesosphere. We will also explore whether enhanced water vapor and ice particles near 82 km in the summer polar mesosphere can influence the local thermal structure through increased cooling and heating of the ambient atmosphere.

SA62A-0395 1330h POSTER

Search for Shuttle-Induced PMCs in SBUV and SBUV/2 Data

Matthew T DeLand[1] (301-867-2164; matt_deland@sesda.com)

Eric P Shettle[2] (202-404-8152; shettle@nrl.navy.mil)

Gary E Thomas[3] (303-492-7022; thomas@alcor.colorado.edu)

John J Olivero[4] (904-226-6453; oliverojj@db.erau.edu)

[1]Science Systems and Applications, Inc., 10210 Greenbelt Rd. Suite 400, Lanham, MD 20706, United States

[2]Code 7227, Remote Sensing Division, Naval Research Laboratory, Washington, DC 20375-5351, United States

[3]LASP, Campus Box 392 University of Colorado, Boulder, CO 80309-0392, United States

[4]Embry-Riddle University Dept. of Physical Sciences, 600 S. Clyde Morris Blvd., Daytona Beach, FL 32114, United States

It has recently been suggested that the large amount of water vapor deposited in the upper atmosphere by Space Shuttle rocket exhaust leads to the formation of polar mesospheric clouds (PMCs) during the days following a launch [*Stevens et al., Eos. Trans. AGU, 83*(19), Spring Meeting Suppl., Abstract SA21A-05, 2002]. This conclusion is inferred from MAHRSI OH observations during the STS-66 (November 1994) and STS-85 (August 1997) missions.

The SBUV and SBUV/2 instruments have made PMC measurements continuously since November 1978. We have examined this database for evidence of anomalous PMCs following Shuttle flights during the period 1985-2001. Daily variations in overall SBUV/2 PMC occurrence frequency can reach a factor of 2 due to natural fluctuations and changes in geographic coverage. We therefore focused on launches occurring near the beginning and end of the nominal Northern Hemisphere PMC season (May 21 - August 31), where typical PMC occurrence frequencies are low. Data for 9 Shuttle launches were examined for evidence of increased PMC frequency and longitudinal clustering. Normal SBUV/2 PMC detections represent only the brightest portion of the overall PMC intensity distribution. We also evaluated the impact of reducing the normal PMC detection threshold to look for fainter PMCs. There is some evidence for increased PMC detections eastward of the United States within 3-5 days following a Shuttle launch. We will present examples of these data.

SA62B MCC: Hall D Saturday 1330h

Scientific Results From the TIMED Mission II Posters *(joint with A)*

Presiding: **J M Russell,** Hampton University**; R Niciejewski,** University of Michigan

SA62B-0396 1330h POSTER

A Re-evaluation of Early Solar EUV and Soft X-ray Flux Measurements

Werner M. Neupert (303-497-3274; werner.neupert@noaa.gov)

NOAA Space Environment Center, 325 Broadway, Boulder, CO 80305, United States

Measurements of the solar extreme ultraviolet and soft X-ray spectrum made at the (then) Air Force Geophysics Laboratory (AFGL) by a group under the direction of Hans Hinteregger were the basis for early estimates of the solar flux in the spectral range of 5 to 190 nm. Subsequent studies have indicated a discrepancy between the fluxes reported at the lower end of this spectral range and those required in modeling the Earths ionosphere. We have examined a possible systematic source of error in the original calibration between 25 nm and 120 nm, the range over which the photoelectric yield of a tungsten surface was the basis for calibration. We find differences (never greater than 30 percent) between the adopted photoelectric yield values as a function of wavelength and measurements made elsewhere. Suggested corrections to EUV fluxes due to these deviations will be presented. To extend the analysis of AFGL results below 25 nm, but only for a period of intermediate solar activity, we use an OSO-5 spectrum between 2.5 and 40 nm having a spectral resolution of 0.05 nm. This spectrum was calibrated in-orbit using coronal density-insensitive emission line ratios and absolute flux measurements at 30.4 nm made independently by an instrument on OSO-4. These data provide independent measurements of solar fluxes in the 3-40 nm region that can be compared with AFGL observations and more recent measurements and flux models for moderate levels of solar activity.

SA62B-0397 1330h POSTER

TIDI Preliminary Wind Results: Tidal Features and Validation Effort

Qian Wu[1] (qwu@ucar.edu); T. L. Killeen[1]; S. C. Solomon[1]; W. R. Skinner[2]; R. D. Gablehouse[1]; D. A. Ortland[3]; R. J. Riciejewski[2]; D. A. Gell[2]; R. M. Johnson[1]; J. F. Kafkalidis[2]; D. M. Riggin[4]; R. S. Lieberman[4]; G. Hernandez[5]; C. Y. She[6]; J. Oberheide[1]; M. E. Hagan[1]

[1]NCAR, P.O.Box 3000, Boulder, Co 80307-3000, United States

[2]University of Michigan, SPRL/AOSS The University of Michigan 2455 Hayward St., Ann Arbor, Mi 48109-2143

[3]Northwest Research Associates, P.O.Box 3027, Bellevue, Wa 98009-3027

[4]Colorado Research Associates, 3380 Mitchell Lane, Boulder, Co 80301

[5]University of Washington, Department of Earth and Space Sciences Box 351310 063 Johnson Hall University of Washington, Seattle, Wa 98195-1310

[6]Colorado State University, Physics Department Colorado State University, Fort Collins, Co 80523

Since the launch of the TIMED satellite, the TIDI (TIMED Doppler Interferometer) instrument has been collecting neutral wind data from the lower thermosphere and mesosphere regions. Preliminary winds from the O_2 (0-0) emission have been produced. These winds are being compared with ground based radar, lidar, and Fabry-Perot Interferometer measurements in an effort to validate these TIDI results. Comparisons with GSWM results are also being made in search of tidal signatures. Although, the TIDI data are still being refined, the preliminary winds show clear tidal features. We will describe our on going effort on validation and progresses on processing and analyzing the TIDI neutral wind data.

SA62B-0398 1330h POSTER

Observations of the O_2 Atmospheric Band Nightglow by the TIMED Doppler Interferometer

S. C. Solomon[1] (303-497-2179; stans@ucar.edu); J. Craig[1] (jcraig@ucar.edu); R. D. Gablehouse[1] (rdg@ucar.edu); D. A. Gell[2] (gellda@umich.edu); R. M. Johnson[1] (rmjohnsn@ucar.edu); J. F. Kafkalidis[2] (juliek@umich.edu); T. L. Killeen[1] (killeen@ucar.edu); R. J. Niciejewski[2] (niciejew@umich.edu); D. A. Ortland[3] (ortland@nwra.com); W. R. Skinner[2] (wskinner@umich.edu); Q. Wu[1] (qwu@umich.edu)

[1]National Center for Atmospheric Research, 3450 Mitchell Lane, Boulder, CO 80301, United States

[2]The Universty of Michigan, 2455 Hayward, Ann Arbor, MI 48109, United States

[3]Northwest Research Associates, P.O. Box 3027, Bellevue, WA 98009, United States

Measurements of the O_2 Atmospheric (0-0) band nightglow layer by the TIMED Doppler Interferometer (TIDI) during 2002 are presented. Because TIDI has four separate telescopes observing in orthogonal directions, good coverage of nightglow morphology in latitude and local time is obtained. The emission intensity and layer height are analyzed to investigate the influence of tidal variability on oxygen recombination.

SA62B-0399 1330h POSTER

Coincidence Observations of Mesopause Region Temperatures and Winds of Ground-based Lidar with TIMED/SABER and TIMED/TIDI

Chiao-Yao She[1] (970-492-6261; joeshe@lamar.colostate.edu); Bifford P Williams[1] (970-492-5646; biffw@lamar.colostate.edu); David A Krueger[1] (970-491-7381; krueger@lamar.colostate.edu); James M. Russell[2] (757-728-6893; james.russell@hamptonu.edu); Qian Wu[3] (303-497-2176; qwu@ucar.edu); Timothy Killeen[3] (303-497-1111; killeen@ucar.edu)

[1]Colorado State University, Physics Department Colorado State University 200 West Lake Street, Fort Collins, CO 80523-1875, United States

[2]Hampton University, Center for Atmospheric Sciences, 23 Tyler Street, Hampton University, Hampton, VA 23668, United States

[3]National Center for Atmospheric Research, NCAR/High Altitude Observatory,3450 Mitchell Lane, Boulder, CO 80301, United States

The Colorado State Two-beam Na Lidar has been configured for simultaneous measurement of the profiles of temperature, zonal and meridional winds in the mesopause region over Fort Collins (41N, 105W). Observations over full diurnal cycles began in April 2002. To-date, 144 hours of data with simultaneous observation of temperature and zonal wind were acquired in April. Two more campaigns, one between the end of May and the beginning of June and the other between the end of July and the beginning of August were completed, yielding 268 hours and 180 hours of data, respectively, with simultaneous observation of temperature, zonal, and meridional winds. More than one-third of these data were acquired during daytime. Hours of lidar data coincidence with TIMED have been and more will be identified; they will be compared with SABER temperatures and TIDI winds for the purpose of validation and of science study.