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Poster Sessions Booklet

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Contents

1 Tuesday Evening 18 June 2002 Poster Session Abstracts, Polar Aeronomy and M-I Coupling

1.1 PMI.01: The development of enhanced dusk sector proton precipitation after substorm injection by Morsony, B. J.

Status: student not in poster competition Undergraduate

Authors: Brian J. Morsony, Thomas J. Immel, Harald U. Frey, and Stephen B. Mende

Abstract:

The proton auroral oval is now observed routinely by the SI-12 imager onboard the NASA-IMAGE satellite. It is now possible to investigate the proton component of substorms separate from the electron precipitation. After the initial injection of particles, higher energy protons (¿ 8 keV) will drift toward the dusk sector, and possibly precipitate into the atmosphere as aurora. Proton energy fluxes often exceed electron fluxes in this sector, and the proton precipitation therefore can have a great influence on ionospheric conductivities in the dusk sector. It is found, however, that the dusk sector precipitation following the proton injection varies greatly in intensity, even for substorms of similar magnitude (as quantified by AE or Hp indices) . In this work, factors influencing the development of dusk sector conductance enhancements from proton injections will be investigated (such as conditions in the solar wind or at geosynchronous orbit). More than 100 proton substorms will be used in this statistical study.

1.2 PMI.02: Prompt effects of the interplanetary magnetic field and solar wind pressure on the middle- and low-latitude ionosphere by Huang, Chao-Song

Status: non-student

Authors: Chao-Song Huang and J. C. Foster Haystack Observatory Massachusetts Institute of Technology Route 40 Westford, Massachusetts 01886 cshuang@haystack.mit.edu

Abstract:

We will present the observations and interpretation of solar wind effects on the global ionosphere from middle latitudes to the equator. Different conditions of the interplanetary magnetic field (IMF) and solar wind pressure have been analyzed: periodic IMF oscillations, periodic solar wind pressure oscillations, isolated IMF turnings, and isolated solar wind pressure impulses. In all the cases, the ionospheric perturbations are well correlated with the IMF/solar wind pressure variations. At midlatitudes, the electron density near the F-peak altitude could be increased or decreased by 3030-70 min. We suggest that the ionospheric perturbations are caused by the penetration magnetospheric electric fields which are controlled or modulated by the oscillations in the IMF and solar wind pressure. Since the solar wind is always changing with time, it can be a very common, very important source of midlatitude ionospheric perturbations. This relationship between the solar wind and midlatitude ionosphere has important applications in space weather.

1.3 PMI.03: The Variation of High Latitude Electron Density Distribution with Geomagnetic Activity deduced from IMAGE/RPI Sounding. by Nsumei, Patrick

Status: student not in poster competition Masters

Authors: P. A. Nsumei, B. W. Reinisch, X. Huang, and P. Song Center for Atmospheric Research, Environmental, Earth, and Atmospheric Sciences Department, University of Massachusetts Lowell, USA Patrick_Nsumei@student.uml.edu Bodo_Reinisch@uml.edu Xueqin_Huang@uml.edu Paul_Song@uml.edu

Abstract:

Based on the radio sounding technique, the plasma density distribution in the northern polar region is measured insitu and remotely with the radio plasma imager (RPI) onboard the IMAGE satellite. The

measurements used in this study are in the region above 70 invariant latitudes, and from 1.4 to 5.0 RE, over the period from May to December 2000. An empirical model of the electron density distribution in this region is derived as a function of radial distance and geomagnetic activity. A power law describes the density dependence with radial distance. The density appears to increase exponentially with the Kp index. The altitude dependence of the empirical model at low geomagnetic activity is qualitatively consistent with previous models derived from ISIS 1 and Dynamic Explorer 1 spacecraft.

1.4 PMI.04: Derivation of the energy spectrum of precipitating electrons using multi-wavelengths photometer and EISCAT radar observations by Adachi, Kazuhiro

Status: student in poster competition PhD

Authors: Kazuhiro Adachi, Solar-Terrestrial Environment Laboratory, Nagoya University, kadachi@stelab.nagoya-u.ac.jp Ryoichi Fujii, Solar-Terrestrial Environment Laboratory, Nagoya University, rfujii@stelab.nagoya-u.ac.jp Satonori Nozawa, Solar-Terrestrial Environment Laboratory, Nagoya University, nozawa@stelab.nagoya-u.ac.jp Toshiaki Yamaguchi, Solar-Terrestrial Environment Laboratory, Nagoya University, yamaguti@stelab.nagoya-u.ac.jp Shin-ichiro Oyama, Communications Research Laboratory, oyama@crl.go.jp Asgeir Brekke, Faculty of Science, University of Tromsoe, asgeir.brekke@phys.uit.no Chris M. Hall, Faculty of Science, University of Tromsoe, chris.hall@phys.uit.no Takayuki Ono, Department of Astronomy and Geophysics, Tohoku University, ono@stpp3.geophys.tohoku.ac.jp Shin-ichi Ohtani, The Johns Hopkins University Applied Physics Laboratory, ohtani@larmor.jhuapl.edu Simon Wing, The Johns Hopkins University Applied Physics Laboratory, simon.wing@jhuapl.edu

Abstract:

Ionospheric currents, connected to magnetospheric currents through field-aligned currents, provide indispensable information on the so-called M-I coupling. In order to derive these currents, we need to know spatial and temporal distributions of the ionospheric conductivity and the electric field. In the nightside ionosphere, precipitating electrons produce the conductance. Hence, we believe that optical technique is one of the useful techniques for obtaining the conductance. It is theoretically predicted that the ratio of intensities between certain auroral emissions gives the average energy and flux of incident electrons. However, the validity of this method has not yet been ascertained by other techniques. We hence try to validate this method from experimental viewpoints. For this purpose we have conducted simultaneous multi- wavelengths (427.8 nm, 630.0 nm, 670.5 nm and 844.6 nm) photometer observations and EISCAT UHF radar observations, where, for the first step, the two instruments look into exactly the same magnetic field-aligned direction of the Tromsoe EISCAT site, Norway, in order to avoid possible uncertainties. In this paper, we will present a quantitative comparison of the average energy and flux of precipitating electrons with the photometer and the EISCAT UHF radar. Moreover, we plan to show the preliminary results from the comparison between the photometer data and conjugate DMSP data that directly provide the energy spectra of incident electrons.

1.5 PMI.05: Detecting narrow, field-aligned spatial structures in the auroral ionosphere using the EISCAT Svalbard Radar dual antennas as an interferometer by Grydeland, Tom

Status: student in poster competition PhD

Authors: Tom Grydeland (1) Susumu Saito (2) Cesar La Hoz (3) Tor Hagfors (4) (1) University of Troms, Dept. of physics, The Auroral Observatory N-9037, Troms, Norway Tel: +47 77 64 41 56, Fax: +47 77 64 55 80 E-mail: tom.grydeland@phys.uit.no (2) Kyoto University, Radio Science Center for Space and Atmosphere, Gokasho, Uji Kyoto, 611-0011, Japan Tel: +81 774 31 3847, Fax: +81 774 31 8463 E-mail: susaito@kurasc.kyoto-u.ac.jp (3) As (1) above, but E-mail: Cesar.La.Hoz@phys.uit.no (4) Max-Planck Institut fr Aeronomie, Max-Planck Strasse 2, D-37191, Katlenburg-Lindau, Germany E-mail: hagfors@linmpi.mpg.de

Abstract:

In order to provide observations to help decide between competing theories of Anomalous Ion Spectra (AIS) observed at several Incoherent Scattering Radar (ISR) observatories, to explore the possibility of any connection between this phenomenon and visible auroral forms, and to see if enhanced scattering is due to localised scattering structures, we have used the two antennas of the EISCAT Svalbard Radar (ESR) as an interferometer, recording time series separately from each antenna. This offers an opportunity for high time-resolution observations, and also the possibility of detecting scattering structures localised along the baseline between the two antennas within the radar beam.

1.6 PMI.06: E-region ion temperatures and their relationship to F-region electric fields: ESR and EISCAT observations by MAEDA, Sawako

Status: non-student

Authors: Sawako MAEDA, Kyoto Women's University, smaeda@kyoto-wu.ac.jp Satonori NOZAWA, STEL, Nagoya University, nozawa@stelab.nagoya-u.ac.jp

Abstract:

Simultaneous measurements of high-latitude ionosphere by the EISCAT Svalbard Radar (ESR) at Longyearbyen and the EISCAT UHF radar at Tromso have provided a suitable data set for a comparative study of the E-region ion temperatures in the cusp/cleft region and in the auroral region with respect to F-region electric fields. We report on an analysis of the data obtained from the continuous measurements for the period of 8 - 12 March 1999. The ion temperature at Longyearbyen was maximized for several hours including the local noon. The electric field, however, didn't show a similar variation and the nighttime electric field was sometimes greater than that in the daytime. It seems that the ion temperature and the electric field were not necessarily dependent on a polarity of the IMF Bz component. On the other hand, the ion temperature at Tromso was increased during periods of the southward IMF, and was highly dependent on a magnitude of the electric field and local magnetic field variations.

1.7 PMI.07: Proton Aurora Campaign at Tromso, Norway by Galand, Marina

Status: non-student

Authors: Marina Galand (mgaland@bu.edu), Jeff Baumgardner (jeff@bu-ast.bu.edu), Unni Pia Lovhaug (Dept of Physics, University of Tromso, Norway), Supriya Chakrabarti (supc@bu.edu), and Duggirala Pallamraju (dpraju@bu.edu) Center for Space Physics / Boston University

Abstract:

A High Throughput Imaging Echelle Spectrograph (HiTIES), built at Boston University, was set up last November at Tromso, Norway, for assessing the characteristics of the particle precipitations and the subsequent response of the ionosphere, in a region of intense proton aurora. This site at 66.4 degree N magnetic latitude was chosen because, for moderately disturbed conditions, it is located for several hours at the equator edge of the evening auroral oval, where energetic protons are usually the dominant particle energy source. This site also offers combined experiments with the EISCAT radar probing the ionosphere. HiTIES is a high spectral resolution imaging instrument capable of simultaneously observing multiple wavelength ranges. Four spectral windows were selected around: Ha (656.3nm) and Hb (486.1nm), N2+ 427.8nm and OI 777.4nm. The 8 degree long slit of HiTIES was centered on the magnetic zenith. Information on the weather conditions and the overall auroral activity are provided by a second imaging spectrograph, the Proton Aurora Context (PAC) instrument, of 60 degree field of view and covering the 400-800 nm spectral range. Both optical instruments were successfully operating over the whole winter. We will be presenting PAC and HiTIES observations for January 20th, 2002. We will demonstrate that the spectral resolution of HiTIES (below 0.1 nm) is sufficient to use Ha or Hb for the analysis of proton precipitation.

1.8 PMI.08: Generation mechanisms of spatial and temporal structures of flickering auroras by Sakanoi, Kazuyo

Status: non-student

Authors: Kazuyo Sakanoi, Communications Research Laboratory, ksakanoi@crl.go.jp Hiroshi Fukunishi, Department of Geophysics, Tohoku University, fuku@pat.geophys.tohoku.ac.jp

Abstract:

In order to investigate the generation mechanisms of flickering auroras the high-speed imaging photometer system was operated at Syowa station (-66.2 MLAT) in Antarctica in 1998. The important evidence on the evolution of flickering auroras was found from these observations. That is, neighboring flickering spots (or columns) often appear in pairs and their luminosities change synchronously as if bright and dark spots (or columns) interchange. An isolated flickering spot (or column) is also observed. These flickering spots (or columns) remain in almost the same area during their lifetime and their shapes are smeared every half flickering period. The basic theory of DAW and ray tracing model demonstrate that ray paths of DAW are restricted within a narrow filed-aligned resonance cone. Considering this result, we have proposed a new model in which two waves packets emitted from a localized source and propagating obliquely to the magnetic field line with opposite perpendicular wave vectors interact in the field-aligned resonance cone. Model calculation showed that spatial and temporal structures of two wave packets exhibit similar characteristics as the observed spatial structure and evolution of flickering auroras. All results suggest that combinations of the multi-wave interaction and the resonance cones of DAW in the auroral acceleration region produce the spatial and temporal structures of flickering auroras.

1.9 PMI.09: Measurements of the Saturated Cross-Polar Cap Potential During Periods where Bz < -20 nT by Drake, Kelly

Status: student in poster competition Undergraduate

Authors: Kelly Drake, Marc Hairston, and Rod Heelis Center for Space Sciences University of Texas at Dallas Email: kellyp@utdallas.edu, hairston@utdallas.edu, heelis@utdallas.edu

Abstract:

Previous work by Hairston et al., (2002) showed evidence from DMSP observations of saturation of the cross polar cap potential drop in the polar ionosphere during the 31 March 2001 storm. During that event the Bz component of the IMF ranged from -20 nT to as low as -50 nT, magnitudes great enough for the saturation of the potential predicted by Hill (1984) and Siscoe et al. (2002) to manifest itself. Only six usable measurements (polar passes) were obtained by DMSP during the 31 March 2001 storm. We have searched the ACE database for the period of January 1998 through December 2001 and identified 10 additional events where Bz was less than -20 nT for a period long enough for the ionosphere to react to this extreme condition and for at least one DMSP pass to occur providing us with a measurement of the potential drop. Results from these 14 to 20 additional measurements will be presented to further establish this phenomenon and to define the level of IMF conditions at which saturation begins to manifest itself.

2 Tuesday Evening 18 June 2002 Poster Session Abstracts, Plasma Instabilities and Irregularities

2.1 PII.01: Measurement of the latitudinal extension of plasma bubbles using a network of GPS receivers by Valladares, C.E.

Status: non-student

Authors: C. E. Valladares and R. Sheehan Boston College valladar@bc.edu J. Villalobos University of Colombia ionosfera2001@yahoo.com

Abstract:

Five GPS receivers have been deployed near the 73 degree W longitude meridian to measure the variability of TEC latitudinal profiles and to study the relation of this variability with the onset and evolution of spread-F plasma structures. These 5 GPS receivers, together with 2 other that form part of the IGS network, 3 more that belong to the South Andes project (SAP) network provide TEC values between 15 degree N and 40 degree S geographic latitude. In addition to providing TEC values, all five GPS receivers also measure the amplitude scintillation. This fact allows us to know the maximum latitude to which the irregularities extend to and then infer the maximum altitude of the plasma bubbles. We will present scintillation data and TEC values collected during the first 6-month period of the operation of the GPS receiver located in Bogota, Colombia. We have found that the maximum latitude of the scintillations is closely related to the location of the crest of the anomaly.

2.2 PII.02: Latitudinal distributions of total electron content and the onset of equatorial irregularities by Valladares, C. E.

Status: non-student

Authors: C. E. Valladares and R. Sheehan Boston College valladar@bc.edu

Abstract:

During the last 2 years, five GPS receivers have been deployed in different cities of Peru and Colombia. Total electron content (TEC) measurements from these receivers and from six other receivers, which are located in Peru and Chile, have been used to construct the latitudinal profiles of TEC extending 25 degrees at both sides of the magnetic equator. During the equinoxes, we commonly observe the crests of the anomaly located between 12 and 20 degrees away from the magnetic equator and a deep trough in between. During the solstices the anomaly is less pronounced. Nevertheless, it is quite detectable. Fine inspection of the TEC latitudinal profiles measured between 1998 and 2001 have indicated that during the equinoxes exist a close relationship between the temporal evolution of the TEC profiles near sunset and the onset of equatorial spread F (ESF). We have examined the TEC latitudinal distributions in two different ways. First, we calculated time difference profiles usi! ng! the distributions corresponding to 1800 and 2000 LT. The second method involves using a parameterization of the TEC distributions obtained at 2000 LT. The first method indicates quite drastic increases of the crest values and sharp decreases near the trough during ESF days. In contrast, during days of no ESF there exist almost uniform TEC decreases at all latitudes. The second method displays a preferred high crest/trough ratio (¿2), small TEC values at the trough, and large latitudinal integrated values during ESF events. During the December solstice the crests of the equatorial anomaly are not very pronounced, but a sharp decrease of TEC at the magnetic equator and an increase of the TEC at the crests precedes the onset of irregularities. We have also used a numerical model of the low-latitude ionospheric and varied the input values of the vertical drift and the meridional wind to reproduce the variability of the TEC profiles observed near sunset. This method proves to be very successful to reproduce the observed TEC distributions. This study suggests that recording the time variability of the TEC latitudinal distributions and using a numerical model can be used to forecast the onset of ESF.

2.3 PII.03: DMSP Observations of Equatorial Plasma Bubbles: Positive Correlation with Geomagnetic Activity in the Pre-Midnight Sector by Krause, Linda

Status: non-student

Authors: L. Habash Krause and D. J. Knipp U. S. Air Force Academy, Department of Physics linda.krause@usafa.af.mil delores.knipp@usafa.af.mil

Abstract:

Observations of equatorial ionospheric plasma bubbles during periods of strong geomagnetic activity suggest a positive correlation between impulsive increases in the cross polar cap potential and plasma bubble activity in the pre-midnight sector. Data from four DMSP sunsynchronous satellites, all with equator crossing local times ranging from 18:00 to 21:30, were analyzed to assess the effects of geomagnetic activity controlled by Coronal Mass Ejections (CMEs) on equatorial plasma bubble occurrence. Of the five CME events that were examined, all were associated with equatorial plasma bubble activity in the pre-midnight sector. Two possible explanations for this correlation are 1) the CMEs transferred enough energy and momentum to the polar ionosphere to instigate traveling ionospheric disturbances (TIDs), eventually causing a perturbed equatorial ionosphere, and 2) there was prompt penetration of eastward magnetospheric electric fields toward the low latitude ionosphere, thus facilitating bubble growth. In this study, the evidence supports the latter explanation. From previous studies of TID propagation speeds, there should be a six hour delay between the onset of strong geomagnetic activity and equatorial plasma bubble occurrence, but offset times in this study are much shorter, ranging from 20 minutes to four hours. The latter explanation is supported by an examination of the Polar Cap Index (PCI) shortly before bubble occurrence. Impulsive increases in the cross polar cap potential produce low latitude eastward penetration electric fields in the pre-midnight sector, and impulsive increases in the PCI have been recorded for all five days examined in this study. This work provides the impetus to conduct a rigorous statistical analysis of pre-midnight plasma bubble formation correlated with impulsive increases in the PCI to assess the value in using the PCI as a plasma bubble forecasting tool.

2.4 PII.04: Ion velocity effects on radar observations of the high latitude Farley-Buneman instability in the upper E region by Drexler, Josef

Status: student in poster competition

Authors: Josef Drexler, University of Western Ontario, jdrexler@uwo.ca J.-P. St.-Maurice, University of Western Ontario, jstmauri@uwo.ca

Abstract:

In the upper E-region, Farley-Buneman waves grow if the phase speed in the ion frame of reference is larger than the ion-acoustic speed. Radar observations will most often detect echoes at or nea threshold, i.e. echoes with a phase velocity equal to the ion-acoustic speed, but measured in the ion frame of reference. However when observed with a radar, the backscatter is doppler-shifted by the phase speed given in the radar frame of reference. As a result, in the radar's frame of reference, the measured doppler shift is offset by the line-of-sight component of the ion drift velocity. This difference can be substantial at altitude above 115 km, and must be taken into account when interpreting echoes that might come from higher altitudes. For observations perpendicular to the ExB drift, the line-of-sight component of the phase speed is zero, but in the ion frame of reference, the phase speed can be quite large. Therefore, waves can be linearly unstable even perpendicular to the flow, as long as the electric field exceeds 1.4 times the ion-acoustic speed.

2.5 PII.05: A preliminary numerical investigation of the Perkins instability by Zhou, Qina

Status: student in poster competition PhD

Authors: Q. N. Zhou, Penn State Univ. J. D. Mathews, Penn State Univ. Q. Du, Penn State Univ. C. A. Miller, Univ. of Wisconsin

Abstract:

Perkins [1973] utilized three non-linear moment (partial differential) equations to describe the electrodynamic turbulence (spread-F) behavior of the mid-latitude ionosphere. Although there have been some analytical approximations to this PDE system, an accurate numerical solution of the full non-linear equations yields more details and insights. The pseudo-spectral numerical solution method is known for its high accuracy and is ideal for solving these equations. While assuming the TECs along the magnetic field lines are all the same, following Miller [1996], we investigate instability growth rate as a function of wave vector and electrical field size/direction and check whether self-similar structures are supported in the layer. Finally, we give an example of saturation state.

2.6 PII.06: A Study of Sporadic E Irregularities with SNR and Phase Measurements from GPS Occultation Experiments by Wu, Dong

Status: non-student

Authors: Dong L. Wu, Chi O. Ao, George A. Hajj, Manuel de la Torre Juarez, and Anthony J. Mannucci Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California dwu@mls.jpl.nasa.gov

Abstract:

Thin electron density layers in the ionospheric E-region produce strong fluctuations in signal amplitude (SNR or signal-to-noise ratio) and phase of GPS occultation measurements. Here we present a variance analysis of these fluctuations for vertical scales near and less than Fresnel scale as observed recently by CHAMP receivers, and report monthly climatology for June 2001 and January 2002. To extract the short-scale fluctuations, we use 1-s running windows to remove large-scale variations in SNR and phases, where the 1-s interval corresponds to a vertical distance of 2km for CHAMP. L1 and L2 phases are analyzed separately and detrended twice with the 1-s running windows. Both SNR and phase zonal mean variances reveal similar structures of sporadic-E at heights between 90 and 120km, showing strong-and-extended activities in the summer hemisphere and weak-and-confined activities in the winter hemisphere. Comparing the variances in June 2001 and January 2002, we find that polar sporadic-E activities are strong in the northern hemisphere during January but nearly absent in the southern hemisphere during June, which may suggest their relations to orographical wave sources from the lower atmosphere. The SNR and phase fluctuations also exist in the tropospheric heights, showing good correlation with the tropopause or cloud top statistics. These features are beyond the scope of this paper and will be investigated in separate studies.

To interpret the SNR and phase variances observed in GPS occultation, we use a multiple phase screen model to simulate SNR and phase responses to various wave structures artificially generated in the E-region. We find that the SNR variance responses to electron density perturbations maximize at 1km vertical wavelength whereas the phase responses maximize at 2km. Since the SNR is roughly proportional to the first derivative of refractive index, the variance diminishes at large scales as the vertical gradient decreases. For perturbations at very small scales, the signal power is spread over a large range of angles by diffraction, which causes a decrease again in the SNR variance. On the other hand, signal phase delays are proportional to refractive index, which have no cutoffs at large scales except for the 1-s high-pass filter we implement. As expected, the 1-s high-pass filter works to remove components of scales greater than 2km. For short scale perturbations, the reduction in phase variances is controlled by the limb averaging of long path length, which can wash out high-frequency fluctuations significantly.

2.7 PII.07: Influence of auroral processes upon low latitude dynamics and irregularities by Martinis, Carlos

Status: student in poster competition PhD

Authors: Carlos Martinis, Jules Aarons, and Michael Mendillo Center for Space Physics Boston University

Abstract:

The effects of the April, 6-7, 2000, geomagnetic storm at low latitudes were studied. An allsky imaging system at El Leoncito, Argentina, recorded airglow depletion characteristics, associated with the occurrence of equatorial plasma irregularities. Total Electron Content (TEC) and its rate of change, dTEC/dt, were obtained from the IGS network. On April 7, the day of the storm, an enhanced Equatorial Ionization Anomaly (EIA) was observed. The occurrence of post-sunset and post-midnight irregularities was also observed. The airglow images showed nighttime westward motion during all night. This unusual pattern is attributed to the ionospheric disturbance dynamo. A synthesis for the occurrence of post-sunset and post-midnight irregularities is presented.

2.8 PII.08: Three-Dimensional Spatial Structures of Mid-latitute Type 1 and Type 2 Es Irregularities by Chu, Yen-Hsyang

Status: non-student

Authors: Yen-Hsyang Chu Institute of Space Science/Center for Space and Remote Sensing Research, National Central University, Chung-Li, Taiwan, R.O.C. Chien-Ya Wang Department of Physics, Chinese Culture University, Taipei, Taiwan, R.O.C.

Abstract:

Although the plausible mechanisms involved in the generation of mid-latitude type 1 sporadic E (Es) irregularities have been suggested, rare observational evidence is provided to validate the proposed plasma structure associated with the mid-latitude type 1 Es irregularities. In this article, the type 1 echoes observed by the Chung-Li VHF radar located in the equatorial anomalous region are interferometrically analyzed and the corresponding plasma structure of the type 1 irregularities is reconstructed. We find that the plasma structure has sharp lateral and top and bottom boundaries with thickness of about 1 - 2 km and horizontal extent of about 3 - 5 km in E-W direction. Its dimension in N-S direction cannot be resolved by using interferometry technique because of considerably narrow width of expected echoing region in elevation. The observed Doppler velocity of the type 1 echoes can be as low as 220 m/s, substantially smaller than nominal ion acoustic wave speed (about 360 m/s) in Es region. The spatial structure of the concurrent type 2 irregularities is also reconstructed. The result strongly suggests that it be a well-defined thin layer with thickness of 1 - 2 km and horizontal extent of 9 - 17 km in E-W direction, very different from that of the type 1 irregularities. The whole structure of type 1 irregularities moves bodily toward east at speed of about 31 m/s and no vertical displacement of the structure is observed. Although the movement of the layer structure of the type 2 irregularities in E-W direction is indistinct, it descends remarkably at a rate of 10.3 m/s. These features imply that for the present case the factors governing the dynamic behavior of the type 1 and type 2 irregularities are different and independent, irrespective of the fact that the clump of the type 1 irregularities separates from that of concurrent type 2 irregularities only by about 4 km in distance.

3 Tuesday Evening 18 June 2002 Poster Session Abstracts, Topside Composition and Dynamics

3.1 TOP.01: Observations of geocoronal H emission intensities Observations of geocoronal H-alpha emission intensities over changing solar geophysical conditions by Nossal, Susan

Status: non-student

Authors: S Nossal, Dept. of Physics, University of Wisconsin-Madison nossal@wisp.physics.wisc.edu; F.L. Roesler, Dept. of Physics, Univ. of Wisconsin-Madison roesler@wisp.physics.wisc.edu; R.J. Reynolds, Dept. of Astronomy,Univ.of Wisconsin-Madison reynolds@astro.wisc.edu; E.J. Mierkiewicz, Dept. of Atmospheric and Oceanic Sciences, Univ. of Wisconsin-Madison, emierk@ssec.wisc.edu; J. Bishop, E.O. Hulburt Center for Space Research, Nsval Research Laboratory, jbishop@uap2.nrl.navy.mil G. Madsen, Dept. of Astronomy, Univ. of Wisconsin-Madison madsen@astro.wisc.edu

Abstract:

We will present observations of thermospheric + exospheric hydrogen H-alpha emissions taken by the Wisconsin H-alpha Mapper Fabry-Perot (WHAM) during the time period of 1997 through 2001. WHAM has acquired more than 37,000 spectra to date over about 100 nights. These observations span from near solar minimum through solar maximum conditions. The WHAM Fabry-Perot is located at the Kitt Peak Observatory near Tucson, Arizona and is remotely operable from Wisconsin. WHAM's resolving power is sufficient for the retrieval of the geocoronal H-alpha emission intensity, but not for the resolution of the line profile. The resolution, precision and high signal-to-noise of the WHAM Fabry-Perot facilitate the separation of the terrestrial emission from the galactic emission. Variability in the WHAM geocoronal H-alpha observations over the rise of the solar cycle is limited to within about 35emissions observed during solar maximum conditions. This result is consistent with observed limits to the variability over the past solar cycle made using similarly designed Fabry-Perot instruments, but with photomultiplier detection, from midlatitude Wisconsin and Haleakala observing sites. These data are also consistent with comparisons made between winter solstice zenith observations taken during the early 1990's from Wisconsin (NSF-CHARM campaign) and WHAM zenith observations.

3.2 TOP.02: Comparison of the He+ layer seen above Arecibo with the CTIP model and the DMSP satellites by Wilford, Chris

Status: student not in poster competition

Authors: C.R. Wilford, University of Sheffield, UK. c.wilford@sheffield.ac.uk R.J. Moffett, University of Sheffield, UK. r.moffett@sheffield.ac.uk J.M. Rees, University of Sheffield, UK. j.rees@sheffield.ac.uk G.J. Bailey, University of Sheffield, UK. g.bailey@sheffield.ac.uk S.A. Gonzalez, Arecibo, sixto@naic.edu R.A. Heelis, UTD, heelis@utdallas.edu

Abstract:

Improvements in the measuring techniques used at the Arecibo incoherent scatter radar (ISR) now mean that it is possible to make accurate measurements of the light ion concentrations up to altitudes of approximately 2000 km. Data from the Arecibo radar show the formation of night time He+ layers at an altitude of approximately 800 km. Data from DMSP satellites are also available. The CTIP model is used to study phenomenon of He+ layering. Results from Arecibo are presented and compared with results from the DMSP F13 satellite and the CTIP model.

3.3 TOP.03: Fabry Perot Observations of the Hydrogen Geocorona by Mierkiewicz, Edwin

Status: student in poster competition PhD

Authors: E. Mierkiewicz, UW-Madsion, emierk@wisp.physics.wisc.edu F. Roesler, UW-Madsion, roesler@wisp.physics.wisc.edu S. Nossal, UW-Madison, nossal@wisp.physics.wisc.edu

Abstract:

The recently developed technique of Fabry-Perot annular summing spectroscopy has greatly improved the quality and quantity of geocoronal emissions data. Geocoronal observations with a large-aperture (15 cm), double etalon Fabry Perot spectrometer, specifically designed for the annular summing technique, and dedicated to aeronomical research, have been underway since December 1999. A signal to noise ratio of approximately 50 can be obtained for a typical geocoronal Balmer alpha intensity in a 10 minute integration, covering a 70 km/s velocity interval with 3.5 km/s velocity resolution, from a 1.5 degree beam on the sky. On a "good night", 20 to 40 spectra are obtained. Thus far 70 nights of data have been acquired. Because of the success of the annular summing technique, ground based measurements of the extremely faint (sub Rayleigh) Balmer beta airglow emission feature are also practical, and are being made.

This poster will present an overview of the Wisconsin geocoronal research program underway at the Pine Bluff Observatory and first results including: effective temperatures obtained from the Balmer alpha emission, cascade excitation results, and intensity data from both Balmer alpha and Balmer beta.

3.4 TOP.04: A statistical look at ion upflows and upfluxes as seen by Incoherent Scatter Radar by Remick, Karen

Status: student in poster competition PhD

Authors: Karen Remick Geophysical Institute - University of Alaska - Fairbanks

Abstract:

In recent years, the importance of the ionospheric contribution to the magnetospheric system has become evident. Incoherent Scatter Radar has the capability to look at the source regions of the ions flowing out into the magnetosphere. This study uses statistics to look at the distribution of upflows and upfluxes, as well as the ionospheric conditions during these times in order to characterize the conditions associated with the ionospheric upfluxes which may be responsible for populating the magnetosphere.

3.5 TOP.05: Naturally enhanced ion lines in incoherent scatter radar data by Stromme, Anja

Status: student in poster competition PhD

Authors: Anja Stromme (1,2) anja@phys.uit.no Anthony van Eyken (2) anthony.vaneyken@sri.com Joshua L. Semeter (2) joshua.semeter@sri.com Richard A. Doe (2) richard.doe@sri.com Unni Pia Lovhaug (1) unni@phys.uit.no 1: Auroral Observatory, University of Tromso, Norway 2: SRI International CGS, Menlo Park, CA, USA

Abstract:

Since the early 1980s, naturally enhanced ion lines (NEIL), with strongly enhanced power and asymmetries between the up and down shifted ion shoulders, have been observed regularly with incoherent scatter radars. Several plasma instabilities have been suggested to account for the growing ion acoustic wave modes believed to be responsible for scattering the incident radar signals. The EISCAT Svalbard Radar (ESR) and the Sondrestrom incoherent scatter radar are located at about the same magnetic latitude (75 deg and 74 deg invariant latitude respectively), but operate at different frequencies (fESR=500 MHz and fSon=1290 MHz). At lower latitudes, the EISCAT radars in Tromso have reported large numbers of these echoes at radar frequencies of both 224 and 933 MHz. While fewer such echoes have been recorded at the ESR (reported in several NEIL papers published over the years), none at all have been reported from the Sondrestrom radar. In this poster, we will investigate the threshold parameters for some of the proposed instability processes which might cause the growing ion acoustic waves. In particular, we will investigate the k-vector (or frequency) dependence of the instabilities, and discuss the effect of the different radar frequencies on the apparent lack of NEIL in Sondrestrom data.

4 Tuesday Evening 18 June 2002 Poster Session Abstracts, Part 1 Measurements and Analysis Techniques

4.1 MAT.01: Spectroscopic Observations of 777.4 nm Atomic Oxygen Emission: An Investigation of Ionospheric Electron Density Profiles by Comberiate, Joseph

Status: student in poster competition PhD

Authors: Joseph Comberiate, University of Illinois, comberia@uiuc.edu Romina Nikoukar, University of Illinois, nikoukar@uiuc.edu Farzad Kamalabadi, University of Illinois, farzadk@uiuc.edu Gary R. Swenson, University of Illinois, swenson1@conrad.ece.uiuc.edu

Abstract:

Ionospheric electron density profiles can be indirectly observed through measurement of the density of atomic oxygen, the dominant constituent of the ionosphere at 200 km. A characteristic emission from an excited electron falling from the 3p to the 3s energy level is at 777.4 nm. This emission is dominantly generated from absorption of sunlight, so it can be measured in atmospheric dayglow. The 777.4 nm emission can be measured effectively using a spectrometer, allowing the brightness peak to be separated from continuous background emissions. Observations were taken for several nights in April and May at the Urbana Atmospheric Observatory. The instrument was oriented such that observations could be taken looking across the terminator before sunrise and after sunset, thereby allowing measurement of ionospheric dayglow without direct interference from the sun. This project will investigate the potential of obtaining ionospheric electron density profiles with this insturment, as well as the feasibility of combining the data with space-based EUV measurements at 135.6 nm (e.g. as measured by GUVI instrument on TIMED satellite launched in December 2001).

4.2 MAT.02: Observations of artificial heater-induced airglow during the February 2002 optical campaign at the High Frequency Active Auroral Research Program in Gakona, Alaska by Gerken, Elizabeth

Status: student not in poster competition

Authors: Elizabeth Gerken STAR Laboratory, Stanford University egerken@stanford.edu Todd Pedersen Naval Research Laboratory Todd.Pedersen@hanscom.af.mil Craig Selcher Naval Research Laboratory selcher@itd.nrl.navy.mil Mike McCarrick Advanced Power Technologies, Inc. mmccarri@apti.com Dave Sentman University of Alaska, Fairbanks dsentman@gi.alaska.edu Ralph Wuerker University of California, Los Angeles rwuerker@physics.ucla.edu Jacqueline Pau University of California, Los Angeles pau@physics.ucla.edu Umran Inan STAR Laboratory, Stanford University inan@nova.stanford.edu Al Wong University of California, Los Angeles awong@physics.ucla.edu Minoru Kubota Communications Research Laboratory, Japan mkubota@crl.go.jp Akinori Saito Kyoto University, Japan saitoua@kugi.kyoto-u.ac.jp

Abstract:

An optical campaign was conducted January 31 February 19, 2002 at the High Frequency Active Auroral Research Program (HAARP) in Gakona, Alaska. 630nm and/or 557.7nm artificial airglow was observed on thirteen nights. Three cameras were stationed at HAARP, two at Poker Flat Research Station and one at the HIPAS heating facility. At HAARP there was an all-sky imager, a 60 degree field of view imager, and a 1 degree field of view telescopic imager. During this campaign a dramatic enhancement in airglow brightness was observed when the heater beam was directed along the magnetic field lines (15 degrees from vertical). The airglow spot was displaced within the heater beam and the spot size was found to vary little with heating frequency. 630nm and 557.7nm airglow were observed simultaneously on several nights when the heater frequency was near the foF2 critical frequency. Side view imaging revealed field-aligned striations on some nights and amorphous glows on others. Propagating airglow patches were observed from HAARP to pass at a nearly constant velocity through the heater beam. Airglow was observed at even the

low power level of 1kW per transmitter. Airglow was observed during periods of spread-F. Images from the various participating cameras as well as other HAARP diagnostics and measurements by an SEE receiver are presented to illustrate these preliminary results from the campaign.

4.3 MAT.03: Ionospheric Occultation Experiment (IOX) Measurements of F-Region Peak Characteristics and Scintillation by Straus, Paul R

Status: non-student

Authors: Paul R Straus The Aerospace Corporation Mail Stop M2/259 PO Box 92957 Los Angeles, CA 90009 paul.straus@aero.org

Abstract:

The Ionospheric Occultation Experiment (IOX) is a dual- frequency GPS receiver with a single Earth-limb viewing antenna. Ionospheric remote sensing is possible during occultation events in which the line of sight to a GPS satellite being tracked by IOX sets through the Earth's limb. IOX is in a 67 inclination, 800 km altitude orbit, enabling it to make ionospheric measurements at all local times under near-solar maximum conditions over the course of its mission. IOX has been making routine measurements of occulting GPS satellites since the latter part of November 2001. Observations of the differential phase of the L1 and L2 GPS signals can be used to derive electron density profiles. In addition, fluctuations in the C/A code tracking loop signal-to-noise ratio appear to indicate the presence of ionospheric scintillation. A preliminary evaluation of profile and scintillation parameters derived from the occultation measurements will be presented and compared to climatological expectations.

4.4 MAT.04: Operating Principals and Initial Validation of In-Situ Neutral Wind Instruments by Roddy, Patrick A.

Status: student not in poster competition PhD

Authors: Patrick A. Roddy, UTD, roddy@utdallas.edu Greg D. Earle, UTD, earle@utdallas.edu Roderick A. Heelis, UTD, heelis@utdallas.edu

Abstract:

Neutral winds are and important driving force in the ionosphere, but have proven difficult to measure absolutely. The new Ram-wind (RWS) and Cross-track (XTRK) sensors being developed for NASA's Coupled Ion-Neutral Dynamics Investigation (CINDI) will enable in-situ measurements of the 3-D neutral wind field with unprecedented accuracy and resolution. The CINDI mission will be launched in late 2003 aboard the US Air Force's C/NOFS satellite. It will fly in a low inclination orbit with perigee in the ionospheric F-region. This poster reviews the role of the neutral wind in various ionospheric phenomena, describes the operation of the two neutral wind instruments, and presents preliminary test data from the instruments to validate their capabilities.

4.5 MAT.05: Solar Cycle Variations in Nighttime Electron Densities by Henderlight, Erin E.

Status: non-student

Authors: E.E. Henderlight, NRL, ehenderlight@ssd5.nrl.navy.mil K. F. Dymond, NRL, kdymond@ssd5.nrl.navy.mil S.E. McDonald, NRL,smcdonald@ssd5.nrl.navy.mil A. C. Nicholas, NRL, anicholas@ssd5.nrl.navy.mil S. E. Thonnard, NRL, sthonnard@ssd5.nrl.navy.mil S.A. Budzien, sbudzien@ssd5.nrl.navy.mil R.P. McCoy, ONR, mccoy@tip.nrl.navy.mil

Abstract:

The Advanced Research and Global Observations Satellite (ARGOS) was launched in February of 1999 in a 0230/1430 local time, sun-synchronous orbit and consists of several remote-sensing instruments that

measure density, composition, and temperature of both the thermosphere and ionosphere. The Low Resolution Airglow and Auroral Spectrograph (LORAAS) aboard ARGOS monitors upper atmospheric airglow in the far-ultraviolet and extreme-ultraviolet passband. LORAAS is identical to the Special Sensor UV Limb Imager (SSULI) instrument whose mission will be starting late this year and continuing on the next four Defense Meteorological Satellite Program (DMSP) satellites. We have inverted intensity profiles, of the OI 1356 emission, to obtain electron density profiles of the ionosphere over the peak of the solar cycle. This poster will present and compare results from the month of December in the years 1999, 2000, and 2001.

4.6 MAT.06: The saturation effect of ionospheric ionization by Liu, J. Y.

Status: non-student

Authors: Liu, J. Y., Institute of Space Science, and Center for Space and Remote Sensing Research, National Central University, TAIWAN, jyliu@jupiter.ss.ncu.edu.tw Chen, Y. I., Institute of Statistics, National Central University, TAIWAN, ychen@stat.ncu.edu.tw

Abstract:

This study explores the saturation effects in the ionospheric foF2 due to sunspot number R, solar radio noise (10.7 cm) flux F10.7, and solar EUV fluxes. To locate the R, F10.7, or EUV value at which the foF2 values are saturated, a two-segmented regression model is built based on the data of the strictly rise period of the 21st solar cycle recorded by eight ionosonde stations scattering roughly between 40XN and 40XS geomagnetic latitude. Results show that clear saturation features appear around the equatorial anomaly crest regions. The regression model is then fitted into the foF2 data observed at Chung-Li station (13.8XN, geomagnetic) to investigate the hourly variation of the saturation effect. The saturated foF2, slope and the value of the R or EUV at which the foF2 values are saturated in the fitted models are closely related to the overall mean and standard deviation of foF2. The hourly results demonstrate that the daily ionospheric equatorial fountain and prereversal enhancement are important for the saturation features.

4.7 MAT.07: A study of the nighttime variation in mode structure of VLF signal propogation in the earth-ionosphere waveguide. by Peter, William

Status: student in poster competition Masters

Authors: William Peter Stanford University wpeter@stanford.edu Umran Inan Stanford University inan@nova.stanford.edu Geoff Bainbridge Stanford University geoff_bainbridge@yahoo.com

Abstract:

The mode structure of a sub-ionospheric Very Low Frequency (VLF) wave propagating in the earth-ionosphere waveguide can be determined by measuring the amplitude and phase of the signal at nine receiver sites. Monitoring the NAA broadcast signal (1000 kW, 24.0 kHz), and using amplitude and phase data from these nine stations, a resolution of five modes can be achieved with an average error of six percent. The variations of mode structure are studied over the course of one night, using simultaneous broadband measurements occurring every half hour. Although not discussed in this paper, these mode parameter measurements can be used to model the change of electron density in the nighttime D-region ionosphere.

4.8 MAT.08: TIDs Observed over Texas using the TIDDBIT HF Doppler Radar by Bronn, Justin

Status: student in poster competition Undergraduate

Authors: Justin Bronn (justin.bronn@trinity.edu) Geoff Crowley (crowley@picard.space.swri.edu) Brent Fessler (bfessler@swri.edu) Eddie Weigle (gweigle@swri.edu) Alan Eckhardt (aeckhardt@swri.edu) Carl Zigmund (czigmund@swri.edu) Kevin Jennings (jjenning@swri.edu) - All Southwest Research Institute Greg Wene (gwene@utsa.edu) - University of Texas at San Antonio

Abstract:

The HF Doppler radar technique has been used for the observation of traveling ionospheric disturbances (TIDs) for many years. Previously, systems have been analogue, making data analysis difficult. We have designed and built a completely digital system called "TIDDBIT" (TID Detector Built In Texas) together with a Graphical User Interface (GUI) to perform end-to-end data analysis. The system performs spectral analysis of the ionospheric returns to provide a complete specification of the TID wave packet. Horizontal speeds and azimuths, together with vertical velocities are estimated as a function of wave period.

The TIDDBIT radar has successfully measured TIDs over Texas for the first time, and we present results from various geophysical conditions showing different TID characteristics.

5 Tuesday Evening 18 June 2002 Poster Session Abstracts, Part 1 Modeling and Simulation

5.1 MOD.01: Uncertainties Involved in the Ionospheric Conductivity Estimation by Kwak, Y.-S.

Status: student in poster competition PhD

Authors: Y.-S. Kwak, Kyungpook National University, Daegu, Korea ys-kwak@hanmail.net B.-H. Ahn, Kyungpook National University, Daegu, Korea bhahn@knu.ac.kr A. D. Richmond, High Altitude Observatory, NCAR, Boulder, CO richmond@hao.ucar.edu B. A. Emery, High Altitude Observatory, NCAR, Boulder, CO emery@hao.ucar.edu

Abstract:

Various electrodynamical quantities, such as electric field, ionospheric currents and Joule heating rate etc. are utilized in modeling studies of the magnetosphere/thermosphere/ ionosphere electrodynamics. The ionospheric conductivity distribution is closely associated with these quantities. Considering its importance in the M-T-I coupling study, the accurate determination of the ionospheric conductivity distribution is highly desirable. Unfortunately no systematic attempt to evaluate the uncertainties involved in the ionospheric conductivity estimation has been made. As an effort to provide the community with an idea about the uncertainties, we examine various sources involved in the ionospheric conductivity estimation, particularly the one based on the electron density profile obtained from incoherent scatter radars. Specifically we examine the influence of the uncertainty associated with the temperature measurement in determining the electron density profile and the ion-neutral and electron-neutral collision frequencies, and the dependence of the neutral atmospheric models on the conductivity estimation. Also examined is how the height range of integration affects the height-integrated conductivity, conducance. The selection of the lower and upper boundaries are quite sensitive in determining the Hall and Pedersen conductances, respectively.

5.2 MOD.02: NEURAL NETWORK DEVELOPMENT FOR THE FORECASTING OF UPPER ATMOSPHERE PARAMETERS DISTRIBUTIONS by Martin, Jeff

Status: student in poster competition Undergraduate

Authors: Jeff Martin School of Engineering and Applied Science, Miami University martinjd@muohio.edu Dr. Y.T. Morton School of Engineering and Applied Science, Miami University mortonyt@muohio.edu Dr. Qihou Zhou Arecibo Observatory zhou@naic.edu

Abstract:

This project presents a neural network modeling approach used to forecast distributions of various atmospheric parameters such as electron density, ion temperature, and electron temperature in the 150 to 600 km altitude range. The neural network is trained using incoherent scatter radar data collected at the Arecibo Observatory during the past two decades, as well as the solar planetary indexes provided by the National Space Science Data Center. The data set covers nearly two solar cycles, allowing the neural network to model daily, seasonal, and solar cycle variations of the upper atmospheric parameters distributions. The network design, training strategy, data analysis, as well as preliminary testing results of the network will be discussed.

5.3 MOD.03: A New Upper Atmosphere Model by Deng, Yue

Status: student in poster competition PhD

Authors: Y. Deng, A.J. Ridley, C.R. Clauer, T.I. Gombosi

Abstract:

We present a progress report on our creation of a new upper atmosphere model (UAM). This new model solves for the coupled thermosphere - ionosphere system, and is built upon a flexible grid structure which allows high resolution simulations of the upper atmosphere. This grid structure is designed to be run in parallel using MPI. The model can be started with an MSIS derived atmosphere and an IRI derived ionosphere, and can be driven at high latitudes by output derived from the AMIE technique. We present some limited runs which show neutral winds being spun up by high-latitude ionospheric convection, electron ionization caused by solar illumination and auroral precipitation, and some basic tests to show that most of dynamics are working properly.

5.4 MOD.04: The use of Empirical Orthogonal Functions (EOFs) in the AMIE Procedure: Effects of Improved Background Error Covariance by Matsuo, Tomoko

Status: student in poster competition PhD

Authors: Tomoko Matsuo and Arthur D. Richmond, NCAR-HAO, P.O. Box 3000, Boulder, CO 80307-3000, United States, tmatsuo@ucar.edu; richmond@ucar.edu

Abstract:

The Assimilative Mapping of Ionospheric Electrodynamics (AMIE) procedure [Richmond and Kamide, 1988] estimates high-latitude ionospheric electrodynamic variables by objectively synthesizing observations y and prior information (climatology) x_b. The optimal estimate of variables x_a is obtained by making a correction to the background (climatological) fields of first guess x_b, as following:

$x_a = K(y - H(x_a)) + x_b$,

where K is an optimal weight matrix. For this optimal weight to be truly optimal, an accurate representation of the background error covariance is known to be crucial. Modeling of the background error covariance in a data sparse region such as the upper atmosphere is a challenging problem, as the spatial correlation over a large range needs to be taken into account in order to be able to impose constraints even in the data void area.

EOFs are a set of orthogonal functions adapted to dominant modes of the natural variability in the system, and therefore the use of EOFs as a basis in data assimilation procedures enables the procedures to automatically take account of the spatial coherence of the variables as well as effectively diagonalize the background error covariance. Improvements of the background error covariance in the AMIE procedure are being made by employing the set of the 11 EOFs of Matsuo et al. [2002].

5.5 MOD.05: Joule heating as a function of Polar Cap (PC) Index and Distrubance Storm Time (Dst) Index by Knipp, Delores J.

Status: non-student

Authors: Delores J. Knipp and Terrence Welliver Department of Physics US Air Force Academy, CO 80840 delores.knipp@usafa.af.mil

Abstract:

We have investigated a method for estimating high latitude geomagnetic heating from near real-time geomagnetic indices. This work follows that of Chun et al. 1999 (JGR). They estimated Joule heating from the Polar Cap (PC) index alone. In comparing those heating estimates with data from many Assimilative Mapping of Ionospheric Electrodynamics (AMIE) campaigns we found that using the PC Index alone often underestimated the heating during large storms. We believe this underestimate occurred because the PC Index, which represents the solar wind-ionosphere coupling, does not effectively account for magnetosphere-ionosphere coupling. We have completed a new regression analysis that includes the PC Index, the Disturbance Storm Time (Dst) Index and an indicator of major storm activity (MSI) that roughly accounts for changes in conductivity that occur during large storms. Our new fit is $JH(GW) = .586 + 24.73(PCI) + 3.15(PCI^2) - .501(DST) + 28.75(MS1)$ We will show a comparison of

regression and AMIE heating estimates for quiet times, periods of high speed solar flow and for storm intervals.

5.6 MOD.06: The coupled Magnetosphere-Thermosphere-Ionosphere Electrodynamics General Circulation Model (MTIEGCM) by Maute, Astrid

Status: non-student

Authors: A. Maute (*), C. Peymirat (**), A.D. Richmond (*), R.G. Roble (*) * High Altitude Observatory National Center for Atmospheric Research Boulder, CO 80307-3000, USA maute@ucar.edu richmond@ucar.edu roble@ucar.edu
** Centre d'Etude Spatiale des Rayonnements 9 Avenue du Colonel Roche 31028 Toulouse Cedex, France peymirat@cesr.fr

Abstract:

The National Center for Atmospheric Research Thermosphere-Ionosphere-Electrodynamics General-Circulation Model (TIE-GCM) was coupled with the Ionosphere-Magnetosphere Model (IMM). The resultant MTIEGCM can simulate self-consistently the dynamics of the inner magnetosphere, the ionosphere and the thermosphere assuming closed magnetic field lines. To study the influence of the coupling with the magnetosphere, ionospheric electric fields and ground-level geomagnetic perturbations simulated with the MTIEGCM are compared with those from a control simulation in which magnetospheric coupling is absent. Differences are found not only in the polar regions, but also at middle and low latitudes. We examine these differences in relation to observations.

5.7 MOD.07: The role of the ion-drag process in the coupled Ionosphere-Thermosphere system by Maruyama, Naomi

Status: student in poster competition PhD

Authors: Naomi Maruyama, Earth and Planetary Science, Hokkaido University, naomi@ep.sci.hokudai.ac.jp, Shigeto Watanabe, Earth and Planetary Science, Hokkaido University, shw@ep.sci.hokudai.ac.jp, Timothy Fuller-Rowell, Space Environment Center, NOAA, tim.fuller-rowell@noaa.gov

Abstract:

We have developed a 3-dimensional coupled model of the global Ionosphere and Thermosphere, and examined the importance of an ion-drag process as an interaction between the neutral and ionized species in the neutral dynamics and energetics. The model demonstrated the general structures of the global ionosphere-thermosphere in geomagnetically quiet conditions. The comparison between the model results and the DE-2 observations showed that the ion-drag process plays a significant role in the zonal neutral momentum balance. Furthermore, our result suggested that the ion-drag in the direction parallel to the field-lines had to be taken into consideration, in interpreting the observed latitudinal structures of the equatorial neutral wind and temperature within the Equatorial Anomaly latitudes. On the other hand, the model was applied to the storm-time simulations. The model results demonstrated that the neutral atmospheric disturbances propagate to lower latitudes. It had the LT(Longitude) dependences, which could be attributed partly to the ion-drag associated with the distribution of the plasma density and drift. From our simulation results, it is pointed out that the 3-dimensional behaviors of the neutral wind system should be considered in order to understand properly the dynamic and energetic coupling of the global Ionosphere-Thermosphere system.

6 Wednesday Evening 19 June 2002 Poster Session Abstracts, Troposphere-Stratosphere and Transient Phenomena

6.1 TTP.01: Numerical Simulation of lightning-generated EM field in ionosphere by Hu, Wenyi

Status: student in poster competition PhD

Authors: Wenyi Hu Department of Electrical Engineering, Duke University wyhu@ee.duke.edu Steven A. Cummer Department of Electrical Engineering, Duke University cummer@ee.duke.edu

Abstract:

Intense lightning-generated electromagnetic fields play an important role in the studies of the effects caused by lightning-ionosphere interaction and sprites. In this work, a fully electromagnetic 2-D model treating the ionosphere as a true cold plasma is developed by using finite-difference time domain method (FDTD) and PML technique to simulate the slowly varying fields in a large volume of space. Being valid throughout geospace, this model is shown to be a powerful tool to simulate electromagnetic fields generated by both lightning currents and sprite currents with different source altitude. The results of several numerical simulations are given. The intensity and frequency distributions of ionospheric electromagnetic fields are shown, which show that sprite-generated waves suffer less attenuation before entering the magnetosphere. The signatures of intense lightning and sprites at different altitudes are compared. The conditions for a lightning discharge to excite nonli! ne! ar processes are discussed. Also the model is used to interpret the transient electromagnetic fields recorded by a ground-based ELF remote sensing system.

6.2 TTP.02: Modeling of electrical discharges from thundercloud tops to the lower ionosphere by Pasko, Victor

Status: non-student

Authors: Victor Pasko, Jeremy George CSSL Laboratory, Penn State University, University Park, PA 16802, USA Email: vpasko@psu.edu

Abstract:

Many decades ago C.T.R. Wilson theorized that an electrical discharge could bridge the gap between a thundercloud and the upper atmosphere [Wilson, Proc. Phys. Soc. Lond., 37, 32D, 1925]. Blue jets represent one of the several types of large-scale optical flashes recently discovered above thunderclouds. Blue jets develop upwards from cloud tops to terminal altitudes of about 40 km at speeds of the order 100 km/s and are characterized by a blue conical shape [Wescott et al., Geophys. Res. Lett., 22, 1209, 1995; J. Geophys. Res., 106, 21549, 2001]. Recently, the first video recording of a blue jet, which electrically connected a thundercloud with the lower ledge of the Earth's ionosphere, has been reported [Pasko et al., Nature, 416, 152, 2002, http://pasko.ee.psu.edu/Nature/]. Recent photographic [Wescott et al., 2001] and video [Pasko et al., 2002] observations have clearly shown the streamer structure of blue jets predicted in [Petrov and Pertova, Tech. Phys., 44, 472, 1999]. In this talk we report results from a three-dimensional fractal model, which simulates the propagation of branching streamer channels constituting blue jets as a three dimensional growth of fractal trees in a self-consistent electric field created by thundercloud charges. We place emphasis in our modeling on comparison with the most recent observations of blue jets [Wescott et al., 2001; Pasko et al., 2002].The obtained results closely resemble characteristics of blue jets in terms of their altitude extents, transverse dimensions and conical structure. In partcular, the fractal model allows for the propagation of blue jets to the lower ledge of the Earth's ionosphere, in good agreement with the recent observations of Pasko et al. [2002]. The model results also show good agreement with observations of Pasko et al. [2002] in terms of the initial phases of blue jet development and in terms of the general volumetric shape of the blue jet. A comparison of the video sequence from [Pasko et al., 2002], the 2-min time exposure photograph from [Wescott et al., 2001], and the fractal model results indicates that the blue jet streamer structure reported by Wescott et al. [2001] was likely formed during the initial stages of the blue jet development.

6.3 TTP.03: Ionospheric remote sensing using EM fields from lightning by Cheng, Zhenggang

Status: student in poster competition PhD

Authors: zhenggang cheng Electrical and Computer Engineering Department Duke University zc@ee.duke.edu Steven A. Cummer, Assistant Professor Electrical and Computer Engineering Department Duke University cummer@ee.duke.edu

Abstract:

Lightning discharges radiate the most of their electromagnetic energy in the very low frequency (VLF, 3-30kHz) and extremely low frequency (ELF, 3-3000Hz) bands. The energy, which is contained in impulse-like signals called radio atmospherics or sferics, is guided for long distances by multiple reflections from the ground and the ionosphere. This indicates that the observed sferic waveforms radiated from lightning and received at long distance (around and above 1000km) from the source can be used for radio sounding of the ionosphere. We measure the VLF sferics radiated from South Florida for the remote sensing of ionosphere D region. The reasons for choosing the lightning source from South Florida are that the distance of the source can be accurately calculated and that the distance to Duke University is long enough so that the sferics should contain sufficient information for sounding ionosphere D region. Radio remote sensing of the ionosphere E region can be difficult. However extremely low frequency (ELF) electromagnetic waves launched from below can penetrate this region because of their low attenuation and can be reflected from both D region and the top of the E region valley. This double reflection can produce a measurable effect on the subionospheric propagation of ELF waves. Thus we can measure the E region ionosphere by comparison the observed sferics from the Midwest US and the modeled sferics resulted from the ELF sferic propagation model.

6.4 TTP.04: Properties of processes occurring in sprites and other emissions above thunderstorms by Moudry, Dana

Status: student in poster competition PhD

Authors: Dana Moudry and Hans Stenbaek-Nielsen and Davis Sentman and Gene Wescott drm@gi.alaska.edu Geophysical Institute Univ. of Alaska Fairbanks 903 Koyukuk Dr. Fairbanks, AK 99775-7320

Abstract:

The processes responsible for optical emissions of sprites include several which have been described previously, namely downward tendrils and upward branches. The additional proces- ses which are important for optical emissions include forma- tion of 1) bright bead formation in the upper parts of ten- drils and lower parts of branches, 2) columns, 3) diffuse puffs above branches in carrot sprites (not to be confused with halos preceding sprites); the rearrangement of i) bran- ches into columns, ii) beads into undefined elongated blobs, and iii) similar transformations of bright regions. Seconda- ry tendrils and branches can start a few ms after the prima- ry tendrils and branches. The characteristics of these proc- esses are discussed. All these additional processes influ- ence strongly the apparent shape of a sprite and need to be included in sprite models. We also describe other upper at- mospheric optical emissions above very active thunderstorms (elves, halos, and post-sprite events named embers and crawl- ers) which were imaged with a 1 ms high speed imager in 1999. Embers are the most complicated: a bead brightens in a re- gion formerly within the sprite tendrils, and brightness propagates downward from it, similar to a sprite tendril. La- ter another bead brightens above, below, or to the side of the first one, and the ember-tendril propagates along the same path as the previous ember-tendril. In TV data the long temporal integration completely masks this complex behavior.

7 Wednesday Evening 19 June 2002 Poster Session Abstracts, Winds, Tides and Waves

7.1 WTW.01: Thermospheric Neutral Winds Observed at Arecibo during Solar Cycles 21, 22, and 23 by Robles, Eva

Status: non-student

Authors: Eva Robles (erobles@naic.edu), Raul Garcia (rgarcia@naic.edu), and Craig Tepley (ctepley@naic.edu)
all at: The Arecibo Observatory / Cornell University HC-03 Box 53995 / Arecibo, Puerto Rico 00612

Abstract:

Observations of thermospheric neutral winds have been made at the Arecibo Observatory since 1980 using a Fabry- Perot interferometer to measure the O(1D) 630 nm emission. Burnside and Tepley [1989] examined the first eight years of this extended data set, but they found no solar cycle influence on the magnitude or direction of the wind field, nor on its horizontal gradients. Such affects have been observed at other locations, however, and their absence at Arecibo may be due to the limited number of years that were evaluated. Thus, we have extended the analysis of our neutral wind measurements to include just over two complete solar cycles (22 = years) and will present our results within the framework of the earlier work.

7.2 WTW.02: "Interannual variability of the semidiurnal tide in the midlatitude mesopause region" by Xu, Lifang

Status: student in poster competition PhD

Authors: LiFang Xu, B. P. Williams, C. Y. She, and D. A. Krueger Colorado State University lfxu@lamar.colostate.edu

Abstract:

The sodium resonance lidar in Fort Collins, Colorado (40.6N,105W) has made routine nighttime measurements of the altitude profiles of the temperature in the mesopause region (80–105 km) on over 500 nights since 1991. A strong (typically 5-20 K) nocturnal variation of temperature occurs on most nights, most likely due to the tides. The 2–6 nights of data taken each month between 1991 and 2001 were averaged to form a monthly composite night and then fit for semidiurnal amplitude and phase. This will contain some diurnal tide contamination. The tidal amplitudes show the expected annual variation with a maximum in the winter from 85-100. ¿From 85-90 km, there is a 2-year oscillation in the amplitudes with maxima during the winters corresponding to January 1993, 1995, 1997,1999 and minima in 1992, 1994, 1996, and 1998. This 2-year signal occurs mostly during the months of December, January, and February. The phase of the tide is the same for odd and even winters and agrees with the semidiurnal phase measured during 24-hr campaigns and predicted by models The biennial signal is not evident from April to October, when the diurnal tide contamination would be the worst. The 2-year period suggests some connection to the equatorial QBO, possibly due to filtering of gravity waves or planetarty waves.

7.3 WTW.03: Observations of non-migrating components of the semi-diurnal tide over Antarctica. by Murphy, Damian

Status: non-student

Authors: Damian J Murphy - Australian Antarctic Division - damian.murphy@aad.gov.au Masaki Tsutsumi - National Institute of Polar Research - tutumi@uap.nipr.ac.jp Dennis Riggin - Colorado Research Associates/NWRA - riggin@colorado-research.com G. Owen L. Jones - British Antarctic Survey - GOLJ@bas.ac.uk Robert A. Vincent - University of Adelaide - robert.vincent@adelaide.edu.au Maura Hagan - National Center for Atmospheric Research - hagan@hao.ucar.edu Susan Avery - Coop. Inst. for Research in Env. Sciences - susan.avery@colorado.edu

Abstract:

Non-migrating components of the semidiurnal tide have been observed using MF radar wind measurements from three Antarctic stations: Davis, Syowa and Rothera. These stations lie within a few degrees of latitude of each other and allow for the removal of the migrating tidal component by differencing the amplitude and phase in local time. The results of this differencing show an enhancement in the non-migrating component of the semidiurnal tide during the southern summer. These data are then interpreted using the characteristics of known tidal modes.

7.4 WTW.04: Temperature and wind tides based on diurnal cycle observations by Yuan, Titus

Status: student in poster competition PhD

Authors: Titus Yuan, Physics Dept, Colorado State University titus@lamar.colostate.edu James Sherman, Physics Dept, Colorado State University jsherman@lamar.colostate.edu

Abstract:

With the development of Faraday filters, narrowband sodium ldar can now perform measurements of mesopause temperature and winds during both daytime and night-time. Data sets acquired from observations of mesopause temperature over Fort Collins, CO (41degN, 105degW) covering full diurnal cycles have been acquired in campaign mode and analyzed in terms of harmonics with 12 and 24 hour periods. The demand on the stability of Faraday filter for accurate wind measurements turned out to be much more stringent. Only recently were we able to overcome this obstacle. making possible simultaneous temperature and wind measurements over complete diurnal cycles. We hope to report correlated diurnal and semi-diurnal oscillations in mesopause temperature and winds and to investigate their relevance to solar atmospheric tides.

7.5 WTW.05: Pseudo analysis of tidal activity in SABER temperature data by Oberheide, Jens

Status: non-student

Authors: Jens Oberheide (jenso@ucar.edu) Maura Hagan (hagan@ucar.edu) Ray Roble (hagan@ucar.edu) HAO/NCAR

Abstract:

Migrating and non-migrating temperature tides from January 11, 1993 TIME-GCM histories with realistic solar, geomagnetic, and NCEP forcing are sampled along the SABER measurement track from January 11, 2002. The sampled model results provide estimates how SABER is sampling realistic tidal fields and how incompletely sampled tidal modes can alias into equilibrium (=background)temperature fields derived from the real data. These topics are of particular interest for later comparisons of the satellite observations with models, climatologies, and ground based observations. The SABER constituent data should also exhibit tidal signatures associated with the vertical motion of the tides. A first guess of the vertical tidal motion is presented by converting the sampled tidal temperature fields to equivalent vertical displacements, assuming the tidal motions are adiabatic.

7.6 WTW.06: Seasonal dependence of gravity waves occurrence frequency using the OH imager at Platteville,CO by Li, Tao

Status: student in poster competition PhD

Authors: Tao Li, Department of Physics, Colorado State University, taoli@lamar.colostate.edu B. P. Williams, Department of Physics, Colorado State University, biffw@lamar.colostate.edu L. Keiffaber, Whitworth College A. Peterson, Whitworth College

Abstract:

The Whitworth College OH imager has been taking broadband OH images at a 2 min cadence on most nights since it was installed in a trailer at Platteville,CO (40.2N, 104.7W) in August 2001. The autumn and winter images show near-constant gravity wave activity on most nights, with 2-3 simultaneous waves typical. In winter, the occurrence of small scale "ripples" increased. This is in contrast with the low fall and winter occurrence frequency observed at Peach Mountain Observatory in Michigan [Wu and Killeen, 1996]. We will analyze the spring images and report on the gravity wave occurrence frequency from August 2001 to June 2002.

7.7 WTW.09: All-Sky Measurements of Short-Period Gravity Wave Characteristics During the DAWEX Campaign. by Pautet, P-D

Status: non-student

Authors: P.-D. Pautet and M. J. Taylor, Center for Atmospheric and Space Science and Physics Department, Utah State University email : pautet@cc.usu.edu

Abstract:

The Darwin Area Wave Experiment (DAWEX) is an international program that was conducted from northern Australia during the Austral Spring, 2001. This program was designed to investigate the generation and propagation of gravity waves from tropospheric convective regions into the upper mesosphere (80-100 km), and utilized coordinated optical, radar and in-situ measurements. In the pre-monsoon period around mid-November, an intense convective storm develops over the Tiwi Islands near Darwin, each afternoon, known as 'Hector'. Measurements of the source region were made locally by several radars and by a series of radionosonde soundings. Several all-sky airglow imagers were deployed in Australia to determine the near and far field characteristics and propagation anisotropy of small-scale (horizontal wavelengths less than 100 km) gravity waves at mesospheric heights. In this poster we summarize measurements from Wyndham, WA (15.5 S, 128.0 E) using the Utah State University All-Sky Airglow Imager. Observations were conducted during November and data were obtained on a number of well-defined wave events. The horizontal scale sizes, apparent periods, and propagation headings of these events have been determined and indicate a clear preponderance for southward motion.

7.8 WTW.08: Imaging Gravity Waves From Halley Station, Antarctica by Olsen, Christian

Status: student in poster competition Undergraduate

Authors: C. L. Olsen, Utah State University, lorenzo@cc.usu.edu M. J. Taylor (Center for Atmospheric Space Science, Utah State University), mtaylor@cc.usu.edu M. Jarvis (British Antarctic Survey, U.K.)

Abstract:

In January 2000 Utah State University installed an all-sky multi-wavelength CCD airglow imager at Halley Station, Antarctica (75.35) in collaboration with British Antarctic Survey, U.K. Image data showing short-period (¡ 1 hour) mesospheric wave structure were obtained in the near infrared hydroxyl (OH) and O2(0,1) emissions and the visible Na (589.2 nm) emission during the austral winter period 17 March to 30 September 2000. Approximately 50 Gbytes of data were obtained during this period revealing considerable short-period gravity wave activity (structure on 56

Examples of these data including an initial study of the emission intensity variability and short-period gravity wave parameters (horizontal wavelength, observed period and directionality) will be presented and compared with measurements obtained at mid-latitudes from Bear Lake Observatory, Utah (41. 6N) using a similar CCD system.

7.9 WTW.09: On Correlations of Gravity Wave Intensity in the MLT over Hawaii with El Nino activity. by Gavrilov, Nikolai

Status: non-student

Authors: N. M. Gavrilov(1), D. M. Riggin(2), and D. C. Fritts(2) 1) Atmospheric Physics Department, Saint-Petersburg University, Petrodvorets, 198904, Russia, E-mail: gavrilov@pobox.spbu.ru (2) Colorado Research Associates Division, NorthWest Research Associates, 3380 Mitchell Lane, Boulder, CO 80301, USA, E-mail: riggin@colorado-research.com

Abstract:

Using simple numerical filters, wind variances with time scales 0.1 - 1 hr and 1 - 4 hr are estimated from wind observations with an MF radar at altitudes 70 - 94 km over Hawaii (22 N, 160 E) during the years 1990 - 2000. Average seasonal changes of the wind variances are calculated. Residual monthly values, obtained after subtraction of the seasonal variations are compared with monthly mean values of the Southern Oscillation Index (SOI). During El Nino (negative SOI) eastward velocity is smaller at heights 80 - 90 km. An ncrease in SOI leads to the increase in southward velocity. El Nino events (negative SOI) correspond to an increase in the wind variances with time scales 0.1 - 1 hr. Larger scale wind variances with time scales 1 - 5 hr show similar correlation with larger magnitudes at negative SOI above altitudes of 80 km.

7.10 WTW.10: Using GPS/MET Measurements of the Refraction Index Variations as an Indicator of Dynamically Active Regions in the Atmosphere. by Gavrilov, Nikolai M.

Status: non-student

Authors: N. M. Gavrilov, N. V. Karpova Atmospheric Physics Department, Saint-Petersburg State University, Petrodvorets, 198504, Russia E-mail: gavrilov@pobox.spbu.ru

Abstract:

Mesoscale dynamical processes produce variations of atmospheric characteristics: pressure, density, temperature, humidity and electron density in the ionosphere. These variations produce changes of the refraction index of radio waves in the atmosphere. Satellite measurements of refraction of optical and radio waves in the atmosphere may be used for determination of zones of increased intensities of mesoscale dynamical processes at different altitudes. Analysis of data from GPS/MET satellite reveals dynamically active regions located in tropospheric jet streams and tropical deep convection. These regions may generate acoustic-gravity waves propagating to the upper atmosphere providing dynamical coupling between different atmospheric layers.

8 Wednesday Evening 19 June 2002 Poster Session Abstracts, Mesosphere and Lower Thermosphere

8.1 MLT.01: Large variations in Mesospheric OH Rotational Temperature: Case Studies. by Taori, Alok

Status: non-student

Authors: A. Taori, M. J. Taylor Center for Atmospehric and Space Science and Physics Dept. Utah State University, USA R. Sridharan Space Physics Laboratory, VSSC, Trivandrum, INDIA, and, C. Y. She Department of Physics, Colorado State University, USA.

Abstract:

The mesosphere exhibits a variety of dynamical processes. Highly variable structures in the mesospheric airglow emissions (altitude 80-100 km) are usually attributed to the passage of gravity waves and tides, which are also clearly evident in the OH rotational temperature data. Apart from the small variations that are frequently present the OH temperature data sometimes exhibit much larger amplitude oscillations. Occasionally, these oscillations may be as high as 40 K (peak-to-peak). The present study aims at the identifying the some of these cases using data from: 1)Low-latitude daytime OH temperature measurements using the Multi Wavelength Daytime Photometer (MWDP) instrument, from Kolhapur, India (16.8 N, 74.2 E) during January 1997 and, 2)Mid-latitude nighttime OH temperature measurements using the CEDAR Mesospheric Temperature Mapper (MTM) from Bear Lake Observatory (BLO), Logan UT (41.6 N, 111.6 W) during September 2000 to July 2001. This poster will present an initial analysis of the characteristics of these large-scale disturbances and discuss their possible causes.

8.2 MLT.02: The quasi 2-day wave observed in the polar mesosphere by Nozawa, Satonori

Status: non-student

Authors: S. Nozawa, Nagoya University, nozawa@stelab.nagoya-u.ac.jp S. Imaida, Nagoya University, imaida@stelab.nagoya-u.ac.jp H. Iwahashi, Nagoya University, iwahashi@stelab.nagoya-u.ac.jp A. Brekke, University of Tromsoe, Asgeir.Brekke@phys.uit.no C. M. Hall, University of Tromsoe,@chris.hall@phys.uit.no@phys.uit.no A. Manson, University of Saskatchewan, manson@skisas.usask.ca C. Meek, University of Saskatchewan, meek@dansas.usask.ca S. Oyama, CRL, oyama@crl.go.jp R. Fujii, Nagoya University, rfujii@stelab.nagoya-u.ac.jp

Abstract:

In this paper, we present characteristics of the quasi 2-day wave (Q2DW) observed in the polar mesosphere based on the MF radar data obtained at Tromsoe (69.6 degree N, 19.2 degree E) for about 37 months occurring between November 1, 1998 and December 8, 2001. We revealed characteristics of the quasi 2-day wave in the polar mesosphere in the height range from 70 to 91 km. The activity of the quasi 2-day wave is higher in winter months (November to February) than in summer months (May to August) over the height region. The maximum values of the amplitude are about 25 m/s in winter and about 15 m/s in summer. Between 70 and 82 km, the amplitude appears to maximize at around winter solstice over the 3 years. The average ratio of meridional to zonal amplitudes is about 1.1-1.2 over the height region, and thus there is no trend found that one component is stronger than another component. The variation of the period is also examined, and periods with 45.2 and 54.8 hrs occur more frequently than those with 48.0 and 51.2 hrs. However, no clear seasonal trend of the variation of the period is found. In addition, the amplitude is modulated at 4-10 days rate.

8.3 MLT.03: Regions of Convective and dynamic instability in the winter mesopause region over Fort Collins, CO (41N, 105W) by Sherman, James

Status: student in poster competition PhD

Authors: James Sherman, Dept of Physics, Colorado State University jsherman@lamar.colostate.edu Bifford Williams,Dept of Physics, Colorado State University biffw@lamar.colostate.edu Takuya Kawahara, Dept of Physics, Colorado State University kawahara@lamar.colostate.edu David Krueger, Dept of Physics, Colorado State University krueger@lamar.colostate.edu Joe She, Dept of Physics, Colorado State University joeshe@lamar.colostate.edu

Abstract:

In February, 2002, the Colorado State University Na lidar was configured for night-time simultaneous observations of temperature, zonal and meridional wind profiles in the mesopause region (80-110km). A total of 6 nights of observations were conducted, with datasets ranging between 4 and 10 hours per night. Winter wave activity is evident, containing regions of instabilities throughout the campaign. This paper reports the stability analysis of the winter mesopause region based on temperature and wind profiles, showing evidence of large winds and windshear. Augmented by simultaneous temperature and wind profiles (either zonal or meridional)acquired between 1999 and 2001, the statistics of strong wind and stability of the mid-latitude winter mesopause region will be discussed.

8.4 MLT.04: Gravity Waves and Bores in the Mesosphere by Smith, Steven M

Status: non-student

Authors: Steven M Smith Center for Space Physics Boston University 725 Commonwealth Ave Boston MA 02215

Abstract:

Although bores are relatively common in the Earth's rivers, oceans and troposphere they have only rarely been observed in the mesosphere. A study of a year's all-sky data at Millstone Hill yielded 12 bore-like events. We present the results of this study.

8.5 MLT.05: Investigations of Heterogeneous Reactions Involving Atomic Oxygen Relevant to the Middle Atmosphere by Boulter, J. E.

Status: non-student

Authors: J. E. Boulter J. Marschall james.boulter@sri.com jochen.marschall@sri.com Molecular Physics Lab SRI International 333 Ravenswood Avenue Menlo Park, CA 94025

Abstract:

We are investigating heterogeneous reactions involving atomic oxygen that may occur in the mesosphere and lower thermosphere (MLT). Atomic oxygen, the most abundant reactive species in this region, increases by more than two orders of magnitude between 70 km and 100 km. A variety of particles may serve as sites for surface mediated reactions, including ice particles and mineral dust from meteor ablation.

We are currently investigating two surface reactions that may play a significant role in the MLT, the formation of water on meteoric dust surfaces from the reaction of O-atoms with molecular hydrogen, and the recombination of O-atoms on ice particles to form molecular oxygen. The former reaction was suggested by Summers and Siskind [1] as a mechanism for the existence of a narrow water layer centered near 70 km that was observed in HALOE data which is not satisfactorily explained using conventional chemical and dynamical models. The second reaction was proposed by Gumbel et al. [2] to account for bite-outs in atomic oxygen concentrations within NLC layers observed during several rocket campaigns between 1978 and 1993.

Experiments are being performed with representative mineral oxide powders or ice surfaces in a Knudsen cell: a low-pressure, stirred reactor in which the loss of a reactant species to a sample surface competes with escape through an exit aperture. Steady state reactant and product concentrations are measured with laser-induced fluorescence and mass spectrometry. Atomic oxygen uptake coefficients on the sample can be derived and then related to specific heterogeneous chemical reactions. The recombination of O-atoms on the reactor walls complicates the measurement and data analysis procedure considerably.

[1]Summers, M. E., and Siskind, D. E., Geophys. Res. Lett., 26, 1999, pp. 1837-1840.

[2]Gumbel, J., Murtagh, D. P., Espy, P. J., Witt, G., and Schmidlin, F. J., J. Geophys. Res., 103, 1998, pp. 23,399-23,413.

8.6 MLT.06: Measurement of OH(X 2Pi, u = 2, 3, 4) Collisional Removal Rate Constants by Oxygen Atoms by Boulter, J. E.

Status: non-student

Authors: J. E. Boulter J. Marschall R. A. Copeland james.boulter@sri.com jochen.marschall@sri.com richard.copeland@sri.com Molecular Physics Lab SRI International 333 Ravenswood Avenue Menlo Park, CA 94025

Abstract:

The fluorescence of vibrationally excited, ground electronic state hydroxyl radical (OH) in the airglow originates in the mesosphere-lower thermosphere (MLT) region of Earth's atmosphere. Spectroscopic measurements of this infrared emission are being made by the TIMED satellite to characterize the dynamics, temperature profiles, and HOy chemistry in the region 80C100 km. In the atmosphere, low-lying vibrational levels of OH are populated from collisional deactivation of hydroxyl radicals formed in v = 6-9 and are significantly affected by collisions with atomic oxygen. We have performed experiments to determine the collisional removal rate constants of OH(v = 2, 3, 4) by atomic oxygen. Ozone is photodissociated at 248 nm in nitrogen using a pulsed excimer laser to generate O(1D). Most is rapidly deactivated by collisions with N2 to produce ground state O(3P), and the remainder reacts with either H2 to form OH(v 4) or H2O to form OH(v 3). A second, tunable dye laser pulse probes the OH population as it undergoes collisions with O(3P). The experimentally determined room-temperature rate constants for the removal of OH(v) by O(3P) are (4.9 0.8) x 10-11, (7.3 1.1) x 10-11 and (11.5 1.2) x 10-11 for v = 2, 3 and 4, respectively. Our rate constant for OH(v = 2) removal by O(3P) is less than half of the single previous, indirect measurement of the removal rate constant for OH(v = 1) [1]. These removal rate constants increase with OH vibrational energy and speculative extrapolations suggest that collisions of O(3P) with OH(v = 6-9) may have a significant influence on the total removal of these highly excited levels in the MLT region.

[1] Spencer J. E, and Glass, G. P., Int. J. Chem. Kinetics, 9, 1977, pp. 97-109 and 111-122.

9 Wednesday Evening 19 June 2002 Poster Session Abstracts, Lidar Investigations

9.1 LID.01: Boltzmann Lidar Measurements of Temperature and Iron in the Arctic by Hou, Tao

Status: student in poster competition Masters

Authors: Tao Hou, University of Alaska Fairbanks, ftth@uaf.edu Manasi Peshave, University of Alaska fairbanks, ftmap@uaf.edu

Abstract:

An iron Boltzmann temperature lidar allows the measurement of both the temperature and iron concentration profile in the mesopause region (80-100 km). This poster describes the initial development and the further improvement of an iron Boltzmann temperature lidar at Poker Flat Research Range (PFRR). An excimer pumped dye laser was installed at PFRR in April 1999. Observations of iron were made between December 2000 to March of 2001 and again between November 2001 and May 2002. The first temperature measurement was made in December 2000. A control system to improve the resolution of the laser tuning was developed in the summer of 2001. This improvement was verified by measurements during the winter of 2001-2002. Temperature measurements were again made in November 2001 and January 2002. The lidar measurements to date were made under open-loop tuning control. We are currently investigating a closed-loop control system. The poster will present the temperature and iron concentration measurements and discuss the possible improvements to the lidar system.

9.2 LID.02: Fe lidar study of the middle atmosphere temperatures and Fe layers at South Pole by Pan, Weilin

Status: student not in poster competition PhD

Authors: Weilin Pan, Chester S. Gardner, and Xinzhao Chu University of Illinois at Urbana-Champaign wpan@uiuc.edu, cgardner@uillinois.edu, xchu@uiuc.edu

Abstract:

Fe Boltzmann temperature lidar measurements at South Pole from Dec 1999 through Oct 2001, combined with balloon observations, are used to characterize for the first time, the monthly mean temperature profiles from the surface to about 110 km.

The summertime temperatures agree reasonably well with current model predictions and exhibit very cold mesopause. During mid-winter, both the stratopause and mesopause regions are 20-30 K colder than the model. The seasonal thermal structure near mesopause exhibits significantly stronger annual plus semiannual oscillations than in the mid-latitude.

The seasonal variations of the Fe layer column abundance, height and width are similar to Na observations at South Pole in 1995-1997. The Fe densities display strong 12-month oscillations with amplitudes comparable to the background level, resulting in an extremely thin layer and very low Fe abundance at summertime.

9.3 LID.03: High-latitude lidar studies of mesospheric sodium and iron by Stern, Timothy

Status: student in poster competition Undergraduate

Authors: Timothy Stern, timestern@hotmail.com Tao Hou, ftth@uaf.edu Hannah Abend, Cogito34@aol.com all 3 from Univ. of Alaska-Fairbanks, Geophysical Institute

Abstract:

Resonance lidar measurements of the mesospheric sodium (Na) layer have been ongoing at Poker Flat Research Range, Alaska (65 o N, 147 o W), since the spring of 1995. Simultaneous lidar measurements of

the mesospheric iron (Fe) layer were begun in the early winter of 2000. Simultaneous sporadic layers of atomic sodium (Nas) and iron (Fes) have been observed on several occasions. This poster presents both the general characteristics of the mesospheric Na and Fe layers and the observations of the sporadic layers at this high-latitude site. The simultaneous observations highlight the differences in the relative behavior of Na and Fe over seasonal variations as opposed to during sporadic events.

9.4 LID.04: "Hodograph analysis of temperature and zonal and meriodional wind measured by sodium lidar" by Acott, Phillip E.

Status: student not in poster competition Undergraduate

Authors: Phillip E. Acott, B.P. Williams, James Sherman, Kam Arnold, Takuya Kawahara, Tao Yuan, Lifang Xu, Tao Li, and C. Y. She

Abstract:

In February 2002, the Colorado State Na lidar took 6 nights of simultaneous observations of temperature, zonal and meridional wind profiles in the mesopause region (80 and 110 km). Strong waves were present on most of the nights. We will present a hodograph analysis of the temperature and wind vector including a 3D movie illustrating the wave motion.

9.5 LID.05: Noctilucent Cloud Detection with the Rayleigh Lidar at Poker Flat Research Range by Nicolls, Michael

Status: student in poster competition Undergraduate

Authors: Michael Nicolls (mjn25@cornell.edu) Michael Kelley (mikek@ece.cornell.edu) Camilo Ramos (camilor@ece.cornell.edu) Cornell University, School of Electrical and Computer Engineering Rich Collins (rlc@gi.alaska.edu) Tao Hou Timothy Stern University of Alaska Fairbanks, Geophysical Institute and Department of Electrical Engineering T Itabe (itabe@crl.go.jp) K Mizutani (mizutani@crl.go.jp) Communications Research Laboratory

Abstract:

Rayleigh lidar measurements were made on two nights in August 2001 at Poker Flat Research Range (PFRR), Alaska (65 N, 147 W) in which noctilucent clouds (NLCs) were observed. The lidar employs an Nd:YAG laser and a 60 cm Newtonian telescope. On the night of August 16-17, a weak echo was detected, and a stronger echo was detected on the night of August 20-21. The data sets were binned and normalized, and temperatures were calculated based on the assumption of an atmosphere in hydrostatic equilibrium. The density profiles did not seem to be smooth and evidence for internal waves existed on both days. To investigate this, cubic spline interpolations were fit to the Rayleigh profiles to create model density profiles, and relative density fluctuation profiles were then examined. Wave-like disturbances seemed to exist on both nights, exponentially increasing in amplitude with height. These seem to match very well with the expected rate for internal waves. The wave harmonics were extrapolated upwards to the altitudes where the NLCs were observed. The location of the NLCs seems to correspond to minima in the temperature profiles. This supports the view that internal waves can influence the formation of NLCs by creating regions colder than the ambient atmosphere in which water can freeze into ice. In addition, an HF radar was utilized during the summer of 2001 at the HIPAS Observatory to detect polar summer mesospheric echoes near local noon. PMSE was observed on the 21st of August at about the same altitude as the NLC was detected.

9.6 LID.06: Comparison between Sodium Lidar, Medium Frequency Radar and Meteor Radar Wind Observations at ALOMAR, Norway by Williams, Bifford

Status: non-student

Authors: B. P. Williams, J. Vance, K. Arnold, and C. Y. She Physics Department, Colorado State University, Fort Collins,CO biffw@lamar.colostate.edu D. E. Gibson-Wilde, D. C. Fritts Colorado Research Associates Division, Northwest Research Associates Inc., Boulder, CO W. Singer, R. Latteck, Leibniz-Institute for Atmospheric Physics, Kuhlungsborn, Germany.

Abstract:

The Weber sodium resonance wind/temperature lidar system (Weber lidar) at the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR, 69N) was operated simultaneously with the medium frequency (MF) and very high frequency (VHF) meteor radars collocated on the island of Andoya in northern Norway. We here present analysis of data obtained on the night 17-18 January 2002 from the three independent wind measurement techniques in the mesosphere and lower thermosphere (MLT) region – sodium lidar Doppler wind measurement, MF radar spaced-antenna full correlation analysis, and meteor radar winds technique. The comparison between Doppler lidar and meteor radar measurements of zonal winds indicates excellent agreement in both wind magnitude and direction over the altitude range 82-98 km. MF radar zonal winds for this time period are subject to interference due to particle precipitation and show generally more eastward zonal wind velocities than the other two methods.

9.7 LID.07: ALOMAR Weber sodium lidar upgrades by Vance, Joe presented by Arnold, Kam

Status: student not in poster competition

Authors: Joe Vance, CSU, jvance@lamar.colostate.edu Kam Arnold, CSU, kamarnold@hotmail.com Biff Williams CSU, biffw@lamar.colostate.edu Phyl Acott, CSU, acott@lamar.colostate.edu Lifang Xu, CSU, lfxu@lamar.colostate.edu Joe She, CSU, joeshe@lamar.colostate.edu

Abstract:

The ALOMAR Weber sodium lidar was designed for simultaneous temperature and wind measurements in the Arctic mesopause region, with day and night observation capability, weather permitting. Taking the advantage of the giant twin mirrors, 1.8m diameter each, the main objective of the Weber is for dynamics studies with capability of measuring momentum fluxes in a polar mesopause region. As deployed in the summer of 2000, the lidar was capable of measuring mesopause region temperatures in the sunlit polar region. However, accurate wind measurement was still lacking. Frequency and power modulation are inherent to the design of the seed laser. These effects make locking to the D2a Lamb dip difficult, introducing large uncertainty and bias into wind measurement. A new D2a Lamb dip locking system was implemented in July 2001. Wind measurement improved dramatically, but with a large 50 m/s bias. In January 2002, additional synchronization electronics were implemented removing the last impediment to accurate wind measurement. Observation yielding a zonal momentum flux followed immediately with 5 m/s bias still remaining. It is expected that by the summer of 2002 that there will little or no remaining seed laser bias. This paper will briefly describe the principle behind this unique lidar system, and discuss the measurement enhancements enabled by the recent upgrades.

9.8 LID.08: Comparison of mesopause region winds measured by the CSU sodium lidar and the Platteville MF and meteor radars by Arnold, Kam

Status: student in poster competition Undergraduate

Authors: Kam Arnold, Physics Dept,Colorado State University, arnold@lamar.colostate.edu James Sherman, Physics Dept,Colorado State University, jsherman@lamar.colostate.edu

Abstract:

The CSU sodium lidar at Fort Collins, CO has been making routine measurements during the winter and spring of 2002, as well as 6 nights of zonal and meridional wind measurements. We will present the results of comparisons with winds measured by the MF and meteor radars operated at Platteville, CO by ISAS and CU, respectively

10 Wednesday Evening 19 June 2002 Poster Session Abstracts, Part 2 Measurements and Analysis Techniques

10.1 MAT.09: Artificial Airglow Excitation - A Laboratory for Investigating Electrical Effects on the Upper Atmosphere From Tropospheric Sources by Sao Sabbas, Fernanda T.

Status: student in poster competition PhD

Authors: F.T. Sao Sabbas, D.D. Sentman, E. M. Wescott, H. Stenbaek-Nielsen, D. Lummerzheim
Geophysical Institute, University of Alaska, Fairbanks, AK, 99775, USA contact e-mail:
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Abstract:

Ionospheric airglow emissions have recently been excited in the F-Region by the HAARP and HIPAS RF facilities in Alaska. The excited airglow regions have been simultaneously imaged from several sites using low light level cameras and spectrographs. The observed emissions include OI 557.7 nm, 630.0 nm, 777.4 nm and 844.6 nm, as well as N2+ (B-X) 427.8 nm. The University of Alaska made the first spectral measurements of the artificially created airglow under both nighttime and twilight ionospheric conditions. Both spots were excited when the transmitter frequencies are slightly below the nighttime F-region F0f2 critical frequency. The observations made near Fairbanks imaged the vertical structure of the HAARP heated region. The heated region was spatially diffuse and possessed a faint upward field aligned extrusion. Maximum optical intensity was located at an altitude 300+5 km, and the transverse dimension of the region was 30+ 5 km. The airglow excited by HIPAS was viewed from below looking along the field line and exhibited maximum intensity at an altitude of 259+5 km, with a transverse width of 36+5 km. Experiments of this kind provide a means for investigating atomic and molecular excitation of the upper atmosphere by ground-based electromagnetic sources. The microphysical excitation mechanisms operating to create both artificial airglow and sprites are similar, and involve electron-energization and interaction with neutral species. Controlled studies of RF airglow excitation may help elucidate microphysical processes of sprites and similar upper atmospheric phenomena.

10.2 MAT.10: Interannual variability and trends in Moscow Noctilucent Clouds by Pertsev, N.

Status: non-student

Authors: N.N.Pertsev (A.M.Oboukhov Institute of Atmospheric Physics, Moscow, Russia, n_pertsev@hotmail.com), V.A.Romejko (Space Research Institute, Moscow, Russia, vitrom@tunguska.ru), P.A.Dalin (Institutet for Rymdfysik, Kiruna, Sweden, pdalin@irf.se)

Abstract:

NLCs near Moscow (56 N, 37 E) were observed by the permanent technique almost every summer season within 40 years (1962-2001). Some conclusions, obtained from the analysis of these observations are summarized as follows: 1. NLCs time series contain quasiperiodic variations with periods of 10 and 2-5 years. The autocorrelation functions and autospectra demonstrate distinct difference between decadal (10 years) variability for solar activity indices and for seasonal parameters of NLCs. 2. The correlation analysis between the seasonally averaged characteristics of NLCs and the solar activity index is carried out. Tests for statistical reliability do not allow to distinguish unambiguously the found correlation from a random one. Besides, periods for NLCs characteristics are by 1-1.5 years less than the period of 10.5 years for solar activity index F10.7. 3. Probability of NLCs appearance in a clear night shows a zero trend since 1962. It is in accordance to the conception of zero trend in summer temperature at NLC altitudes. 4. NLCs brightness, accumulated over a season and normed by a number of clear nights, demonstrates positive trend for the same time period, about 1brightness grows together with water vapour density at NLC altitudes.

10.3 MAT.11: Signal Processing for Meteor Detection from Arecibo Observatory Data by Wen, Chun-Hsien

Status: student not in poster competition

Authors: Chun-Hsien Wen, The Pennsylvania State University, cxw381@psu.edu John F. Doherty, The Pennsylvania State University, jfdoherty@psu.edu Jonh D. Mathews, The Pennsylvania State University, JDMathews@psu.edu Stanley J. Jr. Briczinski, The Pennsylvania State University, sjb144@psu.edu

Abstract:

As part of an NSF Information Technology ans Research (ITR) project, we present signal processing techiniques that detect meteor returns from Arecibo observatory radar data in this poster. We exploit the characteristics of the data in the frequency domain as well as in the time domain. Two detection methods are investigated. First, when a meteor is present in the radar return over several inter-pulse periods, there will be a periodic structure in frequency spectrum. By detecting the special structure, we detect the presence of a meteor. Second, we construct a noncoherent matched filter bank to detect the energy of different Doppler frequency components. When the energy exceeds certain a threshold, we claim there is a meteor. We can also find the range of a meteor by finding the peak of the matched filter output. Experimental results show that we can efficiently and reliably detect meteors using these methods.

10.4 MAT.12: Development of a Meteor Interferometer for the 430 MHz Arecibo Observatory Radar by Briczinski, Stan

Status: student in poster competition PhD

Authors: Stan Briczinski The Pennsylvania State University sjb144@psu.edu John Mathews The Pennsylvania State University jdmathews@psu.edu

Abstract:

The micrometeor observations performed using the 430 MHz Arecibo Observatory Radar have greatly enhanced the understanding of meteoric effects in the ionosphere. While line-of-site trajectories are easily obtained, the ability to determine an incoming meteor?s tilt has not been possible up to this point although dynamics consistancy arguments allow identification of across-the-beam meteors. In this poster we present the design of an interferometer designed to measure non-line-of-site trajectories for meteors in the main beam of the 96-foot Arecibo line feed. We will also discuss the effects of the properties of the spherical reflecting dish on interferometer gain.

11 Wednesday Evening 19 June 2002 Poster Session Abstracts, Part 2 Modeling and Simulation

11.1 MOD.08: Sampling the TIME-GCM Model Along the SABER Satellite Orbit Track by Hartsough, Craig

Status: non-student

Authors: Craig Hartsough, HAO/UCAR, craigh@ucar.edu Maura Hagan, HAO/UCAR, hagan@ucar.edu Ray Roble, HAO/UCAR, roble@ucar.edu

Abstract:

Models and observations work in a complementary way in learning about the upper atmosphere. Remote and ground-based observations serve to validate the model results, while the model can provide a fuller picture of the events which observations are sampling. Developing methods to merge these two areas is a critical component in moving our understanding forward.

For many years the TIME-GCM model has been able to produce output to simulate ground-based single-locations observations. We have been working to develop methods to provide model results which simulate satellite measurements, interpolated in space and time along a prescribed orbital track. Here we will report on the progress of our satellite sampling work, using an orbit generator provided to us for the SABER instrument on the TIMED spacecraft and data from a 1993 TIME-GCM run. We will describe our plans for the 2002 TIME-GCM simulation, including analyses using the true TIMED satellite paths and the provisions of a TIME-GCM Web site. This site will contain files of daily TIME-GCM results along the TIMED instruments viewing paths, which can be used for comparisons to the satellite measurements. Finally we will show some ways that the full model view can be helpful in interpreting the observations seen by SABER and ground-based instruments.

11.2 MOD.09: WEB ACCESS TO TIDAL MODELS FOR TIMED by Zhang, Xiaoli

Status: non-student

Authors: Xiaoli Zhang (1), Jeffrey M. Forbes (1), S. Miyahara (3), Maura E. Hagan (2) (1) Department of Aerospace Engineering Sciences UCB 429, University of Colorado, Boulder, CO 80309-0429 (Email: forbes@zeke.colorado.edu; Fax: +1-303-492-7881) (2) High Altitude Observatory, National Center for Atmosphereic Research, P.O. Box 3000, Boulder, CO 80307 (Email: hagan@ucar.edu; Fax: +1-303-497-1589) (3)Department of Earth and Planetary Science, Kyushu University, Hakozaki, Fukuoka, 812-8581 Japan (Email: sbm@rossby.geo.kyushu-u.ac.jp; Fax: 92-642-2685)

Abstract:

As part of the interdisciplinary investigation "Tides, Planetary Waves, and Eddy Forcing of the Mean MLT Circulation", we provide web-based access to global monthly mean tidal fields from two models:the Kyushu University General Circulation Model, and the NCAR/HAO Global Scale Wave Model. Interactive solutions (Hough functions) to Laplace's Tidal Equation and various animations are also available. Herein, we briefly describe the models and illustrate the various tabular and plot options available. This web site also illustrates web data sharing protocols relevant to wider applications: (1) Balance of public access vs. rights of the investigators – Data sharing agreements, appropriate uses and attribution of the data; (2) Levels of accessibility – Agreement, simple form, application and request for password; (3) Methods of data distribution – Data tables, data files, archived data files and plots; (4) Database management – data dictionary, data recovery, resource lock and security.

11.3 MOD.10: Modeling Non-Specular Meteor Trails in the E-Region Ionosphere by Ray, Licia C

Status: student in poster competition Undergraduate

Authors: Licia C. Ray (lcray@bu.edu), Meers M. Oppenheim (meerso@bu.edu), Lars P. Dyrud Kelly D. McMillion, Sigrid Close, Stephen Hunt Boston University Dept. of Astronomy 725 Commonwealth Ave. Boston, MA 02215

Abstract:

Large aperture radars frequently detect meteors and meteor trails in the lower ionosphere between 80 - 130km. Plasma simulations show that Farley-Buneman gradient drift (FBGD) instabilities create field aligned irregularities (FAI) within these trails at a limited range of altitudes. We have constructed a model of meteor processes starting with an ablating meteoroid and ending with the turbulent diffusion of the trail. The model input parameters are initial meteor mass, composition, and velocity, and the output is a simulated non-specular trail. The altitude range of the simulated output coincides remarkably well with RTI images of observed trails. Using this formulation of meteor processes we can calculate several meteor parameters based on observed trail properties.

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