The N_2 Lyman-Birge-Hopfield (LBH) bands (a-X transition) extend throughout the Earth's far-ultraviolet spectrum in the dayglow and aurora. LBH band emissions are important for remote sensing of the Earth's thermosphere, used in both limb-scanning techniques that retrieve N_2 and O_2 densities and in nadir-viewing techniques for retrieving the O/N_2 column density ratios. There is significant uncertainty in modeling the LBH emissions, yet reliable interpretation of remote sensing data depends on the ability to accurately model the emissions. Over the years a wide variety of a-state vibrational population distributions have been inferred from different remote sensing experiments. We present the vibrational population distributions from ultraviolet spectra collected by the High resolution Ionospheric and Thermospheric Spectrograph (HITS) aboard the Advanced Research and Global Observation Satellite (ARGOS). These high spectral resolution (.2 nm) limb-scan data exhibit brighter emissions from the lower vibrational levels than would be expected from traditional models. The altitude- and latitude-resolved vibrational populations provide clues to the N_2 singlet excitation and cascade mechanisms that are key to correct interpretation of LBH observations.

SA12A-1084 1330h POSTER

Photodissociation and Photodissociative Ionization Excitation Emissions from Molecular Nitrogen in the Thermosphere: Results from Analysis of FUSE Dayglow Measurements

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Photodissociation and photodissociative ionization (PDI) excitations of molecular nitrogen result in a number of relatively bright far ultraviolet emission features in the dayglow in addition to the more commonly analysed emissions generated by photoelectron impact (e.g., the N_2 LBH band system). Provided spectral resolutions are high enough, several N_2 PDI features (e.g., N^+ 1085 Å) are of considerable interest as remote sensing alternatives to N_2 LBH. Recent work with Astro-1/Hopkins Ultraviolet Telescope (HUT) data [Bishop and Feldman, *JGR*, *108*(A6), 1243, doi:10.1029/2001JA000330, 2003] made this point but also showed that the emission ratios of the N_2 PDI N*,N^+ lines in the dayglow are not consistent with the ratios of Samson et al [*J Chem Phys*, *95*, 717-719, 1991] obtained with a synchrotron light source. The Far Ultraviolet Spectroscopic Explorer (FUSE) dayglow measurements reported in Feldman et al [*JGR*, *106*, 8119-8129, 2001] are of sufficient spectral resolution to provide reference intensities and emission ratios. First-principles model analysis results for the FUSE LWRS ("low resolution", 0.38 Å) dayglow data from September 1999 for N_2 PDI N*,N^+ and other N_2 features are presented and compared with the Astro-1/HUT analysis results.

SA12A-1085 1330h POSTER

Preliminary Validation of Atmospheric Neutral Density Derived From Ultraviolet Airglow Observations

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In the past, orbit determination and prediction for resident space objects relied on climatological models to estimate atmospheric drag. Characteristic of climatology, atmospheric density models have errors that range from 10% to 15%. For Low Earth Orbiting (LEO) satellites, the error due to an imprecise density specification is the most significant contribution to the error ellipse associated with the position of the object. Several techniques to obtain corrections for the atmospheric density models and improve orbit determination are in various stages of research and development. This paper presents ultraviolet airglow derived atmospheric density corrections for the NRLMSISE-00 model during January and February 2001. Observations of the naturally occurring airglow on the Earth's limb were obtained from the Low-Resolution Airglow and Auroral Spectrograph (LORAAS) on the Advanced Research and Global Observation Satellite (ARGOS). Inversion algorithms developed at the Naval Research Laboratory were used to retrieve neutral density profiles from the observations. The result of the inversion process produces four correction coefficients for the NRLMSISE-00 atmospheric model; one for the F10.7 cm solar flux model input parameter, and three scalars for the O, O2 and N2 model output. The proper application of these correction coefficients with NRLMSISE-00 allows for the calculation of a global total density specification. Ultraviolet airglow derived density for January and February of 2001 were first compared to climatology using the Jacchia J70 and NRLMSISE-00 models. Additionally the ultraviolet derived density was compared to global density specification from the High Accuracy Satellite Drag Model (HASDM) developed for the Air Force Battlelab. HASDM determines global atmospheric density by simultaneously evaluating the drag on a reference set of resident space objects. From the Space Surveillance Network (SSN) observations of the HASDM reference objects, in-track total density was computed using Special-K software for direct comparison to ultraviolet derived atmospheric density. The results of the preliminary validation of the ultraviolet airglow derived density specification are provided in this paper through comparisons to the techniques mentioned above.

SA12A-1086 1330h POSTER

Precision Measurement of the O II 732,733 nm Wavelengths from High Resolution Sky Spectra

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We present new measurements from high resolution sky spectra taken with the Keck I HIRES spectrograph of the wavelength splittings and intensity ratios between the components of the O^+ $2p^3$ $^2P_{1/2,3/2}$ - $^2D_{5/2}$ 732 nm and $^2P_{1/2,3/2}$ - $^2D_{3/2}$ 733 nm ionospheric emission line doublets. Specifically, the wavelength splittings of the 732 and 733 nm doublets are redetermined to be 0.1077 $\pm$ 0.0003 and 0.1080 $\pm$ 0.0003 nm, respectively. This determination represents a slight improvement in precision over previous astrophysical values. However, a number of atmospheric scientists have incorrectly used a much older value of about 0.08 nm in previous Fabry-Perot observational campaigns.

SA12B MCC: Level 2 Monday 1330h

New Measurement and Analysis Techniques Posters

Presiding: **Q Wu,** National Center for Atmospheric Research

SA12B-1087 1330h POSTER

Thermospheric Composition from Scale Height Analysis

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Efforts to validate spectroscopic methods of monitoring the thermosphere and ionosphere have led to renewed interest in thermospheric composition and models. In the past, different methods of measuring composition have produced conflicting results. In the present work, we use scale heights to constrain the composition measurements through the mean molecular mass and temperature. Scale height analysis has the advantage that it compresses the measurements, thus facilitating comparison and evaluation. To determine a physically reasonable composition profile, we start with a consideration of eddy diffusion near the intersection of the thermosphere with the mesosphere, and use scale height analysis at the higher altitudes. Neutral density measurements using improved drag coefficients constrain the sum of the constituents. The resulting composition at altitudes between 90 and 350 km at a time of average solar and geomagnetic activity will be compared with several data sets, and with some old and new thermospheric models.

SA12B-1088 1330h POSTER

An Evaluation of the Charge Exchange Equilibrium Technique to Derive [H]/[O]

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Quantification of neutral species densities in the upper thermosphere and lower exosphere using ground-based remote sensing remains a difficult problem. One method to derive [H]/[O] utilizes the O on H^+ charge exchange equilibrium equation (CEE) with incoherent scatter radar (ISR) observations of [H^+] and [O^+]. The CEE technique has been historically hamstrung by the requirement of very high precision measurements of minor constituents in the region where the equilibrium condition holds, and is not violated by H escape, near and just above the F-region peak. By taking advantage of the precise values of [H^+], [O^+], and T_i now available by consequence of the multiple ion spectral fitting at Arecibo, an investigation into the usefulness of the CEE condition for neutral density determination is now possible. More than 50 days of Arecibo topside ISR measurements are used to derive [H]/[O] at and above the F-region peak, and a statistical comparison with MSIS derived estimates is performed to evaluate the CEE technique. Local time, seasonal, and solar cycle trends are examined. Finally, the differences between the two estimates of [H]/[O] are also characterized.

SA12B-1089 1330h POSTER

Estimating the Neutral Atmospheric Forcing Using Data Assimilation

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Based on data assimilation techniques developed in meteorology and oceanography, a data assimilation system has been developed to provide a time-dependent estimate of the thermospheric density, temperature, and composition. Through its application, distinct characteristics of the neutral atmosphere have become apparent. It has been long realized that, unlike the troposphere, the neutral atmosphere is more strongly driven by external forcing, which includes Joule, particle, and solar heating. It has also been understood that knowing the forcing alone, over a period of days, can allow for a fairly accurate modeling of the neutral atmospheric conditions: density, temperature, and composition. Unfortunately, the magnitude and the distribution of the forcing are difficult to observe since scalar values are typically used to describe complicated processes. The research presented here attempts to better estimate the forcing and its effect on the neutral atmosphere from observing the neutral atmospheric conditions and the changes in these conditions spatially and temporally. Since the magnitude and distribution of the forcing cannot be observed directly, a statistical approach is used to provide the best' description for this process through data assimilation.

SA12B-1090 1330h POSTER

Determination of Density and Temperature at High Altitudes using Raleigh and Raman Scattering of Solar radiation

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The concept of determining the density (particles/unit volume) of atomic and molecular species at high altitudes (100-600 km) by passive remote sensing of the Raleigh and Raman limb-scattered solar radiation is explored. While both atoms and molecules contribute to Raleigh Scattering, only molecules normally contribute to Raman Scattering. Although the rotationally Raman Scattered component of the radiation is usually 20-40 times weaker than its Raleigh counterpart, the atomic and molecular contributions may be separated using different functional dependence of the two mechanisms on the scattering angle. Since the atmosphere at these altitudes is not well mixed, the dominant contributors to atomic (O, N, He, Ar) and molecular (nitrogen, oxygen) scattering may be further distinguished by their differing scale heights. The limb densities thus obtained will be used to calculate the filling in of a number of Fraunhofer lines (Ring effect) to derive the rotational temperatures of the molecular species. Finally, Abel inversions will be carried out to obtain the density and temperature profiles as functions of altitude.

SA12B-1091 1330h POSTER

Development of and Initial Results From Stimulated Electromagnetic Emission Measurement Systems at Tromsø, Norway

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It is well known that the electric field of a high power HF wave transmitted into the ionosphere will interact with the free electrons in the plasma by causing them to oscillate at the same frequency as the transmitted wave, and then to re-emit other electromagnetic waves, with frequencies near the original wave, but with the power in the new emission being much weaker than the original. This effect is known as stimulated electromagnetic emission, or SEE. On 11 and 12 November 2001, high power HF radio wave heating experiments were carried out in the ionosphere above the EISCAT observatory near Tromsø, Norway. Optical observations revealed artificial aurora in the form of rings, which lasted for several seconds before collapsing into blobs, while at the same time descending in altitude, and then disappearing. During this experiment SEE were recorded on a traditional spectrum analyzer system; this can tell us information about the relationship between the auroral rings and the local electron gyrofrequency, and thus help to determine why the rings occur. The geometry of the rings suggests a dependence of the emissions to the angle with respect to the geomagnetic field, or possibly to the spatial gradient in the HF radio wave pump beam. An angular dependence in the artificial excitation of enhanced ion-acoustic and Langmuir waves has also been seen in incoherent scatter radar (ISR) observations. In an attempt to determine if such a dependence exists in SEE, an interferometric SEE system is being developed and will be described. ISR observes Langmuir turbulence and SEE is a result of upper hybrid turbulence, either of which may accelerate electrons and produce optical emissions. The combination of angle-sensitive SEE and ISR observations, along with other available measurements, will thus help to determine if the optical emissions are due primarily to one type of turbulence or to a combination of both.

SA12B-1092 1330h POSTER

Stimulated Emission and Radar Observations of RF-Ionosphere Interaction Experiments at HAARP

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High power HF radiowaves launched from ground-based transmitters interact with overdense ionospheric plasma to produce strong nonlinear effects. Where available, VHF/UHF radar data reveal several spatial and temporal signatures in the plasma line backscatter indicative of strong turbulence effects at many scales. Stimulated electromagnetic emissions (SEE) which propagate to HF receivers on the ground may provide information complementary to plasma line backscatter. Many experiments using SEE receivers have been performed using relatively long (seconds) HF pulses. Long HF pulses are sufficient to produce irregularities and turbulence at several scales, incorporating many effects, evident in the complex SEE spectra recorded. We report a series of experiments performed at HAARP (Gakona, Alaska) using both HF radar and SEE diagnostics together with a range of HF pulse widths down to ten mil-liseconds. Using short HF pulses, we are able to discriminate, characterize, and compare prompt SEE spectra over the time-scales of typical radar features. HF radar studies of HF pump-induced field-aligned irregularities allow the formation, evolution, and transport of these intermediate-scale structures to be characterized. Results of numerical modeling of the development of strong short-scale turbulence and mesoscale irregularities are presented for comparison with these experiments.

SA12B-1093 1330h POSTER

The Use of Plasma Fluid Finite Difference Time Domain (PF-FDTD) Models In the Analysis of the E-Winds Plasma Impedance Probe Observations

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Utah State University has developed a Plasma Fluid Finite Difference Time Domain (PF-FDTD) model to simulate an antenna in magnetized space plasma. This simulation tool, based on the five moment Maxwellian plasma fluid equations, allows the impedance of an antenna to be determined for varying plasma parameters. This paper will compare the Plasma Fluid Finite Difference Time Domain (PF-FDTD) model to the experimental data of the E-Winds mission, validating the model and improving the accuracy of the electron density, collision frequency, and temperature measurements. Analytic closed form theories for the impedance of an antenna in a plasma predicts a large resistive component for frequencies around the upper hybrid frequency. These were not observed in the E-winds data were discrepancies of an order of magnitude are observed in some cases. Signatures of kinetic effects on antenna impedance are observed E-winds data set which cannot be reproduced by the PF-FDTD model.

SA12B-1094 1330h POSTER

Moving of the High-Speed Plasma jet Through the Ionosphere of the Different Density: Optical and Radiation Effects

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The investigation of the high-speed plasma jet dynamics in the geomagnetic field has important implications to the basic magnetospheric and ionospheric physics and to the applied problems. The new results of the active geophysical rocket experiment (AGRE) "North Star" (1999) are represented. The high-speed plasma jet was injected on the altitudes 360 and 280 km perpendicular to the geomagnetic field. During first injection plasma jet was injected in the artificial air cloud with the density 10-12 g/cm3, during second one - in the free space with the density 10-15 g/cm3. The design and characteristics of the plasma jet generator, the radiation dynamics of the plasma cloud and dynamics of the charged particles takes place during of the process of the interaction of the plasma jet with environment are discussed.

SA12B-1095 1330h POSTER

New 430 MHz Radar Capabilities for Aeronomy at Arecibo Observatory

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The Arecibo 430 MHz radar is overall the world's most sensitive instrument for incoherent scatter radar. Recent and ongoing improvements in hardware and signal processing allow new experiments, more flexible implementation of existing radar modes for better implementation of special experiments, and higher quality data in our World Day observations. These improvements include: The dual beam radar is a regular capability. Most World Days now use both the line feed and Gregorian radars to provide higher time resolution for vector velocity velocity measurements, better spatial sampling during rapidly varying storm conditions, and the capability to look at gradients that exist even under nominally quiet conditions. The dual beam capability is available to visiting scientists for D and E as well as F region studies. We are accomplishing upgrades to our data-taking system on an incremental basis. For example, we now take nearly all data in the raw data mode where all samples are stored on disk. For all but special experiments, processing occurs on a Linux pc in real time, but it is possible to reprocess if necessary. It is also possible to use data taken for one purpose for other purposes. For example, it is possible to use coded long pulse E region data to gather statistics on meteors. Our digital receiving system is nearing completion. It will replace our entire old IF and base band system (red panels). Set ups will consist only of cables to connect the receiver IFs and the transmitter samples to the new system, as well as the transmitter control connections. Special experiments will become standard. For example, it will be possible to get independent calibrations on the line feed and Gregorian radars using plasma line cut off and plasma line power profiles with

no additional setup. Also, the extra stability of the digital system will make it easier to keep independent accurate calibrations during the night when plasma lines are not available. High resolution plasma line spectra will become available as a standard technique in the near future. The high bandwidth and large storage capabilities necessary to measure the entire IS spectrum (ion and electron components) above the F region peak will be available. We are developing a new World Day technique to take advantage of the new hardware; it will use modern inverse techniques to eliminate biases and new modulation sequences for best SNR. A poster at this meeting (Nikoukar et al.) describes this technique.

SA12B-1096 1330h POSTER

A Two-Step Lag-Profile-Based Approach to the Inversion of the Incoherent Scatter Radar Data

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The extraction of altitude profiles of ionospheric parameters such as electron density, electron temperature, ion temperature, and ion fractions from the incoherent scatter radar (ISR) measurements requires careful consideration of two main aspects of the inversion process. The first is due to the range smearing effect of the radar pulse on the information from one altitude over a range of altitudes, and the second is due to the nonlinear relationship between the parameters and measured spectra. We propose a two-step lag-profile-based method for accurate and efficient parameter estimation from ISR data. The first step consists of the computation of the incoherent scatter autocorrelation function (ACF) from a set of 1-D deconvolutions. We exploit regularization techniques to overcome the problems associated with the ill-conditioned nature of the convolution matrix. Estimation of the parameters from the resulting incoherent scatter ACF using non-linear least-squares fitting methods forms the second step. Furthermore, as simulations reveal, using two or more pulses improves the deconvolution process by reducing the inherent ambiguity in the range smearing operation. We have developed a technique using a pair of simple amplitude-modulated sequences that has superior performance over a pair of long pulses. The nonlinear least squares fitting of the deconvolved lag-profiles may be accomplished for one height at a time or for an altitude model (such as polynomial) of the ionospheric parameters at a limited range of altitudes. We consider the suitability of each alternative for the inversion of the Arecibo World Day data. Results demonstrate improved spatial resolution obtained while reducing the computational complexity.

SA12B-1097 1330h POSTER

A Continuum of Gravity Waves in the Arecibo Thermosphere?

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Previous radar studies conducted at Arecibo Observatory, Puerto Rico [e.g., Djuth et al., Radio Sci., 32, 2321-2344, 1997] have demonstrated that ∼1-3% electron density "imprints" of internal gravity waves are routinely observed in the Arecibo thermosphere (∼118 km - 400 km). A special radar technique involving photoelectron-enhanced plasma waves (PEPWs) was used for these observations. The imprints are decisively detected at 30-60 standard deviations above the "noise level" imposed by the measurement technique. In general, the observed electron density imprints are relatively "clean" in that their vertical wavelength spectrum is characteristically narrow-banded. This technique is effective only during the daytime when large fluxes of photoelectrons are present in the Arecibo ionosphere. On average, good observing conditions exist for about 7 hours a day. The limited diurnal coverage is arguably the greatest shortcoming of the technique. Recently, it was discovered that the trails of these waves can be detected in standard incoherent scatter power profiles when properly filtered. This result was validated using simultaneous PEPW observations. The new development opens up the possibility of monitoring thermospheric gravity waves day and night. Preliminary studies indicate that "sets" of gravity waves separated by approximately 30-60 minutes are continually propagating through the Arecibo thermosphere, at least during the daytime when most of the current data is available. With the aid of additional radar tests, it may be possible to unlock power profiles recorded over the past 30 years at Arecibo for gravity wave studies. Possible sources of the thermospheric gravity waves include ocean waves or reconstituted waves arising from nonlinear wave processes in the mesosphere. However, the exact origin of the waves is currently not well-settled.

SA12B-1098 1330h POSTER

New Multi-Emission Fabry-Perot Interferometer Observations at Resolute

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A new multi-emission Fabry-Perot Interferometer was installed at the Early Polar Cap Observatory in Resolute, Canada in the summer of 2003. The instrument provides neutral wind measurements from the upper and lower thermosphere and the mesosphere using the atomic oxygen 630 nm and 557.7 nm emissions, and the OH 892 nm emission. Several other filter positions are also available for future expansion and collaborative campaigns. The wind errors for the 630 nm emission range from 3 to 15 m/s with a 5-minute integration. The errors for the 557.7 and 892 nm emissions are 3 and 8 m/s with a 3-minute integration, respectively. The instrument is fully automated and will able to provide continuous coverage during the northern winter season. We present some new results from the instrument, and discuss future collaborations with other ground-based and satellite investigations.

SA12B-1099 1330h POSTER

A New Meteor Radar System in Barrow Alaska

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The University of Colorado in collaboration with the Institute of Experimental Meteorology in Obninsk Russia have developed an inexpensive and robust meteor radar system. This system, named COBRA, has been replicated and deployed to stations around the globe. In this paper we will report on the first results from a COBRA meteor radar system that was installed in Barrow Alaska (71.3N,156.6W) during the summer of 2001. A description of the system operation in conjunction with initial results will be presented. Data from the COBRA system will be compared with the global scale wave model and other currently operating high latitude radar stations.

SA12B-1100 1330h POSTER

L-Band TEC Measurements and Lower Frequency Scintillation

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Signal amplitude measurements from the GPS satellites are currently limited to L-band frequencies above 1 GHz, which often remain unaffected by conditions causing even severe scintillation at more sensitive lower frequencies. Use of differential carrier phase data from dual frequency receivers to drive phase screen models and estimate scintillation at other frequencies is one potential means of monitoring scintillation over a wider range of frequencies. However, this process is complicated by the presence of a diffractive component in the L-band signal phase which can obscure the true structure in total electron content (TEC) needed as input to phase screen models. Signal amplitudes and phases at L1 and L2 frequencies (1.57 and 1.23 GHz, respectively) are calculated after propagation through one-dimensional power-law phase screens and then the resulting differential carrier phase compared with the initial phase values in the screen. Scintillation at a variety of frequencies is then computed from both the original screen and the simulated differential carrier phase, and the two results compared to examine the effects of the unobservable diffractive phase component contained in observational TEC data. Initial results show an increase of 10% in S4 index computed at 250 MHz from simulated differential carrier phase compared to the direct phase screen computation. These results suggest that under many conditions L-band TEC observations can be used effectively to estimate VHF and UHF scintillation over a wide range of scintillation levels, and that the differences resulting from use of observed TEC instead of true ionospheric phase can be accounted for by a relatively simple correction factor.

SA12B-1101 1330h POSTER

Specifying and Predicting Ionospheric Disturbances with C/NOFS

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The purpose of the Communication/Navigation Outage Forecasting System (C/NOFS) is to forecast ionospheric irregularities that adversely impact communication, navigation and surveillance systems. A satellite, scheduled for launch in 2004 into a low inclination (13°), elliptical (400 x 700 km) orbit, is the main component of the C/NOFS Mission. Complementary ground-based measurements form the other Mission segment. C/NOFS is the first satellite solely dedicated to forecasting ionospheric irregularities and radio wave scintillations. Its sensors will measure the following parameters: ambient and fluctuating electron densities; ion and electron temperatures; AC and DC electric fields; magnetic fields; neutral winds; ionospheric scintillations; and electron content along the lines of sight between the C/NOFS and GPS satellites. Forecasting will be based on both ground and space data. In order to predict the presence of scintillation-producing irregularities the following three main tasks need to be accomplished: (1) nowcast and forecast the background equatorial ionosphere; (2) identify mechanisms that trigger or quench the plasma irregularities; and (3) determine how irregularities evolve. In this presentation, we will describe these steps, as well as the validation and campaigns that are planned.

SA12B-1102 1330h POSTER

Ongoing Evolution of the Geospace Electrodynamic Connections (GEC) Mission

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NASA's planned Geospace Electrodynamic Connections (GEC) mission is composed of several identical spacecraft in eccentric (2000 km to below 200 km) orbits, with 83 degree inclinations. GEC observations, complemented by land-based measurements, will delineate the complex spatial and temporal scale ionosphere/thermosphere processes associated with the energy and momentum transfer between the magnetosphere, ionosphere, and thermosphere. GEC will provide the key in situ plasma and neutral particle measurements needed to complete our understanding of the effects of the upper atmosphere on magnetosphere-ionosphere coupling. To best accomplish its science goals, the technical design must strive to minimally disturb the environment, maximize the number of spacecraft, have the ability to traverse the lower ionosphere, and efficiently manage a pearls-on-a-string spacecraft constellation with variable spacecraft separations. Initial industry studies of the mission demonstrated that an ambitious 4-spacecraft mission with deep dipping capability to 130 km is challenging given NASA's cost cap. Therefore some of the mission constraints were

changed to provide an affordable mission concept that still meets the major science goals. Spacecraft accommodation studies, performed by industry in 2003, have now provided mission designs that are consistent with the cost and weight constraints and have highlighted major mission challenges. Preliminary plans are for NASA to issue a GEC Announcement of Opportunity (AO) in 2004 for launch in about 2009.

SA12B-1103 1330h POSTER

Ionospheric Research with Miniaturized Plasma Sensors Aboard FalconSAT-3

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Investigations into a novel technique to measure ionosphere-thermosphere parameters have culminated in the Flat Plasma Spectrometer (FLAPS) experiment, presently under development through a collaboration between NASA Goddard Space Flight Center (GSFC) and the U. S. Air Force Academy (USAFA). FLAPS is capable of providing measurements of the full neutral wind vector, full ion-drift velocity vector, neutral and ion temperatures, and deviations from thermalization. In addition, coarse mass spectroscopy is possible using an energy analysis technique. The suite of instruments is comprised of a set of 16 individual neutral and ion analyzers, each of which is designed to perform a specific function. Advances in miniaturization technology have enabled a design in which the 16-sensor suite resides on a circular microchannel plate with an effective area of 25 cm^2. The FLAPS electronics package, consisting of low voltage and high voltage power supplies, a microprocessor, and Application Specific Integrated Circuit (ASIC) amplifiers, requires a volume of 290 cm^3, power of 1.5 W, and a mass of 500 g. The suite requires a +5V regulated power line from the spacecraft, and the telemetry interface is a 5.0 V TTL-compatible serial connection. Data collection rates vary from 1 to 1000 (192 Byte) spectra per second. The motivation for the FLAPS experiment is driven by objectives that fall into both basic science and technology demonstration categories. Scientifically, there is strong interest in the effects of ionosphere-thermosphere coupling and non-thermalized plasma on the processes associated with equatorial F-region ionospheric plasma bubbles. These bubbles have been known to scintillate transionospheric propagation of radio waves, often resulting in disruptions of space-based communication and navigation systems. FLAPS investigations will assist in quantifying the impact of various processes on the instigation or suppression of plasma bubbles; certain outstanding questions include 1) What is the relevance of meridional winds in suppression of plasma bubble growth? 2) What role does a velocity space instability driven by non-thermalized plasma play in the generation of small scale (<1 km) bubbles? 3) What process is responsible for turbulence in plasma beyond the edges of a bubble structure? Technologically, the need for small yet capable instruments arises from the desire to make multipoint *in situ* measurements of "microscopic" plasma parameters to provide insight into "macroscopic" phenomena. Examples include coherency of spatial boundaries of large-scale (∼100 km) plasma bubbles, three dimensional structure of the equatorial wind and temperature anomaly, and vertical velocity gradients in the low latitude ionosphere. This paper provides an overview of the experiment motivation and instrument design of the FLAPS experiment.

SA12B-1104 1330h POSTER

ROCSAT II Airglow Instrument for Upper Atmospheric Research

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ROCSAT II is an upper atmospheric research satellite to be launched in the end of 2003. The remote sensing instrument-ISUAL include a few imaging and photometric detectors to measure the optical emissions generated by atomic and molecular species in the upper atmosphere. The instrument was designed to study the upper atmospheric lightening- the SPRITES. However, there are aurora and airglow modes to be utilized for aeronomy studies . Furthermore, the Sprite involves many similar optical emissions generated as the airglow. The ROCSAT II Sprite experiment consist of a CCD imager, six-channel photometers, and a 2-channel photometer array, by using filters centered at the wavelengths 557.7 , 630, 760 nm for CCD and additionally 432.7, 777.4 and 762 nm for photometer. The CCD imager will be most useful for studying the airglow globally. The following is a list of the planned airglow research: (1) The global and equatorial distributions of airglow emissions: O(1D), O(1S), and O2(b) (2) The basic physical and chemical process to generate the airglow, such as the production mechanism, (3) Measurements of atmospheric parameters and compositions including the profiles of electron, O atom, ozone. (4)The dynamics of the atmosphere including gravity waves, temperature inversion, tidal and planetary waves, (5) The long term changes of the upper atmosphere related to the cooling of the upper atmosphere due to green house effects. These studies will be compared with previous measurement such as UARS in 1992-1998. The O2 A band airglow will be used as an example.

SA12B-1105 1330h POSTER

Spacecraft Charge Monitor

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We are currently developing a flight prototype Spacecraft Charge Monitor (SCM) with support from NASA's Small Business Innovation Research (SBIR) program. The device will use a recently proposed high energy-resolution electron spectroscopic technique to determine spacecraft floating potential. The inspiration for the technique came from data collected by the Atmosphere Explorer (AE) satellites in the 1970s. The data available from the AE satellites indicate that the SCM may be able to determine spacecraft floating potential to within 0.1 V under certain conditions. Such accurate measurement of spacecraft charge could be used to correct biases in space plasma measurements. The device may also be able to measure spacecraft floating potential in the solar wind and in orbit around other planets.

URL: http://www.goembel.biz

SA12B-1106 1330h POSTER

Next Generation Plasma Impedance Probe Instrumentation Technique

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Four Utah State University Plasma Impedance Probes (PIP) were part of NASA's Sequential Rocket Study of Descending Layers in the E-Region (E-Winds). The payloads were launched at 11:19 pm, 1:41 am, 2:50 am and 3:07 am on June 30 and July 1, 2003 from Wallops Island, Virginia into the nighttime D and E-regions. The PIP is a suite of instruments for observing relative and absolute electron densities, magnetic field strength, and electron-neutral collision frequency. The suite consists of a Plasma Frequency Probe, a Swept Impedance Probe, a Q probe, an experimental Ion Impedance probe, and a DC Langmuir probe. The first four instrument diagnostics are based on the impedance characteristics of an antenna immersed in plasma. Resonance effects at low frequencies (1-100 kHz) where ion dynamics become important were observed by the Ion Impedance Probe. This data set may lead to the first mid-latitude measurements of ion-neutral collision frequency and full conductivity measurements of the ionosphere. Preliminary analysis of flight data shows a considerable amount of sensitivity in all of the instruments that should allow for absolute electron density measurement in the 1 to 10 per cc range and comparable accuracy in electron neutral collision frequency. This paper presents the instrumentation techniques, calibrations and initial results for this flight.

SA12B-1107 1330h POSTER

Observations of vehicle charging in dusty plasma

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The NASA Sudden Atom Layer (SAL) rocket was launched in February of 1998 from Puerto Rico into an approximately 5 km thick sodium layer that peaked at 94 km altitude. This layer was observed from ground based lidar as well as the Arecibo Radar. The instrument payload consisted of a charged dust detector, an electric field probe, a DC Langmuir probe, and a RF impedance probe. The instruments experienced an anomalous charging event as the rocket passed through this sodium layer. We present here an analysis of the DC Langmuir probe data and the RF impedance probe data to compute the amount of vehicle charging attributed to charged dust. Possible scenarios that could lead to the observed charging effects on the instruments are investigated using a novel SPICE model. The model development and its features are also presented in this paper. Finally, our findings are also compared with those of the dust detector.

SA21A MCC: 2006 Tuesday 0800h

Small-Scale Processes in the High-Latitude E Region I *(joint with SM, AE)*

Presiding: **M Conde,** University of Alaska**; M Larsen,** Clemson University

SA21A-01 0800h INVITED

Small-Scale Structure in the Auroral Thermosphere Determined from Rocket and Ground-Based Observations during the CODA and ARIA Set of Experiments

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A set of rocket and ground-based experiments were carried out between 1992 and 2000 at Poker Flat Alaska in the CODA and ARIA experiments to study the state of the thermosphere during primarily diffuse auroral heating events. Both instrumented payloads and chemical release payloads were launched to measure the compositional and wind properties of the lower thermosphere, generally in the altitude region between 90 and 200 km, in order to study the response to small-scale forcing and the gradients in the forcing that existed within the auroral oval. Contrary to conclusions based on early models that predicted enhanced winds over a large range of altitudes, the ARIA results showed large winds in a narrower height range near 100 to 120 km with a vertical scale of only 10 to 20 km. The wind speeds were also smaller than the theoretical predictions except in the most disturbed conditions. Measurements over a range of activity levels from the set of rocket experiments have shown a transition from quiet-time tidal winds with peak speeds of approximately 100 m/s to sub-storm winds with wind speeds up to 250 m/s and strong shears in the lower E-region. Richardson numbers associated with the strong wind shears have been well below the usual instability threshold of 0.25, implying strong instability and turbulence generation in the flow and photographs of the chemical release plumes are suggestive of Kelvin-Helmholtz instabilities. Several different techniques were used to measure the composition in the lower thermosphere during these experiments with varying degrees of success. These included in situ rocket measurements of atomic oxygen using resonance lamp techniques, nitrogen and molecular oxygen using a neutral mass spectrometer, and the O/N2 ratio using rocket-borne and ground-based optical remote sensing techniques. The most striking aspects of these observations are the temporal variability and large magnitude of the atomic oxygen depletions that far exceed model expectations. The contributions these experiments have made to our understanding of the small-scale structure in the lower thermosphere and the questions remaining unanswered will be reviewed.

SA21A-02 0815h

Atomic Oxygen Depletion Observations in a Diffuse Aurora

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