SM11D-07 1130h

Early Observations of Saturn Kilometric Radiation by Cassini

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One of the primary objectives of the Cassini radio and plasma wave science investigation at Saturn is the study of Saturn kilometric radio emissions (SKR). Based primarily on Voyager observations, these emissions are believed to be analogous to auroral kilometric radiation at Earth, generated via the cyclotron maser instability near the electron cyclotron frequency on field lines threading Saturn's aurora. Beginning in early 2002, Cassini has observed Saturn's most prominent radio emission on numerous occasions with signal to noise ratios exceeding 10 dB, even though the spacecraft is still more than two astronomical units from Saturn. One specific objective involving SKR is to develop the relationship between the timing and intensity of the radio emissions as a function of solar wind input; strong correlations with various solar wind parameters are already known on the basis of Voyager studies. A second objective is to measure spectral and temporal variations in the SKR emissions at high resolution. The observations acquired by Cassini to date already allow such studies to begin. Simple ballistic projections of high density regions in the solar wind observed at 1 AU have been used successfully to predict the intensification, hence detection, of SKR by Cassini. Also the first high-resolution frequency-time spectrograms of SKR have been acquired; these show a wealth of spectral and temporal structure one would expect on the basis of observations of terrestrial auroral kilometric radiation.

SM11D-08 1145h

A Global Three Dimensional Hybrid Simulation of the Interaction Between a Magnetized Obstacle and the Solar Wind

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We present results from the numerical modeling of the interaction between the solar wind and a conductive obstacle with a dipole magnetic field using a three dimensional hybrid code where electrons are treated as a massless fluid and ions are treated as particles. The results show that the hybrid approach is capable of describing most of the structures formed due to the interaction between the solar wind and a magnetized planet such as the bow shock, proton foreshock, magnetopause, magnetosheath, northern and southern cusps, current sheath, and reconnection sites. We discuss the applicability of the model for different planets in the Solar System. Results from the hybrid simulation model will be compared with the results from a global MHD simulation model.

SM12A MCC: Hall D Monday 1330h

Magnetosphere-Ionosphere Coupling III Posters *(joint with SA)*

Presiding: **H U Frey,** University of California, Berkeley**; L Andersson,** University of Colorado

SM12A-0457 1330h POSTER

Wave Propagation Through the Collisional Ionosphere

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Under the assumption of a vertical magnetic field, the wave dispersion for plasma waves splits into right- and left-hand circularly polarized waves. At frequencies above 0.1 Hz the waves have a profile consistent with the Alfvén resonator, with the transmission efficiency through the ionosphere depending on frequency, and further being different for the two wave modes. Below this frequency (< 0.01 Hz) the mode structure is the same for both modes. However, the actual mode structure depends on the boundary conditions at the bottom of the surface-ionosphere waveguide, being different for open or perfectly reflecting boundary conditions. One feature missing for parallel propagation is the "Hughes rotation," where the wave magnetic field below the ionosphere is rotated by 90° with respect to the wave magnetic field above the ionosphere. This appears to be a result of oblique propagation, with the fast mode being evanescent in the vertical direction when the mode is assumed to propagate across the ambient field. While some consideration must be given to the differences between parallel and oblique propagation, the results for the parallel case indicate that only low frequency waves would maintain consistent polarization through the ionosphere. The differences in attenuation and polarization as a function of frequency argue against the surface-ionosphere waveguide as being the path for transmitting signals such as changes in magnetospheric convection to lower latitudes.

SM12A-0458 1330h POSTER

Ionospheric Electric Field Perturbations at the Nightside Equator Associated With a Geomagnetic Sudden Commencement

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Ionospheric electric field perturbations associated with a sudden commencement at 1640 UT Apr. 6, 2000 were observed by the FM-CW HF radar at the dip equator station Cebu, Philippine. Ionograms were obtained from the FM-CW HF radar at intervals of 5 minutes. The zonal electric field can be estimated from the time variation of the height profile of ionograms. A sudden increase in the westward electric field of 1.6 mV/m was observed simultaneously with the sudden increases in the H component magnetic field of 250 and 110 nT at the dayside dip equatorial station Ancon, Peru and the dayside off dip equatorial station Eusebio, Brazil, respectively. The amplitude enhancement of the magnetic variation at the dip equator suggest that an eastward electric field was imposed at the dayside equatorial ionosphere. Both the dayside and nightside electric field perturbations show that the dawn to dusk electric field of DP(MI) was imposed globally on the equatorial ionosphere.

The HF Doppler frequency shift was observed at the nightside low latitude station Sugadaira, Japan. From the frequency deviation, it is found that a westward electric field of 2.0 mV/m was suddenly imposed at the beginning of the sc. The amplitude of the westward electric field observed at the nightside equator is 0.8 times that at the nightside low latitude station. It can be caused by the geometrical attenuation [Kikuchi et al., 1978, Nature].

The direction of the zonal electric field observed at Cebu was reversed from westward to eastward and returned westward again. The electric field at Sugardaira shows similar temporal variations. These variations were well correlated with fluctuations of solar wind number density. The eastward electric field may be caused by the over shielding effect of the region 2 field-aligned current [Kikuchi et al., 2000, JGR].

Acknowledgement. The HF Doppler data was provided by Sugadaira Space Radio Observatory, Univ. Electro-Comm.

SM12A-0459 1330h POSTER

The Electrodynamics in the Ionosphere During Substorms

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From the observations by the PIXIE and UVI cameras on board the Polar satellite, we derive global maps of the precipitating electron energy spectra from less than 1 keV to 100 keV. Based on the electron spectra, we infer the height profiles of the resulting ionization. Photoionization by solar illumination is also included in these calculations. We then generate instantaneous global maps of the Hall and Pedersen conductances. The UVI camera provides good coverage of the lower electron energies contributing most to the Pedersen conductance, while PIXIE captures the high energetic component of the precipitating electrons affecting the Hall conductance. A study by Aksnes et al. [Ann. Geophysicae, 20, 1181, 2002] shows that the Hall to Pedersen conductance ratios from combined PIXIE and UVI measurements are larger than those given by existing statistical conductance models. While most statistical conductance models have derived conductances from electron precipitation data below approximately 30 keV, PIXIE measurements provide us with the electron fluxes at higher energies needed to derive an accurate Hall conductance. The instantaneous global conductance maps derived from combined PIXIE and UVI measurements have been implemented in the Assimilative Mapping of Ionospheric Electrodynamics (AMIE) procedure to provide global instantaneous distributions of ionospheric electrodynamical parameters. In this study, we present the electrodynamics in the ionosphere during substorms. We also investigate the possible effects of the PIXIE data on the AMIE outputs.

SM12A-0460 1330h POSTER

Statistical Behavior of Proton and Electron Auroras During Substorms

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The IMAGE FUV imager can provide global maps of electron and proton precipitation and it is possible to observe how these maps change as a result of substorms. The large body of IMAGE FUV data permits the performance of a superimposed epoch analysis for many substorms. For each substorm the onset locations and times were determined from the Wideband Imaging Camera (WIC) images which represent

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mainly electron auroras. For the superimposed epoch analysis the WIC (electron) and Spectrographic Imager SI12 (proton) images were transformed into rectangular magnetic latitude (MLAT) and magnetic local time coordinates (MLT). Each event was plotted on a time scale related to the time of onset and the MLT scale was shifted until the onset point of each substorm was lined up at 0 relative magnetic local time (RMLT). A double Gaussian was then fitted to the data at RMLT of -4,-2,0,+2,+4 by representing the auroral intensity, I, as a function of MLAT. From the Gaussian coefficients we were able to obtain the mean of the peak auroral intensities, the mean location of the maximum intensity, and the mean position of the poleward and equatorward boundary of the proton and electron precipitation. From 91 substorms we derived some statistically meaningful quantities. We showed that presubstorm there is an equatorward motion of the equatorward boundary of the electron and proton aurora. At onset the proton auroral peak intensity increases only by a factor of two compared to a factor of 5 for the electrons. There is rapid poleward expansion of the proton aurora after onset which slows down after the first few minutes. The electron onset continues towards higher latitudes. The relative position of the proton and electron aurora and their boundaries was investigated for various RMLT during substorm phases.

SM12A-0461 1330h POSTER

A Comparison Between Non-potential and Potential Models for the Ionosphere Electric Fields and Calculation of the Shielding Currents.

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The standard models for calculating the electric currents in the ionosphere usually are based on the assumption that the electric field causing this current is a potential field. Recently we have considered the model for numerically simulating the ionospheric currents without assuming a potential electric field. The proposed model involves the non-potential electric field which is not only responsible partially for the ionospheric currents, but also induces the shielding electric currents in the Earth ground.

The latter effect is because the non-potential electric fields are not electrostatic and hence can not be shielded with the simple redistribution of the electric charges. The typical pattern of the shielding currents is obtained.

We compare the solutions obtained within the different models for given IMF conditions, using BATSRUS (ideal MHD code at the adaptive grid) with spherical blocks. The approach with taking the non-potential fields into account appears to be computationally less expensive and works as well than classical ionospheric potential solutions, such as those used in most MHD models.

SM12A-0462 1330h POSTER

Storm-substorm coupling during 16 hours of Dst steadily at -150 nT

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We examine a storm event on October 21-22, 2001, which showed atypically long-lasting, steady depression of the Dst index. The magnetic storm was driven by an interplanetary magnetic cloud, whose sheath region behind the interplanetary shock drove the storm main phase with Dst decreasing to 150 nT within about four hours. The cloud proper had Bz close to zero at its leading edge and negative at the trailing edge. During the cloud passage, the Dst index stayed at about 150 nT, showing neither recovery during the zero IMF Bz nor further enhancement during the stronger driving during the negative IMF Bz. The magnetic indices as well as the Los Alamos energetic particle detectors onboard geosynchronous spacecraft indicate a series of substorms that could be identified in the ionosphere, at geosynchronous orbit, and in the magnetotail as individual activations. We discuss the magnetospheric dynamics that led to the steady Dst development for more than 16 hours: We consider the driving solar wind and IMF properties, analyze the substorms and their role in the longer-term evolution of the state of the magnetosphere, and evaluate the ring current intensity changes from space-borne observations. Finally, we discuss whether this steady behavior of the Dst index reflects steadiness of the ring current or continued balance of the various current systems contributing to the magnetic response recorded on the ground.

SM12A-0463 1330h POSTER

FAST and IMAGE-FUV observations of a Substorm onset

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On the 6th of February 2002, the NASA FAST satellite transited a substorm break up arc approximately one minute after substorm onset as identified by the NASA IMAGE far ultraviolet (FUV) instrument complement. The bright onset feature had two particle components, a poleward super-thermal electron, and an equatorward quasi static "inverted V" electric field generated component. The super-thermal electrons were closely aligned with the magnetic field with a non-peaked energy distribution consistent with an Alfven wave acceleration. The onset arc is at the poleward boundary of the hot plasma sheet protons. Separated from the Alfven wave accelerated aurora, on the equatorward side, an inverted V type aurora was seen with its quasi-static electric field signature. The FAST particle measurements show an extended region of closed field lines separating the ground onset location (64.2^o ILAT) from the closed/open field line boundary identified by polar rain electrons at 70.6^o ILAT. No magnetic or particle activity related to substorm onset was detected in this high latitude region. The onset is therefore located at some distance from the open-and-closed-field-line boundary in the tail, which is the location of the steady state convective reconnection region. Prior work with FAST and IMAGE FUV data showed that during later phases of the substorm development, the Alfven wave accelerated electrons and the corresponding auroral surge were regularly seen much closer to the polar cap boundary. Comparison of the onset event with those indicates that substorm field line configuration change leads to the surge propagating poleward through a region of closed field lines towards the open-and-closed-field-lines boundary. These observations are consistent with both the near earth neutral line (NENL) and the tail current disruption substorm model.

SM12A-0464 1330h POSTER

GUMICS-4 global MHD simulation and data comparison: results for a magnetic storm and a magnetospheric substorm

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We present quantitative comparisons between a global MHD simulationGUMICS-4 and observations from multiple spacecraft in different regions of the magnetosphere and from ground-based instrument networks. We use a recently developed technique to evaluate the energy entry from the solar wind into the magnetosphere and the amount of energy dissipated in the ionosphere. These are compared with their empirical estimates, the Akasofu epsilon-parameter and the Joule heating and precipitation power deduced from the level of magnetic disturbances. The analysis shows that the overall level of ionospheric energy dissipation is smaller in the simulation than given by the observational proxies, but the temporal changes in the dissipated power are quite similar both for the storm and substorm cases. We also use in-situ magnetic field measurements from the high-altitude magnetosphere to examine the temporal variations in the magnetosphere: Comparison of the simulations with dayside geosynchronous orbit observations during the storm shows that the simulated magnetopause location agrees well with the observed. The nightside magnetic reconfiguration, tail stretching and dipolarization, during the substorm were reproduced in the simulation, although there were some differences in the timing and intensity of the variations. These results are discussed in the context of how reliably the global simulations reproduce observations on one hand during a strongly driven storm event and on the other hand during a substorm more dependent on internal tail dynamics. Finally, we compare the GUMICS-4 results with corresponding results from other simulation codes.

SM12A-0465 1330h POSTER

Kinetic Simulation of Local Transition Layers Associated With the Magnetosphere-Ionosphere Interface

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Recent FAST observations[1] have revealed strong localized unipolar parallel electric fields (i.e., potential ramps) together with the electric-field signature of upward moving electron holes in the auroral downward current region. These potential jumps separate a colder, denser plasma on the ionospheric side from a hotter, rarer plasma on the magnetospheric side. Thus, the magnetosphere-ionosphere interface may be composed, in part, of a sequence of such *transition layers*. We have shown via 1-D current-driven Vlasov simulations[2] that the observed potential ramps are consistent with transition layers in the form of *laminar double layers*. The electron-hole turbulence and electron heating on the magnetospheric side are the result of saturation of a two-stream instability driven by electrons accelerated through the potential jump. These simulations, together with more recent 2-D Vlasov simulations with strongly magnetized electrons and ions, suggest that the transition layer can be *turbulent* as well as *laminar* and still support significant changes in potential, temperature, and density across the layer. We will present results from the most recent 2-D simulations contrasting the laminar and turbulent regimes. We will also discuss mechanisms, such as the inclusion of realistic ion magnetization and variation in the angle between **B** and the normal to the layer, that can influence the stability of laminar double layers.

Research supported by NSF, NASA, and DOE.

[1] R. E. Ergun, et al., *Phys. Rev. Lett.*, **87**, 045003 (2001); L. Andersson et al., *Phys. Plasmas*, **9**, 3600 (2002).

[2] D. L. Newman, M. V. Goldman, R. E. Ergun, and A. Mangeney, *Phys. Rev. Lett.*, **87**, 255001 (2001).

SM12A-0466 1330h POSTER

Kinetic Simulations of Shear Alfvén Waves in Magnetospheric Plasmas

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Standing shear Alfvén waves (SAW) are commonly observed in the Earth's magnetosphere. These standing waves excite time-varying electric currents in the direction parallel to the magnetic field. Both observations and numerical studies suggest that low-frequency (a few mHz) standing SAW may produce parallel electric fields in the polar magnetosphere. We extend the linearized perturbation approach of Tikhonchuk and Rankin [*Physics of Plasmas, 7*, 2630, 2000]. They demonstrated that a kinetic treatment of the non-local electron response to the standing SAW can produce parallel electric fields which are in good agreement with observations, in contrast to the two-fluid treatment, which gives parallel electric fields which are too weak. We solve the full nonlinear coupled Vlasov-Maxwell system in one dimension. In order to avoid numerical problems with the evaluation of $E_\parallel = -(\partial A_\parallel/\partial t) - (\partial\phi/\partial z)$ in the electron kinetic equation, we describe the electron distribution function in terms of a spatial coordinate along the field line, the magnetic moment μ, and the canonical momentum $p_\parallel = v_\parallel + (q/m)A_\parallel$. We model SAW with our code and study the resulting parallel electric fields.

SM12A-0467 1330h POSTER

Global MHD Simulation of Magnetic Reconnection and Magnetospheric Dynamics

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Topology of the Earth's magnetosphere is critically controlled by solar wind and the interplanetary magnetic field (IMF) via magnetic reconnection. Reconnection site and reconnection rate are mainly determined by the anti-parallel field condition and the relatively shear velocity. We have studied dynamics of magnetic reconnection at the dayside magnetopause and in the magnetotail in detail when the solar wind velocity and magnitude of the IMF change over wide range of parameter by using a high resolution global MHD simulation. Dayside reconnection rate and cross polar cap potential have a tendency of saturation for a larger electric field in the solar wind. When we look at spatial distributions of the kinetic, internal and Poynting vector energy fluxes, it is noted that the kinetic energy quickly converts to internal plasma energy then Poynting flux. Therefore, it need not to find always the strong kinetic energy and kinetic flux on the earth side of NENL. The tail reconnection occurs in a patchy and intermittent manner to bring MHD fluctuations.

SM12A-0468 1330h POSTER

Seasonal and Solar Activity Dependence of the Generalized Polar Wind with Low-Altitude Auroral Ion Energization

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The effects of low-altitude energization (LAE) of ions on the dynamic behavior of the high-latitude plasma was investigated using a macroscopic particle-in-cell (mac-PIC) model. The model simulates the behavior of a plasma-filled flux tube as it drifts across the different high-latitude regions (cusp, polar cap, auroral, and subauroral regions). In addition to the LAE, the model properly accounts for gravity, electrostatic field, magnetic mirror force, ion-ion collisions, wave-particle interactions, magnetospheric electrons, and centrifugal acceleration. However, the focus here is on the effects of the LAE and their seasonal dependence. The LAE was emulated by uniform energization of the ions in the perpendicular direction as they pass through a narrow domain (200 km in altitude) that is embedded within the cusp/auroral oval region. The roles that season, solar activity, and the altitude of the LAE play, with regard to the effects of the LAE on the plasma characteristics, were studied. In particular, several simulation runs were performed for different seasons (summer/winter), for different solar activity levels, and for different altitudes of the LAE region. Comparing the results from these runs, the following conclusions can be drawn: (1) When the LAE occurs at high altitudes, where less O^+ exists, it does not appreciably enhance the O^+ escape flux. The O^+ escape flux for LAE occurring above $\sim$ 3000 km is almost identical to the case with no LAE; (2) In the absence of LAE, the dominant source of escaping O^+ occurs in the polar cap due to magnetospheric electrons; (3) Both upward and downward O^+ fluxes occur at low altitudes, while only upward O^+ fluxes occur at high altitudes; (4) As the plasma drifts from the polar cap into the auroral region, it is (first) depleted due to the rapid energization associated with wave-particle interactions (WPI) and then it is slowly replenished due to the effect of the LAE; (5) In general, the cases of summer-solar maximum and winter-solar minimum produce the two extreme results, while the other two cases (summer-solar minimum and winter-solar maximum) produce intermediate results. For example, the largest O^+ escape fluxes were found for the case of (summer-solar maximum) and the smallest fluxes were found for the case of (winter-solar minimum).

SM12A-0469 1330h POSTER

Is Transverse Cold-Ion Acceleration a Hot-Ion Finite Gyro-Radii Effect?

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Recent results with the Polar TIMAS instrument (ion mass spectrometer) have revealed that earthward magnetic field-aligned and velocity dispersed flows of 1- to 33-keV protons (and other ions) from the outer magnetosphere are inherently "blast-like" and exhibit a complex filamentary structure where transverse scale sizes may often be a few proton gyro radii. These velocity dispersed protons (and accompanying hot electrons) have been found to have a close association with enhanced large pitch-angle outflow of accelerated (sometimes to more than 10 keV) ionospheric ions (H^+, O^+ and He^+) at Polar. Theoretical considerations suggest a mechanism by which the difference in gyro radii between hot ions and electrons in earthward plasma bursts generates charge imbalance and strong transverse electric fields at density gradients, as the bursts move into an increasingly strong magnetic field, which in turn accelerate the ambient cold ions. Model electric fields greater than 1 V m^{-1} at Polar are readily generated with density gradient scale lengths of a few earth radii in an equatorial source region of the bursts, assuming that the magnetic moments of the burst protons are preserved. The non-adiabatic acceleration of cold ions may act to reduce these fields to the ca 0.1-V m^{-1} amplitude and few-second period fluctuations actually observed. Sample TIMAS data are shown to be consistent with the transverse acceleration of cold O^+ ions to keV energy on a time scale of less than a single gyro period.

SM12A-0470 1330h POSTER

Energy Supply and Release for Auroral Particle Acceleration

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Alfven waves carrying Poynting flux bounce back and forth between the generator, the acceleration region and the ionosphere. In dynamic cases, Alfven waves play an important role in supplying energy to accelerate auroral particles for discrete aurora. By analyzing the development and maintenance of parallel potential, and calculating the required energy supply and release into the acceleration region in the entire auroral current system, necessary conditions for auroral acceleration are determined. The conditions pose constraints for models of auroral particle acceleration.

The nonlinear interaction of Alfven waves and kinetic responses to Alfvenic perturbations can both lead to the formation of such a parallel electric field. However, the energy conversion and release for the acceleration of ions and electrons due to the nonlinear interaction of Alfvn waves can lead to strong parallel electric fields and acceleration of nearly monoenergetic electrons on scales of 1 km or less while that due to dispersive Alfven waves produce lower energy, velocity-dispersed electrons on scales the order of 10 km. This presentation concentrates on emphasizing the role of the nonlinear interaction of Alfvn waves including the role of the localized break down of the frozen-in condition in auroral particle acceleration.

SM12A-0471 1330h POSTER

Modulation of the auroral acceleration region by Alfven waves: A new mechanism for ULF wave modulation of electron acceleration

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We consider the interaction of Alfven waves with the auroral acceleration region. The AAR is characterized by an electric potential drop that supports a field-aligned upward current and the acceleration of electrons. An Alfven wave incident on the AAR from the magnetosphere partially reflects back and partially penetrates into the AAR. The rate of wave reflection/transmission is estimated to be critically dependent on the wave transverse scale. Magnetospheric Alfven waves penetrating into the AAR can produce oscillatory variations of the field-aligned potential drop, thus constituting a new mechanism of ULF modulation of particle acceleration. Analytical estimates of the potential drop modulation by Alfven waves are provided within the "thin" AAR approximation, which is valid for small-scale disturbances. The topside ionosphere between the bottom boundary of the AAR and the E-layer of the ionosphere forms a resonator at auroral latitudes, which can trap Alfvenic small-scale disturbances with frequencies $\sim$ 0.2 Hz. Occurrence of the AAR-associated resonator may cause fine spectral features of modulation of electrons accelerated in the AAR. We outline critical tests for the verification of the proposed mechanism in simultaneous observations at magnetometer and riometer stations at auroral latitudes.

SM12A-0472 1330h POSTER

Refraction Shock and Its Consequences for the Auroral Acceleration Processes

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Satellite observations have now amply demonstrated that the accelerations of electrons and ions in the upward current region of the auroral plasma occur in two layers situated at low and high altitudes. Large localized upward electric fields in the layers accelerate electrons downward and ions upward. Thus, between the two layers accelerated electrons and ions exist simultaneously. Recently we identified that the fields in the lower layer belong to a rarefaction shock. The rarefaction shocks were first studied in connection with expansion of laser plasmas with two electron temperatures. In auroral context, the ionospheric plasma and the backscattered electrons constitute the needed two-electron-temperature plasma. The resulting rarefaction shock in the expanding ionospheric plasma takes up a part of the auroral parallel potential drop. The rest of the potential drop occurs at higher altitudes in a single double layer or multiple ones. Between the rarefaction shock and high-altitude double layer(s), electron and ion beams simultaneously exist. The interaction between the beams generates a variety of wave modes, which trap electrons and ions generating counterstreaming populations of charged particles. Nonlinear wave structures like electron and ion holes and even ion-acoustic shocks, resulting from ion-ion instabilities, become a common feature of the region between the two acceleration layers. Below the low-altitude acceleration layer (rarefaction shock) the cold-hot electron mixture supports the electron-acoustic mode and when destabilized by the downward electron beam, large-amplitude electron holes form. Besides the auroral plasma, when the time history of the ionosphere allows for the presence of warm electrons with a hot to cold temperature ratio of 10, a rarefaction shock forms in the polar wind, accelerating ions upward.

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SM12A-0473 1330h POSTER

Understanding Magnetotail Drivers of Auroral Acceleration Using Polar/FAST Conjunction Data and Simulation Modeling

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The formation of parallel electric fields in the auroral zone and subsequent particle acceleration is thought to be due ultimately to processes that occur in the magnetotail. A study is made to examine the magnetotail drivers of auroral processes using data from the Polar and Fast Auroral SnapshoT (FAST) satellites when the two are near magnetic conjunction in the auroral zone. Large scale kinetic simulations are used along with the satellite data to examine the physics of parallel electric fields as caused by magnetotail input at high altitudes. The results indicate that field-aligned currents, high-energy particle beams, and electromagnetic Alfven wave energy that flows earthward from the magnetotail all drive auroral processes. These different drivers operate at different times and latitude locations depending on magnetic activity level. The different drivers tend to result in different types of parallel electric fields in the auroral zone, which then cause different types of electron and ion parallel particle acceleration. The details of magnetosphere-ionosphere coupling that occurs in the auroral zone in terms of cause and effect will be discussed.

SM12A-0474 1330h POSTER

Multi-Scale Explosive Instabilities of the Inner Edge of the Plasma Sheet at Breakups.

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Ground based and in situ observations of plasma processes during auroral breakups indicate that a complex multi-stage instability develops near the inner edge of the plasma sheet. A breakup starts with the near-exponential growth of the equatorward arc intensity that takes several minutes. It is followed by the vortex development which may be accompanied by the explosive growth of magnetic pulsations. Further evolution can be either saturation, as during pseudo-breakups, or interaction with more global plasma sheet processes leading to a full substorm. We compare these dynamics with the nonlinear analysis of the energy evolution associated with a low-beta ballooning instability in the region where the magnetic field line topology becomes stretched out of dipolar. This analysis suggests that the initial exponential growth stage, that can be responsible for the arc intensity growth, ends up with a linear oscillatory stage that we connect to a vortex saturation. However during this stage, the third order nonlinear term can become dominant in the system. This leads to the explosive growth of the perturbations. Depending on the initial topology, this growth can saturate due to the presence of the stabilizing fourth order term or can lead to a global destabilizing of plasma in the region.

SM12A-0475 1330h POSTER

The Distribution of Parallel Electric Fields along Auroral Flux Tubes

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Recent observations and simulations have shown that the auroral acceleration region is primarily confined to altitudes below 3 Re geocentric, and that a significant portion of the potential drop is often confined to a strong double layer at the lower edge. This double layer acts to accelerate cold ionospheric ions into a beam, reducing the ion density to approximately that of the energetic auroral electron beam. In addition, the double layer reflects most of the up-going scattered primary and secondary electrons created when the primary electrons interact with the upper atmosphere. The magnitude of this strong double layer adjusts to a level that produces charge neutrality within the density cavity. This strong double layer typically contains 30%-50% of the potential drop, however at times the double layer potential is reduced to 10% or less of the total potential. These periods are observed when a population of trapped electrons is present within the density cavity. This paper will present FAST observations of this phenomena and discuss how trapped electrons can affect the potential distribution within auroral arcs. In addition we will discuss a technique that may allow a determination of the distribution of potential along auroral flux tubes based upon single spacecraft measurements of particle distributions. The technique involves identifying the population of field-aligned electrons that result from photo-ionization of geocoronal hydrogen within the acceleration region. Since the spectra of these photo-electrons depends upon the distribution of electric field, an inversion of the spectra can be used to find the potential distribution. Examples from FAST that show this population will be presented along with preliminary attempts at inversion.

SM12A-0476 1330h POSTER

Analysis of DC electric fields and ELF band waves observed by SS-520-2 sounding rocket in the polar region

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SS-520-2 sounding rocket was launched from Norway on Dec. 4, 2000. We developed EFD (Electric Field Detector) onboard SS-520-2 rocket, and observed DC electric fields and ELF band waves (0-50Hz). According to the DC electric fields analysis, we confirmed the existence of DC electric fields. The amplitudes of these DC electric fields are up to 50mV/m, and their directions are almost south-west. Especially, strong DC electric fields are observed during the rocket decreasing period. During all the observation time, on the other hand, no clear ELF waves are observed in EFD data.

In the EFD data analysis, spiky pulses are observed in the almost all EFD data. These pulses are synchronizing with the rocket spin frequency 1.5Hz. These are generated due to the photo electron emission, called photo electron pulses. The amplitudes of the photo electron pulses are expected to be related to the local plasma environment, e.g. electron density and temperatures. Though their amplitudes are in inverse proportion to the altitudes of the rocket, however, we cannot find a clear relation between the distribution of the amplitudes of the photo electron pulses and those of the electron densities, especially in the F region of the ionosphere (500-300km in the altitude) where the electron density increase suddenly. According to the previous study about photoelectron pulses observed by Akebono satellite, the photoelectron pulses are related to the direction of the ambient magnetic field rather than that of the Sun. We investigated the angles between the direction of wire antenna, when photo electron pulses are observed, and that of the Earth's magnetic field, with making use of the MGF data. As a result, we confirmed that the photo electron pulses are observed when the wire antenna become almost parallel to the Earth's magnetic field. This indicates that the photo electron pulses observed by SS-520-2 rocket are also related to the direction of the ambient magnetic field rather than that of the Sun, as previously indicated with using the data of Akebono satellite. We are going to make a statistical study of the amplitudes and duration periods of photo electron pulses and their relation to the Earth's magnetic fields in detail.

SM12A-0477 1330h POSTER

Generation Mechanisms of Narrowband Pc 1 Waves and Wideband Pc 1-2 Bursts Related to Traveling Convection Vortices

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From the analysis of search coil magnetometer data obtained at Automatic Geophysical Observatories (AGOs) and South Pole station in the Antarctic, it is found that there are two types of transient Pc 1-2 waves associated with the passage of traveling convection vortices (TVCs). The first type is transient narrowband Pc 1 waves with mid-frequencies of 0.2 - 0.6 Hz, bandwidths of 0.1 - 0.2 Hz, and durations of typically about 5 min. This type of Pc 1 occurs in the downward field-aligned current region of TCVs, and occasionally shows a falling tone structure as changing the mid-frequencies from 0.3 - 0.4 Hz to 0.1 - 0.2 Hz over the duration of Pc 1. The second type is wideband Pc 1-2 bursts which occur around the poleward edge of upward field-aligned current region. The Pc 1-2 burst region is found to correspond to the region of fast poleward convection flows with intense HF radar backscatter. Based on these characteristics, we will propose the generation mechanisms of these two types of TCV-related transient Pc 1-2 waves. The narrowband Pc 1 waves would be generated by the electromagnetic ion cyclotron (EMIC) instability in the outer magnetosphere adjacent to LLBL. Kataoka et al. [2002] suggested that the main source of TCVs is the formation of hot flow anomalies (HFAs) due to the arrival of solar wind tangential discontinuities. The outward motion of the magnetopause caused by the formation of HFAs would reduce the frequency of ion cyclotron waves. On the other hand, it is likely that the wideband Pc 1-2 bursts are turbulent dispersive Alfven waves generated by localized field-aligned currents. The observed intense HF backscatter can be attributed to F-region irregularities produced by the time-varying electric field of these Pc 1-2 bursts, as suggested by Andre et al. [1999].

SM12A-0478 1330h POSTER

Comparison of Two Different Techniques to Derive the Electric Current Density in the Ionosphere

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Instantaneous global ionspheric conductance maps during substorms can be derived by using PIXIE and UVI data from the Polar satellite, covering an electron energy range between approximately 0.1 and 100 keV. Mesoscale instantaneous conductance profiles can be inferred from the MIRACLE ground-based network in Northern Scandinavia, using electric field measurements of the STARE coherent scatter radar and ground magnetometer data of the IMAGE network. For this purpose, the 1D method of characteristics is used. First comparison results of these two techniques are presented. The computed Hall and Pedersen conductance distributions from Polar and MIRACLE are then combined with the electric field data to derive the true electric current density in the ionosphere in the Northern Scandinavian region. We also use observations of the ground-based magnetometer network to derive the equivalent ionospheric electric current density over the whole Scandinavian area.

SM12A-0479 1330h POSTER

Variability of Auroral Ionospheric Electric Fields and Conductances as Observed by the EISCAT Facility

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The variances, cross-variances, and temporal autocorrelations of auroral ionospheric electric fields and conductances are evaluated as functions of the time of day, season and activity indices, based on sixteen years of observations from the European Incoherent Scatter (EISCAT) Radar. This quantitative information is needed for accurate modeling of auroral energy inputs in thermosphere/ionosphere simulation models, and is also needed for optimization of ionospheric electrodynamic data assimilation procedures. The average electric field and conductances are modeled, about which the statistical variabilities are analyzed. We evaluate the manner in which the calculation of Joule heating is influenced by the interrelated variabilities of the electric field and of the Pedersen conductance.

SM12A-0480 1330h POSTER

The Duskside Low Latitude Boundary Layer as Seen with Cluster and FAST

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We examine a Cluster-FAST near magnetic conjunction in the duskside low latitude boundary layer (LLBL). Cluster was in the LLBL for an extended period, chasing the magnetopause during a recovery from a pressure pulse. During much of this crossing, Cluster observed ions of ionospheric origin flowing tailward at speeds near the solar wind velocity of $\sim$ 400 km/s. Simultaneously, FAST detected several energy-dispersed ion injections and a magnetosheath-like population at about 1700 magnetic local time. Upflowing ions observed equatorward of the conjunction by FAST may be the source of the heavy ion tailward flows observed by Cluster. We speculate as to the location and possible motion of the reconnection site. Implications of these observations for coupling between the LLBL and the ionosphere are discussed.

SM12A-0481 1330h POSTER

Lobe Cell Convection and Polar cap Precipitation

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The characteristic electric and magnetic field signature of lobe cells as observed by the low-altitude FAST satellite are compared with Polar ultraviolet images of polar cap auroral activity. Initial results from 55 events suggest that there is an intimate coupling between the sunward convection flow of the lobe cell and transpolar auroral arcs or diffuse polar cap precipitation. Moreover, the presence of lobe cells coincide with UV data intensifications in the premidnight 2100-2400 MLT sector and/or the postnoon 1500 MLT region in $\sim$54% of all cases with UVI coverage. The magnetic local time dependence of the lobe cells and polar cap precipitation on the interplanetary magnetic field (IMF) are examined using the upstream Wind monitor. The relative importance of the IMF B_y and B_z components are investigated and compared with the predictions of the antiparallel merging model and strongly suggests a connection with the magnetospheric sash, as is further implied by the mapping of magnetic field lines using the *Tsyganenko* [2002] (T01) model. It was also noted that a majority of events occurred during enhanced AE index substorm-like conditions and that generally stronger AE indices are measured for stronger IMF B_y magnitudes.

SM12A-0482 1330h POSTER

Hemispheric asymmetries in the location and intensity of the auroral ovals and their association with ionospheric convection and IMF

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As the orbit of the Polar spacecraft has precessed over time, the VIS Earth camera has been able to capture simultaneous images of the aurora in both the northern and southern hemispheres. The angular resolution of these images is sufficient to be able to determine the accurate location and intensity of the two ovals. Preliminary studies have revealed that while the auroras seem to be mirror images of one another on a broad scale, there are a number of fine scale features which are not conjugate in both hemispheres. The mapping of the auroras has revealed that there are longitudinal differences in the onset locations. In this paper, we use the radars of the northern and southern Super-DARN network to investigate whether the convection patterns match the longitudinal differences in the onset locations of the auroral features in the two hemispheres. Differences in the auroral intensity detected in the two hemispheres were found and we determined their association with the electric field strength and convection speeds. The IMF data were studied to determine if these hemispheric asymmetries were due to variations in the IMF direction.

SM12A-0483 1330h POSTER

Dependence of Dayside Field-Aligned Currents on the Ionospheric Conductivity: Statistical Study With DMSP-F7 Data

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Large-scale field-aligned currents (FACs) are classified into three systems, that is, Region 2 (R2), Region 1 (R1), and Region 0 (R0) systems from equatorward to poleward. Fujii and Iijima (1987) examined R1 and R2 currents at MLT = 4-10 and 14-20 under geomagnetically quiet conditions and found that the intensities of R1 and R2 currents depend on the ionospheric conductivity in different ways. The intensity of R1 currents is strongly controlled by the ionospheric conductivity, but that of R2 currents is not. They concluded that the R1 system is driven by a voltage source, whereas the R2 system is driven by a combination of voltage and current sources. In the present study we have used the summary data of DMSP-F7 developed through the procedure of Higuchi and Ohtani (2000), and extended the study of Fujii and Iijima (1987) by examining currents in other MLT ranges, mainly in the midday sector. In addition, we have also examined the R0 system. The results indicate that R1 and R0 are driven by a more voltage-like source than R2 in the midday region. It is also inferred that R1 and R0 are driven by the same mechanism as Ohtani et al. 1995 suggested.

SM12A-0484 1330h POSTER

Storm enhanced electron density in the polar cap region observed by the Radio Plasma Imager on IMAGE

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The radio plasma imager (RPI) on the IMAGE satellite uses the radio sounding technique to measure both the insitu and remote electron densities in the magnetosphere. Insitu, or local, electron densities are derived from the local plasma resonances stimulated by RPI transmitted signals while the remote densities are obtained from the observed R-X mode echo traces using an inversion technique. Analysis of RPI observations before, during and after a geomagnetic storm shows a greatly enhanced electron density during the main phase over the polar cap at radial distances up to 5.3 RE, invariant latitude above 80° and magnetic local time between 2000 and midnight. In this report a case study will be presented and qualitative and quantitative assessment of the magnitude of electron density enhancement will be discussed.

SM12A-0485 1330h POSTER

The characteristics of the corotating aurora observed at Poker Flat, Alaska

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As part of the CRL-UAF cooperative middle atmosphere project, monochromatic imaging observations of aurora and airglow have been carried out at Poker Flat (65.1N, 212.6E; 65.6 MLAT: MLT = UT-13 hours) since October 2000. Monochromatic images are obtained every 5 minutes using two all-sky imagers at 10 emission lines, i.e., H (486.1 nm), OI (557.7 nm), N2+ (427.8 nm), background (572 nm), Na (589 nm), H background (481 nm), OI (630.0 nm), OI (844.6 nm), OI (777.4 nm), and OI (630 nm). From these data, the new type of aurora which keeps its patch structure at some fixed location in the field of view was found in the magnetic evening sector by Kubota and Nagatsuma [2001]. These characteristics suggest that this type of aurora was corotating with the Earth. We have investigated the characteristics of such 'corotating aurora' in detail using 29 events identified in the period from October 2000 to April 2002. While imaging observation covers from 14 to 07 MLT, this type of aurora is observed only in the dusk to midnight sector (14 - 03 MLT). The aurora occurs on geomagnetic quiet conditions (Kp=0 - 3+) after the decay of substorm activity. The occurrence of this type of aurora are identified at emission

lines, OI 557.7 nm, N2+ 427.8 and OI 844.6 nm, but not at OI 630.0 nm and H 486.1 nm. This feature suggests that this type of aurora is excited by precipitating hard electrons. Precipitating electron and ion data obtained by DMSP/SSJ showed that the precipitating electrons with energies of few keV are the source of this aurora, and that precipitating ions are absent. Using simultaneous IMAGE/EUV (Extreme Ultraviolet Imager) data, we have examined the relationship between the corotating aurora mapped to the equatorial plane and the structure of the plasmasphere in three events observed on February 23, 24 and March 1, 2001. In these events it seems the plasmapause was unclear and the corotating aurora was mapped to the low plasma density region of 10^2 /cm^3. We have also studied the density structure of the plasmasphere from electron number densities estimated from the AKEBONO/PWS data obtained on October 27, 2000. In this event there is no sharp plasmapause, and the source region of the corotating aurora is mapped to the gradually decreasing low density region of the plasmasphere. Further data analysis using spacecraft and ground-based data will be performed to elucidate the generation mechanism of this type of aurora.

URL: http://pat.geophys.tohoku.ac.jp

SM12A-0486 1330h POSTER

Extended Synoptic Analysis Using a Database of Auroral Images

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The UVI Online Search Tool (OST) uses a database of image-derived search criteria such as auroral boundaries, integrated power, polar cap area, and auroral morphology. The database spans the entire UVI mission lifetime (approximately 6.5 years) with a 10 minute resolution. This database of image information represents a useful collection of auroral activity that can be used to perform extended (multi-year) studies of auroral variations.

Previous studies have performed synoptic surveys of auroral activity, correlated auroral intensity with solar wind conditions, examined dynamics of auroral boundaries, and monitored morphological evolution as a function of IMF. All of these studies, however, have been limited to time periods ranging from a few hours to a few months at most. The OST image parameter database provides the opportunity to extend previous studies to time scales heretofore unavailable.

In this paper we use the OST database to study auroral activity during the ascending phase of the current solar cycle (1996-2000) as a function of solar driving conditions and activity indices. Preliminary results indicate that OST has great promise. This paper will report the results of examining the degree to which synoptic auroral behavior varies with solar cycle.

URL: http://csds.uah.edu/uvi-ost/

SM12A-0487 1330h POSTER

Coordinated Radar and Optical Observations of Black Aurora

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Black aurora is a region, spatially well defined, within a broad and usually uniform diffuse aurora that clearly exhibit a lack of luminosity, thus appearing black. These black regions have similar dynamical features as discrete small scale auroral arcs, but the sense of rotation of black curls are opposite to that of auroral curls.

Recent theories explain black aurora as regions where downward currents is closing the auroral current circuit, and electrons are flowing out from the ionosphere. Thus the local plasma density of the ionosphere inside the black aurora should be lower than in the normal night side ionosphere, and distinctively lower than in the adjacent luminous aurora. On the other hand, black aurora can also be explained as an optical effect, where the surrounding luminous aurora tricks both the eye and other advanced optical instruments, because of their limited bandwidth, making it appear darker than what it really is. In this latter case, the plasma density within the black aurora should not differ much from that in the surrounding diffuse aurora.

However, no local measurements of plasma density within black aurora has been made up to now. We present the first results from such measurements, utilizing the EISCAT radar facility in Ramfjordmoen, Norway, for density measurements, and image intensified video for locating the density measurements in relation to the black aurora.

SM12A-0488 1330h POSTER

Altitude dependence (5000-30000 km) of inverted-V associated parameters using Polar

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Discrete auroral arcs and the associated inverted-V type electron precipitation are accompanied by potential structures, upgoing ion beams and plasma density depletions in the acceleration region altitude and above. However, exactly how these phenomena depend on altitude in various Kp and solar illumination conditions as well as at various magnetic local time (MLT) and invariant latitude (ILAT) is not so well known. We review the main results of our recent large statistical studies of the altitude dependence of these parameters using Polar data. We also include similar statistical results on some additional parameters that appear to have major importance in inverted-V auroral acceleration. These parameters include middle-energy (∼50-500 eV) electron anisotropies, certain types of electrostatic wave bursts as well as ion shell distributions. One of the most interesting results of the statistical studies is that many of the parameters mentioned change their behaviour rather abruptly at around 3 R_E radial distance. The implications of this to the understanding of the physical mechanisms responsible for inverted-V auroral acceleration and discrete auroral arcs are discussed.

SM12A-0489 1330h POSTER

Global cause of localized high latitude aurora

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The FUV instrument on IMAGE frequently observes a very localized, spot-like aurora at high latitudes poleward of the dayside auroral oval and the cusp. The absence of simultaneous proton aurora suggests a pure electron precipitation, which was confirmed by a few conjugate FAST observations. This aurora occurs during northward IMF conditions with very low solar wind density (dynamic pressure). Additionally, there is a preference of negative IMF B_x conditions, and B_y has to be positive. These external conditions suggest reconnection at the high latitude magnetopause as the driving mechanism for this phenomenon. During the first two years of IMAGE-FUV operations a clear seasonal dependence was found with frequent and long-lasting occurrence of the spot-like aurora during northern hemisphere summer, and extremely few events during northern winter. We will describe how the seasonal changes of the dipole tilt, solar illumination and ionospheric conductivity influence the local occurrence and intensity of the electron precipitation.

SM12A-0490 1330h POSTER

The Relation of Polar Arcs to Magnetotail Twisting and IMF Direction

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A large statistical study of polar arcs utilizing the Polar UV imager reveals a strong solar wind control of large-scale polar arcs. They occur preferably for a high solar wind energy flux during northward IMF. Different types of polar arcs are triggered by different IMF clock angle changes. Oval-aligned arcs appear often during constant IMF, moving transpolar arcs usually develop after an IMF By sign change. The relation of these two polar arc types to changes in the magnetotail topology are investigated with help of the GUMICS-4 MHD code by Janhunen. The simulations show that for northward IMF with a nonzero IMF By component the magnetotail becomes long and highly twisted at its tailward end. The closed field line region reaches in this case high into the near-Earth tail lobes and poleward of the average polar cap boundary. The poleward displaced part of the polar cap boundary is a probable location for polar arcs to occur. In the case of an IMF By sign change the tail twist rotates such that in an intermediate state near-Earth and far-tail regions are oppositely twisted. This causes a bifurcation of the closed field line region in the tail and a bridge of closed field lines in the polar cap. The over the entire polar cap moving closed bridge indicates a moving transpolar arc.

SM12A-0491 1330h POSTER

The current-voltage relationship, cold electrons and waves in multiple auroral arcs

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Discrete auroral arcs are the result of accelerated electrons colliding with the upper atmosphere. The acceleration of these auroral electrons is often due to quasi-static electric fields which are part of a field-aligned current system. Data from six magnetic conjunctions between the FAST satellite and all-sky image data of multiple arcs are analyzed to examine the current-voltage relationship in mesoscale multiple arcs. FAST electron data are fit with accelerated Maxwellian distributions to obtain field-aligned source temperatures, densities and electrostatic potential drops. These values are then used to calculate a field-aligned conductance using the Lyons-Evans-Lundin (LEL) formulation. When compared with the calculated parallel current (conductance multiplied by the potential energy drop), the measured parallel current shows good agreement across most multiple arc systems except in regions with the largest precipitating energy fluxes. In these regions a significant cold electron population is present at energies above the potential drop energy and the measured currents are larger than the calculated LEL currents. These regions are 100 percent correlated with two narrow-band ELF waves: one band at the oxygen gyrofrequency and one at a fraction of the proton frequency. The properties of these waves and their relationship to observed cold electron distributions will be explored in order to understand the role of the waves in the electrodynamics of the upward current region of multiple arc regions.

SM12A-0492 1330h POSTER

Role of field-aligned current closure via the Pedersen, Hall, and atmospheric displacement current in the formation of ionospheric current system

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To consider the transmission process of electromagnetic disturbances carried by field-aligned current (FAC) into the ionospheric and atmospheric loading region, we construct a simplified model for the ionosphere-atmosphere-Earth electromagnetically coupled system. The ionospheric slab (conductor) separated by Earthfs ground plane by the atmospheric region forms a capacitor. Outgoing current flows in the ionospheric slab and return current flows in the ground plane, forming an inductor. Thus, the ionospheric slab acts as if it has a capacitor in parallel to a ground inductor in series. Electric energy is stored in the dielectric atmospheric region due to the electric field between ionospheric slab and ground plane. Charge present in the ionospheric slab and induced in the ground plane creates a shunt self-capacitance. Magnetic energy associated to currents is stored in the ionospheric slab. The magnetic field links the loop formed by the conductor and ground plane and creates a series self-inductance.

This model clarifies the roles of the FAC closure via the currents in the ionosphere-atmosphere-Earth electromagnetically coupled system. Electromagnetic energy associated with FACs is dissipated in the ionosphere through Joule dissipation of the ionospheric divergent Pedersen current carried by ions. On the other hand, the FAC closure via the divergent Hall current carried by electrons increases the energy of the rotational Hall current, causing it to radiate Poynting fluxes that lead to the growth of a poloidal-type magnetic field in the magnetosphere and atmosphere. Furthermore, the FAC closure via the atmospheric displacement current provides Poynting fluxes for the generation of a non-local ionospheric current system. In this study, we will show the physical details of the redistribution process of the FACfs momentum and energy into current in the ionosphere-atmosphere loading region.

SM12A-0493 1330h POSTER

The Response of the Tail to Extended Intervals of Bz < 0: Periodic Unloading Versus Steady Magnetospheric Convection

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The purpose of this study is to examine magnetospheric responses to periods of relatively steady negative Bz component of the interplanetary magnetic field (IMF). In particular, we wish to determine whether these intervals result in periodic tail loading-unloading or a transition, at some low value of negative Bz to steady magnetospheric convection. Magnetic cloud events during 1995 – 2002 identified by the WIND/MFI team were searched for intervals when IMF Bz was southward more than five hours with a standard deviation less than 20% of the average Bz. We will present an overview of the 7 events meeting these criteria for which Geotail, IMP8, or Interball data were available. Examples of both steady magnetospheric convection and periodic loading-unloading were found. Conditions leading to the development of these magnetospheric states will be discussed.

SM12A-0494 1330h POSTER

Spatial distribution and variation of narrow L-shell bands in the plasmasphere supporting field-aligned propagating modes as observed by the RPI/IMAGE satellite

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Field-aligned propagating (FAP) modes have been a regular characteristic of the RPI/IMAGE plasmagrams from the beginning of the experiment. LF/MF (in the range of 3 kHz to 3 MHz) transmitted radio signals from the satellite propagate in the magnetic meridian plane along the magnetic field line passing through the satellite position to both the northern and southern hemispheres where they reflect at a level that depends on the sounding frequency. This analysis has shown that these hemispherical reflections occur on about 20% of the plasmagrams while the IMAGE satellite is between L = 2.5 and L = 4.5. Occurrences of these FAP plasmagrams were consistently organized into two L-shell bands. The first band was found at L = 3.2± 0.2 moving in and out slowly over a period of a few days. This band, with a width of DL $\gg$ 0.2, is always present. The second observed band also supports hemispherical propagation and was found at higher L-shells, ranging from L = 3.5 under quiet magnetic conditions, moving to L = 4.0 as the level of magnetic activity increases. During high magnetic activity conditions this outer band disappears. When RPI/IMAGE passed through the inner band the probability of the appearance of FAP modes was 98

SM12A-0495 1330h POSTER

April 2000 Geomagnetic Storm: Ionospheric Drivers of Large Geomagnetically Induced Currents

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Geomagnetically induced currents (GIC) flowing in technological systems on the ground are a manifestation of space weather. Due to the proximity of very dynamic ionospheric current systems, GIC are of special interest at high latitudes where they are known to cause harm e.g. for normal operation of power transmission systems and buried pipelines.

Despite numerous studies on GIC, there still exists no well established picture of the detailed structure of the ionospheric currents driving large GIC. Although some rough estimations of large-scale electrojet intensities and structures during GIC events have been carried out, no rigorous study of the ionospheric source currents has been made so far.

In this study, a single intense geomagnetic storm event on April 6-7, 2000 is investigated. During the event, large GIC were measured in technological systems both in Finland and in Great Britain, providing a basis for a detailed GIC study over quite a large spatial scale. By using these GIC data and geomagnetic data from north European magnetometer networks, the ionospheric drivers of the large GIC during the event were identified and analyzed.

URL: http://www.geo.fmi.fi/MAGN/GIC

SM12A-0496 1330h POSTER

Relativistic electron loss investigation from multiple LANL GPS and GEO, HEO and NOAA Spacecraft

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Losses are the most dominant feature during the onset-phase of geomagnetic storms, and strong wave-particle interactions are as part of many of the proposed acceleration mechanism, which often leads to losses of particles.

From existing measurements in the drift-loss cone at low altitude it is known that energetic electron precipitation increases during active times, but it is not known whether this increase is due to increased loss rates or simply an overall increase in the radiation belt population. Furthermore, several of the wave particle interaction processes that may be responsible for both losses and acceleration of are thought to exhibit strong local time preferences - dawn to midnight for whistler chorus, afternoon to dusk for EMIC waves, and are active during different phases of a geomagnetic storm. We can test these hypotheses directly.

Here we intend to use low altitude data from the recent NOAA spacecraft that sample the radiation belts 14 times a day at 4 different local times separated roughly by 6 hours. These spacecraft sample the local electron population in two directions, which for most regions yields a measurement close to the loss cone and one close to the locally mirroring population. By investigating the RATIO of these two detectors we can determine the times during which there are more precipitating versus trapped particles. We intend to compare our results to the in-situ equatorial observations from HEO (near L=2), LANL GPS (near L=4) and LANL GEO (near L=6.6), which can sample the full trapped distribution.

SM12B MCC: 124 Monday 1330h

Discontinuous Cusp and Magnetospheric Boundary Layers II

Presiding: **S Wing,** Applied Physics Laboratory**; K J Trattner,** Lockheed Martin ATC**; H E Spence,** Boston University

SM12B-01 1330h INVITED

Radar and Particle Observations of the Double Cusp: Resolving Spatiotemporal Ambiguities

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The role of radar observations in resolving the ambiguities between spatial and temporal interpretations of the double cusp will be outlined, and related to the wider context of understanding the large-scale physics of reconnection. Our recent work has established that dayside reconnection under conditions of significant IMF y-component can lead to a split reconnection x-line on the magnetopause, which is observable in the polar ionosphere when the geometry of field-line mapping to the ionosphere is favourable. In this presentation, simultaneous DMSP particle data and SuperDARN radar data will be shown from a split x-line

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