because of rapid boundary motion (temporal, as opposed to spatial, effects are better revealed in this reordering). The ordering works irrespective of the presence of accelerated flows, wave motions or FTE signatures, but it is not known how the TP is related to spatial boundary-normal distance. Previous application of the TP to AMPTE-UKS and -IRM data identified the total LLBL thickness to be of order 1500 km. The form of the TP variation in boundary aligned co-ordinates (and specifically with normal distance) is likely to be different in each case, however. Since knowledge of boundary orientation, thickness and motion can independently scale the plasma and field signatures across the boundary layer, the four point Cluster data allow us to compare the TP ordering in the context of well defined boundary behaviour and also allows us to look at the effects of reconnection site motions. We investigate a number of magnetopause crossings observed by Cluster on different spatial scales.

SM51C MCC: Level 1 Friday 0830h

The Role of the Plasmasphere in Ionospheric and Magnetospheric Dynamics I Posters *(joint with SA, AE)*

Presiding: **C L Waters,** School of Mathematical and Physical Sciences, University of Newcastle**; P C Brandt,** Applied Physics Laboratory, Johns Hopkins University

SM51C-0533 0830h POSTER

Pulsed Electric Fields at the Nightside Plasmapause

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It has been suggested that the magnetospheric energy is strongly absorbed near the boundary region between hot and cold plasmas and/or near the steep density gradient region. The plasmapause is considered as such a region. Motivated by this suggestion, we surveyed the electric field data from the Polar satellite for March-May 1997. During these periods, the Polar orbits at geocentric distances of 3-7 Re were inbound passes from the northern tail lobe to the plasmasphere in the 2100-0300 magnetic local time (MLT) sector. We found 15 transient electric field enhancements in the form of pulsed signature at/near the plasmapause. Some of the pulsed electric field (PEF) events were accompanied by the magnetic field perturbations. The electric fields of the pulsed structure were roughly polarized in the direction perpendicular to the ambient magnetic field. The PEF events are distributed in the 2100-0300 MLT and from $\sim 5.6^{\circ}$ to $\sim 27.6^{\circ}$ in magnetic latitude. The peak amplitudes of the PEF events are ~2-14 mV/m larger than the averaged electric field value in the plasma sheet. The 10 (3) PEF events were observed while the AL index was gradually increasing (decreasing). The remaining 2 events occurred during the interval of suddenly decreasing AL. We suggest that the PEF events are a manifestation of the energy absorption at/near the plasmapause and discuss whether their source is associated with magnetospheric substorm because their occurrence was on the nightside.

SM51C-0534 0830h POSTER

PLASMA BLOB EVENTS OBSERVED BY KOMPSAT-1 AND DMSP F15 IN THE LOW LATITUDE NIGHTTIME UPPER IONOSPHERE

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Here we report the plasma blob events (plasma density enhancements) that were observed from KOMPSAT-1 (685-km altitude, 2250 LT) and from DMSP F15 (840-km altitude, 2130 LT) in the low-latitude F region. The blobs were observed mostly along the $\pm 15^{\circ}$ magnetic latitudes. Their global distribution showed a season-longitudinal dependence similar to the distribution of the equatorial plasma bubbles. The blobs drifted upward relative to the ambient plasmas, and the electron temperatures and H^{+} proportions were lower within the blobs compared to those in the background. Those characteristics of the plasma blobs show close similarity to the characteristics of the equatorial plasma bubbles. Therefore, it is suggested that the blobs were originated from the lower altitudes by the mechanism that drives an upward drift of the plasma bubbles. The blob events did not occur in a correlated way with the magnetic activity or daily variation of the solar activity.

SM51C-0535 0830h POSTER

Pitch-Angle Scattering of Relativistic Electrons by Electromagnetic Ion Cyclotron Waves in the Magnetosphere

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Electromagnetic ion cyclotron (EMIC) waves which propagate at frequencies near the proton gyrofrequency can interact with relativistic electrons in the outer radiation belt, through cyclotron resonance, and cause pitch-angle scattering. During magnetic storms EMIC wave amplitudes can exceed the level required for strong diffusion scattering and significant electron losses to the atmosphere can occur over many drift orbits. The Combined Release and Radiation Effects Satellite (CRRES) was ideally situated to observe EMIC waves in the middle magnetosphere. In this study observations from CRRES are used to obtain spectral properties of EMIC waves (1-10 nT), and thus determine typical pitch-angle diffusion coefficients, $D\alpha\alpha$, during different phases of a storm. These diffusion rates are then compared to theoretical calculations assuming a simple functional form for $D\alpha\alpha$ based on quasi-linear theory that is valid for parallel propagating electromagnetic waves.

SM51C-0536 0830h POSTER

Effects of asymmetric plasmasphere on MHD waves in a three-dimensional dipolar magnetosphere

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The plasmaspheric region shows relatively strong longitudinal asymmetry in the sense that the location of the plasmapause and the density distribution significantly vary with respect to local time, and this asymmetry effect has been neglected in previous magnetospheric ULF wave studies. In this study, we numerically examine the MHD wave properties of field line resonances (FLRs) and Pi2 pulsations when the inner magnetosphere is assumed to be asymmetric. We use the dipole magnetic field model, but our density model is based on observational data from the IMAGE satellite. We assume an impulsive input in the magnetotail, which can be associated with a substorm onset. Our results suggest that local FLRs appear in both the radial and azimuthal oscillations owing to the asymmetry. Plasmaspheric Pi2 signals appear in the compressional component, but they are more strongly affected by ambient plasmaspheric structure than the FLRs. We compare our results with the observational data of Pi2 events.

SM51C-0537 0830h POSTER

Monitoring of magnetospheric convection near the plasmapause using corotating aurora

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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 since October 2000. Monochromatic images are obtained every 5 minutes using two all-sky imagers at 10 emission lines. From these data, a new type of aurora which is stationary on the sky with some patch structures was found in the magnetic evening sector by Kubota et al. [2003]. The stationary characteristic suggests that this type of aurora corotates with the Earth. We have investigated this type of aurora in detail using 47 events identified in the period from October 2000 to April 2003. The motion of this type of aurora is not always corotating. Sometimes it drifts slowly. Considering this point, we call this type of aurora 'Quasi-Corotating (QC) aurora' here. QC aurora occurred on geomagnetic quiet conditions (Kp=0-3+)

and mainly in the evening local time sector. From the DMSP/SSJ data, it is identified that precipitating electrons with energies of a few keV are the source of QC aurora, and that precipitating ions make no contribution to this type of aurora. We examined the source region of QC aurora in the magnetosphere using the LANL satellite data. The footprints of the LANL 1989-046 and 1991-080 are in the field of view of our imagers. It is found that the source region is usually located inside the plasmasphere. By comparing the aurora image data with the LANL particle data during the October 27, 2000 event, it is found that the aurora started to drift westward around 1800 MLT when the LANL satellite entered the plasma sheet region. Further we calculated the flow vectors representing the quasi-stationary motions of individual patches in aurora using the maximum cross-correlation method. In the case of the October 27, 2000 event, corotation flows are seen in the early evening sector of 1500-1600 MLT on the equatorial-plane in the magnetosphere (L=5-8). The flow speed becomes faster than the corotation speed after 1700 MLT and earthward flows become dominant around 1800 MLT. In the case of the December 6, 2001 event, corotation flows are seen around 1700 MLT at L=6-7 and its speed becomes less than the corotation speed around 1700 MLT like stagnation flows. Then, sunward flows become dominant after 1730 MLT outside L=7. It is suggested that the motions of the stationary or quasi-stationary patches reflect the fine structure of electric field potential near the plasmapause. Thus, it is possible to monitor the fine structures of magnetospheric convection near the plasmapause using this type of aurora.

SM51C-0538 0830h POSTER

LONGITUDINAL, SEASONAL, AND SOLAR ACTIVITY VARIATIONS OF THE ELECTRON TEMPERATURE AND DENSITY IN THE LOW-LATITUDE TOPSIDE IONOSPHERE OBSERVED BY KOMPSAT-1

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We present the results of the electron density and temperature measurements of the topside ionosphere made by KOMPSAT-1 from June 28, 2000 to August 1. KOMPSAT-1 is a sun-synchronous satellite with the altitude 685 km, orbital inclination 98o, and a descending node at 22:50LT. We have examined only the nighttime ionosphere and analyzed the longitudinal and solar activity variations for the low- and mid-latitude regions between 60o N and 60o S geomagnetic latitude. The results show a rather strong longitudinal and seasonal variation in the electron density and temperature. Latitudinal distributions of the electron density and temperature are nearly symmetric about the dip equator during the equinoctial times while the local maximum of the density and the local minimum of the temperature shift toward the summer hemisphere during solstices. We believe these variations are due to the influences of the meridional winds from the summer hemisphere toward the winter hemisphere. The associated upward and downward drifts along the magnetic field lines are verified by the DMSP ion drift data and the fractional composition of O+ also supports the idea. It is seen that the density and temperature generally increase with F10.7 but they remain more or less the same for F10.7 above 250.

SM51C-0539 0830h POSTER

SC Related Plasma Waves Observed by the Akebono Satellite in the Polar Region and inside the Plasmasphere Region

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Plasma wave phenomena associated with SCs are analyzed using data base of the Akebono satellite observations that have been carried out more than 13 years since March 1989. All the 719 data sets simultaneously observed in the periods of SC events show that plasma waves are enhanced with one-to-one correspondence to SCs in entire regions of the polar cap, auroral zone and plasmasphere within a response time of ± 90 seconds. In the middle latitude and equatorial regions of the plasmasphere, intensification and frequency shift of electromagnetic whistler mode, LHR waves and ion cyclotron harmonic waves are found. The electric field variations in this region also show clear response to the onset of SCs with the amplitude of 0.2-38 mV/m. The variations are observed in the nightside as well as dayside sectors, and no clear dependence of magnetic latitude, local time and L-shell is found. On the other hand, electrostatic whistler mode waves and electromagnetic ion cyclotron waves which show broad band spectra are generated in the high latitude region. Spectra of low energy particles observed simultaneously with the enhancement of these plasma waves show that electron fluxes are enhanced in all of pitch angle bins of the low energy particle detector onboard the Akebono satellite. Near the cusp region, the ion fluxes are more enhanced in the upward direction than in the downward direction along the magnetic field lines. In about half cases of the high latitude events, sudden appearance and intensification of AKR are also found after the onsets of SC. The delay time between the onsets of SC and AKR enhancement shows several minutes with the average time of 5.7 minutes. Time differences between the onsets of SC measured at Kakioka Magnetic Observatory and plasma wave enhancements observed by the Akebono satellite show positive correlation with possible delay time according to the propagation route of SC disturbances. Propagation character of SC disturbances shows two group signatures: one group takes a route which crosses the geomagnetic equator region with an average speed of 389.5 km/sec. The speed is almost consistent with plasmaspheric fast mode MHD wave velocity. The other group takes a route which starts from the dayside cusp region. In the second case, the SC disturbances propagate through the polar ionosphere region from the dayside to the nightside sectors with an average speed of 47 km/sec in the XGSM coordinate corresponding to the ionospheric fast mode MHD wave velocity.

SM51C-0540 0830h POSTER

Simulation of energetic electrons dynamics on the Oct. 2001 magnetic storm

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We study the storm event occurred in October 2001 and examine the dynamics of energetic electrons in the inner magnetosphere using satellite observations and numerical simulations. The storm has a well-developed main phase and slow recovery phase, although the substorm activity in the recovery phase is quite small. During the storm, NOAA, Akebono and Polar satellites successively observe the spatial and temporal evolution of energetic particles and plasma waves in the inner magnetosphere. The hot electrons increase at the dawn-side from main phase to early recovery phase. In contrast, the relativistic electrons in the outer belt disappear during the main phase but show significant enhancement around the late main phase to early recovery phase. We simulate the evolution of phase space distribution function of ring current and radiation belt electrons for energy range from a few hundred eV to a few MeV using the UNH RAM code [Jordanova et al., JGR, 106, 7, 2001], which solves the time-dependent, bounce-averaged kinetic equation of particle drifts, radial diffusion and loss due to Coulomb collisions. We also consider wave-particle interactions in the model. In the simulation, the time-dependent particle distributions measured from the MPA and SOPA instruments on the geosynchronous LANL satellites are used as the outer boundary conditions. We compare the RAM simulation with satellite observations and study the time-evolution of global particle distribution during the storm. We also discuss the contribution of each physical process to particle transport and loss.

SM51C-0541 0830h POSTER

Ring Current Ion Distributions From Dual Vantage Point ENA Images

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Energetic neutral atom (ENA) imaging has been exploited for several years as a tool for observing the global energetic ion morphology and dynamics in the storm-time ring current. Inversion of ENA images to obtain the parent ring current ion distributions has, however, met with limited success. Although the local time variation in ring current ions is often extracted, the ion pitch-angle distributions are more difficult, or impossible, to obtain; the ENA images do not contain sufficient information to uniquely determine the ion pitch-angles. The pitch-angle distributions of ring current ions reveal much about the processes that control ring current decay: interaction with the plasmasphere can drive waves and pitch-angle scatter the ring current ions into the loss cone; current sheet scattering may also play an important role in modifying the ion pitch-angles. With the anticipation of the TWINS mission, we are investigating the extent to which simultaneous ENA images from two separate vantage points can provide the additional information required to obtain pitch-angle distributions, along with the ion spatial distributions. In this talk we will report on efforts to invert ENA images from the IMAGE High Energy Neutral Atom imager, HENA, taken from different locations in the IMAGE orbit. Although such images are necessarily not simultaneous, we restrict the analysis to the recovery phase of major storms, during intervals when there is no additional solar wind energy input. During such times, the ion distributions should be slowly evolving, and we approximate them as stationary over the interval between the two selected HENA images. Early results suggest that dual vantage point imaging will improve the inversion of the ion distributions, including the ion pitch-angle distributions.

URL: http://sd-www.jhuapl.edu/IMAGE/

SM51C-0542 0830h POSTER

Investigating the Properties of Field-Line Resonances in the Inner Magnetosphere Using Independent Techniques

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This paper outlines a new experiment that simultaneously monitors ULF field line resonances and VLF whistler-mode waves propagating in the same L=2.5 duct. Closely-spaced magnetometers located on the Antarctic peninsula and in the SAMNET-BGS array provide measurements of the local field line eigenfrequency. This depends on the mass density near the field line apex, although the magnetometer spectra also contain contributions from non-field guided fast mode waves. VLF signals from transmitters in the US propagate in field-aligned ducts and are received near the duct footprint, by receivers co-located with the Antarctic peninsula magnetometers. Group delay of the VLF transmissions provides a measurement of the electron density. The Doppler shift of the ducted VLF signals is also measured and often shows oscillatory features that relate to radial motions of the duct. These motions are strongly correlated with Pc3-4 ULF pulsations recorded by the co-located magnetometers. We examine power and phase spectra for specific examples and show that the VLF Doppler observations provide direct information on properties of the ULF waves, including

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the electric field and wave mode. We also examine a case where several VLF ducts are simultaneously located within the field of view of the ULF experiment. Related issues include the identification of harmonic oscillations in the spectra, and the effect of the ionospheric conductivity on the standing ULF oscillations.

SM51C-0543 0830h POSTER

Simultaneous Determination of Magnetospheric Mass Density at the Time of Large Pc-5 Fluctuations Using an Electrostatic Analyzer and Toroidal Alfven Frequencies

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Measuring plasmaspheric mass density with particle detectors is usually a difficult task, as cold ions often dominate the mass density, and these do not have a sufficient flux into the detector to be measurable. When there is a significant bulk flow, however, the cold ions can be detected as they sweep across the spacecraft. Such a circumstance occurs when the toroidal Alfven wave (field line resonance, often at Pc5 frequency) has large amplitude, and therefore a large velocity perturbation. Using the Los Alamos National Laboratory Magnetospheric Plasma Analyzer (MPA) onboard geosynchronous spacecraft, we measure the ion composition when such large amplitude waves are present. Because the fluctuating flow exceeds the thermal speed of the particles, populations of H+, He+, and O+ can be distinguished using the E/q discrimination of the MPA. In this way, the mass density is determined. At the same time, we determine the mass density from the frequency of the toroidal Alfven wave. A Tsyganenko 96 magnetic field model is used, and the field line dependence of the mass density is assumed to be that found from Polar spacecraft electron density measurements. The wave equation is solved, and the mass density is adjusted so that the theoretical and observed frequencies are the same.

SM51C-0544 0830h POSTER

Intensity Distribution of Plasmaspheric Hiss in the Plasmasphere

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Plasmaspheric hiss is an electromagnetic emission in the 10s Hz to 10 kHz frequency range propagating in the whistler mode that is typically confined within the plasmasphere. Two of the most important aspects about plasmaspheric hiss are its source location and generation mechanism. Generation mechanisms have been proposed both inside and outside the plasmasphere and are still controversial. To investigate the source location, plasma wave intensity maps have been constructed by using three years of plasma wave observations from the Dynamics Explorer and three years from the Imager for Magnetopause−to−Aurora Global Exploration (IMAGE) spacecraft. These intensity maps show the potential source locations or sites where waves are amplified due to particle− wave interactions. In this presentation, we show that the plasmaspheric hiss spectrum can be viewed as having low (10 to 300 Hz), mid (300 Hz to 3.3 kHz), and high frequency (> 3.3 kHz) components. Observations of low−frequency plasmaspheric hiss show that the most intense region is in or near the magnetic equator in the afternoon sector and that the maximum intensity region tends to move from L value of 3 to less than 2 during times of negative Bz. These observations are consistent with particle−wave interactions in or near the magnetic equator. The mid− frequency portion of the hiss spectrum shows the peak− intensity region moves from high latitudes at L= 4 toward the magnetic equator over L = 2 to 3. The longitudinal distribution of the hiss intensity in this frequency range is similar to that of lightning intensity with the peak near late afternoon and the minimum near early morning local times. The near− equatorial minimum at L= 2 − 3 is also consistent with particle−wave interactions in the magnetic equator. At frequencies above 3.3 kHz the maximum intensity shifts to the local evening−post midnight with enhancements along all L shells from 1.8 to 3. Indications are that the cyclotron resonance also operates in this frequency range.

SM51C-0545 0830h POSTER

Solar Wind Driven ULF Waves and MeV Electron Radial Diffusion in the Magnetosphere: Requirements for the Development of a ULF Index

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We present the results from a statistical analysis of the relationship between ground-based ULF wave power spectra and upstream solar wind parameters. We find that solar wind speed is universally the best correlated with Pc5 ULF wave power in the magnetosphere, both on the ground and in space, and both of these are correlated with MeV electron flux. However, we show that a narrow band ULF index is essentially uncorrelated with MeV electron enhancements. The ground-based data show clear evidence of a spectral peak indicative of the local fundamental field line resonance (FLR), this peak being a strong function of latitude, as expected. Interestingly, the geosynchronous satellite data show no evidence of the FLR spectral peak, and demonstrate power levels orders of magnitude less than observed on the ground, consist with the Pc5 power being dominated by disturbances with fundamental field aligned harmonic mode structure. Importantly, this shows that geosynchronous magnetic field data alone is of little use for monitoring ULF wave power in the magnetosphere, and that it cannot be used as the basis for the development of a ULF wave index. Field aligned Alfven eigenmode calculations show that whilst ionospheric E-field is a strong function of ionospheric Pedersen conductivity, the corresponding ground-based B is almost independent of conductivity, so long as the waves are not critically damped. Significantly, however, the ratio between wave ground-based B and equatorial E is a strong function of magnetospheric density, increasing with the higher density expected both during geomagnetically active times and within the plasmasphere. This means specific ground-based ULF power levels map to lower equatorial E, and slower diffusion, both during storms as well as inside the plasmasphere. For observed ground-based ULF power levels, the diffusion inside the plasmasphere may be very slow, perhaps explaining the link between the position of the plasmapause and the peak in radiation belt flux. Hence for the development of a ULF index, a measure of the density in the magnetosphere is important in addition to ground-based ULF power. Finally, we estimate MeV electron diffusion times expected for the observed ULF power as a function of solar wind speed, L-shell, and magnetospheric density.

SM51C-0546 0830h POSTER

Propagation Characteristics of Electromagnetic Ion Cyclotron Waves and Magnetosonic Waves Observed by the CLUSTER Satellites Within the Plasmasphere

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Electromagnetic Ion Cyclotron waves (EMIC) and Magnetosononic waves (MSW) observed in the equatorial regions of the plasmasphere by the four CLUSTER satellites are studied in the objective to improve wave models used in physical radiation-belt models. Data analyses are performed on each satellite. They include the production of power spectrograms of the magnetic wave fields and the estimation of propagation characteristics (degree of polarisation, sense of polarisation, wave normal direction, ellipticity). Several characteristics of prime importance for the development of wave models are pointed out. They concern : the lower cut-off frequencies of MSW and EMIC waves, the evolutions of the harmonic structure of MSW waves in the course of the propagation towards lower L values, the localisation and the amplitude of the R mode waves that may interact with energetic electrons, and the distribution in K vectors of these emissions. Comparisons are made with results obtained from the GEOS, CRRES and AKEBONO satellites.

SM51C-0547 0830h POSTER

Electron Density Profiles in the Plasmapause and Plasma Trough Regions

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The Polar satellite has passed through the inner magnetosphere more than 5,000 times, crossing the plasmapause region more than 10,000 times (quite often four times per 18-hr orbit). Using the electron densities provided by the EFI experiment, we study statistically the density variation at L = 3-12 shells. With a power law fitting, we determine the plasmapause (PP) location and thickness, and the power law slope of density in the trough region. All characteristics reveal strong variation with MLT and Kp. The average PP location moves from L = 5 to L = 3.5 with increasing Kp. For any Kp, however, the MLT dependence is clear. For instance, the plasmaspheric bulge turns noonward with increasing Kp, and interestingly large PP distances also occur around 9 MLT sector. The PP thickness decreases with increasing Kp from 0.7 L to 0.1 L. However, at 12-21 MLT the PP thickness tends to remain always quite large (0.4-0.8). The trough power law index k (density is proportional to L^{-k}) shows interesting and strong behavior with MLT and Kp; for instance, in the post-midnight sector k decreases from 5 to 3 with increasing Kp whereas in the pre-midnight sector the change occurs between 4 and 3. Near noon k is 2.5 for all Kp conditions. In the plasmapause and trough region, small-scale irregularities are quite common, and we attempt to characterize their occurrence and characteristics with MLT and Kp.

SM51C-0548 0830h POSTER

Pi2 Pulsations With Second Harmonic: CRRES Observations in the Plasmasphere

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Pi2 pulsations observed on the ground at low latitudes often exhibit multiple spectral peaks, and this property has been attributed to the harmonics of plasmaspheric cavity mode resonance. We show that multi-frequency Pi2 pulsations simultaneously observed from the Combined Release and Radiation Effects Satellite (CRRES) and at the Kakioka ground station (L = 1.26) can be explained by the cavity mode. The pulsations occurred in a 40-min time span on January 10, 1991. CRRES was within the plasmasphere at L = 6.1, on the dipole equator, and very near midnight. Kakioka was also very close to midnight. The pulsations consisted of two spectral components, 7 mHz (f1, fundamental) and 12 mHz (f2, second harmonic). At CRRES, the f1 oscillation was observed in the azimuthal component, Ey, of the electric field, while the f2 oscillation was observed in the compressional component, Bz, of the magnetic field. At Kakioka, by contrast, both the fundamental and second harmonic oscillations were detected in the horizontal component, H. The spectral separation between Ey and Bz implies that the spacecraft was located near the node/antinode of cavity mode resonance excited at multiple harmonics. Further support for this interpretation is provided from analyses of the phase of Ey and Bz.

SM51C-0549 0830h POSTER

Electron temperature in the plasmasphere and inner magnetosphere

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Distribution of thermal electron temperature and related electron density in the plasmasphere and high latitude inner magnetosphere (altitude range 5000-20000km) is studied using a data-base resulting from the measurement onboard the Interball-2 and MAGION-5 satellites. A second and seldom a third warmer electron pupolations were found. We perform a statistical study of these populations in relation to geophysical parameters. Probability of occurence of the warmer population increases with altitude and is greater at night than during the days hours.

SM51C-0550 0830h POSTER

Continuum Radiations Characteristics close and far from Sources: Directivity Observations from the four CLUSTER spacecraft

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Non thermal Continuum radiations have been first discovered in the seventies, their main characteristics, including directivity properties, reported as early as 1975. Other findings (like various detailed spectral and temporal behaviours) were later derived from single spacecraft observations (GEOS, ISEE, Dynamics Explorer, GEOTAIL, POLAR). The first multispacecraft studies, based on GEOS and ISEE simultaneous observations, confirmed the general position of sources to be in the vicinity of the Earth plasmapause, a fact compatible with the main generation mechanisms proposed. The CLUSTER constellation, comparing four spacecraft observations, brings forward new findings and new questions about the source localisation. In this poster, we concentrate on reporting about directivity properties in a plane parallel to ecliptic, as derived from the field intensity spin modulation observed by the Whisper instruments. In two case events, we use the directivity properties derived from the four Cluster spacecraft to locate Continuum sources, under the assumption of free propagation. The first case, observed during a Continuum enhancement, at 19 RE geocentric distance, indicates two main ray directions, according to the frequency range considered, thus a superposition of two main events. We discuss possible corresponding source positions. The second case, observed at about 5 RE geocentric distance, indicates a source placed in the dusk sector, Earthward from the Cluster orbital position, near a plasmapause gradient. The beam extension observed in this latter case is discussed.

SM51C-0551 0830h POSTER

Remote Sensing of Magnetospheric Plasma Density from the Analysis of Whistler Mode Echoes Received by RPI on IMAGE

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Whistler mode wave injection and reception using the RPI Instrument on IMAGE satellite has led to a new remote sensing method to measure the plasma density and density structures in the magnetosphere. During 2000-2002 period, RPI frequently recorded discrete (characterized by discrete spectral form) and diffuse (characterized by multiple receptions at each frequency) whistler mode echoes in ∼10-400 kHz frequency range when IMAGE was at low altitudes (< 6000 km) in the inner plasmasphere or near its perigee in the southern hemisphere. In most cases, the whistler mode echoes were accompanied by Z-mode echoes. The discrete and diffuse echoes, were observed ∼ 5% to 10% and ∼ 10% to 20%, respectively, of the total number of transmissions at low altitude. Ray tracing simulations indicate that the discrete echoes may result from reflections of RPI signals from the Earth-ionosphere boundary and that the diffuse echoes may result from scattering of RPI signals from small scale (∼10-100 m) plasma density irregularities. By comparing the measured dispersion of discrete echoes with that from ray tracing simulations, it is possible to determine the plasma density along the ray path as well as to determine the nonducted or ducted modes of propagation. The ray tracing simulations carried out for 10 cases from the period 21 April to 28 August 2000, when the satellite was at > 50° latitude, indicated that the electron density varied between 500 to 1000 el/cc at ∼ 4000 km altitude and showed $R^{-4.5}$ dependence with altitude. Two cases from the period of 20 May to 31 May 2002, when discrete echoes were accompanied by Z-mode echoes, were analyzed to determine the electron density. In these cases, it was possible to determine the local electron density at the satellite from the Z-mode cutoffs and the local gyrofrequency. This allowed determination of electron density at the F2 layer peak. The simulations showed that the electron density at the F2 layer peak (∼ 250 km) was about ∼ 3-4 e5 el/cc in either cases, and the electron density at ∼ 4000 km altitude was about 500 el/cc in one case and about 75 in the other case. By comparing measured dispersion of diffuse echoes with that from ray tracing simulations, it is possible to determine the locations and spatial sizes of density irregularities responsible for diffuse echoes. One diffuse case, 06 August 2000, was analyzed. Simulation result indicated the presence of ∼ 10−100 m scale plasma irregularities within ∼1000 km of the IMAGE satellite (Altitude∼2500 km, λ_m ∼ 65°) at the time of observation. These results are in general consistent with previous observations of plasma density in the low altitude magnetosphere.

SM51C-0552 0830h POSTER

A microscopic and nanoscopic view of storm-time chorus

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We use multipoint measurements obtained by the Cluster spacecraft to investigate intense whistler-mode chorus emissions during the geomagnetic storms. The observations were recorded close to the equatorial plane at a radial distance of 4 Earth radii. We first show a "microscopic view" of spatio-temporal variations of the direction of the Poynting flux. We investigate the central position of the chorus source which fluctuates at time scales of minutes within a few thousands km of the geomagnetic equator. We demonstrate that estimates of the electromagnetic planarity can be used to characterize the extent of the source region parallel to the ambient magnetic field. We also show a "nanoscopic view" of discrete wave packets of chorus rising in frequency between 1 and 4 kHz at a rate up to 20 kHz/s, and having peak amplitudes above 20 mV/m. We study the fine structure of subpackets embedded in the chorus wave packets. This fine structure has a typical delay of a few milliseconds between the two neighboring maxima of the wave amplitude, while longer delays occur with a decreasing probability density.

URL: http://terezka.ufa.cas.cz/santolik/papers/agu2003

SM51C-0553 0830h POSTER

Rapidly Moving Sources of Upper-Band ELF/VLF Chorus Near the Magnetic Equator

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The possibility to resolve the space - time fine structure of wave - particle interactions in the magnetosphere has been realized in the context of the CLUSTER mission. Multiple simultaneous measurements of upper band chorus emissions near the magnetic equator (at magnetic latitudes between -20° and 10° and L shells ranging between L = 4 and L = 5) have been carried out during 2001 - 2003. The first observations were reported by Gurnett et al. [2001], who showed that the same chorus elements on different spacecraft exhibited a distinctive difference in frequency. The unique characteristics of such measurements allow us to deduce key aspects of the mechanism of generation of ELF/VLF chorus emission. In the present paper we show that this frequency difference can be explained as a differential Doppler shift, using a simple model involving rapidly moving sources traveling at speeds comparable to the parallel resonant velocity of counter - streaming electrons moving along the Earth's magnetic field lines. We report observations from the CLUSTER spacecraft of ELF/VLF upper - band chorus, and perform a study of the source characteristics of these waves based on frequency and time differences of the same elements recorded on different spacecraft, traveling with separations ranging from 600 km to 2000 km. These frequency and time differences are interpreted as a direct consequence of the rapid motion of highly localized source regions of chorus.

SM51C-0554 0830h POSTER

The SSC event of April 17 2002:a preliminary analysis from SEGMA array.

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Abstract. We conducted a multi-station analysis of the April 17, 2002 SSC by means of high resolution measurements (1 second) conducted at three stations of SEGMA, the new South European Geomagnetic Array (Nagycenk, NCK, Mlat. 42.68°, Ranchio, RNC, Mlat. 38.19°, L'Aquila, AQU, Mlat. 36.22°, along the same geomagnetic meridian ∼90°). The characteristics of both the main impulse (MI) and the preliminary impulse (PI) are analyzed as a function of magnetic latitude. The PI is characterized by a positive variation along H and a negative variation along D. It is accompanied by a clear Pc3 wave activity at discrete frequencies (∼40 mHz and ∼60 mHz). We adopted also a different approach in which the geomagnetic signal is decomposed along axes associated with maximum (V_{max}) and minimum variance (V_{min}) orientation. The MI field, along V_{max}, is oriented at 45° from the H component; conversely, the PI field has a dominant component along V_{min}.

SM51C-0555 0830h POSTER

Characterizing the mass composition of the inner magnetosphere using ground and space-based techniques

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Electron number density measurements from IMAGE RPI are combined with ULF resonance-ground magnetometer derived mass density estimates during times of IMAGE and MEASURE ground magnetometer array conjunctions to determine the average composition of the plasmasphere during quiet times. Many studies have been performed to characterize the plasma density profile of the inner magnetosphere. The usual result is that the equatorial electron density decreases as a function of distance from the Earth. On the other hand, the mass density profile of the inner magnetosphere has not been extensively studied due to the difficulty of making direct measurements from spacecraft and the fact that ground-based techniques developed for remotely sensing mass density tend to be tedious to perform by hand. Recently, an automated process for estimating the mass density of the inner magnetosphere using pairs of ground magnetometers has been developed by Berube et al. The Radio Plasma Imager (RPI) on board the IMAGE spacecraft makes in situ measurements of magnetospheric electron density. By combining electron density measurements from RPI with mass density estimates obtained using ground techniques we are able to constrain the plasma composition of the inner magnetosphere for instances when IMAGE is in conjunction with the field lines spanned by ground stations.

SM51C-0556 0830h POSTER

Simulation study on how electron and proton whistlers appear for different latitudes

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Electron whistlers frequently excite proton whistlers. The proton whistlers appear on the dynamic spectrum as rising tones, which start after the reception of a short electron whistler, asymptotically approaching the local proton gyro-frequency. The proton whistlers are dispersed forms of lightning impulses and their dispersion can be explained by the effects of ions such as H^{+} and He^{+} on the propagation of an electromagnetic wave in the ionosphere. A wave propagating in the ionosphere changes polarization at the altitude where the frequency is close to a crossover frequency. This polarization reversal provides the mechanism by which an upgoing electron whistler can become a proton whistler. By adopting the multi-fluid numerical wave model, we investigate how the location of the lightning sources affects the electron and proton whistlers. The time histories of electric fields and the dynamic spectra are presented. We show that the polarization reversal occurs at mid- and low-latitudes where the geomagnetic field makes a large angle relative to vertical, while no polarization reversal occurs at high latitudes where the geomagnetic field is nearly vertical. We discuss how electron whistlers disappear when the frequency lies between the crossover frequency and the cutoff frequency in cold plasmas. We also compare our results with the previous theoretical and observational studies.

SM51C-0557 0830h POSTER

Observation of daytime Pc3-4 ULF waves near the plasmapause using SuperDARN TIGER radar

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SuperDARN radars are primarily designed to study large-scale long-period ionospheric plasma convection. However, these radars are also capable of monitoring much weaker and faster processes like ULF waves. Recently, we have shown that simple detrending together with utilization of sea/ground scatter echoes reveal on abundance of ULF waves in SuperDARN data. The basic radar sampling rate of 120 s limits ULF waves, which may be studied, to Pc4-5 frequency range. However, use of a special high time resolution mode shows regular appearance of band-limited daytime Pc3-4 waves. These waves are believed to be generated by ion-cyclotron instability in the reflected proton beams upstream of the Earth's bow-shock. Their propagation to the high-latitude ionosphere remains unclear. In this work we use SuperDARN TIGER radar (Tasmania) to investigate spatial characteristics of high-latitude daytime Pc3-4 waves in an attempt to clarify their propagation modes. Simultaneous ground magnetometer data were used for direct estimates of the ionosphere/ground transfer function in 10-100 mHz range, which was then compared with results of numerical and analytical modelling.

SM51C-0558 0830h POSTER

Monitoring the Ground-Based VLF transmissions from Space using IMAGE RPI

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Using the global network of ground-based VLF transmitters operating at frequency between 10 and 30 kHz, we have monitored the occurrence of whistler mode VLF signals with the RPI instrument on the IMAGE satellite. Our objective was to study the power and effective spatial scales of the whistler waves propagating trough the ionosphere into the magnetosphere. We have identified signals from 20 stations in the plasmasphere region with L shells ranging from 1.1 to 5.2. Ten of these stations have high radiated power, 200 kW to 1 MW. The spatial region where VLF signals were observed was significantly smaller during the dayside measurements than during the nightside ones. We also present azimuthal and radial characteristics of the VLF signal amplitude.

SM51D MCC: 2006 Friday 1020h

The Electrodynamics of the Cusp and the Open/Closed Field Line Boundary Region III *(joint with SA)*

Presiding: **R Pfaff,** NASA Goddard Space Flight Center**; T Yeoman,** University of Leicester

SM51D-01 1020h INVITED

Combined Sounding Rocket and SuperDarn/EISCAT Radar Observations of Plasma Convection, Shear, Irregularities and other Phenomena in the Cusp and Boundary Layer during IMF Bz Negative and By Negative Conditions

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On December 14, 2002, a NASA Black Brant X sounding rocket was launched equatorward from Ny Alesund, Spitzbergen (79 deg. N) into the dayside cusp and subsequently cut across the open/closed field line boundary, reaching an apogee of 771 km. The launch occurred during Bz negative conditions with strong By negative that was changing during the flight. SuperDarn (CUTLASS) radar and subsequent model patterns reveal a strong westward/poleward convection, indicating that the rocket traversed a rotational reversal in the afternoon merging cell. The payload returned DC electric and magnetic fields, plasma waves, energetic particle, suprathermal electron and ion, and thermal plasma data. We provide an overview of the main observations and focus on the DC electric field results, comparing the measured E x B plasma drifts in detail with the CUTLASS radar observations of plasma drifts gathered simultaneously in the same volume. The in situ DC electric fields reveal steady poleward flows within the cusp with strong shears at the interface of the closed/open field lines and within the boundary layer. We use the observations to discuss ionospheric signatures of the open/closed character of the cusp/low latitude boundary layer as a function of the IMF. The electric field and plasma density data also reveal the presence of very strong plasma irregularities with a large range of scales (10 m to 10 km) that exist within the open field line cusp region yet disappear when the payload was equatorward of the cusp on closed field lines. These intense low frequency wave observations are consistent with strong scintillations observed on the ground at Ny Alesund during the flight. We present detailed wave characteristics and discuss them in terms of Alfven waves and static irregularities that pervade the cusp region at all altitudes.

SM51D-02 1040h

Observations of Highly Structured Precipitating Electrons in the Dayside Cusp/Boundary Layer Ionosphere

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Observations of electrons precipitating in the dayside entry region are presented. The measurements were gathered using instrumentation carried on a sounding rocket launched into the cusp region from Ny Ålesund, Svalbard on 14 December 2002. The electron fluxes were highly structured and patchy and correlated with the electromagnetic signatures measured by the fields experiment on the rocket. The electron signatures are interpreted in terms of wave-particle interactions involving the large scale fields including Alfvénic fluctuations as well as the inferred open-closed field line geometry. Mapping of the electrons up the field lines using time-of-flight techniques is used to help understand the coupling between the fields and the waves.

SM51D-03 1055h INVITED

Determining the Open Flux Content of the Magnetosphere From Observations of the Polar Ionosphere

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We employ observations from several sources to determine the location of the polar cap boundary, or open/closed field line boundary, at all local times, allowing the amount of open flux in the magnetosphere to be quantified. These data sources include global auroral images from the Ultraviolet Imager (UVI) instrument onboard the Polar spacecraft, SuperDARN HF radar measurements of the convection flow, and low altitude particle measurements from Defense Meteorological Satellite Program (DMSP) and