generated by each of these radio propagation experiments. We also demonstrate, through these measurements, what quantities can be measured and how best to measure them on a dedicated radio tomography mission.

SM72A-0612 1330h POSTER

Study of Distribution of Pressure in the Magnetosphere Using the Aureol-3 satellite.

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During the last decade many efforts were concentrated on the study of pressure distribution in the inner magnetosphere. Direct measurements of ion distribution functions in the plasma sheet and another magnetospheric regions allowed to obtain the plasma pressure in situ. These results also reveal the average distribution of pressure in the magnetosphere which turns out to be similar to the statistical results obtained from the low-altitude polar orbiting satellites. In addition, the short time of passage of low-altitude polar orbiting satellites - like Aureol-3 - through the auroral zone allows us to obtain the quasi instantaneous radial and azimuthal distribution of pressure in the magnetosphere. To do so we take into account the transformation of the particle distribution functions by the field-aligned potential drops and map the satellite positions to the equatorial plane using geomagnetic field models. This technique allows us to study the changes in magnetospheric pressure associated with a wide class of phenomena including substorms.

SM72A-0613 1330h POSTER

Multipoint Observations of the Ion Isotropy/b2i Boundary:q

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The Ion Isotropy/b2i Boundary is known to correlate well with magnetic field inclination at geosynchronous orbit and thus provides an effective means of remote sensing magnetotail stretching. As the substorm cycle involves dramatic and systematic changes in stretching, it follows that an ability to monitor this important magnetospheric boundary at high temporal resolution at several magnetic local times, or even on a global scale, may provide a valuable diagnostic tool - it may assist in directly quantifying the dynamics of the inner edge of the current sheet throughout the various phases of the auroral substorm. A complement of three instrument platforms (MSPs, SuperDARN, and the IMAGE satellite's Spectrographic Imager) provides us with an exciting new capability to monitor the Ion Isotropy/b2i Boundary on a global scale. We here demonstrate the potential value of high time resolution multipoint b2i boundary identifications in substorm research. Employing the MT index as a convenient proxy, we show how the general trend of, similarities of, and differences between index values obtained simultaneously at different MLTs via these instrument platforms can assist in quantifying the dynamics of the inner edge of the current sheet, as well as the location, timing, and spatial extent of magnetospheric disturbances.

SM72B MCC: Hall D Sunday 1330h

Dipole Tilt Effects on Sun-Earth Connections I Posters *(joint with SA, SH)*

Presiding: **N U Crooker,** Boston University**; Y Kamide,** Nagoya University

SM72B-0614 1330h POSTER

Evidence for a Dominant Russell-McPherron/Rosenberg-Coleman Origin of the Semiannual Variation of Geomagnetic Activity in 1954 and 1996

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Occasionally, the semiannual variation of geomagnetic activity is so pronounced that one can readily identify it in daily averages of the aa index during the year. The solar minimum years of 1954 and 1996 were two such intervals. Using solar eclipse data and the Svalgaard polarity index for 1954 and solar magnetic field and solar wind data for 1996, we show that the six-month wave in geomagnetic activity during these years was primarily due to a flattened current sheet resulting in a strong Rosenberg-Coleman effect (an axial polarity effect), which in turn produced a strong Russell-McPherron response in aa. When we normalize the aa data for these years for the equinoctial effect (based on the angle between the solar wind flow direction and Earths dipole), we remove approximately 30% of the amplitude of the semiannual variation, implying a dominant axial/Russell-McPherron origin. When we perform this normalization for the entire 1868-1998 aa data set, we remove 75% of the six-month wave, indicating that, in general, the equinoctial effect is primarily responsible for the semiannual variation of geomagnetic activity.

SM72B-0615 1330h POSTER

Super Dual Auroral Radar Network Electric Field Variability: Case Studies

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Variability in the high latitude convection electric field can significantly impact the amount of Joule heating that occurs in the upper atmosphere. Little, however, is known about the character of this variability. Using line-of-sight velocity drift measurements from the Super Dual Auroral Radar Network (SuperDARN), we characterize the nature of the temporal electric field variability for several recent periods. The broad spatial extent in magnetic latitude and magnetic local time of the SuperDARN field-of-view allow this variability to be related to global features such as the convection throat and the convection reversal boundary. It is therefore possible to determine and compare the statistical magnitude of the variability in these distinct regions as well as to estimate both the temporal and spatial coherence lengths of the observed variability. We show examples of variability and their coherence lengths for several different regions of the high latitude.

SM72B-0616 1330h POSTER

Dipole Tilt Angle Effects on Joule and Particle Heating in the Ionosphere

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Previous work by Chun et al. [2002] presented spatial distributions of Joule heating as a function of the polar cap (PC) index and the season (summer, equinox, and winter). Noticeable differences in the Joule heating maps were observed with respect to both geomagnetic activity and the season. In this study, we present average patterns of height-integrated Pedersen and Hall conductivity, electric potential, Joule heating, and electron particle heating as a function of PC and dipole tilt angle using 56 days (approximately 12,800 individual patterns) of Assimilative Mapping of Ionospheric Electrodynamics (AMIE) data. We investigate differences in the spatial distributions as well as the hemispheric integrated Joule and particle heating. We also present spatial distributions of the ratios of the Joule to particle heating and the Hall to Pedersen conductance as a function of PC and dipole tilt angle.

SM72B-0617 1330h POSTER

Field Aligned Current Patterns Derived by AMIE - Satellite Data versus Ground Based Data

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When dealing with magnetic field data the Assimilative Mapping of Ionospheric Electrodynamics (AMIE) procedure is traditionally built on ground based magnetometer data. In this study, however, we examine how well it can perform using magnetic field data from the rsted and CHAMP satellites. These high precision data are more readily available and therefore it would be an advantage if data from these satellites to a greater extent could be used as input for AMIE. Furthermore, high-precision satellite data are now in abundance and should thus be well suited for improving the results of statistical as well as event studies of the ionospheric current systems.

For a number of selected days and times, representing different geomagnetic conditions, AMIE fits an electric current pattern to the polar region based on the two satellite passes and we compare the results with similar patterns derived solely from ground based data. The differences and similarities are analysed and discussed with reference to improving the use of satellite data in AMIE.

SM72B-0618 1330h POSTER

Diurnal Dependence of Birkeland Current Intensities: Implications for Magnetosphere-Ionosphere Coupling

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The solar EUV contribution to ionospheric conductivity should produce a diurnal variation in the Birkeland, Hall and Pedersen currents. The Iridium system of satellites provides nearly uniformly spaced coverage at all local times regardless of the time of day and simultaneous observations in northern and southern

hemispheres allow separation of variations in the solar wind dynamo, both due to dipole tilt effects and solar wind/IMF dynamics, from those associated with hemispheric differences. We examine three years of Iridium magnetometer key parameters [Anderson et al., 2002] for seasonal and diurnal variations in the ratio of total Birkeland current flowing in the northern and southern hemispheres. The N/S FAC ratio is evaluated using three different measures of FAC intensity: maximum magnetic perturbation (95-100 percentile average), median magnetic perturbation (45-55 percentile average) and average fraction of samples above the noise level. All three measures show the same basic pattern. The seasonal and diurnal variations on the dayside are much larger than the nightside indicating that variations in solar illumination are responsible. Moreover, the N/S FAC ratio is in phase with the N/S average ionospheric conductance estimated using diurnal variation in magnetic coordinates, dominated by dipole tilt effects. The results imply a strong diurnal hemispherical anti-phase relationship in FACs and in associated Joule heating which should have important consequences for modeling high latitude thermospheric dynamics.

SM72B-0619 1330h POSTER

Storm Time Field-Aligned Currents Derived From Ørsted and CHAMP satellite data

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In this study, we continue our investigation of the magnetic storm time conditions, specifically focusing on the distributions of high-latitude field-aligned currents during intermediate and strong storms derived from high-precision geomagnetic field observations made onboard the Ørsted and CHAMP satellites in 1999-2002. We find that Region 1 field-aligned currents saturate during strong (Dst < -100 nT) storms because of very strong solar wind-magnetosphere-ionosphere (SWMI) coupling, proving experimentally Hill's theoretical SWMI model. This model takes into account a feedback from the ionosphere to the magnetosphere through varying ionospheric conductivity and Region 1 currents, leading to saturation of the cross-polar electric potential. We discuss the obtained statistical distributions of these currents, as well as the voltage-current relation responsible for the generation of these field-aligned and ionospheric current systems.

SM72B-0620 1330h POSTER

Testing the Potential Saturation Predictions of the Hill Model Using Observations From the March 31, 2001 Storm

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Recently Siscoe et al. [JGR, 2001JA000109, 2002] extended Hills hypothesis for saturation of the transpolar potential for high solar wind electric field intensities. For extreme southward IMF conditions the Region 1 current system takes over the role of the Chapman-Ferraro current system of deflecting the solar wind. The high-altitude cusps move toward the equator and a shoulder develops poleward of the cusp. The region 1 currents weaken the magnetic field at the subsolar magnetopause and the nose of the magnetosphere is indented relative to the high latitude magnetopause. A feature of the Hill model (as described by Siscoe et al.) is that the saturation potential increases with increasing solar wind dynamic pressure. Observations of the March 31, 2001 magnetic storm provide a multi-location test of the predictions of the Hill model. The low latitude location of the high-altitude cusp, and the formation of a magnetopause shoulder poleward of the cusp was observed by Polar. GOES data show the reduction of the subsolar magnetic field strength below dipole values. The dynamic pressure and the IMF vary considerably over the day, and DMSP data is used to show that the polar cap potential stayed within the saturation limits defined by the Hill model. MHD simulations using the MRC Integrated Space Weather Model provide the large-scale context for understanding the satellite measurements.

SM72B-0621 1330h POSTER

Polar Cap Potential Drop as a Function of Solar Wind and Interplanetary Magnetic Field: Results from SuperDARN Convection Measurements

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Observations from the Super Dual Auroral Radar Network (SuperDARN) radars were used to generate convection patterns with a temporal resolution of 10 minutes. These convection patterns are derived from direct measurement of plasma flows and do not depend on models of the ionospheric conductance. They therefore provide for the most direct way of determining the ionospheric convection pattern with high temporal resolution.

Linear regression analysis was used to compare the polar cap potential drop determined from the SuperDARN convection patterns with various combinations of the solar wind velocity and density and the IMF. In addition, multi-linear regressions for different combinations of parameters were performed. The analysis has been done for the total polar cap potential drop as well as for the dawn and dusk convection cells separately. The multi-linear regression combination of VB_z and VB_y provides the greatest reduction in the variance. The multi-regression coefficients showed a seasonal dependence. The ground-state of the potential drop was found to be approximately 30 kV on average, with a somewhat higher value in summer and lower value in winter. This seasonal dependence is opposite to that found in a number of previous studies.

SM72B-0622 1330h POSTER

The Role of Storm-Time Parallel Potential Drops in Ion Acceleration

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Recent MHD simulations of the storm-time magnetosphere and observations of the polar cap region have indicated that there is an apparent limit to the transpolar (cross-polar-cap) potential drop. At the same time, the potential across the magnetosphere is not known to saturate. This results in a phenomenon called differential convection which occurs when the transmagnetospheric potential exceeds the transpolar potential when the latter is saturated. A necessary consequence of differential convection is the appearance of parallel potentials comparable to the difference between the potentials across the polar cap and magnetosphere. These parallel potentials can have a profound effect on the plasma population of the near-Earth magnetosphere, We have carried out a series of particle trajectory calculations to evaluate the effect of these parallel potentials on local ion distribution functions. To do so, we have used global snapshots of the magnetic and electric fields from the Integrated Space Weather Model (ISM) MHD simulation and launched distributions of ions from locations in the near-Earth magnetosphere and the auroral zone. Of particular interest are signatures in the ion precipitation pattern which may help pinpoint the location and intensity of the storm-time parallel potential drops in observations.

SM72B-0623 1330h POSTER

Effects of the Southward Solar Wind Magnetic Field and Ionospheric Conductance on Cross Polar Cap Potential: Global MHD Simulation Results

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Recent observations of the cross polar cap potential for large values of the solar wind electric field Ey (with southward interplanetary-magnetic-field (IMF)) indicate saturation when the magnitude of the solar wind Ey exceeds approximately 5 mV/m [Russel et al., 2000; Lu et al., 2001; Kozyra et al., 2001; Shepherd et al., 2002]. We conducted a set of global MHD simulations using the Lyon-Fedder-Mobarry (LFM) code under different solar wind conditions. The ionospheric conductance was taken as constant Pedersen conductance given by 5 and 10 mhos. The global MHD simulations show that for strong solar wind IMF, the ionospheric cross polar cap potential saturates. With higher ionospheric conductance, the saturated value of the cross polar cap potential decreases. The saturation of the ionospheric potential for strong solar magnetic field is originated from the saturation of the electric field (Ey) at the dayside reconnection site. This electric field is what mapped into the ionosphere and dictates the polar cap potential. With the increase of the ionospheric conductance, the value of the saturated electric field at the dayside reconnection site drops. With higher solar wind southward IMF Bz, the magnetosheath region is significantly broadened and after passing the bow shock region, the electric field decreases rapidly before it encounters the reconnection region. The magnetosheath region accounts for diverting a large fraction of the impinging Poynting flux around the magnetosphere without impacting the magnetopause.

SM72B-0624 1330h POSTER

Seasonal Variation of F-region Echo Occurrence in the Midnight Sector

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In this study we consider long-term data (1995-2001) in the midnight sector for the Saskatoon (Canada), Hankasalmi (Finland) and Halley (Antarctica) SuperDARN radars to reveal the seasonal effect upon echo occurrence. The selected radars monitor scatter at about the same magnetic latitudes but significantly different geographic latitudes. The seasonal variations vary between these radars and slightly change with the phase of the solar cycle. The Halley radar clearly shows maxima during equinoxes at solar activity minimum (geomagnetic latitudes 75-80 deg). As the solar activity increases, progressively more echoes are observed during the austral winter, especially at geomagnetic latitudes of 70 deg. The Finland radar, whose location allows it to monitor scatter 5 deg geographically more equatorward than Halley, shows similar features except for more pronounced winter echo occurrence. This radar shows little seasonal effect at low latitude of 65 deg. The Saskatoon radar can observe echoes at even lower geographic latitudes. It measures two equinox maxima at high latitudes and a summer maximum at magnetic latitudes of 65-70 deg during the solar minimum. This maximum changes to a more uniform distribution at the solar maximum. The reasons for the observed differences are discussed in terms of solar illumination conditions, enhanced electric fields controlled by the magnetosphere-solar wind interaction and propagation conditions for radio waves.

SM72B-0625 1330h POSTER

Simulation on the solar cycle variation of the radiation belts - Evaluation on time variation of radial diffusion -

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So far, we have performed the analysis to investigate solar cycle variations of the energetic electros in the radiation belts using the data set from the TIROS/NOAA satellites (1979-) and the EXOS-D satellite (1989-). It is confirmed that there exists the synchronized variation with the solar cycle in both the inner and outer radiation belts. It is also revealed that the spatial structure of the outer radiation belt changes during the solar cycle. As the result, there are phase differences in flux variation among the location of the outer belt.

In order to investigate the control parameters for the long-term variation of the radiation belts, we have developed numerical code on the radial diffusion expressed by the Fokker-Planck equation. The model can cover the dynamics of whole radiation belts, and includes loss processes due to both Coulomb collisions with thermal plasma and wave-particle interaction with plasmasheric hiss. To examine the effect of the variation of the particle transport efficiency, we fix parameters such as wave amplitude, outer boundary condition and plasmapause location, except for the radial diffusion coefficients that are parameterized by Kp index. The model reproduces not only the solar cycle variation but also the semi-annual and recurrent variations of the flux in the inner portion of the outer belt. The evolution of the slot region is also reproduced despite constant plasma wave amplitude. The model, however, cannot reproduce the long-term variation of the flux around outer portion of the outer belt. This result means that the variations of the other parameters on source and losses are important for long-term variation of the outer belt besides the variation of the transport efficiency. Especially, it is important to examine the effect of internal acceleration process on the long-term variation.

SM72B-0626 1330h POSTER

Dynamics of the Inner Magnetosphere Eestimated From Geosynchronous Observation

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We have examined the characteristics of magnetic field variations at geosynchronous orbit using magnetic field data from GOES satellites located at different geomagnetic latitudes and solar wind data from Wind and ACE satellites for the period from 1996 to 1999. We binned the data on the magnetic field data for every 5 degrees range of the dipole tilt angle, since the trend of magnetic field variations at geosynchronous orbit changes depending on the dipole tilt angle.

The results of our data analysis suggests that the magnetic field variations at geosynchronous orbit strongly depend on the variations of dynamic presure of solar wind and those of pressure corrected Dst index (Dst*). The dependence of solar wind electric field is not significant rather than the dependence of Dst*. And magnetic field variations at dayside has a weak dependence of dipole tilt angle on VDH coordinate system but those at nightside has a strong dependence. This difference corresponds to the origin and location of the current system in the inner magnetosphere. However, the Dst* dependences of magnetic field variations derived from two different magnetic latidudes suggest that these magnetic field variations can be explained by the existence of equivalent westward current beyond the geosynchronous orbit. This suggests that westward current grobally dominates in the inner magnetosphere during storm time.

SM72B-0627 1330h POSTER

Magnetopause erosion: A global view from MHD simulation

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In this paper we use a global magnetohydrodynamic simulation of the magnetosphere to examine the behavior of the magnetopause position when the interplanetary magnetic field suddenly changes from northward to southward. The inward motion of the magnetopause under the influence of a southward IMF is generally referred to as magnetopause "erosion." Physical models to explain erosion have been proposed, notably the "onion" peeling model, a model based on the effects of fringe fields from the Region 1 Birkeland currents and the nightside cross-tail current. The simulation shows behavior consistent with aspects of these models, but it also shows behavior that is most consistent with the major driver of erosion being the growth of the nightside cross-tail current. In particular, the simulation exhibits a marked delay between the arrival of the southward IMF at the magnetopause and the inward motion of the magnetopause. We attribute this delay to the delay in the growth of the nightside current system in response to the southward turning of the IMF.

SM72B-0628 1330h POSTER

Correlations between AKR with Auroral Dynamics and Dipole Tilt Angle

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The Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) spacecraft is well suited to make unique observations of the aurora and auroral kilometric radiation (AKR) during substorms. Simultaneous data from the Radio Plasma Imager (RPI) instrument and the Far Ultraviolet (FUV) instrument on the IMAGE satellite will be used to correlate features in the AKR spectrum with substorm onset and dipole tilt angle. The RPI observations used in this study are primarily from passive wave measurements. The AKR spectrum typically shows a single peak in intensity around 180 kHz, however, recent measurements by RPI show that a second peak at higher frequencies (near 300 kHz) in the emission spectrum can occur simultaneously with the primary peak AKR at lower frequency. This higher frequency portion of the AKR emission spectrum does not appear be a harmonic of the primary component. Surprisingly, from a year's worth of IMAGE/RPI data it is found that most of the double-peaked spectra of AKR are observed under positive dipole tilt angle conditions. FUV observations of the aurora are used during the times when IMAGE is at apogee and well situated in the AKR emission cone. At these locations FUV can observe the location and intensity of the aurora over the entire auroral oval. Specific substorms will be examined for onset timing and location and related to the occurrences of the single- and double-peaked AKR emissions in an effort to understand the source location of the emissions and the implications of the double-peaked emission in substorm dynamics.

SM72B-0629 1330h POSTER

Asymmetries produced in the mass loading of the magnetosphere during high dipole tilt and southward IMF

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High dipole tilt events present important opportunities to investigate acceleration processes associated with magnetospheric/ionospheric coupling. One such event occurred on January 8, 1998 where the dipole tilt was large and significant O^+ ions where observed downtail by Geotail. Multi-fluid simulations are used to examine this event, so that solar wind entry relative to ionospheric outflow can by distinctly identified. It is shown that the high dipole tilt leads to clear asymmetries in the solar wind entry occurring preferentially into the summer hemisphere and this preferential entry is seen through the inner and middle tail but not in the deep tail. The light ionospheric ions show a similar asymmetry with preferential mass loading of the summer hemisphere even into the deep tail. The story is very much more complicated for the heavy ions. While there may be preferential outflow from the summer hemisphere, they experience very much stronger dayside convection (due to their slower field-aligned velocity), and are then convected into the nightside winter hemisphere. This leads to strong O^+ loading of the winter hemisphere with O^+ becoming the dominant species in the nightside portion of the winter magnetotail.

SM72B-0630 1330h POSTER

The Influence of Dipole Tilt and Corotation in the Near-Earth Magnetotail

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The rotation of the Earth's tilted magnetic dipole produces a corotation electric field that dominates the electrodynamics of the inner magnetosphere. In particular, it is responsible for the eastward drift of cold plasma in the plasmasphere. However, the extent to which the stretched (but closed) magnetic field lines of the near-earth magnetotail are influenced by the corotation of their ionospheric footpoints is unclear. To what extent might there be decoupling of corotation on stretched magnetic field lines and what effect does dipole tilt have on this decoupling? In this paper we use conjugate ionospheric and magnetospheric measurements to investigate this question. We map SuperDARN measurements of ionospheric convection to the magnetosphere using Tsyganenko magnetic field models and compare with conjugate measurements of magnetospheric drift obtained from the Cluster spacecraft.

SM72C MCC: 105 Sunday 1330h

Magnetosphere-Ionosphere Coupling II *(joint with SA)*

Presiding: **J Sojka,** Utah State University**; B L Giles,** NASA Goddard Space Flight Center

SM72C-01 1330h

Comparison of Iridium Determined Field-Aligned Current Patterns With High-Resolution MHD Simulations

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The engineering magnetometers aboard the 70+ Iridium satellites arranged in six equally spaced polar orbital planes provide a unique database for determination of global field-aligned currents [Waters et al., 2001]. A previous study compared these field-aligned currents with MHD simulation results to quantitatively evaluate the MHD results in a global way [Korth et al., 2002]. The analysis of three events of prolonged steady interplanetary magnetic field orientation, stable to within 25 degrees of the average direction, revealed considerable differences between observed field-aligned current densities and the MHD simulations. The field-aligned current densities in the Lyon-Fedder MHD simulations were evaluated at an inner simulation boundary of 3 Re and mapped on dipole field lines to