input to the magnetosphere by this eddy-viscous coupling is theoretically estimated and compared with the data.

SM11B-0437 0930h POSTER

The Effects of Solar Wind Structure on Magnetosphere Parameters

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During the ISTP program we demonstrated that in order to understand the magnetospheric response to solar wind and interplanetary magnetic field changes we had to simulate the magnetosphere using actual spacecraft observations as input to our global MHD models [Frank et al., 1995]. In these studies, we assumed that plasmas and fields observed by the spacecraft monitoring the solar wind were homogeneous and that all of the variations seen at the monitor reached the Earth. Although this approach allowed us to obtain qualitative agreement between the simulations and observations made within the magnetosphere, it has often limited our ability to quantitatively assess the validity of the model. In this study we have tested the assumptions made on the solar wind properties and propagation by modeling a magnetic storm on May 24, 2000 using data from five solar wind monitors (ACE, Wind, Imp-8, Geotail and Interball-1). We compare quantitatively the results of the five simulations assuming that each spacecraft was the only solar wind monitor and discuss the topological changes in the magnetospheric configuration caused by the different solar wind inputs. We use these results to assess quantitatively the errors encountered using a single spacecraft and homogeneous solar wind.

SM11B-0438 0930h POSTER

Multi-Spacecraft Observations of Whistler Waves Close to the Magnetopause

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We study emissions of whistler waves observed on the magnetospheric side of the magnetopause. Electric and magnetic field observations from the four Cluster spacecraft are used to determine the wave vectors. The results show that the semi-continuous emissions actually are composed of several individual bursts. Some of the bursts can be seen by two or more satellites while other are just observed by one. The direction of propagation is consistent with waves being generated close to the magnetopause. The wavelength is about 35 km. We compare emission events with spacecraft separations of about hundred or about thousand kilometres to investigate the scalelengths of the wave generation region. The possible association of these waves with reconnection processes is also considered.

SM11B-0439 0930h POSTER

Localized Diamagnetism and Phase Transition in High-Temperature Space Plasma

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We present two- and three-dimensional strictly collisionless homogeneous full particle numerical simulations with periodic boundary conditions of the formation of localized diamagnetic structures in high temperature plasmas of the kind observed in the magnetosheath and the geomagnetic tail. Such plasmas are in general anisotropic. It is shown that such plasmas spontaneously evolve into a series of localized electron scale magnetic depressions with anticorrelation between the magnetic and plasma pressures while the correlation lengths in both cases are different. The magnetic depression reaches values of 80%. The effect is purely electronic with the ion remaining strictly inert. The depressions are practically two-dimensional having very long extension along the magnetic field lacking any effect of particle trapping by mirror forces. Closer investigation shows that the effect is due to the spontaneous formation of nearly circular electron drift (Hall) currents and is thus purely diamagnetic which is a typical microscopic effect. Such currents form when diamagnetic drift sets on in density fluctuations. Only a small percentage of electrons contributes to these currents. Moreover, the depressed flux tubes arrange in a quasi-crystalline array which is caused by the repulsing forces between neighbouring diamagnetic current rings. This resembles second order phase transitions in the Landau-Ginzburg model at very low temperatures which here is working at high plasma temperature.

SM11B-0440 0930h POSTER

Vlasov Simulations of Ion-Acoustic Instabilities in Non-Maxwellian Space Plasmas: Enhanced Anomalous Resistivity.

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Results of a one-dimensional electrostatic Vlasov simulation study of ion-acoustic waves in a collisionless plasma are presented. The waves are current-driven unstable. We model the plasma using Lorentzian distribution functions of electrons and ions for similar particle temperatures. Lorentzian (kappa) distributions are observed in planetary magnetospheres, astrophysical plasmas and the solar wind. Stability curves of the Lorentzian plasma for several values of the high energy tail parameter κ are calculated and compared with the Maxwellian stability curve. The threshold for wave growth at given absolute current density is reduced for a Lorentzian distribution and the region of resonance in velocity space is narrower. These two effects are responsible for increasing the anomalous resistivity in the Lorentzian plasma with respect to that in a Maxwellian plasma, which itself has been previously shown by us to be three orders of magnitude above some analytical estimates [Watt et al., Geophys Res. Lett, 29, 10.1029/2001GL013451, 2002]. Hence the form of the distribution function can be a significant factor in electron diffusion across the magnetic field in the reconnection site in the earth's magnetopause region and in similar space plasmas.

SM11B-0441 0930h POSTER

Bursty Mode Conversion in Inhomogeneous Plasmas

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The process of linear mode conversion of electrostatic Langmuir waves into transverse electromagnetic waves in the presence of density inhomogeneities in an unmagnetized plasma is investigated numerically. In inhomogeneous plasmas, Langmuir waves often tunnel into density wells near the mode conversion region and it is shown that these density wells can act as resonators for the mode conversion process. Specifically, changes in the size of the density cavity on scales of order the Langmuir wavelength can alter the mode conversion efficiency from zero to its maximum value (up to 100% in some instances). Thus, with density inhomogeneities evolving on MHD timescales, the production of radio emission by mode conversion of Langmuir waves should be a bursty process. The dependence of the degree of burstiness on the inhomogeneity scales is discussed, together with potential applications to mode conversion phenomena in magnetized space plasmas, including interplanetary and magnetospheric radio emissions and pulsations in auroral roar emissions.

SM11B-0442 0930h POSTER

Finite Larmor Radius Effects in Ponderomotive Force

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The Ponderomotive Force (PF) due to a high frequency electromagnetic wave in a magnetized plasma is derived using a hybrid model that involves both the fluid and the kinetic approaches. We obtain an analytical expression for the PF using the fluid model and the hot plasma dielectric tensor [1] elements where the contribution of finite Larmor radius (FLR) are appropriately incorporated into the model. The contribution of FLR effects due to the Lorentz part of the PF are studied in greater detail. The PF could play a dominant role in the selective charged particle acceleration (energization) in the magnetospere, and possibly in the heliosphere, and in particular, perpendicular heating of ions. In such space plasma environments, the effects of FLR could be significant. Finally, the analytical expression for PF obtained by the above procedure is compared with the results derived from the equation of motion of a single charged particle in a magnetic field in the presence of an arbitrarily propagating electromagnetic wave.

[1] J.R. Myra and D.A. D'Ippolito, Phys. Plasmas 7(2000)3600.

SM11C MCC: Hall D Monday 0930h

High-Latitude Ionosphere and Magnetosphere Posters *(joint with SA)*

Presiding: **D R Weimer,** Mission Research Corporation**; T Moretto,** NASA Goddard Space Flight Center

SM11C-0443 0930h POSTER

Temporal variation in the cross-polar-cap potential for periods of steady IMF as determined using SuperDARN.

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Observations of the cross-polar-cap potential and its variability are presented for several periods during the year of 2001. The periods were selected based upon having similar southward IMF values that were steady for extended periods. All of the periods had IMF Bz in the range of 2 nT to 10 nT, with values of By between +4 nT and 4nT. The ACE database was searched for all periods of greater than two-hours duration that met these criteria. Thirty-three such intervals were found for the year of 2001. High-latitude potential patterns were calculated from the SuperDARN data for each period and the cross-polar-cap potential was extracted from the patterns. Hence, a 160-hour database of cross-cap potentials with two-minute resolution was obtained. It was found that even when IMF conditions do not vary for long periods, the cross-cap potential shows substantial variability. The data were examined to determine the sources of the variability. In addition, correlation coefficients between the potential and various IMF and solar wind parameters are presented.

SM11C-0444 0930h POSTER

The response of ionospheric convection to solar wind pressure fronts under different IMF orientations

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It has recently been found that solar wind dynamic pressure changes dramatically affect the precipitation of magnetospheric particles into the high-latitude ionosphere. It has also been noted that the preexisting interplanetary magnetic field (IMF) orientation significantly affects the resulting changes in the size, location, and intensity of the auroral oval. The question then arises of how ionospheric convection is affected by solar wind pressure changes. We examine a number of solar wind pressure fronts impacting the magnetosphere under various IMF orientations and their effects on ionospheric convection as measured by up to four DMSP spacecraft. We show that for all studied IMF orientations the arrival of the pressure front causes an increase in ionospheric velocities within the polar-cap and auroral ionosphere, and consequently a rise in the cross-polar-cap potential drop. Our results indicate that the most dramatic enhancement of ionospheric convection occurs under steady southward IMF. The convection speeds in one example jumped by a factor of three, both in the polar cap and in the auroral oval. When the IMF is nearly zero before the pressure pulse we observe an increase of ionospheric convection by up to a factor of two. These results provide information on the processes involved in the closing of the polar cap that has been observed to occur under the above IMF conditions, following enhancements of solar wind pressure.

SM11C-0445 0930h POSTER

Imaging the polar cap red-line shelf

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Sensitive all-sky imager (ASI) data from Rankin Inlet (PACE 73 N) can detect relatively weak red-line (630.0nm) emissions. These emissions are typically absent above a poleward boundary, rising to several hundred Rayleighs at lower latitudes.

This "shelf" has been previously observed in meridian scanning photometer data. Blanchard et al. [JGR 1995] found that it corresponded to a boundary in the soft electron precipitation, at least in the evening sector. Others (e.g. Wanliss et al. [JGR 2000]) have consequently used the red-line shelf, as detected by MSPs, as a proxy for the polar cap boundary.

However, ASI data clearly show that the red-line boundary is often dynamic and may be inclined with respect to L-shells. This talk will provide examples of ASI data, compared with coincident MSP observations and satellite overflights, in order to address the problem of identifing the polar cap boundary from ground-based optical data.

SM11C-0446 0930h POSTER

Systematic study of the large-scale field-aligned current structures from large database

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Fast and automatic procedure is required in space weather research based on large database obtained satellite observations. Model used in the procedure should be descriptive and flexible enough to identify a phenomenon that is highly variable depending on various conditions. We applied first-order B-spline fitting with variable node positions to the DMSP-F12, 13, 14, and 15 magnetic field data, and identified large-scale field-aligned currents (LSFACs) for each orbit. To the list of LSFACs, we added solar zenith angles at the ionospheric altitude and solar wind conditions observed by IMP-8 satellite.

SM11C-0447 0930h POSTER

Improved Modeling Techniques and Applications for Ionospheric Electric Fields and Currents

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Improvements are being made in the spherical harmonic models of the high-latitude ionospheric electric potentials and field-aligned currents (FAC) as a function of the solar wind and interplanetary magnetic field (IMF). Techniques have been developed for increasing the spatial resolution of the models, which more accurately reproduce the larger gradients at the reversal boundaries. Another improvement introduces a non-linear IMF response function, which more accurately simulates the saturation effects at large IMF magnitudes. New applications for the models have also been developed, such as a technique for forecasting the ionospheric electrojet (Hall) currents, and the associated magnetic perturbations on the ground. To accomplish this, the Euler potential function that is used to map the FAC is used to derive an approximation for the equivalent current in the ionosphere. From this equivalent Hall current, the magnetic perturbations on the ground are obtained. The ionospheric conductivity variations that occur as a function of both the IMF direction and dipole tilt angle (season) are implicitly contained within this FAC model, thus bypassing the need for a separate model of the conductivity. Comparisons with ground-based magnetometer illustrate the effectiveness of this technique. The FAC model can also be combined with the electric potential model to produce maps of ionospheric Joule heating as a function of the IMF.

SM11C-0448 0930h POSTER

Statistical identification of solar wind origins of magnetic impulse events (MIEs)

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Magnetic impulse events (MIEs) are identified as large-amplitude, impulsive-type magnetic disturbances with durations of 5-15 min and amplitudes of 50-200 nT that occur predominantly at dayside high-latitudes. Because of theose solitary features, MIEs provide a good clue to understanding the transient response of the coupled magnetosphere-ionosphere system to solar wind disturbances. Traveling convection vortices (TCVs), which are transient ionospheric Hall current loops passing overhead of ground-based magnetometers, are the best interpretation of MIEs. In contrast to sudden commencements that are produced by abrupt increases in solar wind dynamic pressure, there is no consensus on the origins of MIEs among researchers.

In this work, we report an investigation of the statistical properties of the solar wind origins of MIEs. We have analyzed fluxgate magnetometer data over 7 years from January 1, 1995 to January 1, 2002 at South Pole Station in Antarctica. Wavelet analysis was used to detect a large number of distinct MIEs automatically with high confidence. Solar wind pressure pulses and directional discontinuities were also detected automatically for the same period using data from the Wind and ACE satellites. Satellite-to-ground timing were determined using normal vectors of the interplanetary discontinuities. The new fully-automated analysis with the longest observation interval (extending from solar minimum to maximum) makes it possible for the first time to find not only the contribution rates to MIEs of different types of solar wind origins but also the seasonal and even the solar cycle dependence of the production of MIEs. Conjugate properties of the TCVs related to these MIEs are also investigated by statistical analysis, combining data sets from both northern and southern magnetometer networks.

SM11C-0449 0930h POSTER

Statistics of Magnetic Impulsive Events

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A large number of transient phenomena are observed in the dayside magnetosheath, magnetosphere, and ionosphere, all of which are specific signatures of the mechanisms that drive the solar wind-magnetosphere interaction and/or the magnetosphere-ionosphere coupling. This makes all of them important objects of investigation and understanding. This study concerns high latitude magnetic impulsive events (MIE) as observed in the network of magnetometer stations in Greenland.

A database of MIE events have been created based on data for the years 1995 through 2001. Identification is done with a computerized algorithm as well as by visual inspection and the results from both approaches will be presented and discussed. A comprehensive set of distribution functions for the events will be presented, including their dependency on season, geomagnetic activity, and solar wind parameters. The results will be discussed in terms of their ability to distinguish between proposed generation mechanisms for the events.

SM11C-0450 0930h POSTER

Magnetospheric Compressions: A Comparison of Polar Observations With MHD Simulations

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When the solar wind dynamic pressure suddenly increase the magnetopause moves inward, the magnetic field increases over much of the magnetopshere (but decreases in a limited region near the noon midnight meridian) and ULF waves propagate through the system. We compare Polar observations during both increases and decreases of local magnetic field to compare with the changes predicted by the UCLA/NOAA Geospace Global Circulation Model (GGCM) for the solar wind conditions observed by Wind for each event. We find that at times the model and data agree. In some cases more waves are predicted than observed and at other times more waves are observed than predicted. Unlike steady state models such as the T89 and T96 this dynamic model can predict fluctuations in the solar wind over short time scales. Overall the MHD model will replicates the Polar magnetic field observations.

SM11C-0451 0930h POSTER

A Numerical Simulation of the Geomagnetic Sudden Impulse

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The geomagnetic sudden commencement (SC) is studied numerically based on a model of buffeting the magnetosphere by the solar wind pressure impulse. The SC has the preliminary impulse (PI) phase and the main impulse (MI) phase according to behavior of plasma convection in the magnetosphere and that in the ionosphere. The magnetospheric current line in the PI event consists of the enhanced Chapman-Ferraro current in the magnetopause, the radial current along the wavefront of the compressional signal launched by the impulse, and the field-aligned current via mode coupling due to plasma non-uniformity. The PI current system is strongly affected by the magnetosphere structure. J*E is negative along the Chapman-Ferraro current in the magnetopause, which means the current generator is located there. Whereas, J*E is positive in the wavefront region of the compressional signal, which means the electromagnetic force moves plasmas. The current in the wavefront region belongs to the inertia current associated with rapid variation due to sudden compression of the magnetosphere. We present a quantitative model of the PI model presented by Araki [1994] by using our numerical simulation. In the PI phase, the magnetospheric vortex is not invoked. The ionosphere does not affect the plasma behavior in the magnetosphere. In the transition from the PI phase to the MI phase, there appears the ionospheric FAC with the region 1 sense (reversed sense of the FAC in the PI phase). At the same time, the new sunward flow appears in the magnetosphere and produces flow shear. This flow shear invokes the FAC. The current generator is located in the inner magnetosphere. In the MI phase, the current is generated due to compression of the nightside magnetopause. The current generated there flows into the ionosphere as the FAC with the region 1 sense. This current is associated with the magnetospheric plasma convection in the closed field line. In this case, the plasma convection is not produced by magnetic reconnection in the magnetopause.

SM11C-0452 0930h POSTER

The Generation and Propagation of Pc 3–4 ULF Waves at High Latitudes

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We present the results from a study of 170 Pc 3–4 ULF waves observed with the IMAGE magnetometer array in northern Scandinavia ($L \geq 3.3$) from January and March, 1998. Amplitude, cross-phase and coherence profiles with latitude and longitude have been used to produce the ground velocity, m-number and coherence length of these waves. Polarization properties are also shown with profiles of the Stokes parameters with latitude and longitude. Interplanetary magnetic field and cone angle measurements from the WIND satellite have been compared with the ULF wave frequency to ascertain the relationship predicted by the upstream ion-cyclotron resonance mechanism. Ground profiles of amplitude with latitude show a high-latitude peak at around 75° CGM, the location of which has been compared with that of the cusp, measured by DMSP satellites and estimated from three empirical models. The possible influence of the plasmapause on ground ULF wave signals has also been investigated, by comparing the latitude profiles with the location of the plasmapause predicted by a further three empirical models. Data from the magnetometer at Davis in Antarctica have been compared with those from Longyearbyen in Svalbard, in an attempt to determine any conjugate point properties of these waves. Finally, the azimuthal spatial separation of the waves has been investigated using data from the MACCS magnetometer array in Arctic Canada ($L \geq 11.9$).

We compare these results with those proposed by various generation and propagation mechanisms, such as the Kelvin-Helmholtz instability, upstream ion-cyclotron resonance, field line resonance harmonics, direct fast mode propagation, waveguide/cavity modes and electron precipitation.

SM11C-0453 0930h POSTER

Studies of ULF Power at Pc4 and Pc5 Frequencies at the Highest Geomagnetic Latitudes

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Two Automatic Geomagnetic Observatory stations, AGOs P5 and P6, were purposely established on opposite sides of the nominal geomagnetic dipole on the Antarctic polar cap in order to compare magnetospheric phenomena during local day and local night conditions over relatively small spatial scales deep in the geomagnetic polar regions. While simultaneous data from all AGOs are often not available due to power problems at the sites, sufficient data from some time intervals exist to make comparisons as a function of local time during these intervals. Ten-minute power spectra of geomagnetic field Z-Component data have been calculated for the three AGOs P1 (80.14°S; 16.75°E CGM), P5 (86.73°S, 29.39°E CGM), and P6 (84.92°S, 215.32°E CGM). The time series of the spectral power values at .01 Hz (100s period) and .005 Hz (200s period) are compared at each of the stations for 15-day intervals during austral spring in 1998 and 1999. A 24-hour variation appears in each of the four power level time series at each station. This frequency, as well as some harmonics, is also found in spectra of the time series of the power levels. There is a tendency for the 24-hour variations to be out of phase on opposite sides of the nominal geomagnetic pole: that is, P1 and P5 tend to be in phase with each other, but out of phase with P6. However there are instances when the phase relationships break down, indicating a more complex geomagnetic situation in the deepest polar cap. These and other findings will be discussed.

SM11C-0454 0930h POSTER

Investigation of the Initial Stages of Ion Heating in the Topside Ionosphere

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Simultaneous observations of ion distribution functions and plasma waves in the topside ionosphere during an auroral substorm near local midnight are presented. A low-energy (0 – 20 eV) ion spectrograph was flown on a sounding rocket and observed over 100 small-scale heating structures with cross-field widths on the order of 50 m. However, the ambient ion temperature remained a few tenths of an eV throughout the flight. Several well-known mechanisms of ion heating in this region are investigated. For example, electromagnetic fields in resonance with ions at their cyclotron frequency have been shown to be capable of energizing ions to tens of eV in seconds (Chang et al., GRL 13,636,1986; Knudsen et al., JGR 103,4171,1998; André et al., JGR 103,4199,1998). On this flight both electric wave power at the local O+ cyclotron frequency and electron fluxes exceeded established thresholds for the onset of ion energization. However, the large plasma density ($> 2 \times 10^4 \mathrm{cm}^{-3}$) may play a role in the observed lack of ion heating. The implications of these observations for theories of ion energization will be discussed.

SM11C-0455 0930h POSTER

Optical Observation of Oxygen Ion Upflow in the Cusp/Cleft Region

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We built the Extreme ultraviolet scanner (XUV) for imaging oxygen ions to outflow from the polar ionosphere into the magnetosphere. The XUV onboard a sounding rocket SS-520-2 imaged the oxygen ions above 1000 km altitude near the polar cusp on December 4, 2000.

The XUV is a normal incidence telescope that has a peak sensitivity at the wavelength 83.4 nm of OII emission and consists of a Mo coated mirror, a band pass filter and a channel electron multiplier. The band pass filter selectively transmits OII emission and eliminates background emissions such as HeI emission at the 30.4 nm, HeII emission at the 58.4 nm, and HI emission at the 121.6 nm. The observed OII emission intensity is proportional to the ion density integrated along the line of sight. Therefore the observed OII emission intensity distribution makes possible to determine the oxygen ion distribution.

After 0928UT, the sudden increase in the OII emission intensity was observed from the cusp region identified by the radar observation. In this presentation, we will discuss the cause of the sudden increase in the OII emission intensity in comparison with the result of ground-based observations.

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High Latitude Ion Up-Fluxes: A Statistical Study Using Incoherent Scatter Radar Data

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The transport of heavy ions from the ionosphere to the magnetosphere has been recognized as an important issue in magnetosphere-ionosphere coupling. Two consecutive mechanisms must operate for the transport to occur. First, a high altitude, high latitude reservoir must be filled by bulk upwelling of ionospheric ions. Then the ions must be further energized by filamentary processes (such as wave-particle interaction), originating in the magnetosphere, to create the ion beams and conics seen by satellites.

This study identifies and characterizes the source regions for the reservoir by comparing locations and conditions for which there is ion upwelling to locations and conditions for which no upwelling occurs. Data from three incoherent scatter radar facilities (EISCAT's Tromso and Svalbard and SRI's Sondrestrom) were used, as they are located in the geographic region whose magnetic field lines connect to the magnetospheric tail.