prevent a tight coupling of the ion and neutral motions. The tendency for high-latitude winds to move in the direction of ion motion tends to reduce the effective conductance of the ionosphere as felt by the magnetosphere, with consequences for magnetosphere-ionosphere coupling. The inertia of the air can cause delayed "flywheel" effects, which can potentially help maintain magnetospheric convection after a sudden reduction in the strength of solar-wind/magnetosphere coupling. At low latitudes, the ionospheric electric fields associated with magnetospheric disturbances can have complex temporal behavior. The electric field that penetrates to the equator directly from the polar cap tends to enhance the regular quiet-day equatorial east-west electric field. In contrast, the equatorial east-west electric field produced by the "shielding" region-2 currents tends to act oppositely to the directly penetrating field, but with a time delay of tens of minutes. Disturbance thermospheric winds have an ionospheric dynamo effect that also tends to act oppositely to the directly penetrating field, but with a time delay of a few hours. The combined effects can lead to electric-field disturbances of either sign, including long-lasting "overshielding" disturbances that can reduce or even reverse the normal quiet-day equatorial east-west electric field.

SM71B-08 1055h INVITED

Cluster / Ground-Based Correlative Observations in the Polar Cusp and the Nightside Magnetotail-Auroral Regions

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ESA's multisatellite mission Cluster is now in its second operational year and has visited some of the key regions of the magnetosphere with different inter-spacecraft separations. This mission concept allowed detailed studies of different scale sizes in the micro-physical plasma-processes which occur at the various boundaries in space (both on the day side magnetopause and Cusp, and in the nightside tail).

Most of the effective plasma processes in these magnetospheric regions have consequences for the magnetospheric and ionospheric plasma populations, convection flows and three-dimensional current systems on meso- and global scales, which cannot directly be monitored by the Cluster multi-spacecraft mission. In order to understand the causal relationships between microphysical processes and the meso-scale and global planetary reactions, combined observations from spacecraft and distributed ground-based networks are absolutely essential.

We will present the recent progress which has been made using such combined observation techniques. We intend to concentrate on a few key regions where such coordinated observations are most effective. These are the dayside interior and exterior Cusp, the nightside tail from the Cluster location at 19 Re and inwards, and the interior auroral field lines on the dawn, dusk and nightside portion of the auroral oval.

SM71B-09 1115h

Ion outflow in a dynamic coordinate frame.

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The ionosphere contributes a significant and variable flux of ions to the magnetosphere, primarily of low energy ions. The transport and energization of these ions play a important and poorly understood role in dynamic processes such as substorms. Progress in understanding the role of ionospheric ions requires incorporating realistic models of ion outflow into global magnetospheric models. Prior reports of ion outflow have used the static geomagnetic coordinate system. In this presentation the ion outflow observed during 1997 (solar minimum) from the FAST satellite is analyzed with the respect to the auroral oval, removing the effects of auroral motion in response to geomagnetic activity. The location of auroral oval is identified from both electron and ion measurements. Within the auroral oval, the ion outflow is then statistical analyzed with respect to the ion characteristics (i.e. beams and conics) and global parameters such as altitude and magnetic activity. In the dynamic boundary oriented coordinate system, we find that ion beams near midnight are found uniformly distributed across the auroral oval. Ion conics at midnight, however, are observed primarily near the poleward boundary of the auroral oval. We will report on these and other features observed in our initial assessment of this new and unique data set.

SM71B-10 1130h

Connections Between SEP Effects on the Atmosphere and Terrestrial Ion Outflows

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Significant increases of solar energetic particles (SEP) impinging on the Earths atmosphere produce enhanced HOx (H, OH, HO2) and NOx (N, NO, NO2) constituents in the middle atmosphere at polar latitudes of both hemispheres [c.f., Jackman et al., GRL, 2883, 2001]. In addition, energy is deposited into the neutral gas that may elevate temperatures. Either density increases or scale height increases will increase the supply of heavy neutral atoms at higher altitudes. Because charge exchange interactions within the ionosphere maintain the O+/H+ ratio in roughly the same proportions as the neutral O/H particle ratio, an increased scale height of light and heavy atmospheric neutrals should then influence the potential supply of light and heavy ions at the topside ionosphere. Lighter ions experience additional evaporative escape along open field lines so that scale height changes lead to changes in the outward flux preferentially for the heavier, more gravitationally bound species. These changes, which take place well in advance of interplanetary shock impacts on the magnetosphere and the dynamics associated with those interactions, offer the opportunity to investigate possible connections between short time scale solar influences on the atmosphere and the magnetosphere storm dynamics that follow on longer time scales. We examine12 SEP events known to induce enhanced atmospheric neutrals and map the temporal evolution of terrestrial ion outflow to the magnetosphere. Particle trajectory tracings show that changing ion outflow rates due to strong SEP are important contributors to plasma sheet and ring current populations during dynamic conditions.

SM71B-11 1145h

Neutral Effects on Magnetosphere-Ionosphere Coupling

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We take a three-fluid approach to describing the dynamic processes of magnetosphere-ionosphere-thermosphere coupling. The three species are electrons, ions, and neutrals. Electromagnetic interactions between the charged species and collisions among the three species are included to derive the three-fluid generalized Ohm's law, the plasma momentum equation, and the neutral momentum equation. The three-fluid generalized Ohm's law describes the time dependence of the current and electron motion, while the plasma (neutral) momentum equation describes the time dependence of the ion (neutral) motion. This formalism adds the neutral momentum equation to the conventional magnetosphere-ionosphere coupling. We derive the general dispersion relation for this three-fluid system and show that at frequencies much below the ion gyrofrequency the phase speed decreases continuously from the Alfven speed as collision frequencies increase at lower altitudes because of neutral-inertia loading . Heavy damping occurs for frequencies higher than 1 Hertz. The magnetosphere-ionosphere coupling is better described as a neutral drag process rather than as resistive Ohmic dissipation.

SM72A MCC: Hall D Sunday 1330h

Magnetotail, Plasma Sheet, and Boundary Layers I Posters

Presiding: **E Zesta,** University of California, Los Angeles**; M Fillingim,** University of California, Berkeley

SM72A-0591 1330h POSTER

Field-aligned currents in the outermost plasma sheet boundary layer with Geotail observation

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We have studied the outermost field-aligned currents (FACs) in the plasma sheet boundary layer (PSBL) with the Geotail observations.

The trajectory and plasma data of Geotail enable us to conduct a more comprehensive and systematic survey than former work based on the ISEE 1 and 2 data.

We identified the FACs with the variation of the dawn-dusk magnetic field component and calculated their intensities on the assumption of the sheet geometry.

A case study indicated that the FACs flow earthward on the earthward side of the reconnection site while the FACs are directed tailward on the tailward side.

This tendency was confirmed statistically for PSBL crossings by Geotail inside $X_{\mathrm{GSM}} = -40\,R_E$.

This FAC distribution can be reasonably interpreted in terms of the Hall current system generated by the magnetic reconnection process.

The statistical study also showed a dawn-dusk asymmetry of the polarity of the outermost FACs on the earthward side of the reconnection site.

That is, while the FACs flow mainly earthward, tailward-flowing FACs frequently appear in the dusk sector.

In the tailward side of the reconnection site, however, we did not find such a dawn-dusk dependence about the polarity of the outermost FACs.

SM72A-0592 1330h POSTER

Comparison of Global MHD Simulations of the Lobe Magnetic Field with Spacecraft Data

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The magnetic field in the magnetotail simulated by the LFM global MHD code is compared with a long time series of lobe field data from observations by Geotail and Interball spacecraft. Earlier comparisons of code results with satellite data have been mainly case studies. The comparison of the data from the code with satellite data on large datasets are used to study in more detail the ability of the code to model magnetospheric dynamics. In a study using large database, several intervals of Bargatze et al [1985] data set were simulated using the global MHD code and the AL index computed from the simulation data compared with the actual data. However, ionospheric indices are not very well defined in the code and the magnetic field in the tail under different solar wind conditions is better suited for detailed study. An important issue is the question of how well the code reproduces the directly driven and and loading-unloading components. The

latter consists of non-linear or even stochastic parts of the magnetospheric dynamics and play a crucial role in the predictability of the magnetosphere. Previous studies of AL index suggest that the directly driven component is reproduced very well while the loading-unloading effects are not reproduced to the same degree. The comparison of the lobe field from the simulation with data shows agreement with this suggestion. For example, the changes in the lobe field in response to variations in the solar wind dynamic pressure are reproduced well. On the other hand, the agreement is not as good during periods with nearly steady solar wind.

SM72A-0593 1330h POSTER

Search for Long-Period Traveling or Standing Waves in the Magnetosphere Using the BATS-R-US MHD Model

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We have begun a search for long-period waves in the magnetosphere using output from the BATS-R-US MHD model. The search methodology involves a visual study of animations created from model output files taken every 20 seconds. The animations are run at 15 frames per second, fast enough to allow waves to be readily visible. To trigger the waves, our intial investigations use as model input an idealized southward turning of Bz from +5 nT to -5 nT over a 10 minute period followed by a later northward turning of the same magnitude. The preliminary search has focused on the magnetotail. Waves appear to be common in the tail. For example, traveling waves are generated by the disruption of high-latitude merging and transition to lower latitude merging following the southward turning. These waves move tailward throughout the lobes. Waves can also be seen associated with the creation of plasmoids. These waves spread around and ahead of the plasmoid. Animations of these traveling waves will be presented.

SM72A-0594 1330h POSTER

Aspects of an Extended-Tail Theorem Supported by two Zero-IMF Computer Simulation Studies

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Two relatively recent zero-IMF MHD computer simulation studies have confirmed that in the absence of an IMF the magnetosphere would still have a very long tail (over 100 RE according to Kageyama et al, JGR, p 3922, 1992, and over 300 RE according to Sonnerup et al, JGR, p 29,419, 2001). These studies strongly imply that flux transfer back into the tail is accomplished by field-line rotation back along the equatorial flanks rather than up over the polar cap as assumed in the Dungey 'reconnection' hypothesis. Finally, it is suggested that during this transfer of flux back into the tail during the pre-substorm buildup, field lines cross regions of normally field-free space where the consequent rapid rise in field strength will Betatron-accelerate solar-wind plasma there to plasma-sheet and auroral energies (cf. Kageyama et al, their Plate 1 and Figure 6- this energy input occurred at t = 1.52 hours, well before the beginning of the sub-storm 'main-phase' plasmoid event at 2.03 hours).

SM72A-0595 1330h POSTER

Energy Flow in the Geomagnetic Tail

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MHD closure of the moment equations neglects the divergence of the off-diagonal elements of the stress tensor, **Π**, as well as the divergence of heat flux **∇q**. In the center of the plasma sheet the local ion gyroradius becomes large, and **q** and **Π** become important components of the current sheet energy and momentum balance. Previous work[1] showed that the heat flux, **q**, plays in important role in substorm dynamics by allowing the non-adiabatic cooling of the magnetotail. The present work will discuss results from large-scale particle simulations with enough particles to resolve the heat flux term in three dimensions.

[1] Doxas, I., W. Horton and R. Weigel, Using Particle Simulations for Parameter Tuning of Dynamical Models of the Magnetotail, *JASTP 64*, 633 (2002).

SM72A-0596 1330h POSTER

Force-balanced Magnetospheric Structure with Thin Current Sheets

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For many magnetospheric physics applications, force balance between the magnetic field and plasma pressure forces is essential. This study presents 3-D solutions for the magnetospheric structure in force balance with observed pressure distributions. The calculation is extended compared to previous work to include the high-latitude (open-field) magnetospheric region. We use several pressure distributions: either taken directly from observations (GEOTAIL pressure data in the plasma sheet and DMSP ionospheric pressure) or empirical (Spence-Kivelson formula on the Sun-Earth axis at midnight local time). The 3-D solutions are obtained by expressing the magnetic field in terms of Euler potentials and numerically solving the force-balance equation in a flux coordinate system. As computational boundary conditions we use magnetic flux surfaces obtained from the T96 empirical model. The numerical results are rich in physical content, and contain the cross-tail and Birkeland currents. By varying the boundary conditions and the pressure distributions, we investigate the change in magnetospheric structure under different external (IMF) conditions. In particular, we discuss the appearance of thin sheets of intense cross-tail current close to Earth ($|X| < 10\, R_E$) during active times.

SM72A-0597 1330h POSTER

Simultaneous Observation of Chorus Waves Going Back and Forth in the Magnetosphere by the CLUSTER Satellites

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This paper is related to the propagation characteristics of a chorus emission recorded simultaneously by the 4 satellites of the CLUSTER mission on October 29, 2001 between 0100 and 0500 UT. During this day, the spacecraft (SC) 1, 2, and 4 are relatively close to each other but SC3 has been delayed by half an hour. We use the data recorded aboard CLUSTER by the STAFF spectrum analyser. This instrument provides the cross spectral matrix of three magnetic and two electric field components. This spectral matrix is processed by a dedicated software in order to determine the wave normal directions relatively to the Earth's magnetic field. This calculation is done for the 4 satellites at different times and different frequencies and allows us to check the directions of these waves. It is shown that the parallel component of the Poynting vector changes its direction when the satellites cross the magnetic equator which indicates that the chorus waves propagate away from the equator. This is valid for the most intense waves observed on the magnetic and electric power spectrograms. But it is also observed on SC1, SC2, and SC4 that lower intensity waves propagate toward the equator simultaneously with the SC3 intense chorus waves propagating away from the equator. Both waves are at the same frequency. Using the wave normal directions of these waves, a ray tracing study shows that the waves observed by SC1, SC2, and SC4 are the same waves which are observed by SC3. Their origin in the equatorial plane is similar. SC3 which is 30 minutes late observes the waves which originate first from the equator, meanwhile SC1, SC2, and SC4 observe the same waves which have suffered a Lower Hybrid Resonance (LHR) reflection at low altitudes and now return to the equator at a different location with a lower intensity. Similar phenomenon is observed when the SCs are on the other side of the perigee. The intensity ratio between magnetic waves coming directly from the equator and waves returning to the equator is between 0.005 and 0.01 which is in agreement with previously published theoretical calculation of the growth rates with the particle distribution seen by GEOS.

SM72A-0598 1330h POSTER

Low Frequency Electromagnetic Fluctuations in the Plasmasheet, Effects on the Ion Distributions and the Plasma Dynamics.

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Using CLUSTER, we investigate different types of electromagnetic fluctuations detected in the plasmasheet in frequency domain ranging from a few millihertz to a few hertz. We compare these observations with results of a theoretical investigation of the electromagnetic propagation in a model current sheet. We show that some of the fluctuations can be interpreted as convected quasi-static 3D deformations of the plasmasheet. We also investigate the possible role of the observed fluctuations in ion heating (oxygen) and their relationship with fast ion flows. One of our goal is to analyse the role of the resonance absorption mechanism in the energization of the plasmasheet.

URL: http://www.cesr.fr

SM72A-0599 1330h POSTER

Cluster Observations of Ion Shell Distributions in the Plasma Sheet on 31 March 2001

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On 31 March 2001 from 0800–1030 UT the Cluster spacecraft traversed the northern plasma sheet at 2200 local time during a time of violent magnetospheric activity (DST = -350 nT). At a distance of 4–5 R_E, the local magnetic field perturbations were as high as 100 nT. Measurements by the Cluster Ion Spectrograph (CIS) experiment revealed intense, energetic (∼15 keV) ion distributions, which exhibited a shell structure in velocity space. Although distributions of this form have been reported before, the capabilities of CIS, and the multi-point observations, allow us to significantly improve the characterization of these ions. The CODIF instrument measured 3-D distributions for H^+, He^{++}, He^+ and O^+, and showed that during this interval oxygen was dominant. For the first time, 8 s integrations permitted the observation of an apparent evolution of the velocity-space shells; bursts of Earthward-streaming O^+ beams were seen to spread in pitch-angle and isotropize over intervals < 1 minute. In addition to the energetic shells, the O^+ had a very cold core, which was seen to stream tailward at low speeds. Both H^+ and O^+ at times had as many as three distinct velocity shells. Initial examination of the distributions indicates that the evolution of the shells can be inconsistent with simple adiabatic unfolding in combination with mirroring below the spacecraft; we will consider the role of the observed strong wave power in their production. Towards the end of this plasma sheet crossing, the boundary passed spacecrafts 1, 3 and 4, separated in z by 1000 km, within a span of about 50 s. Each spacecraft recorded nearly-identical non-gyrotropic distributions that appeared to rotate by more than 110° in gyrophase. These gyrophase-restricted distributions probably indicate remote-sensing of the plasma sheet; we will apply multi-point analyses methods to validate this.

SM72A-0600 1330h POSTER

CLUSTER - RAPID measurements of high energy electron gradients in the Earth's magnetotail

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During the months of June through to November, 2001, the apogee of the CLUSTER spacecraft passed through the Earth's magnetotail, at a distance of around 20 R_E, with an average spacecraft separation of about 1200 km. Using the IES (Imaging Electron Spectrometer) from the RAPID (Research with Adaptive Particle Imaging Detectors) instruments, we present measurements of the energetic electron plasma distribution in the the vicinity of the neutral sheet. Electrons in the RAPID energy range (20-200 keV) are a possible source population for relativistic electrons in the inner magnetosphere, which commonly increase during the recovery phase of magnetic storms. Using magnetic field measurements from the FGM (Flux Gate Magnetometer) instrument we order the electron data in phase space density (PSD) and determine the "instantaneous" PSD gradient in the neutral sheet for each crossing. By combining these CLUSTER gradient observations in the mid-tail region, with LANL geosynchronous (GEO) relativistic electron observations, we wish to test whether there are sufficient PSD gradients between GEO and CLUSTER to explain the observed inner magnetospheric electron dynamics in terms of radial transport alone, or whether one needs to invoke other more localized acceleration processes.

SM72A-0601 1330h POSTER

Electric Field Measurements at the Boundary of the Near-Earth Plasma Sheet as Measured by the Electron Drift Instrument (EDI) and the Electric Field and Waves Instrument (EFW) on the CLUSTER Spacecraft

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The boundary of the night-time plasma sheet connects both to the reconnection regions in the magnetotail and to the poleward auroral region near earth. In active times, fields and particle populations in this boundary near earth often show rapid transport of energy toward the ionosphere. On CLUSTER, three dimensional electric fields, including the component parallel to B, can be measured by combining the information from the double-probe (EFW, measuring potential differences in the spin plane) , and those of the Electron Drift Instrument (EDI, measuring the perpendicular drift velocity of electrons). We will show combined data from the night-time plasma sheet where large electric fields are sometimes observed near the boundaries and particle populations make rapid changes. These fields show a complex spatial and temporal structure that appears to be neither constant in time nor space. At times, the Alfven waves observed on this boundary indicate that a dense (order 1/cc) layer of ions, predominantly oxygen, lies outside the plasma sheet in the otherwise rarified lobe plasma. As these ions are not seen by the composition analyzer on CLUSTER, CODIF, they are apparently very cold.

SM72A-0602 1330h POSTER

Investigations of Plasma Flow Spatial Scales Using the Cluster Electron Drift Instrument

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The character of the flow of plasma within the Earth's magnetosphere is of fundamental importance to the distribution and flow of energy within this system. Two dimensional fluid turbulence theory predicts that energy applied at a given scale length will cascade to larger scales whereas enstrophy will cascade to smaller scales. The uncertainty in equating two dimensional fluid theory to space plasmas arises from the limited analysis that can be performed with single spacecraft measurements. However, with multi-spacecraft measurements such as Cluster, we are able to expand our understanding of plasma flow as a directly measurable function of separation between payloads. The Electron Drift Instrument on board each Cluster satellite directly measures electron drift utilizing a test particle population. From this measurement the plasma flow velocity vector perpendicular to the ambient magnetic field is derived. To further the understanding as to the importance of flow turbulence within the magnetosphere, this study analyzes the structure within plasma flows measured in high latitude crossings. The velocities are correlated as a function of position using multi baseline payload separations and time to determine flow correlations at various scale lengths. This analysis is used to compare with two dimensional fluid turbulence theory as well as for deriving an insight into the scale lengths of flow structures within the magnetosphere. Results suggest energy deposition in a scale range of 5 - 15 km with an approximate -5/3 power law energy cascade to larger scales.

SM72A-0603 1330h POSTER

Cluster Observations In the Magnetotail During Sudden and Quasi-periodic Changes In the Solar Wind Dynamic Pressure

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A clear bipolar (dawnward/duskward) signature in the Ey component was observed by the Cluster satellite in the magnetotail during a sudden impulse (si) on October 11,2001 (day 284). During the interval of the dawnward perturbation in Ey, the magnetic field strength in By and Bz started to increase. The Bx component was strongly enhanced during the duskward Ey perturbation. That is, the field change in By and Bz was earlier than that in Bx. We discuss possible mechanism for the E and B field variations observed at the time of the si event. We also observed quasi-periodic spacecraft potential (SP) variations following the si event in the magnetotail lobe and plasma mantle. The SP variations have good correlation with the magnetic field perturbations. We show that the perturbations at Cluster are caused by quasi-periodic solar wind lateral pressures squeezing the magnetotail axisymmetrically while moving tailward as suggested by previous studies.

SM72A-0604 1330h POSTER

The Nature of Fluctuations Observed by Cluster in the Plasma Sheet

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Cluster fluxgate magnetometer (FGM) data are employed to construct probability distribution functions from magnetic field differences. This simple laboratory plasma technique is used to look for plasma turbulence. We examined the distribution of the magnetic field differences between pairs of highly correlated Cluster times series magnetometer data in both the plasma sheet and lobe regions. The unique Cluster spacecraft configuration allows for the examination of up to 6 spacecraft pairs for small scale sizes relative to the turbulent eddy scales during Cluster's passages through the magnetotail region in the summer of 2001. The determined distribution functions in the plasma sheet clearly do not resemble the expected normal distribution, but is well fit by a Poisson distribution or a log-normal distribution. The lobe probability distribution functions of the magnetic field times series difference, however, more closely resemble a normal distribution of the random magnetic fluctuations. These results suggest that magnetic field line turbulence is occurring within the plasma sheet resulting in turbulent

energy dissipation, which is potentially due to plasma velocity shears [Borovsky et al., 1997].

URL: http://www.igpp.ucla.edu/jweygand

SM72A-0605 1330h POSTER

Compressional Waves in the Current Sheet: A Cluster Study

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It has been shown that compressional waves are responsible for the main wave power in the Earth's current sheet. Case and statistical studies based on single spacecraft observations have been presented, e.g. Bauer et al. [*JGR 100*, 9605, 1995; *JGR 100*, 23737, 1995].

In this new aera, since Cluster was launched in 2000, we have obtained a large set of current sheet crossings with simultaneous magnetic field measurements by the four spacecraft. Our study focusses on the data when Cluster had its apogee in the magnetotail at $19R_E$, and the spacecraft were in a almost perfect tetrahedron with an interspacing of approximately 2000 km (in 2001) and 4000 km (in 2002). Volwerk et al. [*Annales Geophys.*, in press, 2002] have shown case studies of wave power during various magnetospheric activity stages for the 2001 data.

In this study we use the full set of current sheet crossings and determine the general wave properties from the unique three dimensional point of view of Cluster. The different spacing of the spacecraft during the two magnetotail missions give a unique view of the processes in this active region of the magnetosphere.

SM72A-0606 1330h POSTER

The Source of Low Energy O+ in the Inner Magnetosphere

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Using more than a year of CLUSTER Ion Composition (CIS) perigee data, we have compiled a statistical data set of the quiet-time energy spectra of 20 eV to 40 keV H+, O+ and He+ for L-shells of 4–6 Re. The resulting spectra as a function of local time show the expected minima which result from the competition between electric field and magnetic gradient and curvature drifts in this energy range. In addition, the flux of O+ for energies less than 1 keV peaks on the dawn side. This peak may indicate a spatial variation in the O+ in the plasma sheet that feeds this region. We test this hypothesis by determining the drift trajectories of these low energy ions from the plasma sheet to the inner magnetosphere, to determine the source location in the plasma sheet for a particular magnetic local time in the inner magnetosphere. We then use CLUSTER measurements of the plasma sheet at 20 Re to determine whether the O+ flux varies as we would expect. Preliminary results indicate that an O+ flux peak on the dusk side in the plasma sheet is the source for the dawnside O+ enhancement in the inner magnetosphere.

SM72A-0607 1330h POSTER

Temperature and Density of the Plasma Sheet From Remote Observations With 1-70 keV Energetic Neutral Atoms

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In a recent study, McComas et. al. (submitted to GRL 08/22/02) showed the first energetic neutral atom (ENA) observations of the extended plasma sheet, taken with the Medium Energy Neutral Atom (MENA) imager on the IMAGE spacecraft. These authors examined two magnetospheric storm intervals, from the period of September 21 through October 11 of 2000, and showed that plasma sheet loading began prior to the storms and continued under all IMF BZ orientations, reaching its maximum during the peaks of the storms. In this study, we further investigate the MENA observations from these storm intervals to create two-dimensional maps (GSM X-Y) of the ion temperature and density in the mid-tail plasma sheet. We then go on to show how these temperature and density distributions evolve over the magnetospheric storm intervals and interpret them in terms of plasma sheet filling, energization, and injection into the partial ring current.

SM72A-0608 1330h POSTER

Magnetic Moments and Temperatures in the Plasma Sheet

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Geotail data have been used to generate 3-D long term averaged models of many particle and field parameters. The region that can be studied is [(-30 $< x <$ -10), ($|y| < 15$), ($|z| < 7$)] R_E. Average ion and electron magnetic moments and temperatures are closely related so are being studied together. Observed long term averaged distributions of these parameters will be shown and discussed. These distributions provide information about particle energization, sources, and uses of an equation of state for plasma sheet studies.

SM72A-0609 1330h POSTER

Determination of the Quiet-Time Current Sheet Structure Using Geotail CPI Data and Nonlinear Dynamics Modeling

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Computer simulations of nonlinear charged particle dynamics in magnetotail-like magnetic field have pointed towards the existence of an ion distribution function signature that manifests itself as a series of peaks and valleys. The separation of the peaks has been shown to scale as the fourth root of the normalized particle energy, where the normalization in turn depends on parameters that describe the magnetic field structure, i.e. the current sheet half-thickness and the ratio of the magnetic field strength at the midplane to the asymptotic field strength. More recently, using Geotail CPI and magnetometer data, it has been shown that this signature may be used to determine the current sheet structure during quiet-times. In this paper we present the results of a parametric survey of the quiet-time (Kp≤1+) current sheet structure for X_{GSE} between -20 R_E and -50 R_E as determined from the ion distribution signature and magnetic field data. In particular, we1 present data from 43 time intervals randomly distributed near the center of the current sheet that have clearly identifiable distribution signatures and well defined current sheet crossings.

SM72A-0610 1330h POSTER

Escape Rate and Power-law Exponent for the Chaotic Scattering in a Current Sheet Magnetic Field

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We investigate the Hamiltonian system of charged particles in a modified Harris magnetic field model, relevant to plasma dynamics in current sheets such as the geomagnetic tail. This is a chaotic scattering system since the source plasma interacts for a finite time with the field structure. We will present numerical results for the escape rate, an exponential rate at which the particles escape from the scattering region. We show that the escape rate is well-defined only around the resonant energies and it increases as the resonant energy is increased. Away from the resonant energies, the number of particles remaining in the scattering region decreases as a power of time with a characteristic exponent. We will discuss the mechanisms behind both the exponential and the power-law decrease in the number of particles remaining in the scattering region.

SM72A-0611 1330h POSTER

Magnetospheric Radio Tomography Experiments using IMAGE, WIND, and Cluster

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To validate and demonstrate the potential of magnetospheric radio tomography, we have performed three separate experiments using the Radio Plasma Imager (RPI) on the IMAGE spacecraft as the signal source. The WAVES instrument on WIND and the WBD instruments on the four Cluster spacecraft were used as the wave receivers. These experiments were designed to measure the Faraday rotation of the transmitted wave electric field polarization due to propagation through a magnetized plasma. In the proper frequency range, Faraday rotation is proportional to the path-integrated product of the magnetospheric electron density and magnetic field, enabling large-scale measurements of these quantities on the propagation paths in each of these experiments. In August 2000, WAVES received a single frequency (828 kHz) RPI transmission. In October through December 2001, WAVES received two frequency (508 and 828 kHz) RPI transmissions. And in April 2002, WBD on Cluster received stepped frequency (between 100 and 500 kHz) RPI transmissions. Some of the RPI signals have been measured on propagation paths longer than 10 Re. By exploiting the time variation and frequency dependence of Faraday rotation, the integrated electron density/magnetic field product has been measured, with some limitations, in each of these experiments. We report on the novel large scale magnetospheric plasma and magnetic field measurements

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