and major differences are found. Finally, we show that plasma expansion, more likely than a slow mode front, is responsible for the plasma depletion layer.

SM21C-06 0945h

Observational search for magnetosheath merging

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Magnetosheath merging has been predicted using the Integrated Space Weather Model (ISM). Directional discontinuities are distorted as they are slowed inside the bow shock, but continue to propagate downstream in the unshocked solar wind. Merging is predicted to occur as the discontinuity is compressed and the current intensifies. Polar, with its apogee now near the equator, slowly traverses the magnetosheath in front of the nose. Several directional discontinuities have been observed outside of the magnetopause where accelerated particles and wave Poynting flux indicates the possibility of merging (on April 7, 2000, March 31, 2001, and March 12, 2001). For one case in particular where the IMF rotated from south to north and the observation was clearly away from the magnetopause, the ion acceleration and Poynting flux was particularly strong. We will test these observations for other commonly accepted signatures of merging.

SM21D MCC: 131 Tuesday 1020h

Magnetotail, Plasma Sheet, and Boundary Layers II

Presiding: **J M Weygand,** University of California, Los Angeles**; N E Turner,** University of Texas at El Paso

SM21D-01 1020h

Plasma Convection in the Cross-Section of the Magnetotail: Geotail Observation

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Plasma convection pattern in the cross-section of the magnetotail is derived for the first time from the archive plasma dataset of the Geotail spacecraft. In this statistics, the measured ion velocities are divided into two independent components, i.e., components parallel and perpendicular to the magnetic filed, respectively, and only the result for the perpendicular component is discussed. Since Geotail has an equatorial orbit, only the portion of the tail close to the plasma sheet has been covered by Geotail, but still the result provides sufficient information to identify some of the interesting characteristics of the plasma convection in the y-z plane. Some characteristics are consistent with the standard view of the convection in the magnetotail, but others are not readily compatible with the standard view. Important findings are as follows:

(1) The plasma convection is directed from the lobe toward the plasma sheet near the midnight meridian plane as is consistent with the standard view.

(2) Near the flanks of the magnetotail, however, the convection direction is reversed, that is, directed from the plasma sheet to the lobe. This means that two convection vortices are formed within the y-z plane for each hemisphere, and some of the plasmas convecting from high latitudes are deflected towards flanks before they reach the neutral sheet and finally return to the high-latitude portion of the tail along the flank magnetopause.

(3) The sense of rotation for these plasma vortices is not apparently correlated with the sign of the IMF z component. That is, the plasma convection always has a component directed toward the plasma sheet near the midnight meridian even in the case of northward IMF. This probably means that the conversion process of closed field lines to open field lines is occurring at the dayside magnetopause even during periods of northward IMF. The reverse convection expected for the northward IMF seems to be spatially limited to the higher latitude portion of the tail not covered by GEOTAIL observations.

(4) The effect of the y-component of the IMF is visible as an intensification of one of the two vortices, whose dawn-dusk asymmetry is controlled by IMF-By. The effect is smaller than expected, and barely visible at the distances of x=-15 to -25 Re.

SM21D-02 1035h

Cluster Observations of Traveling Compression Regions in the Near-Tail

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Observations of traveling compression regions in the tail lobes accompanied by north-then-south Bz signatures, i.e. NS TCRs, have long been used as indicators of the tailward movement of plasmoid-type flux ropes. South-then-north compression regions, i.e. SN TCRs, are expected to occur in association with the earthward motion of BBF-type flux ropes. However, their interpretation has been problematical because similar magnetic field signatures in single spacecraft observations are also known to be caused by short duration enhancements of the external solar wind pressure. Here we present the first three-dimensional analysis of SN TCRs in the Cluster measurements. The Cluster observations clearly show that these compression regions do, indeed, move earthward. Furthermore, they provide the first direct observations of the plasma sheet "bulge" generating the TCR, and they lend new insights into the nature of the lobe - plasma sheet interface during reconnection events. The implications of these new multi-spacecraft observations for nature of the changes in the configuration of the plasma sheet in response to magnetic reconnection will be discussed.

SM21D-03 1050h

CLUSTER Observation of the Dynamics of Ionospheric O+ and H+ Ions in the Mid-Tail

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Cluster ion measurements inside the tail lobes and inside the plasma sheet clearly indicate the ionosphere is supplying a large amount of ionospheric H+, O+ (He+, O++) ions to the magnetospheric mid-tail both during quiet and disturbed periods. Hydrogen ions and beams of oxygen ions are quasi systematically detected inside the lobe and inside the PSBL, flowing tailward with velocities of the order of 30-80 km/s. These ions are later energized deeper inside the plasma sheet. We analyze in detail the dynamics of this ionospheric magnetotail component, particularly during episodes of fast field aligned flow events of magnetospheric ions inside the PSBL: they drift perpendicular to the local B field either under the influence of diamagnetic pressure effects inside the flow itself or under the action of the electric field fluctuations associated with large alfvenic waves in the vicinity of the flow. Heating processes of oxygen ions inside the plasma sheet are briefly discussed.

SM21D-04 1105h

Characteristics of the Magnetotail Current Density from Cluster Observations

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We present observations of the inferred current density in the magnetotail current sheet from Cluster magnetometer measurements during summer 2001. In particular, the average directions and magnitudes of the current density have been examined for approximately 25 current sheet encounters between July and October 2001. Considerable variation is observed in the current density magnitudes. The current sheet encounters have been organized in local time and we find that the cross-tail current density is not strictly organized along Y_{GSM} across the entire magnetotail. Large deviations from Y_{GSM} are observed at the flanks of the magnetotail. The current sheet encounters have also been organized by solar wind conditions and geomagnetic activity indices. We find that the current sheet becomes more disordered during intervals of increased geomagnetic activity and often the Y-component of the current density is not the dominant component. We will use substorm onset times determined from ground magnetometer observations to gauge changes of the tail current sheet direction and magnitude during substorms. This behavior will be explored for individual current sheet events and also in a superposed epoch analysis.

SM21D-05 1120h

Filling and Emptying of the Plasma Sheet: Remote Observations With 1-70 keV Energetic Neutral Atoms

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This study shows 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. We show that ENA emissions can be routinely observed back to several tens of R_E deep in the magnetotail when IMAGE is in an appropriate orbital position. Enhanced emissions (high plasma sheet densities) are associated with high solar wind densities and with super dense plasma sheet observations at geosynchronous orbit. We examine two magnetospheric storm intervals where plasma sheet loading begins prior to the storms and continues under all IMF B_Z orientations, reaching its maximum during the peaks of the storms. Subsequently, ENA emissions are weak indicating that the plasma sheet is depleted for several days following these storms. This study indicates that routine ENA observations of the plasma sheet content could become an important part of space weather monitoring.

SM21D-06 1135h

Modeling the Inner Plasma Sheet Protons and Magnetic Field Under Enhanced Convection

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In order to understand the evolution of the protons and magnetic field in the inner plasma sheet from quiet to disturbed conditions, we incorporate a modified version of the Magnetospheric Specification Model with a modified version of the Tsyganenko 96 magnetic field model to simulate the protons and magnetic field under an increasing convection electric field with two-dimensional force balance maintained along the midnight meridian. The local-time dependent proton differential fluxes assigned to the model boundary are a mixture of hot plasma from the mantle and cooler plasma from the low latitude boundary layer. We previously used this model to simulate the inner plasma sheet under weak convection corresponding to a cross polar-cap potential drop ($\Delta\Phi_{PC}$) equal to 26 kV and obtained two-dimensional quiet time equilibrium for proton and magnetic field that agrees well with observations. We start our simulation for enhanced convection with this quiet time equilibrium and time independent boundary particle sources and increase $\Delta\Phi_{PC}$ steadily from 26 kV to 146 kV in 5 hours. Simulations are also run separately to steady states by keeping $\Delta\Phi_{PC}$ constant after it is increased to 98 and 146 kV. The magnitudes of proton pressure, number density, and temperature and their increase from quiet to moderate activity ($\Delta\Phi_{PC}$ = 98 kV) are consistent with most observations. Our simulation at high activity ($\Delta\Phi_{PC}$ = 146 kV) underestimates the observed pressure and temperature. This disagreement indicates possible dependence of the boundary particle sources on activity and possible effects of solar wind dynamic pressure enhancements that have not yet been included in our simulation. The simulated equatorial pressures and temperatures show stronger enhancement on the dusk side than on the dawn side as convection is increased, while density profiles show an increase on the dawn side and a decrease on the dusk side. The simulated proton flow speed at the equatorial plane increases with enhancing convection while the overall flow direction does not change significantly, a result of enhancement in both the earthward electric drift and azimuthal diamagnetic drift. The equatorial magnetic field strength decreases more in the near-Earth plasma sheet than at larger radial distances as $\Delta\Phi_{PC}$ increases, resulting in an increasing flat radial profile with enhancing convection. The feedbacks from diamagnetic drift and magnetic fields to increasing convection are found to restrain the pressure increase. Based on the good agreement between our results and observations at moderate activity, our magnetic field indicates the plasma and magnetic field in the plasma sheet can be in a state far from possible force balance inconsistency during periods of moderately enhanced convection. A scale analysis of our results shows that the frozen-in condition E = -vxB is not valid in the inner plasma sheet for moderate activity.

SM21D-07 1150h

Auroral Poleward Boundary Intensifications: their two-dimensional structure and the associated dynamics in the Plasma Sheet

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Auroral poleward boundary intensifications (PBIs) have an auroral signature in ground meridional scanning photometer (MSP) data that appears as an increase in intensity at or near the magnetic separatrix. This increase is often seen to extend equatorward through the ionospheric mapping of the plasma sheet. PBIs are associated with plasma sheet flow bursts and are thus important to plasma sheet dynamics. We previously found that equatorward extending PBIs are either north-south (NS) aligned structures or east-west (EW) arcs that mostly propagate equatorward. We further investigate the plasma sheet dynamic structures associated with these two types of PBIs by combining data from the CANOPUS MSPs, auroral images from the IMAGE spacecraft, and magnetic field and plasma data from the Geotail spacecraft. We study a period on January 3, 2001, when a series of PBIs were seen in the MSP data for 2.5 hrs. From simultaneous IMAGE and Geotail data we find that: (a) PBIs correlate well with plasma sheet fast flows observed within the local time sector of the PBIs. There can be several PBIs over the longitudinal range of fast flows in the tail, (b) multiple PBIs can occur over the whole width of the plasma sheet or in a more restricted local sector (i.e. only premidnight). When PBIs are seen only in a local sector fast flows are seen only in that local sector as well. Where no PBIs are seen no fast flows are seen, (c) most of the observed PBIs were EW arcs that initiated near the poleward boundary and then propagated equatorward. They often tilted and became mostly NS structures as they propagated equatorward and duskward, (d) there is a local time dependence on the type of PBI structure. Most PBIs seem to be narrow structures and primarily aligned with a line that goes through the 02 MLT and 17 MLT sectors. This results in PBIs that are NS structures in the postmidnight sector and EW arcs in the dusk sector. In the premidnight sector (22-00 MLT) PBIs start as EW arcs that then tilt and become primarily NS structures. These results suggest that the same plasma sheet dynamics produce EW and NS PBI structures.

SM22A MCC: Hall D Tuesday 1330h

Coupling of the Subauroral Ionosphere, Plasmasphere, and Magnetosphere II Posters *(joint with SA)*

Presiding: **P C Anderson,** The Aerospace Corporation**; M W Liemohn,** University of Michigan

SM22A-0557 1330h POSTER

Simulations of Stormtime Diffuse Aurora Using AMIE Electric Field and Flux-Dependent Electron Scattering Model

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We obtain distributions of precipitating electrons by tracing drift shells of plasmasheet electrons in the limit of strong pitch angle diffusion in Dungeys model magnetosphere, which consists of a dipolar magnetic field plus a uniform southward field. Under strong pitch-angle diffusion particles drift so as to conserve an adiabatic invariant L equal to the enclosed phase-space volume (i.e., the cube of the particle momentum p times the occupied flux-tube volume per unit magnetic flux). Here we model the magnetospheric convection electric field by mapping an analytical expansion of the AMIE (Assimilative Model of Ionospheric Electrodynamics) ionospheric potential (a function of latitude and magnetic local time) along magnetic field lines from ionospheric latitudes $\geq 50^\circ$ ($L \geq 2.5$) in Dungeys magnetic field model. We trace the bounce-averaged drift motions of representative plasmasheet electrons with values of L corresponding to kinetic energies of $0.25 - 64$ keV on a field line of equatorial radius $r = 6R_E$, which maps to 65° latitude in the ionosphere. Using the simulation results, we map stormtime phase space distributions along particle drift shells, taking into account loss due to precipitation. We consider 3 models of electron scattering: (1) the limit of strong scattering everywhere, (2) an MLT-dependent scattering that is less than everywhere strong in the plasma sheet, and (3) an electron flux-dependent scattering. Our flux-dependent scattering model is based on the Kennel-Petschek concept that wave growth occurs where there is sufficient electron flux to cause it. From the phase space distributions thus obtained, we calculate the precipitating electron energy flux into the ionosphere. For this study we focus on the main phase of the October 19, 1998, storm. Magnitudes of the integrated electron energy flux obtained from our simulations are consistent with statistical averages of precipitating electron flux obtained from NOAA data. For selected times of interest we compare the simulated electron flux with Polar UVI images. We also weight our simulated electron flux by the Bremsstrahlung X-ray production curve to obtain simulated X-ray fluxes for comparison with PIXIE images. Our simulations with the electron flux-dependent scattering model indeed reproduce some of the features that are observed in UVI and X-ray images.

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SM22A-0558 1330h POSTER

Penetration Electric Field Observations and Modeling in the Pre-Noon Mid-Latitude Ionosphere

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