transition points as the magnetic dipole strength is increased in value. Further, for weak dipole fields, which may be relevant for asteroids and smaller planets, the magnetopause takes the form of a very thin current layer with ρ_i/L 7 where ρ_i is the ion gyroradius and L is the current sheet half-thickness. The properties of such thin current sheets are largely unknown. We have used linear kinetic theory as well as 2D and 3D full particle simulations to study the structure and stability of such thin sheets. Some of the important issues that we address include, (i) what is the lower limit of current sheet thickness in the presence of instabilities such as the lower hybrid drift instability that will broaden the sheet? (ii) Can magnetic reconnection occur in this limit and what form will it take? Thin sheets also enable us to settle important issues regarding the stability of thicker current sheets observed at Earth. The study of such current sheets at has been difficult due to small growth rates, and many important issues remain unresolved. Even using unrealistically small mass ratios, relevant simulations remain out of reach of present computational capabilities. Through our study of thin sheets we will address issues that are of direct interest to the Earth's magnetosphere, using realistic mass ratios. Examples include (i) nonlinear interaction of tearing and lower hybrid drift instability and (ii) saturation mechanism of guide field tearing in three-dimensions.

SM52B-0593 1330h POSTER

The magnetic field structure at the dayside magnetopause

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We studied the plasma and magnetic field structure of the magnetopause with Geotail data. We classified the structure of the magnetic field and the plasma flow at the dayside magnetopause in the magnetopause-normal coordinates. We found that the magnetopause has two patterns of magnetic field structure. One is the case in which the strength of the magnetic field becomes small when Geotail crosses the magnetopause. In this case, the southward magnetic field becomes simply the northward magnetic field. The other is the case in which the strength of the magnetic field is almost constant. In this case, the magnetic field rotates. The position where the magnetosheath plasma with low-temperature and high-density changes into the magnetospheric plasma with high-temperature and low-density does not depend on the structure of the magnetic field. The position is at the magnetosphere side of the magnetopause defined by the magnetic field. Sudden southward or northward plasma flows, which are considered to be magnetic reconnection flows, are frequently observed at the magnetopause. These flows can be observed for these two types of the magnetic field structure.

SM52B-0594 1330h POSTER

Response of the Geosynchronous Magnetic Field at the Sub-solar Region to Variations in Interplanetary Magnetic Field Orientations and Changes in Solar Wind Dynamic Pressure

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The magnetic fields Ht at the geosynchronous orbit near the dayside sub-solar region are compared with the up-stream solar wind dynamic pressure (Dp) and north-south component of interplanetary field (Bz) in GSM coordinates based on the 90-second resolution of data observed by WIND, ACE, GOES 8 and 10 satellites for the period 1999-2000. The corrections due to the changes of the latitudinal positions of GOES have been made. There are at most two events selected (one for each GOES) each day when GOES 8 and 10 reach their maximum values of magnetic field strength near the sub-solar region. A total of 507 events are selected such that the up-stream solar wind and IMF data are carefully compared with GOES data so that a proper adjustment for the time delay due to solar-wind propagation from the upstream positions to that of GOES is included. It is found that the well-known results of Ht = a*sqrt(Dp)+b are confirmed for both polarity of Bz where a=30.2, b= 80.2, Ht in nT and Dp in nPa. However, the reduction in Ht due to the negative Bz is not found in our statistical study. Using the magnetopause model of Chao et al. (2002) and Shue et al. (1998), we estimate that the sub-solar distance of the magnetopause, Rmp, reduces about 1 Re on the average for southward Bz when Rmp is in the range of 7 to 10 Re.

SM52B-0595 1330h POSTER

Ion cyclotron waves in the high altitude cusp: CLUSTER observations at varying spacecraft separations

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We have analysed high-resolution Cluster FGM data (22 vectors/s) during three high-altitude cusp crossings on 17th of March 2001, 2nd and 9th of March 2002. The Cluster separations for these crossings varied between 70 - 600 km and therefore provided an unique opportunity to study wave properties at different length scales. After entering the cusp Cluster observed significant level of magnetic field fluctuations with the highest frequencies scaling as a function of the local ion cyclotron frequency (IC). The waves close to local IC frequency appeared at two types of plasma boundaries: higher amplitude (2-5 nT) incoherent wave packets were observed at regions of enhanced plasma flow, and smaller amplitude (< 0.5 nT), more coherent wave trains were observed at shear flow-stagnant plasma boundary. Sometimes also the first and second harmonic of the dominant frequency were present. Surprisingly the cross-correlation coefficients between spacecraft pair were poor for all crossings indicating that these waves were very locally generated and possibly some wave-particle interactions took place, damping the waves before other spacecraft were able to observe them. Both left-and right-handed waves were observed, and there were no correlation between ellipticities and wave propagation angles with respect to the background magnetic field.

SM52C MCC: 2002-2004 Friday 1340h

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

Presiding: **M Moldwin,** University of California, Los Angeles**; J Foster,** Millstone Hill Observatory

SM52C-01 1340h INVITED

Some Questions Concerning the Coupling of the Plasmasphere to the Ionosphere and Other Regions

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This talk is intended to touch upon, and hopefully stimulate interest in, a number of questions that have arisen during past experimental work on the plasmasphere or underlying ionosphere. During disturbed periods, substantial amounts of plasma appear to be lost from the plasmasphere by interchange fluxes with the ionosphere. What is the mechanism of this loss and what is its effect on the ionosphere? What mechanisms establish and control the properties of the plasmapause boundary layer or plasmapause region? How could the development of a new plasmapause boundary be observed with, say, kilometer scale resolution and on a time scale of minutes? Is there a combination of ground based radar and rocket experiments that could accomplish this? Irregular density structure frequently appears in the plasmapause region. How and when do these irregularities form, and what role does the ionosphere play in their formation? At times, but possibly only in the early stages of disturbance, a steep plasmapause boundary is detected at altitudes of a few thousand km. How do the properties of the plasmasphere boundary layer, or plasmapause region, vary as a function of distance along the field lines from the equator to the ionosphere? Limited evidence suggests that the low and high altitude convection flows of eroded plasmasphere plasma may be at least partially decoupled along field lines near the dayside magnetopause. What role do turbulent electric fields play in this process?

SM52C-02 1400h INVITED

Studying the connection between the ionosphere and plasmasphere using GPS observations

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Studying plasmaspheric dynamics during and after magnetic storms provides information on how the plasmasphere responds to and influences storm evolution, and provides insight into magnetosphere-ionosphere coupling. Understanding the source and loss processes of ring current and radiation belt particles requires a dynamic picture of the plasmaspheric mass density, which modifies those populations by particle-particle and indirectly by wave-particle interactions. Studies using plasmaspheric measurements from the IMAGE satellite and ionospheric total electron content measurements from ground-based GPS receivers have demonstrated a striking correlation between stormtime density enhancements in the ionosphere and plasmaspheric drainage plume structure caused by enhanced magnetospheric convection. We describe how the continuous dual-frequency L-band transmissions from 27 Global Positioning Satellites (1.2 and 1.5 GHz), orbiting at about 4 Earth radii, are important observational tools for studying the plasmasphere and ionosphere as a coupled system. Total electron content measurements from ground-based GPS receiver networks are complementary to measurements obtained from zenith-viewing GPS receivers in low-Earth orbit, currently available from a variety of altitudes both within and above the ionosphere. We will report on observed trends such as the plasmaspheric content versus latitude, how this evolves over several hours during a magnetic storm, apparent refilling of the plasmasphere after a storm, and how the plasmasphere structure correlates with ground and space-based GPS measurements of the ionosphere. Since GPS measurements of the plasmasphere are fairly new, we will discuss the measurement system itself, limitations and possible new directions.

SM52C-03 1420h INVITED

On the Relation Between the Ring Current and Sub-Auroral Electric Fields and the Plasmasphere

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It has been known that a strong poleward electric field is created in the evening sector at sub-auroral latitudes during mainphases of geomagnetic storms (Galperin et al., 1981). Recently, ground observation efforts from Millstone Hill Radar, GPS receiver stations have related these phenomena to high sunward flow velocities and enhanced electron densities in a narrow latitudinal band at sub-auroral latitudes, Sub-Auroral Polarization Streams (SAPS) and directly related them to the so-called plasmaspheric drainage plume (Foster et al.). Model tests with the Comprehensive Ring Current Model (CRCM) by M. -C. FOk have shown that the formation of the inospheric poleward electric fields in the SAPS regin are an effect of (1) enhanced Region 2 (R2) field-aligned currents (FAC), and (2) the existence of a Pedersen currents that flow poleward from the dusk R2 FACs to high latitudes through a low conductance gap. Goldstein et al. have shown the effect of the SAPS on the plasmasphere and found that it strips of the outer layers of the evening plasmapause pointing at the effects of the SAPS formation. It appears that SAPS are related to the formation of strong pressure gradients in the ring current and plasma sheet which is consistent with enhanced the R2 FACs. To illuminate the cause/driver for the SAPS, we will investigate the relation with the ring current by utilizing field-aligned current (FAC) observations from magnetometers on board Iridium, total electron content (TEC) maps from GPS receivers, DMSP passes and global proton pressure distributions derived from energetic neutral atom (ENA) data from the high energy neutral atom (HENA) imager on board image together with model runs of the CRCM.

SM52C-04 1440h

Plasmaspheric plumes: CRRES observations

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CRRES plasma wave receiver density data were used to study the distribution and properties of dense plasmaspheric-like plasma observed outside the plasmapause. Our study indicates that outer plasmaspheric structure, often called plasmaspheric plumes, blobs, or detached plasma regions exist at all local times under all levels of geomagnetic activity. Of the 549 CRRES orbits that had at least one clearly defined plasmapause, 201 (or 36.6%) had plasmaspheric-like density structures at higher L shells than the plasmapause. Most of the occurrence of plasmaspheric-like plasma observed by CRRES was in the noon-to-dusk sector and was observed following moderate geomagnetic activity.

SM52C-05 1455h

A new banded hiss-like emission observed by CLUSTER near the plasmapause

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A newly discovered whistler mode ELF/VLF emission, based on CLUSTER measurements, will be presented. When observed, this 1-2 kHz banded hiss-like electromagnetic emission is systematically found near or at the plasmapause, below the electron gyrofrequency but above the lower hybrid resonance. An explanation why this emission has not been studied using previous satellites will be first suggested. The MLT, MLAT, L-shell and Kp dependences will be then presented and their consequences related to the source of these emissions will be discussed. These geophysical properties have been deduced through a survey of more than one year of data measured by three different wave instruments (WHISPER, WBD and STAFF), on each of the four CLUSTER spacecraft. Spatial extent using multipoint measurements, propagation characteristics of these waves and high time resolution insight will also be presented. Finally, some comparisons of this emission observed by CLUSTER together with IMAGE satellite data will be detailed.

SM52C-06 1510h

In-Situ and Ground-Based Intercalibration Measurements of Plasma Density at L=2.5

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Two independent ground-based experiments and two satellite-borne experiments are used to intercalibrate the instruments, and interpret the changes in plasmaspheric composition at the same point in space during a range of geomagnetic activity in 2001 and 2002. Mass density at L=2.5 was determined from an array of magnetometers on the Antarctic Peninsula, while the electron number density along the same flux tube was determined from analysis of the group delay of man-made VLF transmissions from north-east America. The IMAGE satellite RPI experiment provided in-situ measurements of the electron number density in passing the equatorial region of the same field line, while the IMAGE EUV experiment was able to resolve the He+ abundance by looking back toward the same place a few hours later. With a moderately-disturbed plasmasphere, at Antarctic Peninsula longitudes, electron and ion concentrations show good agreement on specific study days. He+ column abundance values of 6 x 10^{10} cm^{-2} are found to be equivalent to plasmaspheric electron density levels of 3000 cm^{-3} at L=2.5. For these conditions the He+ mass abundance was about 12-16% compared with H+. The work has been extended to severely-disturbed plasmasphere conditions, also studied at Antarctic Peninsula longitudes, and we present results which are compared with less disturbed times in terms of He+ column abundance, electron number density profiles, and heavy ion mass abundance. Insight is gained in the interpretation of the effects of severe geomagnetic storms on long-term data sets derived from ground-based VLF whistler-mode experiments.

SM52C-07 1525h

Stormtime Redistribution of the Low-Latitude Ionosphere and the Formation of the Plasmaspheric Bulge

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Ground-based observations of total electron content (TEC) from a global array of GPS receivers are used to map the evolution of the low-latitude ionosphere-plasmasphere system during the onset of strong disturbances.Such images depict a large-scale redistribution of plasma from equatorial latitudes near the dusk terminator to form a region of greatly-enhanced TEC immediately inside the plasmapause between L=2 to 3. The erosion of the plasmasphere and the formation of plumes of storm enhanced density (SED) at mid and high latitudes takes place where the sub auroral polarization stream (SAPS) electric fields overlap this enhanced plasmaspheric bulge region. We combine the GPS maps with overflights of the DMSP satellites and FUV imagery of the equatorial anomaly region from the IMAGE satellite to investigate the causes and development of this inner-magnetospheric stormtime phenomenon. These processes result in a large-scale depletion of the topside ionosphere-plasmasphere over the region of the South Atlantic magnetic anomaly (SAA) and extreme space weather perturbations over the North American continent.

SM52D MCC: 2006 Friday 1340h

Is a New Lexicon Required for High-Latitude Field-Aligned Current Systems? II *(joint with SA, AE)*

Presiding: **D Weimer,** Mission Research Corporation**; V Papitashvili,** Space Physics Research Laboratory, University of Michigan

SM52D-01 1340h INVITED

Birkeland (Field-Aligned) Currents - Then and Now

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(Take) Iijima and (Tom) Potemra pioneered the development of statistical, satellite-measured low altitude models of field-aligned currents that were proposed by Birkeland in 1908. The renowned Region 1 and Region 2 current systems that ring both northern and southern polar regions are still valid today and are still the standard against which geospace models and simulations are measured. Lesser known field-aligned current patterns were inferred from equatorial magnetic field measurements by this same group; the general location and sense of these equatorial patterns are consistent with the Birkeland currents globally connecting both the low and high altitudes. Variations and additions to the low altitude configuration as influenced by the IMF and it's merging with the magnetosphere (e.g. Region 0, IMF By, NBZ) will also be discussed. This presentation is a tribute to the above researchers and a status of their long-cited results.

SM52D-02 1400h INVITED

Is a New Lexicon for Field-Aligned Current Systems Needed?

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In general it is bad to rename something that has a name in general use whose meaning is unambiguous enough to enable efficient communication. For instance, region 1 currents mean high-latitude currents that flow into the dawnside ionosphere and out the duskside; region 2 currents mean currents that flow oppositely at lower latitudes. Oppositely flowing currents at higher latitude are called NBZ currents. These highly serviceable names should be retained as long as the meaning intended does not go beyond the one defined or differs from it. The problem, however, is that these names as defined fail to cover the range of meanings needed to communicate results of recent research. The full range of current morphologies revealed by data and physics-based modeling includes the standard morphologies as part of more integrated patterns that have no labels at present. Moreover, how do we refer to the global current system whose ionospheric part we label region 1, etc.? The goal of this talk is to expose the problem of nomenclature that field-aligned currents present, point to analogous problems in other fields, and offer options to address them.

SM52D-03 1420h

Evolution of current systems in the magnetosphere-ionosphere during the transition from northward to southward IMF

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In order to examine how the current systems evolve in the magnetosphere and ionosphere, we have compared plasma flows in the dayside polar cap and the global DP2 current during the transition from northward to southward of the interplanetary magnetic field