Japan Geoscience Union Meeting 2012
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PEM30-01 Room:304 Time:May 24 13:45-14:00

Energy budget and dynamics in the earth's magnetosphere

OGINO, Tatsuki[1*]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University

Energy transport, accumulation and release, namely energy budgets are important problems in interaction between the solar wind and earth's magnetosphere. We have studied distribution of three kinds of the kinetic, thermal and magnetic energies and three kinds of energy fluxes in the magnetosphere. Most dominant energy flux is Poynting flux in the magnetosphere which is main driver of magnetospheric convection. In the earth side of near-earth neutral line in plasma sheet, thermal energy flux is generally greater than kinetic energy flux, because thermal energy is large and Much number is less than unity. The kinetic energy flux firstly becomes small and the thermal flux does secondly when plasma high speed flows come close to the earth from the neutral line. Poynting flux survives finally and approaches near the earth in the plasma sheet and then carries the energy from nightside to dayside.

At the same time, as the solar wind and IMF becomes abnormal conditions, plasma turbulence are strongly excited in boundary layers on magnetosphere. In the plasma sheet magnetic reconnection occurs in patchy and intermittent manner to produce streamer-like structure. At the magnetopause, more regular vortex train is formed for northward IMF. It is because velocity shear created between the magnetosheath fast flow and magnetopause slow flow. On the other hand, sunward fast flow is produced by tail reconnection for southward IMF. Therefore two types of velocity shears created outside and inside of the magnetopause to excite Kelvin-Helmholtz instabilities in both sides. Moreover dayside reconnection occurs in patchy and intermittent manner to give seeds of plasma turbulence. As the results, complicated and strong vortex turbulence appears in flank magnetopause. We will demonstrate those phenomena from 3-dimensional visualization of simulation results to

discuss relationship between the currents and vortices in boundary layers.

Keywords: MHD simulation, energy budget, interplanetary magnetic field, magnetic reconnection, magnetospheric dynamics, boundary layer instabilities

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PEM30-02 Room:304 Time:May 24 14:00-14:15

Propagation characteristics of ULF waves into middle latitude driven by solar wind dynamic pressure pulses

MATSUSHITA, Toshinori[1*], SEKI, Kanako[1], NISHITANI, Nozomu[1], KIKUCHI, Takashi[1], MIYOSHI, Yoshizumi[1], HORI, Tomoaki[1], TERAMOTO, Mariko[1], Henri Reme[2], Howard Singer[3], Vassilis Angelopoulos[4]

[1]STEL, Nagoya University, [2]IRAP, CNRS, France, [3]SWPC, NOAA, USA, [4]UCLA, USA

Many ULF waves (Pc5) in the magnetosphere are directly driven by the solar wind. It has been considered that these magnetospheric ULF waves are generated either directly on the dayside by solar wind dynamic pressure pulses, Kelvin-Helmholtz surface waves, or indirectly on the nightside by mechanisms like substorms. ULF waves can play an important role in mass and energy transport within the inner magnetosphere. It is well known that energetic particles in the inner magnetosphere can be significantly affected by ULF waves and many studies have suggested their importance in acceleration process of radiation belt electrons. One outstanding problem in ULF studies is to clarify their global characteristics, especially, how energy is transported from the solar wind to the magnetosphere, and finally to the ionosphere.

We have conducted a survey of high-intensity ULF waves observed around 45 deg MLAT by the SuperDARN Hokkaido HF radar at middle latitudes. The ULF events can be categorized into two types in terms of the solar wind velocity, i.e., high- and low-speed solar wind events. In this study, we focus on a low-speed solar wind event on January 31, 2008 to investigate propagation characteristics of the ULF waves based on multi-point observations from geospace to the ground. The SuperDARN Hokkaido HF radar observed the ULF wave at 3.9mHz at about 14:40UT and at 2.6mHz at about 15:30 at MLT=02:00. In this event, the Cluster spacecraft, located at (X,Y,Z)=(15.8,8.9,-9.4) Re in GSM coordinates, observed pressure pulses driven by the high-density solar wind. The propagation time from Cluster to the ground (radar location) was about 400 seconds. In the magnetosphere, GOES-11 and GOES-12 were at 05:40 and 09:40 MLT at geosynchronous orbit, respectively. THEMIS A and D satellites were located on the nightside at (-5.3, 3.2, -1.5) and (-7.1, -5.0, -2.4) Re, respectively. We will report characteristics of the global propagation of the ULF waves obtained from the time delays between these observations.

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PEM30-03 Room:304 Time:May 24 14:15-14:30

Estimation of the spatial structure of the plasmasphere using a data assimilation technique

NAKANO, Shin'ya[1*], FOK, Mei-Ching[2], BRANDT, Pontus[3], HIGUCHI, Tomoyuki[1]

[1]The Institute of Statistical Mathematics, [2]NASA Goddard Space Flight Center, [3]The Johns Hopkins University Applied Physics Laboratory

The plasmasphere is the region of cold dense plasma in the inner magnetosphere. The spatial structure of the plasmasphere is significantly controlled by the electric field in the inner magnetosphere. Therefore, in order to discuss the dynamics of the plasmasphere, it is important to understand the spatial distribution of the electric field in the inner magnetosphere. However, in the magnetosphere, it is basically difficult to observe the static electric field. We are developing a data assimilation technique which incorporates the imaging data of extreme ultra-violet (EUV) from the IMAGE satellite into a two-dimensional fluid model of the plasmasphere using an ensemble Kalman filter. By combining a sequence of EUV images and the dynamic model the plasmasphere, we can estimate the spatial distribution of the electric potential as well as the plasmaspheric plasma. We will overview our approach and demonstrate some examples of the estimates obtained by this approach.

Keywords: plasmasphere, data assimilation, magnetospheric electric field

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PEM30-04 Room:304 Time:May 24 14:30-14:45

Preliminary report of VLF Campaign observation with High-resolution Aurora Imaging Network (VLF-Chain) over Canada

SHIOKAWA, Kazuo[1*], IEDA, Akimasa[1], MIYOSHI, Yoshizumi[1], YOKOYAMA, Yu[1], NOMURA, Reiko[1], LEE, Sungeun[1], Mitsunori Ozaki[2], Kazumasa Ishizaka[2], YAGITANI, Satoshi[2], KATAOKA, Ryuho[3], TSUCHIYA, Fuminori[4], ASAMURA, Kazushi[5], Martin Connors[6], Ian Schofield[6]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University, [2]Kanazawa University, [3]Tokyo Institute of Technology, [4]Tohoku University, [5]Institute of Space and Astronautical Science, [6]Athabasca University

Whistler-mode waves in the VLF/ELF frequency range interact with high-energy (~10 keV) electrons to cause diffuse and pulsating auroras, and with MeV electrons in the radiation belts. However, simultaneous high-time resolution measurements of aurora and these waves have previously not been done sufficiently. We made a campaign observation of such high-time resolution measurements at Athabasca (54.72N, 246.69E, MLAT=61.3) and Fort Vermillion (58.38N, 243.99E, MLAT=64.5) using two loop antennas and several auroral cameras for February 16-26, 2012. The loop antennas at both stations measure east-west and north-south magnetic field variations with a sampling rate of 100 kHz. The panchromatic all-sky cameras at both stations measure auroras with a sampling rate of 30 Hz. The sampling timings of both instruments are corrected by GPS receivers. In addition we installed an oblique looking narrow-FoV EMCCD camera at Athabasca with a sampling rate of 100 Hz, to measure height variation of pulsating aurora. At Athabasca, routine measurements by an induction magnetometer, a proton photometer, an all-sky airglow imager, LF standard wave receiver, were also carried out. We also tried to compare these observations with satellite measurements by REIMEI, THEMIS, NOAA, and DMSP. In this presentation we will show preliminary results obtained from this comprehensive campaign of aurora and radio wave measurements at subauroral latitudes.

Keywords: whistler-mode waves, pulsating aurora, Pc1 geomagnetic pulsations, wave-particle interaction, subauroral latitudes, ground-based observation

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PEM30-05 Room:304 Time:May 24 14:45-15:00

Rising tone chorus emissions without a gap at half the gyrofrequency observed on THEMIS

KURITA, Satoshi[1*], KATOH, Yuto[2], OMURA, Yoshiharu[3], MISAWA, Hiroaki[1]

[1]PPARC, Tohoku Univ., [2]Geophysics, Sci, Tohoku Univ., [3]RISH, Kyoto Univ.

Whistler-mode chorus emissions often consist of discrete rising tone elements in the typical frequency range from 0.1 to 0.8 fce with a gap at 0.5 fce, where fce is the equatorial electron gyrofrequency. The emissions below and above 0.5 fce are called lower- and upper-band chorus emissions, respectively. Based on the duct propagation characteristics of whistler-mode waves, Bell et al. [2009] showed that the gap at 0.5fce can be formed if the lower-and upper-band chorus waves are generated within the enhanced and depleted plasma density region, respectively. While Omura et al. [2009] has suggested that a rising tone chorus element is once generated near the magnetic equator through the nonlinear wave growth mechanism in the purely parallel direction, and that the gap at 0.5 fce is formed by the nonlinear wave damping effect during its propagation away from the equator with a slightly oblique wave normal angle, resulting in the separation of the chorus element into the lower-band and upper-band chorus emissions. Based on the nonlinear wave growth mechanism, chorus emissions without a gap at 0.5 fce are expected to be observed in the source region. In this presentation, we report the presence of rising tone chorus emissions without the gap at 0.5 fce observed by the searchcoil magnetometer (SCM) onboard the THEMIS spacecraft. The propagation angles of the chorus emissions are almost along the background magnetic field in the entire frequency range, indicating that the chorus emissions are observed in the source region. The frequency sweep rates are estimated based on the nonlinear wave growth theory using the observed wave amplitudes and plasma parameters during the observation. We compare them with the instantaneous frequency variation of the elements derived from the SCM data and show that the estimated sweep rates well agree with the observed frequency variations. Furthermore, the frequency profiles of the wave amplitude of the elements are compared with the optimum amplitude proposed by Omura and Nunn [2011]. The comparison shows reasonable agreement between the theory and the observations. These results provide strong observational evidence of the nonlinear wave growth mechanism for the generation of rising tone chorus emissions.

Keywords: whistler-mode chorus, inner magnetoshere, wave-particle interaction

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PEM30-06 Room:304 Time:May 24 15:30-15:45

Seasonal variations of Saturn's auroral acceleration region deduced from spectra of auroral radio emissions

KIMURA, Tomoki[1*], LAMY, Laurent[2], TAO, Chihiro[1], BADMAN, Sarah V.[1], CECCONI, Baptiste[2], ZARKA, Philippe[2], MORIOKA, Akira[3], MIYOSHI, Yoshizumi[4], KASABA, Yasumasa[3], MARUNO, Daichi[3], FUJIMOTO, Masaki[1]

[1]JAXA/ISAS, [2]LESIA, Paris Observatory, [3]Graduate school of science, Tohoku University, [4]Solar Terrestrial Environment Laboratory, Nagoya University

Multi-instrumental surveys of Saturn's magnetosphere by Cassini have indicated that auroral radio emissions (Saturnian Kilometric Radiation, SKR), aurorae at UV and IR wavelengths and Energetic Neutral Atoms (ENA) from the inner magnetosphere exhibit periodic behavior at around Saturn's rotational period with the north-south asymmetry and seasonal variations [e.g., Gurnett et al., 2010; Mitchell et al., 2009; Nichols et al., 2010]. These rotationally periodic phenomena suggest that the magnetosphere-ionosphere coupling process and associated energy dissipation process (aurora & SKR) are dynamically dependent on both magnetospheric rotations and long-term conditions of the magnetosphere/ionosphere.

To reveal the global view of this M-I coupling process, this study investigated seasonal variations of Saturn's auroral acceleration region, which is the interface between the ionosphere and magnetosphere, based on a sufficient data volume of SKR observed by Cassini's Radio and Plasma Wave Science (RPWS) experiment. Morioka et al. [in press] investigated the spatial distribution of the auroral acceleration region along polar magnetic field lines based on spectra of the terrestrial auroral kilometric radiation (AKR). By application of this approach to Saturn, we deduced the height distribution of the auroral acceleration region in the northern and southern hemispheres from SKR spectra acquired during 2004 to 2010. It was found that the southern (summer) SKR spectral density was 10db greater at the peak altitude (~0.9Rs) on average, and harder than in the northern (winter) hemisphere. In addition, the southern and northern spectral densities became comparable with each other around equinox. These results suggest stronger field aligned acceleration and current in the southern hemisphere than north depending on season. The main infrared (H3+) auroral oval in IR was similarly more intense in the southern summer hemisphere than in the north [Badman et al. 2011]. Badman et al. [2011] suggested that greater conductivity in the southern polar ionosphere could result in greater precipitating electron flux and/or Joule heating, which are responsible for the stronger southern IR auroral emissions. The north-south asymmetric acceleration region deduced from SKR will be further compared with ionospheric and magnetospheric parameters (e.g., electron density, temperature, conductivity). Finally, comparative discussions of M-I coupling process between Saturn and Earth will also be presented.

Keywords: magnetosphere-ionosphere coupling, Saturn, aurora, radio emissions

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PEM30-07 Room:304 Time:May 24 15:45-16:00

Universal time control of inverted-V acceleration

MORIOKA, Akira[1*], MIYOSHI, Yoshizumi[2], KURITA, Satoshi[1], KASABA, Yasumasa[3]

[1]Planet. Plasma Atmos. Res. Cent., Tohoku Univ., [2]STEL, [3]Dept. of Geophysics, Tohoku Univ.

It has been demonstrated that the spectral behavior of auroral kilometric radiation (AKR) exhibits structure and dynamical evolution of auroral acceleration region along the field line. The auroral acceleration process at substorm onset, revealed from the AKR spectral analyses, showed basically two stages: (1) appearance/intensification of a low-altitude acceleration region at 4000-6000 km accompanied by initial brightening and (2) breakout of high-altitude field-aligned acceleration above the pre-existing low-altitude acceleration region at 6000-12,000 km, which is followed by auroral breakup and poleward expansion.

The former (low-altitude acceleration region) corresponds to so-called inverted-V acceleration, and it appears not only at substorm time but also during the day. We show, in the present study, that the altitude of the inverted-V acceleration varies systematically during a day, that is, UT variation. The systematic variation changes its phase of 180o around equinox. The possible cause of the altitude variation and its phase change can be (1) ionospheric origin due to daily variation of solar illumination in the polar region and/or (2) magnetospheric origin due to the rocking motion of the geomagnetic field in the magnetosphere. In the presentation, the evaluation of these possibilities will be given.

Keywords: inverted-V acceleration region, aurora, M-I coupling region, substorm, UT control, AKR

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PEM30-08 Room:304 Time:May 24 16:00-16:15

Aurora surge at poleward boundary of aurora zone related to Pi2-associated bi-directional flows

SAKA, Osuke[1*], Kanji Hayashi[2]

[1]Office Geophysik, [2]University of Tokyo

From the statistical analyses of Pi2-associated geomagnetic field changes and plasmas at the geosynchronous altitudes, occurrence of the diversion of the fast earthward flows has been suggested (1). We found a possible manifestation of the flow diversion in aurora (2).

Summares of the aurora observations are:

(1) Poleward surges propagating eastward/westward along a thin and narrow aurora arc were observed in the invariant latitudes from 68 to 74 degrees.
(2) The poleward surge repeated at Pi2 periodicities.
(3) The propagation direction of the surge correlated to the sense of Pi2 polarizations (CW/CCW) at geosynchronous altitudes.
(4) Multiple occurrence of the surge was found at adjoining sectors.

From those observations, we concluded:

(1) The bi-directional flows passing at the outer boundary of the inner magnetosphere generated Pi2 polarizations at the geosynchronous altitudes.
(2) Poleward surge was an auroral manifestation of the plasma instabilities, such as Ballooning-Interchange instabilities, in the directed flows.
(3) The mechanism that repeated the poleward surge at Pi2 periods was not related to the FLR.

References:
(1) First 10 min intervals of Pi2 onset at geosynchronous altitudes during the expansion of energetic ion regions in the nighttime sector (Saka, Hayashi, Thomsen, JASTP, 2010).
(2) Periodic aurora surge propagating eastward/westward at poleward boundary of aurora zone during the first 10 min intervals of Pi2 onset (Saka, Hayashi, Koga, JASTP, 2012).

Keywords: Aurora, Diversion of fast earthward flow, Pi2

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PEM30-09 Room:304 Time:May 24 16:15-16:30

Fine scale structures of pulsating auroras in early recovery phase of substorm

NISHIYAMA, Takanori[1*], SAKANOI, Takeshi[1], MIYOSHI, Yoshizumi[2], KATAOKA, Ryuho[3], KATOH, Yuto[4], ASAMURA, Kazushi[5], Donald Hampton[6], OKANO, Shoichi[1]

[1]Planetary Plasma and Atmospheric Research Center, Graduate School of Science, Tohoku University, [2]Solar-Terrestrial Environement Laboratory, Nagoya University, [3]Tokyo Institute of Technology, [4]Department of Geophysics, Graduate School of Science, Tohoku University, [5]Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, [6]Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska, USA

We have carried out ground-based observations optimized to temporal and spatial characteristics of pulsating auroras (PAs) in micro-meso scale, using an Electron Multiplying Charge Coupled Device (EMCCD) camera with a narrow field of view corresponding to 100km x 100km at altitude of 110 km and high sampling rate up to 100 frames per second. Transient pulsating auroras propagating southward around 1100 UT, in early recovery phase of the substorm, on 4 March 2011 are focused on in this paper. Three independent PAs (PA1-3) with each different periods between 4 and 7s were observed by our EMCCD camera, which means that the periodicity was not bounce motion and strongly depended on local plasma conditions in the magnetosphere, corresponding to 2300 km x 2300 km, or the ionosphere. One more insight is that only PA1 had also a sharp peak of modulations around 1.5 Hz, with a narrow frequency width of 0.30 Hz. In addition, the strong modulations existed as a small spot in the center of PA1, and the spatial distributions of modulations were presented for the first time in this work. We also conducted cross spectrum analysis and obtained coherence and phase maps for auroral variations between 0.1 and 3.0 Hz in order to investigate and quantify the dynamics inside pulsating auroras. The results indicated that low frequency variations from 0.2 to 0.5 Hz inside PA1-3 propagated as a group of flows in the particular directions. The estimated flow velocities were ranged from 80 to 150 km/s at the auroral altitude, corresponding to between 1800 and 3500 km/s at the magnetic equator.

Keywords: Inner magnetosphere, Aurora, Substorm, Wave-particle interactions, Ground observations

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PEM30-P01 Room:Convention Hall Time:May 24 10:45-12:15

Investigations of triggering mechanism of substorm through the analysis of Themis probe data

MACHIDA, Shinobu[1*], MIYASHITA, Yukinaga[2], IEDA, Akimasa[2], NOSE, Masahito[3], NISHIMURA, Yukitoshi[4], Vassilis Angelopoulos[5], James P. McFadden[6]

[1]Division of Earth and Planeary Sciences, Kyoto University, [2]Solar Terrestrial Environment Laboratory, Nagoya University, [3]WDC for Geomagnetism, Kyoto University, [4]Department of Atmospheric and Oceanic Sciences, University of California, Los Angeles, [5]Institute of Geophyiscs & Planetary Physics, University of California, Los Angeles, [6]Space Sciences Laboratory, University of California, Berkeley

In our previous paper, we have presented the result of our superposed epoch analysis applied to the Themis data in which the velocity moments were derived from the ESA, the low energy particle instrument with the upper limit energy of 25 keV. There are some concerns that the flow velocity of plasma obtained only with ESA can be underestimated since the ion fluxes above 25 keV energy range in the near Earth plasma sheet cannot be ignored. Thus we reexamined the Themis data taking into account the contribution of high-energy particles measured by high-energy particle instrument SST. As we expect, the flow velocity of plasma was found to be greater than that evaluated previously in the plasma sheet region of $X > -13$ Re. In our previous study, we pointed out that the earthward flows become quiet about 3 min prior to the auroral breakup, followed by abrupt enhancement of the earthward flows in the region of $-10 > X(Re) > -18$ at the time of auroral breakup (i.e., at t=0). Further, we proposed a new model for substorm onset called Catapult Current Sheet Relaxation Model. In a revised superposed epoch analysis result, we found that the relaxation starts first at X ˜ -12 Re which corresponds to the inner edge of that current sheet and then propagates both earthward and tailward. The tailward propagation of the occurrence of earthward flows corresponds to the relaxation of the catapult current sheet. It is confirmed that about 1 min after the enhancement of the earthward flow at X ˜ -12 Re, the catastrophic change of the current sheet reaches the tailward edge of the current sheet at X ˜ -18 Re at which the magnetic neutral line is formed and the magnetic reconnection starts. Therefore we conclude that the flows appear about 1 min before the substorm onset and continue for about 2 min are produced by the relaxation of the catapult current sheet. In contrast, those follow the initial flows must be produced by the magnetic reconnection.

Keywords: substorm, Themis probes, current relaxation, magnetic reconnection

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PEM30-P02 Room:Convention Hall Time:May 24 10:45-12:15

Global MHD simulation of substorm with effective resistivity models

DEN, Mitsue[1*], HORIUCHI Ritoku[2], FUJITA, Shigeru[3], TANAKA, Takashi[4]

[1]National Institute of Information and Communications Technology, [2]National Institute for Fusion Science, [3]Meteorological College, [4]Kyushu University

Magnetic reconnection is considered to play an important role in space phenomena such as substorm in the Earth's magnetosphere. In the MHD framework, the dissipation model is introduced for modeling of the kinetic effects. Tanaka and Fujita found that the normalized reconnection viscosity, one of the dissipation model employed there, gave a large effect for the dipolarization, central phenomenon in the substorm development process, though that viscosity was assumed to be a constant parameter.

It is well known that magnetic reconnection is controlled by microscopic kinetic mechanism. Horiuchi and his collaborators showed that reconnection electric field generated by microscopic physics evolves inside ion meandering scale so as to balance the flux inflow rate at the inflow boundary, which is controlled by macroscopic physics. That is, effective resistivity generated through this process can be expressed by balance equation between micro and macro physics. We also propose other resistivity model generated in wave-particle interaction, which was evaluated by Moritaka and Horiuchi.

In this paper, we perform substorm simulation by using the global MHD code developed by Tanaka with these effective resistivity models instead of the empirical resistivity model. We obtain the AE indices from simulation data, in which substorm onset can be seen clearly, and investigate the relationship between the substorm development and the effective resistivity model.

Keywords: substorm, global structure, magnetic reconnection, anomalous resistivity

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PEM30-P03 Room:Convention Hall Time:May 24 10:45-12:15

Magnetic field fluctuations in the near-Earth magnetotail at substorm dipolarization onsets

MIYASHITA, Yukinaga[1*], SAITO (HASEGAWA), Miho[2], HIRAKI, Yasutaka[3], MACHIDA, Shinobu[4]

[1]STEL, Nagoya Univ., [2]NASA Goddard Space Flight Center, [3]National Institute for Fusion Science, [4]Dept. of Geophys., Kyoto Univ.

Using Geotail and THEMIS data, we have investigated low-frequency magnetic field fluctuations that were observed in the near-Earth magnetotail at X~-10 Re at substorm dipolarization onsets. A previous study showed that ballooning mode waves with a low-frequency range of ~0.01 Hz were observed near the magnetic equator just before dipolarization onsets for high plasma beta, while they were not observed for relatively low plasma beta. In the present study we analyze low-frequency waves in more detail and discuss the relationship between the ballooning instability, dipolarization, and substorm expansion onset.

Keywords: substorm, magnetotail, dipolarization, magnetic field fluctuation, ballooning

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PEM30-P04 Room:Convention Hall Time:May 24 10:45-12:15

A shock wave in the magnetosheath observed in the substorm growth phase

FUJITA, Shigeru[1*], TANAKA, Takashi[2]

[1]Meteorological College, [2]SERC, Kyushu University

We detected a shock wave in the lower-latitude side to the cusp region in the magnetosheath during the substorm growth phase in the global MHD simulation. This shock is transient because it appears after the southward turn of the IMF and disappears after the onset of substorm. From analysis of the numerical data, we identify the shock as the fast shock. Therefore, this shock is caused by collision between the fast plasma flow in the magnetosheath and the high-pressure region of the cusp extended into the magnetosheath.

The points to be settled are acceleration mechanism of the magnetosheath plasmas and disappearance mechanism of this shock. As for the acceleration, the laval nozzle model [Yamauchi and Lundin, 1997] is one of the candidates, but the simulation result does not seem to support it. Otherwise, the magnetosheath plasmas are accelerated through release of the magnetic tension caused by magnetic field merging between the solar wind field and the magnetospheric field. As for the disappearance, it seems to coincide with the substorm onset. We find that the plasma pressure in the upsteam side of the magnetosheath shock increases at the substorm onset. By analyzing the numerical results carefully, it is obtained that gradual increase in pressure triggered by sudden increase in pressure in the inner magnetosphere in the nightside propagates toward the dayside cusp region. This indicates that the magnetosheath plasma pressure will increase. Then, increase in the sound speed makes the supersonic flow the subsonic flow. Therefore, the shock wave disappears. It is noted that magnetic field erosion from the dayside magnetosphere to the lobe in the magnetotail is also seemed to be ceased at the same time. However, the erosion is active in the early phase of the growth phase and gradually less active in the latter phase of the growth phase. This result probably indicates that activity of the erosion does not control the formation of the shock.

Yamauchi, M. and R. Lundin (1997), The Wave-Assisted Cups Model: Comparison to Low-Latitude Observations, Phys. Chem. Earth, 22, 729-734.

Keywords: shock wave, magnetosheath, cusp, MHD simulation, substorm

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PEM30-P05 Room:Convention Hall Time:May 24 10:45-12:15

Rebound of BBF and vortical plasma motion in the near-Earth plasma sheet

KONDOH, Koji[1*]

[1]Research Center for Space and Cosmic Evolution, Ehime University

Magnetic reconnection in the near-Earth plasma sheet plays an important part in the geo-magnetospheric substorm. Then it is important to understand the plamsma phenomena in this region associated with magnetic reconnection. Recent multi-satellite observations revealed that the interaction of a BBF in the plasma sheet with dipolar field lines of the Earth's magnetic field would result in formation of plasma vortices. In this study, we revealed the requirements, the region and the process of the development of the vortex using three dimensional MHD simulations on the basis of spontaneous fast magnetic reconnection model.

Keywords: MHD simulation, magnetic reconnection, near-Earth plasma sheet, vortical plasma motion, bursty bulk flow

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PEM30-P06 Room:Convention Hall Time:May 24 10:45-12:15

A simulation study of the tail current sheet at the time of substorm onse

UCHINO, Hirotoshi[1*], MACHIDA, Shinobu[1]

[1]SPEL,Kyoto University

A substorm is known as a primarily process to release stored energy in the Earth's magnetotail, and the magnetic reconnection as well as the tearing instability are thought to be related to the substorm. Although a number of models for substorm onset have been suggested so far, no consensus is not obtained yet. Recently we proposed a new scheme of substorm onset called "Catapult Current Sheet Relaxation Model" to comprehensively explain our result of the analysis of Geotail data. However, details of the model still remain to be solved. Thus, we conduct a study on a stability of the current sheet with highly stretched dipole magnetic field in order to clarify the mechanism of substorm onset and further to contribute to the progress of the space weather research.

Initially, we give a solution which is modified from the Harris solution that is widely used in the simulation of the magnetic reconnection, to include the contribution of Earth's dipole magnetic field. Then, we run 2-1/2D full-particle PIC simulation code for the approximated Earth's magnetotail. In this simulation, initial locations of particles are determined with a quiet start method to suppress the numerical noise with limited number of particles. We then investigate the relation between the distribution of northward magnetic field originated from the Earth's dipole magnetic field and the location of the magnetic neutral line, as well as the development of the tearing instability and its relationship to the occurrence of the magnetic reconnection.

Keywords: Substorm, Magnetic reconnection, Tearing instability, PIC simulation

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PEM30-P07 Room:Convention Hall Time:May 24 10:45-12:15

Tailward plasma flow observed in the near-Earth magnetosphere

SUHAMA, yuya[1*], KONDOH, Koji[1]

[1]Research Center for Space and Cosmic Evolution of Ehime University

Magnetic reconnection in the near-Earth magnetotail produces earthward fast plasma flow called Bursty Bulk Flow (BBF) and tailward plasma flow. On the other hand, interaction of this BBF with dipolar field lines of the Earth's magnetic field results in tailward rebound of a BBF. In this study, the differences between these two tailward plasma flows are investigated using GEOTAIL observations and computer simulations. Virtual satellite observations in the three dimensional MHD simulations on the basis of spontaneous fast reconnection model are compared with results of the superposed epoch analyses of GEOTAIL observation data.

Keywords: reconnection, tailward

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PEM30-P08 Room:Convention Hall Time:May 24 10:45-12:15

Streamline reconstruction of the front part of magnetotail reconnection jets

HASEGAWA, Hiroshi[1*], SAITO (HASEGAWA), Miho[2], Kyoung-Joo Hwang[3]

[1]Institute of Space and Astronautical Science, JAXA, [2]STE lab, Nagoya University, [3]NASA Goddard Space Flight Center

We present an in-depth analysis of multiple plasma jet fronts observed on 15 August 2001 by the Cluster spacecraft (at geocentric distance of about 19 Re) in a post-midnight current sheet of Earth's magnetotail, first reported by Hwang et al. (2011). Such jet fronts, accompanied by an increase in the northward magnetic field component (Bz), are suggested to be a key ingredient for earthward injection of plasma and magnetic flux. In part of fast earthward jets where the field is directed earthward ($Bx > 0$), ion velocity distributions consist of two populations, Alfvenic field-aligned beam and cooler ions convected toward the sheet center, supporting that the jets resulted from magnetic reconnection tailward of Cluster. Four-spacecraft timing method and deHoffmann-Teller analysis both show that the entire structure traveled earthward and dawnward. Based on reconstruction of streamlines using a Grad-Shafranov-like equation for flow transverse to a unidirectional field (Hasegawa et al., 2007), it is suggested that a vortex with a diameter of several Re existed near the dawnside edge of each jet front. The results are suggestive of an MHD-scale interchange type instability developed at the front of a two-dimensional (broad) reconnection jet (e.g., Nakamura et al., 2002), although the possibility of multiple bursts of transient and three-dimensional (localized) reconnection cannot be ruled out.

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Keywords: magnetotail, magnetic reconnection, interchange-type instability, Grad-Shafranov equation, jet front

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PEM30-P09 Room:Convention Hall Time:May 24 10:45-12:15

Evolution of Field Structure and Energy in a Solar Flare

TANIMOTO, Hiroshi[1*]

[1]Research Center for Space and Cosmic Evolution of Ehime University

Solar activity, such as solar flare, closely relate to geo-magnetosphere. Therefore, the prediction of solar flare is important to the forecast of the space weather. Then, at first, we have to understand the evelution of field structure before and after the solar flare.

Solar Optical Telescope (SOT) on the Hinode satellite has provided us the high resolution magnetic field vector data on the photosphere. In this study, we extrapolate the three dimensional coronal magnetic field from these observed data using magento-frictional method, and investigate the evolution of field structure and free energy before and after the solar flare.

Keywords: Reconnection

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PEM30-P10 Room:Convention Hall Time:May 24 10:45-12:15

Comparison between emission intensities of magnetic conjugate aurora

SHIGENOBU, Kaoru[1*], Makoto Taguchi[1], Akira Kadokura[2], Natsuo Sato[2]

[1]Rikkyo University, [2]National Institute of Polar Research

Aurora has a lot of information on the magnetosphere along a magnetic field line. The magnetic field of the Earth has a shape close to a dipole, and two ground points connected by a magnetic field line like a Husafell and Syowa Station pair are called geomagnetic conjugate points. The aurora which appears over both points is called geomagnetic conjugate aurora. We observed aurora simultaneously at magnetic conjugate points and compared intensity, shape, and appearance frequency of the conjugate auroras. In general, the conjugate aurora becomes similar shape, if the magnetosphere is symmetric. However, the conjugate property of the aurora along with the states of the magnetosphere and the ionosphere is not always maintained. When, the magnetic field line dynamically change in response to temporal variations in the interplanetary magnetic field (IMF) orientation, it has been sometimes observed that similar auroras change suddenly into dissimilar auroras in a few minutes. One of the causes of this non-conjugate property is an asymmetric diversity in the northern and southern field-aligned acceleration regions that exist around altitudes of 3000~10000 km. Difference in the auroral intensity could result from the interhemispheric difference in the fluxes of auroral particle precipitation. In this study we compare auroral intensities during an event on September 9 and 10, 2011, and also statistically compare emission intensities of auroras observed at Syowa Station and Iceland conjugate points.

Keywords: magnetic conjugate aurora

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PEM30-P11 Room:Convention Hall Time:May 24 10:45-12:15

Development of the automatic observation system for VLF/ELF waves at subauroral latitudes

YOKOYAMA, Yu[1*], SHIOKAWA, Kazuo[1], MIYOSHI, Yoshizumi[1], OzakiMitsunori[2], Ishizaka Kazumasa[2], YAGITANI, Satoshi[2], Martin Connors[3]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University, [2]Kanazawa University, [3]Athabasca University

One of the mechanisms of pulsating aurora is that VLF/ELF waves generated around magnetic equator modulate particle precipitation through wave-particle interaction. In this model, correlations between pulsating auroras and VLF/ELF waves observed at ground are expected. Indeed, examples of such good correlations were reported before (Tsuruda et al., 1981).

In those days, however, all data were in analog recordings. It was difficult to analyze the frequency characteristics and wave forms in detail. Thus, we made a campaign observation of high-time resolution measurements of auroras and VLF/ELF waves at Athabasca (54.72N, 246.69E, MLAT=61.3) and Fort Vermillion (58.38N, 243.99E, MLAT=64.5), using two loop antennas and several auroral cameras for February 16-26, 2012.

The amount of VLF/ELF wave data obtained from this campaign is enormous, because the sampling rate of the wave data is 100kHz. The purpose of this study is to develop automatic software to visualize the wave characteristics. We put instrument name, date, time, sampling frequency, number of channels and site name into the name of data files. We visualize the data as high-resolution dynamic spectra to find interesting events. These procedures are automated using Linux shell commands. In this presentation we will show these procedures and preliminary results obtained from this campaign at subauroral latitudes.

Keywords: subauroral latitudes, pulsating aurora, VLF wave, ELF wave, automatic observation system, high-time resolution

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PEM30-P12 Room:Convention Hall Time:May 24 10:45-12:15

Data analysis of ELF emissions in the visinity of magnetic equator observed by AKEBONO

MATSUDA, Shoya[1*], KASAHARA, Yoshiya[1], GOTO, Yoshitaka[1]

[1]Kanazawa University

Electromagnetic ion cyclotron wave and magnetosonic wave were frequently observed around the magnetic equator by AKEBONO [1,2]. On the other hand, the next inner magnetosphere explorer mission named "ERG" is now under planning [3]. The ERG mission aims to investigate the plasma dynamics of the inner magnetosphere by measuring three-dimensional plasma distributions over a broad energy range from eV to MeV and electric and magnetic field from DC up to HF range simultaneously near the equatorial plane. It is pointed out that ion cyclotron wave and magnetosonic wave play important roles in wave-particle interaction in the radiation belt.

In the present study, therefore, we analyze these data again observed by Akebono to examine their characteristics such as polarization and spectrum feature. According to the analyses, we also propose required frequency and time resolution and additional functions to be implemented on the Plasma Wave Experiment (PWE) onboard ERG to achieve detailed measurements of these ELF emissions.

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Keywords: electromagnetic ion cyclotron wave, magnetosonic wave, radiation belt, AKEBONO, ERG

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PEM30-P13 Room:Convention Hall Time:May 24 10:45-12:15

Evaluation of high-energy electron Detector for Probing the Inner Magnetosphere in High-counting Conditions

TAMADA, Yukihiro[1*], TAKASHIMA, Takeshi[2], MITANI, Takefumi[2], MIYAKE, Wataru[1]

[1]Tokai University, [2]ISAS/JAXA

There are regions where has particles over a broad energy range, from a few electron volts to more than 10MeV in the earth's magnetosphere. Also in radiation belt of inner magnetosphere, high energy electron were observed increased at recovery phase of magneticstorm. Magnetosphere is considered as infrastructure is use now more. And to understand the variation is important for social and science. There is project that integrated observation by ERG satellite. This research is Capability Evaluation of high energy detector (HEP-e) that is used into ERG satellite. At electron flux increase to , counting is occur saturation by dead time of IC chip for read of HEP-e. Reduce sensitive area of detector, and cover high counting by incident particle decrease.

This research used Cs137 and few radiation source that emit lower energy. As Result detector occurred counting loss of Cs137 emited electron when increased incident particle. But counting loss was decreased by reduce sensitive area. Also spectrum occur be shift high energy side in high counting condition. This weigh continue experiment with result simulation of Geant4 that is simulation soft.

Keywords: Inner Magnetiosphere, Electron Detector, Magnetic storm

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PEM30-P14 Room:Convention Hall Time:May 24 10:45-12:15

Latitude dependence of Pi2 Pulsation frequency observed by the mid-latitude SuperDARN radars and the THEMIS satellites

TERAMOTO, Mariko[1*], NISHITANI, Nozomu[1], HORI, Tomoaki[1], John DEVLIN[2], Vassilis Angelopoulos[3]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University, [2]Department of Electronic Engineering, La Trobe University, [3]University of California, Los Angeles

At mid-latitudes, Pi2 pulsations appear clearly on the nightside at substorm onsets. Several studies suggested that a transient Alfven waves might contribute to the excitation of Pi2 pulsations at high latitudes on the nightside. On the other hand, fast mode waves trapped between the ionosphere and plasmasphere are responsible for Pi2 pulsations at mid and low latitudes on the nightside. Using the Sweden And Britain auroral Radar Experiment (SABRE) coherent radar at auroral and sub-auroral latitudes, Yeoman et al. [1991] found that the radar could distinguish between these two types of Pi2 pulsations and suggested that the mid latitude is transition region of these two types of Pi2 pulsations. Few studies have been examined the characteristics of Pi2 pulsations over wide geomagnetic latitude, using radars located at mid latitude.

We report on one event of Pi2 pulsation at 09:10 UT on 11 August 2010 detected simultaneously by the Hokkaido, Tiger, and Unwin SuperDARN radars and THEMIS-A, -D, -E satellites when they were located in the premidnight sector. THEMIS satellites observed Pi2 pulsations predominantly in the compressional and radial components of the magnetic field and the azimuthal component of the electric field when satellites were located at $L < 4$ inside the plasmasphere. These pulsations had a predominant frequency at 14 mHz and high coherence (~1) with the H-component Pi2 pulsations at Kakioka (KAK: magnetic latitude 27.47; magnetic longitude 209.2 degrees). The four radars detected Pi2 pulsations as fluctuation in the Doppler velocities while operating with themisscan mode, which provides 8-s sampling data. Pi2 pulsations in Doppler velocities of echoes backscattered at lower latitude had predominant frequency at 14 mHz while Pi2 pulsations observed at higher latitude by the radars had predominant frequency of both 14 mHz and 21 mHz. These results may indicate that the radars detected harmonic structures of Pi2 pulsations in the plasmasphere.

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PEM30-P15 Room:Convention Hall Time:May 24 10:45-12:15

Estimation of magnetic flux diffusion region using a system of Magnetic Field Tracing in Global MHD simulations

KUBOTA, Yasubumi[1*], MURATA, Ken T.[1], YAMAMOTO, Kazunori[1], FUKAZAWA, Keiichiro[2], TSUBOUCHI, Ken[3]

[1]NICT, [2]RIIT, Kyushu Univ., [3]The University of Tokyo

We developed a system of Magnetic Field Tracing in Global MHD simulations in order to understand magnetosphere convection. To trace magnetic flux tube, 'Frozen-in' needs to hold. We investigated the time revolution of magnetic flux and visualize magnetic diffusion regions. As a result, we find that magnetic diffusion regions change depending on IMF directions. In this lecture, we discuss the application of the magnetic field tracing system to space weather.

Keywords: magnetic field line, frozen-in, magnetosphere convection, space weather

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PEM30-P16 Room:Convention Hall Time:May 24 10:45-12:15

Particle simulations about LH plasma waves observed by Geotail spacecraft

KANEKO, junichi[1*], MIYAKE, Taketoshi[1]

[1]Toyama Prefectual University

According to our previous study, LH plasma waves are observed in Lobe and PSBL region in the magnetosphere. We studied several plasma parameters at the time when LH waves were observed, and found that LH waves were observed with the large perpendicular velocity of ion and the earthward ion flow. In addition, the LH plasma waves observed with the earthward ion flow have low frequencies, and the strengths of those LH plasma waves are relatively large. These results suggest that strong LH plasma waves are observed in the boundary region where ion flow usually exist, such as Lobe region close to PSBL. In addition, LH plasma waves are observed when ion velocity perpendicular to the ambient magnetic field is enhanced and earthward ion flows are observed.

On the basis of these results, we are going to perform 2-dimensional particle simulations about LH plasma waves observed by EFD. In these simulations, we examine effects of perpendicular on thermal velocity and parallel ion drift velocity on the generation mechanism of LH plasma waves. We will farther investigate the occurrence conditions of LH plasma waves to clarify the generation mechanism of these waves and their effects on local plasma environment in the magnetosphere.

Keywords: Lower Hybrid plasma wave, magnetosphere, statistical analysis, ion flow, wave-particle interaction

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PEM30-P17 Room:Convention Hall Time:May 24 10:45-12:15

Global magnetic flux circulation in the magnetosphere during obliquely northward interplanetary magnetic field periods

WATANABE, Masakazu[1*], FUJITA, Shigeru[2], KUBOTA, Yasubumi[3], SHINAGAWA, Hiroyuki[3], TANAKA, Takashi[1], MURATA, Ken T.[3]

[1]Kyushu University, [2]Meteorological College, [3]National Institute of Information and Communications Technology

The structure of the magnetosphere during northward interplanetary magnetic field (IMF) periods is less well known than is generally thought. For example, few people recognize that because open field lines drape over the dayside magnetosphere (the so-called overdraped lobe), the low-latitude boundary layer is located on open field lines. Also, as for the steady-state magnetic flux circulation resulting from reconnection, only the circulation mode that is completed within the lobe [Russell, 1972] has been considered in the past. Consequently, the convection cell that appears in in the ionosphere has been interpreted as the so-called lobe cell for all cases. However, Watanabe and Sofko [2009] has pointed out that considering the magnetic topology, the lobe circulation view is not necessarily true, and in fact another mode of magnetic flux circulation is dominant during northward IMF periods. In that new idea, IMF-lobe reconnection and lobe-closed reconnection occur sequentially in both hemispheres to maintain steady-state flux circulation by reciprocating magnetic flux between the two reconnection processes. This new idea has not been accepted widely, however. One reason is the difficulty in visualizing the three-dimensional topology of the magnetic field, with the result that the discussion stops at the most rudimentary level. The authors previously showed that the outcome of numerical magnetohydrodynamic simulation was consistent with the aforementioned circulation mode. When the IMF clock angle points about 20 degrees from due north, the convection patterns in the ionosphere exhibit those expected from the theoretical prediction. In the current study, we further advance the analysis of the simulation results, and confirm that the magnetic flux circulation mode is in fact that predicted. In addition, we visualize the circulation mode using computer graphics techniques so that everyone can understand the reconnection processes involved. For this purpose, we first determine and visualize magnetic nulls, separatrices, and separators, which are essential in understanding the three-dimensional structure of the magnetosphere. We next show the existence of a streamline that crosses separatrices sequentially in the following order: IMF-lobe-closed-lobe-IMF. This proves the above-mentioned magnetic flux circulation mode. In the presentation, we will also refer to observations that are relevant to the circulation mode.

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Keywords: magnetic topology, magnetic reconnection, magnetic null, separatrix, separator