Formation and movements of transpolar aurora

*Takahiro Obara[1]

1.Planetary Plasma and Atmospheric Research Center,Tohoku University

Formation and movement of the transpolar aurora, which appears under the condition of northward IMF, is investigated from the analysis of the numerical MHD simulation as well as IMAGE FUV observations. It seems that there will be at least three categories.
The 1-st type is the arcs at the poleward edge of the dawn or dusk side of main oval which was thickened on one side by a tilted plasma sheet by the strong IMF By (cf. Makita et al., 1991). This type of arcs do not move so much and remain there for a significant time interval.
The 2-nd type is the moving arcs, which is caused by the transient convection after a sign change of IMF By (Tanaka et al., 2004). This transient convection must include a replacement of lobe field lines from old-IMF-orienting fields, a rotation of plasma sheet to opposite inclination, and a reformation of ionospheric convection cells. In the midst of these reconfigurations, old and new convection system must coexist in the magnetosphere-ionosphere system. In this stage, the polar cap and tail lobes are continuously encroached by the new open field lines connected to the new IMF. Whereas magnetic field lines accumulated in new lobes tend to rotate the outer plasma sheet in the opposite direction, the old merging-cell convection still continues to generate closed field lines that must return to dayside against the new-lobe formation. As time progresses, the growth of new lobes results in the blocking of the return path toward dayside of closed field lines generated in the old merging cell to form the kink structure in the plasma sheet. Losing their return path, these closed field lines generated from old lobes accumulated on the night side.
The 3-rd type is the arc which forms in the midnight and develops toward the noon. Millan et al.(2005) proposed that transpolar arc is formed by the reconnection in the magnetotail, where the foot point of the reconnected field line is pre-midnight in one hemisphere and post-midnight in the other due to the magnetotail By component. The return flow of newly closed field line would be hindered and buildup of the closed flux that protrudes into the polar cap.
Based on the IMAGE observations, Fear and Milan (2012) listed polar cap arc events. We have tried to classify these 21 polar cap arc events into three types. Number of events for each Type is following; i.e. Type 1 (13 events), Type 2 (2 events), and Type 3 (6 events). We also examined the variation of IMF By components and found that the IMF By was almost constant for Type 1, the IMF By changed its polarity for Type 2, and no significant was seen for Type 3. We will demonstrate the results of analyses and will discuss the mechanism in detail in the talk.

Keywords: Polar Cap Aurora, IMF

Stable sun-aligned arcs equatorward of the cusp

*Satoshi Taguchi[1], Keisuke Hosokawa[2], Yasunobu Ogawa[3]

1.Department of Geophysics, Kyoto University, 2.Department of Communication Engineering and Informatics, University of Electro-Communications, 3.National Institute of Polar Research

A well-established feature of the aurora in the cusp is a transient poleward-moving auroral form. The initial brightening of this aurora occurs near the equatorward edge of the persistent east-west aligned aurora, and then the auroral form moves poleward. This aurora form often occurs at several minute intervals. When compared with this kind of active features, the aurora equatorward of the cusp may be thought to be generally quiet. In this study, we focus on auroral arcs that sometimes appear equatorward of the persistent cusp. By examining auroral image data obtained at wavelengths of 557.7 nm and 630.0 nm by an all-sky imager at Longyearbyen, Svalbard, we found several events in which sun-aligned arcs exist stably equatorward of the cusp in the noon sector. The sun-aligned arcs, which range between ~70 and ~76 MLAT, move from the postnoon to the noon sector slowly. The lifetime of the sun-aligned arcs is ~15 min or longer, which is much longer than that of the transient moving auroral form. The poleward portion of this arc, which is located at ~76 MLAT, is measured by the EISCAT Svalbard Radar. Simultaneous observations from the EISCAT Svalbard Radar and the all-sky imager show that fast plasma flow exists in the region of the auroral arc. Multiple sun-aligned arcs can also be observed. We discuss the spatial distribution of the plasma flow associated with the stable sun-aligned arcs equatorward of the cusp, and interpret the flow distribution in terms of temporal variations in the duskside convection cell.

Keywords: aurora, cusp, plasma convection

Statistical Analysis of Severe Magnetic Fluctuations in the near-Earth Magnetotail Observed by THEMIS-E

*Heqiucen XU[1], Kazuo Shiokawa[1], Dennis Fruehauff

1.Institute for Space-Earth Environmental Research, Nagoya University

We made a statistical analysis of severe magnetic fluctuations in the nightside near-Earth plasma sheet at |X| = 6 - 12 R_E, which is considered as a necessary cause for current disruption (CD) in the inside-out substorm model. We used magnetic field data for two years of 2013 and 2014 with a sampling rate of 4 Hz, obtained by the THEMIS-E satellite. The 1283 severe fluctuation events were identified as $sigma_B$ / $average_B$ > 0.5, where $sigma_B$ and $average_B$ are standard deviation and average value of magnetic field intensity during the time interval of local gyroperiods. We found that the occurrence rates of severe fluctuation events are extremely low (0.00118%, 0.00899% and 0.0238% at |X| = 6 - 8 R_E, 8 –10 R_E and 10 –12 R_E, respectively), and most of them last for no more than 15 s. The superposed epoch analysis of AL index and magnetic field variations indicate that they occur associated with sudden decrease of AL index value and magnetic field dipolarization. Meanwhile, 62% of events were accompanied by ion flow with v > 100 km/s. Superposed epoch analysis of the flow speed indicates that flow speed increases before the severe magnetic fluctuations. This fact suggests that the magnetic fluctuations are caused by the ion flow, and contradicts the suggestion of inside-out model that the fluctuations cause earthward ion flow by reducing the tailward pressure-gradient force. These results indicate that the inside-out model can only be suitable for relatively small amount of substorm cases. In the presentation, we plan to show the actual distance between event location and the neutral sheet, using Tsyganenko Model (T01).

Keywords: Inner Magnetosphere, Magnetic Fluctuation, Substorm

Global evolution and propagation of electric fields during sudden impulses using satellites and ground-based observations

*Naoko Takahashi[1], Yasumasa Kasaba[1], Yukitoshi Nishimura[2], Takashi Kikuchi[3,4], Atsuki Shinbori[3], Tomoaki Hori[4], Nozomu Nishitani[4]

1.Dep. Geophysics Graduate School of Science Tohoku University, 2.University of California, Los Angeles, 3.Research Institute for Sustainable Humanosphere, Kyoto University, 4.Institute for Space-Earth Environmental Research, Nagoya University

Sudden impulses (SI) are triggered by compression of the dayside magnetosphere, leading to fast mode wave propagation in the equatorial plane. Broadband fast mode waves generated in the magnetosphere propagate tailward from the dayside magnetopause, and the abrupt compression of the dayside magnetosphere induces Alfven wave propagation toward the polar ionosphere along magnetic field lines. Then the ionospheric electric field penetrates from polar toward low-latitude ionosphere at speed of light. These propagation processes have been supported by previous event and statistical studies using multi-point observations. However, there are few papers that performed a statistical analysis of the precise temporal evolution of the SI-associated MHD waves, particularly using satellites in the inner magnetosphere or ionosphere. Further, it is known that the Poynting flux plays a crucial role in the electromagnetic energy transport, but the detailed propagation path is still an open issue.
Motivated by these issues, we investigate global evolution and propagation of electric fields using in-situ satellites and ionospheric radars. In order to clarify the magnetospheric response, we obtain the magnetospheric electric and magnetic field data from THEMIS (5 probes) and Van Allen Probes (2 probes). Magnetospheric magnetic field data obtained from GOES 13 and 15 are also referred to. We identify the ionospheric response using the C/NOFS satellite, SuperDARN (high latitude) and HF Doppler (mid latitude) radars.
Seventeen events occurred from October 2012 to December 2014 show that both THEMIS and Van Allen Probes detect the westward electric field regardless of the local time. We also find time delay of onsets between dayside and nightside magnetospheric electric fields. In a representative event on 17 March 2013, the onset time of the dawnside electric field (~4.8 h LT, L~4) is 24 s later than the dayside one (~10.4 h LT, L~7). The nightside electric field (~1.8 h LT, L~5.5) starts to decrease 32 s after the onset of the dawnside electric field. These time lags can be explained by the fast mode wave propagation in the equatorial plane. However, in the eveningside, the onset of the nightside magnetic field (~19 h LT) is 20 s later than that of the midnight one. In the ionosphere, C/NOFS (~11 h LT) and HF Doppler radar (~15 h LT) detects the dusk-to-dawn electric field 19 s later than the onset of the midnight electric field. Although SuperDARN radar cannot detect the precise onset time due to the normal scan mode with time resolution of 1 min, we find the dusk-to-dawn electric field observed as the negative peak of the line-of-sight velocity. Since the ionospheric electric field propagates globally and simultaneously, it is speculated that the nightside ionospheric electric field also responds with 19-s delay from the onset of the nightside magnetospheric electric field. Estimated Poynting fluxes are directed toward the ionosphere along field lines, which indicates the Alfven wave propagation toward the ionosphere in both the dayside and nightside. Therefore, the possible propagation path is as follows: first, the fast mode wave propagates from dayside to nightside magnetospheres in the equatorial region through the dawnside, and then the Alfven wave propagates from the magnetosphere toward the ionosphere.
On the basis of such individual events, we statistically derive the spatial distribution of the time response of magnetospheric electric fields. In the dayside, the magnetospheric electric field

responds more gradually as the L-value of satellites becomes smaller. The estimated propagation velocity in the dayside is ~600-900 km/s, which is consistent with the fast mode wave speed. In the nightside, however, the post-midnight electric field responds faster than the pre-midnight one. The asymmetric distribution with respect to the midnight meridian may be associated with the plasmapause location.

Forecast of AU/AL index with real time data assimilation

*Ryota Yamamoto[1], Yoshizumi Miyoshi[1], Shinobu Machida[1], Genta Ueno[2], Yukinaga Miyashita[1], Masahito Nose[3]

1.The Solar-Terrestrial Environment Laboratory, 2.The institute of Statistical Mathematics, 3.Kyoto-University

The AU index is a proxy of substorm as well as auroral activity, so that the forecast of the index is important for the space weather research and forecast. In this study, we have developed a data-assimilation code to estimate variations of the AU index based on Goertz's model. In the Goertz's model, there are several parameters, and these parameters are related to the ionospheric conductivity. From the estimation of the developed data-assimilation code, we found a seasonal dependence of these parameters in the model. It is expected that these seasonal variations are caused by the seasonal variations of ionospheric conductivity as indicated by Goertz et al. The original Goerts model assumed the constant amplitude for these parameters, and seasonal dependence derived from our data assimilation may contribute the improve the forecast score.

Keywords: data assimilation, AU index

Bi-modal distribution of substorm intensity

*Akira Morioka[1], Yoshizumi Miyoshi[2], Masahito Nose[3]

1.Planetary Plasma and Atmosphere Recearch Center,Guraduate School,Tohoku University, 2.Institute for Space-Earth Environmental Research, Nagoya University, 3.Graduate School of Science, Kyoto University

One of the essential issues in substorm study is how is the substorm intensity distributed and what determines the distribution. In this study, the substorm intensity (AL index at substorm) distribution is statistically studied using the Wp index provided by WDC for Geomag, Kyoto University and OMNI data base. The results showed that substorm intensity distribution is composed of bi-modal peaks with lognormal distribution. The major peak is in small AL range around 100 nT (named group-S substorm) and the secondary peak is around 300 nT (named group-L substorm). The bi-modal distribution of substorm intensity means that substorm is not a continuum state between pseudo-substorms and full substorms as has been discussed. The solar cycle variation of the substorm intensity distribution showed that group-S substorms occure rather constantly during a solar cycle, whereas the appearance of group-L substorms is strongly dependent with the solar activity. These observations suggest that two different substorm processes are working in the magnetosphere or different solar wind-magnetosphere interaction processes are operating.

Keywords: substorm, intensity distribution, lognormal distribution

Ion cyclotron waves detected by Kaguya and Geotail in the Earth’s plasma sheet boundary layer

*Tomoko Nakagawa[1], Hideo Tsunakawa[2]

1.Information and Communication Engineering, Tohoku Institute of Technology, 2.Deparment of Earth and Planetary Sciences, Tokyo Institute of Technology

Nearly monochromatic, narrowband ion cyclotron waves found by Apollo 15 and 14 Lunar Surface Magnetometers (Chi et al., 2013) were detected in the magnetic field data obtained by GEOTAIL in the distant tail lobe as well as in the data obtained by Kaguya orbiting around the moon in the tail lobe of the Earth’s magnetosphere. They have common characters such as the frequency range near the local proton cyclotron frequency, significant compressional components, and wave forms comprising discrete packets. They are also similar to the waves found by Cassini during its Earth swing-by (Bogdanov et al., 2003). Polarization of the narrowband ion cyclotron waves was predominantly left-handed at far downstream, while near the lunar orbit, both right-handed and left-handed polarization was detected.

Keywords: ion cyclotron wave, plasma sheet boundary layer, lobe, Kaguya, GEOTAIL, left-handed polarization

Simultaneous observations of magnetospheric ELF/VLF emissions at Canada, Finland, and Syowa Station

*Yusuke Yonezu[1], Kazuo Shiokawa[1], Martin Connors[2], Mitsunori Ozaki[3], Jyrki K Manninen[4], Hisao Yamagishi[5], Masaki Okada[5]

1.Institute for Space-Earth Environmental Research, Nagoya University, 2.Athabasca University, 3.Faculty of Electrical and Computer Enginnering, Institute of Science and Engineering, Kanazawa University, 4.Sodankylä Geophysical Observatory, 5.National Institute of Polar Research

Whistler mode wave emissions in the ELF/VLF range, such as chorus, hiss, and quasi-periodic (QP) emissions, accelerate relativistic electrons in the inner magnetosphere. Relativistic particles drift around the Earth in the longitudinal direction with time scales from tens of minutes to hours and interact with ELF/VLF emissions. However, global extent of ELF/VLF emissions has not been well understood. We investigate this by analyzing the data obtained at 2 longitudinally-separated stations in the northern hemisphere and 1 station in the southern hemisphere in the auroral and subauroral latitudes, i.e., Athabasca, Canada (54.7N, 113.3W, magnetic latitude (MLAT): 61.3N), Kannuslehto, Finland (67.7N, 26.3E MLAT: 64.4N) and Syowa Station, Antarctica (69.0S, 39.6E, MLAT: 70.5S). Simultaneous data at these stations are available for total 48 days during December 10-14, 2012, January 9-19 and January 29-February 5, 2013, and February 26-March 21, 2014.
As an initial analysis, we evaluated the simultaneous wave occurrence rate of ELF/VLF emissions at Athabasca and Kannuslehto, which have about 11 hour differences in MLT. The wave occurrence rate was about 4 % in all available hours of the simultaneous observations. We found that the MLT dependence of simultaneous wave occurrence was basically a superposition of wave occurrence distribution at two stations.
In order to study details of the simultaneous wave occurrence features, we report intense hiss emissions observed at three stations associated with a sudden impulse event with enhancement of solar wind dynamic pressure with northward IMF on January 18, 2013. The hiss emissions were observed at frequencies expanding from below 1 kHz to over 2.5 kHz starting at 1235 UT (1240MLT) at Syowa Station, 1236 UT (1524 MLT) at Kannuslehto, and 1240 UT (0440MLT) at Athabasca during the recovery phase of a weak geomagnetic storm. We compared the timings of wave generation and the increase of magnetic field intensity at these 3 stations. At Syowa station and Kannuslehto, there were no discernible timing differences. At Athabasca, however, the wave was generated 4 minutes after the local magnetic field enhancement.
These results suggest that 4 % of ELF/VLF emissions may have a spatial extent of more than 11 hours. The event suggests that the timing of wave generation and magnetic field variation is not necessarily coincident. In the presentation, we will report statistical results of simultaneous occurrence of ELF/VLF emissions using all three stations.

Keywords: ELF/VLF emissions, Whistler mode wave emission, simultaneous wave occurrence

Local time and seasonal dependence of occurrence rate for the zero-order mode of tweek atmospherics

*Hiroyo Ohya[1], Tohru Araki, Kazuo Shiokawa[2], Yoshizumi Miyoshi[2], Takashi Kikuchi[2]

1.Graduate School of Engineering, Chiba University, 2.Institute for Space-Earth Environmental Research, Nagoya University

Tweek atmospherics are VLF/ELF electromagnetic waves originated from lightning discharges and propagate in the Earth-ionosphere waveguide for long distances. So far, there are few studies for the zeroth-order mode of the tweeks. The preliminary reverse impulse (PRI) electric field of the geomagnetic sudden commencement (SC) is transmitted by the TM0 mode waves propagating at the speed of light in the Earth-ionosphere waveguide (Kikuchi et al., 1978; Kikuchi and Araki, 1979). In this study, we investigate the local time and seasonal dependence of the tweek zero-order mode to understand the characteristics of the zero-order mode. For statistical analysis, we developed the automatic detection procedure for the zero-order mode. In this session, we will discuss the results for the tweek zero-order mode in detail.

Seasonal variation in equatorial plasma mass density in the New Zealand meridian

*Yuki Obana[1], Mayumi Nakata[1], Kazuya Terauchi[1]

1.Department of Engineering Science, Faculty of Engineering, Osaka Electro-Communication University

We present a statistical analysis on the plasma mass density derived from the ULF wave observations by the CRUX magnetometer array. The array consists of magnetometer stations along the 170°E longitude, spanning L-values between 2.2 and 2.8. Using the cross-phase method and an automated procedure for FLR detection, we studied 13 months of observations between March 2013 and March 2014. We found a semi annual variation in plasma density with equinoctial maxima. Similar semi annual variation in electron density was reported by the previous studies. Bouriot et al., 1967 studied whistler data recorded at Poitier (0°E) and showed clear semi annual variation. On the other hand, Park et al., 1978 found unclear semi annual variation from the whistler data recorded at Stanford University (~110°W). The plasmaspheric density may require more specification of longitude. This is the first statistical study of plasma mass density in the New Zealand meridian.

Mapping of the small scale magnetic fluctuations observed by LEO satellites to the equatorial plane of magnetosphere

*Yoshihiro Yokoyama[1], Toshihiko Iyemori[2], Kunihito Nakanishi[1], Tadashi Aoyama[1]

1.Department of Earth and Planetary Sciences, Graduate School of Science, Kyoto University, 2.Data Analysis Center for Geomagnetism and Space Magnetism, Graduate School of Science, Kyoto University

In regions of high-beta (i.e., the plasma sheet and the boundary layer) in the magnetosphere,it can be expected that the plasma behaves as turbulence due to the effects of various plasma instabilities, non-linear development of Alfven waves and so on. Satellites in plasmasheet also have observed the fluctuations in velocity and magnetic field that have the characteristics of fluid turbulence. If the plasma always behaves as turbulence, the distribution and the spectrum become important for understanding phenomena in the magnetosphere. However, it is almost impossible to have sufficient simultaneous satellite observations that could physically cover the huge magnetospheric domain. On the other hand, we confirmed that the magnetic fluctuations over the high-latitude ionosphere observed by low-altitude satellites almost can be regarded as the manifestation of the spatial structure of field aligned currents by using the magnetic data obtained by SWARM satellites during December,2013 when the SWARM satellites flew on nearly the same orbits with slight time separations. In addition, the low-altitude satellites scan wide range on the equatorial plane of the magnetosphere in short time.therefore, by projecting these fluctuations into the equatorial plane of the magnetosphere,i.e., the source regions of Field aligned currents, we try to estimate the distribution and the characteristics of plasma there.
We made statical maps of the amplitude of magnetic fluctuations having period shorter than 8s for both quiet(AE<50nT) and disturbed(AE>50nT)condition. We found that the large amplitude regions exist to the same extent in both conditions. This result suggest that the plasma might behave as turbulence even in quiet condition. In order to examine in more detail, we also calculated the spectral index of these fluctuations.

Keywords: field aligned currents, low altitude satellites, small scale magnetic fluctuations

Seasonal dependence of the plasmaspheric density along the 210MM: Observations in the northern and southern hemispheres

Sakiko Onoue[2], *Hideaki Kawano[1], Teiji Uozumi[3], Boris Shevtsov[4], Sergey Khomutov[4], Igor Poddelskiy[4], Richard Marshall[5], Akimasa Yoshikawa[1], group MAGDAS/CPMN[3]

1.Department of Earth and Planetary Sciences, Faculty of Science, Kyushu University, 2.Department of Earth and Planetary Sciences, School of Science, Kyushu University, 3.International Center for Space Weather Science and Education, Kyushu University, 4.IKIR FEB RAS, Russia, 5.Space Weather Services section, Bureau of Meteorology, Australia

In this paper we have applied the cross-phase method and the amplitude-ratio method to the MAGDAS/CPMN ground-magnetometer pairs MGD-PTK (Magadan and Paratunka, located in the Russian Far East) and CAN-HOB (Canberra and Hobart, located in eastern Australia), both along the 210MM (Magnetic Meridian), and identified FLR (field-line resonance) events.
MGD is located at (53.6, 219.1) magnetic latitude and longitude [deg], and PTK is located at (46.2, 226.2). Their L values are 2.9 and 2.1. CAN is located at (-45.7, 226.6), and HOB is located at (-54.2, 226.5). Their L values are 2.1 and 2.9. We have identified the FLR events by using both visual inspection and an automatic-identification computer code.
Although the MGD and PTK (CAN and HOB) are separated by about seven (nine) degrees in magnetic latitudes, which is larger than the typical separation (about 1-2 degrees) to which the cross-phase and amplitude-ratio methods are efficient, but we could identify more than a hundred FLR events a year from the both station pairs, and the FLR events had a fairly continuous coverage.
In this paper we estimate the plasmaspheric density from thus obtained FLR frequencies, and examine their seasonal dependence. The result suggests a weak, but marginally significant seasonal dependence with maxima in winter and minima in summer for the both hemispheres. More details will be discussed at the presentation.

A new perspective of MI-coupling in auroral zone associated with Pi2 pulsations

*Osuke Saka[1]

1.Office Geophysik

A new perspective of MI coupling in auroral zone proposed in our model includes:
(1). During the substorm onset, the surface waves are excited in the nighttime sector by the K-H instability at the earthward interface of the flow diversion.
(2). The surface waves were coupled to the Alfven waves in the magnetosphere, where a strong wave coupling that leads to FLR was not assumed.
(3). The weakly coupled Alfven waves may not carry field-aligned currents (FAC) from the magnetosphere but generate the convergent electric field regions in the ionosphere by the combined modes of the field line oscillations.
The convergent electric fields produce loop currents in the ionosphere, as well as upward FAC at the center and downward FAC in the peripheral. The FAC system may be sustained directly by the enhanced parallel flows of plasma sheet electrons and their returns. The convergent electric field regions correspond to the westward traveling surge (WTS) in the active auroras.

References:

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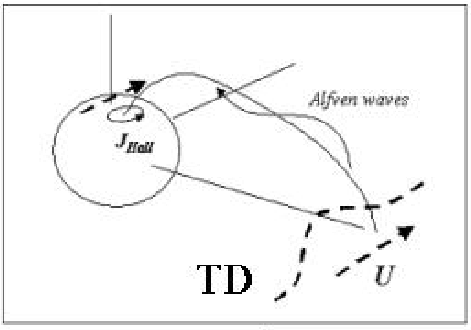
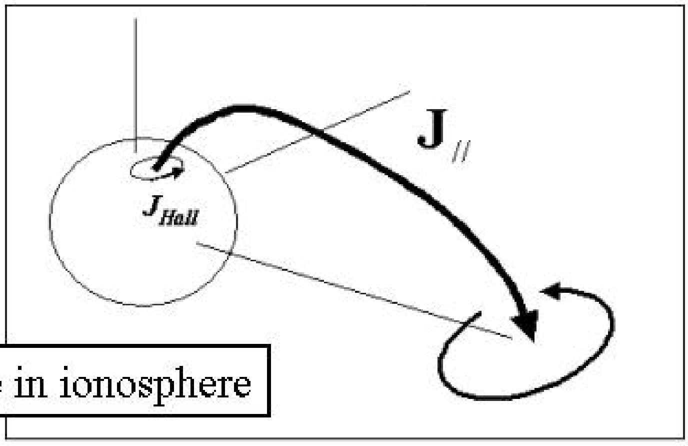
Saka et al., JGR, 2012, 2015
Saka et al., AnnGeo, 2014

Keywords: substorm, MI coupling, Auroras

New perspective of MI coupling associated with Pi2

- Shear flow (U) supported by TD
- K-H instability
- Surface waves





- FAC source in ionosphere

Auroral activity observed during the SC event on June 22 in 2015

*Akira Kadokura[1]

1.National Institute of Polar Research

Auroral activity observed at Syowa Station during the SC event on June 22, 2015 will be analyzed.
Some features of this event are as follows:
(UT)
18:03 Shock arrival at ACE position
18:33 SSC at Kakioka, maximum:+104nT
18:33:30 SC magnetic variation start at Syowa
18:34 Auroral variation appear at lowest horizon
18:40 Poleward expansion of auroral arc
18:40:30 Break of arc, N-S aurora; diffuse spread
19:32 poleward expansion again
19:54 spread from higher latitude to lower latitude
20:30 going back to calm
During this period, following optical instruments were operated at Syowa Station:
- All-sky Monochromatic imagers(427.8,557.7,485.0,480.5nm)
- All-sky panchromatic TV camera
- Multi-color Scanning Photometer
During this period, very bright proton auroral emission over 500 R was observed.
In our presentation, details of temporal variation of auroral activity will be shown..

Keywords: SC event, Shock Aurora, Syowa Station

Conjugate observation of auroral finger-like structures by ground all-sky cameras and the THEMIS sarellite

*Katsuki Nishi[1], Kazuo Shiokawa[1], Erick Donovan[2]

1.Institute for Space-Environmental Research Division for Ionospheric and Magnetospheric Research, 2.Department of Physics and Astronomy, University of Calgary

Aurora dynamics is a manifestation of plasma dynamics in the magnetosphere and auroral emissions are caused by electrons precipitating from the magnetosphere. Investigation of auroral structure helps to deepen our knowledge of dynamical variation of magnetospheric plasma and their connection to the Earth’s atmosphere. We expect that these knowledges will be useful for space developments.

In this study, we observed finger-like structures of aurora using the THEMIS satellites and ground all-sky imagers to investigate physical processes that cause auroral fragmentation. We succeeded the first conjugate observation of auroral finger-like structures with magnetospheric satellites and investigated dynamical variation of magnetospheric plasma.

We searched conjugate ground-satellite events for the interval between October 2007 and December 2014. However, we found only one conjugate event that is observed at Narsarsuaq (MLAT: 69.3) in Greenland at 0720-0830UT (0506-0616LT) on 17 February 2012. Investigation of the event produced following observation facts: plasma pressure and magnetic pressure fluctuate in anti-phase with time scales of 5-20min, parallel electron flux and plasma pressure fluctuate in same time scales, and perpendicular ion velocity is very small (less than 50km/s) during the event.

Keywords: THEMIS, All-sky imager, auroral finger-like structure, magnetosphere

Plasma density enhancements in the period of Pc 2 observed near the plasmapause in association with Pi 2 and auroral breakup

*Tohru Sakurai[1]

1.Tokai University

Plasma density enhancements in the period range of Pc 2 (T = ~ 10 sec) were observed near the plasmapause around midnight in association with Pi 2 oscillations and the initial auroral brightening at 0826 UT on 04 April 2009. During this substorm the THEMIS B satellite took an inbound-pass and crossed the plasmapause, observed extraordinary large plasma density oscillations with the period of Pc 2, which enhanced in close association with Pi 2 oscillations. Enhancements of the Pc 2 oscillations were observed with the magnetic, electric field and plasma instruments on board the satellite. Large amplitude plasma density oscillations well correlated with the electric field oscillations and the polarization of the magnetic field Pc2 oscillations showed a left-hand polarization through the event. Therefore the oscillations seem to be the ion-cyclotron oscillations. Auroral breakup and associated Pi 2 oscillations were observed at the THEMIS GBO stations covering over the wide range longitudes from east to west of the Canada. The dominant period of Pi 2 oscillations was almost similar at both these THEMIS GBO stations and the satellite location. The relationships between the Pc2 enhancements and Pi 2 oscillations will be discussed in the presentation in more detail.

Keywords: substorm, aurora, Pc2 oscillations, Pi2 oscillations, Plasmapause

Ionospheric electric field oscillation associated with Sudden Impulse seen by SuperDARN radars

*Kouhei Iida[1], Nozomu Nishitani[1], Tomoaki Hori[1]

1.Institute for Space-Earth Environmental Research, Nagoya University

Sudden Impulse (SI) is a sudden increase of H-component geomagnetic field often seen at low latitudes. Past studies showed that it is caused by a sudden compression of the magnetosphere associated with rapid increases of the solar wind dynamic pressure. At middle and high latitude, SIs cause some kind of perturbation in twin vortex type ionospheric currents. It was reported that the disturbance of the ionospheric current and the electric field associated with SI consists typically of the Preliminary Impulse (PI) and the Main Impulse (MI). Examining SI-associated flow variations observed by SuperDARN radars in the present study, we find that some of them show only two successive pulses, while some others are accompanied by damped oscillations of the ionospheric electric field lasting for about several tens of minutes to an hour with periods of several minutes, which is consistent with the past geomagnetic field observations of damped oscillations known as Psc’s. However, the cause of this difference is not understood. We examine the cause of the difference between the two kinds of SI events, using SuperDARN radars in north hemisphere covering ~40 to 90 geomagnetic latitudes. From January 2012 to December 2014, 161 SI events were identified and 30 events out of them were accompanied by the ionospheric electric field oscillations as observed by at least one SuperDARN radar immediately following SIs. We have statistically investigated the relation between the ionospheric oscillations after SI and solar wind dynamic pressure. As a result, it is found that presence/absence of ionospheric electric field oscillations do not much depend on solar wind dynamic pressure. We will discuss the MLT dependence, comparison with previous studies of Pc5 pulsations, spatial displacement of the magnetopause and oscillations of the solar wind dynamic pressure as the external factor.

Keywords: SuperDARN, Sudden Impulse, ionospheric electric field oscillation

High-resolution auroral acceleration signatures within a highly dynamic onset arc

*Tetsuo Motoba[1], Masafumi Hirahara[1]

1.Nagoya University

Auroral acceleration processes and structures related to onset auroral arcs remain poorly understood mostly due to the lack of adequate observations. The Reimei spacecraft has so far offered the best possibility to perform detailed high-resolution particle measurements conjugate to detailed fine-scale optical measurements with a small field of view. In this study we present simultaneous conjugate Reimei observations of fine-scale optical and particle signatures of a structured, highly dynamic onset arc that occurred on 16 March 2006. The favorable Reimei observations for the active arc crossing within a few seconds provide a detailed picture of the relationship between the structuring arc emissions and the causal particle acceleration processes.

Keywords: aurora

