Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P01 Room:Convention Hall Time:May 26 18:15-19:30

Magnetic storms during solar 'mini-max'

EBIHARA, Yusuke[1*] ; TANAKA, Takashi[2] ; FOK, Mei-ching[3]

[1]RISH, Kyoto University, [2]Kyushu University, [3]NASA GSFC

Large magnetic storms, such as Dst being less than -100 nT, have rarely been observed during Solar Cycle 24. One of the reasons would be a weak driver in the solar wind. We focus on another possibility; the influence of the solar EUV radiation on the storm intensity. According to the ring current simulation coupled with the ionosphere, the intensity of the ring current becomes high when the background ionospheric conductivity is high. The reason is that the shielding electric field is weak and ions with energy of the order of keV penetrate deep into the inner magnetosphere when the ionospheric conductivity is high. According to the magnetohydrodynamics (MHD) simulation coupled with the ionosphere, the convection electric potential is weak when the background ionospheric conductivity is high. Thus, the ring current is expected to be weak because the keV ions are primarily transported from the near-earth plasma sheet by the convection electric field. This is opposite to that expected from the ring current simulation. We evaluate and discuss the overall influence of the solar radiation on the intensity of the ring current.

Keywords: Magnetic storms, Ring current, Solar Max, Solar radiation, Ionospheric conductivity

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P02 Room:Convention Hall Time:May 26 18:15-19:30

Global MHD simulation of the magnetospheric response of the Bastille day storm

KUBOTA, Yasubumi[1*] ; NAGATSUMA, Tsutomu[1] ; DEN, Mitsue[1] ; TANAKA, Takashi[2] ; FUJITA, Shigeru[3]

[1]NICT, [2]SERC, Kyushu University, [3]Meteorological College

We are developing a real-time numerical simulator for the solar wind-space-magnetosphere-ionosphere coupling system using next a generation magnetosphere-ionosphere coupling global MHD simulation. The feature of simulation has an advanced robustness to strong solar wind case because a triangular grid is used, which is able to calculate in the uniform accuracy over the whole region. The resolution is 7682 grids in the horizontal direction and 240 grids in the radial direction. The inner boundary of the simulation box is set at 2.6 Re. We want to investigate the reproduction of the magnetosphere-ionosphere simulation result in the case of strong solar wind. Therefore we compared the simulation results with the observation of the Bastille day storm event (2000/6/15), in which the solar wind velocity was above 1000 km/s and the value of Bz reached -60 nT. In this lecture, we will report the result compared with AE index, CPCP, and artificial satellites observation.

Keywords: global MHD simulation, magnetosphere, extreme event

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P03 Room:Convention Hall Time:May 26 18:15-19:30

Ionospheric convection enhancement for extremely weak (<1 nT) interplanetary magnetic field

MINOBU, Iwaki[1*] ; KATAOKA, Ryuho[2] ; WATANABE, Masakazu[3] ; FUJITA, Shigeru[4] ; TANAKA, Takashi[3] ; YUKIMATU, Akira sessai[2] ; HOSOKAWA, Keisuke[5] ; GROCOTT, Adrian[6]

[1]Department of earth and planetary sciences, Faculity of sciences, Kyushu University, [2]National institute of polar research SOKENDAI (The Graduate University for Advanced Studies), [3]Graduate School of Sciences, Kyushu University, [4]Meteorological College, Japan Meteorological Agency, [5]Department of Communication Engineering and Informatics, University of Electro-Communications, [6]University of Leicester

It is well known that the north-south component of the interplanetary magnetic field (IMF B_Z) controls the strength of ionospheric two-cell convection. When the IMF is southward, ionospheric convection exhibits the two-cell pattern that is generated by low-latitude dayside reconnection (known as Dungey-type reconnection, after Dungey [1961]). In contrast, when the IMF is northward, the two-cell convection becomes weaker, and the viscous interaction [Axford and Hines, 1961] between magnetosheath flow and magnetospheric flow remains. The viscous interaction is considered to be independent of IMF B_Z. However, Milan [2004] determined the cross polar cap potential as a function of IMF B_Z and obtained a different picture. His results indicated that for northward IMF the cross polar cap potential was on average 25 kV. He concluded that the contribution of the viscous interaction was about 10 kV. He further suggested that the remnant convection for northward IMF was caused by a combination of nightside (tail) reconnection and high-latitude (lobe-cell) reconnection. On the basis of their results, we investigated the ionospheric convection pattern for extremely weak northward IMF using the SuperDARN statistical database established by Grocott et al., [2009]. It is found that for northward IMF, the statistical ionospheric convection shows an enhancement during intervals of weak IMF (B <1nT) compared to intervals of stronger IMF (B >1nT).

In order to elucidate the physical mechanism of the peculiar convection system for weak (<1 nT) IMF, we performed global MHD simulation using the REPPU code developed by T. Tanaka. The simulation reproduced the observed ionospheric convection enhancement for such conditions. The cause of the convection enhancement is explained as follows in terms of the magnetospheric dynamo. At the upper part of the cusp adjacent to the magnetosheath, for strong IMF, there is a strong magnetic pressure region that prevents magnetosheath plasmas from intruding into the cusp. On the other hand, for weak IMF, that high magnetic pressure region disappears, resulting in an increase of the cusp thermal pressure. In consequence, the dynamo region where J • E is negative is formed at the high latitude boundary region with enhanced intensity. The enhanced dynamo makes field-aligned currents and ionospheric convection strong. This mechanism for driving the convection is therefore distinct from the conventional Dungey cycle and viscous interaction.

When the solar activity is extremely weak like the Maunder minimum, it is expected that the IMF also becomes extremely weak. This study therefore contributes to the prediction of magnetospheric phenomena in a grand solar minimum in the future.

Keywords: MHD simulation, severe space weather, M-I convection

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P04 Room:Convention Hall Time:May 26 18:15-19:30

SuperDARN studies on possible grand minimum influences on geospace environment

YUKIMATU, Akira sessai[1*]

[1]NIPR, SOKENDAI, [2]SOKENDAI

The current unusual solar cycle is thought possibly to be the beginning of so-called Grand-Minimum period when solar activity stays at a very low level for a considerably long period. If this is the case, geospace environment (e.g., solar wind energy input and high energy particles distribution) might change largely and consequently resulting in e.g., less frequent storms and substorms, shrunk polar cap and auroral oval and unexpected environmental changes in upper atmosphere or even global climate changes. Such a view is one of the important scientific issues in new SCOSTEP VarSITI program (2014-2018).

SuperDARN HF radar network is a powerful tool to monitor fundamental ionospheric physical parameters to investigate global electric potential maps and the dynamics of ionospheric and magnetospheric plasma convection under a variety of solar wind and magnetospheric/ionospheric conditions.

SuperDARN HF radar network and various ground-based electro-magnetic field/waves and optical instruments at manned and unmanned stations have been deployed in Antarctic region - which are powerful and unique tools to study storms, substorms and M-I (magnetosphere-ionosphere) coupling processes. Using these instrumental setup, the influence of current solar activity changes on storms, substorms and a variety of coupling processes in Earth's geospace environment should be investigated at this opportunity by collaborating with in-situ satellite measurements (e.g., THEMIS, VAP, ERG) and theoretical researches.

How SuperDARN and NIPR Space and Upper Atmospheric Sciences Research Group can contribute to this particular important studies and what can be expected to be done during JARE (Japanese Antarctic Research Expedition) project phase IX period (2016-2022) will be discussed, and how polar cap sizes and cusp latitudes, global convection strength and cross polar cap potential have behaved depending on the past solar cycle activities and under current solar activity will be studied and shown mainly using long term global SuperDARN observation data and influences of possible grand minimum will be discussed.

Keywords: SuperDARN, Grand Minimum, low solar activity, polar upper atmosphere, ionospheric convection, cross-region coupling

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P05 Room:Convention Hall Time:May 26 18:15-19:30

Characteristics of equatorial Pc 5 observed by the MAGDAS network under high-speed solar wind conditions

AKIMOTO, Kaisei[1*] ; FUJIMOTO, Akiko[2] ; YOSHIKAWA, Akimasa[1] ; UOZUMI, Teiji[2] ; ABE, Shuji[2]

[1]Department of Earth and Planetary Sciences Graduate school of Sciences Kyushu University, [2]International Center for Space Weather Science and education

While investigating auroral latitude Pc 5 pulsations, Baker et al. (2003) and Mathie and Mann et al. (2001) found that these pulsations have a good correlation with the solar wind flow speed. Also, Mathie and Mann et al. (2000) found that auroral latitude Pc 5 is related to relativistic electron flux variation in the radiation belt. There are many studies about the characteristics of auroral latitude Pc 5, while equatorial Pc 5 received little attention because there are fewer observation points in the equatorial region. So, we investigated the characteristics of equatorial Pc 5 under high-speed solar wind conditions by using the data from dip equator stations of the MAGDAS/CPMN network (Kyushu University) during 2005/01/01 ˜2013/12/31. We found that electron flux enhancement is preceded by an intense activity of Pc 5 at the dayside equatorial MAGDAS stations during 2010/08/24˜2010/08/27. Reeves et al. (2003) showed that different types of relativistic electron flux variation are observed after geomagnetic disturbances such as magnetic storm (i.e. not only increase type but also no-change type and decrease type).We statistically analyzed the dependence of equatorial Pc 5 pulsations on the relativistic electron flux variation.

Keywords: MAGDAS, dip equator, Pc 5

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P06 Room:Convention Hall Time:May 26 18:15-19:30

Prediction of the Auroral Electro jet index from the solar wind

YAMAMOTO, Ryota[1*] ; MIYOSHI, Yoshizumi[1] ; MIYASHITA, Yukinaga[1] ; MACHIDA, Shinobu[1]

[1]STEL, [2]Nagoya Univ.

The auroral electrojet indices (AU, AL, AE) are a proxy of substorm as well as the auroral activity. The prediction of the these indices is important for the space weather forecast, because we can understand the basic mechanisms of the development of space environment, which may reduce possible space hazards. In this study, we develop a code to calculate the time variations of the AU and AL indices using the solar wind parameters based on the algorithm proposed by Goertz et al.(1993). Using the ACE measured solar wind data, we calculate the long-time variations of the AU index from 2000 to 2008. In order to evaluate the performance of the model, we calculate the skill score for each year. The largest skill score is found to be about 0.8. In this presentation, we report details of our code and how to improve the performance of the model, which has a strong dependence on the solar wind structure.

Keywords: AU index, AE index, AL index, Space weather

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P07 Room:Convention Hall Time:May 26 18:15-19:30

Analyzing the influence of the solar wind on climate during 1900-20014 using correlation maps

ITOH, Kiminori[1*] ; KAWANO, Shoh[1]

[1]Yokohama National University

We are examining the relation between geomagnetic disturbance indices (aa index, in particular) and surface temperatures as well as teleconnection patterns (Arctic Oscillation, Pacific Decadal Oscillation, etc.) by using correlation maps (spatial distribution of correlation coefficient) to investigate influence of the solar wind on climate.

Stratification based on the phase of the QBO (Quasi-biennial oscillation at equatorial stratosphere) is essentially important, but reliable data are available only after 1942. There is a report, however, showing QBO phases from 1900 which we utilized here although its reliability may not be very high.

We observed also for the period 1900-2014 that the correlation maps for the aa vs Ts are similar to those for the teleconnection pattern indices vs Ts (cf. Fig. 1). Thus, the solar wind appears to influence on the teleconnection patterns (hence on the climate) throughout the period from 1900. In addition, it was observed that the sign of the correlation changed at around 1930 at the *singular spot*s where high correlation was persistently observed (high negative correlation at central Pacific regions, for instance).

Keywords: solar wind, temperature, teleconnection pattern, Arctic Oscillation, Pacific Decadal Oscillation

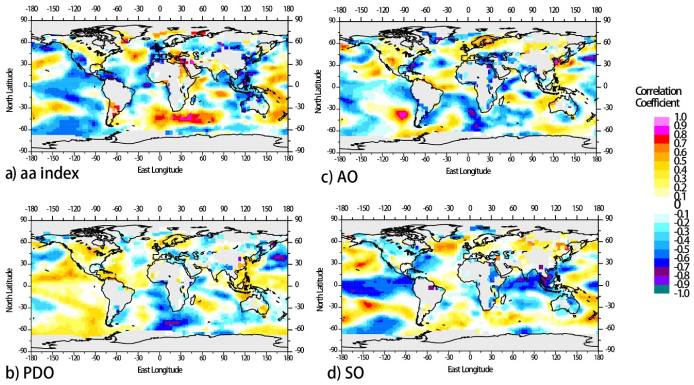

Fig. 1. Correlation maps (1901-1920, January, westerly QBO). a) aa index, b) PDO (Pacific Decadal Oscillation), c) AO (Arctic Oscillation), d) SO (Southern Oscillation).

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P08 Room:Convention Hall Time:May 26 18:15-19:30

Influence of solar wind and ozone on the temperatures of the troposphere and stratosphere

YAMASHITA, Kazuyoshi[1*]

[1]YOKOHAMA National University

The correlation between global atmosphere and solar magnetic activity is evident though the cause is not clear. In this presentation, we analyze the influence that solar wind and ozone give to the global atmosphere to examine the cause on the basis of the previous observations [1].

The AE and Dst index data were used to detect the influence of the solar wind on the total ozone and the air temperature change of the troposphere and stratosphere.

In the analysis, the following factors were taken into account: 1)EPP-NOx effects on ozone at low latitudes may be comparable to the effects of solar UV radiation [Callis et al., 2000, 2001; Langematz et al., 2005; Rozanov et al., 2005]. 2) Since the ozone generated at low latitude is conveyed to the pole aria of the winter hemisphere, EPP-NOx has affected the ozone reduction of the pole area.

As the analysis result, showalter stability index which is calculated from the temperature of 500hPa and 850hPa in polar regions correlates with the AE index, Especially QBO is strong the trend at the time of the west wind. This increase in high-energy particles with the solar wind, to reduce the stratospheric ozone polar, it is possible to increase the amount of solar radiation reaching the troposphere, there is a possibility that influence the stability of the atmosphere.

Thus, changes in the stratospheric ozone due to the influence of the solar wind appears to affect the climate of the troposphere.

Reference

[1]K.Itoh, JpGU. 2008-2014

Keywords: solar wind, ozone, tropopause, AE index, Dst index, stability of atmosphere

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P09 Room:Convention Hall Time:May 26 18:15-19:30

Study of process of the generation and disappearance of coronal holes using tracking module

KANO, Ohzora[1*] ; IMADA, Shinsuke[1] ; MACHIDA, Shinobu[1]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University

We have developed the automatic tracking module, which tracks the time variation of coronal holes based on the data from Atmospheric Imaging Assembly (AIA) on board Solar Dynamics Observatory (SDO) satellite and Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) on board two Solar TErrestrial RElations Observatory (STEREO) satellites. We have analyzed the process of the generation and disappearance of coronal holes using the module. The module has four main functions. (1)creating the Mercator map of the sun full, using the data from three satellites. (2)detect the regions of the coronal hole candidates by the intensity threshold. (3)remove the micro region by the size threshold and determine the regions which are tracked. (4)detect the same regions as determined one and track them on the Mercator map.

Because we always observe the sun full, we can track the coronal holes continuously. Therefore, We discuss how a coronal hole generate and how the hole disappear over six months.

Keywords: coronal hole, automatic detection, mercator map

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P10 Room:Convention Hall Time:May 26 18:15-19:30

Reception of real-time solar wind data from DSCOVR and its application

WATARI, Shinichi[1*] ; KUBO, Yuki[1] ; ISHII, Mamoru[1]

[1]National Institute of Information and Communications Technology

DSCOVR (Deep Space Climate Observatory) was successfully launched on February 11, 2015 (UT) from Cape Canaveral, USA. DSCOVR is a successor of NASA scientific mission, ACE (Advanced Composition Explorer) and the first operational mission for space weather. It takes approximately 110 days for DSCOVR to reach the Lagrangian point (L1). DSCOVR provides one-second and one-minute data of three components of magnetic field and three-second and one-minute data of three components of velocity, temperature, and density in near real-time. We will present overview of DSCOVR data and their application, such as identification of regime of solar wind.

Keywords: solar wind, space weather, L1, ACE, DSCOVR

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM07-P11 Room:Convention Hall Time:May 26 18:15-19:30

SCOSTEP-WDS Workshop on Global Data System for the Study of Solar-Terrestrial Variability

WATANABE, Takashi[1*]

[1]ICSU-WDS International Programme Office

This workshop will be held on 28-30 September 2015 at the National Institute of Information and Communications Technology (NICT) at Koganei, Tokyo. The principal objective of the workshop is to stimulate interaction among data providers (WDS members, data centres, data networks, etc.), data scientists, and data-oriented researchers participating in SCOSTEP, which is the Interdisciplinary Body of ICSU promoting a series of international research programs on solar-terrestrial connection. Its current program VarSITI (Variability of the Sun and Its Terrestrial Impact, http://www.varsiti.org/) will strive for international collaboration in data analysis, modelling, and theory to understand how the solar variability affects the Earth's environment in a vast range of time scale, from seconds to billions of years. Long-term preservation and provision of quality-assessed data and information will be common objectives for SCOSTEP and WDS. Development of advanced data systems to enable scientists to perform multidisciplinary data-analysis will be another common target. This workshop will be a remarkable opportunity to initiate close collaboration between SCOSTEP and WDS to promote our data-oriented activities by introducing outcomes from the information technology. Data analysis of selected solar-terrestrial events will be an important component of the workshop also not only to develop the study of solar-terrestrial variability but also to establish a mutual feedback loop between "data users" and data providers. Principal topics of the workshop are: (1) Application of information technologies to mutual data activities, (2) Data systems for VarSITI (data centres, data networks, data analysis systems, etc.), (3) Data analysis (VarSITI Campaign Intervals and others), and (4) Data-oriented collaborations between SCOSTEP and WDS. The registration and abstract submission will be initiated on 1 April 2015. Please visit our Web page http://isds.nict.go.jp/scostep-wds.2015.org/ for further information.

Keywords: ICSU, SCOSTEP, WDS, VarSITI, Data, Workshop