Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM07-P01 Room:Convention Hall Time:May 23 15:30-17:00

Space Weather Activities in Korea Astronomy and Space science Institute

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To meet the growing demands of space weather information in Korea, the Korea Astronomy and Space Science Institute (KASI) has recently established the Korean Space Weather Prediction Center (K-SWPC) and now operates a number of ground facilities: the solar flare telescope, the solar spectroscopy telescope, the sunspot telescope, the solar radio spectrograph, magnetometers, the scintillation monitor, VHF ionospheric coherent scattering radar, and the all-sky imager. About 20 members including scientists, engineers and students are involved in K-SWPC project and contribute to produce variety space weather information in wide area, from the Sun to the Earth ionosphere. Based on the close relationship with space weather user groups, recently K-SWPC start to do space weather forecasting service. To strengthen its capability as a center for space weather forecasting, KASI has reached an agreement with NASA to set up a storage and dissemination center for Solar Dynamics Observatory (SDO) data and an antenna to receive space weather broadcast data from NASA upcoming Radiation Belt Storm Probes (RBSP) mission. In current poster presentation, we briefly introduce the recent progress of KASI space weather activities; extension of ground observation system, construction of space weather database and network, and space weather studies.

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Magnethydrodynamic simulation of reconnection jets and chromospheric evaporation jets

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We reproduce reconnection jets and chromospheric evaporation jets simultaneously in the oblique coronal magnetic field based on a magnetic reconnection model by the two-dimensional MHD simulations. Our simulations include the effects of the thermal conduction and radiative cooling. We assume a steady coronal heating to keep the coronal energy balance. The magnetic reconnection occurs between the oblique coronal magnetic field and the emerged magnetic flux from the convection zone. Firstly, reconnection jets are caused by the magnetic force of the magnetic reconnection. After the reconnection, a steep temperature gradient reaches the chromosphere and chromospheric evaporation jets occur. The characteristics of the reconnection jets and evaporation jets in our simulations are consistent with the theoretical model: (1) The velocities of the reconnection jets and evaporation jets are around Alfven velocity and sound speed respectively. (2) The density of the evaporation jets is higher than that of the reconnection jets. Our results show that magnetic and thermal accelerations occur simultaneously. We compare our results with the the observational characteristics and discuss the magnetic and thermal accelerations.

Keywords: solar coronal jet, MHD simulation

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Relationship between Solar Wind Parameters and Seismic Activities

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Solar wind parameters play significant roles in electromagnetic coupling of the Sun-Earth system. From an earthquake database (called ANSS), we extracted all the earthquake events during the latest entire solar cycle, and analyzed the occurrences of the daytime and nighttime earthquakes as a function of the time difference from the maximum time (Tmax below) of the following three solar wind parameters: the epsilon parameter (reflecting the electromagnetic energy input rate into the magnetosphere), the solar wind dynamic pressure (Pdyn), and the solar wind kinetic energy flux density, rho∗Vswˆ3 (Fkin). We also applied this analysis to the earthquakes with magnitudes 4.0 to 9.9 Richter scale. As a result, we found that, for both epsilon and Pdyn, and for all the above earthquake-magnitude range, the earthquakes occur the most frequently near Tmax, regardless of whether we analyzed the daytime or nighttime earthquakes. At a glance this result is surprising, because the dayside of the earth is closer to the solar wind flow than the nightside; we will discuss the meaning of this result at the meeting. The analysis of Fkin is under way, and the results will also be presented at the meeting.

Acknowledgement
Solar wind parameters were obtained from the Goddard Space Flight Center, NASA via the OMNIWeb Data Explorer and the Space Physics Data Facility. Earthquake events were extracted from the Advanced National Seismic System (ANSS) database.

Keywords: Solar Wind, Solar Wind High Dynamic Pressure, Solar Wind High Input Energy, Solar Wind Kinetic Energy, Earthquake

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Solar cycle dependence of the solar wind control on the geomagnetic activity

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In this study, we examined the correlations between solar wind parameters and geomagnetic indices over solar cycle 23 and 24. The interplanetary magnetic field (IMF) magnitude, B, and the geocentric solar magnetospheric (GSM) By and Bz components, as well the solar wind velocity, Vsw, dynamic pressure, P_{DP}, and calculated epsilon parameter are used to signify the solar wind parameters. In order to understand the control of these parameters over the geomagnetic activity on the Earth, we used the geomagnetic indices from different latitudes represented by PC index for the polar region, AE index for the auroral region, Kp index for middle latitudes and Dst index for low latitudes. The yearly correlation coefficient between these solar wind parameters and geomagnetic indices is calculated with the aim to study the energy transfer process and the solar cycle dependence. The result obtained shows that the response time for energy transfer is increasing with decreasing latitude in which 0 hour for polar region, 1 hour for auroral region, 1 hour for middle latitude and 2 hours for low latitude. The time delay represents the necessary period for current system to build up. The total period required for energy transfer process is less than 1 hour for all the regions except for the low latitudes where the total period is up to 5 hours after response time. As for the solar cycle dependence epsilon is highly correlated during solar minimum and weakly correlated during solar maximum for all the regions except for the low latitudes, where only Vsw shows the same dependence. At the same time, for the polar and auroral regions, Bz component shows a high correlation during solar maximum and a low correlation during solar minimum, meanwhile for the middle latitude region, B and Vsw show high correlations but the correlations have no clear solar cycle dependence. The results obtained explain the solar wind control on the geomagnetic activity at different latitudes by means of the energy transfer along high to low latitudes. More detailed study is required to understand the enquiries of solar wind parameters correlation dependence on solar cycle. The OMNI data were obtained from the GSFC/SPDF OMNIWeb interface at http://omniweb.gsfc.nasa.gov. We also thank N. F. Ness for the ACE magnetic field data, D. McComas for the ACE plasma data and the Danish Meteorological Institute for the PC index data.

Keywords: solar wind parameters, geomagnetic indices, correlation coefficient, energy transfer, response time, solar cycle dependence

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Pitch angle scattering of relativistic electrons by EMIC waves in the inner magnetosphere

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Pitch angle scattering arising from the anomalous cyclotron resonance of left-hand polarized EMIC waves with relativistic electrons contributes to the sharp decrease in relativistic electron flux in the outer radiation belt in the main phase of magnetic-storms. Although we have focused on acceleration mechanism of relativistic electrons by the cyclotron resonance with whistler-mode chorus emissions, we also investigate the loss mechanism of relativistic electron flux by the anomalous cyclotron resonance with EMIC waves in the radiation belts. We perform test particle simulations to reproduce the nonlinear orbits, pitch angle scattering and energy change of relativistic electrons due to the anomalous cyclotron resonance by interacting with left-hand polarized EMIC waves generated in the equatorial region and propagating along the magnetic field line of the mirror magnetic field model. In the simulation, we trace a large number of electrons to verify the effectiveness of EMIC waves on pitch angle scattering of the relativistic electron flux in the Earth's radiation belts.

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Propagation characteristics of lightning whistlers in the Earth's plasmasphere

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Akebono (EXOS-D) satellite as Japanese scientific spacecraft has observed the Earth's plasmasphere for almost 23 years. Lightning whistler is known as one of typical VLF wave phenomena observed by Akebono. When Akebono traversed in the plasmasphere, a series of lightning whistlers were frequently observed by the analogue wideband receiver (WBA) which covers below 15kHz. Recently, we developed an intelligent algorithm to detect lightning whistler from the WBA data. In the present study, we analyzed two typical events representing clear dispersion characteristics of lightning whistlers along the trajectory of Akebono. Event on 20th March, 1991 was observed at latitude from 56.48 degree N to -5.5 degree S and altitude between 2232 km and 7537 km. Another event on 12th July, 1989 was at latitude 45.35 degree N and -33.38 degree S through altitude 1420 km towards 7911 km. These events show systematic tendency so that can be easily concluded whether the wave packets of whistler originated from lightning strikes in the northern hemisphere or southern hemisphere. Event on 20th March, 1991 that observed at 19.13-19.51 UT has about 564 detected whistlers and their dispersion becomes smaller, which suggests the source of whistlers originate from southern hemisphere. Event on 12th July, 1989 has 542 detected whistlers. There is uncommon phenomenon in the event that is exist two tendency of whistler dispersion, that suggests there are two series of lightning whistlers whose sources were located at both hemispheres coincidently. Finally, we roughly estimated the path lengths of these whistlers from source to the observation points along the Akebono trajectory. In the calculation, we assumed dipole model as geomagnetic field and a simple electron density profile in which electron density is inversely proportional to the cube of geocentric distance. The analysis could make sure that the dispersion characteristics of whistlers agree with the path lengths of wave. That is, it was found that dispersion of whistler D is proportional to square of path length S. It is noted that our current estimation is quite simple but this fact shows the residual between our estimation and observation data is mainly due to electron density profile and dispersion analyses of lightning whistlers is useful technique to reconstruct electron density profile in the Earth's plasmashpere.

Keywords: Akebono, Lightning Whistler, Propagation, Dispersion, Plasmasphere, Electron Density

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Multi-technique observation of ionospheric irregularities during disturbed period

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During geo-magnetic disturbed conditions, the ionosphere becomes highly turbulent and small scale (from centimeters to a few kilometers) irregularities, typically enhancements or depletions of the electron density embedded in the ambient ionosphere are formed. In order to investigate the dynamics of plasma density irregularities of different scale sizes, a campaign was carried out during 11 to 15 September 2005 at Gadanki (geog.13.45ˆ0N, 79.17ˆ0E, geomag. 4.44ˆ0N, 151.73ˆ0E), an off-equatorial Indian station. During the campaign, an equatorial spread F event occurred on the night of 15 September 2005 during geomagnetic disturbed period (Dst˜ -86 nT around 1700 UT). The development and dynamics of equatorial ionospheric plasma bubble irregularity on this night are investigated using the data collected by multi-instrument operated at equatorial (Trivandrum, geog. 8.5ˆ0N, 77ˆ0E, dip angle 0.5ˆ0N) and low latitude (Gadanki, 13.45ˆ0N, 79.17ˆ0E, dip angle 12.5ˆ0N and Sriharikota, 140N, 80ˆ0E, dip angle 14ˆ0N) stations using GPS receiver, VHF coherent backscatter radar, and Digisondes. The range type spread F on ionograms and radar plume signatures on range-time-intensity maps from the VHF radar on the same day were observed. Using the GPS receiver, association of the fluctuations in the signal intensity (S4 ˜ 0.36 and 0.39) with the depletions in total electron content (5 and 12 TECU) is seen on the same day which affect the positional accuracy of the GPS by 0.8m and 1.92m. The results of the campaign will be presented.

Keywords: Ionosphere, storm, irregularities