Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PEM028-P01 Room:Convention Hall Time:May 27 10:30-13:00

Relation between activities on the solar surface and solar wind variation

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Various disturbances in geospace are generated by solar activities and solar wind variations. Optiz et al. (2009) compared solar wind velocity measured by STEREO-A and &8211;B probes, and explained the difference in velocity as not only simple time-lag, but also as effects of CME, CIR, and latitudinal gradient of velocity. In this research we add ACE measurement of solar wind parameters, will make more detailed comparison at the solar wind source region with various data on the solar surface, and discuss possible causes of the solar wind variation.

Keywords: disturbance, solar wind, solar surface, time lag, Temporal effect, Spatial effect

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A statistical study of IMF Bz fluctuations during the solar cycle 23

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It is well known that the geomagnetic activity is associated with the direction of the interplanetary magnetic field (IMF) : the southward directed IMF (Bz component) allows solar wind plasmas into the magnetosphere due to the occurrence of the day side reconnection. On the other hand, while it is well known that the intensity of IMF fluctuations is of the same order to that of the ambient IMF, most past studies have not discussed the geoeffectiveness of the fluctuations. In the recent studies, the ”Alfvenic” IMF fluctuations often correspond to the occurrence of the auroral storm. However, it is still unclear why the Alfvenic fluctuations play ab important role in the geomagnetic activity.

In the present study, we statistically discuss the Alfvenic IMF Bz component observed by the ACE spacecraft from February 1998 to December 2009 using the higher order statistics and the Shannon entropy in order to quantify the characteristics of the IMF fluctuations.

Keywords: solar wind turbulence, IMF, Alfvenicity

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Study of Solar Flare Energetic Electrons by Using Synthesized Microwave Emission Based on Fokker-Planck Simulation Resul

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Temporal, spatial and spectral variation of microwave emissions from solar flares are studied by solving the electrons transport in a flare loop and their production of gyro-synchrotron photons. The issue of generation mechanisms of high-energy electrons in flares have been known but have not yet understood for more than decades. In observations, for example, the Nobeyama Radio-heliograph has made clear descriptions on the gyro-synchrotron emissions from them, such as, relative brighter loop-tops than footpoints, and steeper (softer) spectra toward footpoints. These observational results should include information on the phase-space-density of injected electrons and could be used as keys to the acceleration mechanisms. It is, however, not straightforward and is a difficult task since such injection information is strongly modulated through the transport and the emission processes. We study this problem by a ”forward” approach: First, we solve the electron transport Fokker-Planck equation along a flare loop. The dependence of phase-space density on time, space, electrons pitch-angle, and their energy is derived. The pitch-angle scattering by the Coulomb collisions throughout the loop and the electrons loss at both footpoints are included. Second, the gyro-synchrotron emission (assumed optically-thin) is derived from non-isotropic distribution of emitting electrons. We found that: (1) The loop top is relatively brighter than the footpoints. (2) Both footpoints have steeper (softer) spectrum than the loop top. (3) The emission is harder than what is expected from the isotropic electrons.

Keywords: solar flare, acceleration, microwave observations

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Comparison between Inactive BGD spots NOAA9957 and Active BGD spots NOAA10652 by using MDI dopplergram

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The delta type sunspot groups are known to produce very strong flares and to have high flare productivity. In particular,beta-gamma-delta type spots are the strongest type of all.

In solar cycle 23, there are 200 beta-gamma-delta type regions, and 141 regions of them(70.5 %) undergo stronger flares than M1.0. This means the other 59 regions did not show high flare activities. We attention these two groups as control groups.

Active Region NOAA9957 was observed on solar disc from 2002 May 16 to May 28. During observation time NOAA9957 was classified into beta-gamma-delta type region for 10 days, but this region did not show marked flare activity.

Using SOHO-MDI dopplergram data, we detect continuous marked down flow motions at neutral line in this region. For example, a down flow indicates 1500-1700m/s maximum value for several hours. The 300m/s contour includes both magnetic polarities and penumbral area decay and the prominent down flow carry on simultaneously. We are assuming this phenomenon as submergence of the magnetic flux. We also check up the structure of the magnetic field lines with vector magnetogram of Huairou Solar Observing Station.

In addition, we report the result for comparison between high flare activity beta-gamma-delta region NOAA10652 and low flare activity beta-gamma-delta region NOAA9957 for line of sight velocity with SOHO-MDI dopplergram.

Keywords: sun, active region, dopplergram, magnetic flux, down flow motions, submergence

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Numerical simulation of shielding to the relativistic solar cosmic rays by using the dipole magnetic shield

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The solar wind, which is composed of electrons and protons, blows out from the sun into interplanetary space. The high energetic components in the solar wind are so called solar cosmic rays, which energy sometimes approach 108ev. Humankind, who lives in the Earth, had been protected from the harmful cosmic rays by the atmosphere and magnetic field of the Earth. After the middle of 20th century, we widened our sphere of influence to the cosmic space, which is outside the atmosphere and geospace. As a result, we and our civilization are now directly exposed to danger of the cosmic rays. Recently, the experimental and simulation studies were carried out to discuss the usage of magnetic field to shield satellite from cosmic rays effect. However, models and parameters used in the past studies are non-realistic.

In the present study, we numerically discuss the magnetic shield using dipole magnetic field for relativistic solar cosmic rays. The numerical results show that the magnetic dipole moment with the maximum amount of cosmic rays going in the magnetic shield increases with increasing the kinetic energy of particles, while the maximum amount of cosmic rays going in the magnetic shield itself decreases.

Keywords: magnetic shield, solar cosmic ray

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SYNOPTIC VARIATIONS OF THE OCB DURING CIR-DRIVEN EVENTS: ISSUES WITH PC5 PERIODICITIES IN THE SOLAR WIND?

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Synoptic observations of the magnetospheric open-closed field-line boundary [OCB], made by an array of fluxgate magnetometers distributed at high geomagnetic latitudes across Antarctica as part of the PENGUIn-AGO program, were presented in Urban et al. [2011]. Key to that study was the detection, or lack thereof, of Pc5 oscillations on the magnetic field lines. However, a number of observations of Pc5-type frequencies have been observed in the solar wind and question the validity of using synoptic fluxgate observations to determine the OCB. Using ACE data, we show that these discrete periodicities do exist, are likely associated with solar p-modes, and do not impact the results of Urban et al. [2011].

Keywords: open-closed field-line boundary [OCB], Pc5 pulsation at high latitudes, the PENGUIn-AGO program, Pc5-type oscillation in the solar wind, solar p-modes

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Difference between average AKR spectra on dayside and nightside of the moon observed by the KAGUYA spacecraft

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The KAGUYA spacecraft continuously observed natural plasma waves from a lunar orbit during the mission. One of the strongest waves among them is auroral kilometric radiation (AKR) propagating from the earth. In the present study, in order to derive an average AKR spectrum on the lunar orbit, we statistically constructed two-dimensional histograms of the spectrograms, which were obtained by the waveform capture instrument (WFC) onboard the KAGUYA spacecraft, relative to frequency and power. The average AKR spectrum can be derived by contrasting the histograms which are constructed for the farside and near-side of the moon, respectively.

Comparing the average AKR spectra on dayside and nightside of the moon, we found a difference between them. That is, the wave strength below 250 kHz on the dayside is relatively larger than that on the nightside. This result can be explained by (i) localtime difference of the AKR source on the earth or (ii) frequency dependence of reflection condition of the AKR near the lunar surface.

In the case (ii), the difference of the average AKR spectra can be explained by total reflection of the lower frequency waves due to a plasma layer between observation altitude and the lunar surface. The reflection condition is that peak plasma density on the layer is 800 /cc on the assumption of vertical AKR incidence. In case of oblique incidences, the required density becomes smaller.

In the presentation, we would like to discuss possible explanations for the difference between the average AKR spectra.

Keywords: KAGUYA spacecraft, wave observation, auroral kilometric radiation

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Solar radio observation and the database project in Tohoku University

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Planetary Plasma and Atmospheric Research Center of Tohoku University has started continuous observation of solar radio bursts. Non-thermal electrons accelerated in the solar corona emit radio waves in the meter wavelength range. Coronal radio emission phenomena are included in flares and coronal mass ejections, which have a large influence on planetary environments. In addition, coronal particle acceleration and radio emission mechanisms themselves have not been understood well. Therefore, the monitoring observation of solar radio bursts is important for both forecasting planetary environments and understanding solar plasma physics.

Iitate Planetary Radio Telescope (IPRT) is a ground based radio telescope of Tohoku University set at the Iitate observatory in Fukushima prefecture, Japan. A physical aperture of IPRT is 1023 square meter enabling high sensitivity observations. We have newly developed a radio observation system to observe solar radio bursts with high time and frequency resolutions. The developed system enables to observe solar radio bursts in the frequency range between 100 and 500MHz with the minimum detectable sensitivity of better than 0.7SFU under the integration time of 10 ms and the frequency bandwidth of 61KHz. This system also enables to observe left and right polarization components simultaneously. These specifications are suitable for observing metric solar radio bursts and the system is one of the world prominent equipments for solar radio bursts. We have started regular observations of the Sun since September 2009. Many solar radio burst events have been observed until now.

The observation data are disclosed as a part of the Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project. There are two formats in the providing database. One is low-resolution data consisted of standard FITS formatted 8 bits binary data files with 1 sec time resolution and 1 MHz frequency resolution. Users are able to download these data files from our web page. The other one is high-resolution data consisted of 8 or 16 bits binary data files with 10 ms time resolution and 61 kHz frequency resolution. These data files are too large to upload via network so users are asked to log in to the computers of Tohoku University for handling them. We also provide softwares to analyze and visualize the observation data. There are two types of analysis software written in IDL. One is based on TDAS (Themis Data Analysis Software suite) and the other one is based on SSW (SolarSoftWare). Thus, users are able to choose softwares they are more familiar with and start data analysis easily.

Keywords: Sun, radio burst, database, IUGONET