Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM08-P01 Room:Poster Time:May 2 16:15-17:30

Cosmic-ray exposure Space weather information during aircraft operation

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Effects of exposure to cosmic-ray during aircraft operation are divided into exposure of aircrew and operational impact.

International Commision on Radiological Protection (ICRP) issued a recommendation to include occupational exposure of aircrew with a jet operated exposure from natural radiation source in 1990. Radiation Council consists of the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Health, Labour and Welfare, the Ministry of Land, Infrastructure, Transport and Tourism establised Guidelines for management of aircrew exposure to cosmic radiation in 2006. In response to this, airlines keep record of assessed doses on each aircrew using Japanese Internet System for Calculation of Aviation Route Doses (JISCARD-EX) developed by National Institute of Radiological Sciences (NIRS).

Impacts of space weather on aircraft operations can be classified into communications and navigations.

For communicaton, it includes difficulties on HF radio due to Dellinger Phenomenon while flying out of range of VHF coverages as international flight. And also includes difficulties on SATCOM voice communication and Controller Pilot Data Link Communication (CPDLC) in oceanic region.

Modern navigation by Global Navigation Satellite System (GNSS) is becoming mainstream. GNSS are used all phase of aircraft operation during on the ground, depareture, en-route, and approach. Future of operations aim high category precision approach using automatic approach and landing by GNSS even extremely low visibility until stop on runway. Cosmic-ray re-write the data in memory known as soft error on electronic equipment onboard aircrafts.

Use of SpaceWeather forecast, how to provide the information to aircrew and how to make decisions are urgent consideration.

For these problems International Airways VolcanoWatch Operations Group (IAWOPSG) which one of operations group of International Civil Aviation Organization (ICAO) is making draft Concept of Operations (ConOps) for international space weather information in support of international air navigation. Adoption of ConOps is targeted for ICAO/WMO divisional meeting in 2014.

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PEM08-P02 Room:Poster Time:May 2 16:15-17:30

Rdiation exposure management for astronauts

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On the International Space Station (ISS), a habitable artificial satellite that orbits the Earth at an altitude of about 400 km, astronauts receive space radiation exposure 0.5-1.0mSv in one day which is equivalent to what humans on the Earth receive in six months.

The Japan Aerospace Exploration Agency (JAXA) employs radiation exposure management for JAXA astronauts to minimize the health damage caused by space radiation exposure.

Because of we must take action at space environment anomaly, the space environment monitoring and space weather is important information.

In this report, we introduce space radiation exposure management by JAXA.

Keywords: Astronaut, Space radiation exposure

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PEM08-P03 Room:Poster Time:May 2 16:15-17:30

On a new antenna system for reception of real-time solar wind data

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In-situ solar wind data are important for space weather to estimate effects of solar wind disturbances on magnetosphere and ionosphere of the Earth and investigate their solar sources. Since 1997, National Institute of Information and Communications Technology (NICT) contributes reception of real-time solar wind data from Advanced Composition Explorer (ACE), which observes solar wind at L1 point, for 24-hour data coverage. Deep Space Climate Observatory (DSCOVR) following on mission of ACE is plan to be launched in the end of 2014. NICT renews the antenna system, which enables to receive real-time data from DSCOVR. We will report on details of the new antenna system completed in March, 2014 and our application of real-time solar wind data in the presentation.

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

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PEM08-P04 Room:Poster Time:May 2 16:15-17:30

Solar cell degradation of Akebono satellite due to space radiation and effect of temperature variation

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Solar cells on any satellite degrade gradually due to severe space radiation environment. We have analyzed the degradation of the solar cells of the Akebono satellite, and found a fair correlation between the decrease rate of the solar cell output current and the trapped proton flux between 1989 and 1996. The previous studies demonstrated that we can deduce information of proton radiation belt from degradation of solar cells of the Akebono satellite. The relationship cannot be discernible after 1996. The previous studies suggested more prominent temperature effect in the later years because of progress of the degradation. In order to expand studies by using solar cells as a radiation monitor, we must separate exactly the contribution of temperature and of proton radiation. Since the sensor for solar cell temperature failed in 1991 and no temperature is available after 1991, we try to model the temperature variation at solar cells from the temperature of other surface parts. Once we establish the method, we correlate the temperature with solar cell output current and deduce the contribution of proton radiation.

Keywords: Akebono satellite, proton radiation belt

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PEM08-P05 Room:Poster Time:May 2 16:15-17:30

Development of space weather prediction algorithm using big data analysis

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To predict and forecast the occurrence of solar flares and coronal mass ejections automatically without human power is one of the major goals in the space weather forecast research. Many studies have been performed in space weather prediction until today; For example, there are heuristics studies from the correlation of flares and the physical quantity being observed from the shape of the each sunspot. We always have required human power in such studies.

In recent years, the accuracy of the satellite and observation equipment has been increasing with the development of technology. Given that observation data is fast increasing, it is difficult for us to directly survey all data. On the other hand, big data analysis has developed rapidly in the field of information processing technology; Methods of machine learning and processing of unstructured large amounts of data by the parallel/distributed processing have been widely adopted in various fields of science. Therefore, we began to research fully automated flare prediction methods, in aim to utilize entire exhaustively large amount of data available for space weather forecast research. We set our goal to predict the X-ray flux with GOES satellites (Geostationary Operational Environmental Satellite.) More specifically, our goal is to predict the maximum of the X-ray flux from the present to 24 hours in the future.

First, we tried to predict GOES X-ray flux from past data of GOES X-ray flux and magnetic field data (Helioseismic and Magnetic Imager HMI) with SDO (Solar Dynamics Observatory), then evaluated the flare prediction accuracy using HSS (Heidke Skill Score) and TSS (True Skill Statistic) (see figure). Next, we added the extreme ultraviolet data observed with SDO/AIA (Atmospheric Imaging Assembly, wavelength: 193$\mathring{A}$) to the original dataset that consists of HMI and GOES data, and evaluated the flare prediction accuracy in the same way.

The reason for adding the AIA data is twofold. First, flare prediction studies using extreme ultraviolet full-disk image data with SOHO (Solar and Heliospheric Observatory) have revealed that we can construct a good indicator of flare activity of active regions by integrating over only pixels brighter than certain threshold in extreme ultraviolet images (threshold integral). Second, we expected to improve prediction accuracy by adding the AIA data, because magnetic field data cannot capture precursory phenomena of flare occurring in the rim of the sun, while AIA data can.

By our comparison study we found that adding full-disk integral of the AIA images to the data set improve the prediction accuracy, particularly that of X- class flares. In this presentation, we will try flare prediction based on the data set with additional features obtained by preprocessing AIA images, such as the threshold integral values, and report the results. This study is a joint research program with BroadBand Tower, Inc.

Keywords: Space weather, Solar flare, Active region, SDO/AIA, SDO/HMI, GOES

		GOES+MHI	AIA+GOES+MHI
X class Flare	HSS*1	0.209	0.215
	TSS*2	0.551	0.581
M class flare	HSS	0.439	0.402
	TSS	0.500	0.470
C class flare	HSS	0.521	0.542
	TSS	0.627	0.605

*1HSS=Heidke Skill Score

*2TSS=True Skill Statistic

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PEM08-P06 Room:Poster Time:May 2 16:15-17:30

Statistical study on generating factors of white light solar flares

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'White Light Flare' is a flare with enhancement of visible continuum and is mainly associated with energetic flares like GOES X-class flares. But it could not be always observed in energetic flares and recently it is observed in relatively weak flares like GOES C-class flares (Matthews et al. 2003; Hudson et al. 2006). Its occurring mechanism has not been well understood yet and hence a key question remains; "What is needed to enhance white light emission in solar flares?"

In this study, we chose 37 events observed with Hinode/SOT and RHESSI among M- and X-class flares from January 2011 to August 2013. Out of the 37 events, Using running difference images of SOT three continuum bands (red, green, blue), we identified 13 White Light (WL) events. Remaining 24 events are classified into No White Light (NWL) events. We compare these two groups in several parameters (e.g., duration, distance between flare ribbons, and so forth) to find a generating factor of White Light event.

We found the following characteristics of WL events. (1) Most of WL events show a short duration within 20 minutes in GOES soft X-rays. (2) WL events show high (>15MK) temperature and relatively low emission measure at the peak of GOES soft X-rays. (3) The distance between two ribbons in WL events is short as 10arcsec. (4) Assuming the thick-target model, the mean dissipation rate of non-thermal energy in WL events is larger than that of NWL events. (5) WL events do not tend to coincide with CME comparing to NWL. These results indicate that precipitation of large amount of accelerated electrons into a compact area within a short time plays a key role to generate a WL event.

Keywords: solar flare, white light, hinode

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PEM08-P07 Room:Poster Time:May 2 16:15-17:30

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

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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.

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

References
[1]K.Itoh,JpGU 2008-2013

Keywords: troposphere, stratosphere, temperature, ozone, solar wind, geomagnetic activity

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On the influence of the luni-solar oscillation on the climate

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We have demonstrated a close relation between solar wind and regional temperatures, and suggested the participation of the Arctic oscillation. On the other hand, a link between the luni-solar oscillation and the Arctic oscillation has also been suggested [1]. Thus, both the sun and the moon appear to be important climatic factors to consider.

An interesting mechanism was proposed recently for the luni-solar oscillation cycle associated with the population change of the snowshoe hare in Canada [2]; that is, the position of the moon changes the intensity of the ionizing cosmic ray to induce changes in the activity of plants, which results in the changes in the forage quality.

This mechanism suggests a combination between the influences of the sun and the moon on the climate while their mutual independence is also possible. Thus, we try to examine the possible contribution of the luni-solar oscillation for establishing the effect of the solar wind on the climate.

1) Renato Ramos da Silva and Roni Avissar, The impacts of the Luni-Solar oscillation on the Arctic oscillation, Geophys. Res. Lett., VOL. 32, L22703 (2005)

2) Vidar Selås, Linking ’10-year’ herbivore cycles to the lunisolar oscillation: the cosmic ray hypothesis, Oikos, Volume 123, 194?202 (2014)

Keywords: Luni-solar oscillation, Arctic oscillation, Solar wind, Climate