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

PEM006-01 Room:101 Time:May 25 10:45-11:05

Current Status and Future Activiteies of CAWSES-II

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ICSU-SCOSTEP which promoted the STEP program (1990-1997) and the S-RAMP program (STEP-Results, Applications and Modeling Phase, 1998-2002) carried out the first international collaborative research project on CAWSES (Climate And Weather of the Sun-Earth System, 2004-2008) which examined space weather and space climate of sun-earth system in the twenty-first century. ICSU-SCOSTEP successively established an international program of the CAWSES-II (2009-2013) with an aim of significantly enhancing our understanding of the space environment and its impacts on life and society. The main functions of CAWSES-II are to help coordinate international activities in observations, modeling, and applications crucial to achieving this understanding, to involve scientists in both developed and developing countries, and to provide educational opportunities for students of all levels.

CAWSES-II is organized by the four Task Groups and other two Groups.
TG1. What are the solar influences on climate?
TG2. How will geospace respond to an altered climate?
TG3. How does short-term solar variability affect the eospace environment?
TG4. What is the geospace response to variable inputs from the lower atmosphere?
G5. Capacity building
G6. Escience and informatics (Virtual Institute)

For the middle year (2011) of CAWSES-II, we review the current status and will discuss next activities and next action plans.

Keywords: CAWSES-II, Space Weather, Space Climate, Current Status, Next Action Plans, SCOSTEP

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PEM006-02 Room:101 Time:May 25 11:05-11:25

Japan's Contribution to the ISWI

Kiyohumi Yumoto[1*], Takahiro Obara[2], Shinichi Watari[3]

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In February 2010, the International Space Weather Initiative (ISWI) was proposed as a new agenda item to be addressed by the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPOUS), United Nations (UN). The ISWI agenda item was endorsed by the Committee in June 2010 and by the General Assembly in October 2010. The ISWI is governed by a Steering Committee, and being supported by the United Nations, ESA, NASA, JAXA and the International Committee on Global Navigation Satellite Systems.

The objectives of ISWI are to develop the scientific insight necessary to understand the physical relationships inherent in space weather, to reconstruct and forecast near-Earth space weather and to communicate this knowledge to scientists and to the general public. This would be accomplished by (a) continuing to expand and deploy new and existing instrument arrays, following the successful practices of the IHY 2007, (b) promoting data coordination and analysis to develop predictive models using ISWI data from the instrument arrays to improve scientific knowledge and to enable future space weather prediction services and (c) continuing to promote knowledge of heliophysics through training, education and public outreach.

In Japan, the STPP (Solar Terrestrial Physics Program) subcommittee of the Science Council of Japan is participating in ISWI as a follow-on program of the IHY (2006-2009). The Chairman of the STPP subcommittee (Prof. K. Yumoto of Kyushu Univ.) and other members of the subcommittee are moving forward to newly construct Japan's programs of (a) instrument arrays, (b) data coordination and analysis, and (c) training, education and public outreach. Five instrument array programs, i.e., the Continuous H-alpha Imaging Network (CHAIN), the Global Muon Detector Network (GMDN), the Magnetic Data Acquisition System (MAGDAS), the Optical Mesosphere Thermosphere Imagers (OMTIs), and the South-East Asia Low-Latitude Ionosonde Network (SEALION) were already proposed by Dr. S. Ueno and Prof. K. Shibata, Kwasan and Hida Observatories, Kyoto Univ., Prof. K. Munakata, Shinshu Univ., Prof. K. Yumoto, Space Environment Research Center, Kyushu Univ. (SERC), Prof. K. Shiokawa, Solar-Terrestrial Environment Laboratory, Nagoya Univ. (STEL), and Dr. T. Nagatsuma, NiCT, respectively. The existing databases of Solar Wind, Space Environment (satellite measurements), and Geomagnetic Field will be provided by Prof. M. Tokumaru, (STEL), Dr. T. Obara, JAXA, and Prof. T. Iyemori, WDC for Geomagnetism, Kyoto Univ., respectively, to contribute to the data coordination and analysis programs for ISWI in Japan. Public outreach will be carried out through the Network of International Space Environment Services (ISES) of NiCT, (Dr. S. Watari). The ISWI Newsletter is published by SERC, Kyushu Univ. (Prof. K. Yumoto is Publisher and Mr. G. Maeda is Editor) by e-mail and mail. Distribution of the Newsletter to UN Member States is also supported through mailing system of the United Nations, Office for Outer Space Affairs (UNOOSA).

The First 2010 UN/ESA/NASA/ JAXA Workshop on ISWI was held at Helwan, Egypy, during November 06-10, 2010 for the presentation of science results from existing and future distributed observatories and their applications for prediction of space weather. Four Japanese instrument array programs, i.e., CHAIN, GMDN, MAGDAS, and OMTIs, were reported by respective project leaders. They presented their recent activities, and discussed future collaborations with the ISWI attendees of the first ISWI workshop.

In particular, SERC organized the first MAGDAS Session during the ISWI Workshop to realize 'Equal Partnership' of 'instrument provider' and 'instrument hosts'. This is the guiding principle of IHY/ISWI. The objectives of the MAGDAS Session were to frankly exchange information and opinions of MAGDAS members, and to start discussion on how we can accelerate Capacity Building.

Keywords: International Space Weather Initiative (ISWI), Scientific and Technical Subcommittee of the Committee on th, the STPP (Solar Terrestrial Physics Program), First 2010 UN/ESA/NASA/ JAXA Workshop, Capacity Building

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PEM006-03 Room:101 Time:May 25 11:25-11:40

Update on MAGDAS Activities in Africa and Around the Globe during ISWI

Kiyohumi Yumoto[1*], MAGDAS/CPMN Group[1]

[1]SERC, Kyushu University

The Space Environment Research Center (SERC), Kyushu University has deployed the MAGnetic Data Acqusition System (MAGDAS) at 54 stations along the 210- and 96-degree magnetic meridians (MM) and the magnetic Dip equator, and three FM-CW radars along the 210o MM during the International Heliophysical Year (IHY; 2005-2009) and the International Space Weather Initiative (ISWI; 2010-2012) (see http://magdas.serc.kyushu-u.ac.jp/ and http://magdas2.serc.kyushu-u.ac.jp/). The deployment of MAGDAS began in Africa in the Year 2006, with installations along the dip equator in three countries. In 2008, the 96 Deg. MM Chain was established, running from Hermanus to Fayum. In 2010, a major upgrade was performed on the equatorial stations of MAGDAS. The goal of MAGDAS project is to become the most comprehensive ground-based monitoring system of the earth's magnetic field. It does not compete with space-based observation. Rather, this ground-based network complements observation from space. To properly study solar-terrestrial events, data from both are required.

This project intends to get the MAGDAS network fully operational and provide data for studies on space weather. By analyzing these new MAGDAS data, we can perform a real-time monitoring and modeling of the global (e.g. Sq, EEJ) current system and the ambient plasma mass density for understanding the electromagnetic and plasma environment changes in geospace during helio-magnetospheric storms. In order to examine the propagation mechanisms of transient disturbances, i.e., sc/si, Pi 2, and DP2, relations of ionospheric electric and magnetic fields are investigated by analyzing the MAGDAS magnetic data and the Doppler data of our FM-CW ionospheric radar.

In this paper, we will present update on MAGDAS activities in Africa and around the globe, several scientific results obtained by MAGDAS project, and a coordinated near-earth satellite and MAGDAS observations for space weather during ISWI.

Keywords: the MAGnetic Data Acqusition System (MAGDAS), FM-CW radar, the International Heliophysical Year, the International Space Weather Initiative

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PEM006-04 Room:101 Time:May 25 11:40-12:00

IHY to ISWI: Overview of Results from Geomagnetic Field Measurements in Africa Using MAGDAS

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[1]Space Physics Lab, FUTA; NASRDA, Nigeria, [2]SERC, Kyushu Univ, Fukuoka, Japan

From the International Heliophysical Year to International Space Weather Initiative, the Space Environment Research Centre of Kyushu University, Japan, installed 14 units of Magnetic Data Acquisition Systems MAGDAS over Africa. Magnetic records from these 14 stations have been employed in various research efforts to obtained interesting results hitherto unknown. Temporal and continental-spatial variation of Solar quiet daily Sq variation in the three geomagnetic field components H, D and Z have been invetsigated. H field experienced more variation within the equatorial electrojet zone. Day-to-day variability of Sq in H was examined. Twenty four (24) points analysis of numerical harmonic theory is applied to Sq in H, D and Z geomagnetic components in order to extract the amplitudes and the phase angles. A set of normalized percentage harmonics projects the influence of the contributions of each harmonic and the phase angles picture relative timing of their influence. Signature of the Equatorial electrojet over the African sector was identified and examined. The EEJ appear stronger in East than West Africa. Flow gradient do not follow a definite diurnal pattern. There is clear indication that equatorial ionosphere exhibits longitudinal variability. There exists variation in electromagnetic inductive from one station to another. A call is made for continuous deployment of magnetometers in Africa.

Keywords: Geomagnetic, field, Equatorial, Electrojet, MAGDAS, Africa

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PEM006-05 Room:101 Time:May 25 12:00-12:15

Investigating the mid-latitudes extent of the ExB drift phenomenon

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The study investigates the mid-latitude extent of the vertical ExB drift velocities and provides the feasibility of studying this phenomenon using the data from the MAGDAS at Lusaka, Zambia. Over the years our understanding of the vertical ExB drift velocities has improved with better understanding of their dynamics in the equatorial regions where the theory shows that these drift velocities are most prevalent and have the most effect, but more work remains, notably with regard to their extent toward the midlatitude regions. The study provides a comprehensive overview of the mid-latitude vertical ExB drift and suggests approaches to investigating this phenomenon in the mid-latitude sector.

Keywords: midlatitude ionosphere, ExB drift, MAGDAS

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PEM006-06 Room:101 Time:May 25 12:15-12:30

Lithosphere-Atmosphere-Ionosphere Coupling

Katsumi Hattori[1*]

[1]Chiba Univerisity

Electromagnetic phenomena preceding large earthquakes have been reported in various frequency ranges and they are considered as candidates for the short-term precursor. ULF electromagnetic phenomena and Ionospheric anomalous changes such as GPS-TEC (Total Electron Content) are one of the most promising phenomena and they are the possible indices to monitor/forecast future crustal activities. Therefore, ULF geoelectromagnetic activities and Ionsopheric changes associated with large earthquakes in Asia in this study. So far, empirical detectable distance of earthquake-related ULF anomalies is about 60 km for M6 and 100 km for M7 earthquake, respectively. For TEC anomaly, significant decreases have been reported for M>5 Taiwan earthquakes. The purpose of this study is to evaluate the reported results in Indonesia and Taiwan based on observation because they are one of the most seismically active regions in the world. We believe that our results also provide a new knowledge to upper atmosphere physics in the point view of ”Lithosphere-Atmosphere-Ionosphere Coupling”.

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PEM006-07 Room:101 Time:May 25 12:30-12:45

RADIATION BELT MEASUREMENTS AND DATA BASE IN JAXA

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In order to monitor space environment and its temporal variations, JAXA (Japan Aerospace Exploration Agency) Space Environment Group has been conducting space environment measurements for more than 20 years. JAXA installed space radiation detectors, magnetometers and plasma detectors on LEO (Low Earth Orbit) satellites, GEO (Geostationary Orbit) satellites, GTO (Geostationary Transfer Orbit) satellites and JEM (Japanese Experimental Module) of the ISS (International Space Station). These space environment data brought by JAXA satellites and International Space Station /Japan Experimental Module (ISS/JEM) have been used in real-time to inform warnings through the SEES (Space Environment & Effects System; http://sees/tksc.jaxa.jp/) to operators of JAXA satellites as well as ISS/JEM when the space environment becomes dangerous. With these data, some distinguish achievements on radiation belt science have been obtained and an assessment of radiation belt models is under taken. Intensity of MeV electrons in the radiation belt (L˜3 to L˜8) increases by the increases of solar wind velocity as well as magnetic activities. We confirmed seasonal variation of outer belt electrons; i.e. in both spring and autumn seasons the intensity of outer belt electrons increases together with magnetic activity. This phenomenon is understood as Russell - McPherron effect. Strong injection or transportation of intermediate energy (40-100keV) electrons into the heart of outer radiation belt was identified during the magnetic storms. These intermediate energy electrons should be seeds of MeV electrons and then accelerated internally. Transport of MeV electrons into the inner radiation belt was identified; i.e. MeV electrons penetrate into the inner radiation belt across the slot region during the recovery phase of the very big magnetic storms. These penetrations will be one of the supply processes of MeV electrons in the inner radiation belt. We also identified intense precipitations of outer belt electrons into the atmosphere by means LEO satellite observations. These losses have been evident during main and recovery phases of the magnetic storms.

Keywords: Radiation Belt, Satellite Observation, Data Base

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PEM006-08 Room:101 Time:May 25 14:15-14:35

Global cooperation in the science of space weather

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The international space science community had recognized the importance of space weather more than a decade ago, which resulted in a number of international collaborative activities such as the Climate and Weather of the Sun Earth System (CAWSES) by SCOSTEP and the International Space Weather Initiative (ISWI). The ISWI program is a continuation of the successful International Heliophysical Year (IHY) program. These programs have brought scientists together to tackle the scientific issues behind space weather. In addition to the vast array of space instruments, ground based instruments have been deployed, which not only filled voids in data coverage, but also inducted young scientists from developing countries into the scientific community. This paper presents a summary of CAWSES and ISWI activities that promote space weather science via complementary approaches in international scientific collaborations, capacity building, and public outreach.

Keywords: Space Weather, ISWI, CAWSES, Capacity building, Gloabal Cooperation

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PEM006-09 Room:101 Time:May 25 14:35-14:50

Program of the Antarctic Syowa MST/IS Radar

Kaoru Sato[1*], Masaki Tsutsumi[2], Toru Sato[3], Takuji Nakamura[2], Akinori Saito[4], Yoshihiro Tomikawa[2], Koji Nishimura[2], Hisao Yamagishi[2], Takashi Yamanouchi[2]

[1]U. Tokyo, [2]National Inst. Polar Res., [3]Kyoto U., [4]Kyoto U.

Syowa Station is one of the distinguished stations, where various atmospheric observations for research purposes by universities and institutes as well as operational observations by Japan Meteorological Agency and National Institute of Information and Communications Technology are performed continuously. National Institute of Polar Research plays a central part in the operations. The observation of the Antarctic atmosphere is important in two senses. First, it is easy to monitor weak signal of the earth climate change because contamination due to human activity is quite low. Second, there are various unique atmospheric phenomena in the Antarctic having strong signals such as katabatic flows, the ozone hole, noctilucent clouds, and auroras. The middle atmosphere is regarded as an important region to connect the troposphere and ionosphere. However, its observation is sparse and retarded in the Antarctic compared with the lower latitude regions; nevertheless the vertical coupling through the mechanisms such as momentum transport by gravity waves is especially important in the polar region.

Since 2000, we have developed an MST/IS radar to be operational in the Antarctic and have made feasibility studies including environmental tests at Syowa Station. Various significant problems have been already solved, such as treatment against low temperature and strong winds, energy saving, weight reduction, and efficient construction method. A current configuration of the planned system is a VHF (47MHz) Doppler pulse radar with an active phased array consisting of 1045 yagis.

The value of the PANSY project has been approved internationally and domestically by resolutions and recommendations from international scientific organizations such as IUGG, URSI, SPARC, SCOSTEP, and SCAR. The scientific research objectives and technical developments have been frequently discussed at international and domestic conferences and at a scientific meeting at NIPR organized by the PANSY group every year. Special and union sessions of PANSY were organized at related scientific societies such as MSJ (Meteorological Society of Japan), SGEPSS (Society of Geomagnetism and Earth, Planetary and Space Sciences) and JpGU (Japan Geophysical Union) to deepen the discussion. The PANSY project was authorized as one of main observation plans for the period of JARE52-57 in 2008, and funded by Japanese government in 2009. We have started the radar construction in late December of 2010. After one year for initial test observations, MST/IS observations will be made over 12 years which covers one solar cycle.

Keywords: Antarctic atmosphere, gravity waves, polar stratospheric clouds, polar mesospheric clouds, atmospheric dynamics, MST/IS radar

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PEM006-10 Room:101 Time:May 25 14:50-15:05

CCM simulation of the effect of solar proton events on middle atmospheric ozone: A case study of July 14-16, 2000 event

Kiyotaka Shibata[1*]

[1]Meteorological Research Institute

Influence of large solar proton events (SPEs) is investigated with the chemistry-climate model of Meteorological Research Institute by imposing ion pair production rate profile in polar caps. An ion pair is assumed to produce 1.25 N atoms, which in turn create 0.55 N(4S) and 0.75 NO. In the case of July 14-16, 2000 SPE, it is found that ozone destruction occurs substantially in the upper stratosphere and lower mesosphere with a maximum of about 10 % at the stratopause in the northern polar cap.

Keywords: solar proton events, middle atmospheric ozone, chemistry-climate model, simulation

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PEM006-11 Room:101 Time:May 25 15:05-15:20

CAWSESII task group 3

Kazunari Shibata[1*]

[1]Kwasan and Hida Observatories, Kyoto U.

The purpose of the task group 3 of CAWSESII is
to answer the question :
How does short-term solar variability affect the geospace environment?
Namely, the space weather science is the central theme of this
task group 3.
Co-Leaders of Task Group 3 are Kazunari Shibata (Kyoto University, Japan) and
Joseph E. Borovsky (Los Alamos National Laboratory, USA).
Recent activity of the task group 3 of CAWSESII will be reviewed.

Keywords: space weather, solar flare

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PEM006-12 Room:101 Time:May 25 15:20-15:40

Vortical Structures in the Magnetosphere and Ionosphere, their Relationships and Effects

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Vortical structures in both the ionosphere and the magnetosphere are signatures of field-aligned currents. The ionosphere supports vortical structures in various forms such as horizontal currents, plasma flows, and optical displays. The magnetosphere is known for vortical plasma flows. In this talk I will present observations from the five THEMIS spacecraft as well as the THEMIS ground network of all-sky imagers and magnetometers to demonstrate relationships and effects of such structures.

Keywords: substorm, storm, vortex, currents, magnetosphere

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PEM006-13 Room:101 Time:May 25 15:40-15:55

CAWSES-II Task Group 4: What is the geospace response to variable inputs from the lower atmosphere?

Kazuo Shiokawa[1*], Jens Oberheide[2], CAWSES-II Task Group 4[3]

[1]STEL, Nagoya Univ., [2]Clemson University, [3]SCOSTEP/CAWSES-II

Studying the geospace response to variable inputs and waves from the lower atmosphere is particularly important since the induced variability competes with the solar and magnetic driving from above. Consequences for telecommunications, re-entry and satellite operations still need to be explored. The extent to which the effects of this quiescent atmospheric variability are transmitted to the magnetosphere is yet to be resolved. We thus stand right now at an exciting research frontier: understanding the cause-and-effect chain that connects tropospheric and strato-/mesospheric variability with geospace processes. CAWSES-II Task Group 4 (TG4) will therefore elucidate the dynamical coupling from the low and middle atmosphere to the geospace including the upper atmosphere, ionosphere, and magnetosphere, for various frequencies and scales, such as gravity waves, tides, and planetary waves, and for equatorial, middle, and high latitudes. Attacking the problem clearly requires asystems approach involving experimentalists, data analysts and modelers from different communities. For that purpose, the most essential part of TG4 is to encourage interactions between atmospheric scientists and plasma scientists on all occasions. TG4 newsletters are distributed to the related scientists every 3-4 months to introduce various activities of atmospheric and ionospheric researches. Five projects are established in TG4, i.e., Project 1: How do atmospheric waves connect tropospheric weather with ITM variability?, Project 2: What is the relation between atmospheric waves and ionospheric instabilities?, Project 3: How do the different types of waves interact as they propagate through the stratosphere to the ionosphere?, Project 4: How do thermospheric disturbances generated by auroral processes interact with the neutral and ionized atmosphere?, and Project 5: How do thunderstorm activities interact with the atmosphere, ionosphere and magnetosphere? Three campaign observations have been carried out in relation to the TG4 activity, i.e, stratospheric sudden warming campaign (January-February, 2010), longitudinal campaign (September 1-November 12, 2010), and CAWSES Tidal Campaign. In this presentation we show the current status and future plan of CAWSES-II TG4 activities of 2009-2013.

Keywords: atmosphere, ionosphere, gravity wave, tide, planetary wave, CAWSES-II

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PEM006-14 Room:101 Time:May 25 15:55-16:15

CAWSES-II TG 4 Longitudinal Network Campaign for investigation of atmosphere ionosphere dynamical coupling

Hisao Takahashi[1*], Jonathan J. Makela[2], Kazuo Shiokawa[3], Jens Oberheide[4]

[1]Instituto Nacional de Pesquisas Espaciai, [2]University of Illinois, [3]Nagoya University, [4]Clemson University

CAWSES-II, Task Group 4 works on the scientific objectives of geospace response to variable waves from the lower atmosphere. As one of the projects of this group, Project 2 focuses in a subject of the relation between atmospheric waves and ionospheric instabilities. In order to investigate it, we proposed to have a longitudinal network observation campaign around the equatorial and low latitude regions. The first tentative campaign has been carried out during the period of September to November (˜75 days), 2010, crossing the September equinox. Ground based Ionosonde, magnetometer, MF radar, VHF radar, meteor radars and some other optical sensors have been used to collect mesosphere ionosphere related data from the different longitudes in a global scale. The campaign overview and some preliminary results will be presented and discussed.

Keywords: CAWSES-II, Task group 4, mesosphere-ionosphere coupling, longitudinal campaign

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PEM006-15 Room:101 Time:May 25 16:30-16:45

Introduction of Various CAWSES-II / Capacity-Building Activities of Japan

Satoru UeNo[1*], Kiyohumi Yumoto[2], Kazuo Makita[3], Kazuoki Munakata[4], Akira Mizuno[5], Toshitaka Tsuda[6]

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In this talk, we introduce various capacity-building activities of Japanese observation-network projects that have been led by Japanese domestic members of CAWSES-II Capacity-building group.

Makita et al. are promoting SARINET project whose objective is the examine the environment of the upper atmosphere in the Geomagnetic Hole (GH) around South America by using imaging Riometers (IRIS) and 1ch Riometers. They have performed cooperative research with Brazilian students of Santa Maria University and technical meetings with related universities.

Munakata et al. are promoting GMDN project in order to identify the precursory decrease of cosmic ray intensity that takes place more than one day prior to the Earth-arrival of shock driven by an interplanetary coronal mass ejection, through the cooperation with USA, Australia, Brazil, Kuwait, Armenia and Germany.

Mizuno et al. are promoting NDACC project that aim to investigate composition's change of middle atmosphere and elucidation of the mechanism by expanding lidar-observation network mainly in Argentina.

Tsuda et al. are promoting "Ground-based Atmosphere Observation Network in Equatorial Asia" in which they are doing internationally collaborated researches on the behavior of the equatorial atmosphere and ionosphere in tropical Asia by using ground-based and satellite observations, so that the scientific North-South problem will be improved.

Keywords: SCOSTEP, CAWSES-II, Capacity Building, ground-based observation network

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PEM006-16 Room:101 Time:May 25 16:45-17:00

Capacity Building of CHAIN and MAGDAS

Kiyohumi Yumoto[1*], Satoru UeNo[2]

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Capacity Building is one of the major goals of the CAWSES-II and IHY/ISWI. In the present paper, we will introduce a good example of Capacity Building of CHAIN and MAGDAS projects. The first one is the Continuous H-alpha Imaging Network (CHAIN) project which is promoted by Kwasan & Hida Observatories of Kyoto University. They are planning to install several Flare Monitoring Telescopes all over the world in order to monitor all explosive solar phenomena continuously, because such solar phenomena are very important sources of perturbations of space weather environment. They already installed the first oversea telescope in Ica University of Peru in March 2010, and they are now preparing to install the 2nd overseas telescope in Algeria. Through the distribution of flare monitoring telescopes, they have performed various international personnel training and academic exchanges. For example, technical training of young Peruvian staff in Japan, guidance of the solar observation method in Peru, some lectures in Peru and Algeria, scientific data-analysis training for Peruvian students and young reserchers in Peru. Moreover, they held last November in Peru a science workshop of solar physics and space weather by using their own data. Such capacity-building activities are surely promoting and spreading solar physics and space weather researches throughout the world. The second example is the MAGnetic Data Acquisition System (MAGDAS) Project conducted by Space Environment Research Center (SERC), Kyushu University. SERC has deployed the MAGDAS at 54 stations along the 210- and 96-degree magnetic meridians (MM) and the magnetic Dip equator, and three FM-CW radars along the 210o MM during 2005-2010 (see http://magdas.serc.kyushu-u.ac.jp/ and http://magdas2.serc.kyushu-u.ac.jp/). The goal of MAGDAS Project is to become the most comprehensive ground-based monitoring system of the earth's magnetic field. By analyzing these new MAGDAS data, we can perform a real-time monitoring and modeling of the ambient plasma mass density and the global current system (e.g. Sq, EEJ) for understanding the plasma and electromagnetic environment changes in geospace and lithosphere during helio-magnetospheric storms. The first MAGDAS school was organized on November 8-9, 2010, Egypt, where 31 persons (mainly MAGDAS hosts from all over the world, but mostly from Africa) delivered 20-minute talks. The general theme of the MAGDAS school is Capacity Building, which consists of three phases: (a) development of instrument capacity, (b) development of data analysis capacity and (c) development of science capacity. Capacity Building is one of the major goals of the IHY/ISWI. Because of MAGDAS hosts, the Space Environment Research Center is able to successfully operate ground observatories all over the world.

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PEM006-17 Room:101 Time:May 25 17:00-17:15

A new muon observation using the SciBar detector in Mexico I: Performance evaluation with a proto-type detector

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We plan to fill a gap existing in viewing directions of the Global Muon Detector Network (GMDN) by adding a new detector at Sierra Negra, a high altitude (4600 m a.s.l.) mountain in Mexico. The detector will be installed primarily for observing solar neutrons, but we plan to use it also as a muon detector. The detector (SciBar) consisting of ˜15000 scintillator strips (2.5x1.3 x 300 cm^3 each) viewed by ˜250 multi-anode photomultipliers is capable for precisely measuring particles produced by various interactions of the primary cosmic rays with the atmospheric nuclei. The detector forms about 130 vertical layers of scintillator strips which are aligned in X or Y direction in each layer alternatively. In order to keep the dead time due to the muon measurement as small as possible, we plan to trigger the muon detection with the 4-fold coincidence between 4 layers forming the top and bottom X-Y pairs and indentify the muon incident direction from X-Y positions in the top and bottom pairs. In this paper, we evaluate the performance of this new muon detector based on the preliminary experiment carried out with a small proto-type detector at Sierra Negra. We also demonstrate performances of this new detector in observing the space weather as an important component of the GMDN.

Keywords: global muon detector network, space weather, galactic cosmic rays

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PEM006-18 Room:101 Time:May 25 17:15-17:30

Equatorial Electrodynamics in the Asian Sector During the 2009 Stratospheric Sudden Warming

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Using observations of the TEC, NmF2 and EEJ from the ground network in south-east asia, the Equatorial Ionization Anomaly (EIA) and related electrodynamics in this longitude sector are examined during the period of stratospheric sudden warming in January 2009. Plasma density and neutral density from the CHAMP satellite are also employed to investigate the neutral background and possible longitudinal variability. The analysis reveals the following features. 1. The EIA indicated by both the TEC and NmF2 was seen to experience a semi-diurnal perturbation, with strong enhancement around 09 LT and significant weakening in the afternoon around 15 LT. This perturbation was consistent with that seen in the EEJ with strong counter electrojet developed in the afternoon during the same period. 2. Strong hemispheric asymmetry occur in the afternoon sector, with the plasma depletion in the northern EIA crest being 3 times of that in the southern crest. 3. Significant longitudinal difference was observed in the plasma density variation around 15 LT, with stronger depletion in the American sector than in the Asian sector. 4. Neutral density around 350 km was found to decrease by about 30% in the equatorial region, indicating overall cooling effects in the equatorial region associated with the warming in the polar region. It also demonstrates that the plasma density response in the EIA region may likely evolve chemical changes in the neutral background, in addition to electrodynamical processes.

Keywords: equatorial electrodynamics, equatorial electrojet, stratospheric warming, neutral-plasma interaction

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

PEM006-19 Room:101 Time:May 25 17:30-17:45

SuperDARN Hokkaido radar: present status and future perspectives

Nozomu Nishitani[1*], Takashi Kikuchi[1], Tadahiko Ogawa[2]

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Super Dual Auroral Radar Network (SuperDARN) is a powerful tool for studying magnetosphere-ionosphere-thermosphere coupling with various spatial temporal scales. Recent deployment of mid-latitude SuperDARN radars such as Wallops, Hokkaido, Blackstone, Kansas East / West, Falkland Islands and Oregon East / West has made it possible to study a great variety of processes at subauroral and mid latitudes as well as auroral latitudes. In this paper we will present overview of the SuperDARN Hokkaido radar, which is the 2nd mid-latitude SuperDARN radar and the only one in the Asian region. The SuperDARN Hokkaido radar began operation in November 2006, and has been working for more than 4 years. In the presentation we will show main scientific results using the radar, ranging from the magnetosphere, ionosphere to the thermosphere and upper mesosphere at mid- and subauroral latitudes. We will also present future perspectives, including plans of building a new radar in Hokkaido, covering the region to the west of the present Hokkaido radar FOV and adjacent to FOVs of Russian SuperDARN radars recently funded.

Keywords: SuperDARN, Hokkaido HF radar, mid-latitude ionosphere, inner magnetosphere, international collaboration, dynamics of geospace

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PEM006-20 Room:101 Time:May 25 17:45-18:00

Report of the STEL optical observation at the Tromsoe EISCAT radar site by March 2011

Shin-ichiro Oyama[1]*, Satonori Nozawa[1], Ryoichi Fujii[1], Kazuo Shiokawa[1], Yuichi Otsuka[1], Takuo Tsuda[1]

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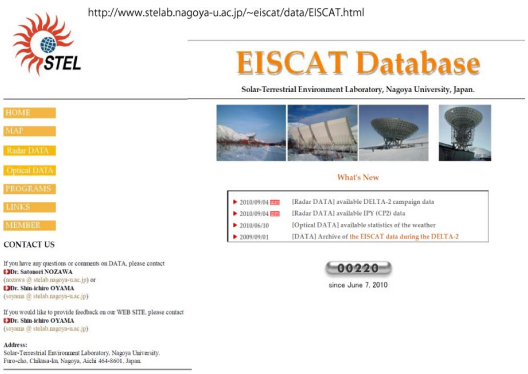
Solar-Terrestrial Environment Laboratory (STEL) has operated various kinds of optical instruments for more than 10 years at the Tromsoe EISCAT (European Incoherent Scatter) radar site in Norway (69.6^{o}N, 19.2^{o}E), which is one of the state-of-art observatories at high latitudes. Five instruments are now in automatic operation regularly from October to March: (1) four-wavelength photometer (427.8 nm, 630.0 nm, 557.7 nm, and 844.6 nm), which is fixed to look along the magnetic field line, (2) digital camera for monitoring the weather condition and the auroral morphology, (3) proton all-sky camera (486.1 nm), (4) multi-wavelength all-sky camera (557.7 nm, 630.0 nm, OH band, 589.3 nm, 572.5 nm, and 732.0 nm), and (5) Fabry-Perot interferometer (557.7 nm, 630.0 nm, and 732.0 nm). While these instruments are programmatically operated, they have contributed to many campaign observations with the EISCAT radars, rockets, satellites, and other ground-based instruments. The quick looks are available on the web at www.stelab.nagoya-u.ac.jp/~eiscat/data/EISCAT.html. This paper reports activity of the optical instruments including the data archive and notable events during some Japanese special programs of the EISCAT radar.



Keywords: aurora, airglow, optical instrument, ionosphere, thermosphere, high latitude

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

PEM006-21 Room:101 Time:May 25 18:00-18:15

Cosmic noise absorption at Kakioka and Brazil by using imaging riometer during quiet period

Kazuo Makita[1*], Yoshimasa Tanaka[2], Hiroyasu Tadokoro[2]

[1]Takushoku University, [2]National Institute of Polar Research

During geomagnetic very quiet period(1 day Sum Kp $<$ 4), cosmic noise absorption(CNA) are sometimes observed at Brazilian geomagnetic anomaly region. We compared such CNA events with imaging riometer (IRIS) data at Kakioka, Japan. It was found that similar CNA events are observed at both places with time lag about +,-12hrs. CNA shows stripe structure similar to Traveling Ionosphere disturbance (TID). We also examined low altitude NOAA particle data. But there is no clear particle precipitation in this time.

These CNA are observed around 9h or 21h local time. If the CNA source region are stably exist during more than 10hours in both hemispheres, similar CNA at two points will be observed. However, we do not know what kind of such stable source is. We will check again IRIS data/analysis method and also examine possible stable source.

Keywords: cosmic noise absorption, imaging riometer, geomagnetic anomaly

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

PEM006-22 Room:101 Time:May 25 18:15-18:30

NICT's Space Weather Observation Networks -Next 5 Years-

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[1]NICT

We are operating space weather monitoring networks (NICT-SWM) as a research project for measurements of solar-terrestrial environment and space weather prediction. The magnetometer and HF radar networks are running in the arctic region and Japanese meridional sector for monitoring energy flow from the magnetosphere to the polar ionosphere, and propagation of disturbances from the polar to the equator. Solar and solar wind activity, and ionospheric activity over Japan is monitored by domestic ground-based observatories and satellite data receiving facilities. Equatorial ionospheric disturbances are observed by South East Low Latitude Ionosonde Network (SEALION). From April 2011, NICT newly start the 3rd medium-term plan. In this period, our capabilities of space weather monitoring will be expanded based on the international collaborations around Asia-Oceania region. We plan to construct an early warning system of equatorial plasma bubbles, and plan to construct a prediction model of space environment around geosynchronous orbit based on the collaborations with simulations and informatics. We will introduce current status and next 5 years perspective of NICT's space weather monitoring networks.

Japan Geoscience Union Meeting 2011
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PEM006-P01 Room:Convention Hall Time:May 26 10:30-13:00

Asia VLF/LF wave observation network (AVON) system for monitoring of the lower ionosphere and lightning

Hiroyo Ohya[1*], Kozo Yamashita[2], Fuminori Tsuchiya[2], Yukihiro Takahashi[3], Kazuo Shiokawa[4], Yoshizumi Miyoshi[4], Hiroyuki Nakata[1]

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We explain the scientific goals and instrumentations of Asia VLF Observation Network (AVON) system for monitoring the lower ionosphere and lightning. The system consists of three observation sites: Tainan site (23.08N, 120.12E) in Taiwan, Saraburi site (14.53N, 101.03E) in Thailand, and Pontianak site (0.00N, 109.37E) in Indonesia. At each site, we use a monopole antenna and a dipole antenna for the electric field measurements and an orthogonal loop antenna for the magnetic field measurements. The signals detected through these antennas are split into three PCs and used for the monitoring of broadband lightning atmospherics (0.1-40.0 kHz), tweek atmospherics (0.1 ? 10.0 kHz), and transmitter signals (40.0 and 60.0 kHz etc). Analyzing the VLF/LF data obtained at three sites, we can monitor the lower ionosphere and lightning in Southeast Asia. This network system is utilized in cooperation with other ground-based and satellite-based observation projects to clarify the meteorological aspects of lightning activity and their effects on the middle/upper atmosphere, ionosphere, and magnetosphere. In the presentation, we introduce the AVON system and show the initial results.

Japan Geoscience Union Meeting 2011
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PEM006-P02 Room:Convention Hall Time:May 26 10:30-13:00

Loss of high-energy electrons into the atmosphere during the magnetic storm and substorm

Fuminori Tsuchiya[1*], Akira Morioka[1], Hiroaki Misawa[1], Yoshizumi Miyoshi[2], Kazuo Shiokawa[2], Takashi Kikuchi[2], Yasunobu Ogawa[3]

[1]Tohoku University, [2]STEL, Nagoya University, [3]NIPR

Man-made VLF/LF radio wave observation at Ny-Alesund in Norway was used to study precipitations of high-energy (>100keV) electrons into the atmosphere during the geomagnetic storm and substorm. The observation system was installed at the NIPR station on March 2010 and measures transmitter signals operated at UK (60.0 kHz) and Germany (77.5 kHz). During three magnetic storms occurred on 5 Apr., 2 May, and 29 May, strong phase variations in the received signals were detected. Comparison of the phase change with the precipitation electron flux observed by the MEPED instrument onboard the NOAA/POSE satellites above the LF wave propagation paths showed the good correlation between them. It is expected that plasma waves excited in the magnetosphere are responsible for the energetic electron precipitation into the atmosphere through the pitch angle scattering. Therefore, local time distribution of the plasma wave would cause the local time dependence of the electron precipitation region. To investigate this process, local time distribution of the electron precipitation events was examined by using the LF wave observation and was compared with the substorm onset timing. At present, the substorm onset timing was determined by the Kakioka Pi2 and the positive bay observed by low-latitude magnetometers located near the local midnight. In the morning and noon sectors, it is found that onset of the precipitation is delayed ten to several tens minutes from the substorm onset. The delay time is consistent with the drift time of energetic electron with energy of >100 keV. On the other hand, the electron precipitation onset found in the dusk sector occurred at or just before the substorm onset. This implies that different types of plasma waves are responsible for the dependence of the electron precipitation characteristics on local time.

Japan Geoscience Union Meeting 2011
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PEM006-P03 Room:Convention Hall Time:May 26 10:30-13:00

Global thunderstorm activities and OLR, and their dependence on solar cycle

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[1]Hokkaido University, [2]University of Tokyo, [3]Tohoku University

Global ELF observation network, GEON, constructed and operated by Hokkaido University, provides information of each cloud to ground lightning discharge, CG, that is, GPS time, location and energy, as well as Schumann resonance, SR, power, a proxy of global energy proxy of lightning discharge. From the standpoint of the relationship between the effect of solar activity to the climate, lightning activity estimated from the ELF measurement in the frequency range between 1 and 100 Hz and the outgoing longwave Radiation, OLR, an indicator of cloud amount, are examined for their periodicity in the periodic range of about one month. SR power shows about 27 day periodicity in solar maximum years and it becomes elongated toward solar minimum. On the other hand, OLR shows same kind of 27 day periodicity in solar maximum years, but only in the Western Pacific Warm Pool area. Both the spectra of SR and OLR have a peak around 35 days in solar minimum years. The average spectrum of OLR in solar maximum years also shows an enhancement in the range of 50 or 60 days corresponding to the main MJO period. In this paper the relationship between the global lightning distribution based on GEON measurement and OLR are discussed in detail, considering one-month periodicity. Especially synchronization of thunderstorm activity between different longitudes is focused.

Keywords: solar cycle, climate, lightning, thunderstorm, OLR, ELF

Japan Geoscience Union Meeting 2011
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PEM006-P04 Room:Convention Hall Time:May 26 10:30-13:00

Ionospheric heating effects on the polar lower thermospheric wind

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[1]STEL, Nagoya Univ., [2]NIPR

Of vital importance is to qualify significance of the magnetospheric forcing (such as the Joule heating and the ion drag) to the polar lower thermospheric wind dynamics, in order to obtain better understanding of the Magnetosphere-Ionosphere- Thermosphere (MIT) coupling process. Several measurements by Incoherent Scatter (IS) radars and Fabry-Perot Interferometers (FPIs) demonstrated neutral winds with speeds exceeding 300 m/s in the polar lower thermosphere during geomagnetically active intervals. The wind speeds are significantly larger than a typical wind speed (less than 200 m/s). This suggests that the magnetospheric forcing can accelerate the neutral wind. While a number of observations demonstrated relationships between the neutral wind variations and magnetospheric forcing, there are a few studies on examining quantitatively the forcing on the neutral wind based on observational data. A case study determined contributions of the Joule heating and the ion drag on the acceleration of neutral wind at 118 km, and suggested that the Joule heating was a major important factor. At lower heights (below 110 km), however, the heating effects on the neutral wind dynamics are little known. A couple of studies suggest that an anomalous heating on the atmosphere become important for the wind dynamics in the lower heights due to cooling of the heated electrons induced by the Farley-Buneman instability during the strong electric field.

We have investigated such ionospheric heating effects on the wind dynamics at 100-120 km using data obtained with the European Incoherent SCATter (EISCAT) Svalbard Radar (ESR) located in Longyearbyen (78.2N, 16.0E in geographic coordinates, 75.2 in invariant latitude). As a case study, we have determined contributions of the Joule heating, the ion drag, and also the anomalous heating on the neutral wind acceleration at 100–110 km during a strong electric field. The ESR result shows that electron temperatures in the cusp electrojet reach up to about 4000 K. The heat is transferred to the neutral gas by collisions (i.e., cooling of the heated electrons). This anomalous heating effect can be more important at 101–109 km, compared with that at higher altitude. We have found that the anomalous heating effect at 101 km was comparable to the Joule heating effect and occasionally became much more effective. On the other hand the ion drag contribution became less effective. During the strong electric field, at 101 km, the wind speed increase of 60 m/s was found, while the wind speed increase was decreasing with decreasing altitudes. These results suggest that main contributor to the wind acceleration at 101 km would be a total of the anomalous heating and the Joule heating.

Keywords: EISCAT, Polar region, Lower thermosphere, Neutral wind, Ionospheric electric field, Joule heating

Japan Geoscience Union Meeting 2011
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PEM006-P05 Room:Convention Hall Time:May 26 10:30-13:00

Spatial and temporal variations of TEC fluctuations and losses of lock associated with equatorial plasma bubbles

Hayato Kikuchi[1], Hiroyuki Nakata[1*], Takuya Tsugawa[2], Michi Nishioka[3], Yuichi Otsuka[3], Toshiaki Takano[1], Shin Shimakura[1], Kazuo Shiokawa[3], Tadahiko Ogawa[2]

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Equatorial plasma bubbles (EPBs) are depletion of the plasma density in the ionosphere and, inside of EPBs, there are field-aligned irregularities (FAIs) which affects wide-band radio waves. Therefore, EPB causes scintillations on GPS signals because of rapid variations of signal amplitude and phase, and limit the availability of carrier phase measurements. The spatial scale of FAIs that causes the scintillation is determined by Fresnel scale, which is about 2-300 m for GPS signals. This means that loss of phase lock (LOL) on GPS signals is a good proxy for hundred-meter-scale FAIs. It is also widely known that rate of TEC change index (ROTI) enhances around EPBs. Assuming that the altitude of the ionosphere is about 400 km, the velocity of the pierce point of GPS satellites at the ionospheric altitude is approximately 70 m/s around the zenith. ROTI averaged during 5 minutes is a reference of ten-kilometer-scale fluctuations.

In this study, we analyzed LOL and 5-min ROTI to examine the spacial and temporal variations of electron density disturbances associated with EPBs. Examining LOL and ROTI, the developments of two different-scale irregularities are identified. LOL and ROTI data are obtained from GPS data from GPS Earth Observation Network (GEONET) of Japan. From 630-nm airglow images obtained by all-sky imager at Sata, Japan, in 2001, we selected 11 EPBs where the EPBs reach to the geographic latitude of 30 degrees. This is because we compare the distributions of LOL and ROTI determined by GEONET with the airglow imager at Sata whose field of view is 26-34N in geographic latitude.

Both LOL and the enhancement of ROTI were observed in 7 events out of 11 events. The distributions of occurrence of LOLs are approximately in accordance with the depleted region of the airglow intensity, namely the ionospheric electron density. The distribution of the enhancement of ROTI spreads in the vicinities of EPBs, which is wider than that of LOL. The hundred-meter-scale irregularities are distributed within EPBs while the ten-kilometer-scale disturbances are located around EPBs.

In the events associated with LOLs, the kilometer-scale disturbances can be more developed as showing the value of ROTI since there are lacks of observation due to LOL and ROTI would be smaller than the case where there is no lack of observation. In the events without LOL, on the other hand, the fresnel-scale disturbances are not developed enough to cause the scintillation in GPS receivers. The mean values of ROTI in the events associated with LOLs are larger than those not associated with LOLs. Therefore, the kilometer-scale and hundreds-meter-scale disturbances tend to grow and decay simultaneously.

Keywords: Ionosphere, plasma bubble, GPS, loss of lock, TEC, scintillation

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PEM006-P06 Room:Convention Hall Time:May 26 10:30-13:00

Study of equatorial Spread-F with GNU Radio Beacon Receiver (GRBR) network in Asia, Pacific and Africa

Mamoru Yamamoto[1*], Takuya Tsugawa[2], Tsutomu Nagatsuma[2], Yuichi Otsuka[3], Roland Tsunoda[4], Sri Kaloka[5], Le Truong Thanh[6], Ha Duyen Chau[6], Pornchai Supnithi[7], Paul Baki[8]

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Equatorial spread F (ESF) is intense ionospheric irregularity that occurs around the geomagnetic equator. It can cause intense scintillation to satellite-ground communications, and serious error in the GPS measurements. The ESF has been a hot research topic of the equatorial/low-latitude ionosphere for long time. However, its day-to-day variability is not well understood. In the southeast Asian region, Japanese researchers developed a network of ground-based observations with the Equatorial Atmosphere Radar (EAR) of RISH, Kyoto University, the ionosonde network SEALION (SouthEast Asia Low-latitude IOnospheric Network) of NICT, and optical instrument network OMTI (Optical Mesosphere Thermosphere Imager) of STEL, Nagoya University. SRI International deploys a VHF radar, an ionosonde and several satellite beacon receivers on Pacific islands. In addition to these, we are deploying the digital satellite beacon receivers named ”GNU Radio Beacon Receiver (GRBR)” to fulfill observation gaps. The GRBR-TEC with C/NOFS successfully shows longitudinal large-scale wave structure that is in good relationship to the ESF occurrence. In 2010 we further expanded the network in Asia, Pacific, and African regions. In presentation, we review current status of the wide network of GRBR, and achievement from the observations.

Keywords: Equatorial Spread-F, Satellite beacon experiment, Total electron content

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PEM006-P07 Room:Convention Hall Time:May 26 10:30-13:00

Study of impacts of ionospheric irregularities associated with plasma bubbles on GNSS and its day-to-day variability

Susumu Saito[1*], Keisuke Matsunaga[1], Takayuki Yoshihara[1], Kazuaki Hoshinoo[1], Takeyasu Sakai[1], Yuichi Otsuka[2]

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GNSS (Global navigation satellite system) has been widely used for various applications. Ionospheric irregularities are one of the most serious issues that prevent advanced use of GNSS. Plasma bubbles are among those irregularities that have a great impact on GNSS. Characterization of the ionospheric irregularities are demanded by GNSS applications to realize the high level of services with reliability.

For differential GNSS applications, spatial variability of the total electron content (TEC) is most important, because it directly leads to positioning errors and threatens safety. However, it has not been well studied. Scintillation of GNSS signals due to small-scale irregularities is another aspect of plasma bubble's impact on GNSS degrading the quality of signals.

Indeed, importance of the characterization of the ionospheric irregularities in the low latitude regions has been recognized in the GNSS community, especially in the field of air navigation that requires extremely high level of safety.

Electronic Navigation Research Institute (ENRI) is contributing to International Civil Aviation Organization (ICAO) to provide ionospheric information needed by their own applications. ENRI's activities on this issue are (1) ionospheric data (TEC, TEC gradient, and scintillation) collection in the low latitude regions and (2) leading coordination of the ionospheric data collection in the Asia-Pacific region collaborating with ICAO.

At the meeting, these activities of ENRI including the plan of observation network will be presented more in detail. We believe that these studies should be an important part of the CAWSES-II or ISWI activities and that more attentions should be paid to.

Keywords: ionosphere, plasma bubble, observation network, GNSS, space weather application

Japan Geoscience Union Meeting 2011
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PEM006-P08 Room:Convention Hall Time:May 26 10:30-13:00

A New Project for Constructing a Magnetometer Array in Tasmania and New Zealand: A Preliminary Result

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A project for observations of quarter-wave length and higher harmonic modes of field line resonances is planned. In February 2011, we installed a magnetometer in Middlemarch, New Zealand for the first step to develop a magnetometer array in Tasmania and New Zealand region. Some magnetometers have been operated by previous projects in this region and its conjugate point. Coordination of their and our magnetometers will allow us to study spatial structure of quarter-wave and higher harmonic modes of field line resonances. Such results will give some boundary for latest Magnetosphere-Ionosphere coupling models.

Keywords: geomagnetic field, ULF wave, field line resonance, magnetosphere-ionosphere coupling, plasmasphere, magnetosphere

Japan Geoscience Union Meeting 2011
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PEM006-P09 Room:Convention Hall Time:May 26 10:30-13:00

SuperDARN contributions to CAWSES-II

Akira Sessai Yukimatu[1*], Keisuke Hosokawa[2], Tetsuo Motoba[1], Natsuo Sato[1]

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Super Dual Auroral Radar Network (SuperDARN) is an international collaborative HF-radar network originally designed to obtain global large scale two-dimensional polar ionospheric plasma convection patterns in both hemispheres with a temporal resolution of 1 to 2 minutes since 1995. SuperDARN is a powerful tool to be applied to many scientific issues, which can be used not only to deduce dynamics of global large-scale convection patterns, but also to study dynamics of transient meso-scale phenomena like flux transfer events (FTEs), magnetospheric responses to solar wind dynamic pressure like travelling convection vortices (TCVs) and polar cap boundary or open-closed field line boundary (OCB), to detect reconnection sites and to deduce reconnection rates, to study substorms, storms and phenomena related to subauroral regions like sub-auroral polarisation stream (SAPS), to deduce field aligned electric currents (FACs), to study MHD waves in a variety of frequency ranges, and also to study ionospheric irregularities in D-, E-, and F-regions. Moreover, it can be utilised not only to ionospheric researches but also to neutral atmospheric studies, e.g., on atmospheric waves e.g., traveling ionospheric disturbances (TIDs), tides and gravity waves, deducing neutral winds around mesopause region, and also detecting and studying polar mesospheric summer echoes (PMSEs), etc. These days, the fields-of-view (FOVs) of SuperDARN have been expanded to higher latitude (PolarDARN) and mid-latitude (StormDARN) which covers considerable portions of mid- and polar latitudes of earth's ionosphere in both hemispheres and enables us to address much wider ranges of scientific questions (including inner magnetospheric physics). SuperDARN has extensively evolved successfully and has been extremely productive by strong cooperation and competitions within the community and also by collaborative studies with other ground-based and satellite/rocket observations and theoretical research groups.

We present what SuperDARN has done so far and what could not be done by SuperDARN so far, and what SuperDARN will be able to do by recent technical development, e.g., by increasing spatial and temporal resolution and combining with other ground based and satellite observations, and then, discuss how SuperDARN can contribute to CAWSES-II program in terms of the main CAWSES-II themes, especially on the effect of short-term solar variability on the geospace environment (TG3), the geospace response to an altered climate (TG2), and the geospace response to variable inputs from the lower atmosphere.

Keywords: CAWSES-II, SuperDARN, magnetosphere-ionosphere coupling, MLT region dynamics, aurora, neutral winds

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PEM006-P10 Room:Convention Hall Time:May 26 10:30-13:00

Long-term variation of auroral activity at Syowa-Iceland conjugate stations (1)

Akira Kadokura[1*], Natsuo Sato[1]

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Long-term variation of auroral activity at Syowa Station (SYO) (S69.00 deg) in Antarctica and Leirvogur (LRV) (N64.18 deg) in Iceland is investigated. Both SYO and LRV are located at auroral latitudes and in an unique geomagnetically conjugate relationship with each other. Geomagnetic variation data from 1958 and 1966 at LRV and SYO, respectively, are used for this analysis. Using those almost four solar cycle data, similarity and dissimilarity in the solar cycle variation, seasonal variation, and daily variation of geomagnetic activity at those conjugate stations are investigated to understand interhemispheric difference in auroral activity responding to the variation of the solar wind input and solar activity.

Keywords: aurora, magnetic activity, solar activity, long-term variation

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Altitudinal response of global ionosphere to short-period recurrent geomagnetic activity during extreme solar minimum

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The deep solar minimum of solar cycles 23/24 was exceptionally quiet, with sunspot numbers at their lowest in at least 75 years. During this unique solar minimum epoch, however, solar wind high speed streams emanating from near-equatorial coronal holes occurred frequently and are the primary contributor to the continuous geomagnetic activity at the Earth. These conditions enable the isolation of forcing by geomagnetic activity on the preconditioned solar minimum state of the upper atmosphere caused by Corotating Interaction Regions (CIRs). Global observations of vertical electron density profiles by Formosat3/COSMIC provided a unique opportunity to study the altitudinal response of global ionosphere to this recurrent geomagnetic force caused by CIRs during the extreme solar minimum. The results indicate that the topside ionospheric response (above 350 km) appears to be dominated by changes in the plasma temperature and/or scale height and exhibits concurrent enhancements with the oscillations in geomagnetic activity during both day and nighttime. However, the electron density response at altitudes between 200 and 350 km is dominated by changes in the neutral composition and exhibits significant latitudinal, local time, and seasonal variations. The results are discussed in light of equatorward wind perturbations during enhanced geomagnetic activity and summer to winter transequatorial neutral wind patterns.

Keywords: Co-rorating Interaction Regions, recurrent geomagnetic activity, ionosphere, solar minimum