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

PEM006-01 会場:101 時間:5 月 25 日 10:45-11:05

CAWSES-II の活動の現状と将来
Current Status and Future Activiteies of CAWSES-II

荻野 竜樹 [1*]
Tatsuki Ogino[1*]

[1] 名古屋大学太陽地球環境研究所
[1]Solar-Terrestrial Environment Laboratory

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.

キーワード: CAWSES-II, 宇宙天気, 宇宙気候, 活動の現状, 将来計画, SCOSTEP
Keywords: CAWSES-II, Space Weather, Space Climate, Current Status, Next Action Plans, SCOSTEP

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PEM006-02 会場:101 時間:5 月 25 日 11:05-11:25

国際宇宙天気イニシアティブ事業への日本の貢献
Japan's Contribution to the ISWI

湯元 清文 [1*], 小原 隆博 [2], 亘 慎一 [3]
Kiyohumi Yumoto[1*], Takahiro Obara[2], Shinichi Watari[3]

[1] 九州大学宙空環境研究センター, [2] 宇宙航空研究開発機構, [3] 情報通信研究機構
[1]SERC, Kyushu University, [2]Japan Aerospace Exploration Agency, [3]NICT

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 会場:101 時間:5 月 25 日 11:25-11:40

ISWI 事業期間のアフリカと世界における MAGDAS プロジェクト活動の最新情報
Update on MAGDAS Activities in Africa and Around the Globe during ISWI

湯元 清文 [1*], MAGDAS/CPMN グループ [1]
Kiyohumi Yumoto[1*], MAGDAS/CPMN Group[1]

[1] 九州大学宙空環境研究センター
[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 会場:101 時間:5 月 25 日 11:40-12:00

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

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

Rabiu Akeem Babatunde[1*], 湯元 清文 [2]
Akeem Babatunde Rabiu[1*], Kiyohumi Yumoto[2]

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

キーワード: Geomagnetic, field, Equatorial, Electrojet, MAGDAS, Africa
Keywords: Geomagnetic, field, Equatorial, Electrojet, MAGDAS, Africa

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PEM006-05 会場:101 時間:5 月 25 日 12:00-12:15

ExB ドリフト現象の中緯度域への広がりについて
Investigating the mid-latitudes extent of the ExB drift phenomenon

P. Sibanda[1], Nambala F.J.[1*], N. Mwiinga[1], H.V. Mweene[1], 湯元 清文 [2]
P. Sibanda[1], F.J. Nambala[1*], N. Mwiinga[1], H.V. Mweene[1], Kiyohumi Yumoto[2]

[1] ザンビア大学理学部物理学科, [2] 九州大学宙空環境研究センター
[1]Phys. Dept., Natural. Sci., Zambia Univ., [2]SERC, Kyushu Univeristy

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.

キーワード: 中緯度電離圏, ExB ドリフト, MAGDAS
Keywords: midlatitude ionosphere, ExB drift, MAGDAS

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PEM006-06 会場:101 時間:5 月 25 日 12:15-12:30

地圏ー大気圏ー電離圏ー磁気圏結合の解明～アジア地域における地球電磁気変動と地殻変動の関連について～
Lithosphere-Atmosphere-Ionosphere Coupling

服部 克巳 [1*]
Katsumi Hattori[1*]

[1] 千葉大学大学院理学研究科
[1]Chiba Univerisity

近年，地震や火山活動などの地殻活動に関連する様々な電磁気学的な現象が報告されており，従来の弾性学的なパラメータに加えて，地殻活動を予測するためのパラメータとして有効である可能性が極めて高い．なかでも，ULF 帯の電磁場変動と電離圏・大気圏擾乱は有望で，地殻変動をモニタする指標になる可能性がある．そこで，本プロジェクトではアジア地域の（１）ULF 帯電磁場変動と地殻変動の関係および（２）M＞６の地震の前に生じる電離圏電子数 (Total electron Content: TEC) の異常変動についてイベント解析と統計解析を行う。ULF 帯磁場変動ではこれまでに経験的に M6 クラスならば 60km、M7 クラスならば 100km が異常検知距離であることがわかっている。そこで、本プロジェクトでは、地震活動を考慮した観測点の整備（インドネシア）と従来の観測データの解析による検証を実施する。本研究の結果は地圏‐大気圏‐電離圏結合の観点から超高層物理学にも新たな知見を与えると考えている。

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PEM006-07 会場:101 時間:5 月 25 日 12:30-12:45

ＪＡＸＡにおける放射線帯観測とデータベース
RADIATION BELT MEASUREMENTS AND DATA BASE IN JAXA

小原 隆博 [1*]
Takahiro Obara[1*]

[1] 宇宙航空研究開発機構
[1]Japan Aerospace Exploration Agency

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.

キーワード: 放射線帯, 衛星観測, データベース
Keywords: Radiation Belt, Satellite Observation, Data Base

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PEM006-08 会場:101 時間:5 月 25 日 14:15-14:35

Global cooperation in the science of space weather
Global cooperation in the science of space weather

Nat Gopalswamy[1*]
Nat Gopalswamy[1*]

[1]NASA Goddard Space Flight Center
[1]NASA Goddard Space Flight Center

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.

キーワード: Space Weather, ISWI, CAWSES, Capacity building, Gloabal Cooperation
Keywords: Space Weather, ISWI, CAWSES, Capacity building, Gloabal Cooperation

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PEM006-09 会場:101 時間:5 月 25 日 14:35-14:50

南極昭和基地大型大気レーダー計画
Program of the Antarctic Syowa MST/IS Radar

佐藤 薫 [1*], 堤 雅基 [2], 佐藤 亨 [3], 中村 卓司 [2], 齊藤 昭則 [4], 冨川 喜弘 [2], 西村 耕司 [2], 山岸 久雄 [2], 山内 恭 [2]
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] 東大院理, [2] 極地研, [3] 京大院情報, [4] 京大院理
[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.

キーワード: 南極大気, 重力波, 極成層圏雲, 極中間圏雲, 大気力学, 大型大気レーダー
Keywords: Antarctic atmosphere, gravity waves, polar stratospheric clouds, polar mesospheric clouds, atmospheric dynamics, MST/IS radar

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PEM006-10 会場:101 時間:5 月 25 日 14:50-15:05

ソーラ・プロトン・エベントの中層大気オゾンに及ぼす影響の化学-気候モデルによるシミュレーション：2000 年 7 月 14-16 日の事例
CCM simulation of the effect of solar proton events on middle atmospheric ozone: A case study of July 14-16, 2000 event

柴田 清孝 [1*]
Kiyotaka Shibata[1*]

[1] 気象研究所
[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.

キーワード: ソーラ・プロトン・エベント, 中層大気オゾン, 化学-気候モデル, シミュレーション：
Keywords: solar proton events, middle atmospheric ozone, chemistry-climate model, simulation

Japan Geoscience Union Meeting 2011
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PEM006-11 会場:101 時間:5 月 25 日 15:05-15:20

CAWSESII task group 3
CAWSESII task group 3

柴田 一成 [1*]
Kazunari Shibata[1*]

[1] 京都大学理学研究科附属天文台
[1]Kwasan and Hida Observatories, Kyoto U.

CAWSESII のタスクグループ３の目的は、次の問いの答えを見出すことである：
短時間の太陽変動はいかにジオスペース環境に影響を与えるか？
すなわち、本タスクグループ３の主目的は、宇宙天気科学である。
co-leaders は、K. Shibata と J. E. Borovsky。
講演では、本タスクグループ３の１年間の活動報告を行う。

キーワード: 宇宙天気, 太陽フレア
Keywords: space weather, solar flare

Japan Geoscience Union Meeting 2011
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PEM006-12 会場:101 時間:5 月 25 日 15:20-15:40

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

Andreas Keiling[1*]
Andreas Keiling[1*]

[1]University of California-Berkeley
[1]University of California-Berkeley

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.

キーワード: substorm, storm, vortex, currents, magnetosphere
Keywords: substorm, storm, vortex, currents, magnetosphere

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PEM006-13 会場:101 時間:5 月 25 日 15:40-15:55

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

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

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

[1] 名古屋大学太陽地球環境研究所, [2] クレムソン大学, [3]SCOSTEP/CAWSES-II
[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.

キーワード: 大気圏, 電離圏, 大気重力波, 潮汐, プラネタリー波, CAWSES-II
Keywords: atmosphere, ionosphere, gravity wave, tide, planetary wave, CAWSES-II

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PEM006-14 会場:101 時間:5 月 25 日 15:55-16:15

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

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]
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
[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.

キーワード: CAWSES-II, Task group 4, mesosphere-ionosphere coupling, longitudinal campaign
Keywords: CAWSES-II, Task group 4, mesosphere-ionosphere coupling, longitudinal campaign

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PEM006-15 会場:101 時間:5 月 25 日 16:30-16:45

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

上野 悟 [1*], 湯元 清文 [2], 巻田 和男 [3], 宗像 一起 [4], 水野 亮 [5], 津田 敏隆 [6]
Satoru UeNo[1*], Kiyohumi Yumoto[2], Kazuo Makita[3], Kazuoki Munakata[4], Akira Mizuno[5], Toshitaka Tsuda[6]

[1] 京都大学・理・附属天文台, [2] 九州大学・宙空環境研究センター, [3] 拓殖大学・工学部, [4] 信州大学・理学部, [5] 名古屋大学・太陽地球環境研究所, [6] 京都大学・生存圏研究所
[1]Kwasan & Hida Observatories, Kyoto Univ., [2]SERC, Kyushu Univ., [3]Faculty of Engineering,Takushoku Univ., [4]Faculty of Science, Shinshu Univ., [5]STE-Lab. Nagoya Univ., [6]RISH, Kyoto Univ.

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 会場:101 時間:5 月 25 日 16:45-17:00

CHAIN プロジェクトと MAGDAS プロジェクトの能力開発
Capacity Building of CHAIN and MAGDAS

湯元 清文 [1*], 上野 悟 [2]
Kiyohumi Yumoto[1*], Satoru UeNo[2]

[1] 九州大学宙空環境研究センター, [2] 京都大学理学研究科附属花山・飛騨天文台
[1]SERC, Kyushu University, [2]Kwasan & Hida Observatories, Kyoto Unive

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 会場:101 時間:5 月 25 日 17:00-17:15

SciBar 検出器を用いたメキシコ・ミューオン計の新設計画 1 : 小型試験機による観測結果に基づく性能評価
A new muon observation using the SciBar detector in Mexico I: Performance evaluation with a proto-type detector

中野義丈 [1], 鶴指眞李 [1], 宗像 一起 [1*], 加藤千尋 [1], 安江新一 [1], 小財正義 [1], 永井雄也 [2], さこ隆志 [2], 松原豊 [2], 伊藤好孝 [2], 三塚岳 [2], ディエゴ・ロペス [2], 柴田祥一 [3], 小島浩司 [4], 土屋晴文 [5], 渡邉恭子 [6], 小井辰巳 [7]
Y. Nakano[1], M. Tsurusashi[1], Kazuoki Munakata[1*], C. Kato[1], S. Yasue[1], M. Kozai[1], Y. Nagai[2], T. Sako[2], Y. Matsubara[2], Y. Itow[2], G. Mitsuka[2], D. Lopez[2], S. Shibata[3], H. Kojima[4], H. Tsuchiya[5], K. Watanabe[6], T. Koi[7]

[1] 信州大理, [2] 名大 STE 研, [3] 中部大工, [4] 愛知工業大, [5] 理研, [6] 宇宙航空研究開発機構, [7]SLAC 国立加速器研究所
[1]Physics Department, Shinshu University, [2]STE laboratory, Nagoya University, [3]Faculty of Engineering, Chubu University, [4]Aichi Institute of Technology, [5]RIKEN, [6]JAXA, [7]SLAC National Accelerator Laboratory

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.

キーワード: 汎世界的ミューオン計ネットワーク, 宇宙天気, 銀河宇宙線
Keywords: global muon detector network, space weather, galactic cosmic rays

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

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

Liu Huixin[1*], M. Yamamoto[1], T. Tsugaawa[2], Tulrasi Ram[1], Y. Otsuka[3]
Huixin Liu[1*], M. Yamamoto[1], T. Tsugaawa[2], Tulrasi Ram[1], Y. Otsuka[3]

[1] 京都大学生存圏研究所, [2]NICT, [3]Nagoya University
[1]RISH, Kyoto University, [2]NICT, [3]Nagoya University

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

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SuperDARN Hokkaido radar: present status and future perspectives
SuperDARN Hokkaido radar: present status and future perspectives

西谷 望 [1*], 菊池 崇 [1], 小川 忠彦 [2]
Nozomu Nishitani[1*], Takashi Kikuchi[1], Tadahiko Ogawa[2]

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

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.

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

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EISCAT レーダートロムソ観測所における 2011 年 3 月までの STEL 光学観測報告
Report of the STEL optical observation at the Tromsoe EISCAT radar site by March 2011

大山 伸一郎 [1*], 野澤 悟徳 [1], 藤井 良一 [1], 塩川 和夫 [1], 大塚 雄一 [1], 津田 卓雄 [1]
Shin-ichiro Oyama[1*], Satonori Nozawa[1], Ryoichi Fujii[1], Kazuo Shiokawa[1], Yuichi Otsuka[1], Takuo Tsuda[1]

[1] 名古屋大学太陽地球環境研究所
[1]Solar-Terrestrial Environment Laboratory

太陽地球環境研究所（Solar-Terrestrial Environment Laboratory; STEL）は欧州非干渉散乱（European Incoherent Scatter; EISCAT）レーダーが設置されているノルウェーのトロムソ（北緯 69.6^o、東経 19.2^o）で 10 年以上に渡り光学観測を実施してきた。トロムソは主に夜間はオーロラ帯に、昼間はオーロラ帯の赤道側に位置し、欧米・アジア諸国が様々な光学・電波観測装置を設置し、EISCAT レーダーを軸とした国際共同観測研究を展開する世界最大級の観測拠点である。2011 年 1 月現在、我々はトロムソ観測所に以下に述べる 5 台の光学観測装置を設置し、10 月から翌 3 月の約半年間、自動観測とともに共同研究者からの要請に応じた観測モードで運用を行っている。尚、これら光学観測装置以外にナトリウムライダーが 2010 年 10 月から稼働している。これについては別に報告する。

1. 4 波長フォトメータ

1997 年 1 月に最初のキャンペーン観測を実施後、2001 年 10 月に自動運用を開始した本装置は現在 4 つの光学フィルター（427.8 nm, 630.0 nm, 557.7 nm, 844.6 nm）を持ち、20Hz の高速サンプリングが可能な装置である。2010 年 10 月に運用・データの自動処理システムを更新した。常に磁力線方向に固定した観測を行い、EISCAT UHF レーダーの主要観測モードの一つである CP-1 モード（同じく磁力線方向にアンテナ方向を固定した観測）とほぼ完全な時間的・空間的同時性を確保している。

2. 天候・オーロラ観測用デジタルカメラ

対流圏高度の雲の発生状況を把握することは、光学観測データの解析にとって必須事項である。光学フィルターを通した単色画像では判別しにくく、デジタルカメラで撮影されるカラー画像が適している。そこで 2001 年 10 月からデジタルカメラによる自動観測を開始した。撮影画像は天候確認だけでなく、磁力線付近のオーロラ微細構造などオーロラ形態情報の提供も兼ねている。

3. プロトン全天カメラ

2006 年 10 月から自動運用を開始した本装置は、下向き沿磁力線電流の発生領域における電離圏応答を捉えることを目的に設置された。上向き沿磁力線電流の発生領域（オーロラアーク発生領域に相当）に近接するオーロラ発光が弱く、電離圏電子密度が周辺より極端に低い領域には、下向き沿磁力線電流と磁場に垂直な電場が発生すると考えられている。これら電流回路の連続性を維持するために下向き沿磁力線電場が形成され、磁気圏からのプロトン降込みが誘導される結果、プロトン発光（486.1 nm）が期待される。これまでの観測で数例だがこの仮説を裏付ける観測結果が取得されている。

4. 多波長全天カメラ

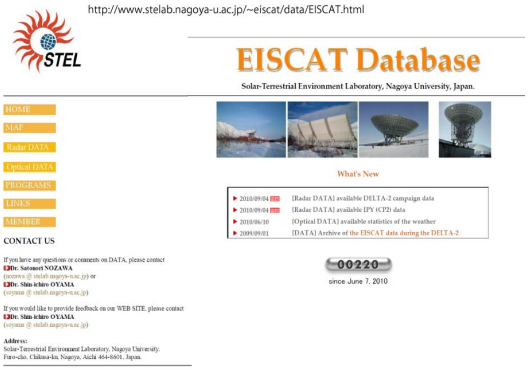
電子降込みによるオーロラ発光や大気光を観測する目的で 2009 年 1 月に設置された本装置は、6 種類の光学フィルターが装着されたホイールを備え、積分時間や観測波長の順番などを任意に設定できる自動観測プログラムによって制御されている。現在保有する光学フィルターの波長は、557.7 nm、630.0 nm、OH バンド、589.3 nm、572.5 nm、732.0 nm である。

5. ファブリペロー干渉計（Fabry-Perot interferometer: FPI）

多波長全天カメラ（上記 4）と同時にトロムソ観測所に設置された本装置は、視野角約 4° の狭視野タイプの装置であり、3 種類の光学フィルターを装着したホイールを持つ。装置上部にはスカイスキャナーと呼ばれる回転モーター付ミラーがあり、観測プログラムでホイールとスカイスキャナーを制御することで、観測波長やその選択順序と積分時間を科学目的に合わせて任意に設定することができる。観測される物理量は中性大気の風速と温度である。

これらの光学観測装置は、EISCAT レーダーをはじめ様々な観測装置との共同観測実験に利用されてきた。最初の装置

が自動観測を始めて以来、稼働期間は太陽活動周期の１サイクルに近く、超高層大気の長期変動研究やイベント解析を行う上で貴重なデータセットが整備された。今後も全装置の自動観測を継続し、間もなく訪れる太陽活動極大期に向けて計画されている様々な観測実験に参画し、国内外の共同研究者の研究活動に寄与していく。これまでに蓄積された観測データのクイックルックはウェブページで公開されている（www.stelab.nagoya-u.ac.jp/~eiscat/data/EISCAT.html）。本発表では、日本の EISCAT 特別実験との同時観測イベントを紹介しながら観測状況を報告する。



キーワード: オーロラ, 大気光, 光学装置, 電離圏, 熱圏, 高緯度
Keywords: aurora, airglow, optical instrument, ionosphere, thermosphere, high latitude

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静穏時に柿岡とブラジルでイメージングリオメータにより観測された宇宙雑音吸収
Cosmic noise absorption at Kakioka and Brazil by using imaging riometer during quiet period

巻田 和男 [1*], 田中 良昌 [2], 田所 裕康 [2]
Kazuo Makita[1*], Yoshimasa Tanaka[2], Hiroyasu Tadokoro[2]

[1] 拓殖大学工学部, [2] 極地研究所
[1]Takushoku University, [2]National Institute of Polar Research

静穏時（Kp の１日の合計が４以下で、それが２日間継続する時のデータを抽出）において、磁気異常帯に位置するブラジルで宇宙雑音吸収現象が見られる日を選び、この時の柿岡のイメージングリオメータとの比較を行った。その結果、ブラジルで見られた吸収現象のおよそ 12 時間前あるいは 12 時間後に似たような吸収現象が柿岡で数例観測された。この吸収現象は縞状の吸収領域を形成しており、以前に報告した Traveling Ionosphere Disturbance(TID) 現象の吸収パターンと似ていた。また、低高度を飛んでいる NOAA 衛星の同時刻の粒子データと比較を行ったが、顕著な降下粒子は見られなかった。

地球の反対側の 2 か所で見られた同じような吸収現象はローカルタイムで 21 時あるいは 9 時頃に起きている。このローカルタイムに長時間ソース源が固定されていると仮定すれば、2 か所での似たような吸収現象は理解出来る。しかし、10 時間以上にわたり、宇宙空間の定まった領域（LT=9h or LT=21）に、しかも南北半球に広がって安定に存在するソース源があり得るのか、もし、あるとすればどのようなものなのか。今後、観測データおよび解析方法に誤りがないかを含め、ソース源についての検討を行っていきたい。

キーワード: 宇宙雑音吸収, イメージングリオメータ, 磁気異常帯
Keywords: cosmic noise absorption, imaging riometer, geomagnetic anomaly

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PEM006-22 会場:101 時間:5 月 25 日 18:15-18:30

NICT の宇宙天気観測ネットワーク　－次の５年－
NICT's Space Weather Observation Networks -Next 5 Years-

長妻 努 [1*], 津川 卓也 [1], 国武 学 [1], 久保 勇樹 [1], 久保田 実 [1], 石橋 弘光 [1], 加藤 久雄 [1], 陣 英克 [1], 坂口 歌織 [1], 亘 慎一 [1], 村田 健史 [1]
Tsutomu Nagatsuma[1*], Takuya Tsugawa[1], Manabu Kunitake[1], Yuki Kubo[1], Minoru Kubota[1], Hiromitsu Ishibashi[1], Hisao Kato[1], Hidekatsu Jin[1], Kaori Sakaguchi[1], Shinichi Watari[1], Ken T. Murata[1]

[1] 情報通信研究機構
[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.

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PEM006-P01 会場:コンベンションホール 時間:5 月 26 日 10:30-13:00

下部電離圏および雷モニタリングのためのアジアVLF/LF波観測ネットワーク（AVON）システム
Asia VLF/LF wave observation network (AVON) system for monitoring of the lower ionosphere and lightning

大矢 浩代 [1*], 山下 幸三 [2], 土屋 史紀 [2], 高橋 幸弘 [3], 塩川 和夫 [4], 三好 由純 [4], 中田 裕之 [1]
Hiroyo Ohya[1*], Kozo Yamashita[2], Fuminori Tsuchiya[2], Yukihiro Takahashi[3], Kazuo Shiokawa[4], Yoshizumi Miyoshi[4], Hiroyuki Nakata[1]

[1] 千葉大学大学院工学研究科, [2] 東北大学大学院理学研究科, [3] 北海道大学大学院理学研究院, [4] 名古屋大学太陽地球環境研究所
[1]Graduate School of Eng., Chiba Univ., [2]Graduate School of Science, Tohoku Univ., [3]Graduate School of Sci., Hokkaido Univ., [4]STE Laboratory, Nagoya Univ.

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.

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磁気嵐・サブストーム時における放射線帯電子の大気降下損失
Loss of high-energy electrons into the atmosphere during the magnetic storm and substorm

土屋 史紀 [1*], 森岡 昭 [1], 三澤 浩昭 [1], 三好 由純 [2], 塩川 和夫 [2], 菊池 崇 [2], 小川 泰信 [3]
Fuminori Tsuchiya[1*], Akira Morioka[1], Hiroaki Misawa[1], Yoshizumi Miyoshi[2], Kazuo Shiokawa[2], Takashi Kikuchi[2], Yasunobu Ogawa[3]

[1] 東北大学, [2] 名古屋大学太陽地球環境研究所, [3] 国立極地研究所
[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.

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全球雷雲活動と OLR 及びそれらの太陽活動依存性
Global thunderstorm activities and OLR, and their dependence on solar cycle

高橋 幸弘 [1*], 佐藤 光輝 [1], 宮原 ひろ子 [2], 星野 直哉 [3], 山下 幸三 [1]
Yukihiro Takahashi[1*], Mitsuteru Sato[1], Hiroko Miyahara[2], Naoya Hoshino[3], Kozo Yamashita[1]

[1] 北海道大学 宇宙理学専攻, [2] 東京大学　宇宙線研究所, [3] 東北大学　地球物理学専攻
[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.

キーワード: 太陽活動, 気候, 雷放電, OLR, ELF
Keywords: solar cycle, climate, lightning, thunderstorm, OLR, ELF

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電離圏加熱現象が極域下部熱圏風へ与える影響
Ionospheric heating effects on the polar lower thermospheric wind

津田 卓雄 [1*], 野澤 悟徳 [1], 大山 伸一郎 [1], 小川 泰信 [2], 藤井 良一 [1]
Takuo Tsuda[1*], Satonori Nozawa[1], Shin-ichiro Oyama[1], Yasunobu Ogawa[2], Ryoichi Fujii[1]

[1] 名古屋大学 太陽地球環境研究所, [2] 極地研究所
[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.

キーワード: EISCAT, 極域, 下部熱圏, 中性風, 電離圏電場, ジュール加熱
Keywords: EISCAT, Polar region, Lower thermosphere, Neutral wind, Ionospheric electric field, Joule heating

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赤道プラズマバブルに伴う TEC 変動・ロック損失の時空間変動
Spatial and temporal variations of TEC fluctuations and losses of lock associated with equatorial plasma bubbles

菊地 隼人 [1], 中田 裕之 [1*], 津川 卓也 [2], 西岡 未知 [3], 大塚 雄一 [3], 鷹野敏明 [1], 島倉 信 [1], 塩川 和夫 [3], 小川 忠彦 [2]
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]

[1] 千葉大学大学院工学研究科, [2] 情報通信研究機構, [3] 名古屋大学太陽地球環境研究所
[1]Graduate School of Eng., Chiba Univ., [2]NICT, [3]STE Lab., Nagoya Univ.

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

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

山本 衛 [1*], 津川 卓也 [2], 長妻 努 [2], 大塚 雄一 [3], Roland Tsunoda[4], Sri Kaloka[5], Le Truong Thanh[6], Ha Duyen Chau[6], Pornchai Supnithi[7], Paul Baki[8]
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]

[1]RISH, Kyoto University, [2]NICT, [3]STEL, Nagoya University, [4]SRI International, [5]LAPAN, Indonesia, [6]HIG, Vietnam, [7]KMITL, Thailand, [8]KPUC, Kenya
[1]RISH, Kyoto University, [2]NICT, [3]STEL, Nagoya University, [4]SRI International, [5]LAPAN, Indonesia, [6]HIG, Vietnam, [7]KMITL, Thailand, [8]KPUC, Kenya

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.

キーワード: 赤道スプレッドＦ, 衛星ビーコン観測, 電離圏全電子数
Keywords: Equatorial Spread-F, Satellite beacon experiment, Total electron content

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プラズマバブルに伴う電離圏不規則構造の衛星航法に対する影響とその発生の日々変動に関する研究
Study of impacts of ionospheric irregularities associated with plasma bubbles on GNSS and its day-to-day variability

斎藤 享 [1*], 松永 圭左 [1], 吉原 貴之 [1], 星野尾 一明 [1], 坂井 丈泰 [1], 大塚 雄一 [2]
Susumu Saito[1*], Keisuke Matsunaga[1], Takayuki Yoshihara[1], Kazuaki Hoshinoo[1], Takeyasu Sakai[1], Yuichi Otsuka[2]

[1] 電子航法研究所, [2] 名古屋大学太陽地球環境研究所
[1]Electronic Navigation Research Institute, [2]STEL, Nagoya University

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.

キーワード: 電離圏, プラズマバブル, 観測ネットワーク, 衛星航法, 宇宙天気利用
Keywords: ionosphere, plasma bubble, observation network, GNSS, space weather application

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タスマニア-ニュージーランド地域における新しい地磁気観測計画：初期解析結果について
A New Project for Constructing a Magnetometer Array in Tasmania and New Zealand: A Preliminary Result

尾花 由紀 [1*], 塩川 和夫 [2], 吉川 顕正 [3], 田中 良昌 [4], 才田 聡子 [5], Frederick. W. Menk[6], Colin. L. Waters[6], Brian. J. Fraser[6], Craig. J. Rodger[7]
Yuki Obana[1*], Kazuo Shiokawa[2], Akimasa Yoshikawa[3], Yoshimasa Tanaka[4], Satoko Saita[5], Frederick. W. Menk[6], Colin. L. Waters[6], Brian. J. Frase[6], Craig. J. Rodger[7]

[1] 大阪電気通信大学工学部基礎理工学科, [2] 名古屋大学太陽地球環境研究所, [3] 九州大学理学研究院地球惑星科学部門, [4] 国立極地研究所, [5] 新領域融合研究センター, [6]The University of Newcastle, [7]The University of Otago
[1]Osaka Electro-Communication University, [2]Nogoya University, [3]Kyushu University, [4]National Institute of Polar Research, [5]The Institute of Statistical Mathematics, [6]The University of Newcastle, [7]The University of Otago

タスマニア-ニュージーランド地域に計画中の、新しい地磁気観測網について、計画の概要を紹介するとともに、初期観測結果を報告する。

観測計画の主たる目的は、磁力線共鳴振動の 1/4 波長モードおよび高調波モードの空間構造を明らかにすることである。太陽風から流入する電磁気エネルギーは電離圏に投影され、磁気嵐時には磁気圏と電離圏の間で巨大な電流系が形成される。磁気圏ー電離圏（M-I）結合系における電磁気エネルギーの入射と伝搬の解明は、重要な課題であり、精力的な研究が行われているところである。従来の M-I 結合モデルでは、電離圏がエネルギー散逸を引き起こす境界条件としてのみ取り扱われ、磁気圏以外の電磁的環境の効果は基本的に無視されてきた。しかし 90 年代後半から、電離圏からのエネルギー変換過程へのフィードバックを積極的に評価する動きが進みつつある。これは理論やシミュレーション研究が先行しており、観測サイドからのサポートは必ずしも十分ではない。

磁力線共鳴振動の諸モードは、現象それ自体が未知の興味深い研究対象であると同時に、 最新の M-I 結合モデルを検証する上での高感度な指標となりうる現象でもある。たとえば観測で得られた磁力線共鳴振動 1/4 波長モードの発生条件を説明するためには、電離圏から M-I 結合系へのエネルギーフィードバックを組み込んだ磁気圏モデルが必要であると言われている。また、1/4 波長から 1/2 波長へのモード遷移は、電離圏上におけるアルフヴェン波の反射係数が、符号を反転させる事に関連して生じると考えられており、沿磁力線電流の反射に対して実効的なアルフヴェン電導度と、それを与えるプラズマ密度について、世界で初めて具体的な観測値を得ることが期待できる。

我々は 2011 年 2 月にニュージーランドのダニーデン近郊、ミドルマーチに地磁気観測点を開設した。将来的にはさらに観測点を増やし、先行する地磁気観測プロジェクト等との連携により、タスマニアーニュージーランド地域とその共役点における地磁気多点観測体制を構築する計画である。磁力線共鳴振動現象の三次元的空間構造を解明し、観測データと最新の磁気圏モデルを用いた数値計算結果を比較することで、M-I 結合系における諸問題の解明を目指すものである。

キーワード: 地磁気観測, ULF 波動, 磁力線共鳴振動, 磁気圏ー電離圏結合, プラズマ圏, 磁気圏
Keywords: geomagnetic field, ULF wave, field line resonance, magnetosphere-ionosphere coupling, plasmasphere, magnetosphere

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SuperDARN contributions to CAWSES-II
SuperDARN contributions to CAWSES-II

行松 彰 [1*], 細川 敬祐 [2], 元場 哲郎 [1], 佐藤 夏雄 [1]
Akira Sessai Yukimatu[1*], Keisuke Hosokawa[2], Tetsuo Motoba[1], Natsuo Sato[1]

[1] 国立極地研究所, [2] 電気通信大学
[1]ROIS/NIPR, [2]Univ. Electro-Communications

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.

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

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昭和基地－アイスランド共役点におけるオーロラ活動の長期変動（１）
Long-term variation of auroral activity at Syowa-Iceland conjugate stations (1)

門倉 昭 [1*], 佐藤 夏雄 [1]
Akira Kadokura[1*], Natsuo Sato[1]

[1] 国立極地研究所
[1]National Institute of Polar Research

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.

キーワード: オーロラ, 地磁気活動, 太陽活動, 長期変動
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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Tulasi Ram Sudarsanam[1*], M. Yamamoto[1], C. H. Liu[2], H. Liu[1], S.Y. Su[3], J. Lei[4]
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[1]RISH, Kyoto University, Kyoto, Japan, [2]Academia Sinica, Taipei, Taiwan, [3]National Central University, Taiwan, [4]University of Colorado, Boulder, USA
[1]RISH, Kyoto University, Kyoto, Japan, [2]Academia Sinica, Taipei, Taiwan, [3]National Central University, Taiwan, [4]University of Colorado, Boulder, USA

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.

キーワード: Co-rorating Interaction Regions, recurrent geomagnetic activity, ionosphere, solar minimum
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