Institute for Space–Earth Environmental Research Nagoya University

Annual Report

2015

Institute for Space–Earth Environmental Research

Annual Report

2015

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1. Preface

The Institute for Space–Earth Environmental Research was established on October 1, 2015, by merging the Solar–Terrestrial Environment Laboratory, the Hydrospheric Atmospheric Research Center, and the Center for Chronological Research at the Nagoya University campus. The name of the institute represents our mission to conduct studies to clarify the mechanisms and relationships that exist between the Earth, the Sun, and cosmic space, treating them as a seamless system, to contribute to solving Earth's current environmental issues and to expanding human activity out into space. The new institute is approved to be a new Joint Usage/Research Center for the period from April 1, 2016, to March 31, 2022. Therefore, we continued our activities both as the Center for Solar–Terrestrial Environmental Study and as the Center for Hydrospheric Atmospheric Research from October 1, 2015, to March 31, 2016. The annual report for the former two centers are published separately, and this report is dedicated to describing the structure of the new institute and its activities for the first fiscal year (October 1, 2015–March 31, 2016).

Previously three different organizations promoted studies in separate research fields even though they had a common scientific goal. However, we have now succeeded in making our research fields more closely related to each other, and we have organized our system to make our research fields further interdisciplinary to create a new research field. We aim to promote interdisciplinary research using advanced knowledge and expertise accumulated at our previous laboratory and centers. To start our activities, we created seven divisions in our Research Department, i.e., Integrated Studies, Cosmic-Ray Research, Heliospheric Research, Ionospheric and Magnetospheric Research, Meteorological and Atmospheric Research, Land–Ocean Ecosystem Research, and Chronological Research, as well as three centers, i.e., International Collaborative Research, Integrated Data Science, and Orbital and Suborbital Observations. In the research divisions, we emphasize conducting basic science and education for undergraduate and graduate students. At the three centers, we primarily conduct activities to promote joint usage and research. Further, we conduct interdisciplinary studies to effectively organize the research department and the three centers to explore the continuity of the boundary region and the interaction between the different regions.

To manage the activity of the institute, we have a director and two vice directors, three directors for the centers, and other necessary people in the administrative department. Further, we have a faculty council to deliberate important matters concerning the organization, human resources, research plans, and the budget. In addition, to offer various opinions and advice to the institute director, we have an advisory board that consists of the institute's professors, professors of associated graduate schools in our university, and experts from related field outside the university; this promotes our activity as a Joint Usage/Research Center.

It is known that the Sun's activity varies with an approximately 11-year period; however, the 24th solar epoch that started in the year 2009 has had the lowest activity observed in the last 100 years. Currently, numerous researchers are concerned about the behavior of the Sun. To understand and forecast such variations in the Sun and its effects on the electromagnetic environments and climate of the Earth, a program called "Variability of the Sun and Its Terrestrial Impact" (VarSITI), which is promoted by the Scientific Committee on Solar–Terrestrial Physics (SCOSTEP) has been formed. One of the members of our institute was selected as an international leader of this project, and our institute is expected to play a major role in running this program. It is necessary to conduct research to predict space weather and to respond to space storms, which could become a serious problem for human beings

advancing out into space, and to understand and to predict extreme weather, which has started to occur frequently due to global warming. In terms of considering long-term fluctuations in extreme weather and global climate, the energy balance of the Earth's surface is an important issue. In this case, greenhouse gases, such as carbon dioxide, aerosols, and clouds formed using aerosols as a nucleus, are important elements. Further, the formation of clouds causes more rain to fall, and the circulation of water associated with precipitation has a significant influence on the land vegetation and marine ecosystems, and these ecosystems control the climate and weather in turn. There are certain locations where disasters related to water, such as heavy rain, typhoons, and floods, occur frequently, and there is a hypothesis that the circulation of water is changing due to global climate change; therefore, the importance of these studies is increasing. We conduct interdisciplinary studies of phenomena that occur in the atmosphere, ocean, and on land using in-situ observations, satellite observations, and numerical models, and we plan to contribute to society by applying the outcomes of our research to preventing disasters, protecting the environment, and understanding the causes of extreme weather. To promote such interdisciplinary studies, we created the following four projects, i.e., solar–terrestrial climate research, aerosol and cloud formation, the interaction of neutral and plasma atmosphere, and space–Earth environmental prediction.

As for joint usage/research activities, we offer the following programs: ISEE International Joint Research Program, ISEE/CICR International Workshop, Joint Research Program (International, General, Student Encouragement, Symposium, Computing Infrastructure, Database Management, and Accelerator Mass Spectrometry Analysis), and Carbon 14 Analysis Service.

The faculty members at our institute belong to one of the following graduate schools, the graduate school of science, the graduate school of engineering, and the graduate school of environmental studies, and are involved in their educational activities.

We have participated in the 21st Century COE program, the Global COE program, and the Leading Graduate School program and have been involved in educational activities related to these programs. Therefore, we are further developing educational content, using our infrastructure and human resources, to foster young students in this interdisciplinary environment in which the subjects of science, engineering, and environmental studies are truly intermixed with each other. At the same time, we foster people who can play an active role in various fields in society, such as in companies and in governments, to solve the various issues that humans are encountering. In addition, we aim to contribute to the internationalization of our community by dispatching students overseas as well as accepting students from foreign countries. As mentioned above, we plan to deploy the international joint research program to study the space–Sun–Earth system comprehensively and to settle issues in Earth's environment and in our space activities, such as Earth's climate variation, which depends on solar activity, predictions of the space–Earth environment, and extreme weather.

We will try to make our efforts at the center of space–Earth environmental research open to the world to contribute to academic and social developments. I sincerely ask everyone for their understanding and cooperation for our institute and our activities.

As mentioned at the beginning, this report describes the structure of the new institute and its activities for the period from October 1, 2015, when our institute was formed, to March 31, 2016. We hope this report helps you understand our activities and the current status of our institute.

December 1st, 2016

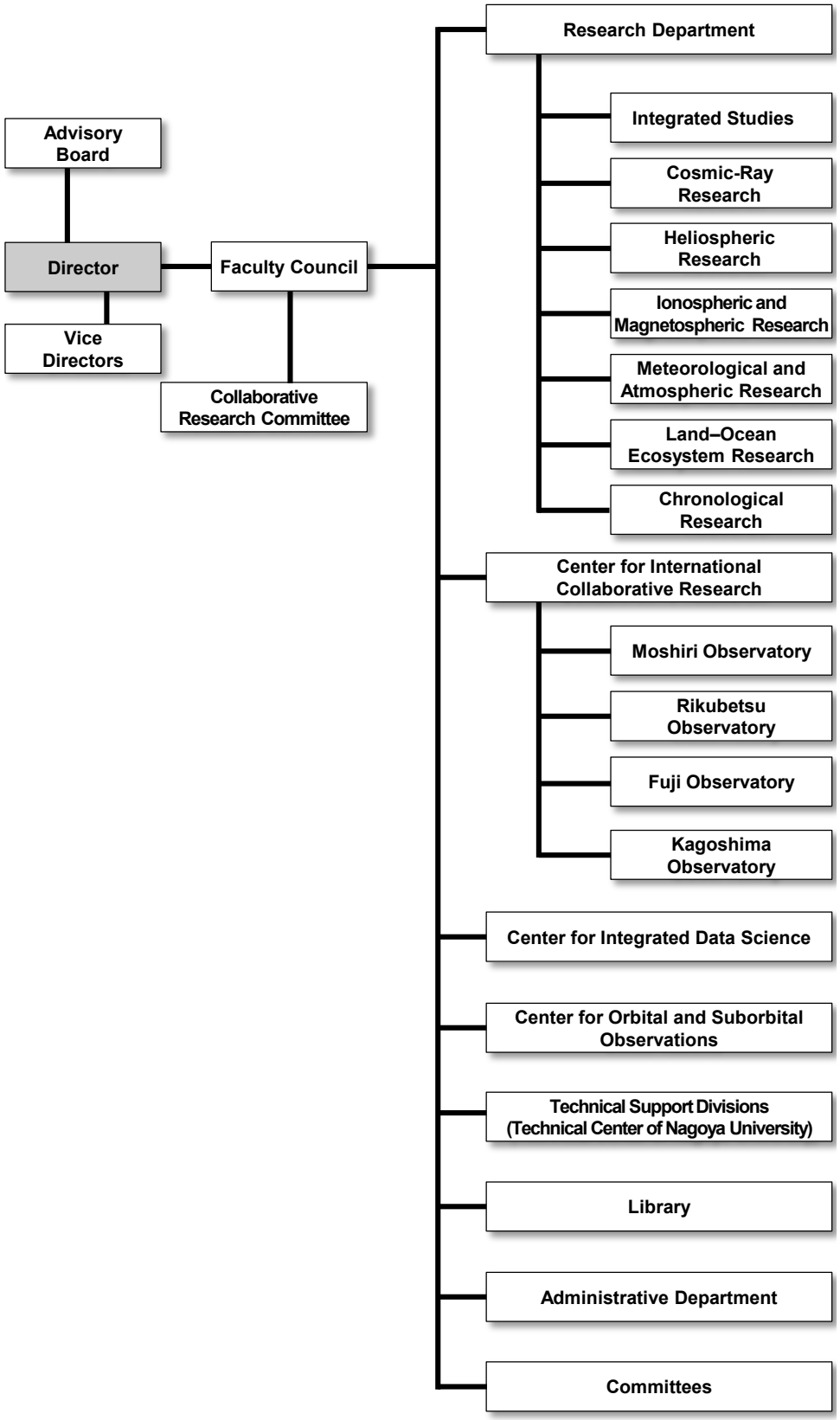
Director Shinobu Machida

2. History

Solar-Terrestrial Environment Laboratory	Hydrospheric Atmospheric Research Center (HyARC)	The Nagoya University Center for Chronological Research
May, 1949 Research Institute of Atmospherics, Nagoya University was established.		
	April, 1957 The Water Quality Science Research Facility, Faculty of Science, Nagoya University was established.	
April, 1958 Cosmic-ray Research Laboratory, Faculty of Science, Nagoya University was established.		
	September, 1973 The Institute for Hydrospheric Sciences, Nagoya University was organized.	
		February, 1981 The Tandetron Accelerator Laboratory was established in the Radioisotope Research Center of Nagoya University.
		March, 1982 Installation of the Tandetron Accelerator Mass Spectrometry (AMS) machine No.1 was completed.
		January, 1987 Inter-University Service of ^{14}C measurements was started with the Tandetron AMS machine No.1.
June, 1990 The Solar-Terrestrial Environment Laboratory (STEL) was established.	**April, 1993** The Institute for Hydrospheric-Atmospheric Sciences (IHAS), Nagoya University was organized.	**June, 1990** The Nagoya University Dating and Material Research Center was established.
April, 1995 The Center for Joint Observations and Data Processing was organized.		**March, 1997** 1997 The Tandetron AMS machine No. 2 was newly introduced.
	April, 2001 Hydrospheric Atmospheric Research Center (HyARC), Nagoya University was established.	**April, 2000** The Nagoya University Center for Chronological Research was organized. The CHIME dating system was transferred from the School of Science.
April, 2003 The Rikubetsu Observatory was organized.		
April, 2004 The Geospace Research Center was established.		
March, 2006 Laboratory was relocated to the Higashiyama Campus		
	April, 2010 Approved as one of the Joint Usage/Research Centers	
April, 2010 Approved as one of the Joint Usage/Research Centers		

October, 2015, Institute for Space–Earth Environmental Research (ISEE), merging the laboratory and two centers, was established.
January, 2016, ISEE was approved as one of the Joint Usage/Research Centers.

3. Organization



4. Staff

As of Mar. 31, 2016

Director Shinobu Machida

Vice Directors Joji Ishizaka Kanya Kusano

Division for Integrated Studies

Professor	Shinobu Machida
Professor	Kanya Kusano *
Associate Professor	Satoshi Masuda
Associate Professor	Kanako Seki ▲
Associate Professor	Yoshizumi Miyoshi *
Designated Associate Professor	Shinji Saito
Lecturer	Takayuki Umeda *
Assistant Professor	Akimasa Ieda
Assistant Professor	Sinsuke Imada
JSPS Research Fellowship	Satoshi Kurita
JSPS Research Fellowship	Kei Masunaga ▲
Research Institution Researcher	Yasunori Tsugawa

Visiting Academic Staff/Visiting Faculty Members

Visiting Professor	Kiyoto Shibasaki
Visiting Associate Professor	Yusuke Ebihara ▲

Division for Cosmic-Ray Research

Professor	Yoshitaka Itow
Professor	Hiroyasu Tajima *
Associate Professor	Kimiaki Masuda
Associate Professor	Yutaka Matsubara
Associate Professor	Fumio Abe *
Designated Associate Professor	Kazutaka Yamaoka
Lecturer	Takashi Sako
Assistant Professor	Akira Okumura
Designated Assistant Professor	Fusa Miyake
Designated Assistant Professor	Hiroaki Menjo
Technical Assistant	Kinji Morikawa ○

Visiting Academic Staff/Visiting Faculty Members

Visiting Professor	Katsuaki Kasahara▲

Division for Heliospheric Research

Professor	Munetoshi Tokumaru
Assistant Professor	Ken-ichi Fujiki
Designated Assistant Professor	Keiji Hayashi ▲
Technical Assistant	Kazuo Maruyama ▲
Cooperating Research Fellow	Tomoya Iju

Division for Ionospheric and Magnetospheric Research

Professor	Masafumi Hirahara
Professor	Ryoichi Fujii ▲
Professor	Kazuo Shiokawa *
Associate Professor	Yuichi Otsuka
Associate Professor	Satonori Nozawa
Associate Professor	Nozomu Nishitani *
Lecturer	Shin-ichiro Oyama
Research Institution Researcher	Tetsuo Motoba

Visiting Academic Staff/Visiting Faculty Members

Visiting Associate Professor	Yasunobu Ogawa
Visiting Associate Professor	Takuya Kawahara ▲
Visiting Associate Professor	Yoshifumi Saito
Visiting Associate Professor	Ayako Matsuoka

Division for Meteorological and Atmospheric Research

Professor	Akira Mizuno
Professor	Yutaka Matsumi *
Professor	Nobuhiro Takahashi *
Professor	Kazuhisa Tsuboki *
Associate Professor	Tomoo Nagahama
Associate Professor	Hirohiko Masunaga
Associate Professor	Taro Shinoda *
Lecturer	Tomoki Nakayama
Assistant Professor	Taku Nakajima
Designated Assistant Professor	Tadayasu Ohigashi
Researcher	Hirofumi Ohyama
Researcher	Fumie Furuzawa
Technical Assistant	Kazuji Suzuki
Technical Assistant	Tomoko Tanaka
Researcher Assistant	Maho Nakagawa

Division for Land–Ocean Ecosystem Research

Professor	Joji Ishizaka
Professor	Tetsuya Hiyama *
Associate Professor	Hidenori Aiki ○
Associate Professor	Tomo'omi Kumagai
Lecturer	Hatsuki Fujinami
Assistant Professor	Yoshihisa Mino
Researcher	Yasunori Igarashi
Researcher	Atsuhiro Takahashi
Researcher	Hiroyuki Tomita
Researcher	Taro Nakai
Researcher	Chiho Sukigara ▲
Research Institution Researcher	Takami Saito
Research Institution Researcher	Akiko Mizuno
Technical Assistant	Hirotaka Tsukamoto
Researcher Assistant	Daisuke Hatsuzuka

Divison for Chronological Research

Professor	Masaki Enami
Professor	Toshio Nakamura ▲
Associate Professor	Masayo Minami
Associate Professor	Takenori Kato *
Associate Professor	Kimiaki Masuda *
Assistant Professor	Hirotaka Oda
Research Institution Researcher	Fumiko W. Nara
Technical Assistant	Masami Nishida
Technical Assistant	Miyo Yoshida
Visiting Academic Staff/ Visiting Faculty Members	Kazuhiro Suzuki
Visiting Academic Staff/ Visiting Faculty Members	Tsuyoshi Tanaka

Center for International Collaborative Research

Director・Professor	Kazuo Shiokawa
Professor	Tetsuya Hiyama
Professor	Akira Mizuno *
Professor	Masaki Enami *
Associate Professor	Nozomu Nishitani
Associate Professor	Satonori Nozawa *
Associate Professor	Tomo'omi Kumagai *
Lecturer	Takashi Sako *
Lecturer	Hatsuki Fujinami *
Researcher	Hironari Kanamori
Researcher	Masaki Nishino

Moshiri Observatory

Technical Assistant	Yuuji Ikegami
Technical Assistant	Masayuki Sera

Foreign Visiting Research Fellow (Visiting Professor)

Aug. 1, 2015–Jan. 31, 2016	Kim Khan-Hyuk
Sept. 1, 2015–Dec. 31, 2015	Melnikov Victor Fedorovich
Oct. 6, 2015–Dec. 28, 2015	Goes Joaquim Ignacio
Oct. 6, 2015–Dec. 28, 2015	Gomes Helga Do Rosario

Foreign Visiting Research Fellow (Visiting Associate Professor)

Aug. 1, 2015–Oct. 31, 2015	Anukul Buranaprapteprat
Mar. 8, 2016–Apr. 7, 2016	Ruohoniemi John Michael

Center for Integrated Data Science

Director・Professor	Kanya Kusano
Professor	Kazuhisa Tsuboki
Professor	Joji Ishizaka*
Professor	Shinobu Machida*
Associate Professor	Fumio Abe
Associate Professor	Takenori Kato
Associate Professor	Yoshizumi Miyoshi
Associate Professor	Satoshi Masuda *
Associate Professor	Hirohiko Masunaga *
Designated Associate Professor	Tomoaki Hori
Lecturer	Takayuki Umeda
Assistant Professor	Akimasa Ieda *
Assistant Professor	Sinsuke Imada *
Designated Assistant Professor	Sachie Kanada
Designated Assistant Professor	Kunihiro Keika
Designated Assistant Professor	Daikou Shiota
Designated Assistant Professor	Masafumi Shoji
Designated Assistant Professor	Yukinaga Miyashita
Designated Assistant Professor	Mayumi Yoshioka
Researcher	Norio Umemura
Researcher	Masaya Kato
Research Institution Researcher	Takenori Okamoto ▲
Cooperating Research Fellow	Kumiko Hori
Technical Assistant	Takahiro Tsukamoto
Technical Assistant	Mariko Kayaba
Technical Assistant	Asayo Maeda

Visiting Academic Staff/Visiting Faculty Members

Visiting Professor	Yoshiya Kasahara
Visiting Professor	Takashi Sakurai ▲
Visiting Professor	Takashi Watanabe ▲
Visiting Professor	Kanako Seki ○
Visiting Associate Professor	Iku Shinohara

Center for Orbital and Suborbital Observations

Director・Professor	Nobuhiro Takahashi
Professor	Hiroyasu Tajima
Professor	Yutaka Matsumi
Professor	Masafumi Hirahara *
Professor	Joji Ishizaka *
Professor	Kazuhisa Tsuboki *
Associate Professor	Taro Shinoda
Researcher	Takehiro Hidemori ▲
Technical Assistant	Hiroshi Sasago
Researcher Assistant	Mai Ouchi

Visiting Academic Staff/Visiting Faculty Members

Visiting Professor	Gen Inoue ▲
Visiting Professor	Masahiro Kawasaki
Visiting Professor	Kunihiko Kodera
Visiting Professor	Yoshikatsu Kuroda
Visiting Professor	Masataka Murakami
Visiting Associate Professor	Yasutaka Narusawa

Technical Center of Nagoya University

Senior Technical Specialist	Yasusuke Kojima
Technical Specialist	Akiko Ikeda
Technical Specialist	Haruya Minda
Technical Specialist	Tetsuya Kawabata
Technical Specialist	Tomonori Segawa
Technical Specialist	Yosiyuki Hamaguchi
Technical Specialist	Yasushi Maruyama
Technical Specialist	Yuka Yamamoto
Technical Specialist	Takayuki Yamasaki
Technical Staff	Moeto Kyushima
Technical Staff	Ryuji Fujimori
Technical Staff	Takumi Adachi

Toyokawa Branch

Technical Assistant	Kayoko Asano
Technical Assistant	Yasuo Kato

Administration Department

Director, Administration Department	Yoshinori Nagao▲
Manager, General Affairs Division	Tadashi Tsuboi
Specialist, General Affairs Section	Norishi Sugiyama
Section Head, General Affairs Section 1	Naoki Kohsaka
Section Head, General Affairs Section 2	Sayuri Morino
Section Head, Personnel Affairs Section	Shoji Asano
Office Manager, Research Support Office	Tohru Kawai
Section Head, Research Support Office	Naoki Fujiki
Leader, General Affairs Section 1	Yumi Matsubara
Administrator	Harumi Morishita
Administrator	Tsukina Ino
Administrator	Satomi Fukami
Manager, Accounting Division	Toshihiro Sakaguti
Section Head, Accounting Section	Hideki Kamada
Section Head, Supplies Section	Yuko Horinouchi
Section Head, Maintenance Section	Shinichi Nakagawa
Leader, Accounting Section	Yumiko Kiso
Administrator	Mio Kato
Administrator	Airi Ito
Administrator	Ayaka Nakamura
Administrator	Hokuto Kamiya

* : Concurrent post

▲ : Left the Institute in the 2015 academic year

○ : Joined the Institute in the 2015 academic year

5. Joint Research Programs

One of the major functions of the ISEE is to promote and conduct collaborative research on Space–Earth Environmental Science together with researchers from universities and institutes outside the ISEE. On January 14, 2016, the ISEE was certified as a core research institution of Space–Earth Environmental Science, which is a "Joint Usage / Research Center" as defined by MEXT of Japan. We prepared application forms for joint research programs focusing on the following two research issues. One is the "Study of coupling processes in the solar–terrestrial system using ground-based observation network," and the other is the "Establishment of an international collaborative research hub to solve research issues in the global (terrestrial) environment and space applications based on comprehensive studies of the space–Sun–Earth system." The former focuses on coupling processes in the solar–terrestrial system and the interactions of neutral and plasma components in the Earth's atmosphere by establishing an international ground-based observation network ranging from low to high latitude regions, especially in Asia and Africa. The latter aims to establish an international collaborative research hub for comprehensive studies of the space–Sun–Earth system, space applications, space weather forecasting, and environmental problems, such as global warming. The following ten research programs were prepared for the application during the 2016 Japanese fiscal year.

01) Joint Research Program (International)
02) ISEE International Joint Research Program (*)
03) ISEE/CICR International Workshop
04) Joint Research Program (General)
05) Joint Research Program (Student Encouragement)
06) Joint Research Program (Symposium)
07) Joint Research Program (Computing Infrastructure)
08) Joint Research Program (Database Management)
09) Joint Research Program (Accelerator Mass Spectrometry Analysis)
10) Carbon 14 Analysis Service

(*) Applicable only to foreign researchers

These collaborative research programs will be executed using the instruments, software / databases, and facilities of the ISEE. Joint research programs from 01) to 03), described above, will be managed by the Center for International Collaborative Research (CICR). Those of 07) and 08) will be managed by the Center for Integrated Data Science (CIDAS), and 09) - 10) will be managed by the Division for Chronological Research.

6. Committees

Advisory Board

As of Mar 31, 2016

Mamoru Ishii	Space Weather and Environment Informatics Laboratory, Applied Electromagnetic Research Institute, National Institute of Information and Communications Technology
Takahiro Obara	Planetary Plasma and Atmospherixc Research Center, Graduate School of Science, Tohoku University
Takaaki Kajita	Institute for Cosmic Ray Research, The University of Tokyo
Takeshi Kawano	Japan Agency for Marine-Earth Science and Technology
Nobuko Saigusa	Center for Global Environmental Research, National Institute for Environmental Studies
Takuji Nakamura	National Institute of Polar Research, Research Organization of Information and Systems
Tsuneto Nagatomo	Nara University of Education
Hiroshi Niino	Atmosphere and Ocean Research Institute, The University of Tokyo
Hironobu Hyodo	Research Institute of National Sciences, Okayama University of Science
Masahiro Hoshino	Graduate School of Science, The University of Tokyo
Kazuhisa Mitsuda	Institute of Space and Astronautical Science, Japan Aerospace eXploration Agency
Tetsuzo Yasunari	Research Institute for Humanity and Nature, National Institutes for the Humanities
Junichi Watanabe	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Mamoru Yamamoto	Research Institute for Sustainable Humanosphere, Kyoto University
Naoshi Sugiyama	Graduate School of Science, Nagoya University
Akihiro Sasoh	Graduate School of Engineering, Nagoya University
Takashi Shibata	Graduate School of Environmental Studies, Nagoya University
Yoshitaka Itow	Institute for Space–Earth Environmental Research, Nagoya University
Masafumi Hirahara	Institute for Space–Earth Environmental Research, Nagoya University
Joji Ishizaka	Institute for Space–Earth Environmental Research, Nagoya University
Masaki Enami	Institute for Space–Earth Environmental Research, Nagoya University
Kazuo Shiokawa	Institute for Space–Earth Environmental Research, Nagoya University
Kanya Kusano	Institute for Space–Earth Environmental Research, Nagoya University
Nobuhiro Takahashi	Institute for Space–Earth Environmental Research, Nagoya University

Collaborative Research Committee

Yusuke Ebihara	Research Institute for Sustainable Humanosphere, Kyoto University
Akira Kadokura	National Institute of Polar Research, Research Organization of Information and Systems
Kazuyuki Kita	College of Science, Ibaraki University
Yoko S. Kokubu	Tono Geoscience Center, Japan Atomic Energy Agency
Akinori Saitou	Graduate School of Science, Kyoto University
Takeshi Sakanoi	Graduate School of Science, Tohoku University
Shoichi Shibata	College of Engineering, Chubu University
Kanako Seki	Graduate School of Science, The University of Tokyo
Takashi Sekii	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Toshihiko Takemura	Center for East Asian Ocean-Atmosphere Research, Research Institute for Applied Mechanics, Kyushu University
Tsutomu Nagatsuma	Space Weather and Environment Informatics Laboratory, Applied Electromagnetic Research Institute, National Institute of Information and Communications Technology
Yoichiro Hanaoka	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Atsushi Higuchi	Center for Environmental Remote Sensing, Chiba University
Ayako Matsuoka	Institute of Space and Astronautical Science, Japan Aerospace eXploration Agency
Hiroyuki Matsuzaki	The University Museum, The University of Tokyo
Kazuoki Munakata	Faculty of Science, Shinshu University
Akihiko Morimoto	Center for Marine Environmental Studies, Ehime Univercity
Hiroyuki Yamada	Faculty of Science, University of the Ryukyus
Satoshi Masuda	Institute for Space–Earth Environmental Research, Nagoya University
Yutaka Matsubara	Institute for Space–Earth Environmental Research, Nagoya University
Munetoshi Tokumaru	Institute for Space–Earth Environmental Research, Nagoya University
Masafumi Hirahara	Institute for Space–Earth Environmental Research, Nagoya University
Yuichi Otsuka	Institute for Space–Earth Environmental Research, Nagoya University
Tomoo Nagahama	Institute for Space–Earth Environmental Research, Nagoya University
Hidenori Aiki	Institute for Space–Earth Environmental Research, Nagoya University
Masayo Minami	Institute for Space–Earth Environmental Research, Nagoya University
Kazuo Shiokawa	Institute for Space–Earth Environmental Research, Nagoya University
Tetsuya Hiyama	Institute for Space–Earth Environmental Research, Nagoya University
Nozomu Nishitani	Institute for Space–Earth Environmental Research, Nagoya University
Kazuhisa Tsuboki	Institute for Space–Earth Environmental Research, Nagoya University
Taro Shinoda	Institute for Space–Earth Environmental Research, Nagoya University
Shinobu Machida	Institute for Space–Earth Environmental Research, Nagoya University
Joji Ishizaka	Institute for Space–Earth Environmental Research, Nagoya University
Kanya Kusano	Institute for Space–Earth Environmental Research, Nagoya University

Joint Research Technical Committee

Integrated Studies Technical Committee

Ayumi Asai	Kyoto University Unit of Synergetic Studies For Space, Center for the Promotion of Interdisciplinary Education and Research
Yusuke Ebihara	Research Institute for Sustainable Humanosphere, Kyoto University
Iku Shinohara	Institute of Space and Astronautical Science, Japan Aerospace eXploration Agency
Kanako Seki	Graduate School of Science, The University of Tokyo
Takashi Sekii	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Akimasa Yoshikawa	Graduate School of Sciences, Kyushu University
Shinobu Machida	Institute for Space–Earth Environmental Research, Nagoya University
Satoshi Masuda	Institute for Space–Earth Environmental Research, Nagoya University
Kanya Kusano	Institute for Space–Earth Environmental Research, Nagoya University
Yoshizumi Miyoshi	Institute for Space–Earth Environmental Research, Nagoya University

Heliospheric and Cosmic-Ray Research Technical Committee

Masamitsu Ohyama	Faculty of Education, Shiga University
Shoichi Shibata	College of Engineering, Chubu University
Tomoko Nakagawa	Faculty of Engineering, Tohoku Institute of Technology
Tohru Hada	Interdisciplinary Graduate School of Engineering Sciences, Kyushu University
Yoichiro Hanaoka	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Kazuoki Munakata	Faculty of Science, Shinshu University
Yoshitaka Itow	Institute for Space–Earth Environmental Research, Nagoya University
Yutaka Matsubara	Institute for Space–Earth Environmental Research, Nagoya University
Munetoshi Tokumaru	Institute for Space–Earth Environmental Research, Nagoya University

Ionospheric and Magnetospheric Research Technical Committee

Akinori Saitou	Graduate School of Science, Kyoto University
Takeshi Sakanoi	Graduate School of Science, Tohoku University
Masaki Tsutsumi	National Institute of Polar Research, Research Organization of Information and Systems
Keisuke Hosokawa	Graduate School of Informatics and Engineering, University of Electro-Communications
Masayuki Yamamoto	School of Systems Engineering, Kochi University of Technology
Masafumi Hirahara	Institute for Space–Earth Environmental Research, Nagoya University
Satonori Nozawa	Institute for Space–Earth Environmental Research, Nagoya University
Yuichi Otsuka	Institute for Space–Earth Environmental Research, Nagoya University
Shin-ichiro Oyama	Institute for Space–Earth Environmental Research, Nagoya University
Kazuo Shiokawa	Institute for Space–Earth Environmental Research, Nagoya University
Nozomu Nishitani	Institute for Space–Earth Environmental Research, Nagoya University

Meteorological, Atmospheric and Land-Ocean Ecosystem Research Technical Committee

Yoshizumi Kajii	Graduate School of Human and Environmental Studies, Kyoto University
Kenshi Takahashi	Research Institute for Sustainable Humanosphere, Kyoto University
Toshihiko Takemura	Center for East Asian Ocean-Atmosphere Research, Research Institute for Applied Mechanics, Kyushu University
Atsushi Higuchi	Center for Environmental Remote Sensing, Chiba University
Akihiko Morimoto	Center for Marine Environmental Studies, Ehime University
Akira Mizuno	Institute for Space–Earth Environmental Research, Nagoya University
Tomoo Nagahama	Institute for Space–Earth Environmental Research, Nagoya University
Joji Ishizaka	Institute for Space–Earth Environmental Research, Nagoya University
Tetsuya Hiyama	Institute for Space–Earth Environmental Research, Nagoya University

Chronological Research Technical Committee

Hiroyuki Kitagawa	Graduate School of Environmental Studies, Nagoya University
Yoko S. Kokubu	Tono Geoscience Center, Japan Atomic Energy Agency
Wallis, Simon	Graduate School of Environmental Studies, Nagoya University
Hiroyuki Matsuzaki	The University Museum, The University of Tokyo
Hiromi Yamazawa	Graduate School of Engineering, Nagoya University
Naoto Yamamoto	Graduate School of Letters, Nagoya University
Kimiaki Masuda	Institute for Space–Earth Environmental Research, Nagoya University
Masaki Enami	Institute for Space–Earth Environmental Research, Nagoya University
Masayo Minami	Institute for Space–Earth Environmental Research, Nagoya University
Takenori Kato	Institute for Space–Earth Environmental Research, Nagoya University

Airplane Usage Technical Committee

Seiho Uratsuka	Applied Electromagnetic Research Institute, National Institute of Information and Communications Technology
Kazuyuki Kita	College of Science, Ibaraki University
Makoto Koike	Graduate School of Science, The University of Tokyo
Rikie Suzuki	Japan Agency for Marine-Earth Science and Technology
Hiroyuki Yamada	Faculty of Science, University of the Ryukyus
Taro Shinoda	Institute for Space–Earth Environmental Research, Nagoya University
Nobuhiro Takahashi	Institute for Space–Earth Environmental Research, Nagoya University
Hiroyasu Tajima	Institute for Space–Earth Environmental Research, Nagoya University
Yutaka Matsumi	Institute for Space–Earth Environmental Research, Nagoya University

Steering Committee of the Center for International Collaborative Research

Yusuke Ebihara	Research Institute for Sustainable Humanosphere, Kyoto University
Takashi Shibata	Graduate School of Environmental Studies, Nagoya University
Hiroyuki Matsuzaki	The University Museum, The University of Tokyo
Kazuoki Munakata	Faculty of Science, Shinshu University
Kazuo Shiokawa	Institute for Space–Earth Environmental Research, Nagoya University
Tetsuya Hiyama	Institute for Space–Earth Environmental Research, Nagoya University
Nozomu Nishitani	Institute for Space–Earth Environmental Research, Nagoya University

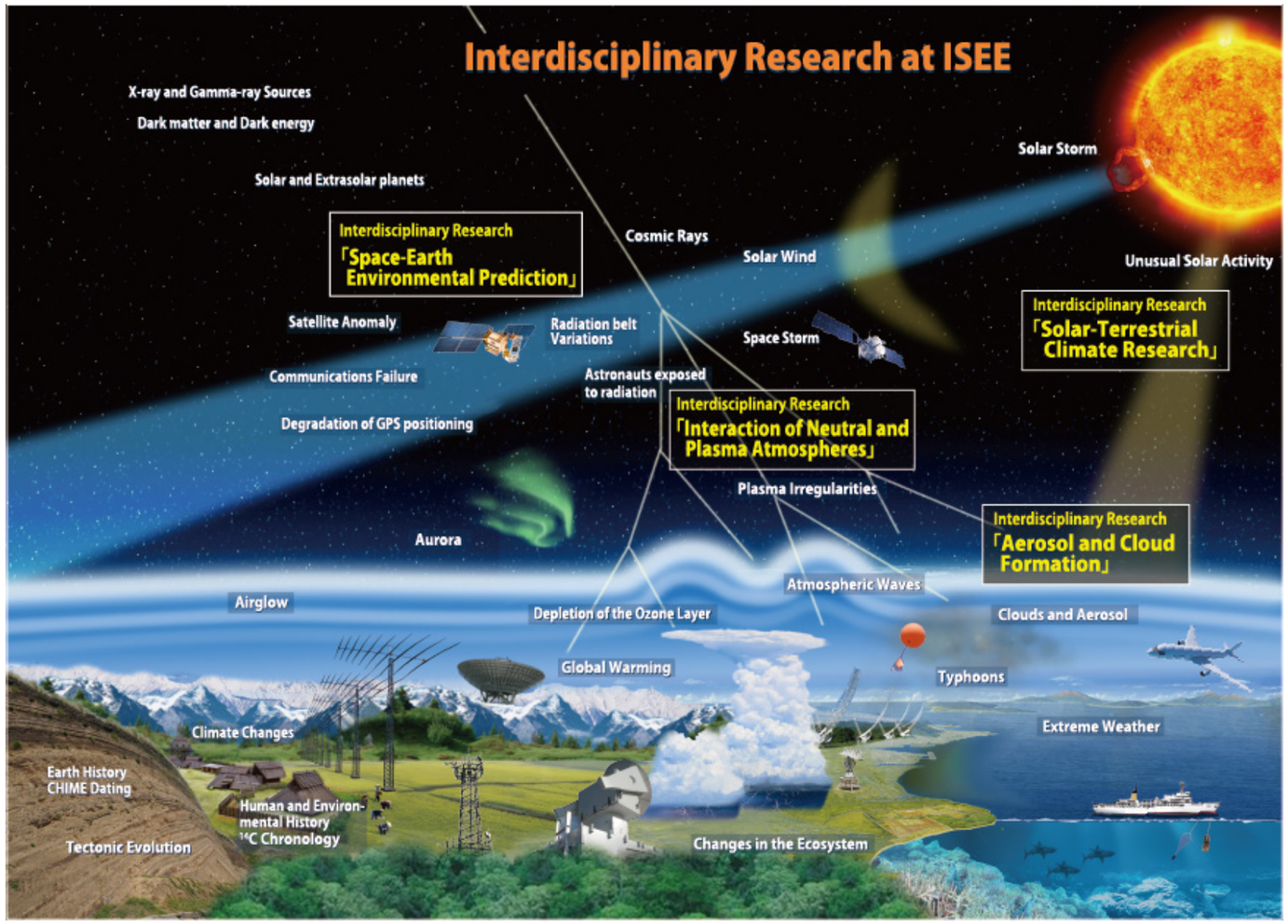
Steering Committee of the Center for Integrated Data Science

Shin-ichiro Shima	Graduate School of Simulation Studies, University of Hyogo
Tohru Hada	Interdisciplinary Graduate School of Engineering Sciences, Kyushu University
Masahiro Hoshino	Graduate School of Science, The University of Tokyo
Kazuhisa Mitsuda	Institute of Space and Astronautical Science, Japan Aerospace eXploration Agency
Koshi Yamamoto	Graduate School of Environmental Studies, Nagoya University
Junichi Watanabe	National Astronomical Observatory of Japan, National Institutes of Natural Sciences
Kanya Kusano	Institute for Space–Earth Environmental Research, Nagoya University
Kazuhisa Tsuboki	Institute for Space–Earth Environmental Research, Nagoya University
Fumio Abe	Institute for Space–Earth Environmental Research, Nagoya University
Yoshizumi Miyoshi	Institute for Space–Earth Environmental Research, Nagoya University

Steering Committee of the Center for Orbital and Suborbital Research

Riko Oki	Earth Observation Research Center, Japan Aerospace eXploration Agency
Kazuyuki Kita	College of Science, Ibaraki University
Masato Nakamura	Institute of Space and Astronautical Science, Japan Aerospace eXploration Agency
Hiroyuki Yamada	Faculty of Science, University of the Ryukyus
Nobuhiro Takahashi	Institute for Space–Earth Environmental Research, Nagoya University
Hiroyasu Tajima	Institute for Space–Earth Environmental Research, Nagoya University
Masafumi Hirahara	Institute for Space–Earth Environmental Research, Nagoya University
Yutaka Matsumi	Institute for Space–Earth Environmental Research, Nagoya University

7. Research Topics



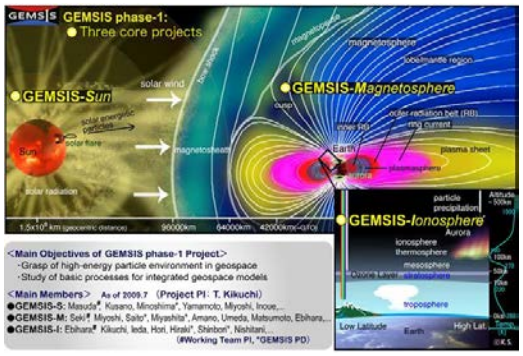
The mission of the Institute for Space–Earth Environmental Research (ISEE) is to understand the mechanisms and interactions of diverse processes occurring in the integrated space-Sun-Earth system to deal with global environmental problems and to contribute to human society in the space age. To develop this new research field, four subjects of Interdisciplinary Research are being conducted with strong collaborations from seven Research Divisions (Divisions for Integrated Studies, Cosmic Ray Research, Heliospheric Research, Ionospheric and Magnetospheric Research, Meteorological and Atmospheric Research, Land-Ocean Ecosystem Research, and Chronological Research). The "Project for Space–Earth Environmental Prediction" aims to develop our understanding and predictive capabilities of the influences of solar dynamics and atmosphere–ocean activities on the global environment. The "Project for the Interaction of Neutral and Plasma Atmospheres" aims to improve our understanding of the connection between the Earth's atmosphere and space using a global observation network of interactions between the upper plasma and middle atmosphere. The "Project for Solar–Terrestrial Climate Research" aims to observe the long-term variability in the solar activity over more than several thousands of years via radioisotopes and to examine the influences of the solar activity on the atmosphere using observations and models to understand the influence of solar activity on global climate variability. The "Project for Aerosol and Cloud Formation" aims to understand the processes that form cloud and precipitation particles from aerosol particles with regard to the influence of cosmic rays and the processes of scattering and absorption of radiation by clouds and aerosol particles using experiments, field observations, and simulations.

ISEE has also organized three Research Centers to contribute to national and international research development of the relevant disciplines in cooperation with the Research Divisions. The Center for International Collaborative Research (CICR) conducts extensive observations with four domestic observatories (Moshiri, Rikubetsu, Fuji, and Kagoshima) and a global observation network and enhances collaboration and joint research with domestic and international researchers and institutions. The Center for Integrated Data Science (CIDAS) conducts infrastructure and research development of intensive studies of the space–Sun–Earth system through the analysis of big data and advanced computer simulations. The Center for Orbital and Suborbital Observation (COSO) conducts planning and technological development of research using orbital and suborbital observation vehicles, such as aircraft, balloons, rockets, and satellites, with national and international networks.

- Research Department
  - Division for Integrated Studies
  - Division for Cosmic-Ray Research
  - Division for Heliospheric Research
  - Division for Ionospheric and Magnetospheric Research
  - Division for Meteorological and Atmospheric Research
  - Division for Land–Ocean Ecosystem Research
  - Division for Chronological Research
- Center for International Collaborative Research
  - Moshiri Observatory
  - Rikubetsu Observatory
  - Fuji Observatory
  - Kagoshima Observatory
- Center for Integrated Data Science
- Center for Orbital and Suborbital Observations

Interdisciplinary Research
- Project for Solar-Terrestrial Climate Research
- Project for Space–Earth Environmental Prediction
- Project for the Interaction of Neutral and Plasma Atmospheres
- Project for Aerosol and Cloud Formation

7-1. Research Division
Division for Integrated Studies



Research topics and keywords

- Solar Flare · CME
- Inner-magnetosphere · Radiation belt
- Aurora substorm
- Space weather · Space storm
- Space climate · Long-term variation of the Sun
- Space Plasma
- Computer simulations
- Data assimilation

Introduction to Division for Integrated Studies

The solar-terrestrial environment is a complex system that consists of nonlinear, non-equilibrium, and multi-scale interacting processes. The research activities in the Division for Integrated Studies aim to understand the mechanisms, as well as predict the dynamics, of various phenomena in the solar-terrestrial environment via data analyses and modeling studies. Some of their major results are introduced below.

1. Microwave Observations of White-Light Flares

White-light (WL) flares are solar flares that are enhanced in the WL continuum. To investigate the key factors generating a WL flare, we analyzed six WL and four non-WL (NWL) flares. The microwave spectrum has a peak at the so-called turnover frequency. WL flares show systematically higher turnover frequencies, which might correspond to stronger magnetic fields. This is consistent with the fact that WL flares tend to be compact. NWL flares tend to show spectral hardening in time; this indicates that the magnetic mirror effectively works due to the weak magnetic field in the loop.

2. The Trigger Mechanism of Solar Flares

Solar flares are explosive phenomena, in which free energy stored in the solar corona is disruptively liberated. However, their triggering mechanism is still not sufficiently understood, and therefore our capacity to predict the occurrence of solar eruptions and to forecast space weather is substantially hindered. We recently revealed, using numerical simulations and analyses of solar magnetic field data observed by the Hinode and SDO satellites, that internal reconnections between sheared magnetic fields and small-scale magnetic fields of two different structures can trigger solar flares. We further studied the detailed trigger process based on a statistical analysis of the magnetic field data and data-driven simulations, in which the photospheric boundary condition was given by the data. As a consequence, we successfully reconstructed the three-dimensional structure of the magnetic field during the flaring process and found an MHD instability that may trigger the initial phase of the flares.

3. Solar Cycle Variation of Coronal Heating Characteristics Above the Polar Coronal Hole

We studied the coronal heating process above the polar coronal hole using Hinode/EIS data. The corona above the polar coronal hole is very dark at EUV wavelengths. The stray light/scattered light from the solar limb/disc may affect this result. Therefore, we tried to model the stray light/scattered light effect using a Moon eclipse event or a Venus transit on the solar disc event. We statistically studied the solar cycle variation of the coronal heating characteristics above the polar coronal hole. We found that the characteristics of the coronal heating process seem to change from fast solar wind (solar minimum) to slow solar wind (solar maximum).

4. The Energy Spectra of the Pulsating Aurora and the Frequency Spectra of the Chorus Waves

We investigated the origin of the fine structure of the energy spectrum of precipitating electrons in the pulsating aurora (PsA) observed by the low-altitude Reimei satellite. The main modulation of the electron precipitation, of a few seconds, and the internal modulations, of a few hertz, which are embedded inside the main modulations, was identified above ~3 keV. Moreover, stable precipitations at ~1 keV were found for the PsA. A "precipitation gap" was discovered between two energy bands. We identified the origin of the fine structure of the energy spectrum for the precipitating electrons using a computer simulation. The lower band chorus (LBC) bursts cause the main modulation of the energetic electrons, and their generation and collapse determines the on-off switching of the PsA. A train of rising tone elements embedded in the LBC bursts drives the internal modulations. A close set of upper band chorus (UBC) waves causes the stable precipitations at ~1 keV. A wave power gap near the half gyrofrequency at the equatorial plane in the magnetosphere between the LBC and UBC reduces the loss rate of the electrons in the intermediate energy range, forming a gap of precipitating electrons in the ionosphere.

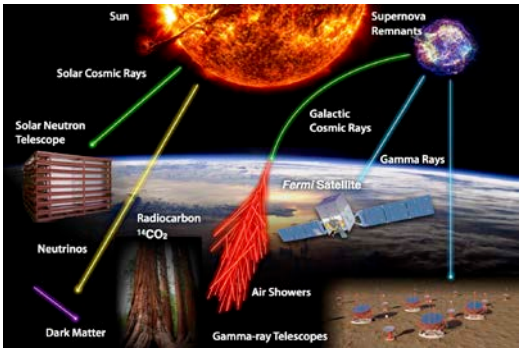
5. Stepwise Tailward Retreat of Magnetic Reconnection: THEMIS Observations of an Auroral Substorm

A multiple-onset substorm that occurred on February 27, 2009, was investigated Five successive auroral brightenings were identified at approximately 10-min intervals. The first brightening was a faint precursor. The second one had a wide longitude and therefore represents the Akasofu substorm onset. The other brightenings expanded poleward and therefore were interpreted to be auroral breakups. They occurred stepwise; that is, later breakups were initiated at higher latitudes. Their corresponding reconnection signatures were studied using THEMIS satellite observations from between 8 Re and 24 Re down the magnetotail. The Akasofu substorm onset was not accompanied by a clear reconnection signature. Conversely, the three subsequent auroral breakups occurred concurrently with three successive fast flows at 24 Re; accordingly, these breakups have been interpreted as being associated with impulsive reconnection episodes. These three fast flows consisted of one tailward and two subsequent earthward flows. The flow reversal at the second breakup indicated that a tailward retreat of the near-Earth reconnection site occurred during the substorm expansion phase. This tailward retreat is likely to have occurred in a stepwise manner. We interpreted the stepwise characteristics of the tailward retreat and poleward expansion to potentially be associated with the stepwise magnetic flux pile-up.

6. Ion Gyro-Viscosity in the Kelvin-Helmholtz Instability

The Finite-Larmor-radius (FLR; gyro-viscous) term was evaluated using a full kinetic Vlasov simulation result for the Kelvin-Helmholtz instability (KHI). The velocity field and the pressure tensor were calculated from high-resolution data of the velocity distribution functions obtained by the Vlasov simulation, which was used to approximate the FLR term according to Roberts and Taylor (PRL, 1962). A direct comparison between the pressure tensor and the FLR term shows agreement. In addition, the off-diagonal pressure gradient enhances the linear growth of the KHI when the inner product between the vorticity of the primary velocity shear layer and the magnetic field is negative, which is consistent with previous FLRMHD simulation results. This suggests that it is not sufficient when reproducing the kinetic simulation results using fluid simulations to only include the FLR term (or the pressure tensor) in the equation of fluid motion.

7-1. Research Division
Division for Cosmic-Ray Research



Research topics and keywords

- Acceleration and propagation of cosmic rays
  - Cosmic gamma-ray observations
  - Solar neutron observations
- Cosmic-ray interactions with the Earth's atmosphere
  - Hadron interactions of very-high-energy cosmic rays
  - Past solar activities probed by cosmogenic nuclides
- Particle astrophysics and non-accelerator physics
  - Dark matter and neutrino physics
- Wide-field transient survey by an optical telescope

Introduction to Division for Cosmic-Ray Research

Cosmic rays, which are mostly protons with small amounts of charged particles such as electrons or nuclei and neutral particles such as gamma rays or neutrinos, are produced in space and propagate through interstellar and interplanetary magnetic fields before reaching the Earth. The Division for Cosmic-Ray Research performs cosmic gamma-ray observations using the Fermi Gamma-ray Space Telescope (Fermi satellite) and the Cherenkov Telescope Array (CTA) and high-altitude solar neutron observations to reveal the cosmic-ray acceleration mechanisms as common space plasma phenomena.

Cosmic rays also provide hints for ultra-high energy phenomena and unknown particles that cannot be explored in a laboratory. We conduct LHCf and RHICf experiments to study hadronic interactions of ultra-high energy cosmic rays using accelerators such as LHC or RHIC. This division also conducts neutrino physics research with the Super-Kamiokande experiment and participates in the XMASS liquid xenon experiment at the Kamioka Observatory in Japan to search for dark matter.

Cosmic rays deeply penetrate the atmosphere, producing ionization and cosmogenic nuclides. Our division studies past solar activities and sudden changes in cosmic-ray flux that are recorded in the carbon-14 fractions of ancient tree rings and other cosmogenic nuclides from Antarctic ice cores.

In addition, this division conducts the MOA experiment with a dedicated 1.8-m wide-field optical telescope at Mt. John University Observatory in Tekapo, New Zealand. It conducts surveys of gravitational microlensing due to massive astrophysical compact halo objects (MACHOs) or exoplanets and optical follow-up observations of gamma-ray bursts and gravitational wave events.

Main Achievements in FY2015

1. Cosmic gamma-ray observations

We conducted morphological studies of supernova remnant IC 443 as a verified galactic cosmic-ray source using the Fermi satellite. We found that acceleration characteristics of cosmic rays are rather uniform in IC 443. We also searched for gamma-ray signals from annihilation of weakly interacting massive particles (WIMPs) in the Galactic Center and nearby dwarf galaxies using the Fermi satellite, excluding WIMPs with a mass region below 100 GeV/c^2. In parallel, we developed custom integrated circuits and silicon photon sensors for the Gamma-ray Cherenkov Telescope of the CTA. We fabricated a prototype in December 2015 and successfully observed cosmic-ray air showers for the first time in CTA. Furthermore, we played a central role in developing a new-generation gamma-ray instrument, the Soft Gamma-ray Detector, which launched

onboard Hitomi, a JAXA X-ray Satellite, on February 17, 2016. Commissioning of the instrument was completed on March 25, but the mission was terminated owing to an accident on March 26, 2016.

2. Solar neutron observations using SciCRT

We installed a new detector SciCRT at Sierra Negra, Mexico, (19°N, 97°W, 4600 m) in April 2013 and started data taking using 3/8 volume of a full detector for the muon telescope and the solar neutron telescope. We developed a new, fast data acquisition system using a network processor called SiTCP, developed by KEK, and installed it for the data taking of 1/8 of the full detector.

3. Cosmic neutrinos and direct dark matter search

We performed a design study for the Hyper-Kamiokande detector that aims to enlarge the fiducial volume of Super-Kamiokande by a factor of 20. We conducted research and development activities for a new photomultiplier tube (PMT) dedicated to Hyper-Kamiokande and studied various performance aspects of the PMT, such as incidence position dependence. We also conducted WIMP direct searches using the XMASS liquid xenon experiment and published emission time measurements of xenon scintillation light irradiated by low-energy gamma rays. Moreover, we developed a single-phase liquid xenon TPC prototype with thick glass GEM electrodes.

4. Studies of cosmic-ray interactions using accelerators

A highlight in 2015 was collecting data from proton-proton collisions at 13 TeV in the LHC. We gathered physics data for 27 hours, taken over the course of three days of a special physics run for LHCf in June, after which the detectors were removed from the LHC. We also continued analyses of data taken before 2015 and published cross-sections of neutron production in 7-TeV collisions and neutral pion production in various collisions. A proposal for a new experiment to take data during 510 GeV proton-proton collisions planned for 2017 at the RHIC at Brookhaven National Laboratory in U.S.A has been approved and preparation is now in progress.

5. Past cosmic-ray variability probed by cosmogenic nuclides

We continued C-14 and Be-10 measurements for the AD775 and AD994 cosmic-ray rapid-increase events discovered in 2012-13 and confirmed that the AD775 event was found in Be-10 data from the Dome Fuji Antarctica ice core. We also measured old tree rings in the U.S. and found a possible rapid-increase similar to the AD775 one.

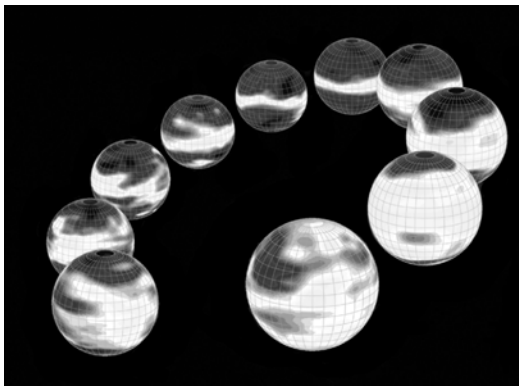
6. Laboratory experiment for cloud formation by cosmic rays

In 2015, we continually studied cloud formation in a reaction chamber using high-energy proton, nitrogen ion, and xenon ion beams at HIMAC as radiation sources. We found that cloud density depended on ion density and formation rate seems unrelated to beam species.

7. Search for exoplanets and optical counterparts for gravitational waves by a wide-field optical telescope

In 2015, we detected 577 microlensing events and issued real-time alerts to follow-up groups. We discovered eight candidates for new exoplanets. Among the past events, we found six new exoplanets, bringing the total number of exoplanets discovered by microlensing to 46. We also observed the occultation of a star by Pluto in June. In addition, we executed follow-up observations for the first gravitational wave detection by the LIGO group on September 14, 2015 using a 61-cm B&C telescope. We found no suitable candidates for optical counterparts.

7-1. Research Division
Division for Heliospheric Research



Research topics and keywords

- Solar Wind
- Coronal Mass Ejection
- Heliosphere
- Space Weather
- Solar cycle change
- Radio Science
- Interplanetary Scintillation
- Ground-based Observation

Introduction to Division for Heliospheric Research

We have conducted remote-sensing observations of the solar wind since the 1980s using the multi-station Interplanetary Scintillation (IPS) system. Tomographic analyses of IPS observations enable accurate determination of the global distribution of the solar wind speed and density fluctuations. IPS observations provide valuable information particularly for high-latitude solar wind, where in situ observations are currently unavailable. We investigate the global structure of the solar wind, the acceleration mechanism of the solar wind, the propagation of interplanetary-coronal mass ejections (CMEs), and their solar cycle dependences using IPS.

Main Achievements in FY2015

1. North–South Asymmetry in the Solar Wind Structure at the Solar Cycle 24 Maximum

The Solar Cycle 24 (SC24), whose activity is the lowest observed in the past 100 years, passed its maximum phase and is currently entering its declining phase. The structural evolution of the solar wind during the SC24 maximum to declining phase, that is, the appearance of a fast solar wind at the poles, was clearly discernible from our IPS observations. Polar fast winds observed by IPS showed marked differences in their distribution between the north and south. Such an asymmetric distribution of the polar fast wind has been observed in the maximum phases of past cycles. However, the asymmetry of this cycle lasted longer than that of past cycles. The north–south asymmetry of the polar fast winds is likely due to the effect of the Sun's magnetic field. We compared our IPS data with magnetograph observations at the Wilcox Solar Observatory. As the result, we found a significant correlation between the observed asymmetry and the ratios of the quadrupole to dipole moments of the Sun's magnetic field.

2. International Collaborations for Space Weather Forecasts

We collaborated with Dr. B. V. Jackson and his colleagues at the University of California, San Diego on 3D reconstructions of the time-varying heliosphere from tomographic analyses of the IPS observations. The time-dependent tomography (TDT) program was developed via this collaboration. This program is now freely available to researchers on the web server of the NASA Community Coordinated Modeling Center (CCMC) and is also running at the Korean Space Weather Center (KSWC) in real-time to predict the solar wind at the Earth. The TDT enables the determination of the solar wind speed and density at the Earth using our IPS observations. To make reliable predictions of space weather, information about the interplanetary magnetic field (IMF) is necessary. A computer system to predict the IMF was established at KSWC by combining the TDT analysis and the ENLIL solar wind model (developed by Dr. D. Odstrcil, GMU/NASA). The IMF Bz (north-south) component is particularly important, because it

controls the influence of solar wind disturbances on the Earth's magnetosphere, and reliable predictions of the IMF Bz are required. We collaborated with Dr. Jackson's group to improve the IMF Bz prediction by combining a potential field model of the Sun's magnetic field and the TDT analysis of the IPS data. The results obtained so far show that a significant correlation exists between the calculated fields of the potential field model and the IMF Bz data observed near the Earth.

3. Study on the Propagation Dynamics of CMEs

Precise predictions of CME arrivals at the Earth are important from the viewpoint of space weather forecasts. CMEs are known to accelerate or decelerate during propagation in the solar wind. However, their physical processes are not yet fully understood, and this results in large errors in the prediction of CME arrival times. We collaborated with Dr. S. Yashiro (Catholic University) on the acceleration/deceleration of CMEs using our IPS data and SOHO/LASCO observations. As a result, we found an excellent correlation between CME acceleration rates and its speed relative to the ambient solar wind. This suggests that the acceleration/deceleration of CMEs is controlled by interactions with the ambient solar wind, and this is thought to be an important finding that will lead to improvements in space weather forecasts.

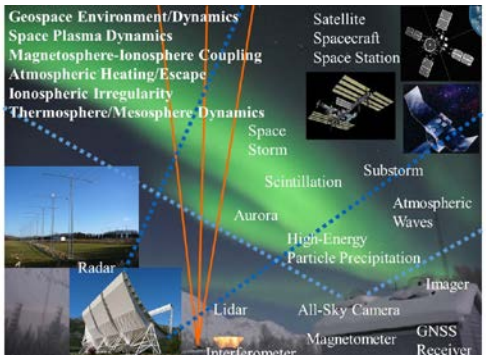
4. Very Low Density and Very Low Speed Solar Wind

The density of the solar wind according to in-situ measurements in SC24 decreased more than 30% compared to SC23. Recent IPS observations also indicate that very low speed solar wind has decreased density. We analyzed solar wind with very low density and very low speed (LDSW) to reveal the origin of this peculiar solar wind and its solar cycle dependence using IPS data from 1997 to 2014. We found that the LDSW originating from mid-latitudes (30–50°) increased remarkably in SC24. In addition, we determined the coronal magnetic properties via PFSS analysis and found that the magnetic field strength in the photospheric origin of the LDSW decreased in SC24; however, the magnetic expansion factor did not change significantly. We concluded that LDSW originating from open magnetic field regions in quiet regions increased remarkably and that the supply of mass flux from these regions into the corona decreased in SC24.

5. Determination of solar wind density and temperature using the IPS-MHD tomography method

The solar wind is a consequence of coronal heating and solar wind acceleration processes that have not been completely solved. The solar wind is the background for the propagation of interplanetary disturbances. To address the unknown coronal dynamics and enhance our capabilities in the space weather paradigm, it is important to determine and characterize the solar wind plasma quantities on a global scale. In this context, IPS solar wind speed data provide a unique and powerful observation-based approach. We recently developed a new approach to find a three-dimensional MHD solution of the solar wind solution that simultaneously satisfies three theoretical and observational constraints, the MHD equations, the IPS-LoS observation of the solar wind speed, and the in-situ measurements (ULYSSES and/or the near-Earth OMNI dataset). The preexisting IPS-MHD tomography can find solutions satisfying the first two constraints. By embedding an optimization algorithm to satisfy the third requirement in the tomography method, we can now derive MHD solutions of the solar wind that are more realistic. An advantage of this new optimization method is that we can determine solar wind solutions from the early 1970s until now and assess long-term variations in the solar wind characteristics. The dependency of solar wind plasma on the solar cycle and/or coronal magnetic field found in the results could be key to enhancing our understanding of solar coronal heating and acceleration processes.

7-1. Research Division
Division for Ionospheric and Magnetospheric Research



Research topics and keywords

- Understanding the process of energy transfer from the solar wind to the magnetosphere and ionosphere
- Understanding the magnetosphere–ionosphere–thermosphere coupled system
- Ground-based and network observation
- Space and planetary exploration

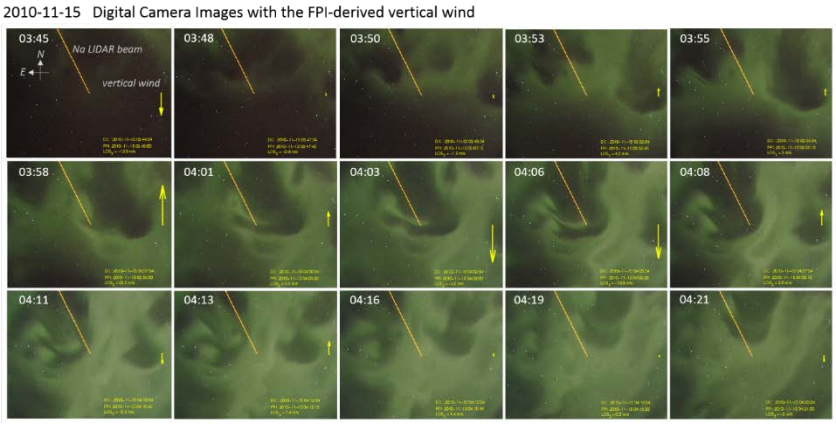
Introduction to Division for Ionospheric and Magnetospheric Research

The Division for Ionospheric and Magnetospheric Research investigates the physical processes of transfers of matter and energy from the magnetosphere to the ionosphere and thermosphere. The plasma and energy carried by the solar wind to the Earth and other planets exert physical effects on the magnetosphere and ionosphere; in other words, the region known as geospace. We study these effects and associated phenomena with international cooperation primarily through various observational approaches using ground-based instruments, for example, EISCAT radars, HF/VHF radars, GNSS receivers, high-sensitivity passive/active optical instruments, magnetometers, and instruments onboard satellites/spacecraft, which are developed in our division. We also lead future space exploration missions based on our expertise. Remote sensing data are combined with in situ measurements from rockets and satellites/spacecraft for studying dynamic phenomena in geospace. These data are then used to study the interactions between space plasma and the Earth's atmosphere, as well as couplings between the high- and mid-latitude regions.

Main Achievements in FY2015

1. Lower thermospheric wind variations in auroral patches

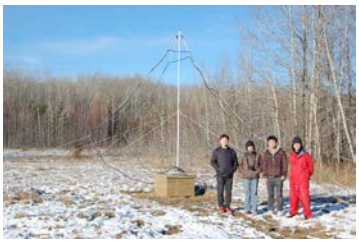
Auroral patches, which tend to appear during the second half of the substorm recovery phase, are characterized by an eastward drift along the ionospheric convection path and a relatively clear edge of each patch. Many measurements with a Fabry-Perot interferometer showed that lower thermospheric vertical winds fluctuated with amplitudes of greater than tens of m/s only in the darker area and/or at the edges of patches. We investigated their presence by analyses of measurements by EISCAT radars and the results of simulations.



Pulsating auroral patches and vertical winds measured by FPI (white arrows).

2. Simultaneous ground–satellite measurements of ELF/VLF waves generated by magnetospheric compression

We have succeeded in making the first simultaneous ground–satellite measurements of magnetospheric ELF/VLF waves generated by a compression of the magnetosphere associated with CME in the solar wind. The temporal variation in the observed waves indicates the difference in the generation mechanisms of ELF/VLF chorus and hiss waves in the magnetosphere and their propagation processes from the magnetosphere to the ground.



ELF/VLF receiver antenna at Athabasca, Canada.

3. GNSS observations of ionospheric irregularities in equatorial regions

In order to observe ionospheric irregularities in equatorial regions, we have been operating GNSS receivers at Abuja, Nigeria and Chiang Mai, Thailand since March 2016. These receivers track GNSS signals from GPS, GLONASS, and Galileo satellites at triple frequencies so that total electron content (TEC) and scintillation data can be obtained simultaneously at multiple points. At both Abuja and Chiang Mai, optical instruments belonging to Optical Mesosphere Thermosphere Imagers (OMTIs) are in operation. Coordinated observations with the GNSS receivers and the optical instruments could enable us to reveal the structures of the ionospheric irregularities and disturbances.

Antenna of a GNSS receiver installed at Chiang Mai, Thailand.

4. Experimental development and facility improvement of the Atmospheric Neutral Analyzer (ANA) for realizing in situ observations of the terrestrial and planetary upper atmospheres

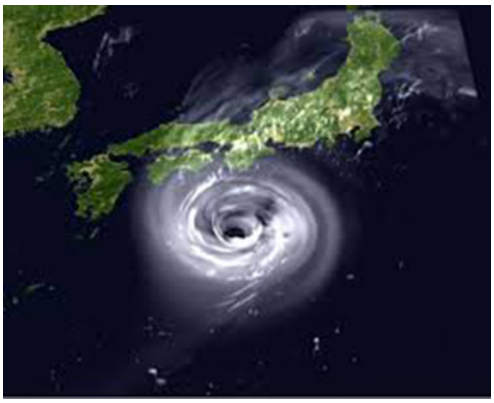
In order to understand the atmospheric circulations, heating, and dissipation, observations of neutral particles in the terrestrial and planetary upper atmospheres have been carried out over many years. For further detailed investigations of these dynamics in the neutral upper atmospheres, in situ observations utilizing spacecraft are required. We are newly developing a Bennett-type radio-frequency mass spectrometer, which is called the Atmospheric Neutral Analyzer (ANA). The ANA is capable of observing 2D velocity distributions, from which the density, wind velocity, and temperature are derived, for each component of neutral species. We use a suprathermal ion beamline for the calibration of the ANA and are now improving the capability of the beamline in order to obtain more detailed specification data of the ANA.

5. Calibration of the space plasma particle analyzers for the ERG geospace exploration mission

We conducted laboratory calibrations of the space plasma particle analyzers for the ERG geospace exploration mission, which will be launched in 2016 in order to carry out in situ observations of the plasma dynamics occurring in the terrestrial radiation belts. We have completed the calibration of the medium-energy ion analyzer, which is one of the six particle analyzers on the ERG mission, using a high-energy beamline in our institute. The results indicated good agreement with the numerical design performance and previous experimental data, and we also obtained more detailed calibration data for evaluating the instrument specification.

Experimental work for calibrating the medium-energy ion analyzer set in a vacuum chamber.

7-1. Research Division
Division for Meteorological and Atmospheric Research



Research topics and keywords

- Millimeter-wave/infrared interferometry of trace gasses such as greenhouse gases and ozone depleting substances
- Precipitation measurements using advanced polarimetric radar and hydrometeor videosondes
- Laser/optical measurements and chamber data analyses of trace gases and aerosol properties
- Development of new instrumental technology
- Development of a numerical cloud model (CReSS) and meteorological studies with numerical simulations
- Cloud and precipitation measurements using multiple satellites

Introduction to Division for Ionospheric and Magnetospheric Research

The ongoing global warming, due to an increase in carbon dioxide and other greenhouse gases, will not only result in gradual climate change but may also lead to an intensification of weather extremes and ecological catastrophes. To better confront global environmental problems, one of our most urgent tasks is to closely monitor the atmosphere using various means of observations and to better understand the atmosphere using theoretical insights and numerical modeling. To address these problems, the Division for Meteorological and Atmospheric Research is dedicated to a number of research projects to explore the atmosphere from a range of different angles.

Main Achievements in FY2015

1. Balloon-borne measurements of CO_2 and O_3 vertical profiles over Syowa Station, Antarctica

We conducted balloon-borne measurements of CO_2 and ozone to obtain detailed information on the source and sink of CO_2, the transport of air masses, and the chemical reactions of ozone in Antarctica. As a result, the influence of the uptake of CO_2 by the ocean and the depletion of O_3 by photochemical reactions with halogens emitted from the ocean was detected.

2. Continuous in-situ observations of CH_4 using an open path sensor at a paddy field in India

We have conducted in-situ observations of CH_4 at north of Delhi, India, since the end of 2014 using a low-cost CH_4 measurement system based on laser absorption spectroscopy. Large variations in the CH_4 concentrations between day and night often appear, especially in winter, likely due to the formation of a stable boundary layer during the night. In addition, concentrations of CH_4 increased in the monsoon season due to large CH_4 emissions from the paddy field during rice cultivation.

3. Observations of the light absorption properties of black carbon particles at the Noto Peninsula

Coating black carbon (BC) with inorganic salts and organic compounds can enhance the magnitude of light absorption by BC. To examine the enhancement of light absorption of aged BC particles, we conducted observations of particles at an Asian outflow site at the Noto Peninsula in Japan. A large enhancement in the light absorption of coated BC of up to approximately 50% was observed when the air mass was transported long-range from urban areas in China.

4. Assessment of a Satellite-based Atmospheric Budget Analysis Method with Ground Data

For global climate research, it is critical to better understand tropical convective systems. A developed satellite-based method to analyze moisture and the thermal budget was examined in comparison with sounding array observations from CINDY2011. Overall, the satellite analysis was found to quantitatively reproduce the statistical behaviors of large-scale mean vertical motion, moisture convergence, and moist static energy (MSE) convergence as observed from the sounding arrays.

5. Analysis of Arctic Mixed-Phase Clouds Using a Cloud Radar

Mixed-phase clouds are clouds in which ice particles and liquid droplets coexist below the freezing point. In the Arctic boundary layer, mixed-phase clouds are frequently observed and maintained up to several days. The maintenance mechanisms and climatological roles of Arctic mixed-phase clouds are currently being examined. In this study, an estimation method for ice mass fluxes at the mixed-phase cloud bases was developed using a Ka-band vertical pointing cloud radar. Theoretical considerations showed that the riming process must be taken into account for clouds with high liquid water paths, even for clouds developing in high latitudes. This result provides both a constraint for studying the maintenance processes of clouds and an observational estimation for comparisons with numerical simulations.

6. End of mission experiments of the Tropical Rainfall Measuring Mission (TRMM) satellite

The TRMM satellite re-entered the Earth's atmosphere on June 16, 2015. During its descent, special experiments using the Precipitation Radar were implemented to obtain fundamental data for future spaceborne precipitation radar designs. Early analysis results indicate that a wide swath observation can be achieved with the current radar design. The incident angle dependency of the surface echo from a single target was confirmed via a 90-degree yaw experiment.

7. Monitoring of stratospheric ozone, UV, and aerosols in the Patagonia region, South America

A joint research project called the “Development of the Atmospheric Environmental Risk Management System in South America,” started as a part of the Science and Technology Research Partnership for Sustainable Development (SATREPS) program operated by the Japan Science and Technology Agency (JST) and the Japan International Cooperation Agency (JICA), has been continued with Argentina and Chile. In 2015, we made several campaign observations during the period from October to December, coordinating with the Differential Absorption Lidar (DIAL), ozonesondes, and the millimeter-wave radiometer. Comparisons show a good agreement between these instruments within a difference of 10% at altitudes ranging from 20 km to 35 km. We also detected significant variations in the vertical profiles of ozone during the period when the site was located within the ozone hole.

8. Measurements of composition changes in the polar stratospheric and mesospheric atmosphere

The polar middle-atmosphere is a region where energetic particle precipitation (EPP) events due to solar activity frequently occur due to the configuration of the magnetic field. The ISEE and the National Institute of Polar Research (NIPR) started ground-based observations at Syowa Station in Antarctica in March 2011 using a millimeter-wave spectroscopic radiometer, and we have carried out continuous monitoring of millimeter-wave nitric oxide (NO) and ozone spectra since January 2012. An analysis of the monitoring data obtained over four years clearly detects seasonal variations peaking near polar winter, except in 2014. In addition, several events of short-term sporadic enhancement lasting for several days were observed in the fall of 2015.

7-1. Research Division
Division for Land–Ocean Ecosystem Research

Research topics and keywords

- Global warming and changes in terrestrial water-material cycles in the Arctic circumpolar region
- Effects of climate change and anthropogenic forcing on the terrestrial ecosystem
- Cloud/rainfall variability in Asian monsoon regions
- Dynamics of phytoplankton in marginal seas and coastal areas
- Transport of biogenic materials from the ocean surface to the mid- and deep-layers
- Interaction between oceanic waves and climate variations

Introduction to Division for Land–Ocean Ecosystem Research

The Land–Ocean Ecosystem Research Division investigates regional and global energy, water and material cycles, and physical/biogeochemical processes in the land–ocean ecosystem primarily via in situ observations, data analysis, and numerical modeling.

On land, synthetic research is performed using in-situ observations, sophisticated coupled land–atmosphere models, atmospheric reanalysis data, and remote sensing to understand the relationships between climate change and water/material cycles over land from the tropics to the north polar region. We observe precipitation, evapotranspiration, soil moisture, carbon dioxide, and the methane budget at multiple observation sites. We intensively investigate how anthropogenic forcing, such as land-use and land-cover change; surface conditions, such as sea-ice change and sea surface temperature; and the responses of vegetation interact with local and global climate systems through the atmospheric water cycle.

Ocean research is performed using satellite remote sensing, numerical simulations, and in-situ observations. We perform synthetic studies of physical and biogeochemical processes in the ocean and their interactions with the atmosphere and climate. In particular, we investigate the manner in which oceanic heat content, circulation, and surface waves interact with atmospheric environments and how they are linked to climate and meteorological phenomena such as tropical cyclones. We also investigate how the variations in ocean circulation, mixing processes, and air–sea fluxes influence marine ecosystems where phytoplankton is a primary producer. Moreover, we are interested in the possible impact of the marine ecosystem on physical processes and climate in the ocean and atmosphere.

1. Interdecadal changes in the interannual variability of precipitation and atmospheric circulation over northern Eurasia

We found interdecadal modulations in the relationships between the interannual variability in summer (June, July, and August) precipitation and atmospheric circulation patterns in three major Siberian river basins (Lena, Yenisei, and Ob) over northern Eurasia. The interannual variations in summer precipitation over the Ob and Lena River Basins were negatively correlated from the mid-1970s to the mid-1990s. By contrast, a significant positive correlation was apparent between the Yenisei and Lena River Basins after the mid-1990s. We also found that there has been a significant increasing trend in the geopotential height in the low-level troposphere since the

mid-1980s over Mongolia and European Russia, resulting in an increasing trend of westerly moisture flux into the Yenisei and Lena River Basins. Summer precipitation in both basins was continuously high from 2005 to 2008 under a trough that broadly extended from the Yenisei and Lena River Basins, which has been a typical pattern of interannual variation since the mid-1990s. This trough increased the meridional pressure gradient between Mongolia and eastern Siberia in combination with the trend pattern. This further enhanced the eastward moisture flux towards the Lena River Basin and its convergence over the basin, resulting in high summer precipitation from 2005 to 2008.

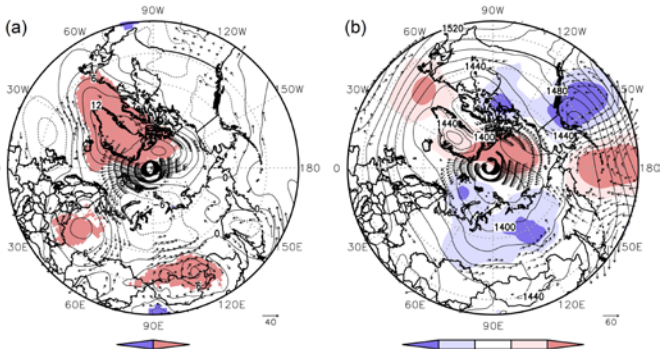


Fig. 1. Left: Linear trend in 850-hPa geopotential height (Z) and moisture flux during the summer from 1984 to 2011. Right: Composite of 850-hPa Z for 2005–2008 and its difference from the climatological mean. Vectors indicate moisture flux anomalies in 2005–2008 relative to the 16-year (1995–2011) mean fields.

2. Reducing Errors in Satellite Chlorophyll-a in the Ise/Mikawa Bay and Absorption Aerosols

Phytoplankton is an ocean primary producer and the base for fish production. However, phytoplankton abundance often increases too much due to human nutrient input in coastal areas and forms red tides, which sometimes harm aquaculture and form anoxic conditions in the water. Ocean color remote sensing is a useful tool to observe chlorophyll-a concentrations in surface water, which is an indicator of the total phytoplankton biomass; however, errors are large in coastal areas due to complex water and atmospheric optical properties. The frequency of negative remote sensing reflectance (the ratio of the radiance from the water and the input irradiance) at 412 nm measured by the satellite sensor MODIS is shown in Fig. 2 for the Ise/Mikawa Bay. High frequency was observed in spring and fall, and the frequency in a large area was greater than 80%. It is believed that the cause of the negative remote sensing reflectance is related to the presence of absorptive aerosols. In this study, we developed a method of atmospheric correction using optical properties in the in situ water and reduced the error of the in-water algorithm estimating chlorophyll-a to make an accurate chlorophyll-a dataset in the Ise/Mikawa Bay. Making further improvements in the atmospheric correction algorithm is critical to better evaluate the influence of absorptive aerosols

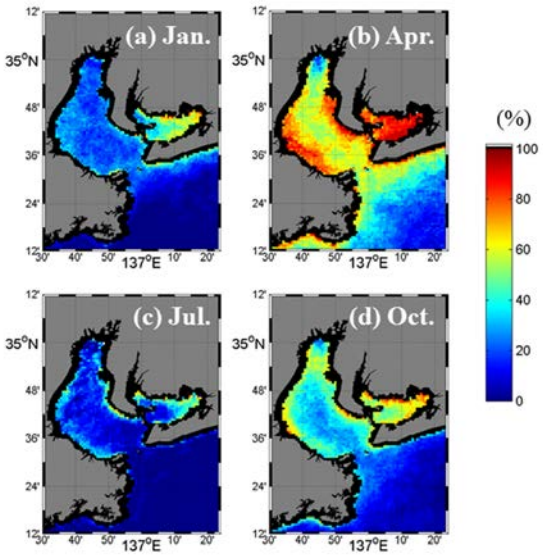


Fig. 2. Frequency of negative remote sensing reflectance of the ocean color sensor MODIS 412 nm for 2000–2012: (a) January, (b) April, (c) July, and (d) October.

7-1. Research Division
Division for Chronological Research

Research topics and keywords

- Accelerator mass spectrometry (AMS)
- Radiocarbon (^{14}C) dating
- Developing radiocarbon (^{14}C) pre-treatment and measurement techniques
- Analysis of cosmogenic nuclides
- CHIME (chemical U-Th total Pb isochron method)
- Microanalysis and X-ray spectroscopy
- Geochronology
- Isotope analysis

Introduction to Division for Chronological Research

Short- and long-term forecasts of global environmental changes and their countermeasures are issues of great urgency. Determining when an event occurred in the past, “dating,” is of great importance to predict future states of the Earth. Therefore, we conduct chronological studies on a broad range of subjects from events in Earth’s history spanning approximately 4.6 billion years, to archeological materials, cultural properties, and modern cultural assets.

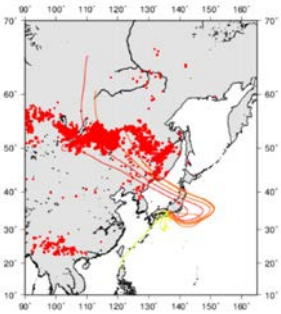
The Tandetron dating group conducts interdisciplinary research that involves radiocarbon (^{14}C) dating using accelerator mass spectrometry (AMS) to understand changes in the Earth’s environment and the cultural history of humankind from approximately 50,000 years ago to the present day; the group also conducts R&D on new methods of ^{14}C analysis and dating. In addition, the group studies near-future forecasts of Earth and space environments, focusing on spatiotemporal variations in cosmogenic nuclides, such as ^{14}C and ^{10}Be, and conducts research that integrates art and science through collaborations between researchers in archeology, historical science, and other fields.

The micro-scale spatial dating group uses CHIME (the chemical U-Th total Pb isochron method), which was first developed at Nagoya University, to shed light on events in Earth’s history from the formation of Earth 4.6 billion years ago up to approximately 1 million years ago. With an electron probe microanalyzer (EPMA), non-destructive microanalyses of rocks and other samples are performed to reveal records of complex events recorded in zircon, monazite, and other materials.

Main Achievements in FY2015

1. Changes in the ^{14}C Contents in Environmental Samples

Since 1983 we have measured the ^{14}C content in pine needles at Nagoya University to study changes in the atmospheric ^{14}C within an urban area. The sample values are significantly lower than global estimates based on ^{14}C in the CO_2 observational data at Mauna Loa, Hawaii, confirming local increases in ^{14}C-free CO_2 caused by the heavy use of fossil fuels. We also examined regional characteristics and sources of $PM_{2.5}$ aerosols in urban, suburban, and mountainous areas based on ^{14}C in carbonaceous aerosols in the atmosphere. In addition, we detected foreign aerosols entering Japan from neighboring countries.



Backward trajectories of an air mass traced from Nagoya during a day of $PM_{2.5}$ collection and forest fire points of origin.

2. Attempts to Reconstruct Paleoclimates from ^{14}C in Stalagmite

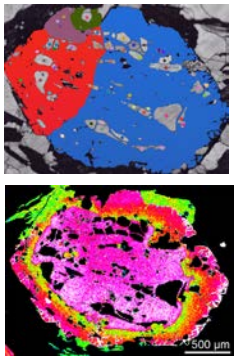
Collecting a sample of drip water.

The ^{14}C content in stalagmite is diluted by ^{14}C-free (dead) carbon derived from the limestone bedrock. To quantitatively interpret the ^{14}C in stalagmite, we investigated ^{14}C in drip water in the Ryugashi Cave in Shizuoka Prefecture, Japan, over a span of two years. The result shows a correlation between the precipitation amounts and the ^{14}C in the drip water, illustrating a trend of higher ^{14}C in drip water during periods of high precipitation. Therefore, ^{14}C in stalagmite is likely an effective proxy for palaeoclimate reconstructions.

3. AMS ^{14}C Dating of Historical Materials

We focus on materials such as fragments of ancient manuscripts and bronze artifacts and investigate methods to determine their ages. The fragments, known as *kohitsugire,* are valuable source materials to investigate society in the Heian and Kamakura Periods. However, included with the genuine *kohitsugire* are numerous counterfeits and copies created later. Therefore, we are working to reveal the ages of *kohitsugire*, and, in turn, their historical value.

4. Growth Histories of Rocks and Minerals through a Combination of EBSD and EPMA



EBSD image (top) and EPMA image (bottom) of a garnet.

Understanding the formation processes of minerals is essential for interpreting the "age" from a geoscientific viewpoint. We combined two methods of electron backscatter diffraction (EBSD) and EPMA and applied them to metamorphic and deformed rocks to examine their metamorphic and deformation histories. The garnet shown in the right figures appears to have grown as a single crystal based on its chemical composition information; however, the EBSD data reveals a polycrystalline garnet composed of four domains with different crystallographic orientations, forcing us to significantly alter our interpretation of its growth process.

5. Ultratrace Titanium in Zircon with High Precision

U-Pb dating was used on zircon in Toki granite to define the period of zircon crystal growth, while EPMA was used to measure the formation temperature of the dated region with high precision. The study succeeded in measuring titanium concentrations of approximately 10–20 ppm with less than a 10% relative error (2σ level). The zircon can be divided into two types with different crystal growths and different formation times.

6. Developing a Simple Fixed Dead Time System for EPMA

In quantitative EPMA analyses of trace elements, it is necessary to detect very weak X-rays at large currents. However, the X-ray strength is extremely high when measuring standard materials at large currents. Because dead time inherent in X-ray detectors can lead to counting losses, the accuracy of the dead time correction is indispensable for accurate quantitative EPMA analyses. We developed a simple fixed dead time circuit designed specifically for quantitative EPMA analyses.

7. Making a Nationwide Spatial Distribution Map of Sr Isotope Ratios

We are making a nationwide spatial distribution map of strontium isotope ratios ($^{87}Sr/^{86}Sr$) using <180 μm stream sediments to detect the producing area of crops and ancient human migrations. Our studies have demonstrated that information on the origin of biological samples can be predicted from $^{87}Sr/^{86}Sr$ in the exchangeable fraction, while geological information of drainage basins can be estimated from $^{87}Sr/^{86}Sr$ in bulk stream sediments.

7-2. Center for International Collaborative Research (CICR)

Research topics and keywords

- Internationally coordinated programs
- Ground-based observation networks and satellite projects
- Hosting international workshops
- International exchange of foreign and Japanese researchers and students
- Capacity building in developing counties through training courses and schools
- Observatories

Introduction to CICR

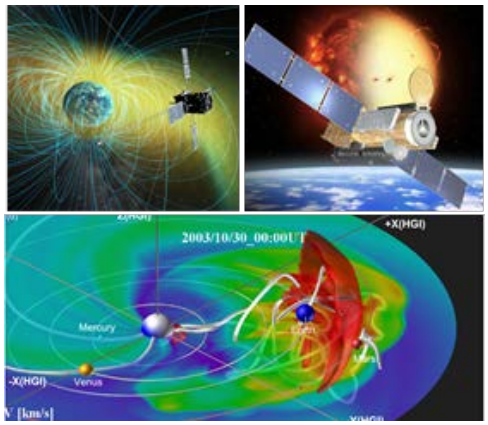
The Center for International Collaborative Research (CICR) was established in October 2015 to promote international collaborative research to understand the physical mechanisms of phenomena occurring in the space–Sun–Earth environmental system and their interactions with each other. CICR uses leadership to encourage and promote internationally coordinated programs, such as those carried out by SCOSTEP and Future Earth, ground-based observation networks, international satellite projects, hosting international workshops and conferences, international exchange of foreign and Japanese researchers and students, and capacity building in developing counties through training courses and schools. CICR replaces the Geospace Research Center of the former Solar-Terrestrial Environment Laboratory at Nagoya University.

The cycle 24 of the 11-year solar cycle has had the smallest maximum in the last 100 years, and scientists in solar–terrestrial physics worldwide are greatly interested in this anomaly and its consequences for Earth's environment. Therefore, the Scientific Committee On Solar–TErrestrial Physics (SCOSTEP) under ICSU started a 5-year international program in 2014 entitled "Variability of the sun and its terrestrial impact (VarSITI)". One of the co-chairs of the VarSITI program belongs to CICR and is responsible for leading this program. Therefore, CICR publishes the VarSITI Newsletter every three months, operates the VarSITI mailing list, which currently contains more than 700 VarSITI members from more than 60 countries, and coordinates international symposiums related to VarSITI. CICR also contributes to other international programs related to the space–Sun–Earth environment, such as Future Earth and iLEAPS. Related to these international programs, CICR also takes part in/operates ground-based observation projects, i.e., the EISCAT radar project, Optical Mesosphere Thermosphere Imagers (OMTIs), the ISEE magnetometer network, the SuperDARN radar network including the Hokkaido HF radars, the ISEE VLF/ELF network, and the ArCS operation office.

In addition, CICR is preparing international collaborative research programs, 01) the Joint Research Program (International), 02) the ISEE International Joint Research Program (applicable only to foreign researchers), and 03) the ISEE/CICR International Workshop, as well as introducing new foreign appointed professors. These new programs and positions were started in the 2016 fiscal year. The ISEE/CICR international workshop is intended to provide a comprehensive discussion on a focused topic with 10–15 attendees for one week and will summarize the results in international journal papers and/or books.

In addition to these activities, CICR maintains four domestic observatories at Moshiri, Rikubetsu, Fuji, and Kagoshima, which make observations of solar wind, the geomagnetic field, and the upper atmosphere, as well as VLF radio waves. Some of these observations have been conducted for over 30 years.

7-2. Center for Integrated Data Science (CIDAS)



Research topics and keywords

- Hinode Science Center
- ERG Science Center
- Research and development of advanced simulations (SUSANOO, CReSS, Monte Carlo simulations for high-precision age calculations, etc.)
- Construction of various databases (IUGONET, WDS-CR, etc.)
- Operation of CIDAS supercomputer system
- Membership activity of HPCI consortium

Introduction to CIDAS

The purpose of the Center for Integrated Data Science (CIDAS) is to construct infrastructure and conduct research and development to realize cutting-edge scientific study of the space–earth environmental system through integrated analyses using various kinds of observational data and advanced computer simulations. CIDAS operates many projects in cooperation with the research divisions and the centers of the Institute for Space–Earth Environmental Research (ISEE), as well as other universities and institutes.

Science centers for space missions: Hinode and ERG

The Hinode Science Center is operated as a joint project with the National Astronomical Observatory of Japan (NAOJ) and developed the database and analytical environment for the data provided by the Japanese solar observation satellite Hinode. In addition, the Exploration of Energization and Radiation in Geospace (ERG) Science Center operates as a joint research center in cooperation with the Institute of Space and Astronautical Science/Japan Aerospace Exploration Agency (ISAS/JAXA), which releases the data from ERG and develops the data analysis software.

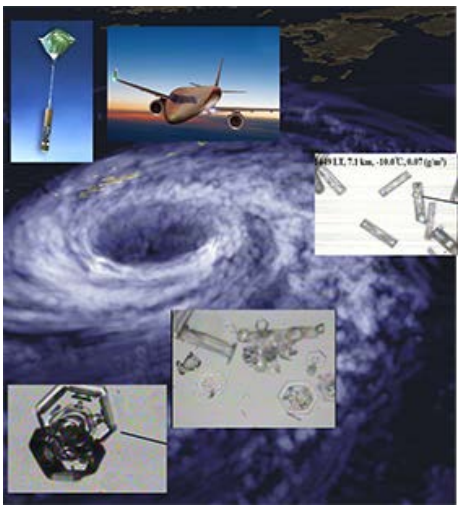
Cooperative research program for database construction and supercomputing

CIDAS is producing various databases for space–earth environmental research and provides supercomputing facilities in collaboration with the Information Technology Center (ITC) of Nagoya University and other universities and institutes. CIDAS has also joined the inter-university network project (IUGONET) with Tohoku University, the National Institute of Polar Research, Kyoto University, Kyushu University, and Nagoya University to develop a metadata server and data analysis software. CIDAS takes charge of activities in ISEE as a member of the High-Performance Computing Infrastructure Consortium (HPCI) in Japan.

Research and development of advanced simulations

CIDAS plays a leading role in research and development of the following advanced computer simulation models: Space Weather Forecast Usable System Anchored by Numerical Operations and Observations (SUSANOO), the Cloud Resolving Storm Simulator (CReSS), and Monte Carlo simulations for accurate Th-U-Pb dating.

7-2. Center for Orbital and Suborbital Observations (COSO)



Research topics and keywords

- Establishment of a central base for aircraft observations
- Implementation of aircraft observations
- Development of CO_2 measurements with balloons
- Promotion of the Exploration of Energization and Radiation in Geospace (ERG) mission
- Development of ChubuSat and promotion of its applications
- Observation of polar ionosphere/magnetosphere by formation flight satellites
- Climate systems research at a virtual laboratory (VL) under the collaboration of four universities

Introduction to COSO

Because the research subjects of ISEE encompass natural phenomena over a wide region ranging from the Earth's surface to outer space, COSO is expected to perform empirical and advanced research by observation. In particular, collaborations between industry, academia, and government have led to remarkable technological developments in observations by aircraft, balloons, sounding rockets, and spacecraft. We develop and implement innovative observation projects for orbital and suborbital observations and also promote technological developments in these fields.

COSO plays a key role in aircraft observations in Japan and promotes aircraft observations of the Earth in cooperation with other organizations. We also investigate and promote future space exploration missions in collaboration with institutions in Japan and overseas to gain new insights into physical phenomena. We help to advance observation capabilities for future orbital and suborbital observations by developing an efficient common technological and development environment via interdisciplinary activities. In addition, the Hydrospheric Atmospheric Research Laboratory in COSO contributes aircraft/balloon observations and satellite observations via two X- and Ka-band radars, together with observational and numerical model studies related to the VL.
Details about ongoing projects and technological developments in COSO are as follows: (1) We plan to establish a central base for aircraft observations at this center, which will lead aircraft observations in Japan and also implement aircraft observations of phenomena such as typhoons. (2) We use comparatively small balloons and are working on the development of devices for measuring the distribution of concentrations of the greenhouse gas CO_2 as far as 10 km above the ground. A balloon-borne CO_2 sonde can function regardless of the location, even when there are clouds. (3) We promote the ERG satellite mission, which is an exploration project being developed at the JAXA/ISAS. The ERG satellite will be launched and start observations in 2016. COSO has contributed to the development of the space plasma particle analyzers onboard the ERG satellite. (4) ChubuSat-2, which is a 50-kg microsatellite designed to observe solar neutrons, was launched in February 2016. (5) COSO also plans the world's first exploration project for performing state-of-the-art measurements with high temporal and spatial resolution for space physics by a formation flight of a number of spacecraft in the ionosphere/magnetosphere of the Earth's polar regions.

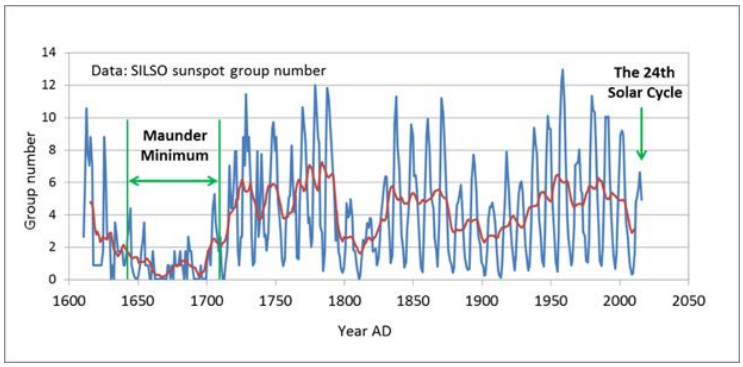
7-3. Interdisciplinary Research Project for Solar–Terrestrial Climate Research

Solar activity, which corresponds to the sunspot number, has an 11/22-year cycle. However, it undergoes long-term variability on cycles ranging from decades to several thousands of years. Because long-term solar activity has coincided with variations in the terrestrial climate over several thousands of years, many researchers have reported that long-term solar activity, as well as volcanic activity, may be one of the causes of natural climate variability. In particular, the years between the 1650s and the 1700s are known as the Maunder Minimum, during which time the sunspot number was significantly lower than the mean and the terrestrial climate was reported to have fallen into the so-called Little Ice Age.

However, the physical processes by which solar activity affects terrestrial climate variations is not very clear. Therefore, understanding this physical process is not only one of the main scientific issues in solar–terrestrial environmental research but it also contributes to our understanding of the current climate warming trend, as well as our ability to predict climate variations in the near future. Because the current solar activity (cycle 24) is considered to be the lowest in the last few decades, most solar–terrestrial environmental researchers believe that solar activity may be shifting into a quiet phase in the near future. Therefore, revealing how solar activity affects the terrestrial climate in the 21st century is an important issue both scientifically and socially.

This research project aims to reveal how solar activity affects the terrestrial climate and environment via a collaboration of researchers from fields such as solar physics, meteorology, oceanography, paleoclimatology, space physics, and cosmic-ray physics. This collaborative research focuses on the following issues, which will be studied by both domestic Japanese and international researchers:

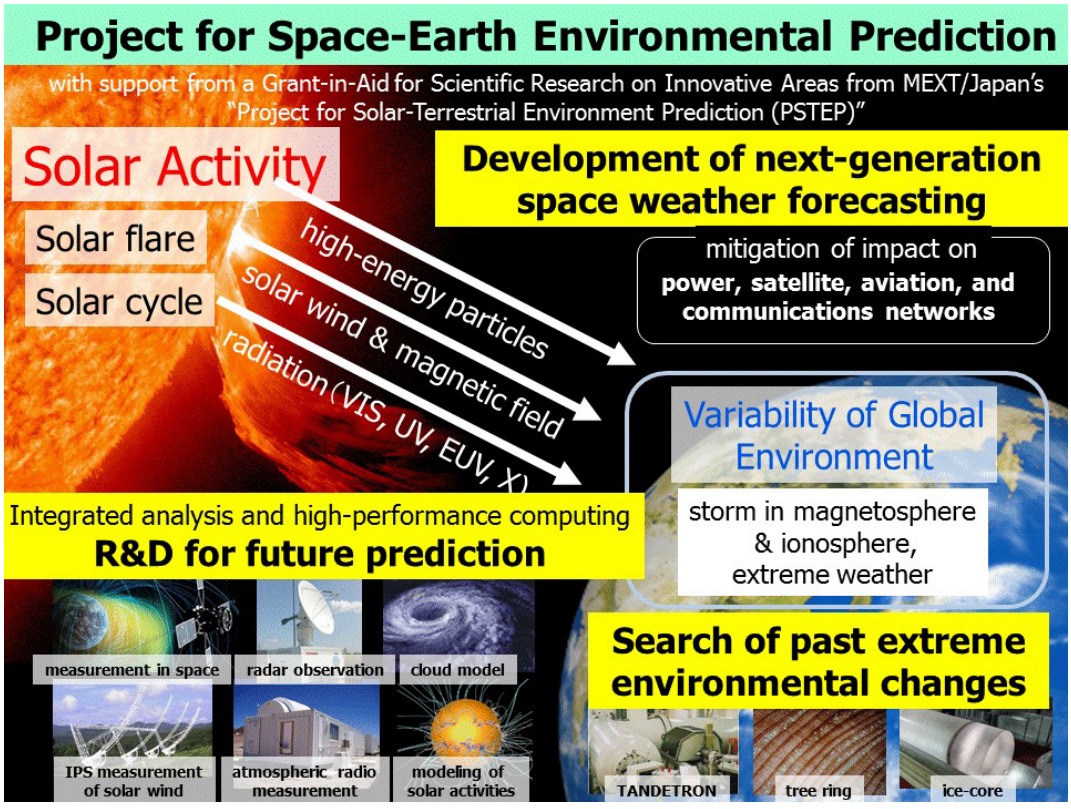
1. Paleoenvironmental and solar activity data from the past will be reconstructed at high resolution using tree rings, ice cores, and permafrost.
2. Nitrogen oxides and hydroxide, both of which are produced by intrusions of high-energy charged particles (i.e., galactic cosmic rays) accelerated by solar flares into the atmosphere, will be measured over the Antarctic.
3. The physical mechanisms of variations in sunspot number will be revealed via numerical simulations compared to observation data. Based on this analysis, total solar irradiance in the recent past, as well as in the near future, will be projected along with terrestrial climate change.
4. The effects of solar radiation, high-energy charged particles, and cosmic rays on the terrestrial climate and environment will be analyzed using several Earth system models. Future projections of such effects will also be actively performed.



Sunspot number variations over the past 400 years.

7-3. Interdisciplinary Research Project for Space–Earth Environmental Prediction

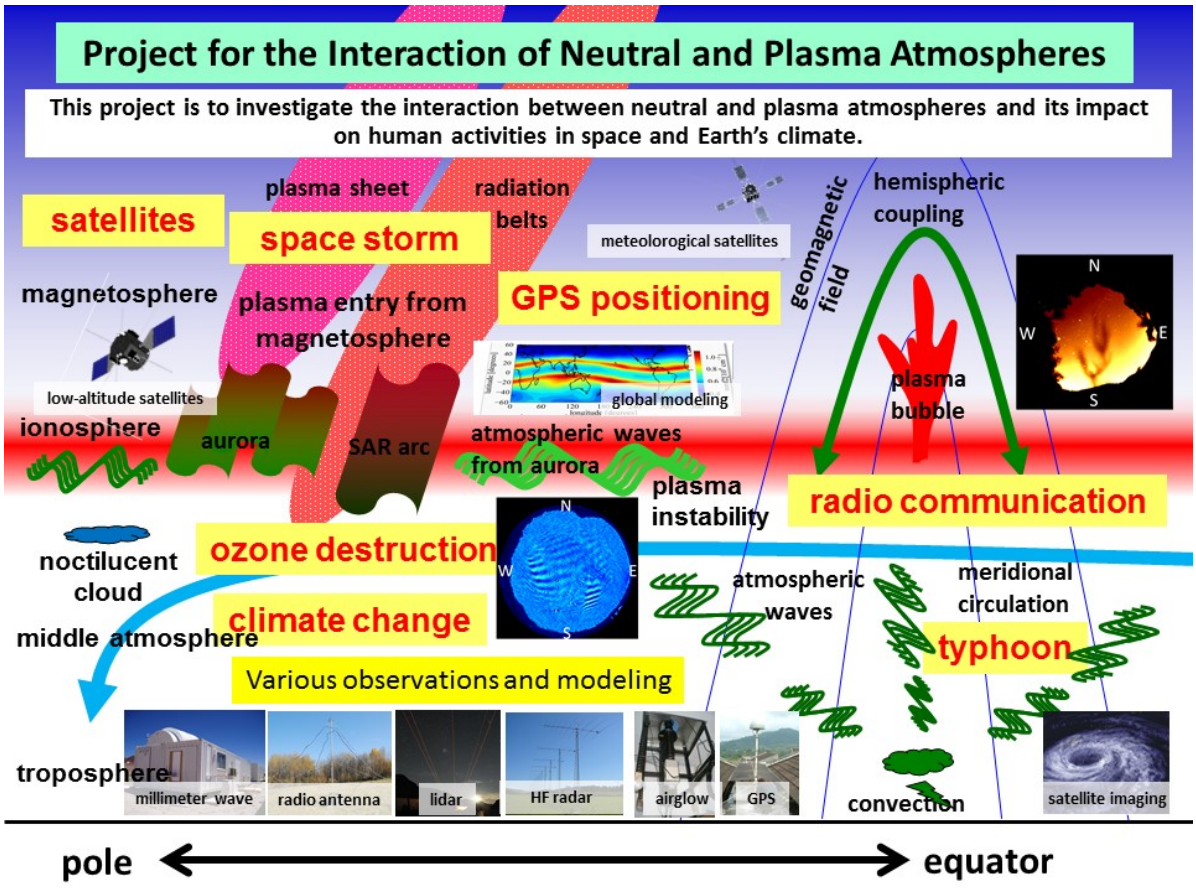
Over the past 50 years, space exploration has expanded rapidly and has now reached past the edge of the heliosphere. Consequently, it is known that solar activity and the dynamics of the space environment can significantly impact human socio-economic systems as well as the global environment. For example, the giant solar flare observed by the British astronomer Richard Carrington in 1859, called the Carrington Event, caused powerful magnetic storms. If such an event occurred in the modern era, power, satellite, aviation, and communication networks would possibly suffer damage on a global scale. Moreover, analyses of the latest stellar observations and of cosmogenic isotopes in tree rings suggest the possibility of even larger solar flares. However, the mechanisms of the onset of solar flares and their subsequent processes have not yet been fully explained. Therefore, modern society is at a risk from severe space weather disturbances, which are caused by such solar explosions, and understanding and predicting variations in the space–Earth environment is both a scientific subject and a crucial issue for modern society. Further, because the accurate prediction of complex phenomena is a common problem in science, this is also a crucial subject for various scientific disciplines. The Project for Space–Earth Environmental Prediction is a new joint research project aimed at synergistically developing our predictive capability for the space–Earth environment through the cooperation and interaction of solar physics, geomagnetism and space sciences, meteorology, climatology, space engineering, and other related fields. This project addresses the various issues shown in the figure below based on the ISEE Collaborative Research Programs and the support of a Grant-in-Aid for Scientific Research on Innovative Areas from MEXT/Japan “Project for Solar-Terrestrial Environment Prediction (PSTEP).”



The objectives and subjects of the Project for Space–Earth Environmental Prediction.

7-3. Interdisciplinary Research
Project for the Interaction of Neutral and Plasma Atmospheres

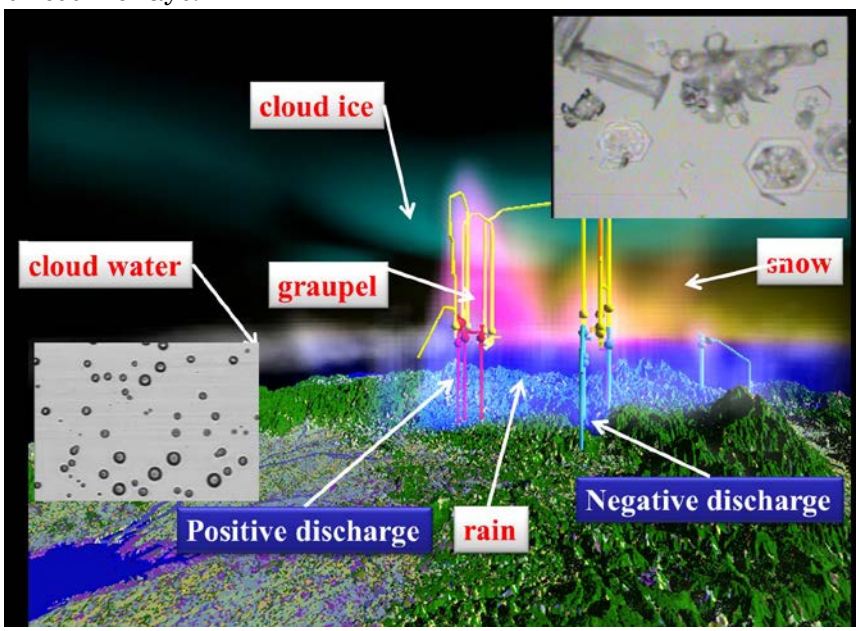
The Earth's atmosphere is partly ionized due to solar ultraviolet emissions forming the ionosphere. Ionospheric plasma affects human activities in space, such as radio communications and GPS positioning. The significant consequences of climate change appear in the upper atmosphere and ionosphere. As shown in the figure below, the neutral–plasma interaction processes in the upper atmosphere and ionosphere can be observed as various phenomena occurring from high to low latitudes. The aurora in the polar region is caused by precipitation of high-energy plasma, which heats the upper atmosphere and generates atmospheric waves and disturbances that propagate toward low latitudes. Conversely, ionospheric plasma instabilities, which are called plasma bubbles, occur in the equatorial upper atmosphere, causing interference in satellite–ground communication and GPS positioning. These phenomena can be measured by various ground-based remote-sensing instruments, such as airglow imagers, magnetometers, radars, lidars, and millimeter-wave telescopes. This interdisciplinary project investigates the interaction of neutral and plasma components of the Earth's atmosphere using various ground remote sensing techniques and in situ satellite measurements, as well as global and regional high-resolution modeling of the neutral–plasma interaction, and contributes to dependable human space activities.



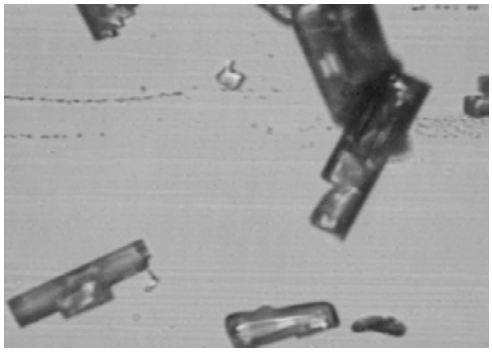
Research topics of the project for the interaction of neutral and plasma atmospheres.

7-3. Interdisciplinary Research Project for Cloud and Aerosol Processes

Hydrometeors and aerosols closely interact with each other in their generation and dissipation and play important roles in the atmospheric water circulation and the earth's radiation budget. They are, however, some of the most unknown quantities in the atmosphere. So far, hydrometeors and the related circulation of water have been studied in the Hydrospheric Atmospheric Research Center, whereas aerosols and related processes have been studied in the Solar–Terrestrial Environmental Laboratory. In the joint research program, researchers from both sides will cooperate to study the interaction between aerosols and hydrometeors, their variations in the formation of precipitation, and cloud–aerosol–radiation interactions using laboratory experiments, field observations, and numerical simulations. On the basis of field observations, the numerical model will be improved for quantitative simulations of cloud and aerosol processes. In cooperation with the Center for Orbital and Suborbital Observations, we will make in situ observations of typhoons using an aircraft, balloons, and drones. This research will improve the cloud-resolving model (CReSS) and the impact of aerosols on typhoon clouds will be studied. The present program will interact with the other program on solar climate impacts to study the formation of clouds in association with cosmic rays.



A mesoscale convective system and formation of hydrometeors simulated by the CReSS model. The superimposed images show hydrometeors expected to be present in the convective system.



A balloon observation of typhoon clouds. Launching the balloon (left panel) and observed hydrometeors (right panel).

8. Publications and Presentations

Papers (in refereed journals) (October, 2015 – March, 2016)

* Only with ISEE affiliation

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Publications of proceedings

Title	Date of Publication
Proceedings of 20th Workshop on Lidar Observation of Atmosphere	March 15, 2016
The International Science Conference on MAHASRI Program & Abstracts	March 18, 2016
Summaries of Research Using AMS at Nagoya University (XXVII)	March, 2016

Three more proceedings were published in Japanese.

Conference Presentations（October, 2015–March, 2016）

International Conferences

Title	Country/Region	Date	Organizers	Number of Presentations			
				Staff and PDs	Students	Total	Invited
The 9th Workshop of the Virtual Laboratory for the Earth's Climate Diagnostics Program, and the University Allied Workshop (UAW)	Kashiwa, Japan	Sept. 29-Oct. 1, 2015.			3	3	
International WS Issues in downscaling of climate change projection	Kashiwa, Japan	Oct. 5-7, 2015		1		1	
The 6th East Asia Accelerator Mass Spectrometry Symposium (EA-AMS 6)	Taipei, Taiwan	Oct. 5-8, 2015	1	1		1	1
Cluster 15th and Double Star 10th anniversary workshop	Venezia, Itaria	Oct. 12-16, 2015.		1		1	1
ISEE-KASI Korea-Japan Space Weather Workshop 2015	KASI, Daejeon, Korea	Oct. 13, 2015		5		5	1
2015 PICES Annual Meeting	Qingdao, China	Oct. 14-25, 2015	1				
14th International Symposium on Equatorial Aeronomy (ISEA14)	Bahir Dar, Ethiopia	Oct. 19-23, 2015	1	2	1	3	
ALMA/NRO45m/ASTE/Mopra Users Meeting 2015	Tokyo, Japan	Oct. 20-22, 2015		2		2	
Third remote sensing of the inner heliosphere and space weather applications workshop	Morelia, Mexico	Oct. 20-24, 2015		1		1	1
ISEST/MiniMax 2015 Workshop	Mexico City	Oct. 25-30, 2015		1		1	
TeVPA 2015	Kashiwa, Japan	Oct. 26-30, 2015		1		1	
Workshop on tree mortality and the future of tropical forests	Santa Fe,NM, U.S.A.	Oct. 26-28, 2015		1		1	1
MAVEN Project Science Group Meeting	Greenbelt MD, U.S.A.	Oct. 27-30, 2015		1		1	
The 3rd Asia -Pacific Solar Physics Meeting	Seoul, Korea	Nov. 2-6, 2015			3	3	
25th International Toki Conference	Gifu, Japan	Nov. 3-6, 2015		1		1	1
Founding Symposium for the Institute for Space–Earth Environmental Research "Evolution of the Space-Sun-Earth Environmental System in Space and Time"	Nagoya, Japan	Nov. 4-5, 2015	4	24	14	38	
International Conference on Weather Forecast & Hydrological Applications of Radar	Jeju, Korea	Nov. 4-6, 2015			1	1	1
Symposium on “Quarks to Universe in Computational Science (QUCS 2015)”	Nara, Japan	Nov. 4-8, 2015		1		1	1

Title	Country/Region	Date	Organizers	Number of Presentations			
				Staff and PDs	Students	Total	Invited
The Sixth Asia/Oceania Meteorological Satellite Users' Conference	Tokyo, Japan	Nov. 9-13, 2015		1		1	
The 6th Fermi Symposium	Arlington, Virginia, U.S.A.	Nov. 9-13, 2015	1				
The 13th international conference on the Atmospheric Sciences and Application to Air Quality (ASAAQ13)	Kobe, Japan	Nov. 11-13, 2015	2	3		3	
22nd Radiocarbon Conference	Dakar, Senegal	Nov. 16-20, 2015	1	2		2	
The 4th ENRI International Workshop on ATM/CNS (EIWAC) 2015	Tokyo, Japan	Nov. 17-19, 2015			1	1	
Russia/Japan Joint Workshop on Environmental Investigations in West Siberia and the Arctic using a synergy of Russian Airplane-Laboratory and Japanese Satellites	Moscow, Russia	Nov. 23-24, 2015		1		1	
JSPS-DFG workshop on Aerosols	Mainz, Germany	Nov. 25-27, 2015		1		1	
ILTS International Symposium on Low Temperature Science	Sapporo, Japan	Nov. 30-Dec. 2, 2015		1		1	1
Multi-TeV and beyond: SST sciences and the GCT project for the high energy section of CTA	Paris, France	Nov. 30-Dec. 2, 2015	1				
ISAS Workshop: Magnetospheric Plasmas 2015	Tokyo, Japan	Dec. 1-3, 2015		3	2	5	1
Workshop “MHD-Days 2015”	Ilmenau, Germany	Dec. 7-9, 2015		1		1	
2015 CHAMOS meeting	Luosto, Finland	Dec. 7-11, 2015		2		2	
The 12th Korea-Japan Workshop on ocean clolor	Yokohama, Japan	Dec.8-10, 2015	1	4	6	10	
3rd International Symposium on Computing and Networking (CANDAR)	Sapporo, Japan	Dec. 8-11, 2015		1		1	
2015 AGU (American Geophysical Union) Fall Meeting	San Fransisco, CA, U.S.A.	Dec. 14-18, 2015		16	7	23	1
CLIVAR/JAMSTEC Workshop on the Kuroshio Current and Extension System	Yokohama, Japan	Jan. 12-13, 2016		1		1	
1st PSTEP International Symposium “Toward the Solar-Terrestrial Environment Prediction as Science and Social Infrastructure”	Nagoya, Japan	Jan. 13-14, 2016		6	4	10	2
20th Microlensing workshop	Paris, France	Jan. 13-15, 2016		1		1	

Title	Country/Region	Date	Organizers	Number of Presentations			
				Staff and PDs	Students	Total	Invited
Joint PI Meeting of Global Environment Observation Mission 2015	Tokyo, Japan	Jan. 18-22, 2016		1		1	
Science for Space Weather	Goa, India	Jan. 24-29, 2016		2		2	2
火星探査機 MAVEN 衛星の The Project Science Group meetings (PSG)	Boulder, CO, U.S.A.	Feb. 1, 2016			1	1	
International Space Science Institute Workshop “Shallow Clouds, Water Vapor, Circulation and Climate Sensitivity”	Bern, Switzerland	Feb. 8-12, 2016		1		1	
ISSI Meeting: possible application of magnetotail acceleration mechanisms to the standard solar flare scenario.	Bern, Switzerland	Feb. 14-19, 2016		3	1	4	1
Vienna Conference on Instrumentation	Vienna, Austria	Feb. 15-19, 2016	1		1	1	
4th Annual Symposium of the Innovative Area on Multi-messenger Study of Gravitational Wave Sources	Tokyo, Japan	Feb. 18-20, 2016		1		1	
Dynamic Sun: I. MHD Waves and Confined Transients in the Magnetized Atmosphere meeting	Varanasi, India	Feb. 22-26, 2016		1		1	1
The International Science Conference on MAHASRI	Tokyo, Japan	Mar. 2-4, 2016		3		3	
MR2016 (The US-Japan Workshop on Magnetic Reconnection)	Napa, CA, U.S.A.	Mar. 7-11, 2016			1	1	
International Symposium “Metamorphic rocks and Metamorphism: Future Perspectives”	Okayama, Japan	Mar. 12-14, 2016		1		1	
International GEMSIS and ASINACTR-G2602 Workshop	Nagoya, Japan	Mar. 22-25, 2016		15	10	25	2
Total			14	115	56	171	19

Domestic conferences

Number of Conferences	Organizers	Number of Presentations			
		Staff and PDs	Student	Total	Invited
64	13	149	70	219	16

Lectures for researchers

Date	Title	Staff	Number of Participants
Nov. 4-5, 2015	Evolution of the Space-Sun-Earth Environmental System in Space and Time	See below*	177
Jan. 13-14, 2016	PSTEP-1 "Toward the Solar-Terrestrial Environment Prediction as Science and Social Infrastructure"	Kanya Kusano, Yoshizumi Miyoshi	125
Mar. 25, 2016	Study of E- and F-region Coupling at Mid-Latitudes by Optical and Radio Observations	Yuichi Otsuka	25

Additionally, two domestic lectures for researchers were held.

* ISEE Inauguration Symposium

The symposium was held to discuss scientific topics to study in the new institute. Following the ceremony, there were 10 invited oral presentations, 4 introductive presentations from the ISEE members, and 82 poster presentations with 177 participants. Invited speakers were Prof. Bruce T. Tsurutani (NASA Jet Propulsion Laboratory), Prof. A. J. Timothy Jull (The university of Arizona), Prof. Alex B. Guenther (University of California, Irvine), Prof. Joaquim Goes (Lamont-Doherty Earth Observatory, Columbia University), Prof. S. Yoden (Kyoto University), Prof. T. Iyemori (Kyoto University), Prof. H. Niino (University of Tokyo), Prof. Y. Iryu (Tohoku University), Prof. S. Tuneta (Director of ISAS), Prof. T. Terasawa (University of Tokyo).

Awards

Date	Awards	Award winners	Title
Nov. 2, 2015	Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS) Obayashi Early Career Scientist Award	Kunihiro Keika	Study on ion dynamics in the inner magnetosphere using spacecraft data
Nov. 8, 2015	Breakthrough Prize in Fundamental Physics 2016	Yoshitaka Itow	・Super-Kamiokande Collaboration ・K2K (KEK to Kamioka) and T2K (Tokai to Kamioka) Long Baseline Neutrino Oscillation Experiments

Additionally, one domestic award and two students awards.

9. Education

The Institute for Space–Earth Environmental Research primarily offers graduate programs in three schools, i.e., Science, Engineering, and Environmental Studies; however, it also provides opportunities for both undergraduate and postdoctoral experiences in these schools. In addition to the academic staff of the faculties, specially appointed members also contribute to education via graduate and undergraduate courses. Graduates are enrolled in the doctoral programs. Academic members are responsible for guiding the progress of the students' thesis projects. The students studying at the institute also have opportunities to attend seminars and discussions with foreign researchers and to participate in international meetings/conferences and observations/experiments.

Graduate Programs

The institute has its own graduate course program for Heliospheric and Geospace Physics as a part of the Division of Particle and Astrophysical Science in the Graduate School of Science at Nagoya University.

In addition, it cooperates with the Department of Electrical Engineering and Computer Science via the Space Electromagnetic Environment group (http://www.nuee.nagoya-u.ac.jp/soshiki/electrical-e.php) in the Graduate School of Engineering and the Department of Earth and Environmental Sciences (as a group in the Earth and Planetary Sciences Course and the Hydrospheric–Atmospheric Sciences Course http://www.env.nagoya-u.ac.jp/english/dept/index.html) in the Graduate School of Environmental Studies by teaching/training graduate students in disciplines related to Space–Earth Environmental Research. Graduates are enrolled in the doctoral programs. Academic members are responsible for guiding the progress of the students' thesis projects. They also teach core and topical courses.

		Graduate School of Science					Graduate School of Engineering		Graduate School of Environmental Studies					
		Division of Particle and Astrophysical Science					Department of Electrical Engineering and Computer Science		Department of Earth and Environmental Sciences					
		Heliospheric and Geospace Physics					Electrical Engineering Course Space Electromagnetic Environment		Earth and Planetary Sciences CourseEarth History Study		Hydrospheric-Atmospheric Sciences Course Global Water Cycle			
		Atmospheric and Environmental Science AM	Space Science – Experiment SSE	Solar and Space Physics - Theory SST	Cosmic-Ray Physics CR	Heliospheric Plasma Physics SW	Space Observation	Information Engineering	CHIME	Tandetron AMS	Meteorology	Cloud and Precipitation Sciences	Hydroclimatology	Oceanography
Institute for Space–Earth Environmental Research	Meteorological and Atmospheric Research			●				●						
	Cosmic-Ray Research				●									
	Heliospheric Research					●								
	Ionospheric and Magnetospheric Research		●				●							
	Meteorological and Atmospheric Research	●					●				●	●		
	Land–Ocean Ecosystem Research												●	●
	Chronological Research				●				●	●				

Staff association between the research divisions in the Institute for Space–Earth Environmental Research and the graduate schools.

Number of students supervised by ISEE staff

As of Mar 31, 2016

	M1	M2	D1	D2	D3	Undergraduate Students	Research Students	Total
Graduate School of Science	17	24	1	8	9			59
Graduate School of Engineering	10	5	0	0	1			16
Graduate School of Environmental Studies	10	9	4	3	10		1	37
School of Science						7		7
School of Engineering				1		10		11
Total	37	38	5	12	20	17	1	130

Faculty Members

Field/Topics	Professor	Associate Professor	Lecturer	Assistant Professor
Graduate School of Science Division of Particle and Astrophysical Science				
Solar-Terrestrial Chemistry	Yutaka Matsumi		Tomoki Nakayama	
	Akira Mizuno	Tomoo Nagahama		
Solar-Terrestrial Relationships	Ryoichi Fujii▲			
	Masafumi Hirahara	Satonori Nozawa	Shin-ichiro Oyama	
	Kazuo Shiokawa	Yuichi Otsuka		
	Kanya Kusano	Satoshi Masuda		Akimasa Ieda
		Kanako Seki▲		
Solar-Terrestrial Physics	Yoshitaka Itow	Kimiaki Masuda	Takashi Sako	Akira Okumura
	Hiroyasu Tajima	Fumio Abe		
		Yutaka Matsubara		
	Munetoshi Tokumaru			Ken-ichi Fujiki
Graduate School of Engineering Department of Electrical Engineering and Computer Science				
Space Electromagnetic Environment	Kazuo Shiokawa	Nozomu Nishitani		Taku Nakajima
	Shinobu Machida	Yoshizumi Miyoshi	Takayuki Umeda	Sinsuke Imada
Graduate School of Environmental Studies Department of Earth and Environmental Sciences				
Hydrospheric-Atmospheric Sciences Course Global Water Cycle	Kazuhisa Tsuboki	Taro Shinoda		
	Nobuhiro Takahashi	Hirohiko Masunaga		
	Tetsuya Hiyama	Tomo'omi Kumagai	Hatsuki Fujinami	
	Joji Ishizaka	Hidenori Aiki		Yoshihisa Mino
Earth and Planetary Sciences Course Earth History Study	Masaki Enami	Takenori Kato		
	Toshio Nakamura▲	Masayo Minami		Hirotaka Oda

▲:Left the Institute in the 2015 academic year

Undergraduate Education

Based on demand, the faculty of the institute offers numerous undergraduate courses in the School of Science, the School of Engineering, and in other departments and at other universities in the adjacent area.

During the 2015 academic year, the following courses were offered;

・First Year Seminar A
・Foundations of Electromagnetics I, II
・Laboratory in Physics
・Astrophysics and Space Science
・Science of Atmospheric-Hydrospehric Environment
・Introduction to Earth Science
・Problems of Quaternary Man-land Relationships
・Experimental Physics
・Physics Experiments I/II
・Introduction to Physics I
・Graduation Research-Experiments
・Astrophysics III
・Solar System Science
・Atmospheric and Hydrospheric Sciences
・Petrology
・Geochemical Analysis I and Experiments
・Environmental Earth Sciences
・Electromagnetic Wave Engineering
・Electric Circuits with Exercise
・Probability Theory and Numerical Analysis with Exercises
・Mathematics 1 with Exercises A/B

10. International Relations

Academic Exchange

Institution	Country/Region	Establishment
Indonesian National Institute of Aeronautics and Space	Indonesia	May 31, 1988
Korean Space Weather Center	Korea	December 24, 2012
Korea Institute of Ocean Science and Technology, Korea Ocean Satellite Center	Korea	April 17, 2014
Pukyong National University, College of Fisheries Sciences	Korea	October 2, 2006
Institute of High Energy Physics, Chinese Academy of Sciences	China	February 20, 2001
Polar Research Institute of China	China	November 11, 2005
National Taiwan University Atmospheric Sciences	Taiwan	October 30, 2009
Taiwan Ocean Research Institute	Taiwan	December 30, 2011
Center for Weather Climate and Disaster Research, National Taiwan University	Taiwan	September 3, 2014
Bangladesh University of Engineering & Technology, Department of Physics	Bangladesh	May 4, 2008
National Institute of Water & Atmospheric Research Ltd.	New Zealand	July 26, 1989
Center for Geophysical Research, University of Auckland	New Zealand	December 7, 1992
Faculty of Science, University of Canterbury	New Zealand	July 30, 1998
Geophysical Institute, University of Alaska Fairbanks	U.S.A.	July 16, 1990
Space Environment Laboratory, National Oceanic and Atmospheric Administration	U.S.A.	December 15, 1992
National Geophysical Data Center, National Oceanic and Atmospheric Administration	U.S.A.	January 5, 1993
Haystack Observatory, Massachusetts Institute of Technology	U.S.A.	October 24, 1994
Center for Astrophysics and Space Sciences , University of California at San Diego	U.S.A.	December 22, 1997
Center for Space Science and Engineering Research (Space@VT), Virginia Polytechnic Institute and State University	U.S.A.	January 23, 2013
Universidad Mayor de San Andres, La Paz, Faculty of Sciences, Chacaltaya Cosmic Ray Observatory	Bolivia	February 20, 1992
Ministry of Science and Technology, National Institute for Space Research	Brazil	March 5, 1997
Swedish Institute of Space Physics	Sweden	September 1,2005 (since Mar 25, 1993)
Faculty of Science, University of Tromsø	Norway	April 2, 2003 (since Oct 8, 1993)
Department of Geophysics, Finnish Meteorological Institute	Finland	October 21, 1994
Yerevan Physics Institute	Armenia	October 18, 1996
Institute of Cosmophysical Research and Radiowave Propagation, Far Eastern Branch, Russian Academy of Sciences	Russia	April 14, 2007
Institute of Solar-Terrestrial Physics (ISTP), Siberian Branch, Russian Academy of Science, Russian Federation	Russia	October 28, 2008
YuG. Shafer Institute of Cosmophysical Research and Aeronomy (IKFIA) , Siberian Branch, Russian Academy of Sciences	Russia	November 28, 2012

Note: The list includes the academic exchanges established in the former organizations before ISEE.

Major International Projects・International Collaborative Projects

Major International Projects

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Project for Development of the Atmospheric Environmental Risk Management System in South America	Akira Mizuno	Argentina, Chile	CEILAP/UAMG
VarSITI (Variability of the Sun and Its Terrestrial Impacts)	Kazuo Shiokawa	U.S.A., U.K., France, Germany, Australia, Canada, Italy, India, China, and other countries	SCOSTEP
Study of the Polar/Midlatitude Ionosphere and Magnetosphere Using the SuparDARN HF Radar Network	Nozomu Nishitani	U.S.A., U.K., France, South Africa, Australia, Canada, Italy, Russia, China	JHU/APL, Virginia Polytechnic Institute and State University, University of Leicester, LPCE/CNRS, University of Natal, La Trobe University, University of Saskatchewan, IFSI, ISTP, Polar Research Institute of China

International Collaborative Projects

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Laboratory Studies on Atmospheric Fate Processes of Hydrofluorocarbons	Yutaka Matsumi	U.S.A.	Ford Research Laboratory
Laboratory Studies on Elementary Reactions of Atmospheric Minor Constituents	Yutaka Matsumi	U.S.A.	University of Bristol
Application of the Cavity Ring Down (CRD) Spectroscopy to Atmospheric Measurements	Yutaka Matsumi	U.S.A.	Geophysical Institute, University of Alaska Fairbanks
Research on Optical Properties of Atmospheric Aerosol Particles	Yutaka Matsumi	Ireland	University College Cork
Continuous Observation of Methane at a Paddy Field in Northern India	Yutaka Matsumi	India	University of Delhi
High Energy Particles in Geospace: the Acceleration Mechanism and the Role in Earth's Climate	Akira Mizuno	U.S.A., Norway, Sweden	University of Colorado Boulder, UCLA, University of Arizona, University of Tromsø, EISCAT Scientific Association
Magnetic Conjugate Observations of Midlatitude Thermospheric Disturbances	Kazuo Shiokawa	Australia	IPS Radio and Space Services
Variation of the Thermosphere and Ionosphere owing to the Energy of Atmospheric Waves	Kazuo Shiokawa	Indonesia	LAPAN
High-Sensitive Imaging Measurements of Airglow and Aurora in the Canadian Arctic	Kazuo Shiokawa	U.S.A., Canada	University of California, University of Calgary
Global Observation of Airglow Rotational Temperature in the Mesopause Region	Kazuo Shiokawa	Brazil	INPE

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Ionosphere and Upper Atmosphere Research, Observations and Monitoring	Kazuo Shiokawa	Thailand	Chiang Mai University
Ground and Satellite Measurements of Geospace Environment in the Far-Eastern Russia	Kazuo Shiokawa	Russia	Institute of Cosmophysical Research and Radiowave Propagation, Far Eastern Branch, Russian Academy of Sciences
Observations of the Equatorial Ionosphere in South-East Asia and West Africa	Kazuo Shiokawa	Nigeria, Cote d'Ivoire	National Space Research and Development Agency, Federal University of Technology, Akure, Université Félix Houphouët-Boigny
Study of the Polar Upper Atmosphere Using the EISCAT Radars and Other Instruments	Satonori Nozawa	Norway, U.K., Sweden, Finland, Germany, China	University of Tromsø , EISCAT Scientific Association
Research and Development of the Low-Energy Electron Instrument Onboard the ERG Satellite	Masafumi Hirahara	Taiwan	Academia Sinica Institute of Astronomy and Astrophysics, National Cheng Kung University
Research and Development of the Plasma/Particle Instrument Suite for the Mercury Magnetospheric Exploration Mission	Masafumi Hirahara	France, Sweden, U.K., U.S.A., Switzerland	CESR-CNRS, CETP-IPSL, Institute for Solar Physics of the Royal Swedish Academy of Sciences, Rutherford Appleton Laboratory, Boston University, University of Bern, and other institutions
Study of Pulsating Aurora Using AMISR and Optical Instruments	Shin-ichiro Oyama	U.S.A.	Geophysical Institute, UAF, Geophysical Institute-ARSC, SRII Univ. Maryland College Park
Study of Auroral Energetic Electron Precipitation (EEP) impacts on the upper/middle atmosphere	Shin-ichiro Oyama, Yoshizumi Miyoshi	Finland, New Zealand, U.K., Norway, U.S.A.	Sodankyla Geophysical Observatory, University of Oulu, Finnish Meteorological Institute, University of Otago, British Antarctic Survey, University Centre in Svalbard, University of Alaska Fairbanks
Observations of Interplanetary Disturbances Using the International IPS Network	Munetoshi Tokumaru	U.K., India, Mexico	LoFAR, Tata Institute of Fundamental Research, UNAM
Study of 3-D Solar Wind Structure and Dynamics Using Heliospheric Tomography	Munetoshi Tokumaru	U.S.A.	UCSD/CASS
Study on the Application of Interplanetary Scintillation Observations to Space Weather Forecast	Munetoshi Tokumaru	Korea	Korean Space Weather Center
Study of the Heliospheric Boundary Region Using Observations of Interplanetary Scintillation	Munetoshi Tokumaru	U.S.A.	University of Alabama in Huntsville, CSPAR
A Search for Dark Objects Using the Gravitational Microlensing Effect	Fumio Abe	New Zealand, U.S.A.	University of Auckland, University of Canterbury, Victoria University of Wellington, Massey University, University of Notre Dame
Study of Solar Neutrons	Yutaka Matsubara	Bolivia, Armenia, China, Switzerland, U.S.A. , Mexico	Research Institute of Physics University of San Andres, Yerevan Physics Institute, Institute of High Energy Physics, Chinese Academy of Sciences, University of Bern, University of Hawaii, National Autonomous University of Mexico

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Study in Interaction of Very High Energy Cosmic Rays by Using Large Hadron Collider	Yoshitaka Itow	Italy, France, Switzerland, U.S.A.	University of Florence, Catania University, École Polytechnique, CERN, Lawrence Berkeley National Laboratory
Study of Dark Matter and Solar Neutrinos Using a Liquid Xenon Detector	Yoshitaka Itow	Korea	Seoul National University, Sejong University, Korea Research Institute of standards and Science
Study in Cosmic Neutrinos by Using a Large Water Cherenkov Detector	Yoshitaka Itow	U.S.A., Korea, China, Canada, Poland, Spain, U.K.	Boston University, Brookhaven National Laboratory, UCI, Duke University, George Mason University, University of Hawaii, Indiana University, Los Alamos National Laboratory, University of Maryland, State University of New York, University of Washington, University of British Columbia, University of Toronto, TRIUMF, Queen Mary University of London, Imperial College London, University of Liverpool, University of Oxford, University of Sheffield, Complutense University of Madrid, Chonnam National University, Seoul National University, Sungkyunkwan University, Tsinghua University, University of Warsaw
Research and Development for the Next Generation Water Cherenkov Detector, Hyper-Kamiokande	Yoshitaka Itow	U.S.A., Korea, Canada,Italy, Spain, Poland, U.K. , France, Switzerland, Brazil, Russia, Portugal, China	Boston University, Brookhaven National Laboratory, UCI, Duke University, George Mason University, Indiana University, University of Hawaii, Los Alamos National Laboratory, University of Maryland, State University of New York, University of Washington, Chonnam National University, Seoul National University, Sungkyunkwan University, Tsinghua University, INFN Sezione di Bari, INFN Sezione di Napoli, INFN Sezione di Padova, INFN Sezione di Roma, Imperial College London, Lancaster University, University of Oxford, Queen Mary University of London, University of Sheffield, Rutherford Appleton Laboratory, Autonomous University of Madrid, University of Warsaw, CEA Saclay, École polytechnique, University of Bern, Swiss Federal Institute of Technology Zurich, University of São Paulo, and other institutions

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Study in Interaction of Very High Energy Cosmic Rays by using Relativistic Heavy Ion Collider	Takashi Sako	Italy, U.S.A.	Università degli Studi di Firenze, University of Catania, Brookhaven National Laboratory
Research on Origin of Cosmic Rays with Fermi Satellite	Hiroyasu Tajima	U.S.A., France, Italy, Sweden	Stanford University, SLAC National Accelerator Laboratory, GSFC/NASA, U.S. Naval Research Laboratory, UCSC, Sonoma State University, University of Washington, Purdue University, Ohio State University, University of Denver, CENS, CNRS, École Polytechnique, INFN, Italian Space Agency, IFSI, Royal Institute of Technology, Stockholm University,
Research on Origin of Cosmic Rays with Soft Gamma-ray Detector Onboard ASTRO-H Satellite	Hiroyasu Tajima	U.S.A., France	Stanford University, CENS
Solar Flare Research with Hard X-ray Spectral Imaging Observations	Hiroyasu Tajima	U.S.A.	UCB, MSFC/NASA, Air Force Research Laboratory, National Astronomical Observatory of Japan, Institute of Space and Astronautical Science, Kyoto University
Solar Flare Research with Gamma-ray Spectral Imaging Observations with Polarimetry	Hiroyasu Tajima	U.S.A.	UCB, Lawrence Berkeley National Laboratory, GSFC/NASA, Institute of Space and Astronautical Science
Research on Origin of Cosmic Rays with CTA (Cherenkov Telescope Array)	Hiroyasu Tajima	Germany, France, Italy, Spain, Poland, U.S.A., Brazil, Argentina, Armenia, Australia, Bulgaria, Croatia, Czech, Finland, Greece, India, Ireland, Slovenia, South Africa, Sweden, Switzerland, U.K.	Deutsches Elektronen-Synchrotron, Max-Planck-Institut, Heidelberg University, CENS, École Polytechnique, University of Paris, INFN, IFSI, University of Barcelona, Complutense University, University of Zurich, Durham University, University of Leicester, University of Leeds, SLAC National Accelerator Laboratory, Argonne National Laboratory, University of Washington, Iowa State University, UCLA, UCSC, University of Chicago, Smithsonian Observatory, and other institutions
Solar Researches with Nobeyama Radioheliograph	Satoshi Masuda	U.S.A., China, Korea, Russia, U.K.	NASA/GSFC, Catholic U., NAOC, KASI, RAS, U. of Warwick, Queen's U. Belfast
Study of the Mercury's Magnetosphere Based on Numerical Simulations	Kanako Seki	France	CNRS/LATMOS, CNRS/ LPP
Study of Atmospheric Escape Processes from Mars Based on Observations by MAVEN, MEX, and MGS	Kanako Seki	U.S.A., Germany, Sweden	NASA, LASP/CU, SSL/UCB, IRF
Radiation Belt Storm Probes Project	Yoshizumi Miyoshi	U.S.A.	NASA, APL/JHU
Modeling Study of Inner Magnetosphere	Yoshizumi Miyoshi	U.S.A.	LANL (Los Alamos National Lab)

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI)	Tetsuya Hiyama, Tomo'omi Kumagai, Hatsuki Fujinami	U.S.A. , China, Taiwan, Viet Nam, India, Thailand, Philippines, and other countries	
Project of international collaborative investigation on giant jellyfish	Joji Ishizaka	China, Korea	Chinese Academy of Fishery Science, Korea National Institute of Fisheries Science
Validation of GOCI Products and Application to Environmental Monitoring of Japanese Coastal Waters	Joji Ishizaka	Korea	Korea Institute of Ocean Science and Technology
Data Collection for Validation of Coastal Ocean Algorithms and Products, including Primary Production and Red Tide	Joji Ishizaka	Korea, U.S.A. , Estonia	Korea Institute of Ocean Science and Technology, The Scripps Research Institute
Joint research project for analyzing water budget to propose flood- and drought-adaptive cropping systems, which can conserve water environment of the semi-arid region in northern part of the republic of Namibia	Tetsuya Hiyama	Namibia	University of Namibia
Integrated Land Ecosystem - Atmosphere Processes Study (iLEAPS), a core project of the International Geosphere-Biosphere Programme (IGBP)	Tetsuya Hiyama	Sweden, Finland, China, and other countries	iLEAPS / IGBP
Joint research project for detecting influences of current global warming on the boreal forest ecosystem and the water cycle in the Lena river basin in eastern Siberia	Tetsuya Hiyama	Russia	Institute for Biological Problems of Cryolithozone (IBPC), Siberian Branch (SB) of the Russian Academy of Sciences (RAS)
Understanding how drought affects the risk of increased mortality in tropical rain forests	Tomo'omi Kumagai	U.K., Malaysia, U.S.A.	Natural Environment Research Council
Biodiversity And Land-use Impacts on Tropical Ecosystem Function (BALI) - A multidisciplinary consortium exploring the biogeochemical impacts of tropical forest degradation, agricultural conversion and biodiversity Loss	Tomo'omi Kumagai	U.K.	Natural Environmental Research Council
T-PARCII (Tropical cyclones-Pacific Asian Research Campaign for Improvement of Intensity estimations/forecasts)	Kazuhisa Tsuboki, Taro Shinoda	Taiwan	National Taiwan University Atmospheric Sciences
Global Precipitation Measurment Mission (GPM)	Hirohiko Masunaga	U.S.A.	National Aeronautics and Space Administration
Study on radiocarbon chronology of archaeological remains from Mongolia	Toshio Nakamura	Mongolia	The National Museum of Mongolian History, Ulaanbaatar, Mongolia
Study of grand-water circulation based on ^{14}C ages of underground water and hot-spring water samples from Korea	Toshio Nakamura	Korea	Korean Institute of Geoscience and Mineral Resources (KIGAM)
Radiocarbon method in environmental monitoring of CO_2 emission	Toshio Nakamura	Germany	Leibniz Laboratory for Radiometric Dating and Isotope Research, University of Kiel, Germany
Study on radiocarbon chronology of archaeological remains from the Tianluoshan site, Zhejiang Province, China	Toshio Nakamura	China	Zhejiang Provincial Relics and Archaeology Institute, People's Republic of China
Heidelberg pure CO_2 intercomparison project	Toshio Nakamura	Germany	Heidelberg University, Germany
^{14}C dating of iron artifacts collected from archeological site in Dubai	Toshio Nakamura	Australia	University of New England, Australia

Research Project	ISEE Representative	Collaborating Country/Region	Collaborating Organization
^{14}C dating of iron artifacts collected from archeological site at Assam in India	Toshio Nakamura	India	Department of Geology, College of Jorhat, Kolkata, India
Study on history of palaeo-environmental changes based on radiocarbon ages of cored-sediment samples from a wetland in South India	Toshio Nakamura	India	Indian Institute of Science, Banglore, India
Study on radiocarbon chronology of Buddhistic archaeological remains at the Bamiyan site, Islamic Republic of Afghanistan	Toshio Nakamura	France	Ministry of Information and Culture, Islamic Republic of Afghanistan, in collaboration with Japan center for International Cooperation in Conservation and National Research Institute for Cultural Properties
^{14}C concentration of atmospheric CO_2	Toshio Nakamura	Poland	Silesian University of Technology, Gliwice, Polan
International $^{14}CO_2$ Intercomparison	Toshio Nakamura	U.S.A.	NOAA Earth System Research Laboratory, Boulder, Colorad UAS
Comparison between 1 MV AMS and 5 MV AMS on precision and accuracy of ^{10}Be measurements	Masayo Minami	Korea	Korea Institute of Geoscience and Mineral Resources (KIGAM)

Visitors from Foreign Institutes (October, 2015 - March, 2016)

Name	Country/ Region	Affiliation	Period	Status at Nagoya University
Anukul Buranaprathepprat	Thailand	Burapha University	August. 1, 2015- October. 31,2015	Foreign Visiting Research Fellow
Khan-Hyuk Kim	Korea	Kyung Hee University, Korea	August. 1, 2015- January 31,2016	Foreign Visiting Research Fellow
Victor F.Melnikov	Russia	Central Astronomical Observatory at Pulkovo of Russian Academy of Sciences	September 1, 2015- December 31, 2015	Foreign Visiting Research Fellow
Guozhu Li	China	Institute of Geolgy and Geophysics Chinese Academy of Science Beijing	September 28, 2015- November 13, 2015	Foreign Visiting Cooperation Researcher
Wee Cheah	Malaysia	Research Center for Environmental Changes, Academia Sinica, Taiwan	October. 5, 2015- November 12, 2015	Foreign Visiting Cooperation Researcher
Joaquim Ignacio Goes	U.S.A.	Columbia University	October. 6, 2015- December 28, 2015	Foreign Visiting Research Fellow
Helga Rosario Do Gomes	U.S.A.	Columbia University	October 6, 2015- December 28, 2015	Foreign Visiting Research Fellow
Tomoko Kawate	U.K.	Queen's University Belfast	October 10, 2015- October 23, 2015	Foreign Visiting Cooperation Researcher
Syun-Ichi Akasofu	U.S.A.	University of Alaska	October 27, 2015	
Mark Cheung	U.S.A.	Lockheed Martin Solar Astrophysics Laboratory	October 30, 2015	Foreign Visiting Cooperation Researcher
A. J. Timothy Jull	U.S.A.	Geosciences and Physics NSF Arizona AMS Laboratory, University of Arizona	November 2, 2015 - November 6, 2015	
Elijah Olukayode Falayi	Nigeria	Tai Solarin University, Nigeria	November 2, 2015 - November 6, 2015	Foreign Visiting Cooperation Researcher
Le minh Tan	Viet Nam	Ho Chi Minh City University of Science	November 2, 2015 - November 5, 2015	Foreign Visiting Cooperation Researcher
Alex B. Guenther	U.S.A.	University of California, Irvine	November 3, 2015 - November 6, 2015	
Hwajin Kim	Korea	KIST	November 10, 2015	
Paola Formenti	France	CNRS	November 10, 2015	
Hung-Chi Kuo	Taiwan	National Taiwan University	November 24, 2015	
Sacha Drun	France	CEA-Saclay	November 24, 2015	Foreign Visiting Cooperation Researcher
Facundo Orte	Argentine	Centro de Investigacionese en Laseres v Aplicaciosnes (CEILAP)	December 1, 2015- March 19, 2016	Foreign Visiting Cooperation Researcher
Barry Gardiner	France	French National Institute for Agricultural Research	December 4 2015	
Viswanathan Lakshmi Narayanan	India	Indian Institute of Science Education and Research Mohali	January 7, 2016- March 30, 2016	Foreign Visiting Cooperation Researcher
Bernard Jackson	U.S.A.	University of California, San Diego	January 12, 2016- January 22, 2016	Foreign Visiting Cooperation Researcher

Name	Country/ Region	Affiliation	Period	Status at Nagoya University
Hsiu-Shan Yu	U.S.A.	University of California, San Diego	January 12, 2016- January 20, 2016	
Seiji Yashiro	U.S.A.	Catholic University and GSFC/NASA	January 12, 2016- January 15, 2016	Foreign Visiting Cooperation Researcher
Neethal Thomas	India	Indian Institute of Geomagnetism	January 16, 2016- February 20, 2016	Foreign Visiting Cooperation Researcher
Daniel Okoh	Nigeria	Center for Atmospheric Research, National Space Research and Development Agency	January 30, 2016- March 1, 2016	Foreign Visiting Cooperation Researcher
Marcoz Anzorena Mendez	Mexico	Universidad Nacional Autonoma de Mexico	February 20, 2016- March 19, 2016	Foreign Visiting Cooperation Researcher
J. Michael Ruohoniemi	U.S.A.	Virginia Tech	March 7, 2016- April 8, 2016	Foreign Visiting Research Fellow
Chak K. Chan	China	City University of Hong Kong	March 9, 2016	
Tai-Jen Chen	Taiwan	National Taiwan University	March 10, 2016	
Yih-Chi Tan	Taiwan	National Taiwan University	March 10, 2016	
Jong-Dao Jou	Taiwan	National Taiwan University	March 10, 2016	
Jihn-Sung Lai	Taiwan	National Taiwan University	March 10, 2016	
Hsin-yu Lee	Taiwan	National Taiwan University	March 10, 2016	
Yong-Jun Lin	Taiwan	National Taiwan University	March 10, 2016	
Meng-Ha Tsai	Taiwan	National Taiwan University	March 10, 2016	
Kai-Yuan Ke	Taiwan	National Taiwan University	March 10, 2016	
Fong-Zuo Lee	Taiwan	National Taiwan University	March 10, 2016	
Yung-Chiu Hsu	Taiwan	National Taiwan University	March 10, 2016	
Ji-Hua Lin	Taiwan	National Taiwan University	March 10, 2016	
Yun-Ping Wang	Taiwan	National Taiwan University	March 10, 2016	
Li-Lie Lin	Taiwan	National Taiwan University	March 10, 2016	
Pei-Hsuan Chen	Taiwan	National Taiwan University	March 10, 2016	
Jou-Ping Wang	Taiwan	National Taiwan University	March 10, 2016	
Po-Chia Chen	Taiwan	National Taiwan University	March 10, 2016	
Dang Phong Xuan	Viet Nam	Institute of Geology, Vietnam Academy of Science and Technology	March 11, 2016	Foreign Visiting Cooperation Researcher
Shinichi Ohtani	U.S.A.	Johns Hopkins University Applied Physics Laboratory（JHU/APL）	March 14, 2016	

Seminars by Foreign Visitors (October, 2015 - March, 2016)

Date	Name	Affiliation	Title	Participants
Oct. 2, 2015	Khan-Hyuk Kim	Kyung Hee University, Korea	EMIC waves observed at geosynchronous orbit under quiet geomagnetic conditions (Kp = 0-1)	29
Oct. 16, 2015	Guozhu Li	Institute of Geology and Geophysics, Chinese Academy of Science, China	Study of ionospheric irregularity using Sanya VHF radar	28
Oct. 20, 2015	Tomoko Kawate	Queen's University Belfast, UK	The role of waves/turbulence for particle acceleration in solar flares	15
Oct. 27, 2015	Shun-ichi Akasofu	University of Alaska	The 1st ISEE/CICR colloquium “Auroral substorms and solar flares”	15
Oct. 30, 2015	Mark Cheung	Lockheed Martin Solar Astrophysics Laboratory, U.S.A.	Probing the Thermal Structure of the Solar Corona using SDO/AIA	10
Nov. 9, 2015	Kazue Takahashi	The Johns Hopkins University/Applied Physics Laboratory, U.S.A.	Giant Pulsations	16
Nov. 10, 2015	Hwajin Kim	KIST	Optical and chemical properties of secondary organic aerosols: smog chamber study	15
Nov. 10, 2015	Paola Formenti	CNRS	An overview of the studies of aerosol formation and properties in the CESAM smog chamber	15
Nov. 24, 2015	Sacha Drun	CEA-Saclay, France	Exo Space Weather	15
Nov. 24, 2015	Hung-Chi Kuo	National Taiwan University	The 2nd ISEE/CICR colloquium “Wavenumber-2 Deep Convection in Tropical Cyclones”	11
Nov. 27, 2015	Elijah Olukayode Falayi	Tai Solarin University, Nigeria	Response a Ionospheric disturbance dynamo and electromagnetic induction during geomagnetic storm	26
Dec. 4, 2015	Le minh Tan	Ho Chi Minh City University of Science	Study of the nighttime D-region ionosphere using tweek method	24
Dec. 4, 2015	Barry Gardiner	French National Institute for Agricultural Research	The 3rd ISEE/CICR colloquium “Prediction of wind speeds and wind damage risk in forested complex terrain”	11
Dec. 7, 2015	Andrew W. Yau	University of Calgary	The 4th ISEE/CICR colloquium “Heavy Ion Energization and Outflow”	13
Dec. 17, 2015	Victor Melnikov	Pulkovo Observatory, Saint Petersburg, Russia	Recent results on diagnostics of flaring loops as derived from NoRH, RHESSI and other observations	12

Date	Name	Affiliation	Title	Participants
Jan. 18, 2016	Bernard Jackson	University of California, San Diego	Recent IPS Analysis Advancements - a way to determine North-South Magnetic Field Components from Closed Loops (2)	10
Jan. 18, 2016	Hsiu-Shan Yu	University of California, San Diego	Recent IPS Analysis Advancements - a way to determine North-South Magnetic Field Components from Closed Loops (3)	10
Jan. 29, 2016	Neethal Thomas	Indian Institute of Geomagnetism	Low-latitude Pi2 oscillations observed by polar Low Earth Orbiting satellite	31
Feb. 5, 2016	Daniel Okoh	Center for Atmospheric Research, National Space Research and Development Agency	A brief about the space environment research laboratory	28
Feb. 19, 2016	Viswanathan Lakshmi Narayanan	Indian Institute of Science Education and Research Mohali	Understanding the disappearance of nighttime electrified medium-scale traveling ionospheric disturbances reaching lower latitudes	28
Mar. 3, 2016	Facundo Orte	Centro de Investigacionese en Laseres v Aplicaciosnes (CEILAP)	Implementation of Qpack+ARTS and improvements in the data analysis algorithm to retrieve O_3 profiles with a Microwave Spectral Radiometer installed in Rio Gallegos, Argentina	10
Mar. 9, 2016	Chak K. Chan	City University of Hong Kong	The Role of Photochemistry in Secondary Aerosol Formation and Evolution during High Particulate Matter Episodes at a Suburban Site in Hong Kong	20
Mar. 18, 2016	J. Michael Ruohoniemi	Virginia Tech	The 5th ISEE/CICR colloquium “The SuperDARN HF radar technique and new perspectives on geospace research from mid-latitudes to the polar cap”	10
Mar. 25, 2016	Carsten Rott	Sungkyunkwan University	First Observation of Time Variation in the Solar-Disk Gamma-Ray Flux with Fermi	10

Contributions in the Foreign Committees

Organizations	Committee Name	Contribution from ISEE
International Astronomical Union (IAU)	Organizing Committee Member of Commission E3 Solar Impact throughout the Heliosphere	Kanya Kusano
Committee on Space Research (COSPAR)	Vice-chair of the Panel on Radiation Belt Environment Modeling (PRBEM)	Yoshizumi Miyoshi
American Geophysical Union (AGU)	Guest Editor of Journal of Geophysical Research	Yoshizumi Miyoshi
Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)	Campaign coordinator of VarSITI/SPeCIMEN	Yoshizumi Miyoshi
Telescope Array collaboration	Telescope Array External Advisory committee	Yoshitaka Itow
B-factory Programme Advisory Committee	Committee member	Hiroyasu Tajima
The Scientific World Journal	Editorial Board member	Hiroyasu Tajima
ISTS (International Symposium on Space Technology and Science) special issue	Associate Editor	Hiroyasu Tajima
Progress of Theoretical and Experimental Physics	Editor	Hiroyasu Tajima
Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)	Co-chair of the SCOSTEP VarSITI (Variability of the Sun and Its Terrestrial Impact) (2014-2018)	Kazuo Shiokawa
Committee on Space Research	Chair of the COSPAR Sub-Commission C1 (The Earth's Upper Atmosphere and Ionosphere)	Kazuo Shiokawa
Earth, Planets and Space (EPS)	Guest Editor for the special issue of the International CAWSES-II Symposium	Kazuo Shiokawa
Earth, Planets and Space (EPS)	Guest Editor for the special issue of the 12th International Conference on Substorms	Kazuo Shiokawa
Journal of Astronomy and Space Sciences	Editor	Yuichi Otsuka
EISCAT Scientific Association	Council member	Satonori Nozawa
Super Dual Auroral Radar Network	Executive Council	Nozomu Nishitani

Organizations	Committee Name	Contribution from ISEE
Earth, Planets and Space (EPS)	Editor	Nozomu Nishitani
Earth, Planets and Space (EPS)	Guest Editor for the special issue of Coupling of the High and Mid Latitude Ionosphere and Its Relation to Geospace Dynamics	Nozomu Nishitani
Committee on Space Research (COSPAR)	Science Organizing Committee member	Shin-ichiro Oyama
Journal of Oceanography	Editor-in-Chief	Joji Ishizaka
Continental Shelf Research	Guest editor of Special Issue of “Coastal Seas in a Changing World: Anthropogenic Impact and Environmental Responses”	Joji Ishizaka
North Pacific Marine Science Organization (PICES)	Co-Chair of Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas	Joji Ishizaka
Northwest Pacific Action Plan (NOWPAP)	Focal Point of Center for Special Monitoring and Coastal Environmental Assessment Regional Active Center (CEARAC)	Joji Ishizaka
World Climate Research Programme (WCRP) Global Energy and Water cycle Exchanges (GEWEX)	GEWEX Data and Assessments Panel (GDAP) member (2010-)	Hirohiko Masunaga
Integrated Land Ecosystem - Atmosphere Processes Study (iLEAPS), a core project of the Future Earth	Scientific Steering Committee (SSC) member (2014-)	Tetsuya Hiyama
European Journal of Mineralogy	Member of Editorial Board	Masaki Enami
Radiocarbon	Member of Editorial Board	Toshio Nakamura
19th INQUA Congress	Member of Local Organizing Committee	Toshio Nakamura
6th East Asia Accelerator mass spectrometry Symposium (EA-AMS6)	Member of Scientific Committee	Toshio Nakamura
Goldchimidt 2016	Member of Local Organizing Committee	Masayo Minami

11. Outreach

Public lectures, open lab., and school visits (October, 2015 – March, 2016)

ISEE members have contributed to the public education through 13 lecture visits, 4 public lectures in the university, 3 open laboratory events, 6 receipts of the high-school students' visits. ISEE and former STEL have continued a close relationship with the Rikubetsu town in Hokkaido since 2003. A public lecture and experiment were held on 13 Nov. at the Rikubetsu elementary and junior-high school. Another public experiment took place on 14 Nov. at the Rikubetsu Space Earth Science Museum. From 22 to 29 Nov. ISEE hosted a visit of 24 high-school students and teachers from Finland. They learnt research topics at ISEE and visited other facilities in the Nagoya university and also a facility of the Kyoto university.

ISEE distributes series of booklet to answer 50 questions and comics related to the space–Earth environment for public.

The website of ISEE (http://www.isee.nagoya-u.ac.jp/) continues to publish the most up-to-date activities and outcomes of the laboratory to public.

Special class at Rikubetsu Elementary School on November 13, 2015 with “Night glow."

12. External Funding and Industry–Academia–Government Collaborations

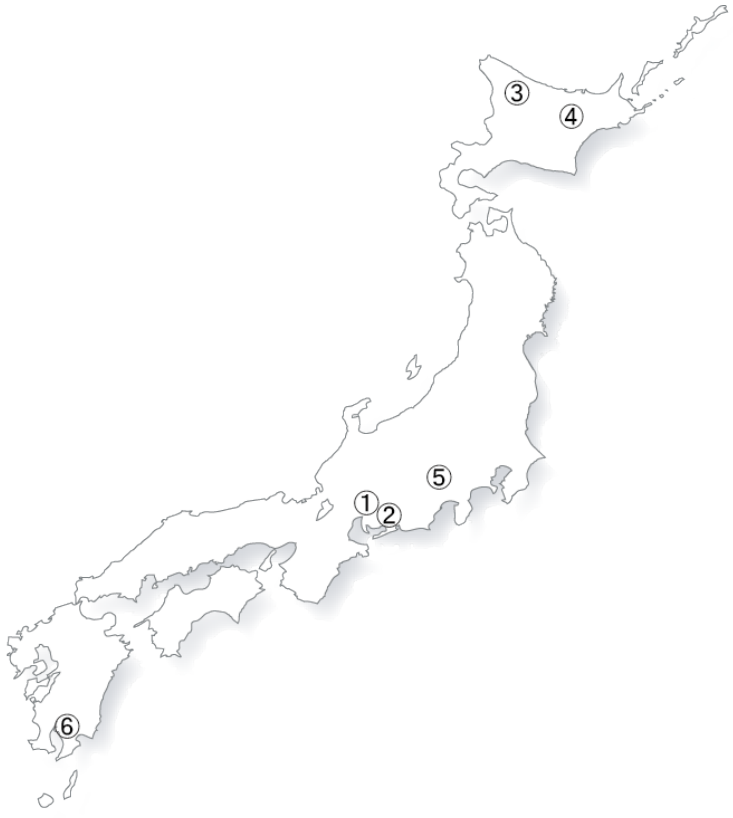
Researches of ISEE members as principle investigator were supported by the following external funds.

Kakenhi category	Number of subjects	Total amount (JPY)
Grant-in-Aid for Scientific Research on Innovative Areas	5	111,540,000
Grant-in-Aid for Scientific Research (S)	1	88,660,000
Grant-in-Aid for Scientific Research (A)	6	65,390,000
Grant-in-Aid for Scientific Research (B)	14	61,490,000
Grant-in-Aid for Scientific Research (C)	6	7,410,000
Grant-in-Aid for Challenging Exploratory Research	8	10,400,000
Grant-in-Aid for Young Scientists (A)	2	12,870,000
Grant-in-Aid for Young Scientists (B)	6	6,825,000
Grant-in-Aid for Research Activity Start-up	1	1,950,000
Grant-in-Aid for JSPS Research Fellow	2	2,860,000

- Fifty-one research subjects listed in the table were supported by the JSPS Kakenhi.
- Thirty-seven research subjects supported by governmental funds except Kakenhi, other universities, and companies received total 218,865,696 JPY plus 487,150 USD. Eighteen of them were collaborative researches between ISEE and companies, or national institutes.
- Four research subjects received total 632,694 JPY plus 380,035 AUD of donation.

Addresses of Facilities

Location		Name	Address	TEL/FAX
Nagoya	①	ISEE Research Institutes Buildings I/II	Furo-Cho, Chikusa-Ku, Nagoya, Aichi 464-8601	TEL:+81-52-747-6303 FAX:+81-52-747-6313
Toyokawa	②	Toyokawa Branch	3-13 Honohara, Toyokawa-Shi, Aichi 442-8507	TEL:+81-533-89-5206 FAX:+81-533-86-0811
Hokkaido	③	Moshiri Observatory	10815 Moshiri, Horokanai-cho, Uryu-gun, Hokkaido 074-0741	TEL:+81-165-38-2345
	④	Rikubetsu Observatory	345 Uembetsu, Rikubetsu-cho, Ashoro-gun, Hokkaido 089-4301	TEL:+81-156-27-8103
			58-1, 78-1, 78-5, 129-1, 129-4 Pontomamu, Rikubetsu-cho, Ashoro-gun, Hokkaido 089-4300	TEL:+81-156-27-4011
Yamanashi	⑤	Fuji Observatory	1347-2 Fujigane, Fujikawaguchiko-machi, Minamitsuru-gun, Yamanashi 401-0338	TEL:+81-555-89-2829
Kagoshima	⑥	Kagoshima Observatory	3860-1 Honjo, Tarumizu-shi, Kagoshima 891-2112	TEL:+81-994-32-0730

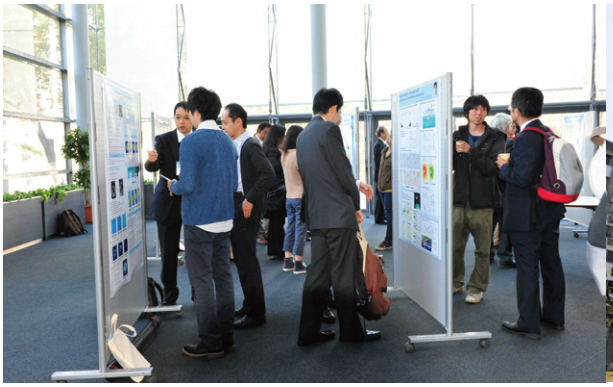


Ceremony to place a new signboard (October 1, 2015)

Inauguration public lecture (November 3, 2015)

Inauguration ceremony (November 4, 2015)

Founding Symposium for the Institute for Space–Earth Environmental Research (November 4–5, 2015)



Founding Symposium for the Institute for Space–Earth Environmental Research (November 4–5, 2015)

Research Institutes Buildings I (right) and II (left)

ISEE Institute for Space-Earth Environmental Research

Institute for Space–Earth Environmental Research
Nagoya University

Address: Furo-cho, Chikusa-ku, Nagoya Aichi 464-8601, Japan
TEL: +81-52-747-6303, FAX: +81-52-747-6313
http://www.isee.nagoya-u.ac.jp/

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