

10. Education

The Institute for Space–Earth Environmental Research (ISEE) primarily offers graduate programs in the Science, Engineering, and Environmental Studies schools of Nagoya University. The ISEE has its own graduate course for Heliospheric and Geospace Physics in the Division of Particle and Astrophysical Science of the Graduate School of Science. ISEE also cooperates with the Department of Electrical Engineering, through the Space Electromagnetic Environment group in the Graduate School of Engineering, and the Department of Earth and Environmental Sciences, through the Chronology and Natural History, and Global Water Cycle groups, in the Graduate School of Environmental Studies, by teaching / training graduate students in disciplines related to space–earth environmental research.

Our graduate students use various methodologies and techniques, including ground observation, fieldwork, laboratory experiments, radioactive dating, numerical simulations and modeling, and theoretical research. Their work includes the development of satellite, balloon, and aircraft instruments—and the analysis of observational data. As ISEE members conduct research that involves analyzing data captured by both domestic and international instrument platforms, and / or by collaborative research with foreign researchers, our students are actively pioneering new research fields, through their involvement with other scholars in international collaborations, and in interdisciplinary research. Their studies mature as MSc or PhD theses, which are presented at international workshops and conferences, and published in academic journals. We nurture researchers who can apply their knowledge to benefit society, who have a broad perspective, and who demonstrate an international perspective.

Staff association between the research divisions in the ISEE and the graduate schools

| | | 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 Course Chronology and Natural History | | 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 | Geochronology | Environmental History | Meteorology | Cloud and Precipitation Sciences | Atmospheric Chemistry | Hydroclimatology |
| Institute for Space–Earth Environmental Research | Integrated Studies | | | ● | | | ● | | | | | | | |
| | Cosmic-Ray Research | | | | ● | | | | | | | | | |
| | Heliospheric Research | | | | | ● | | | | | | | | |
| | Ionospheric and Magnetospheric Research | | ● | | | | ● | | | | | | | |
| | Meteorological and Atmospheric Research | ● | | | | | ● | | | ● | ● | ● | | |
| | Land–Ocean Ecosystem Research | | | | | | | | | | | | ● | ● |
| | Chronological Research | | | | | | | | ● | ● | | | | |
| | Center for International Collaborative Research | ● | ● | | ● | ● | ● | | ● | | | ● | ● | ● |
| | Center for Intergrated Data Science | | ● | ● | ● | | ● | | ● | | ● | ● | | ● |
| | Center for Orbital and Suborbital Observations | | ● | | ● | | | | | ● | ● | ● | | ● |

Number of Students supervised by ISEE Staff

(April 1, 2021–March 31, 2022)

| | M1 | M2 | D1 | D2 | D3 | Undergraduate Students | Non-regular students | Total |
|--|----|----|----|----|----|------------------------|----------------------|-------|
| Graduate School of Science | 11 | 11 | 0 | 3 | 4 | - | 0 | 29 |
| Graduate School of Engineering | 12 | 11 | 0 | 0 | 0 | - | 0 | 23 |
| Graduate School of Environmental Studies | 11 | 13 | 2 | 3 | 4 | - | 5 * | 38 |
| School of Science | - | - | - | - | - | 8 | 0 | 8 |
| School of Engineering | - | - | - | - | - | 9 | 0 | 9 |
| ISEE | - | - | - | - | - | - | 2* | 2 |
| Total | 34 | 35 | 2 | 6 | 8 | 17 | 7 | 109 |

Cumulative total in FY 2021 * Research Student

Faculty Members

(April 1, 2021–March 31, 2022)

■ Division of Particle and Astrophysical Science, Graduate School of Science

| Field/Topics | Professor | Associate Professor | Lecturer | Assistant Professor |
|---|--------------------|---------------------|-------------------|---------------------|
| Solar-Terrestrial Environmental Science | Akira Mizuno | Tomoo Nagahama | | |
| Solar-Terrestrial Interrelation Science | Masafumi Hirahara | Satoru Nozawa | Shin-ichiro Oyama | |
| | | Yuichi Otsuka | | |
| | Kanya Kusano | Satoshi Masuda | | Akimasa Ieda |
| Solar-Terrestrial Physics | Yoshitaka Itow | Yutaka Matsubara | Akira Okumura | Hiroaki Menjo |
| | Hiroyasu Tajima | Fusa Miyake | | |
| | Munetoshi Tokumaru | Kazumasa Iwai | | Ken-ichi Fujiki |

■ Department of Electrical Engineering and Computer Science, Graduate School of Engineering

| Field/Topics | Professor | Associate Professor | Lecturer | Assistant Professor |
|-----------------------------------|-------------------|---------------------------|------------------|---------------------|
| Space Electromagnetic Environment | Kazuo Shiokawa | Nozomu Nishitani | | Taku Nakajima |
| | | Masahito Nosé | | |
| | | Martinez-Calderon Claudia | | |
| | Yoshizumi Miyoshi | Takayuki Umeda | Shinsuke Imada * | |

* Left the Institute at August 31, 2021

■ Department of Earth and Environmental Sciences, Graduate School of Environmental Studies

| Field/Topics | Professor | Associate Professor | Lecturer | Assistant Professor |
|---|--------------------|---------------------|------------------|---------------------|
| Hydrospheric-Atmospheric Sciences Course Global Water Cycle | Kazuhisa Tsuboki | Taro Shinoda | | |
| | Nobuhiro Takahashi | Hirohiko Masunaga | | |
| | Michihiro Mochida | | | Sho Ohata |
| | Tetsuya Hiyama | Naoyuki Kurita | Hatsuki Fujinami | |
| | Joji Ishizaka | Hidenori Aiki | | Yoshihisa Mino |
| Earth and Planetary Sciences Course Chronology and Natural History | Masayo Minami | Takenori Kato | | |
| | Hiroyuki Kitagawa | | | Hirohiko Oda |

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 2021 Academic Year, The Following Courses were offered;

- Astrophysics and Space Science
- Astrophysics III
- Earth and Planetary Science Seminar I
- Electric Circuits with Exercise
- Electromagnetic Wave Engineering
- Environmental Chemistry
- Experimental Physics
- Experiments in Physics - Advanced Course
- Field work
- First Year Seminar A
- Frontier of Earth and Planetary Sciences
- Geochemical Analysis II and Experiments
- Geology Experiments
- Graduation Thesis A · B
- Introduction to Physics I
- Introduction to Physics II
- Laboratory in Physics
- Mathematics I and Tutorial A
- Mathematics I and Tutorial B
- Mathematics II and Tutorial
- Meteorology
- Physics Experiments I
- Physics Experiments II
- Probability Theory and Numerical Analysis with Exercises
- Remote sensing
- Science of Atmospheric-Hydrospheric Environment
- Solar System Science
- Topics in Advanced Physics

11. International Relations

Academic Exchange

(28 in total)

| Institution | Country/Region | Establishment |
|---|-------------------------------|---|
| Indonesian National Institute of Aeronautics and Space | Indonesia | May 31, 1988 |
| Pukyong National University, College of Fisheries Sciences | Korea | October 2, 2006 |
| Korea Institute of Ocean Science and Technology, Korea Ocean Satellite Center | Korea | April 17, 2014 |
| Institute of High Energy Physics, Chinese Academy of Sciences | China | February 20, 2001 |
| Polar Research Institute of China | China | November 11, 2005 |
| Department of Atmospheric Sciences, National Taiwan University | Taiwan | October 30, 2009 |
| Center for Weather Climate and Disaster Research, National Taiwan University | Taiwan | September 3, 2014 |
| Bangladesh University of Engineering & Technology, Department of Physics | Bangladesh | March 4, 2008 |
| National Institute of Water and Atmospheric Research | New Zealand | July 26, 1989 |
| Centre 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 Center, 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, Virginia Polytechnic Institute and State University | U.S.A. | January 23, 2013 |
| Chacaltaya Cosmic Ray Observatory, Faculty of Sciences, Universidad Mayor de San Andres, La Paz | Bolivia | February 20, 1992 |
| National Institute for Space Research | Brazil | March 5, 1997 |
| Yerevan Physics Institute | Armenia | October 18, 1996 |
| Swedish Institute of Space Physics | Sweden | September 1, 2005 (since March 25, 1993) |
| Faculty of Science, UiT The Arctic University of Norway | Norway | May 3, 2019 (since October 8, 1993) |
| Department of Geophysics, Finnish Meteorological Institute | Finland | October 21, 1994 |
| Institute of Cosmophysical Research and Radiowave Propagation, Far Eastern Branch, Russian Academy of Sciences | Russia | April 14, 2007 |
| Institute of Solar-Terrestrial Physics, Siberian Branch of the Russian Academy of Sciences | Russia | October 28, 2008 |
| Yu.G. Shafer Institute of Cosmophysical Research and Aeronomy, Siberian Branch of the Russian Academy of Sciences | Russia | November 28, 2012 |
| The Polar Geophysical Institute, Murmansk | Russia | March 13, 2017 |
| Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) | International Science Council | July 30, 2019 |

Visitor : 1 / Going Abroad : 0

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

Research Projects

■ Major International Collaborative Projects

(86 in total)

| Research Project | ISEE Representative | Collaborating Country/Region | | Collaborating Organization |
|--|---------------------|--|----|---|
| Study of the Onset Mechanism of Solar Eruptions | K. Kusano | Germany | 1 | University of Potsdam |
| Observational Study of the Onset Mechanism of Solar Eruptions | K. Kusano | U.S.A. China | 2 | New Jersey Institute of Technology University of Science and Technology of China |
| Study of Modeling of Solar Eruptions | K. Kusano | U.S.A. | 1 | Harvard-Smithsonian Center for Astrophysics |
| Study of Triggering Mechanism of Solar Flares | K. Kusano | U.K. | 1 | UCL Mullard Space Science Laboratory |
| Study of Magnetic Reconnection | K. Kusano | U.K. | 1 | University of Manchester |
| Modeling Study of Inner Magnetosphere | Y. Miyoshi | U.S.A. | 1 | Los Alamos National Laboratory |
| Collaborative Study on ERG Project | Y. Miyoshi | Taiwan | 1 | Academia Sinica Institute of Astronomy and Astrophysics |
| International Heliophysics Data Environment Alliance | Y. Miyoshi | U.S.A. Europe (Member States of ESA) | 23 | NASA (SPDF, SDAC, HPDE, SPASE, CCMC) European Space Agency (ESA), Centre National d'Études Spatiales |
| Collaborative Researches Based on Solar Radio Observations with MUSER | S. Masuda | China Korea | 2 | National Astronomical Observatory of China KASI |
| Physics of Energetic and Non-Thermal Plasmas in the X (= magnetic reconnection) Region (PhoENIX) Mission | S. Masuda | U.S.A. U.K. Switzerland Hungary Germany Austria | 6 | NASA, UCB, University of Minnesota, University of Colorado, New Jersey Institute of Technology, Southwest Research Institute, Princeton University Northumbria University, University of Glasgow University of Applied Sciences and Arts Northwestern Switzerland Eötvös Loránd University Leibniz Institute for Astrophysics Potsdam Austrian Academy of Sciences |
| Study in Cosmic Neutrinos by using a Large Water Cherenkov Detector | Y. Itow | U.S.A. Canada U.K. Spain Korea China Poland | 7 | 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 |
| Study in Interaction of Very High Energy Cosmic Rays by using Large Hadron Collider | Y. Itow | Italy France Switzerland U.S.A. | 4 | University of Florence, Catania University École Polytechnique CERN Lawrence Berkeley National Laboratory |

| Research Project | ISEE Representative | Collaborating Country/Region | Collaborating Organization |
|---|---------------------|---|---|
| Study in Interaction of Very High Energy Cosmic Rays by using Relativistic Heavy Ion Collider | Y. Itow | Italy U.S.A. | 2 University of Florence, Catania University Brookhaven National Laboratory |
| Study of Dark Matter and Solar Neutrinos using a Liquid Xenon Detector | Y. Itow | Korea | 1 Seoul National University, Sejong University, Korea Research Institute of standards and Science |
| Research and Development for the Next Generation Water Cherenkov Detector, Hyper-Kamiokande | Y. Itow | U.S.A. Korea China U.K. Italy France Switzerland Spain Poland Brazil <i>Canada, Russia Portugal</i> | 13 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 Imperial College London, Lancaster University, University of Oxford, Queen Mary University of London, University of Sheffield, Rutherford Appleton Laboratory INFN Sezione di Bari, INFN Sezione di Napoli, INFN Sezione di Padova, INFN Sezione di Roma CEA Saclay, École Polytechnique University of Bern, Swiss Federal Institute of Technology Zurich Autonomous University of Madrid University of Warsaw University of São Paulo <i>and other Institutions</i> |
| Study of Dark Matter and Solar Neutrinos using a 2-Phase Liquid Xenon TPC Detector | Y. Itow | Germany Italy Switzerland U.S.A. Sweden Israel Portugal <i>France, UAE, Netherlands</i> | 10 Deutsches Elektronen-Synchrotron, Albert-Ludwigs-Universität Freiburg Max-Planck-Institut INFN, Università di Bologna University of Zurich Columbia University, University of Chicago, Purdue University, UCSD Stockholm University Weizmann Institute of Science University of Coimbra <i>and other institutions</i> |
| A Search for Dark Objects using the Gravitational Microlensing Effect | Y. Itow | New Zealand U.S.A. | 2 University of Auckland, University of Canterbury, Victoria University of Wellington, Massey University University of Maryland, NASA |
| Research on Origin of Cosmic Rays with Fermi Satellite | H. Tajima | U.S.A. France Italy Sweden | 4 Stanford University, SLAC National Accelerator Laboratory, GSFC/NASA, U.S. Naval Research Laboratory, UCSC, Sonoma State University, University of Washington, Purdue University, University of Denver CENS, CNRS, École Polytechnique INFN, Italian Space Agency, IFSI Royal Institute of Technology, Stockholm University |

| Research Project | ISEE Representative | Collaborating Country/Region | | Collaborating Organization |
|---|---------------------|---|----|---|
| Research on Origin of Cosmic Rays with CTA (Cherenkov Telescope Array) | H. Tajima | Germany France Italy Spain Switzerland U.K. U.S.A. <i>Brazil, Argentina, Poland, Armenia, Australia, Czech, Bulgaria, Croatia, Finland, Greece, Sweden, Slovenia, India, Ireland, South Africa</i> | 22 | Deutsches Elektronen-Synchrotron, Max-Planck-Institut, Heidelberg University CENS, École Polytechnique, University of Paris INFN, IFSI University of Barcelona, Complutense University of Madrid University of Zürich 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 <i>and other institutions</i> |
| Solar Flare Research with Hard X-Ray Spectral Imaging Observations | H. Tajima | U.S.A. | 1 | UCB, MSFC/NASA, Air Force Research Laboratory |
| Solar Flare Research with Gamma-Ray Spectral Imaging Observations with Polarimetry | H. Tajima | U.S.A. | 1 | UCB, Lawrence Berkeley National Laboratory, GSFC/NASA |
| Study of Solar Neutrons | Y. Matsubara | Bolivia Armenia China Mexico | 4 | Research Institute of Physics, University of San Andrés Yerevan Physics Institute Institute of High Energy Physics, Chinese Academy of Sciences National Autonomous University of Mexico |
| Search for Cosmic-Ray Excursions in the Past by Single-Year Measurements of ¹⁴ C in Tree Rings | F. Miyake | U.S.A. Switzerland | 2 | The University of Arizona Swiss Federal Institute of Technology Zürich |
| Observations of Interplanetary Disturbances using the International IPS Network | M. Tokumaru | U.K. Russia India Mexico Australia | 5 | LOFAR-UK Lebedev Physical Institute Tata Institute of Fundamental Research National Autonomous University of Mexico Murchison Widefield Array |
| Study of 3-D Solar Wind Structure and Dynamics Using Heliospheric Tomography | M. Tokumaru | U.S.A. | 1 | CASS/UCSD |
| Study on the Application of Interplanetary Scintillation Observations to Space Weather Forecast | M. Tokumaru | Korea | 1 | Korean Space Weather Center |
| Study of the Heliospheric Boundary Region using Observations of Interplanetary Scintillation | M. Tokumaru | U.S.A. | 1 | Interstellar Boundary Explorer, IMAP |
| Research and Development of the Plasma/Particle Instrument Suite for the Mercury Magnetospheric Exploration Mission | M. Hirahara | France Sweden U.K. U.S.A. Switzerland | 5 | CESR-CNRS, CETP-IPSL Institute for Solar Physics of the Royal Swedish Academy of Sciences Rutherford Appleton Laboratory Boston University University of Bern |
| Future Satellite Mission for the Terrestrial Magnetosphere-Ionosphere-Thermosphere Explorations by Formation Flight Observations and its Feasibility Study and Collaboration of the Satellite and Ground-Based Observations | M. Hirahara | Sweden | 1 | Swedish Institute of Space Physics, Swedish National Space Board |

| Research Project | ISEE Representative | Collaborating Country/Region | | Collaborating Organization |
|---|---------------------|--|----|--|
| Study on Science Subjects and Developmental Techniques of Observational Instruments toward Future Spacecraft Exploration Missions for the Space-Earth Coupling System | M. Hirahara | Sweden | 1 | Swedish Institute of Space Physics |
| PRESTO (Predictability of Variable Solar-Terrestrial Coupling) | K. Shiokawa | U.S.A., France, Germany, U.K., Italy, Canada, Australia, India, China, and other countries | 30 | SCOSTEP |
| High-Sensitive Imaging Measurements of Airglow and Aurora and Electromagnetic Waves in Canadian Arctic | K. Shiokawa | U.S.A. Canada | 2 | University of California, Augsburg College, Virginia Polytechnic Institute and State University University of Calgary, Athabasca University |
| Magnetic Conjugate Observations of Midlatitude Thermospheric Disturbances | K. Shiokawa | Australia | 1 | IPS Radio and Space Service |
| Comparison of Dynamical Variations of the Mesosphere, Thermosphere, and Ionosphere between Asian and Brazilian Longitudes | K. Shiokawa | Brazil | 1 | INPE |
| Ground and Satellite Measurements of Geospace Environment in the Far-Eastern Russia | K. Shiokawa | Russia | 1 | Institute of Cosmophysical Research and Radiowave Propagation, Far Eastern Branch, RAS |
| Observations of the Equatorial Ionosphere in South-East Asia and West Africa | K. Shiokawa | Nigeria | 1 | National Space Research and Development Agency, Federal University of Technology Akure, Tai Solarin University of Education |
| Observations of Waves and Particles in the Inner Magnetosphere in the Siberian Region of Russia | K. Shiokawa | Russia | 1 | Institute of Cosmophysical Research and Aeronomy/SB RAS, ISTP/SB RAS |
| Study of the low-latitude and equatorial ionosphere at Eastern Africa | K. Shiokawa | Egypt Ethiopia | 2 | Egypt-Japan University of Science and Technology (E-JUST) Bahir Dar University |
| Study of the middle latitude ionosphere at Ukraine | K. Shiokawa | Ukraine | 1 | Institute of ionosphere (IION) |
| Collaborative Research and Operation in the Field of Space Weather Observations | Y. Otsuka | Indonesia | 1 | LAPAN |
| Observations and Researches of Ionosphere and Upper Atmosphere in Thailand | Y. Otsuka | Thailand | 1 | Chiang Mai University, King Mongkut's Institute of Technology Ladkrabang |
| Study on the Occurrence Characteristics of Ionospheric Irregularity and its Day-to-Day Variability over Southern China and Southeast Asia Regions | Y. Otsuka | China Indonesia Thailand | 3 | Institute of Geology and Geophysics Chinese Academy of Sciences LAPAN King Mongkut's Institute of Technology Ladkrabang |
| Study of the Polar Upper Atmosphere using the EISCAT Radars and Other Instruments | S. Nozawa | Norway Sweden, Finland, Germany, U.K., China | 6 | UiT The Arctic University of Norway EISCAT Scientific Association |
| Derivation of Substorm Index from Low-Latitude Geomagnetic Field Data | M. Nosé | Australia Turkey Germany Spain Denmark U.S.A. | 6 | Geoscience Australia Boğaziçi University Ludwig-Maximilians-Universität München Universitat Ramon Llull Technical University of Denmark United States Geological Survey |
| Experiment of geomagnetic field with sounding rocket LAMP | M. Nosé | U.S.A. | 1 | NASA |
| Study of high-frequency geomagnetic field variations with low-latitude induction magnetometer network | M. Nosé | Australia New Zealand | 2 | Geoscience Australia Dr. Peter Jaquiere |

| Research Project | ISEE Representative | Collaborating Country/Region | | Collaborating Organization |
|---|--|---|---|--|
| Study of the Polar/Midlatitude Ionosphere and Magnetosphere using the SuperDARN HF Radar Network | N. Nishitani | U.S.A. U.K. France South Africa Australia Canada Italy Russia China | 9 | JHUAPL, Virginia Polytechnic Institute and State University University of Leicester LPC2E/CNRS University of KwaZulu-Natal La Trobe University University of Saskatchewan IFSI ISTP/SB RAS Polar Research Institute of China |
| SDI-3D Project: Development of SDI | S. Oyama | U.S.A. Finland Sweden | 3 | Geophysical Institute of the University of Alaska Fairbanks University of Oulu, Finnish Meteorological Institute, Sodankylä Geophysical Observatory, Lappeenranta-Lahti University of Technology The Swedish Institute of Space Physics |
| Study of Auroral Energetic Electron Precipitation (EEP) Impacts on the Upper/Middle Atmosphere | S. Oyama | Finland New Zealand U.K. Norway U.S.A. | 5 | University of Oulu, Finnish Meteorological Institute University of Otago British Antarctic Survey University Centre in Svalbard University of Alaska Fairbanks |
| Study of Aerosols and Atmospheric Trace Gases by using SAVER-Net Observation Network in South America | A. Mizuno | Argentina Chile Bolivia | 3 | CEILAP, Servicio Meteorológico Nacional University of Magallanes, Dirección Meteorológica de Chile University of La Frontera, Universidad Mayor de San Andrés |
| High Energy Particles in Geospace: the Acceleration Mechanism and the Role in Earth's Climate | A. Mizuno | U.S.A. Norway Sweden | 3 | University of Colorado Boulder, UCLA, University of Arizona UiT The Arctic University of Norway EISCAT Scientific Association |
| Source Apportionment of Organic Aerosols in Beijing | M. Mochida | China | 1 | Tianjin University |
| Characterizing Organics and Aerosol Loading over Australia (COALA) | M. Mochida S. Ohata | Australia U.S.A. U.K. | 3 | University of Wollongong, Commonwealth Scientific and Industrial Research Organisation, Australian Nuclear Science and Technology Organisation, NSW Department of Planning, Industry and Environment Georgia Institute of Technology, UCI Lancaster University |
| Characterization of atmospheric organic aerosol over a boreal forest in northern Europe | M. Mochida S. Ohata | Finland | 1 | University of Helsinki |
| Global Precipitation Measurement Mission (GPM) | H. Masunaga N. Takahashi | U.S.A. | 1 | NASA |
| Tropical Cyclones-Pacific Asian Research Campaign for Improvement of Intensity Estimations/Forecasts (T-PARCII) | K. Tsuboki T. Shinoda N. Takahashi | Taiwan U.S.A. | 2 | National Taiwan University Atmospheric Sciences Colorado State University |
| Observational Study on Convective Self-Aggregation | H. Masunaga | U.K. | 1 | University of Reading |
| Satellite Algorithm Development for Tracking Precipitating Clouds | H. Masunaga | U.S.A. | 1 | NASA Jet Propulsion Laboratory |
| Development and Validation of a Satellite-Based Scheme to Estimate In-Cloud Vertical Velocity | H. Masunaga | U.S.A. | 1 | City University of New York |

| Research Project | ISEE Representative | Collaborating Country/Region | | Collaborating Organization |
|---|---------------------|---|----|--|
| Long-Term Observation of Black Carbon Aerosols in the Arctic | S. Ohata | Norway U.S.A. Canada Finland | 4 | Norwegian Polar Institute National Oceanic and Atmospheric Administration Government of Canada Finnish Meteorological Institute |
| Energetic Particle Chain -Effects on the middle/lower atmosphere from energetic particle precipitations- | T. Nakajima | Finland | 1 | University of Oule Finnish Meteorological Institute |
| High Aerosol High Ice Water Content project | M. Murakami | U.S.A. | 1 | Federal Aviation Administration, NASA |
| Continuous Observation of Methane at a Paddy Field in Northern India | Y. Matsumi | India | 1 | University of Delhi |
| Observation of PM2.5 in Ulan Bator | Y. Matsumi | Mongolia | 1 | National University of Mongolia |
| Observation of PM2.5 in Hanoi | Y. Matsumi | Vietnam | 1 | Hanoi University of Science and Technology |
| Validation of GOCI Products and Application to Environmental Monitoring of Japanese Coastal Waters | J. Ishizaka | Korea | 1 | Korea Institute of Ocean Science and Technology |
| Sea Surface Nitrate and Nitrate Based New Production - Two Innovative Research Products from SGLI on board GCOM-C | J. Ishizaka | U.S.A. | 1 | Columbia University |
| Collection of Validation Dataset of GCOM-C Coastal Products | J. Ishizaka | Korea U.S.A. Taiwan Thailand China Estonia | 6 | Korea Institute of Ocean Science and Technology Columbia University, East Carolina University National Cheng Kung University Burapha University First Institute of Oceanography, Nanjing, University of Science and Technology University of Tartu |
| Validation of Ocean Color Products in the Western North Pacific and Japanese Coastal Waters: Collaboration with JAXA GCOM-C Project | J. Ishizaka | Member States of EUMETSAT: Germany, U.K., France, Italy, Spain, Netherlands <i>and others countries</i> | 30 | European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) |
| Investigating the Optical Characteristics of Red Tides in the Upper Gulf of Thailand | J. Ishizaka | Thailand | 1 | University of Burapa, Kasetsart University |
| Integrated Land Ecosystem - Atmosphere Processes Study (iLEAPS), one of the Global Research Projects (GRPs) of the Future Earth | T. Hiyama | U.K., India, Finland, New Zealand, China, Korea <i>and others countries</i> | 6 | iLEAPS/Future Earth |
| Observational Study of Vegetation, Energy and Water in Eastern Siberia Towards Elucidation of Climate and Carbon Cycle Changes | T. Hiyama | Russia | 1 | Institute for Biological Problems of Cryolithozone/SB RAS |
| Arctic Challenge for Sustainability II (ArCS II) Project | T. Hiyama | U.S.A. | 1 | International Arctic Research Center of the University of Alaska Fairbanks |
| Estimating Permafrost Groundwater Age in Central Mongolia | T. Hiyama | Mongol | 1 | Institute of Geography and Geoecology of the Mongolian Academy of Sciences |
| Study of Methane Flux Observation in Eastern Siberia and the Obtained Data Analysis | T. Hiyama | Russia | 1 | Institute for Natural Science, North Eastern Federal University |
| An International Study on Precipitation Variability in High-Altitude Areas of the Himalayas in Nepal | H. Fujinami | Nepal | 1 | Kathmandu University, Nepal Academy of Science and Technology, International Centre for Integrated Mountain Development |

| Research Project | ISEE Representative | Collaborating Country/Region | Collaborating Organization |
|--|---------------------|---|--|
| Asian Precipitation Experiment (AsiaPEX) | H. Fujinami | India Nepal China Korea Bangladesh | 5 India Meteorological Department, Indian Institute of Tropical Meteorology, University of Rajasthan International Centre for Integrated Mountain Development, Nepal Academy of Science and Technology, Kathmandu University Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Tsinghua University Pusan National University <i>and other institutions</i> |
| International Continental Scientific Drilling Program - Dead Sea Deep Drilling Project (ICDP-DSDDP) | H. Kitagawa | Israel U.S.A. Germany Switzerland | 4 Geological Survey of Israel, Hebrew University of Jerusalem Columbia University, University of Minnesota Twin Cities GFZ Helmholtz Centre Potsdam, Max Planck Institute for Chemistry University of Geneva |
| Climate Change Reconstruction of the Central Highlands in Vietnam | H. Kitagawa | Vietnam | 1 Vietnam Academy of Science and Technology |
| Climate Reconstruction using Travertine from Takht-e-Soleyman Area in Kurdistan, Iran | M. Minami | Iran | 1 University of Kurdistan |
| Study of Ground-Water Circulation Based on ¹⁴ C Ages of Underground Water and Hot-Spring Water Samples from Korea | M. Minami | Korea | 1 Korea Institute of Geoscience and Mineral Resources |
| Establishment of Master Dendrochronological Calibration Curve Around 660 BC using Annual Tree Ring Samples from Poland | M. Minami | Poland | 1 Silesian University of Technology |
| Measurements of Cosmic-Ray-Produced ¹⁴ C in Iron Meteorites | M. Minami | U.S.A. | 1 UCB |
| Geochronological Research on the Basement Rocks in Japan and Korea | T. Kato | Korea | 1 Korea Institute of Geoscience and Mineral Resources |
| Development of New Analytical Techniques and Accurate Quantification of Electron Microprobe Analysis | T. Kato | Korea | 1 Pusan National University |
| International Ocean Discovery Program (IODP) Expedition 379: Amundsen Sea West Antarctic Ice Sheet History | M. Yamane | U.S.A. Germany U.K. France Sweden Norway China Korea India New Zealand | 10 University of Houston, Texas A&M University, Appalachian State University, U.S. Army Engineer Research and Development Center, University of Massachusetts, University of South Florida, Montclair State University, University of Florida, Northern Illinois University, Colorado College Alfred Wegener Institute for Polar and Marine Research, University of Bremen, University of Kiel, Museum für Naturkunde University of Southampton, University of Birmingham, British Antarctic Survey Université de Perpignan Stockholm University UiT The Arctic University of Norway China University of Geosciences, Tongji University Korea Institute of Geoscience and Mineral Resources National Centre for Antarctic and Ocean Research GNS Science |

Visitors from Foreign Institutes

(April 1, 2021–March 31, 2022)

| Country/Region | | | |
|---|----------|---|---|
| Asia | India | 1 | 4 |
| | Korea | 1 | |
| | China | 2 | |
| Europe (Including New Independent States) | Russia | 1 | 1 |
| Middle East | Iran | 1 | 1 |
| Africa | Ethiopia | 1 | 2 |
| | Nigeria | 1 | |
| Total | 7 | 8 | |

| Funding Source | |
|--|---|
| Japan Society for the Promotion of Science | 2 |
| Nagoya University | 4 |
| Self-funding | 1 |
| Government | 1 |
| Total | 8 |

| Purpose | |
|----------------|---|
| Joint Research | 8 |
| Total | 8 |

Overseas Business Trips of Faculty

(April 1, 2021–March 31, 2022)

| Country/Region | | | |
|---|-------------|---|---|
| North America | U.S.A. | 3 | 3 |
| Europe (Including New Independent States) | U.K. | 1 | 3 |
| | Switzerland | 1 | |
| | Norway | 1 | |
| Total | 4 | 6 | |

Online Seminars by Foreign Scientists**(16 in total)**

| Date | Name | Affiliation | Title | Number of Participant |
|---------------|----------------------|---|--|-----------------------|
| Apr. 29, 2021 | Alphonse C. Sterling | NASA Marshall Space Flight Center, U.S.A. | 4th SCOSTEP Online Capacity Building Lecture/ An overview of the Sun's structure, and a closer look at solar magnetism and activity | 52 |
| May 21, 2021 | Franz-Josef Lübken | Leibniz-Institute of Atmospheric Physics, Germany | 7th SCOSTEP/PRESTO Online Seminar/ Physics at the edge between Earth's atmosphere and space | 114 |
| May 31, 2021 | Esa Turunen | Sodankylä Geophysical Observatory, Finland | 5th SCOSTEP Online Capacity Building Lecture/ The variable geospace environment and our radio wave based modern society: basic concepts of ionosphere and recent research problems at high latitudes | 108 |
| Jun. 8, 2021 | Kristof Petrovay | ELTE Eotvos Lorand University, Hungary | 8th SCOSTEP/PRESTO Online Seminar/ The Sun making history. The mechanism behind the varying amplitude of the solar cycle | 159 |
| Aug. 19, 2021 | Craig Rodger | University of Otago, New Zealand | 7th SCOSTEP Online Capacity Building Lecture/ Energetic electron precipitation from the radiation belts: How plasma waves in space kill atmospheric ozone | 49 |
| Sep. 14, 2021 | Dibyendu Nandi | Indian Institute of Science Education and Research, India | 8th SCOSTEP Online Capacity Building Lecture/ Solar magnetic fields: Their origin and predictability | 90 |
| Sep. 23, 2021 | Richard Eastes | University of Colorado Boulder, U.S.A. | 9th SCOSTEP/PRESTO Online Seminar/ Space weather in the thermosphere-ionosphere system - observation and Insights from the GOLD (Global-scale Observations of the Limb and Disk) * mission | 121 |
| Oct. 21, 2021 | Sarah Gibson | High Altitude Observatory at NCAR, U.S.A. | 9th SCOSTEP Online Capacity Building Lecture/ Whole Heliosphere and Planetary Interactions (WHPI): Connecting Sun to solar wind to planets during "quiet" times of the solar cycle | 40 |
| Nov. 16, 2021 | Samuel Schonfeld | Boston College, U.S.A. | 10th SCOSTEP Online Capacity Building Lecture/ F10.7 and solar spectral irradiance: drivers of ionosphere models | 35 |
| Nov. 30, 2021 | Tibor Török | Predictive Science Inc., U.S.A. | 10th SCOSTEP/PRESTO Online Seminar/ Understanding and modeling solar eruptions: Where do we stand? | 83 |
| Dec. 2, 2021 | Aleksandr Rubstov | Institute of Solar-Terrestrial Physics SB RAS, Russia | Division for Ionospheric and Magnetospheric Research Seminar/ Characteristics of Pc4-5 waves in the magnetosphere by satellites measurements | 25 |
| Dec. 16, 2021 | Adhitya Pavithran | Indian Institute of Geomagnetism, India | Division for Ionospheric and Magnetospheric Research Seminar/ The study of ionospheric Alfvén resonator (IAR) at low latitude | 25 |
| Jan. 27, 2022 | Michael Kosch | South African National Space Agency, South Africa | 11th SCOSTEP Online Capacity Building Lecture/ The energetics of sprites: New results from South Africa | 53 |
| Feb. 10, 2022 | Cora Randall | University of Colorado, U.S.A. | 11th SCOSTEP/PRESTO Online Seminar/ Solar-terrestrial coupling via energetic particle precipitation | 155 |
| Feb. 17, 2022 | KD Leka* | NorthWest Research Associates, U.S.A. | ISEE Solar Seminar/ The Sun is Not Divergence Free! (Not Yet) | 17 |
| Mar. 31, 2022 | Martin Connors | Athabasca University, Canada | 12th SCOSTEP Online Capacity Building Lecture/ Space weather geoelectromagnetic effects | 39 |

* Foreign Visiting Staff

<Abbreviations>

| | |
|----------|---|
| AS CR: | Academy of Sciences of the Czech Republic |
| CASS: | Center for Astrophysics and Space Sciences |
| CCMC: | Community Coordinated Modeling Center |
| CESR: | Centre d'Etude Spatiale des Rayonnements |
| CETP: | Centre d'étude des environnements terrestres et planétaires |
| CNRS: | Centre National de la Recherche Scientifique |
| EISCAT: | European Incoherent Scatter Scientific Association |
| GSFC: | Goddard Space Flight Center |
| HPDE: | Heliophysics Data Environment |
| IBEX: | Interstellar Boundary Explorer |
| IFSI: | Istituto di Fisica dello Spazio Interplanetario |
| IMAP: | Interstellar Mapping and Acceleration Probe |
| INFN: | Istituto Nazionale di Fisica Nucleare |
| INPE: | Instituto Nacional de Pesquisas Espaciais, Brazilian Institute of Space Research |
| RAS | Russian Academy of Sciences |
| IPS: | Ionospheric Prediction Services |
| IPSL: | Institut Pierre-Simon Laplace |
| JHUAPL: | Johns Hopkins University Applied Physics Laboratory |
| KASI: | Korea Astronomy and Space Science Institute |
| LAPAN: | Lembaga Penerbangan dan Antariksa Nasional, National Institute of Aeronautics and Space |
| LOFAR: | Low Frequency Array |
| LPC2E: | Laboratoire de Physique et Chimie de l'Environnement et de l'Espace |
| MSFC: | Marshall Space Flight Center |
| MWA: | Murchison Widefield Array |
| NASA: | National Aeronautics and Space Administration |
| SB RAS: | Siberian Branch, Russian Academy of sciences |
| SCOSTEP: | Scientific Committee on Solar Terrestrial Physics |
| SDAC: | Solar Data Analysis Center |
| SLAC: | Stanford Linear Accelerator Center |
| SPASE: | Space Physics Archive Search and Extract |
| SPDF: | Space Physics Data Facility |
| UCB: | University of California, Berkeley |
| UCI: | University of California, Irvine |
| UCLA: | University of California, Los Angeles |
| UCSC: | University of California, Santa Cruz |
| UCSD: | University of California, San Diego |
| UiT: | University of Tromsø |

12. Outreach

Public Lectures, Open Labs, and School Visits

The ISEE organizes a variety of outreach events and activities. In continuation from FY2020, some events were canceled in FY2021 because of the COVID-19 pandemic, but many events and activities were still conducted online or in a hybrid format. Some were also conducted in-person. Specifically, seven visiting lectures, 12 online or hybrid lectures, two high-school student visits, two online open laboratory events, two online training courses for young researchers, and one virtual tour for university students, one online workshop for children were organized.

We also distributed a series of booklets in Japanese that answered 50 questions on various topics and a series of comic (manga) books. They are related to space–Earth subjects for science education and are suitable for the public and schoolchildren. We have added two new booklets this year. These booklets can also be browsed and downloaded from the ISEE website (<https://www.isee.nagoya-u.ac.jp/hscontent/books.html>). These comic books were translated into English in collaboration with SCOSTEP’s CAWSES program (<https://www.isee.nagoya-u.ac.jp/en/outreach.html>). Translations in other languages are available on the SCOSTEP website (<https://scostep.org/space-science-comic-books/>). We also published two newsletters. The research results, event reports, and English columns have been posted.

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



Latest issues of the Japanese booklet series “50 questions”.

Addresses of Facilities

| Name | | Address | TEL/FAX |
|------|---|---|--|
| ① | Institute for Space–Earth Environmental Research | Research Institutes Buildings I/II, Furo-cho, Chikusa-ku, Nagoya, Aichi 464-8601 | TEL:+81-52-747-6303 FAX:+81-52-747-6313 |
| ② | Toyokawa Branch | 3-13 Honohara, Toyokawa-shi, Aichi 442-8507 | TEL:+81-533-89-5206 FAX:+81-533-86-3154 |
| ③ | Moshiri Observatory | Moshiri, Horokanai, Uryu, Hokkaido 074-0741 | TEL:+81-165-38-2345 FAX:+81-165-38-2345 |
| ④ | Rikubetsu Observatory | Uenbetsu, 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 |
| ⑤ | Fuji Observatory | 1347-2 Fujigane, Fujikawaguchiko-machi, Minamitsuru-gun, Yamanashi 401-0338 | TEL:+81-555-89-2829 |
| ⑥ | Kagoshima Observatory | 3860-1 ShimoHonjo Honjo, Tarumizu-shi, Kagoshima 891-2112 | TEL:+81-994-32-0730 |

