Ref.No.33

September 3, 2018

Director Kazushige Obara
Earthquake Research Institute
The University of Tokyo

To whom it may concern,

Earthquake Research Institute Joint Usage/Research Program

Call for proposals for research projects and workshops for the Academic Year 2019

The Earthquake Research Institute (ERI) has been designated as a nationwide Joint Usage/Research Center for Earthquake and Volcano Sciences by the Ministry of Education, Culture, Sports, Science and Technology since the academic year 2010.

The goal of this center is to promote solid-earth sciences related to earthquakes and volcanoes, science and engineering to mitigate disasters caused by earthquakes and volcanic eruptions, and observational research both in Japan and abroad for the prediction of earthquakes and volcanic eruptions. In order to achieve this goal, the ERI conducts joint researches, accepts visiting researchers from both Japan and abroad, and provides facilities, equipment, materials, and data held by the ERI to related research institutions nationwide.

This time, we call for proposals for joint research projects, those for workshops and participants for Specific Research Projects for the Academic Year 2019.

1. Categories (See the Application Guidelines for the details)
   (1) Joint Research
   (2) Workshop/Symposium
   (3) Usage of Facilities, Observation Equipment, and Laboratory Equipment
   (4) Usage of Data and Records
   * We call for proposals for (1) and (2) annually. Please be aware that the period of application submission varies depending on the specific category. Applications for (3) and (4) are accepted all the year round, but with some exceptions.

2. Eligibility for application:
   Faculty members and researchers of national, public, and private universities, or national and public research institutions, and their equivalents (a professor emeritus, graduate students, and researchers in private companies) are eligible to apply. For more explanations about students, please refer the “13. precautions (5).”

3. Submission of proposals:
   Fill out necessary fields on the specified forms to be found on the joint usage homepage

(http://www.eri.u-tokyo.ac.jp/en/joint-usage-top/) and submit the form online.

Please follow the procedure shown in the homepage on Web-application guideline (https://erikyodo.confit.atlas.jp/en/)

4. Period of research: From April 2019 to March 2020.

5. Review Policy:

The Joint Usage Committee of the ERI will review the submitted applications. It is important that the content of the research plan follows the intent of the category for the joint usage/research program. It is required that a proposed project/workshop has relevance to the researches conducted in the ERI and/or to the facilities, equipment, records and data provided by the ERI. Applications are reviewed by all members of the Joint Usage Committee from several research fields.

For specific research projects (A), (B), and (C), the ERI will compile submitted participation applications for each project and send them to each principal investigator of the project. The principal investigator should submit a proposal for review by summarizing the application information before mid-November.

6. Application Deadline: October 31, 2018 (Wed).

7. Submission of Letter of Consent:

All members of a "1. Joint Research," except those who belong to the ERI, must submit a Letter of Consent (Form C-2a-E) by the project. Please submit one with signature of the head of your affiliated institution within two weeks after you submitted application by postal mail to the mailing address shown at the end of this document. In case that an applicant moves to a new institution, he/she should submit a Letter of Consent signed by the head of the new place without delay.

Submission of the Letter of Consent is not required for the one applying for "2. Workshop/Symposium," "3. Usage of facilities, observation equipment, and laboratory equipment" or "4. Usage of data and records."

Researchers who belong to ERI do not need to submit the letter of the consent.

8. Submission of Confirmation of Research Ethics form:

The Confirmation of Research Ethics form (Form C-2b-E) must be submitted by the all participants for "1. Joint Research", "3. Usage of facilities, observation equipment, and laboratory equipment", and "4. Usage of data and records".

Submission of the form is not required for the participants for "2. Workshop/Symposium". Members of the University of Tokyo do not have to submit the form, either. Please send a signed Confirmation of Research Ethics form by postal mail to the mailing address shown at the end.

9. Review Results:

The Joint Usage Committee of the ERI will evaluate all applications, and principal investigators of the projects will be informed the results before late March, 2019.

10. Funds for research/workshop:

The ERI will make expenditures for research/workshop expenses (travel costs, consumables and service fees) within its budget. Expense for equipment is not allowed basically. Please check the definition and examples of the equipment and the consumable in "13. precautions (6)."

11. Acknowledgements:

On publishing papers based on the results of the researches performed under the ERI's joint usage/research program, please acknowledge the program in the paper. Also, please provide a copy of the paper to the ERI.

12. Lodging facilities:

The ERI is not equipped with lodging facilities. Please arrange accommodations by yourself.

13. Precautions:

(1) When using facilities, comply with the rules of the ERI as well relevant laws, and follow the directions of the director for better management and safety.

(2) Keep in adequate contact with and follow the orders of the contact person and/or related members in the ERI when executing budget, implementing research, and using equipment.

(3) Losses and damages suffered by participants of the joint research projects or users of the equipment from outside the University of Tokyo shall be covered by their institution, and the University of Tokyo is not liable for them. A student participating in a joint research project should take out an accident insurance. If provided equipment or accessories are damaged or lost, repairs or replacement will be made in the sole responsibility of the user. If defects are found after a device is returned, repair fee maybe claimed.

(4) If you create intellectual property through this joint usage program, please inform the contact person at the ERI and research group members before making a copyright or patent application. Additionally, please contact the intellectual property department of your affiliated institution. Division of rights and the application procedures will be determined following discussion among related parties.

(5) Graduate students may participate in the projects as members of a research group with acceptance of his / her supervisor, but they cannot be a principal investigator. Graduate students may, however, apply as a principal investigator to use facilities, equipment, and data. Undergraduate students cannot participate in the projects, but can be a "research assistant" by request of the principal investigator. A letter of consent is needed for the "research assistant", too. Please contact the "Research Support Team" if you want to add a new "research assistant".

(6) A material that is durable more than one year and costs more than ¥100,000 per one

piece/set is considered as the equipment. Batteries/cells, chemicals, or software are, however, handled as the consumable, even if they are expensive. Please contact to the Research Support Team (Joint Usage Section), if it is difficult to decide.

(7) If you have any other inquiries with regard to the joint usage program, please ask the Research Support Team (Joint Usage Section).

[Contact Information]
1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-0032
Earthquake Research Institute, the University of Tokyo
Research Support Team (Joint Usage Section)
Phone: 03-5841-1769, 5710
FAX: 03-5689-4467
Email: k-kyodoriyo@eri.u-tokyo.ac.jp

Application Guidelines

In order to facilitate researches in the fields relevant to earthquakes and volcanoes across Japan, the Earthquake Research Institute conducts various joint usage/research programs. Applications for joint researches are accepted annually.

Please refer to the explanations in the following, and apply online web system from the site

http://www.eri.u-tokyo.ac.jp/en/joint-usage-top/

Forms required for applications and related information are posted to the above URL.

If you apply for usage of equipment, please arrange a plan for the usage with a person in charge for the equipment at the ERI before submitting an application.

1. Joint Research

(1) Specific Research Project (A):

Specific Research Project (A) is for research projects that already have funds other than that by the joint usage/research program. Individual projects are being conducted nationwide by the ERI and/or other institutions. We call for applications to participate in these projects.

Research projects in this category are listed in Appendix A. Expenses to work for the projects will be supported.

An applicant should contact the principal investigator of the project or the contact person of the project at the ERI that he/she wishes to join to arrange research plan and submits the participation application (Form T-3B-E).

With regard to the joint research program based on "Promoting the Earthquake and Volcano Hazards Observation and Research Program (proposition)" (referred to as "Earthquake and Volcano Hazard Mitigation Research", hereafter) (A-01), call for registrations of projects and call for proposal will be placed in January of 2019 or after, because the proposition will finish at the end of this fiscal year.

(2) Specific Research Project (B):

The projects in this category include those planned by individual researchers or research groups with the aim of forming future large-scale projects. Those who wish to participate in these projects are invited for application. The projects in this category are not currently supported by large-scale project-funds such as the "Earthquake and Volcano Hazard Mitigation Research." Exploratory or international/interdisciplinary subjects are registered as in Appendix B.

Those who are interested in joining the project should inquire about the details of the research project with the principal investigator of it or the contact person of the project at the ERI. Those who wish to join the research projects listed in Appendix B should submit application form T-3B-E.

(3) Specific Research Project (C):

The projects in this category include those operated with funding other than joint usage/research program but the ERI approved as projects that belong to the program. The projects are listed in Appendix C.

Those who are interested in participating a project should inquire about the details of the research content with the principal investigator of it or the contact person of the project at the ERI. Those who wish to join the research projects listed in Appendix C should submit application form T-3B-E. Some research titles are open to applications at all times of a year.

(4) General Research Project:

This category is for joint research projects conducted by small group of researchers formed from inside and outside of the ERI. Proposals that advance researches performed at the ERI further, or that stimulate research activities in the ERI are welcome. In addition, proposals that involve foreign visiting researchers accepted by the ERI's International Research Promotion Office for the joint usage/research program are given appropriate consideration. Proposals for researches that are not yet conducted at the ERI are also welcome. A principal investigator of a project must be a faculty member or researcher of university/institution other than the ERI, and at least a member of the ERI must be involved in the project. A principal investigator of a project should submit an application (Form G-1-E).

A project in this category shall receive ¥500,000 or less for travel cost, consumables and services to conduct the research. However, appropriate considerations shall be made for research projects that require more than ¥500,000 by some reasons, which must be explained in the application.

For researches conducted at the ERI, please see the "2017 Handbook for Earthquake Research Institute, the University of Tokyo" or check the ERI website at (http://www.eri.u-tokyo.ac.jp/en/).

A principal investigator of a project must submit a project report (Form G-2-E) within 30 days of the completion of the research period through the online web system.

(5) Cooperative Study on Elucidation and Prediction of Earthquakes and Volcanic Eruptions:

This category is for research projects related to items in "Earthquake and Volcano Hazard Mitigation Research." With regard to "Cooperative Study on Elucidation and Prediction of Earthquakes and Volcanic Eruptions", call for proposal will be placed in January of 2019 or after, because "Promoting the Earthquake and Volcano Hazards Observation and Research Program (proposition)" will finish in the end of this fiscal year and a new research program is being developed now.

(6) Cooperative Study on High Energy Geophysics Research:

This category is for research projects related to items in "High Energy Geophysics Research." Proposals based on industry-academia collaboration are given high priorities, in particular with matching funds of the applicants themselves.

Period of research for a project is one year, but it may be continued as long as three years. Research funds shall be ¥1,000,000 or less per research project per year. Expenses shall include travel costs and joint

research expenses (consumables and service fees).

The Coordinating Committee of High Energy Geophysics Research conducts initial review of the proposals, and the Earthquake Research Institute Joint Usage Committee will make final decision regarding the review.

A faculty member shall be the contact person at the ERI for accepted research projects. Principal investigator of a project should submit an application form H-1-E. All members of a project must submit a Confirmation of intellectual property (Form C-3-E). Those who submitted it once in FY 2016 - 2021, or belong to the University of Tokyo are not required to submit it.

A principal investigator of a project must submit a project report (Form H-2-E) within 30 days of the completion of research period through the online web system. As for the projects in this category, acknowledgements for the joint usage/research program by the ERI must be included in publications and participants shall be obligated to submit reprints of the publications.

2. Workshop/Symposium

This category is for holding workshop and symposium for topics on earthquakes, volcanoes and related sciences. The length of a workshop or symposium is supposed as one to three days. The category includes summer school and other workshops that are expected to contribute to the development of the research community on earthquakes, volcanos and related field. A representative of workshop/symposium should submit an application (Form W-1-E). At least one member of the ERI must be included in the application as a contact person. The venue shall be in the ERI. If a workshop is to be held outside of the ERI (including overseas), please state the necessity for this clearly. And, if you accept to attend public people with the workshop, please select “open”, otherwise select “closed”.

Domestic workshop/symposium will receive ¥1,000,000 or less, and international one will do ¥2,000,000 or less, per a workshop/symposium. The fund is spent to cover travel and printing costs.

If major changes in the plan, such as a change of venue, are needed, those should be reviewed again at the Joint Usage Committee of the ERI. The representative of the workshop/symposium should submit a statement of the reason explaining the changes as soon as possible to the Research Support Team of the ERI.

The Joint Usage Committee will evaluate the original proposal and the statement of the reason to decide whether to approve the changes or not.

The representative to the workshop/symposium must submit a workshop/symposium report (Form W-2-E) within 30 days of the completion of the workshop/symposium through the online web system.

3. Usage of Facilities, Observation Equipment, and Laboratory Equipment

Some of the facilities, observation equipment, and laboratory equipment managed by the ERI are available for joint usage. Available items are listed in Appendix J-3. Those who wish to use the items should contact the contact person at the ERI for arrangement, and submit an application (Form J-1-E). It is necessary to submit another form, a specified items lease form (Form C-1-E), to take observation equipment outside the institute. If funds are required to use these facilities, please apply to the general research project instead.

A user of the item must submit a report (Form J-2-E) within 30 days of the completion of the usage of the items through the online web system.

4. Usage of Data and Records

Appendix J-4 is a list of earthquake and other earth science data and records, which are available for joint usage, managed by the ERI. Those who wish to use them should contact the contact person of the data and records at the ERI for arrangement, and submit an application (Form J-1-E) by the online system. Applications to use the computer system database of the Earthquake Information Center are accepted by the Earthquake Information Center homepage below.

http://wwweic.eri.u-tokyo.ac.jp/computer/manual/eic2015/index.php?English

If funds are required to use these data and records, please apply to the general research project instead.

If you wish to receive national earthquake observation system data using satellite communications, please submit an application (Form S-1-E). In addition, please submit reports (Forms J-2-E, S-2-E) within 30 days of the completion of the research using the data and records through the online web system.

【Appendix T-2A】 2019FY Specific Research Project (A) Titles

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-A-02 Structure and dynamics of Earth's deep interior	○Daisuke Suetsugu（JAMSTEC） ・Hisayoshi Shimizu	This collaboration aims to reveal the structure and dynamics of the Earth's deep interior mainly by observational approach. We carry out long-term observation by geophysical network in the Pacific region (Ocean Hemisphere Network) and seismic and/or electromagnetic array studies both on land and seafloor, and contribute to the scientific aim by analyzing data from these observations. **Project name of the financial base to conduct this specific research project :** Contribution to Global Seismographic Network Geophysical studies by using submarine cables, TPC-1 and TPC-2.
2019-A-03 Science of Slow Earthquakes	○Kazushige Obara（Earthquake Research Institute） ・Kazushige Obara	Our research will shed light on the mystery of “slow earthquakes”, which have been detected in succession in recent years. This will require an approach integrating the conventional fields of geophysics, seismology, and geodesy with materials science and non-equilibrium statistical physics, among others. By explaining the mechanisms, environmental conditions and principles of slow earthquakes, our goal is to accelerate a unified understanding of all earthquake events, from low-speed deformation to high-speed slip, and at the same time, to rebuild the way research is conducted on earthquakes. We collaborate with many researchers not only in Japan but also in various countries in the world in order to clarify (A) mechanisms involved in the occurrence of slow earthquakes, (B) environment in which slow earthquakes occur, and (C) principles by which slow earthquakes occur. We welcome research collaborators who are interested in this project【Table A-03】. If your proposal is accepted, a part of the travel fee will be supported. URL:http://www.eri.u-tokyo.ac.jp/project/sloweq/ **Eligibility for application:** Faculty members and researchers of national, public, and private universities, or national and public research institutions, and their equivalents are eligible to apply. **Project name of the financial base to conduct this specific research project :** 2016-2020 Japan Society for the Promotion of Science, Grant-in-Aid for Scientific Research on Innovative Areas “Science of Slow Earthquakes”
2019-A-04 Upper mantle structure of the northern Okinawa Trough	○Kazuo Nakahigashi（Tokyo University of Marine Science and Technology） ・Tomoaki Yamada	We conduct bathymetric and seismic surveys, and a seismic and magnetic observation in the northern Okinawa Trough. We will try to elucidate the relationship between the earthquake occurrence and the inhomogeneity structure of the upper mantle, and propose a large earthquake occurrence model in the northern Okinawa Trough. In addition, we will compare with the 2016 Kumamoto earthquake and contribute to the understanding of the inland earthquake occurrence model. **Project name of the financial base to conduct this specific research project :** Grant-in-Aid for Scientific Research (B) Upper mantle structure and its implications for the earthquake occurrence and the back-arc rifting in the Okinawa Trough

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-A-05 Intelligent seismic data processing based on integration of next-generation seismic observations and the forefront of Bayesian statistics	○Naoshi Hirata（Earthquake Research Institute） ・Hiromichi Nagao	In our country, more than 1,000 seismic stations have been continuously acquiring high-resolution digital seismic data. A large amount of instrumentally measured vibration data, which can be so-called big-data, will be available in near future. The data consist of both the conventional high quality seismic data by well-calibrated seismometers and many kinds of new vibration data measured by accelerometers based on Micro Electro Mechanical Systems (MEMS), which are installed in such as infrastructures, lifelines and smartphones. This project, which consists of the three research topics shown in the attached table【Table A-05】, aims to develop, collaborating with the forefront of Bayesian statistics, a set of algorithms that enable us to comprehensively analyze the seismic data obtained by sensors of various types. This project will eventually contribute to prevention/mitigation of seismic disasters and clarification of earthquake phenomena. **Requirement for participation:** Applicants must contribute to the promotion of the JST CREST project that this collaborative research bases. **Project name of the financial base to conduct this specific research project :** JST CREST "Intelligent seismic data processing based on integration of next-generation seismic observations and the forefront of Bayesian statistics"

【Table A-03】 2019-A-03 Projects

No	PI	Institution	Research Project
A01 Study on the mechanisms involved in the occurrence of slow earthquakes based on temporal inland and offshore observations (PI: Kazushige Obara, Earthquake Research Institute, The University of Tokyo)			
A0101	Kazushige Obara, Akiko Takeo	Earthquake Research Institute, The University of Tokyo	Study on activity pattern of deep slow earthquakes based on inland broadband seismograph observations
A0102	Kazushige Obara, Aitaro Kato	Earthquake Research Institute, The University of Tokyo	Study on activity pattern of deep slow earthquakes based on inland very dense array observations by using short-period seismometers
A0103	Youichi Asano	National Research Institute for Earth Science and Disaster Resilience	Temporary observation of regular and very low-frequency earthquakes for understanding on seismic behavior along the Ryukyu trench
A0104	Sachiko Tanaka	National Research Institute for Earth Science and Disaster Resilience	Spatial and temporal changes in tidal modulation of low frequency tremor and very low frequency earthquakes
A0105	Mamoru Nakamura	University of the Ryukyus	Study of spatiotemporal variation in tidal response of very low frequency earthquakes in the Ryukyu Trench
A0106	Naoki Uchida	Tohoku University	Study on the interaction between various slip phenomena on the plate boundary
A0107	Masatoshi Miyazawa	Disaster Prevention Research Institute, Kyoto University	Temporal changes of frictional parameters on the plate interface estimated by using dynamic triggering of tectonic tremor
A0108	Yusuke Yamashita	Disaster Prevention Research Institute, Kyoto University	Study on modeling of shallow SSE based on ocean bottom pressure observations
A0109	Masanao Shinohara	Earthquake Research Institute, The University of Tokyo	Study on activity pattern of shallow slow earthquakes based on offshore broadband seismological observations
A02 Study on physical mechanisms of slow earthquakes based on geodetic observations (PI: Hitoshi Hirose, Kobe University)			
A0201	Hitoshi Hirose	Kobe University	GNSS Observations for crustal deformations due to slow slip events in southwest Japan (around the Bungo channel area etc.)
A0202	Shinichi Miyazaki	The University of Tokyo	GNSS Observations for crustal deformations due to slow slip events in southwest Japan (Okinawa islands) and data assimilation to infer slip evolutions
A0203	Takeshi Matsushima	Kyushu University	GNSS Observations for crustal deformations due to slow slip events in southwest Japan (remote islands)
A0204	Takao Tabei	Kochi University	GNSS Observations for crustal deformations due to slow slip events in southwest Japan (Shikoku district)
A0205	Kenichi Yamazaki	Disaster Prevention Research Institute, Kyoto University	GNSS Observations for crustal deformations due to slow slip events in southwest Japan (around the Kyushu area etc.)
A0206	Yoshiyuki Tanaka	The University of Tokyo	Detection of crustal fluid flow associated with slow slip events
A0207	Ryota Takagi	Tohoku University	Detecting slow slip events and understanding interaction with tremor activity based on GNSS data analysis
A0208	Takeshi Kimura	National Research Institute for Earth Science and Disaster Resilience	Development of automated system for detection of slow slip events from continuous tilt and strain data
A0209	Satoshi Itaba	National Institute of Advanced Industrial Science and Technology	Detection of shallow and deep SSE by onland and ocean area crustal movement records

No	PI	Institution	Research Project
B01 Study on seismic and electromagnetic subsurface structure around the source of slow earthquakes (PI: Kimihiro Mochizuki, Earthquake Research Institute, The University of Tokyo)			
B0101	Kimihiro Mochizuki	Earthquake Research Institute, The University of Tokyo	Seismic structure and seismicity around slow-slip region in the Hikurangi subduction margin, New Zealand
B0102	Makoto Uyeshima	Earthquake Research Institute, The University of Tokyo	EM observations on land in the vicinity of the Bungo Channel
B0103	Hiroshi Ichihara	Nagoya University	Ocean bottom electromagnetic survey in the southwestern Nankai Trough
B0104	Seiichi Miura	JAMSTEC	Marine seismic survey in the Nankai Trough
B0105	Eiji Kurashimo	Earthquake Research Institute, The University of Tokyo	Study on heterogeneous structure in and around the slow-earthquake source region based on dense seismic array observations
B0106	Katsuhiko Shiomi	National Research Institute for Earth Science and Disaster Resilience	Seismological features around the LFE zone beneath western Shikoku
B0107	Junichi Nakajima	Tokyo Institute of Technology	Seismic properties around slow-slip areas and possible drainage from the megathrust
B02 Study on geological perspectives, frictional and hydrological properties of slow earthquakes (PI: Kohtaro Ujiie, University of Tsukuba)			
B0201	Kohtaro Ujiie	University of Tsukuba	Geology of slow earthquake source
B0202	Ikuo Katayama	Hiroshima University	Experimental study of frictional properties for slow earthquakes
B0203	Yasushi Mori	Kitakyushu Museum of Natural History & Human History	Fluid flow and silica transport toward the source area of deep slow earthquakes
B0204	Simon Wallis	The University of Tokyo	Patterns of fluid flow and deformation in the shallow mantle wedge
B0205	Yoshitaka Hashimoto	Kochi University	Frictional heating and slip behavior along micro-faults in exhumed accretionary complexes
B0206	Wataru Tanigawa	JAMSTEC	Laboratory determination of slip velocity dependence on dynamic permeability of fault zone
B0207	Akito Tsutsumi	Kyoto University	Effect of pore fluid pressure on the frictional properties of subduction zone material

No	PI	Institution	Research Project
C01 Study on geoscientific modeling of earthquake phenomena from low-speed deformation to high-speed slip (PI: Satoshi Ide, The University of Tokyo)			
C0101	Satoshi Ide	The University of Tokyo	Modeling broadband slow earthquakes
C0102	Takanori Matsuzawa	National Research Institute for Earth Science and Disaster Resilience	Comprehensive numerical model of observed slow slip events
C0103	Yuta Mitsui	Shizuoka University	Search for new factors of slow earthquake occurrence
C0104	Eiichi Fukuyama	National Research Institute for Earth Science and Disaster Resilience	Modeling of slow earthquakes based on large-scale friction experiments
C0105	Keisuke Ariyoshi	JAMSTEC	Understanding of relationship between migration speed for slow earthquake and frictional properties
C0106	Shoichi Yoshioka	Kobe University	Relationship between occurrence of slow earthquakes in circum-Pacific subduction zones and temperature and dehydration field inferred from 3D thermal modeling
C0107	Masaru Nakano	JAMSTEC	Estimations of heterogeneous structures along source faults based on statistical characteristics of shallow slow earthquakes
C02 Unified understanding of slow and regular earthquakes from nonequilibrium physics point of view (PI: Takahiro Hatano, Earthquake Research Institute, The University of Tokyo)			
C0201	Takahiro Hatano	Earthquake Research Institute, The University of Tokyo	Unified understanding of earthquake generation process with nonlinear dynamics approach
C0202	Tetsuo Yamaguchi	Kyushu University	Studies on control of frictional constitutive laws and earthquake cycles using gels
C0203	Yutaka Sumino	Tokyo University of Science	Construction and analysis of analogue system for slow earthquake using brittle viscoelastic fluid.
C0204	Takehito Suzuki	Aoyama Gakuin University	Analytical treatment of nonlinearity generated by the interaction among heat, fluid pressure and dilatancy associated with earthquake source process

【Table A-05】 2019-A-05 Projects
(Intelligent seismic data processing based on integration of next-generation seismic observations and the forefront of Bayesian statistics)

No.	PI	Institution	Research Project
A	Aitaro Kato	Earthquake Research Institute, The University of Tokyo	Methodology for utilization of various types of seismic data and its validation
B	Hiromichi Nagao	Earthquake Research Institute, The University of Tokyo	Development of algorithms for seismic data processing based on the forefront of Bayesian statistics
C	Takuto Maeda	Graduate school of Science and Technology, Hirosaki University	Intelligent seismic data processing: application to real data and development of data assimilation methods

【Appendix T-2B】 2019FY Specific Research Project (B) Titles

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2017-B-01 Developing a numerical method simulating magma fracture	○Masaharu Kameda （Tokyo University of Agriculture and Technology） ・Mie Ichihara	Deformation and fracture of visco-elastic fluid is an important process controlling a volcanic eruption. The phenomenon includes interesting problems in computational science for continuum mechanics. Developing a mathematical model and numerical methods to solve the problems will bring about a breakthrough not only in volcanology but also in engineering. In this project, we develop a numerical method to simulate fracture of visco-elastic fluid using the brittleness parameter presented by Ichihara and Rubin (2010). We also conduct fracture experiment on viscoelastic fluid to test the numerical method. **List of affiliations for projected participants:** Akinori Yamanaka (Tokyo University of Agriculture and Technology) Osamu Kuwano (JAMSTEC) Satoshi Okumura (Tohoku University) Atsushi Toramaru, Tetsuo Yamaguchi (Kyushu University) Hiromichi Nagao (Earthquake Research Institute, The University of Tokyo)

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2017-B-02 Image analysis of muography applying medical computer-assisted detection/diagnosis (CAD) technology	○Naoto Hayashi（The University of Tokyo Hospital） ・Hiroyuki Tanaka	High-speed computer-assisted image diagnostic technology applying machine learning have been developed in Department of Computational Diagnostic Radiology and Preventive Medicine, The University of Tokyo Hospital. Meanwhile, muographic visualization of a volcano's internal structure has been demonstrated to the rest of the world by Earthquake Research Institute, The University of Tokyo. This project aims to combine computer-assisted image diagnostic technology with muography to facilitate observation of eruption style and process, and accelerate research of the volcano. Muography visualizes density distribution of the object by measuring the direction and number of muons that pass through it. Although muography is expected to be useful to understand the internal structure of volcanoes, it has not been sufficiently utilized in connection with volcanic activity. That was because analysis of muon track information more than ten million per year has took time, and tens of thousands of muographic images has not been evaluated. In the medical field, advanced technology has been developed to demonstrate and analyze medical images including radiography, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET). Recently, the number of images per medical examination has exponentially increased, and it causes increase of burden on physicians who read images to detect and diagnose lesions. To support physicians, software has been developed to reconstruct and analyze images, and demonstrate lesion candidates. Moreover, machine learning has been applied to improve its accuracy. Both muography and medical imaging technology including radiography aims to utilize track information of radiation or elementary particles to detect abnormality (lesion) inside the target and evaluate it qualitatively. This project aims to combine advanced medical image diagnostic technology with muography to develop high-speed volcano diagnostic technology. In fiscal year 2018, we will continue to observe Sakurajima, analyze its data applying computer-assisted detection/diagnosis technology, and facilitate observation of eruption style and process to promote research of the volcano. Furthermore, we will improve accuracy of prediction of eruption time and scale to utilize disaster prevention. **List of affiliations for projected participants:** Department of Computational Radiology and Preventive Medicine, The University of Tokyo Hospital Department of Radiology, The University of Tokyo Hospital Faculty of Information Sciences and Graduate School of Information Sciences, Hiroshima City University, Faculty of biology-oriented science and technology, Kindai University Department of Radiological Sciences, Ibaraki Prefectural University of Health Sciences
2017-B-04 Development of muography technologies using nuclear emulsion	○Kunihiro Morishima（Nagoya University） ・Hiroyuki Tanaka	Muography is the non-destructive inspection technology of the giant objects. By using muography, we can take transmission images of volcanoes. And also, density change inside of mountains can be imaged. Nuclear emulsion is a muon detector. Nuclear emulsion is high sensitive photographic film, which can record three dimensional trajectories of muons with high space resolution. Thus, Nuclear emulsion is no need of electric power. This is advantage for applying to volcanoes. In this study, It is planned to develop technologies of high-speed analysis system of nuclear emulsion for muongraphy of volcanoes. In this development, we have a plan to develop the noise rejection methods. **List of affiliations for projected participants:** Nagoya University, The University of Tokyo, Kobe University, Toho University, Gifu University, Central Research Institute of Electric Power Industry, Salerno University, Bern University, Napoli University

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2017-B-05 Understanding of deep Earth using directionally sensitive large detector	○Kunio Inoue（Tohoku University） ・Hiroyuki Tanaka	A cooperative research was started in FY 2014 to launch an interdisciplinary research, which provide new observation for understanding the Earth with neutrinos. In FY 2017, we constructed new research group based on our achievements of the last cooperative research. We combine study of new measurement technology and geo-neutrino flux calculation model. By doing so, our research aims to drive “Neutrino Geoscience” by specifying what we can do to understand the Earth. In this FY, we will improve the mirror array to increase the number of measuring photons and install the cooling system for photon detector. We will combine these developments and measure angular resolution of directional measurement using already developed 3D measurement technology. Furthermore, we will evaluate the measurement sensitivity assuming directional sensitive large detector by using newly constructed geo-neutrino flux calculation model based on seismic wave observation and geochemical analysis. **List of affiliations for projected participants:** Tohoku University, The University of Tokyo, Tokyo Institute of Technology, JAMSTEC, National Institute of Advanced Industrial Science and Technology
2017-B-06 Construction of overriding plate deformation in subduction zones	○Hiroshi Sato（Earthquake Research Institute, The University of Tokyo) ・Hiroshi Sato ・Tatsuya Ishiyama	Our goal is to construct community block models of Japanese Islands including seismic source fault models and three dimensional crust and mantle rheology models based on seismic tomography, elastic wave velocity experiments, and structural and thermal evolution of Japanese islands. Our purpose also includes comparison between these models with a long-term crustal deformation. We expect participants from Iwate, Tohoku, Niigata, Yokohama National, Aichi University of Education, Kyoto Universities, National Research Institute for Earth Science and Disaster Resilience, and JAMSTEC.
2018-B-01 Data-driven geoscience: application for the dynamics in mobile belts	○Kenta Yoshida（JAMSTEC） ・Hiromichi Nagao	Dynamics in the mobile belt involves several geophysical and geochemical processes and their interactions, and our observation is only the result of such comprehensive interactions. Data-driven approach, dealing with high-dimension data and seeking its hidden structure, may be an effective way to solve such complex systems. Although geophysics start to utilize data-driven approach for several purposes, it has not been common in geology and geochemistry, yet. In this project, we would like to establish an open scheme of data-driven geoscience that deals with problems in dynamics in mobile belts including volcanism, seismicity, and fluid circulations. Our target is cross-cutting research not only among earth scientists, but also involving information scientists, to construct a new analytical scheme for the challenging issues. **List of affiliations for projected participants:** JAMSTEC, Hokkaido University, Tohoku University, The University of Tokyo, Tokyo Institute of Technology, Tokoha University, Kanazawa University, University of Tsukuba, Kyoto University, Osaka City University, Kagoshima University, Kitakyushu Museum of Natural History & Human History, National Institute of Advanced Industrial Science and Technology, National Research Institute for Earth Science and Disaster Resilience

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2018-B-02 Study on the crustal and surface deformation using multiple SAR techniques	○Youichiro Takada （Hokkaido University） ・Yosuke Aoki	Many has been found using various new sensors during the last three years due to the launch of ALOS-2 satellite. We must prepare the study environment which makes such latest SAR technologies available to Japanese researchers to address international competition. Such an environment has been maintained by PIXEL, a study group of SAR, founded on the joint usage of ERI, the university of Tokyo. This project serves as base of the PIXEL activities. Under this project, the participants can share the SAR data provided by JAXA under the research contract between ERI and JAXA. The purpose of this project is to detect various phenomena as earthquakes, volcanic unrests, landslides, glaciers, ground subsidence, etc. using multiple state-of-the-art techniques of SAR analysis and/or technologies of SAR satellites. We also pay special attention to the time evolution of crustal and/or surface deformation using ALOS1 and other satellites. Furthermore, we put weight on the information exchange and the lectures on the SAR analysis software named “RINC”. During the first year of this project, the RINC user has been increasing. Therefore, in the second year, we are planning to open the lecture of RINC, especially on the reduction of ionospheric disturbance effects, which should remain PIXEL participants competitive. We also discuss on new satellites (i.e., Sentinel-1), especially for their new function and properties, to share the know-how. We also collaborate with the project “Next Generation Volcano Research B2-1”. **List of affiliations for projected participants:** Hokkaido University, The University of Tokyo, Tohoku University, Kanazawa University, Ibaraki University, Tokyo Metropolitan University, University of Aizu, Nihon University, Shizuoka University, Nagoya University, Kyoto University, Kochi University, University of Kochi, Kyushu University, Kagoshima University, Kagawa University, Japan Aerospace Exploration Agency, National Research Institute for Earth Science and Disaster Resilience, National Institute of Advanced Industrial Science and Technology, Center for Environmental Science in Saitama, Tono Research Institute of Earthquake Science, Hot Springs Research Institute of Kanagawa Prefecture, National Institute of Polar Research, Japan Meteorological Agency, Meteorological Research Institute, Fukada Geological Institute
2018-B-03 Nation-wide utilization of integrated earthquake simulation using high performance computing	○Watanabe Gakuho （Yamaguchi University） ・Muneo Hori	In this research, we have tried to evaluate high-resolution, high-reliability earthquake disasters and damage in each city throughout the country by using the program package of integrated earthquake simulation using high-performance calculation under development at the University of Tokyo Earthquake Research Institute. Especially, we will evaluate damage to social infrastructure such as transportation network, river port facility, lifeline, etc. and lead to calculation of economic loss with higher accuracy. Through them, we aim to contribute to computer science and earthquake / seismic engineering through construction and implementation of new numerical simulations. **List of affiliations for projected participants:** Earthquake Research Institute, The University of Tokyo, Research Center for Large-scale Earthquake, Tsunami and Disaster, The University of Tokyo, RIKEN Center for Computational Science, JAMSTEC, Kagawa University, Kochi University of Technology, Kyushu University, Nagoya Institute of Technology, Niigata University, Research Center for Urban Safety and Security, Kobe University, University of Yamanashi, Yamaguchi University, Tokyo Institute of Technology

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2018-B-04 Establishment of dense infrasound observing network	○Masa-yuki Yamamoto （Kochi University of Technology） ・Yuichi Imanishi	Along with the most recent environment of rapid developing of sensors with viewing of coming IoT (Internet Of Things) era, a basic research to establish of dense infrasound observing network will be carried out. Owing to our collaborative results in past 3 years until fiscal year of 2016, collaborations with involved researchers and institutes were significantly improved, and establishment of low cost sensing with MEMS sensors was also proven. We will extend its collaboration for the next 3 years with local governments and citizens so as to realize a domestic network of low cost infrasound microphones. **List of affiliations for projected participants:** Hokkaido University, Hokkaido Information University, The University of Tokyo, Japan Weather Association, National Institute of Polar Research, National Institute of Information and Communications Technology, Nagoya University, Kanazawa University, Kochi University of Tecnology, Kyushu University
2019-B-01 Volcano observation using MEMS infrasound sensor	○Isao Shimoyama （The University of Tokyo） ・Mie Ichihara	The purpose of this project is to develop and evaluate high performance compact infrasound sensor for use in volcano monitoring by using MEMS high sensitive differential pressure sensor. We plan to conduct comparative tests and field tests with the conventional sensors. By using MEMS, we believe that it is possible to realize a sensor that is compact, highly sensitive and low cost. We expect this research helps efficiently development of the proposed sensor. **List of affiliations for projected participants:** Kyushu University, Kochi University of Technology
2019-B-02 Development of Global Muography Network	○Hiroyuki Tanaka （Earthquake Research Institute, The University of Tokyo） ・Hiroyuki Tanaka	The Global Muography Network (GMN) is a new framework for muography researchers, created in order for participating countries to share muographic observational detectors, muography technologies and muography researchers. Based on the GMN activities, the International Virtual Muography Institute (VMI) was established between European and Japanese Institutions and private entities in 2016. During the course of the project-oriented activities in the VMI, Muographic network created in Europe has been supported by the Horizon 2020 program and researchers involved will transfer the expertise in advanced detector technologies to the VMI. Thus far, the VMI has established a European-Japanese joint volcano research centre at Sakurajima, one of the most active volcanoes in the world, and several interdisciplinary muography projects with NEC, one of the largest electronics companies in the world. The current project will further develop this GMN in the frame work of the VMI and Horizon 2020. **List of affiliations for projected participants:** Tohoku University, High Energy Accelerator Research Organization, Kansai University, Kyushu University, Catholic University of Louvain, Wigner Research Center for Physics of the Hungary Academy of Science, National Institute for Nuclear Physics, National Institute of Geophysics and Volcanology

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-B-03 High precision total geophysical observation for unified understanding of crustal activity	○Makoto Okubo（Kochi University） ・Akito Araya	As a continuous crustal activity observation, extensometers (strain) and water tube tiltmeters (inclination) have been operating. Recently, space-borne observational technologies such as GNSS and interference SAR are also available. In addition, various precise observations, for example, laser extensometers, borehole strainmeters, rotational seismometers, and so on are being developed, and observational fields are extended to not only in-land but also to sea floor. By connecting these observations, by unifying their different physical quantities, and by integratedly analyzing these records, we aim to comprehensively understand the crust activities that change with time and space. Additionally, we will promote advanced observation technologies. We will also discuss new techniques leading to new observation methods and analyses with interdisciplinary participants. We expect that the researchers' application concerning development of a new measurement method, crustal activity observation, and its analysis. **List of affiliations for projected participants:** Hokkaido University, Tohoku University, Nagoya University, The University of Tokyo, Kyoto University, Kochi University, Kyushu University, Meteorological Research Institute, National Research Institute for Earth Science and Disaster Resilience, National Institute of Advanced Industrial Science and Technology, Association for the Development of Earthquake Prediction, Hot Springs Research Institute of Kanagawa Prefecture, JAMSTEC
2019-B-04 Development of data assimilation methods for understanding and predicting seismic and volcanic phenomena	○Masayuki Kano（Tohoku University） ・Junichi Fukuda	For understanding and predicting seismic and volcanic phenomena, it is important to estimate state variables and model parameters used in physics-based numerical simulations based on observation data. Data assimilation can effectively combine numerical simulation and observation data based on Bayesian statistics. Data assimilation has been originally developed and widely used in meteorology and oceanology. In these days, data assimilation has been introduced in the field of solid earth science to estimate frictional parameters on the plate interface, seismic wavefield, physical parameters inside volcanoes, and to predict fault slip, ground motions and tsunami arrivals. As the next step for further understanding seismic and volcanic phenomena, it is necessary to develop new methods that are applicable to problems with strong non-linearity such as earthquakes and volcanic eruptions and high degrees-of-freedom. In this project, to solve such problems, researches in solid earth science and researchers in statistical science and meteorology, who are familiar with algorithms on data assimilation, collaborate together to develop data assimilation methods. Applying the developed methods to observations, we aim to further understand and predict seismic and volcanic phenomena. **List of affiliations for projected participants:** Earthquake Research Institute, The University of Tokyo, The Institute of Statistical Mathematics, University of the Ryukyus, Kyoto University, Tohoku University, Tokiwa University, JAMSTEC, RIKEN

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-B-05 Study on movement of crustal fluid and viscoelastic crustal response based on combined gravimetric and geodetic techniques	○Satoshi Miura（Tohoku University） ・Yuichi Imanishi	Gravimetry is a powerful tool for tracking movement of underground material and spatiotemporal changes in subsurface density distributions. For example, gravity changes have been observed associated with magma movements in conduits of volcanoes, occurrences of slow earthquakes, and viscoelastic response after the 2011 Tohoku-oki earthquake. These gravity changes are so small, a few micro-Gal, that the improvement of the accuracy of measurements is essential through excluding external disturbances such as soil moisture. In addition, densification of measurements by miniaturization of conventional gravimeters, and developments of new instruments based on brand-new principles to measure spatial derivatives or integrals of gravity acceleration are also important. Nationwide participants in this project will share these issues and integrate the recent advances toward applications to a wide variety of geosciences. **List of affiliations for projected participants:** Hokkaido University, Tohoku University, The University of Tokyo, University of Tsukuba, University of Toyama, Kanazawa University, Nagoya University, Kyoto University, Hiroshima University, Ehime University, Kyushu University, National Astronomical Observatory of Japan, National Institute of Polar Research, Geospatial Information Authority of Japan, National Research Institute for Earth Science and Disaster Resilience, National Institute of Advanced Industrial Science and Technology, National Institute of Information and Communications Technology, RIKEN, JAMSTEC, Tono Research Institute of Earthquake Science
2019-B-06 Frontier earth observation	○Hitoshi Kawakatsu（Earthquake Research Institute） ・Masanao Shinohara ・Hajime Shiobara ・Kimihiro Mochizuki	For future observational research in solid earth science in Japan, it is necessary to develop a direction to promote research based on the optimal field on the Earth for scientific problems (referred as to "frontier earth observation"). Researchers who have made similar attempts in the past and researchers who have similar ideas and hopes in the future gather together to exchange opinions and information, and discuss the necessary infrastructures (shared use framework, software/hardware support, etc.) for promoting such observational research. **List of affiliations for projected participants:** Earthquake Research Institute, The University of Tokyo, JAMSTEC, Atmosphere and Ocean Research Institute, The University of Tokyo, Hokkaido University, Tohoku University, Chiba University, Nagoya University, Kyoto University, Kobe University, Hiroshima University, Kyushu University, Kagoshima University
2019-B-07 Compilation of damages of castles caused by historical disasters	○Yasuyuki Kano（Earthquake Research Institute） ・Yasuyuki Kano	Examine the history of damages and repair of the castles caused by natural disasters. Collaborations among researchers from multiple fields such as archaeologists, historians, seismologists, engineers, geologists, meteorologists are expected. The collaborative research will provide rich information to historical earthquake study such as distribution and strength of damages. Since the castles are symbol of the city, past damages of castles will be good example to improve social awareness on local disasters. The result may provide a suggestion to restoration of castles from present disasters or protection and preservation of cultural properties. **List of affiliations for projected participants:** The University of Siga Prefecture, Graduate School of Science, Kyoto University, Disaster Prevention Research Institute, Kyoto University, Ritsumeikan University, National Museum of Japanese History, Earthquake Research Institute, The University of Tokyo, Collaborative Research Organization for Historical Materials on Earthquakes and Volcanoes, The University of Tokyo

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-B-08 Basic research of quantum sensing technologies to realize the portable absolute gravity measurement at the field	○Hajime Shiobara（Earthquake Research Institute） ・Hajime Shiobara	The gravity measurement is the most important and reliable technique to know density distribution below the ground for researches in solid geophysics and mineral resources. But, the off-line and long-term gravity measurement at the remote area, such as deep seafloor or active volcanoes, is still impossible with the latest measurement technology. The aim of this research is to realize an absolute gravimeter of small, portable, low power and low cost by using the quantum technology, which is highly advanced in abroad. At the first step to develop basic technologies, we have several discussions of understanding the quantum technology, practical implementations, and geophysical new findings expected, to apply the large KAKENHI program to start the real developments. Other than the gravimeter but related with the practical quantum sensing is also for considerations. **Condition to join this proposal:** The core member expected is already in the team of the application for the MEXT Q-LEAP project. We welcome ones have interest in development of the practical absolute gravity measurement in the remote field, its technical and geophysical applications and other quantum sensing. In this research proposal, we only have several specific interest group meetings. **List of affiliations for projected participants:** The University of Tokyo, National Institute of Advanced Industrial Science and Technology, Kobe University, The University of Electro-Communications, JAMSTEC

【Appendix T-2C】 2019FY Specific Research Project (C) Titles

Project code Project title	○ Principle investigator ・ Contact Person at ERI	Details of the project and condition to participate in the project
2019-C-01 Research on Seismicity and Plate Structure by the Metropolitan Seismic Observation Network (MeSO-net)	○Hisanori Kimura（National Research Institute for Earth Science and Disaster Resilience） ・Shinichi Sakai	Metropolitan Seismic Observation Network (MeSO-net) is a dense, widely distributed seismograph network, which is unique in the world. In this project, we will conduct a research, which advances understanding of the seismotectonics beneath the metropolitan area and contributes to refinement of the assessment of the seismic hazards that have been elucidated so far and detailed evaluation of damages at cities caused by disastrous earthquakes, by using data obtained from the MeSO-net. Seismic and meteorological data until FY2016 is used in this project. **Project name of the financial base to conduct this specific research project :** Tokyo Metropolitan Resilience Project Sub-program - b; Ultra dense seismic networks by public-private partnerships

【Appendix J-3】
2019FY List of Facilities, Observation Equipment, and Laboratory Equipment

Please refer to Joint usage URL（http://www.eri.u-tokyo.ac.jp/en/joint-usage-top/）

On publishing papers based on the results of the researches performed by using facilities in the Earthquake Research Institute joint usage program, **please acknowledge the program in the paper**. Also, please provide a copy of the paper or report to Earthquake Research Institute, joint usage section.

Examples of the appropriate format for the indication in the acknowledgments are given below.

This study was supported by ERI JURP 20XX-X-XX.

（facilities）

Joint Usage Code and Name of facility/equipment	Information of facility	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F1-01 Tsukuba Seismological Observatory Aburatsubo Geophysical Observatory Nokogiriyama Geophysical Observatory Wakayama Seismological Observatory Hiroshima Seismological Observatory Yahiko Geophysical Observatory Dodaira Seismological Observatory Shin-etsu Seismological Observatory Fujigawa Geophysical Observatory Muroto Geophysical Observatory Observatories and facilities	Nokogiriyama： http://eoc.eri.u-tokyo.ac.jp/GOP/ngy.html (In Japanese only) Wakayama： http://www.eri.u-tokyo.ac.jp/WSO/index.html (In Japanese only) Fujigawa： http://www.eri.u-tokyo.ac.jp/fujigawa/indexJ.html (In Japanese only) Muroto： http://eoc.eri.u-tokyo.ac.jp/GOP/Mrt/indexM.html (In Japanese only)	○To Be Advised : Details will be posted on the web site when the person in charge of these observatories for the next fiscal year is decided.		
2019-F1-02 Yatsugatake Geo-electromagnetic Observatory		○Tsutomu Ogawa	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F1-03 Asama Volcano Observatory Komoro observatory of Seismology and Volcanology Izu-Oshima Volcano Observatory Kirishima Volcano Observatory		○To Be Advised : Details will be posted on the web site when the person in charge of these observatories for the next fiscal year is decided.		

(observation equipment)

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F2-01 Data receiver system by satellite communication for a nation-wide seismic telemetry network.	http://eoc.eri.u-tokyo.ac.jp/eisei_system/riyou/data_jushin_riyou.htm (In Japanese only)	○Shinichi Sakai	Must contact with the responsible person prior to the application. It is a rule that the users install it and maintain it by themselves. Another application about data use is needed.	Any time, as needed.
2019-F2-02 Temporal seismic data acquisition systems (incl. data transfer units, seismometers and recording units)	http://eoc.eri.u-tokyo.ac.jp/eisei_system/riyou/vsat_riyou.htm (In Japanese only) http://eoc.eri.u-tokyo.ac.jp/eisei_system/riyou/chijo_souti.htm (In Japanese only)	○Shinichi Sakai	Must contact with the responsible person prior to the application. Not always available for period of specific research projects.	Any time, as needed.
2019-F2-04 Broadband-MT instruments	Metronix 1) Main unit: ADU07e 19 sets ADU08e 2 sets 2) Induction coils MFS06: 24 coils MFS07: 4 coils MFS06e: 16 coils MFS07e: 30 coils Phoenix 1) induction coils MTC50 3 coils Basically, 5 component data (2-component E-field and 3-component H-field) can be measured. Sample frequency is 2^n Hz up to 524 kHz. In addition, we have some other items necessary to the MT survey, such as, various batteries and electrodes.	○Makoto Uyeshima	Must contact with the responsible person prior to the application. Please recognize that we cannot let you use the instruments if we have some field campaigns.	Any time, as needed.
2019-F2-05 Network-MT voltage difference measurement system	SES93: 8 channel 20 bit voltage difference acquisition systems developed by ADOSYSTEMS. We have about 20 instruments. Sampling interval is 0.1, 1 or 10 s. SESNET93: Data transfer units.	○Makoto Uyeshima	Must contact with the responsible person prior to the application. Please recognize that we cannot let you use the instruments if we have some field campaigns.	Any time, as needed.

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F2-06※ Marine heat flow measurement system	The system consists of a data logger, probes, temperature sensors, weight, and an acoustic pinger. Heat flow is measured by penetrating a probe equipped with multiple temperature sensors into seafloor sediment. An instrument for thermal conductivity measurement on sediment samples (Quick Thermal Conductivity Meter, Kyoto Electronics Manufacturing Co., Ltd.) is also available.	○Makoto Yamano	Users must have an experience in marine heat flow measurement, unless they conduct cooperative research with the Earthquake Research Institute.	Any time, as needed.
2019-F2-07 Portable broadband seismic observation system(1)	Broadband seismometers: CMG3T,STS2 Recorders: REKTEK130 40 sets	○Kawakatsu Hitoshi	Data have to become open in public at the data center of OHRC, ERI after 2-3 years of moratorium period. For the system availability, consult with the contact person.	Any time, as needed.
2019-F2-08※ Portable broadband seismic observation system (2)	Broadband seismometers (Nanometrics Inc., Canada) Trillium 120PA Number of equipment: 14	○Jun Oikawa	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F2-09※ Absolute gravimeter	FG5 gravimeter with 1-2 microgal accuracy manufactured by microg-Lacoste corp., U.S.A.	○Yuichi Imanishi	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F2-10※ Lacoste & Romberg Land gravimeter	Spring gravimeter with 10 microgal accuracy manufactured by microg-Lacoste corp., U.S.A.	○Yuichi Imanishi	Operational instruction should be understood.	Any time, as needed.
2019-F2-11※ Potable strong motion observation system	Potable strong motion observation system(Revision of SMAR-6A3P) 16 equipment with amplifier(16 JEP-6A3P sensors with 1V/G) (Akashi Corporation) 5 equipment without amplifier (5 JEP-6A3P sensors with 10V/G) (Akashi Corporation) 10 logger LS-7000XT(Hakusan Corporation) 10 logger LS-7000 (Hakusan Corporation) ※A single set consists of an equipment and a logger. ※20 sets are available. ※Amplifier gain is a multiplication of 1, 20, 50, 100 and 0.1, 1, 10, 100.	○Kazuki Koketsu	Must contact with the responsible person prior to the application.	Any time, as needed.

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F2-12 Volcanic gas observation system		○Jun Oikawa	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F2-13 Ultra-long period MT instruments	LEMI-417 fluxgate MT observation instruments. We have 6 instruments. 4 component E-fields and 3-component H-fields can be measured with 1s sampling.	○Makoto Uyeshima, Hisayoshi Shimizu	Must contact with the responsible person prior to the application. Please recognize that we cannot let you use the instruments if we have some field campaigns.	Any time, as needed.
2019-F2-14 High accuracy gyro-compass system	A SOKIA's GP1X manual gyro-compass system. Measurement accuracy is 20 angle-seconds.	○Makoto Uyeshima, Hisayoshi Shimizu	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F2-15※ 3D deep-sea current profiler system	NORTEK Aquadopp - 6000m 1 system (http://www.nortek-as.com/en/products/CurrentMeter/Aquadopp6k) A current profiling system by combination of the Doppler current profiler (Aquadopp) and the Ti sphere transponder system of a self pop-up recovery, which enables 10 s interval observation of more than one-year-long by the external power supply. Use of the current profiler only is also available.	○Hajime Shiobara	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F2-16 High accuracy broad-band voltage difference measurement instruments	NT System Design's Elog1k. We can measure 2-component voltage differences at 1024Hz or 32 Hz with 24 bit accuracy. Very low power consumption(1.8W).	○Makoto Uyeshima	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-M-01 Specific equipment・Seismometers(1Hz, Lennarz electronic GmbH)	LE-3Dlite MkII 30 sets LE-3Dlite MkⅢ44 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.
2019-M-02 Specific equipment・Low electric power data recording units	HKS-9700a-0505 30 sets LS-8800 44 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.
2019-M-03 Specific equipment・Broad-band seismometers	Trillium-120PA 6 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-M-04 Specific equipment・ Nanometrics data recording units	Centaur digital recorder 6 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.
2019-M-05 Specific equipment・ Broad-band seismometers	TS17840/Trillium-120PA 9 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.
2019-M-06 Specific equipment・ Seismic/volcanic observation units	LF-1100R/LF-2100R 9 sets	○Shinichi Sakai	Normal usage period (less than 2 months) Application required for longer usage in June.	Any time, as needed.

(laboratory equipment)

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F3-01 Controlled Seismic source	Minivibrator T-15000 (IVI, Inc.)	○Hiroshi Sato, Tatsuya Ishiyama	Users are required to have precise and detailed knowledges on how to use the controlled Seismic source.	Any time, as needed.
2019-F3-02 Computer system of Earthquake and Volcano Information Center	http://wwweic.eri.u-tokyo.ac.jp/computer/manual/eic2015/index.php?English	○Head of Earthquake and Volcano Information Center	Limited to academic use and along with the purpose of ERI, according to the rule. Apply directly to ERI, if joint usage fund is not needed.	Any time, as needed.
2019-F3-03 Rock Fracture Apparatus with Data Acquisition System	http://www.eri.u-tokyo.ac.jp/gijyutsubu/jikken/ (In Japanese only)	○Shingo Yoshida, Masao Nakatani	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-F3-05 XRF spectrometer	RIGAKU Wavelength dispersive-X-ray fluorescence spectrometer ZSX Primus II http://www.rigaku.com/en/products/xrf/primus2	○Atsushi Yasuda	All users were requested to receive instruction beforehand upon contact to responsible persons. Consumables were users' pocket.	
2019-F3-06※ Vibration testing system	EMIC Corp. Vibration testing system F-1400BD/LAS15 Horizontal or vertical shaking table(1-axis)	○Akito Araya	Must contact with the responsible person prior to the application. Operate the equipment by yourself in principle.	Any time, as needed.
2019-F3-07※ Laser source equipment	NEOARK Corp. Frequency stabilized He-Ne laser Emission wavelength 633nm (red light)	○Akito Araya	Must contact with the responsible person prior to the application.	Any time, as needed.

Joint Usage Code and Name of facility/equipment	Information of Equipment	Contact person (○Responsible person)	Conditions of Use and Remarks	Application periods
2019-F3-08 National Seismogram Data System		○Head of Earthquake and Volcano Information Center	System to use national seismogram data, jointly operated with Japanese universities. Consult with corresponding faculty.	Any time, as needed.
2019-F3-09 Karl Fischer moisture titrator (Coulometric titration)	Kyoto Electronics Manufacturing Co., Ltd. Karl Fischer moisture titrator (Coulometric titration) ＜MKC-610＞ http://www.kyoto-kem.com/en/product-category/karl/ Evaporator for measurement of water in rocks ＜ADP-512＞ http://www.kyoto-kem.com/en/product-category/option-karl/	○Kenji Mibe	All users must be trained before operating the machine. It is requested that all applicants discuss their projects with contact person before submitting the proposal. The chemicals for measurements have to be purchased by users.	Any time, as needed.
2019-F3-10 Laser diffraction particle-size analyzer(wet dispersion condition)	Sympatec HELOS/KF-RODOS-QUIXEL System	○Fukashi Maeno	All users are required to receive instruction from contact persons and to adjust schedule.	Any time, as needed.
2019-F3-11※ Equipment set for thermometer calibration	Fluke 1586A, 9142, 7103 etc. Thermostatic bath(-30 degC to 150 degC), thermistor scanner, and so on	○Masao Nakatani	Must contact with the responsible person prior to the application. Operate the equipment by yourself in principle.	Any time, as needed

※Detailed information posted at Earthquake Research Institute, joint usage page.

【Appendix J-4】

2019 FY List of earthquake and other Earth Science Data and Records

Please also refer the our database page (http://www.eri.u-tokyo.ac.jp/en/publication/)

On publishing papers based on the results of the researches performed by using facilities in the Earthquake Research Institute joint usage program, **please acknowledge the program in the paper**. Also, please provide a copy of the paper or report to Earthquake Research Institute, joint usage section.

Examples of the appropriate format for the indication in the acknowledgments are given below.

This study was supported by ERI JURP 20XX-X-XX.

Joint Usage Code and Name of data/ records	Contact person (○Responsible person)	Conditions of Use and Related URL	Application periods
2019-D-01 WWSSN Seismogram microfiche	○Head of Committee for old seismograms and mareograms	Advance appointment required. Inquire about paper supplies. http://wwweic.eri.u-tokyo.ac.jp/wwssn/filmlist.html	Any time, as needed.
2019-D-02 Historical seismograms	○Head of Committee for old seismograms and mareograms	Use microfiche archives. Original records can be used with ERI staff. http://wwweic.eri.u-tokyo.ac.jp/susu/ (In Japanese only)	Any time, as needed.
2019-D-03 Seismological Bulletin, Selected newspaper articles, Foreign seismological reports	○Head of Committee for old seismograms and mareograms	Copies can be made in library. Bulletins: http://wwweic.eri.u-tokyo.ac.jp/record-J/index.html Foreign seismological reports: http://wwweic.eri.u-tokyo.ac.jp/record-W/index.html	Any time, as needed.
2019-D-04 Earthquake data of Center for Geophysical Observation and Instrumentation	○To Be Advised：Details will be posted on the web site when the person in charge of the date for the next fiscal year is decided.	Data should be used under the treatment of earthquake data of Japanese universities.	
2019-D-05 Nation-wide earthquake data transfer by satellite communication system and other facilities	○To Be Advised：Details will be posted on the web site when the person in charge of the date for the next fiscal year is decided.	Application required under the treatment on earthquake data transfer by satellite communication system. http://eoc.eri.u-tokyo.ac.jp/eisei_system/riyou/data_jushin_riyou.htm (In Japanese only)	
2019-D-06 Japan University Network Earthquake Catalog(JUNEC)	○Head of Earthquake and Volcano Information Center	Hypocenter data can be accessed through anonymous ftp. ftp://ftp.eri.u-tokyo.ac.jp/pub/data/junec/ Arrival time data can be provided by CD, according to rule among the universities.	Any time, as needed.
2019-D-07 Seismic data of Asama, Izu-Oshima, Kirishima, and Fuji volcanoes	○Head of Volcano Research Center	Must contact with the responsible person prior to the application.	Any time, as needed.

Joint Usage Code and Name of data/ records	Contact person (○Responsible person)	Conditions of Use and Related URL	Application periods
2019-D-08 Broadband Seismic Waveform Data(1)	○Head of Ocean Hemisphere Research Center	none. http://ohpdmc.eri.u-tokyo.ac.jp/dataset/permanent/seismological/index.html	Any time, as needed.
2019-D-10 New J-array seismogram data	○Head of Earthquake and Volcano Information Center	Can be used through website. http://jarray.eri.u-tokyo.ac.jp/ .	Any time, as needed.
2019-D-11 Earthquake data in Nikko region, Northern Kanto, Japan, in 1993	○To Be Advised：Details will be posted on the web site when the person in charge of the date for the next fiscal year is decided.	Treatment of data usage by participants of the 1993 Nikko seismic observation.	
2019-D-12 Strong motion observation database (mainly Suruga bay, Izu peninsula, and Ashigara valley)	○Kazuki Koketsu	http://smsd.eri.u-tokyo.ac.jp/smad/	Any time, as needed.
2019-D-13 Copies of old historical documents and interpretation	○Kenji Satake	No limitation Copies and interpretation of a part of special database of ERI library. http://wwweic.eri.u-tokyo.ac.jp/dl/meta_pub/G0000002erilib (In Japanese only)	Any time, as needed.
2019-D-14 Geoelectromagnetic Observation Database	○Makoto Uyeshima	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-D-15 Provisional data at Yatsugatake geo-electromagnetic observatory	○Tsutomu Ogawa	Those who wish to use the data should contact the contact person at the ERI for arrangement and submit an application.	Any time, as needed.
2019-D-16 Heat flow dataset	○Makoto Yamano	No limitation. Compilation of heat flow data in the northwest Pacific area, covering an area from 0 to 60°N and from 120 to 160°E, which includes the whole Philippine Sea, Japan Sea, and Sea of Okhotsk. It consists of station name, coordinates, altitude (or water depth), number of temperature measurements, maximum measurement depth, temperature gradient, number of thermal conductivity measurements, average thermal conductivity, heat flow, reference and year of publication. The heat flow values measured with submersibles or ROVs and those estimated from depths of gas hydrate BSRs (bottom simulating reflectors) are not included. The values less than or equal to zero are also excluded.	Any time, as needed.

Joint Usage Code and Name of data/ records	Contact person (○Responsible person)	Conditions of Use and Related URL	Application periods
2019-D-17 Aerial photographs of Japan	○ERI Library	This collection is for research purposes only: active fault research, seismology, volcanology, tectonics, etc. Please have a request at the service counter of ERI library. http://www.eri.u-tokyo.ac.jp/tosho/collection-e.html	Any time, as needed.
2019-D-18 Digital images of tsunami waveforms	○Head of Committee for old seismograms and mareograms	Apply through search system of digital images of tsunami waveforms. http://wwweic.eri.u-tokyo.ac.jp/tsunamidb/ (In Japanese only) Same condition to joint usage of ERI applies.	Any time, as needed.
2019-D-19 Special Project for Earthquake Disaster Mitigation in the Tokyo Metropolitan Area Date	○Shinichi Sakai	Must contact with the responsible person prior to the application. http://www.eri.u-tokyo.ac.jp/shuto/index.html (In Japanese only)	Any time, as needed.
2019-D-20 Superconducting Gravimeter Data	○Yuichi Imanishi	Must contact with the responsible person prior to the application.	Any time, as needed.
2019-D-21 Special Project for Reducing Vulnerability for Urban Mega Earthquake Disasters Date	○Shinichi Sakai	Must contact with the responsible person prior to the application. http://www.eri.u-tokyo.ac.jp/project/toshi/ (In Japanese only)	Any time, as needed.