【Appendix A】 FY2027 Specific Research Project (A) Titles

Project Code Project Title	○Principal Investigator ・Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2027-A-01 Earthquake and Volcano Hazards Observation and Research Program	◯ List of principal investigators is given in Table A-01 ・Head of Collaboration Center for Earthquake and Volcano Research	The Third Earthquake and Volcano Hazards Observation and Research Program (Earthquake and Volcano Hazard Reduction Research) is a 5-year plan beginning in Fiscal Year 2024, based on a proposal in December, 2023, by the Council for Science and Technology (refer to the website; http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu6/toushin/1413118_00006.htm). The program is composed of the six components as follows; 1. Research for the elucidation of earthquakes and volcanic phenomenon, 2. Research for prediction of earthquakes and volcanic eruptions,. 3. Research for prediction of induce factors of earthquake and volcanic eruption disasters, 4. Research to improve literacy for preventing disasters due to earthquakes and volcanic eruptions, 5. Cross-disciplinary comprehensive research on earthquakes and volcanic eruptions, 6. Improvement of a system for research promotion, Researchers from 42 universities, research institutions and government agencies across the country have been jointly conducting about 160 specific research projects under the program. The Earthquake Research Institute will subsidize the expense of joining any of Universities' projects under this program listed in【Table A-01】for researcher(s) from universities or research institutes which do not participate in the Earthquake and Volcano Hazard Reduction Research. Those researcher(s) who wish to join a specific project should take contact with the Principal Investigator of the project, and submit the application. Please refer to Table A-01 at the following URL for detailed information about the respective projects. (available only in Japanese) https://www.eri.u-tokyo.ac.jp/YOTIKYO/_/f/2026/06/project_3rd_A01_2026.html
2027-A-02 Structure and dynamics of Earth's deep interior	○Masayuki Obayashi（JAMSTEC） ・Hisayoshi Shimizu	This collaborative research aims to improve our understanding of the structure and dynamics of the Earth's deep interior through global-scale geophysical observations. We will continue long-term observations using the geophysical observation network in the Pacific region that succeeds the Ocean Hemisphere Network, and conduct campaign-based seismic and electromagnetic observations on land and on the seafloor. By integrating and analyzing the data obtained from these observations, we aim to advance a comprehensive understanding of the structure and dynamics of the Earth's interior. **Project name of the financial base to conduct this specific research project(A):** Contribution to Global Seismographic Network Geophysical studies by using submarine cables, TPC-1 and TPC-2.

Project Code Project Title	○Principal Investigator ・Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2027-A-03 Acceleration of Earthquake and Geodetic Research Based on Cutting-Edge Information Science	○Hiromichi Nagao (Earthquake Research Institute) ・Hiromichi Nagao	This joint research will conduct developments and applications of cutting-edge information science technique, including AI, with the aim to accelerate earthquake and geodetic research through collaborations of experts in information science, seismology, and geodesy. Not only the following research topics conducted under the STAR-E NEXT Project, which is the foundation for this joint research, but also attempts to start new research topics are welcome. (1)Advancement of techniques to generate earthquake and slow earthquake catalogs; (2)Advancement of short-, medium-, and long-term assessments of seismic activities and hazards considering mega-earthquake affects; (3)Development of automatic geodetic data analysis methods for detecting weak crustal deformation; (4)Development of advanced predictive models for fault slips; (5)Development of seismic wave propagation prediction techniques for damage assessment; (6)Development of information science techniques to uncover past earthquake-related phenomena and insights from historical records and documents; (7)Development of next-generation scientific AI techniques; (8)Development of information science techniques to discover unknown earthquake-related phenomena **Requirement for participation:** Participation in events, such as joint study sessions for early-career scientists, organized by the STAR-E NEXT Project. See below for details on the STAR-E NEXT Project. https://www.mext.go.jp/a_menu/kaihatu/jishin/mext_03435.html **Project name of the financial base to conduct this specific research project(A):** MEXT “Seismology TowArd Research innovation for Earthquake evaluatioN with EXacT data” (STAR-E NEXT Project) PI: Hiromichi Nagao, Earthquake Research Institute, The University of Tokyo Period: FY2026–2030

【Table A-03】2027-A-03 Projects

Research topics in “Acceleration of Earthquake and Geodetic Research Based on Cutting-Edge Information Science”

No.	PI	Affiliation	Research Project
A–1	Hiromichi Nagao	Earthquake Research Institute, The University of Tokyo	Advancement of Simulation Techniques in Seismology Based on Information Science
A–2	Makoto Naoi	Faculty of Science, Hokkaido University	Advancement of Data Analysis Techniques in Seismology Based on Information Science
B–1	Masayuki Kano	Disaster Prevention Research Institute, Kyoto University	Advancement of Simulation Techniques in Geodesy Based on Information Science
B–2	Kazutoshi Imanishi	Research Institute of Earthquake and Volcano Geology, National Institute of Advanced Industrial Science and Technology	Advancement of Data Analysis Techniques in Geodesy Based on Information Science
C–1	Yoshikazu Terada	Graduate School of Engineering Science, The University of Osaka	Development of Information Science Techniques for Earthquake Research
C–2	Keisuke Yano	The Institute of Statistical Mathematics	Development of Information Science Techniques for Geodetic Research

【Appendix B】 FY2027 Specific Research Project (B) Titles

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2025-B-02 Push forward the Nishinoshima interdisciplinary research	★Kenta Yoshida (JAMSTEC) ・Fukashi Maeno	Nishinoshima, a volcanic island in the Ogasawara arc, has been erupting intermittently since 2013. 2020 saw a major change in the eruption style from gentle to explosive, as well as in the magma composition from andesite to basaltic andesite. Although the island is located in a remote area, it is important to monitor its activities from the perspective of volcanic disaster prevention. The island is also of biological interest because it is one of the unique places in the world where we can observe the primary dispersal of organisms on an isolated island. Recent researches on Nishinoshima Island have been conducted through research cruises by JAMSTEC and the Ministry of the Environment, aerial observations mainly by the Japan Coast Guard, and remote observations using satellite. As researchers from various fields are involved, even a cross-disciplinary community of earth sciences such as JpGU is not sufficient for comprehensive discussions. In this joint research project, researchers working on Nishinoshima in the fields of geology, geochemistry, geophysics, ecology, etc. will gather to understand the current status of research of Nishinoshima, and to discuss how to overcome the obstacles faced by each field. The purpose of this meeting is to promote research on Nishinoshima. **<u>List of affiliations for projected participants:</u>** JAMSTEC, Japan Wildlife Res. Center, Forestry and Forest Product Res. Inst., JAXA, Meteor. Res. Inst., NIED, Tsukuba Uni., Uni. Tokyo, Kitasato Uni., Meiji Uni., Shizuoka Uni., Nagoya Uni., Kyoto Uni., Kochi Uni.
2025-B-03 Comprehensive understanding of spatiotemporal mass variations in active volcanoes based on multiscale gravity observations	○Takahito Kazama (Kyoto University) ・Yuichi Imanishi	Our goal is to understand mass variations in active volcanoes on spatiotemporally broadband scales by performing multiple gravity observations at the volcanoes simultaneously. First, participants of this study bring several types of gravimeters (such as absolute, superconducting, and spring-type relative gravimeters) and conduct simultaneous gravity observations at active volcanoes. We then obtain spatiotemporally multiscale gravity variations around the volcanoes, by combining absolute, continuous, and wide-area campaign gravity observations. We also estimate spatiotemporal mass variations in the volcanoes, by applying hydrological disturbance corrections and inverse analyses to the observed gravity data. We finally provide a comprehensive assessment of volcanic activities for the target volcanoes in terms of mass variations, by comparing the estimated mass variations with other geoscience observation data such as GNSS and InSAR data. The target volcanoes for the gravity observations will be determined through discussion among the participants in this research project. The volcanoes to be observed include Aso, Kirishima, Sakurajima, and Ontake volcanoes, where active volcanic activities have been confirmed in recent years, as well as Fuji, Asama, Kusatsu-shirane, and Hakone volcanoes, where gravity observations have been conducted in the past. This research project invites researchers and graduate students specializing in gravimetry and volcanology. Those involved in geodesy and solid earth physics are also welcome to participate. In particular, this study has been conducting simultaneous observations with the GNSS research project of ERI-JURP in FY2026 and beyond, so participants of the GNSS research project are encouraged to join this gravimetry project as well. Note that participants in this project do not necessarily need to own gravimeters, because gravimeters can be rent in the framework of ERI-JURP.

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
		List of affiliations for projected participants: Hokkaido Univ.; Hirosaki Univ.; Iwate Univ.; Tohoku Univ.; Tsukuba Univ.; The Univ. of Tokyo; Waseda Univ.; Nihon Univ.; Toyama Univ.; Kanazawa Univ.; Shizuoka Univ.; Nagoya Univ.; Kyoto Univ.; Kobe Univ.; Kochi Univ.; Kyushu Univ.; Kumamoto Univ.; Kagoshima Univ.; National Astronomical Observatory of Japan; National Institute of Polar Research; Geospatial Information Authority of Japan; Meteorological Research Institute; National Research Institute for Earth Science and Disaster Resilience; National Institute of Advanced Industrial Science and Technology; National Institute of Information and Communications Technology; Institute of Physical and Chemical Research; Japan Agency for Marine-Earth Science and Technology; Hokkaido Research Organization; Hot Springs Research Institute of Kanagawa Prefecture; Mount Fuji Research Institute, Yamanashi Prefectural Government
2026-B-01 Earth's Structures and Physical Properties: Fast-to-Slow Modeling of the Earth	○Nozomu Takeuchi (Earthquake Research Institute) ・Nozomu Takeuchi	Earth shows different (elastic and viscous) features according to the time scales. We so far observed and discussed each feature separately. However, with the progress of the understandings of the viscoelastic properties, unconventional discussions are becoming feasible such as inferring viscosity structures from observed seismic waveforms. In this project, we explore possibilities of new earth sciences through the efforts to interpret various observations and experimental results as an output of a unified viscoelastic model. We expect participations of researchers with various backgrounds including seismology, geodesy, material sciences, geodynamics, and geoelectromagnetics. In this year, we review the current status of each research field and aim to identify the topics which we should address in the near future. **List of affiliations for projected participants:** JAMSTEC, University of Tokyo, Hokkaido University, Tohoku University etc.
2026-B-03 Inter-segment tectonics of the Ryukyu Trench subduction zone	○Kimihiro Mochizuki (Earthquake Research Institute) ・Kimihiro Mochizuki	In the 2011 Tohoku-Oki earthquake, multiple fault segments along the Japan Trench ruptured, resulting in a massive Mw 9.0 earthquake. Similar cases of multiple segments rupturing together to generate large earthquakes have been observed in many other subduction zones. When we take a broad view across both offshore and onshore regions, comparing the distribution of seismic fault segments with volcanic chains and topographic features, striking correlations emerge among these elements. This suggests that the response to subduction processes spanning multiple orders of magnitude in time, from earthquake cycles to landscape formation, may be understood as part of a unified subduction system. To elucidate how such correlated segments of seismicity, volcanism, and topography are formed and interact with each other, an interdisciplinary perspective that spans across these fields is essential. Based on this perspective, we propose a new conceptual framework called "inter-segment tectonics." This project will promote international collaborative research focusing on the prominent segments (segmentation) observed along the Ryukyu Trench. This study welcomes participation from a wide range of research fields related to the Ryukyu subduction zone. **List of affiliations for projected participants:** Earthquake Research Institute, University of Tokyo; Department of Earth and Planetary Science, University of Tokyo; University of the Ryukyus; Shizuoka University, Tohoku University; Academia Sinica (Taiwan); National Central University (Taiwan); National Taiwan University (Taiwan)

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2026-B-04 Establishment of a Remote Disaster Detection Platform and Measurement Standards Using Broadband Infrasound	★Yasuhiro Nishikawa (Osaka Kyoiku University) ・Shingo Watada	This project aims to develop and operate a fundamental technology platform for acquiring source information and estimating disaster scales via remote sensing in response to large-scale natural disasters such as tsunamis, volcanic eruptions, landslides, avalanches, and meteorite impacts. Through the framework of this joint research initiative, infrasound researchers across Japan have collaborated to establish an observational network and strengthen the research infrastructure. As one of the achievements, this effort has evolved into the formation of the *National Infrasound Observation Consortium of Japan* . In recent years, joint efforts among universities, research institutions, and private companies have advanced initiatives including the cost reduction of compact sensors using MEMS-type pressure sensors and microphones, the development of reliable and robust observation systems, and the real-time visualization and partial public release of observational data. The scope of activity has also expanded to glacier observations in Antarctica, sensor deployments in the Australian desert for meteoroid detection, and proposals for payload instrumentation on planetary exploration missions such as those to Mars. This project builds upon such knowledge and technological foundations and utilizes standard datasets derived from existing seismic observation networks to pursue remote detection and assessment of energy released during disaster events. Quantification of disaster scale requires precise measurement of acoustic pressure in the infrasound frequency band. However, this band lies at the boundary between acoustics and barometry, and the lack of established measurement standards poses a significant challenge. The establishment of measurement standards in this domain is recognized internationally as a critical issue, and while discussions are ongoing in several countries, it remains an open area of research and development. Based on the above, this joint research project will leverage the domestic network of infrasound researchers to promote efforts toward the future establishment of national measurement standards, with the aim of improving observational accuracy and ensuring data reliability in Japan. During the current fiscal year, online meetings were held to discuss methods for comparing and calibrating different types of infrasound sensors used in Japan, the frequency ranges to be investigated, and practical issues related to the experiments. As a result of these discussions, the participants agreed on a basic strategy in which background noise and long-period signals below 0.1 Hz will be evaluated through outdoor comparative observations, while sensor responses and instrumental variations above 0.1 Hz will be examined using calibration facilities. Preliminary experiments and a research meeting involving available researchers and institutions are also planned at the AIST Tsukuba Center during the current fiscal year. Several practical constraints have been identified, including the limited number of sensors that can be accommodated simultaneously in the calibration facilities, as well as power supply and installation requirements for operating multiple sensors outdoors. It is therefore difficult to complete the comparison of all sensors and frequency ranges within a single fiscal year, and continued investigation through phased experiments is required. In the next fiscal year, comparative experiments and research meetings will continue primarily at the AIST Tsukuba Center to refine the measurement conditions, data acquisition procedures,

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
		and analysis methods, leading to full-scale comparative calibration and the standardization of measurement procedures. **List of affiliations for projected participants:** National Institute of Advanced Industrial Science and Technology (AIST), Chitose Institute of Science and Technology, Hokkaido Information University, National Institute of Information and Communications Technology (NICT), Earthquake Research Institute, The University of Tokyo, Japan Weather Association, Kanazawa University, Nagoya University, Kyoto Sangyo University, Kyoto University, Kochi University of Technology, Kyushu University, Institute of Space and Astronautical Science (ISAS), National Institute of Polar Research (NIPR)
2026-B-06 Advancing campaign dense seismic observation with seismic nodes	○Ryota Takagi （Tohoku University） ・Akiko Takeo	Aim of the study: Seismic nodes are compact seismic observation systems that integrate a seismic sensor, data logger, GPS, and internal power supply. Their high mobility, combined with technological advancements in broader bandwidth and lower noise levels, has made it easy to conduct effective dense seismic observations. Permanent seismic networks have limitations in unraveling the mechanisms of inland swarm and large earthquakes, and magma plumbing systems in active volcanoes because of their sparsity of the seismic network. This study utilizes nodal seismic observations to achieve high-resolution subsurface structural imaging and precise hypocenter and source process analysis in earthquake and volcanically active regions in the Japanese archipelago. These advancements will contribute significantly to understanding the physical mechanisms driving inland earthquakes and volcanic activity. The target area will be made based on discussions among participants. This project is in its second year as a continuing project. We aim to share the observational data acquired in the previous fiscal year and to date, as well as to promote the effective utilization of high-density seismic observation data. Furthermore, we will promote inter-institutional collaboration by encouraging participation from other organizations in new observations led by participating institutions. Conditions of participation: None **List of affiliations for projected participants:** Hokkaido University, Hirosaki University, Tohoku University, Yamagata University, The University of Tokyo, Nagoya University, Kyoto University, Kyushu University, Kagoshima University, National Research Institute for Earth Science and Disaster Resilience, National Institute of Advanced Industrial Science and Technology
2026-B-08 Synthesis and distribution of standard polycrystalline minerals for room experiments	○Takehiko Hiraga (Earthquake Research Institute) ・Takehiko Hiraga	We will distribute synthetic highly-dense fine grained mineral aggregates that are suitable for room experiments. Any research groups that focus on measuring mineral/rock physical properties are welcome to join this project. **List of affiliations for projected participants:** Uni. Tohoku, Univ. Tokyo, NIMS, Shizuoka Univ., Okayama Univ, Ehime Univ., Kyushu. Univ., Hiroshima Univ., Univ. Bayreuth, Univ. Minnesota, Univ. Montpelier, MIT, Imperial College London, Univ. Princeton, Université d'Orléans, École normale supérieure Paris

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2026-B-09 New Frontiers in Local-Scale Geophysical Research via Ultra-Dense, Multi-Parameter Observations	○Takeo Ito (Nagoya University) ・Yosuke Aoki	This project aims to investigate crustal deformation related to seismic and volcanic activity through integrated geophysical observations. We combine GNSS with absolute and relative gravity, leveling, and magnetotelluric (MT) surveys to better understand mass transport, fluid movement, and subsurface structure. Initial observations will focus on Mt. Ontake, where multi-parameter campaigns will be conducted. By integrating data from different physical quantities, we seek to clarify complex deformation processes that cannot be fully resolved by GNSS alone. Field campaigns also serve as training opportunities for students and early-career researchers. Participants will gain hands-on experience with various instruments and analytical approaches, fostering the development of geophysicists with broad, integrative skills. This joint observation project represents the second year of a 3-years collaborative research program. Requirement: Nothing **List of affiliations for projected participants** Hokkaido University, Tohoku University, University of Tokyo, Nihon University, Toyama University, Kanazawa University, Nagoya University, Kyoto University, Kochi University, Kyushu University, Kagoshima 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, Meteorological Research Institute, National Institute of Information and Communications Technology, RIKEN, Japan Agency for Marine-Earth Science and Technology, Mount Fuji Research Institute
2026-B-10 Developments of Earthquake Location Methods toward the Evaluation of Historical Seismicity	○Motoko Ishise (Yamagata University) ・Shigeki Nakagawa	Research Overview: It is generally understood that earthquakes tend to recur in similar locations with similar mechanisms. Therefore, predicting the sources and ground motions of potential future earthquakes, and estimating the associated damage based on these predictions, is extremely useful for disaster preparedness. However, for earthquakes that occurred before the mid-20th century, both the quantity and quality of seismic observation data are insufficient, making it difficult to determine the hypocenters in qualitatively. Furthermore, no objective method has yet been established for determining earthquake sources based on intensity data, resulting in many damaging earthquakes with poorly defined hypocenters. To address these issues, this research project aims to: 1. Compile and organize historical records of past damaging earthquakes through literature review. 2. Establish an objective method for estimating earthquake hypocenters based on seismic intensity data. By implementing these approaches, we aim to comprehensively reassess the hypocenters of historical earthquakes that have occurred throughout recorded history, thereby clarifying the overall pattern of seismic activity in Japan. This will contribute significantly to improving damage estimation based on scientific evidence, particularly for future scenarios such as a potential Tokyo metropolitan earthquake. This project will be carried out through interdisciplinary collaboration among researchers in history, seismology, and statistical science, and will also contribute to the development of an integrated, cross-disciplinary research framework. Participation conditions: None

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
		List of affiliations for projected participants: Yamagata University, The University of Tokyo, Keio University, Akita University, University of Hyogo, Japan Meteorological Agency, National Institute of Advanced Industrial Science and Technology, National Research Institute for Earth Science and Disaster Resilience
2026-B-11 Relationship between short and long term deformation in major active structures based on geodetic, geomorphologic and geologic observations	○Masayuki Murase （Nihon University） ・Tatsuya Ishiyama	In major active structures, there is often discrepancy between long and short term deformation. Relationship between short and long term deformation are important because the relationship is related to generation mechanisms of the major active structures In this project, we carry out interdisciplinary research based on geodetic, geomorphologic and geologic observations for the Itoigawa-Sizuoka tectonic line and the Longitudinal Valley Fault in Eastern Taiwan to examine the relation between these two timescales of deformations. **List of affiliations for projected participants**: Okayama University, Nagoya University, The university of Tokyo, Shinshu University, Hosei University, Nihon University, National Taiwan University, Institute of Earth Sciences, Academia Sinica, National Dong Hwa University, Japan Fisheries Research and Education Agency, Remote Sensing Technology Center of Japan
2026-B-12 Unified Source Modeling for Ground Motion and Tsunami Prediction	○Hiroe Miyake (Interfaculty Initiative in Information Studies, The University of Tokyo) ・Takashi Furumura	This study aims to integrate source models for ground motion and tsunami prediction. Ground motion and tsunami damage often occur in combination. There is an urgent need to develop a unified source model that can be used for hazard estimates and countermeasures. Source models that explain ground motion and tsunamis are constructed independently, and predictions are also carried out separately. This study cross-validates the tsunami prediction performance of seismic source models and the ground motion prediction performance of tsunami source models to explore for integrating source models. **List of affiliations for projected participants:** e.g., Hokkaido University, The University of Tokyo, Kyoto University, Meteorological Research Institute

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2026-B-13 Study on the spatiotemporal variations of fluids around plate boundaries and their influence on fault slip phenomena through seafloor electromagnetic observations	○Kiyoshi BABA (Earthquake Research Institute) ・Kiyoshi BABA	The behavior of various fault slip phenomena along plate boundaries in subduction zones—including regular earthquakes, slow slip events (SSEs), and tectonic tremors—is known to be strongly influenced by fluid distribution and pore fluid pressure. However, the migration pathways of fluids and the spatiotemporal variations in pore pressure remain poorly constrained. This study aims to clarify the influence of fluids on fault slip behavior by conducting seafloor electromagnetic observations and detecting signals related to changes in electrical resistivity structure over time and space. Off the east coast of New Zealand's North Island, the Hikurangi subduction zone is characterized by the subduction of the Pacific Plate, where a variety of fault slip phenomena occur frequently along the shallow plate interface at depths of around 10 km. This makes it possible to capture spatiotemporal variations in structure at high resolution. As a result, the region is recognized as a globally significant target for scientific investigation. Based on these factors, this study will focus on the Hikurangi subduction zone as a primary research area. This project will be conducted as part of an international collaborative research effort involving researchers from NZ, China, and other countries. **List of affiliations for projected participants:** Earthquake Research Institute, The University of Tokyo・Earth Sciences New Zealand (NZ)・Victoria University of Wellington (NZ) ・ Southern University of Science and Technology (China)

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2027-B-01 Advancing Studies on Land Surface Changes Using Next-Generation SAR Satellite Data	○Ryosuke Doke (Hirosaki University) ・Yosuke Aoki	Abundant data from the ALOS series of domestic SAR satellites are being used not only in Earth sciences but also across a wide range of other research fields. The PIXEL Group, established under joint usage of ERI at the University of Tokyo, receives ALOS series SAR data from the Japan Aerospace Exploration Agency (JAXA). It has established a system for sharing this data exclusively with participants in this project, formed a community of SAR researchers in Japan, and played a fundamental role in promoting the spread of analysis techniques and the development of new technologies. Based on the activities of PIXEL, this research project has two main objectives: (1) to advance and promote research on ground surface changes across a wide range of fields—including earthquakes, volcanology, glaciology, landslides, and land subsidence—using increasingly diverse SAR data; and (2) to further promote and expand the SAR community through information sharing and educational activities. The situation surrounding present-day SAR satellites is changing significantly. ALOS-4, launched in July 2024, enables high-frequency observations while maintaining the high spatial resolution of previous satellites; in addition to advancing existing observation targets, it is expected to expand applications to new areas. Furthermore, the launch and operation of next-generation SAR satellites from other countries, such as Sentinel-1C and D and NISAR, are also progressing. In addition to high-frequency observations, ALOS-4 and the Sentinel-1 series enable long-term InSAR time-series analysis through continuous observations from the same orbit as their predecessor satellites. Private-sector small SAR satellite constellations are also under development; high-resolution SAR data now make it possible to detect localized changes in the ground surface that were difficult to identify with conventional observations. With the appearance of such diverse and abundant SAR data, advancing analysis techniques and establishing and sharing optimal analysis methods for each dataset have become urgent tasks. To address these tasks, this research project will conduct training sessions on analysis software—such as “RINC,” which is available within PIXEL—to expand the community and promote the adoption of analysis technologies. Furthermore, to provide a framework for information sharing, we will hold research meetings to share cutting-edge research findings and updates on technological development. Through this series of activities, we seek to further expand the PIXEL community and ultimately foster the launch of large-scale research projects. **List of affiliations for projected participants:** The University of Tokyo, Hokkaido University, Tohoku University, Hirosaki University, University of Tsukuba, Tokyo Denki University, Tokyo Metropolitan University, Institute of Science Tokyo, Tokyo City University, University of Aizu, Nihon University, Toyama University, Nagaoka University of Technology, Nagoya University, Kyoto University, Kyushu University, Kagoshima University, Kagawa University, National Research Institute for Earth Science and Disaster Resilience, Japan Meteorological Agency, Meteorological Research Institute, Meteorological College, Hokkaido Research Organization, Japan Aerospace Exploration Agency, Public Works Research Institute, Mount Fuji search Institute, Hot Springs Research Institute of Kanagawa Prefecture, National Institute of Advanced Industrial Science and Technology

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2027-B-02 Differentiable Solid Earth Science: Integration of Observations, Numerical Simulations, and Deep Learning	★Ryoichiro Agata (JAMSTEC) ・Shin-ichi Ito	Differentiable programming enables efficient computation of gradients of outputs or objective functions with respect to inputs and model parameters by making entire computational workflows, including numerical simulations and machine-learning models, automatically differentiable. Such gradients are central to inverse problems in solid Earth science, including the estimation of subsurface structures, physical properties, hypocentral parameters, and fault-slip distributions. Conventional approaches, however, often require problem-specific adjoint codes, linearization, or other technically demanding implementations. Recent advances in deep learning (DL) and AI have greatly improved fast and flexible automatic differentiation frameworks. Their integration with numerical simulation, data assimilation, Scientific Machine Learning (SciML), inverse analysis, and uncertainty quantification may enable closer coupling of observational data and physical models. Nevertheless, practical knowledge concerning differentiable implementations of existing simulation codes, gradient verification, computational cost, memory requirements, and limitations remains insufficiently shared across solid Earth science. This project aims to establish “differentiable solid Earth science” by connecting observations, numerical simulations, and DL/SciML within a common differentiable programming framework. We will share relevant domestic and international studies and practical experience, and explore the differentiable implementation, migration, and verification of existing simulation codes with support from AI agents. We will compare computed gradients with those obtained using numerical methods such as finite differences and conventional adjoint methods, and evaluate numerical accuracy, computational cost, and memory efficiency. We will also apply these approaches to real-data inverse problems, including subsurface structure, hypocenter and fault-slip estimation, and data assimilation, while developing reusable knowledge, codes, and documentation. To support these activities, we plan to organize study meetings, workshops, tutorials, and hackathons. We welcome researchers and students in seismology, geodesy, volcanology, geomagnetism and electromagnetism, rock mechanics, geodynamics, automatic differentiation, numerical analysis, data assimilation, deep learning, SciML, inverse problems, uncertainty quantification, and scientific computing with AI agents. No prior experience in differentiable programming is required. We broadly invite those who wish to make existing simulation codes or inverse-problem workflows differentiable, those who can share relevant methods, implementations, or datasets, and those interested in jointly developing example problems and benchmark cases. **List of affiliations for projected participants:** Earthquake Research Institute, Graduate School of Information Science and Technology, The University of Tokyo, The Institute of Statistical Mathematics, Kyoto University, Osaka University, Prefectural University of Hiroshima, Japan Agency for Marine-Earth Science and Technology, RIKEN, Chuo University, University of Tsukuba University

Project Code Project Title	○ Principal Investigator/ ★ Early-Career Scientist ・ Contact Person at ERI	Details of the Project and Condition to Participate in the Project
2027-B-03 Field Observations of Magma Transport Processes at Mid-Ocean Ridges in Response to Surface Load Variations	★Masakazu Fujii (National Institute of Polar Research) ・Takehi Isse	This project investigates how surface loading associated with glacial and sea-level fluctuations influences magma generation, transport, and eruption processes at mid-ocean ridges. The study focuses on the Pacific–Antarctic Ridge and combines multibeam bathymetric mapping, multichannel seismic reflection surveys, deep-towed magnetic observations, rock dredging, and sediment coring including tephra layers. By integrating geophysical observations with geological and geochemical analyses, we aim to link subsurface structure, magnetization, chronology, and petrological characteristics, providing new insights into submarine volcanism and oceanic crustal formation. We welcome researchers with expertise in ocean floor geoscience, marine geophysics, multichannel seismic exploration, geomagnetism, marine seismology, petrology, volcanology, geochemistry, geochronology, paleomagnetism, sedimentology, micropaleontology, glacial isostatic adjustment (GIA), and numerical modeling. Participants are encouraged to contribute through shipboard observations, sample analyses, data interpretation, or numerical simulations according to their expertise. **List of affiliations for projected participants:** ・National Institute of Polar Research (NIPR) ・National Institute of Advanced Industrial Science and Technology (AIST) ・Akita University ・Chiba Institute of Technology ・Tokyo University of Marine Science and Technology (TUMSAT) ・Kyushu University ・Hiroshima University ・Nagoya University ・Tokai University ・Japan Agency for Marine-Earth Science and Technology (JAMSTEC) ・Atmosphere and Ocean Research Institute, The University of Tokyo (AORI) ・Earthquake Research Institute, The University of Tokyo (ERI)
2027-B-04 International use of geophysical observation instruments and records	○Makoto OKUBO (Kochi University) ・Akito Araya	The crustal activities observation networks and their associated technologies for the continuous monitoring on the surface are advancing rapidly, both in Japan and abroad. This project focuses on researching of new analysis techniques and interpreting for crustal deformation data, disseminating, and ensuring the succession of these findings through collaboration with researchers across diverse fields and international borders. In this project, the following three points are treated as important tasks to be resolved or addressed: Task①: Currently, there is a critical shortage of early-career researchers specializing in crustal activities yet training them requires a significant amount of time. To address this shortage, we are recruiting talent widely, looking beyond domestic boundaries. We will promote the continuous observation and analysis of crustal activities, centering on requests for joint research from oversea countries and disseminate of findings and technologies. Task②: Crustal activities observations allow for the simultaneous assessment of inter-seismic (quiescent period) changes and variations associated with earthquakes. Standardizing usage procedures and packaging analysis tools are essential to ensure these observational records are reliably passed on to future generations. Such initiatives not only clarify the necessary analysis methods but also accelerate the development of new techniques. Furthermore, clearly defining which tools should be used for specific purposes significantly lowers the barriers to entry for new researchers, thereby contributing to the resolution of ①. Task ③: In regions with active crustal deformation like Japan, observational Instruments require high precision and long-term stability to detect not only seismic events but also changes occurring during the inter-seismic period; however, such high performance may be

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		excessive for other limited research applications. For example, modularizing extensometers by separating essential components from optional extended functions enhances adaptability to diverse observation targets and improves maintainability. This procedure lowers the barriers to establishing new observation sites and facilitates the transfer and deployment of strain observation technology to overseas and the next generation, thereby contributing to the resolution of ①. This project actively invites applications from individuals who possess (1) crustal activities observation, analysis methods, and (2) technology and know-how for developing equipment, or (3) new technologies and methods should be introduced. As well as from those considering new research topics or observation areas that utilize observational technology. **List of affiliations for projected participants:** Hokkaido Univ., Univ. of Tokyo, Tokyo City Univ., Tsukuba Univ., Nagoya Univ., Kyoto Univ., Kyushu Univ., Kochi Univ., Kagoshima Univ., Meteorological Research Institute, National Institute of Advanced Industrial Science and Technology, Hot Spring Research Institute, Vietnam Academy Science and Technology and Academy of Sciences of the Republic of Uzbekistan
2027-B-05 Long-term Preservation Processes of the 2024 Noto Peninsula Tsunami Deposits and Improved Identification of Paleotsunami Deposits	★Masaki Yamada (Shinshu University) ・Osamu Sandanbata	Tsunami deposits provide crucial geological records for reconstructing the history of past earthquakes and tsunamis beyond the historical record. However, the long-term evolution of geochemical signatures derived from seawater within tsunami deposits remains poorly understood, posing a major challenge for the identification and interpretation of paleotsunami deposits. This project aims to clarify the long-term preservation processes of tsunami deposits formed by the 2024 Noto Peninsula tsunami through continuous post-event monitoring. The principal investigator has secured an agricultural field where the tsunami deposits have been preserved, enabling repeated investigations at the same site and the acquisition of a unique long-term dataset covering at least six years after the tsunami. Integrated analyses, including grain-size measurements, X-ray CT imaging, ITRAX XRF core scanning, ICP-MS, isotope geochemistry, and hydrological monitoring of groundwater and precipitation, will be conducted to evaluate the preservation of marine geochemical signatures and the factors controlling their temporal changes. The results will provide robust geochemical criteria for improving the identification of paleotsunami deposits. Furthermore, preliminary coring within the tsunami inundation area has identified multiple event sand layers beneath the 2024 tsunami deposit. This collaborative project will conduct additional coring campaigns across the Noto Peninsula and integrate regional correlation, chronological dating, sedimentological analyses, and geochemical investigations to reconstruct the earthquake and tsunami history over the past several thousand years. By integrating studies of the preservation processes of modern tsunami deposits with investigations of paleotsunami deposits within the same region, this project aims to advance methods for identifying paleotsunami deposits and to establish a scientific foundation for future tsunami hazard assessment. We welcome researchers and students interested in field investigations of tsunami deposits, sediment coring, sedimentological and geochemical analyses, chronological dating, micropaleontological analyses, and hydrological observations. **List of affiliations for projected participants:** The University of Tokyo, Shinshu University, Kyoto University, Tohoku University, University of Tsukuba, Kanazawa University, Tokushima University, Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST), Agency for Marine-Earth Science and Technology (JAMSTEC)

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2027-B-06 Pioneering and demonstrating small-body seismology.	★Naoya Sakatani (Japan Aerospace Exploration Agency (JAXA)) ・Akito Araya	Seismological investigations have established a solid foundation as a powerful method for probing the internal structure of planetary bodies in geophysics. This research project aims to develop a seismic observation package for exploring the internal structure of small bodies, such as asteroids and comets within the Solar System. Because small bodies exist under extreme environmental conditions that differ significantly from those on Earth—including vacuum, low and high temperatures, microgravity, and highly porous, strongly scattering regolith layers—it is difficult to directly apply conventional terrestrial seismic exploration methods using seismometers. Therefore, through the development of a seismic observation package specifically designed to operate under these environmental conditions, we aim to establish a new methodology for investigating the internal structure of small bodies. The major research objectives are as follows: (1)Demonstration of Active Seismic Exploration Techniques For seismic investigations of small bodies, we will evaluate both passive and active exploration approaches. Passive exploration utilizes naturally occurring seismic sources such as meteorite impacts and cometary activity. Active exploration employs artificial seismic sources, for example by applying pulse inputs to a geophone integrated within the observation package. Through this project, we will conduct proof-of-concept demonstrations and technological validation of both approaches. (2)Development of an Autonomous Seismic Observation System To realize extraterrestrial seismic exploration, we will develop a compact and lightweight system capable of autonomous operation, including data acquisition, recording, communication, and long-term survivability. The autonomous observation technologies developed for this seismic package are expected to have applications beyond small-body exploration. Potential terrestrial applications include subsurface investigations and monitoring in hazardous or inaccessible environments such as volcanic regions and disaster sites, where direct human access is difficult. (3)Simulation and Analysis of Seismic Wave Propagation on Small Bodies We will develop analytical methods for constraining the internal structure of small bodies using seismic data acquired on their surfaces. In particular, we aim to estimate internal heterogeneity, material composition, and pore-size distributions through the analysis of seismic-wave scattering characteristics. To achieve this objective, we will develop numerical simulation tools and corresponding data-analysis methodologies. As plans for seismic exploration of small bodies are becoming increasingly concrete in Japan and internationally, this research will play a key role in establishing the technological foundations required to transform these concepts into future space missions. Through this development effort, we aim to pioneer the emerging field of small-body seismology while also contributing to advances in terrestrial seismology and disaster-mitigation technologies through the transfer of knowledge and techniques. We welcome ambitious researchers from diverse disciplines to participate in this challenging endeavor. **List of affiliations for projected participants:** Japan Aerospace Exploration Agency (JAXA), The University of Tokyo, Okayama University, Université Paris Cité, Osaka Kyoiku University, National Institute of Advanced, Industrial Science and Technology (AIST), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), National Institute of Polar Research (NIPR), Kochi University of Technology, The University of Aizu

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2027-B-07 Integration of Historical Tsunami Investigation and Probabilistic Tsunami Hazard Assessment in the Shirahama Area, Wakayama Prefecture	★Yuchen Wang (JAMSTEC) ・Shingo Watada	The Shirahama area of Wakayama Prefecture has repeatedly been affected by major earthquakes and tsunamis generated along the Nankai Trough, making it an important target area for assessing future tsunami hazards. However, substantial uncertainties remain regarding the local tsunami history, inundation extent, and recurrence intervals. A region-specific tsunami hazard assessment integrating historical records with numerical modeling is therefore needed. This collaborative research will conduct archival and field investigations of historical tsunamis in the coastal lowlands of the Shirahama area. Historical documents will be compiled and examined, and, where necessary, sediment coring and sampling, grain-size analysis, chronological dating, and related analyses will be performed to reconstruct the timing, spatial distribution, and inundation extent of past tsunami events. These results will be used to establish the tsunami history of the Shirahama area and provide site-specific constraints for numerical simulations. Furthermore, a probabilistic tsunami hazard assessment (PTHA) will be conducted by accounting for diverse earthquake scenarios along the Nankai Trough, their occurrence frequencies, and model uncertainties. Numerous tsunami propagation and inundation simulations will be performed, taking into account source models, offshore bathymetry and onshore topography, and tsunami amplification and attenuation processes in the coastal zone. Probability distributions of tsunami height, inundation depth, arrival time, and related parameters in the Shirahama area will be evaluated. Event histories and inundation extents obtained from historical tsunami investigations will be used for PTHA scenario selection and validation, thereby linking evidence over geological timescales with probabilistic analysis. A pressure gauge has been installed by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) along the coast of Kasabo Fishing Port in Shirahama Town. Long-term observations of sea-level variations, including tsunamis and storm surges, are planned to clarify coastal tsunami attenuation processes in combination with offshore DONET data. The Japan Meteorological Agency (JMA) also plans to install coastal CCTV cameras. These pressure and video observations will provide an important basis for directly capturing tsunami waveforms, water-level changes, and inundation conditions after tsunamis reach the coast. By integrating historical tsunami investigation, PTHA, and these new coastal observations, this project aims to evaluate the tsunami history, occurrence probability, coastal response, and actual disaster conditions in the Shirahama area more comprehensively, and to establish a research foundation that contributes to local tsunami disaster prevention and mitigation. **List of affiliations for projected participants:** The University of Tokyo, Shinshu University, Tokushima University, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and Japan Meteorological Agency (JMA).

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2027-B-08 Quantitative Understanding of Earth Dynamics: Statistical and Computational Data Science Using Large-Scale Geoscience Datasets	★Satoshi Matsuno (Atmosphere and Ocean Research Institute, The University of Tokyo) ・Hiromichi Nagao	The application of statistical and computational data science is advancing our understanding of Earth's dynamics. Geological events occur through physical and chemical processes associated with the transfer of energy and mass, resulting in geophysical and geochemical data that record the present state and history of Earth's interior. Recent progress in large-scale data accumulation enables integrated analyses using statistical and computational data science. These advances are opening opportunities for estimating and interpreting quantitative parameters that characterize physical and chemical processes within Earth. This research project aims to promote geological interpretation through the construction of large-scale geophysical and geochemical datasets by applying statistical and computational data science. Although statistical and computational data science has been applied to geoscience datasets in the past, this project will place additional emphasis on collaboration with the measurement and analytical fields. By integrating the entire research process—from data acquisition to analysis and interpretation—the project seeks to further accelerate interdisciplinary research. The objective of this project is to overcome long-standing challenges in data acquisition, accumulation, and analysis. Emphasis will be placed on developing high-throughput approaches for the acquisition of petrological and geochemical data. In addition, new analytical methods will be developed and existing ones improved. This project leverages expertise in statistical and computational data science to address challenges arising from the unique characteristics and increasing scale of geoscience data. Through these efforts, the project will deepen the quantitative understanding of Earth's dynamics, including processes such as mass transfer and chemical reactions. This collaborative research project will provide opportunities for researchers in geoscience, statistical and computational data science, analytical chemistry, and synchrotron radiation science to interact and pursue research that extends beyond the boundaries of their respective disciplines. We welcome the participation of researchers who are eager to develop new interdisciplinary collaborations. **List of affiliations for projected participants:** JAMSTEC, AIST, Hokkaido Univ., Tohoku Univ., Akita Univ., Univ. Tokyo, Kanazawa Univ., Kyoto Univ., Kagoshima Univ., Hiroshima Univ., Nagoya Univ., JASRI

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2027-B-09 New Frontiers in the Analysis of Volcanic Surface Phenomena Using Vision–Language Models	★Takafumi Maruishi (National Research Institute for Earth Science and Disaster Resilience (NIED)) ・Yujiro Suzuki	A wide variety of image data have been accumulated for phenomena occurring at or above volcanic surfaces, including satellite imagery, ground-based camera footage, photographs of collected eruptive products, and microscopic images. These images contain important information for understanding volcanic activity. However, because they differ greatly in data type and observational scale, they have traditionally been analyzed separately. Linguistic descriptions such as “a dark-colored plume is rapidly spreading eastward from the crater” or “the ejecta are angular in shape and contain abundant dark crystals” provide a common framework for linking features observed in different types of images and for communicating their volcanological significance among researchers. Recently developed vision–language models, including ChatGPT, can recognize colors, shapes, textures, and structures in images and describe these features in natural language. In this project, we will integrate observations of plume development, the macroscopic appearance of collected eruptive products, and microscopic textures through descriptions generated using vision–language models. This approach will enable us to relate remotely observed phenomena during eruptions to evidence of magma vesiculation, crystallization, and fragmentation preserved in post-eruption samples. Rather than merely classifying individual images, we aim to interpret these observations as interconnected records of a continuous eruptive process. We will further link image-derived linguistic descriptions with physical models of plume rise, volcanic ash transport, magma vesiculation, and fragmentation. By describing both observed images and model-predicted plume morphologies and pyroclast textures within a common linguistic framework, we will develop a new analytical approach that allows seamless comparison and iteration between observations and simulations. This framework will be used to constrain eruption conditions and magma properties. The project will bring together researchers working on language-model-based analysis, observations of volcanic surface phenomena, and physical modeling to develop an interdisciplinary research program aimed at advancing the analysis of volcanic processes. Participation requirements: Participants should have an interest in the research topics described above and expertise in at least one of the following areas: volcano monitoring and observation, analysis of volcanic products and rock textures, numerical modeling, image or video analysis, machine learning, or vision–language model analysis. **List of affiliations for projected participants:** National Research Institute for Earth Science and Disaster Resilience, Earthquake Research Institute of the University of Tokyo, Kyoto University, Institute of Statistical Mathematics, RIKEN, National Institute of Advanced Industrial Science and Technology, and other related institutions.

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2027-B-10 Probing Fault-Strengthening Mechanisms That May Account for the Fracture Energy of Large Earthquakes	○Osamu Kuwano (JAMSTEC) ・Masao Nakatani	Fracture energies inferred for large earthquakes and those obtained from conventional laboratory friction experiments differ by several orders of magnitude. The physical origin of this discrepancy remains unresolved, and the proposed mechanisms have yet to be adequately tested quantitatively. This project will combine fault friction experiments—including long-duration hold tests and experiments under hydrothermal conditions—with numerical experiments using the discrete element method to quantify the relationships among the magnitude of frictional healing, slip-weakening distance, and fracture energy. We will focus not only on contact-scale frictional healing but also on the formation and evolution of mesoscale structures within a granular layer and on their reorganization during slip. We will test whether these processes can quantitatively account for the fracture energies inferred for large earthquakes. **List of affiliations for projected participants:** Japan Agency for Marine-Earth Science and Technology, University of Tokyo, Shimane University, Ritsumeikan University, Osaka University
2027-B-11 Preservation and Utilization of Historical Observation Records	○Yasuyuki Kano (Earthquake Research Institute) ・Yasuyuki Kano	Regarding historical records (analog seismograph/tiltmeter/tide-gauge charts, etc.) of earthquakes, tsunamis, crustal deformation, and geodetic observations, which are dispersed and preserved across universities and research institutions in Japan and abroad, this project will first conduct a survey of their whereabouts, preservation condition, and risk of deterioration, in order to grasp the nationwide storage situation. Based on the survey results, digitization (scanning and photographing) will be carried out, prioritizing records that are at risk of deterioration or disposal. Including data already made publicly available through the databases of individual institutions, the records will be aggregated across institutions to develop a prototype database (digital archive) using a unified metadata format and image format. The resulting digital archive will be made publicly available in a searchable and downloadable form, and will also be used for analyses—such as waveform extraction and slow-earthquake detection—leveraging information technology (AI). In parallel, discussions, examinations, and information-sharing regarding the utilization and preservation of historical records will be carried out. This research aims to prevent the loss and deterioration of historical records while promoting their utilization, and to advance the understanding of long-term seismic and volcanic activity. There are no particular requirements for participation. **List of affiliations for projected participants:** The University of Tokyo, Hot Springs Research Institute of Kanagawa Prefecture, National Research Institute for Earth Science and Disaster Resilience (NIED), National Museum of Nature and Science, Association for the Development of Earthquake Prediction, Hokkaido University, Tohoku University, Nagoya University, Kyoto University, Kyushu University, Japan Meteorological Agency, Abuyama Earthquake and Disaster Prevention Science Museum

【Appendix C】 FY2027 Specific Research Project (C) Titles

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-	-	There are no projects in FY2027.