60th since 1963

NIED INTEGRATED REPORT 2022

SCIENCE FOR RESILIENCE

NIED 防災科研

National Research Institute for Earth Science and Disaster Resilience (NIED)

SCIENCE FOR RESILIENCE

Earthquake, tsunami, volcanoes, violent winds, heavy rains,
snowstorms, floods, and landslides are
natural threats that will always exist.
However, at NIED, we believe that disasters can be reduced.
Therefore, we are constantly developing technologies and strategies
to prepare for and respond to disasters.
With better prediction, smarter prevention, and faster restoration,
we aim to protect lives and livelihoods for a sustainable future.

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NIED's commitment toward our identity.

Disasters caused by natural threats are not only limited to the moment when the disaster occurs, but also have the long-term impacts. In order to sustain Japan into the future, it will be necessary to establish society with resilience for resiliently overcoming disasters. To this end, NIED promotes comprehensive research and development for every kind of natural hazard (all hazards) for each stage (all phases) of before and after occurrence of disaster and pledges to support the lives and livelihoods of all people with our branding identity: "Science for Resilience".

Meaning of the NIED logo

The two blocks in blue and red respectively represent the before and after phases of a disaster, which express NIED's commitment to conduct research and development for all phases of disaster. The blue color used for pre-disaster symbolizes the prediction and prevention of disaster through the accumulation of wisdom. The red color representing post-disaster symbolizes the response and recovery for tackling a disaster with passion. The grey color at bottom represents the research that forms the basis and foundation for creating trust. The white "resilience curve" that runs across from left to right indicates the capability to overcome disasters for a better future.

Co-creating Resilience

Since FY2019, National Research Institute for Earth Science and Disaster Resilience(NIED) has issued Integrated Report to comprehensively communicate research initiatives and results, foster public understanding, and set the co-creation stage.

NIED promotes various types of research to save the nation from the catastrophic national crises expected to strike in the first half of the 21st century and to achieve sustainable development. Since FY2016, NIED has promoted research and development (R&D) based on the 4th Mid-to-Long-Term Plan, which spans seven years and aims to create a "highly resilient society in which each person has a basic level of competence in disaster risk reduction (DRR)." In the first four years of this plan, NIED focused on research based on societal needs as a core institute for innovation. In the three years since FY2020, we have adopted "co-creation" as a keyword for promoting R&D in science and technology for DRR. In FY2021, we deepened and developed our past efforts by establishing "I-Resilience Co., Ltd." through the joint investment of private companies and started the "research into social wish discovery" through co-creation and collaboration between industry, academia, government, and private sectors. We positioned FY2022 as the final year of the 4th Mid-to-Long-Term Plan.

This report communicates research initiatives and results to provide the impetus for everyone to think and act toward realizing a "highly resilient society in which each person has a basic level of competence in DRR."

NIED Integrated Report 2022

[Fiscal Year] April 1, 2022 - March 31, 2023
(Activities include results from April 2023 onward.)

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For more information on NIED's operations, evaluation, and finances, please visit https://www.bosai.go.jp/introduction/open/.
We welcome your comments and feedback regarding this report.
Please contact us at nied-ir@bosai.go.jp.

NIED promotes the "co-creation" of DRR science and technology to create a resilient

At NIED, we aim to create innovations in DRR science and technology in collaboration with the private sector, universities, research institutes, local governments, government officials, and citizens. Through co-creation with industry, academia, the government, and private-sector stakeholders, NIED promotes research and development that will bring about social change and contribute to the realization of a resilient society.

Aiming for Innovation in DRR Science and Technology across Fields

DRR science and technology comprise many academic fields in which the social implementation of results is necessary. "Co-creation" is necessary for DRR science and technology to produce results, promote research that is genuinely needed by various societal stakeholders, and provide research results.

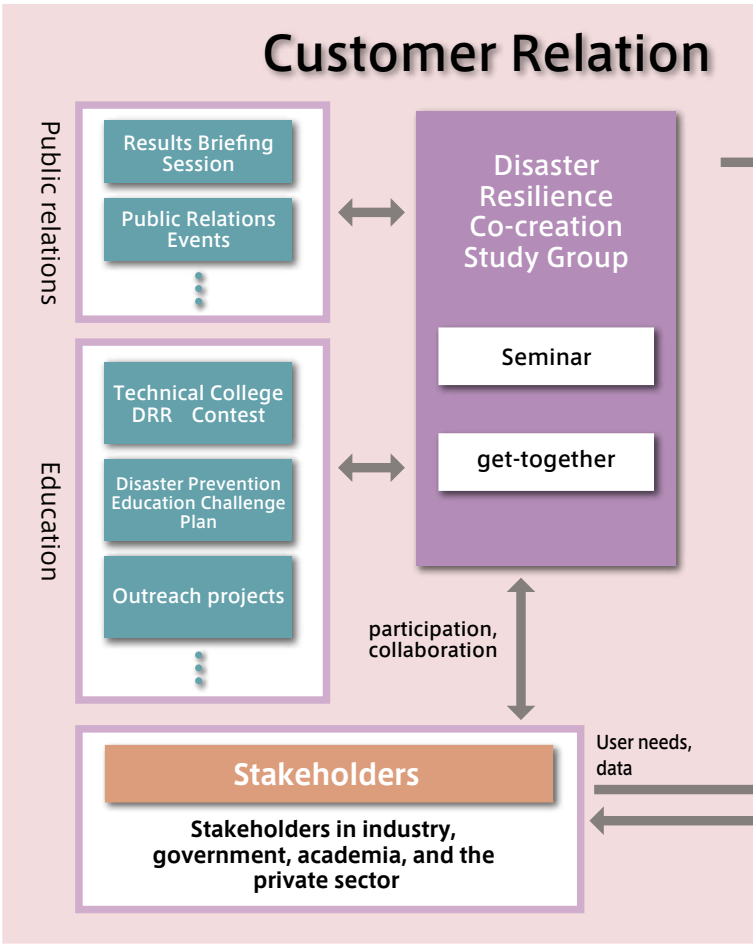
NIED is promoting co-creation as a key for innovation in DRR science and technology in Japan. The Headquarters of Innovation Co-Creation headed by the president plays a central role in this effort. We continuously promote innovation in DRR science and technology by strengthening and developing partnerships with industry, academia, the government, and private-sector stakeholders and sharing vast observational data, large-scale experimental facilities, and R&D results.

Co-creation Mechanisms

Through co-creation, NIED aims to create a system that produces research results through "research that meets social needs" and "effective research that changes society." We aim to provide society with "information products" that lead to individual action.

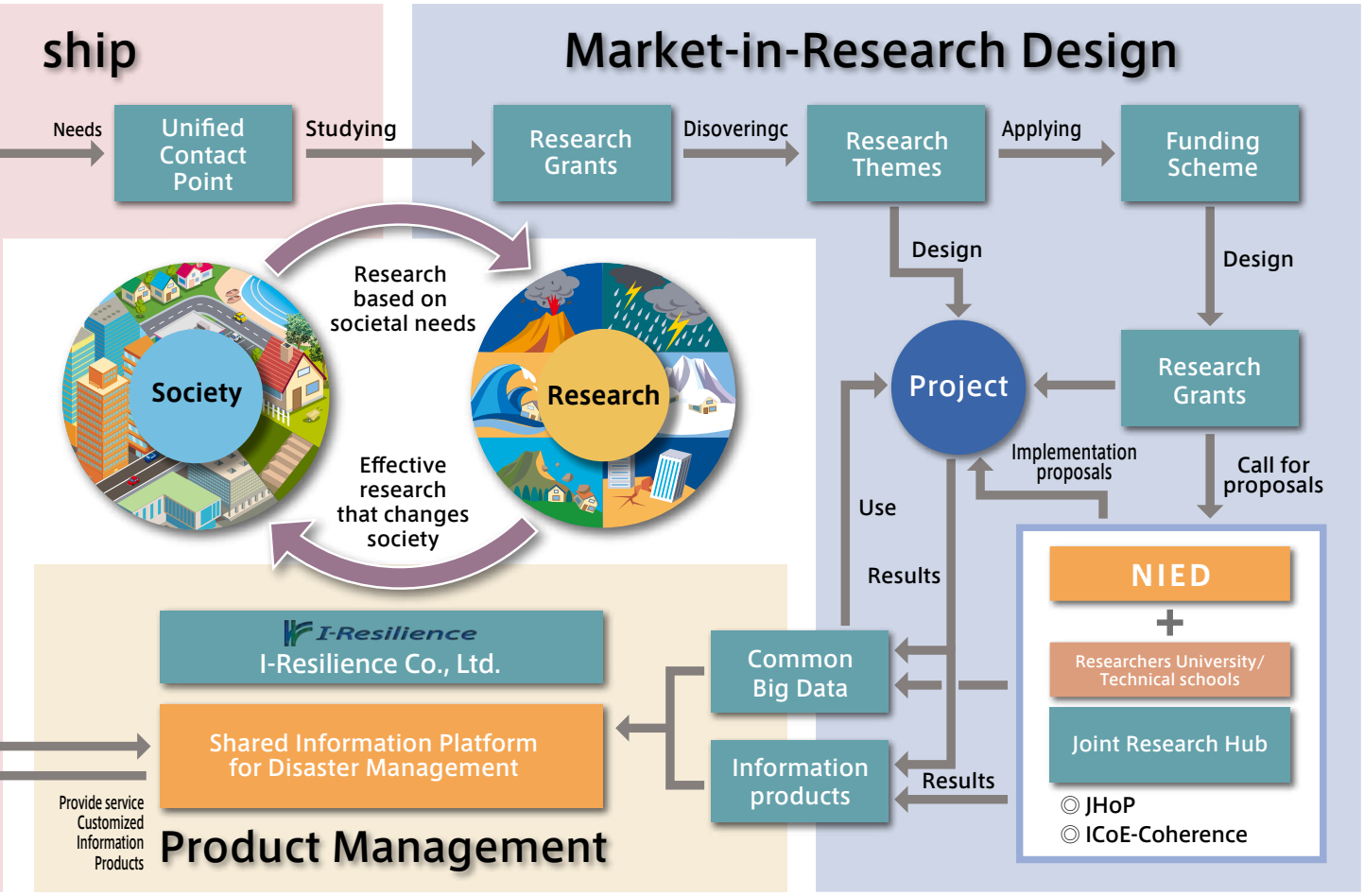
Specifically, we aim to (1) establish a mechanism for collaboration among stakeholders in industry, academia, government, and the private sector (Customer Relationship), (2) promote R&D that accurately identifies social needs and brings about social change (Market-in-Research Design), (3) promote the development of "information products" that are easy to use, such as observation data and research results, and customize "information products" based on the needs of users (product management).

In April 2022, we established the Disaster Resilience Co-Creation Seminar and Workshop as a new initiative to collaborate with stakeholders in the industry, academia, government, and private sector (see p.17-18). In addition, since FY2021, we conducted "research into social wish discovery to improve disaster resilience through public solicitation" as an open joint research project to discover the latent needs of society as a whole (i.e., social expectations) that lie behind the needs of individuals, companies, and organizations. In addition, the Japan Hub of Disaster Resilience Partners (JHoP), which consists of domestic universities, research centers, and practitioner organizations involved in disaster prevention and mitigation, made emergency proposals to understand the earthquake mechanism, identify the actual damage, clarify the expansion mechanism, and support restoration in affected areas in the wake of the February 2023 earthquake in southeastern Turkey.



society with you

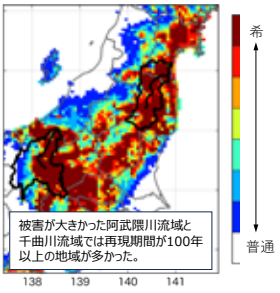
System for Co-Creation sought by NIED



I-Resilience Co., Ltd., a venture company launched by NIED, started full-scale activities

I-Resilience Co. Ltd., a joint venture established by NIED and private companies, began full-scale activities following the revision of the Act on Vitalizing the Creation of Science, Technology, and Innovation(June 2020). The core of the I-Resilience business is the I-Resilience Information Network (IRIN), a platform for the centralized collection and distribution of information related to disaster prevention using digital technology based on the results of the Shared Information Platform for Disaster Management (SPF) developed by NIED. In June 2022, as the first step in providing services through IRIN, I-Resilience began distributing a test on "information on the return period of heavy rain," resulting from research and development by NIED, paving the way for their commercialization in 2023.

I-Resilience Co., Ltd. aims to contribute to solving social issues by providing private companies and others with a wide range of services based on the R&D results of NIED and, at the same time, by collecting feedback and contributing to effective R&D by NIED, which will change society.



Information on return period of heavy rain

A Message from President

Overcoming disasters with minimal damage and recovering quickly. “Let's build a resilient society together”

Accelerate all-hazard, all-phase DRR through "co-creation"

In the 4th Mid-to-Long-Term Plan period, NIED has clarified its identity under the phrase "Science for Resilience" and promoted co-creation with various stakeholders, including the national and local governments, private companies, research institutes, universities, and area residents. As a research institute covering all hazards (various natural hazards) and all phases (prediction/prevention, emergency response, and recovery/reconstruction), we further accelerated co-creation in the 5th period of the Mid-to-Long-Term Plan starting in FY2023. We have summarized our policy on how to realize a safe and secure society through co-creation and how to utilize science and technology under the phrase, "Let's build a resilient society together.” "Us" refers to all members of NIED and stakeholders involved in creating a resilient society. This aligns with the government's policy of promoting cocreation to build a sustainable society in which people's lives and livelihoods are secured.

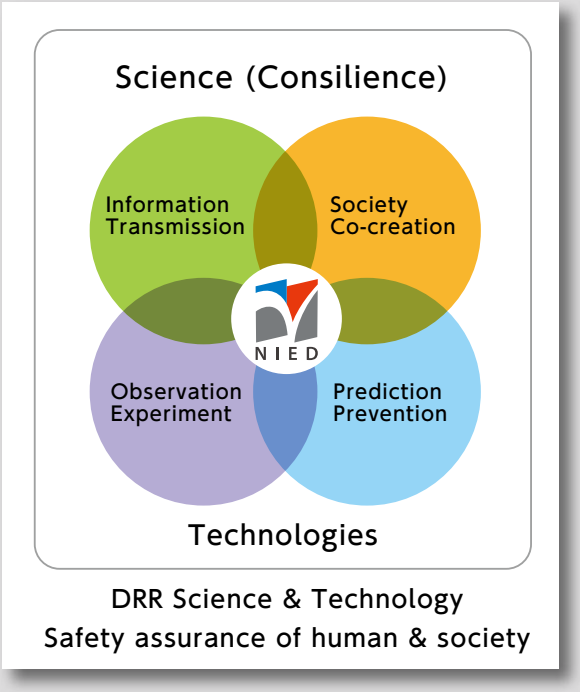
Recently, meteorological disasters have become increasingly frequent, severe, and widespread. In addition, there have been many earthquake disasters in various regions, including a catastrophic disaster caused by the Nankai Trough Earthquake, which will occur at a rate of 70-80% within the next 30 years, and an earthquake directly under the Tokyo metropolitan area, which is predicted to cause extensive damage. There is a need to minimize damage from such disasters through science and technology and to create a resilient society that can overcome disasters and recover quickly.

DRR science and technology contribute to the safety assurance of humans and society

In the fifth R&D period, we will emphasize "consilience" through a trans-disciplinary approach, with "basic R&D in each discipline" as the vertical axis and "comprehensive R&D utilizing digital technology" as the horizontal axis.

The foundation for this approach is the "NIED Digital Twin.” It promotes the integration of knowledge by not only classifying, organizing, and integrating observation data in physical space in cyberspace and visualizing the results of simulations of natural phenomena and disaster processes as information products but also by extracting new issues from them and providing feedback. In addition, we will further raise awareness and promote the use of information products such as BosaiXview (pronounced “bosai cross view”) and "YukioroSignal" (Snow Load Alert) provided by NIED.

We will contribute to the security of the people and society by advancing DRR science and technology through observational experiments, predictions and prevention, information dissemination, and social co-creation.



In addition to expanding DRR science and technology, new initiatives are also planned

Following the Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net) deployed east of Honshu as a submarine earthquake observation network after the Great East Japan Earthquake of 2011, we will complete the Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net) at the end of fiscal year 2024. This will expand the Monitoring of Waves on Land and Seafloor (MOWLAS), making earthquake early warnings even more advanced by detecting ocean-trench earthquakes in the Nankai Trough area approximately 20 seconds earlier and predicting tsunamis 20 minutes earlier.

We will also utilize advanced research facilities such as E-Defense (3D Full-Scale Earthquake Testing Facility), Large-scale Rainfall Simulator, and Cryospheric Environment Simulator. In addition to serving as sites for co-creation with various stakeholders, these facilities also serve as starting points for innovative world-leading research with an eye toward international expansion.

Considering our new approach to heatwave disasters and heat strokes, we signed a collaborative agreement with the National Institute for Environmental Studies (NIES) in July 2023. Heat stroke is not well recognized as a disaster in Japan, but the number of deaths from heat waves is on the rise owing to global warming, with more than 1,000 deaths annually. Regarding the "Science for Resilience," such disasters should also be the subject of research by the NIED, and we will work on this in cooperation with related organizations.

Practical research contributing to society, with an eye to Japan and the world

NIED is the secretariat of an international research framework called the Integrated Research on Disaster Risk (IRDR) in Japan. We will serve as the Center of Excellence (COE), consolidating resources and results in this context. Specifically, we will enhance our international presence by reflecting on the results of our research in the Sendai Framework for Disaster Risk Reduction (2015-2030) agreed upon at the World Conference on Disaster Risk Reduction in 2015 and beyond 2030 (post-Sendai Framework).

In Japan, we aim to contribute to DRR in DX, education, and life by providing information products through a new company named as I-Resilience, established in 2021 through a joint investment with private companies. In the future, we will work to network and activate approximately 260,000 certified disaster-prevention specialists nationwide.

In FY2023, NIED celebrated its 60th anniversary. I would also like to thank the wide range of stakeholders in Japan and abroad. We will continue to engage in cutting-edge research through co-creation with you based on the DRR science and technology we have cultivated over the years.

Thank you very much for your continued support and cooperation.

President

TAKARA KAORU

National Research Institute for Earth Science and Disaster Resilience

NIED provides society with “information products” leading to individuals’ actions

NIED observes and analyzes disasters scientifically and technologically and conducts research to provide society with information products that lead to individual actions. Our research objectives include all types of natural hazards in all phases of disaster prediction, prevention, response, and recovery/reconstruction.

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We use feedback to improve quality

This value-creation model is a system that takes feedback from behavior to experiments/observations, which clarifies the issues to be solved regarding social implementation and scientific and technological innovation. This two-way process enhanced the quality of the steps required to resolve these issues.

Definition of “Information Products”

Information products are observation and experimental data that are integrated and processed with geospatial information that meets user needs and is user-friendly.

The term "information products" refers to information that has been created by adding value to various research and development results, such as observation, experimental, and analysis data, which can be easily used to meet user needs, mainly geospatial information, as well as systems that provide such information, information sites, and information services.

NIED promotes the creation and utilization of information products based on the results of its R&D and publishes products that contribute to the creation of scientific and technological innovations and the solution of social issues on the Web. The "Information Products Policy" is set forth regarding providing information products and other related matters.

Examples of NIED’s information products

bosai Xview

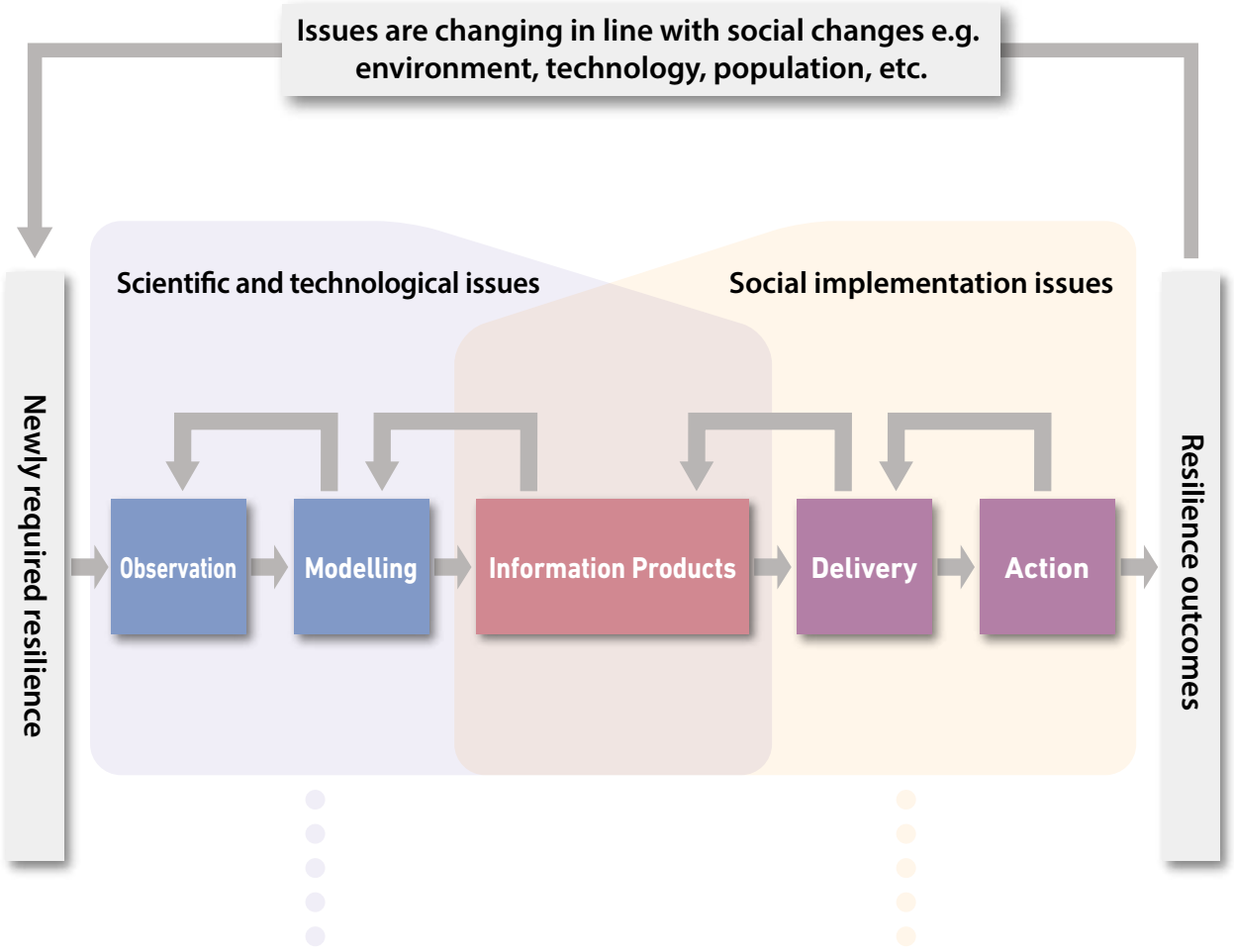
bosaiXview

"bosaiXview" (pronounced “bosai cross view”)is a system that looks beyond (view) a disaster by overlaying (cross) all disaster information, including occurrence, progress, recovery, past records, and future projections.
https://xview.bosai.go.jp/

雪おろシグナル Snow Load Alert

YukioroSignal (Snow Load Alert)

“YukioroSignal”(Snow Load Alert), which shows the distribution of snow weight on a map to help people make decisions about removing snow from roofs. It has been developed to help reduce accidents during roof snow removal, which causes casualties every year.
https://seppyo.bosai.go.jp/snow-weight-japan/



Scientific and technological issues

Comprehensive research on "all hazards × all phases".

NIED is a unique organization that conducts comprehensive research across all phases, from prediction and prevention to response and recovery and encompasses all natural hazards. We implement a wide range of R&D to create high-quality information products by combining natural, engineering, and social sciences, such as an observation network for earthquakes, tsunamis, and volcanoes; MOWLAS (Monitoring of Waves on Land and Seafloor), which covers all land in Japan; and the Shared Information Platform for Disaster Management (SIP4D), a platform that can deliver disaster information between the government, municipalities, private companies, and others.

Social implementation issues

Providing information products for appropriate "actions".

For information products to lead to "actions" that overcome disasters, it is vital to clarify users' needs and ensure that users utilize such information products. Therefore, NIED engages in R&D to create high-quality information products that support decision-making at disaster sites and their delivery methods.

NIED implements nine initiatives regarding technology for DRR to realize a society with

As a National Research and Development Agency, NIED, leading Japan in science and technology for disaster risk reduction (DRR), is required to maximize the R&D results, namely, the realization of "a society with high resilience by empowering each individual to have the basic ability of DRR." In the 4th Mid-to-Long-Term, we established the following two objectives to promote the actualization of the value-creation model. In FY2023, the 5th phase of Mid-to-Long-Term Objectives and Plans will begin (until FY2029), and we will further promote the research and development of DRR science and technology to realize a resilient society.

Activities as a core institute for innovation

NIED plays a core role in implementing six initiatives to realize a value-creation model in cooperation with diverse organizations such as governments, municipalities, private companies, universities, and research institutes.

Promotion of basic research and fundamental R&D

As a driving force for innovation, NIED promotes observation research on hazards, experimental research using the world's most extensive class of facilities, empirical research on disaster response and recovery/reconstruction, and R&D on technologies to become the nucleus for simulation that integrates the research mentioned above activities and utilization of the information.

Promotion of co-creation by industry, government, academia, and the private sector

As a core institute for science and technology for DRR, NIED is promoting cooperation with municipalities and private companies (such as infrastructure companies with needs for reducing disaster damage and securing business continuity) on disaster risk reduction and mitigation.

Dissemination of Research Results/Application of Intellectual Properties

By investigating the needs of governments and municipalities on DRR, NIED implements initiatives to reflect these needs in R&D. We are also committed to effective information delivery of our research results and acquisition and licensing of high-quality patent rights.

Observation and Prediction of Disasters

NIED conducts strategic advanced research for earthquake and tsunami prediction technology, research on mega-earthquake generation process, and research regarding multi-disciplinary evaluation of volcanic activities.

science and high resilience

4th Mid-to-Long-Term Plan [From FY 2016 to FY 2022]

This IR Report mainly introduces NIED's best practices for "strengthening of function as a core institute for innovation in science and technology for DRR." For more details regarding "Promoting basic research and foundational R&D regarding science and technology for disaster resilience," please refer to NIED's brochure (https://www.bosai.go.jp/ introduction/abstract.html) * Japanese only.

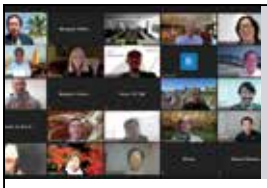
The 5th phase of Mid-to-Long-Term Goals and Plans began in FY2023 (until FY2029).

Fundamental Observation Network, Advanced Research Facilities, Information Distribution Infrastructure

NIED maintains establishment/stable operation of the fundamental observation network and effective/efficient and safe operation of the advanced research facilities. In addition, we construct information platform regarding science and technology for DRR and disaster information, and promote sharing it with external research institutes including industries.

Contribution to Disaster Management Practice at National Government

As a designated public corporation according to the Basic Act on Disaster Management, after a disaster has occurred, NIED delivers information promptly based on science and technology for DRR to relevant organizations, provides assistance at the disaster site, and strengthens cooperation with the government and municipalities.



International Collaboration

As a core institute for innovation in science and technology for DRR of Japan, NIED promotes joint research with foreign organizations and international cooperation through the delivery of information. In light of international needs, we will pursue overseas deployment of Japan's science and technology for DRR.

Human Resource Development

To contribute to the improvement of entire nation's DRR literacy and to the securing of safety and security, NIED trains researchers and works on municipalities, school education and leaders of local disaster management teams to support fostering of wide range of human resources and enhancing their qualifications.

Reduction of Disaster Risk

NIED conducts development of prediction technologies for water-related disasters based on multi-sensing, combined research on grasping degree of risk for changing snow and ice disasters and their whole area prediction, research regarding hazard risk assessment, and research regarding disaster countermeasures based on utilization of information.

Enhancement of the Resilience of Social Infrastructures

NIED conducts earthquake disaster mitigation research using research infrastructure as 3-D Full-Scale Earthquake Testing Facility "E-Defense".

TOP PRACTICE REPORT

Activities as a core institute for innovation

A resilient society that everyone thinks about and creates.

TOP PRACTICE REPORT

01 Promotion of co-creation between industry-academia-government- private sectors

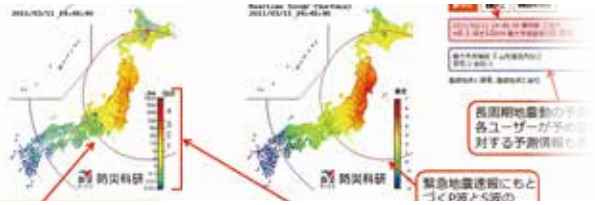
P.17～18

By promoting co-creation that transcends organizational and research field barriers, we encourage efforts to bring innovation into DRR.

02 Fundamental Observation Networks

P.19～20

In preparation for the Nankai Trough Earthquake and other disasters, NIED establishes a full-scale real-time observation network for earthquakes/tsunamis/volcanos covering the whole of Japan and provides its data to a wide range of government and private sectors.



03 Advanced Research Facilities

P.21～22

Through the use and application of our large-scale experimental facilities, we promote co-creation among industry, academia and government, endeavoring to elevate science and technology for DRR.

04 Information Distribution Infrastructure

P.23～24

NIED has established system that goes beyond single organizations for the information sharing/utilization conducive to the prompt and effective response to disasters.

Activities as a core institute for innovation

As initiatives based on the 4th Mid-to-Long-Term Plan, this section introduces specific application results for information products generated through the value creation model, as well as initiatives for co-creation.

05 Contribution to Disaster Management Practice at National Government

P.25～26

Contribution to Disaster Management Practice at National Government as well as supporting the consolidation of information by the government.

NIED promotes the unification of information recognition using SIP4D and ISUT, as well as supporting the consolidation of information by the government.

06 Dissemination of Research Results and Utilization of Intellectual Property

P.27～28

We provide a variety of information on products and services in many fields. We are also engaged in the dissemination of the research results to society.

07 International Collaboration

P.29～30

NIED is committed to the global challenges of DRR, SDGs, and climate change adaptation to strengthen disaster resilience.

08 Human Resource Development

P.31～32

Through participation in programs for an academic degree through Collaborative Graduate School System, NIED is keenly supporting the next generation of researchers who will play an essential role in science and technology for DRR.

TOP PRACTICE REPORT 01

Promotion of co-creation between industry-academia-government-private sectors

We aim to establish a system that links the needs of companies, municipalities, and so on, with NIED to create and nurture the seeds of co-creation between industry, academia, government, and private sectors

The "Disaster Resilience Co-Creation Seminar and Workshop" was launched in FY2022. It is a mechanism for co-creation between industry, academia, the government, and the private sector to improve disaster resilience through information products in collaboration with various stakeholders, NIED, and researchers from universities and research institutes to enhance business continuity management (BCM) in companies, municipalities, and communities and create new businesses for DRR.

Disaster Resilience Co-Creation Seminar and Workshop

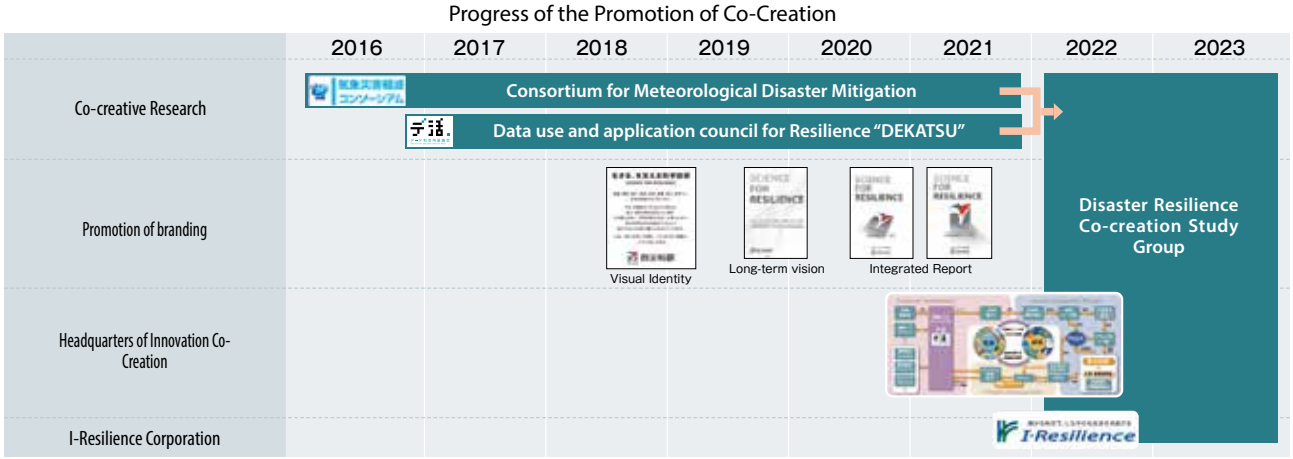
The "Disaster Resilience Co-Creation Seminar and Workshop" is a research group that utilizes the networks established by the "Consortium for Meteorological Disaster Mitigation" and the "DEKATSU" (Data Use and Application Council for Resilience) and progressively integrates them. This research group is a forum for sharing research and social needs and building a human network by promoting exchanges between NIED researchers and stakeholders in the industry, academia, government, and private sector, including companies, municipalities, and NPOs. This will lead to co-creating activities, such as utilizing R&D results and joint research between companies, local governments, NIED, and I-Resilience Co., Ltd. The research group will also improve society's resilience by supporting autonomous activities to improve companies, local governments, and communities' business continuity management (BCM) capabilities and create DRR businesses.

The workshops included presentations of NIED's R&D results and case studies of corporate and municipal applications. In FY2022, the workshops were held four times. Each meeting was divided into two parts: a panel discussion with the speakers moderated by Mr. SHIMOMURA Kenichi, former TBS anchor, the president of the Reiwa Media Kenkyujo, and a roundtable discussion where the speakers and audience members could network. The seminars were held in a hybrid in-person and online format, introducing cutting-edge research and applications to a wide range of participants and allowing for Q&A. The "Roundtable Discussions," facilitated by Professor TAMURA Keiko of Niigata University (Visiting Researcher of NIED) were held in a closed, face-to-face format for on-site participants only to exchange opinions on the possibilities of co-creation and to promote interaction among participants.

In FY2022, the average number of participants at the venue was approximately 50, and the average number of participants online was approximately 200. Many stakeholders from industry, academia, government, and the private sector participated in the event, expanding the human network.

As a core institute for DRR science and technology, it has become an important research group that builds a mechanism for collaboration between industry, academia, government, and private-sector stakeholders and fosters the seeds of co-creation.

Progress of the Promotion of Co-Creation



Disaster Resilience Co-Creation Study Group FY2022 Meeting Results

Session 1 May 31

NIED × "I-Resilience" What can we do?
"Why did NIED establish an incorporated foundation?"
"Cultivating Resilience through the I-Resilience Way" KOBAYASHI Makoto, President, I-Resilience Co., Ltd.

Session 2 September 6

What can we do by combining corporate data and NIED weather data?
"NIED's unique meteorological data."
IWANAMI Koyuru, Vice President (Research) and Assistant General Manager, Headquarters of Innovation Co-Creation, NIED
"Early damage estimation using NIED data and non-life insurance data"
HORIE Kei, Digital Innovation Division, MS&AD InterRisk Research & Consulting Inc.

Session 3 November 22

Decision-making Support through Data Linkage between Municipalities and NIED
"Information Systems for Disaster Response,"
SUZUKI Shingo, Deputy Director-General, Disaster Resilience Research Division, NIED
"Strengthening the Function of headquarters for disaster control in Kashihara City"
YAMAMOTO Tomomi, Director, Crisis Management Section Kashihara City

Session 4 March 14

DRR science and technology × Finance: What can we do?
"Economic Risks in Japan due to Mega Disasters,"
NAGAMATSU Shingo, Director General, Disaster Resilience Research Division, NIED
"Potential of DRR science and technology for disaster risk financing using capital markets"
YAMAMOTO Shinji, President, KEYSTONE ILS Capital Co., Ltd

Seminar

Round-table discussion

NIED co-hosted "The Science Council of Japan in Tsukuba"

On February 15, 2023, the Science Council of Japan (President KAJITA Takaaki) hosted "The Science Council of Japan in Tsukuba," an academic conference in the Kanto region jointly organized by the National Institute for Environmental Studies (NIES) and NIED. This was the first time an academic conference was held at NIED. The conference's theme was "Environment and Development and Disaster Prevention and Mitigation." Participants from academic fields, the government, private companies, and civic organizations in the Kanto region, in addition to the Executive Committee of the Science Council of Japan and Kanto Region Steering Committee members, exchanged opinions on the coherence of the two fields, which have different academic backgrounds and histories of international collaborative discussions. The public lecture "Transition to a Sustainable and Resilient Path" (venue: NIED, hybrid Zoom webinar) was attended by more than 300 people, including general participants.

Round-Table Meeting of the Executive Committee of the Science Council of Japan (Center: President KAJITA)

Public lecture

The use of data from fundamental observation networks that provide real-time earthquake and tsunami information is becoming widespread

The observation network "MOWLAS*1" is deployed over land and sea areas throughout Japan to report earthquakes and tsunamis as soon as possible. The data from this observation network capture earthquakes and tsunamis that affect the Japanese Archipelago, including the anticipated Nankai Trough Earthquake. These data are widely used by governments, municipalities, private companies, and other organizations.

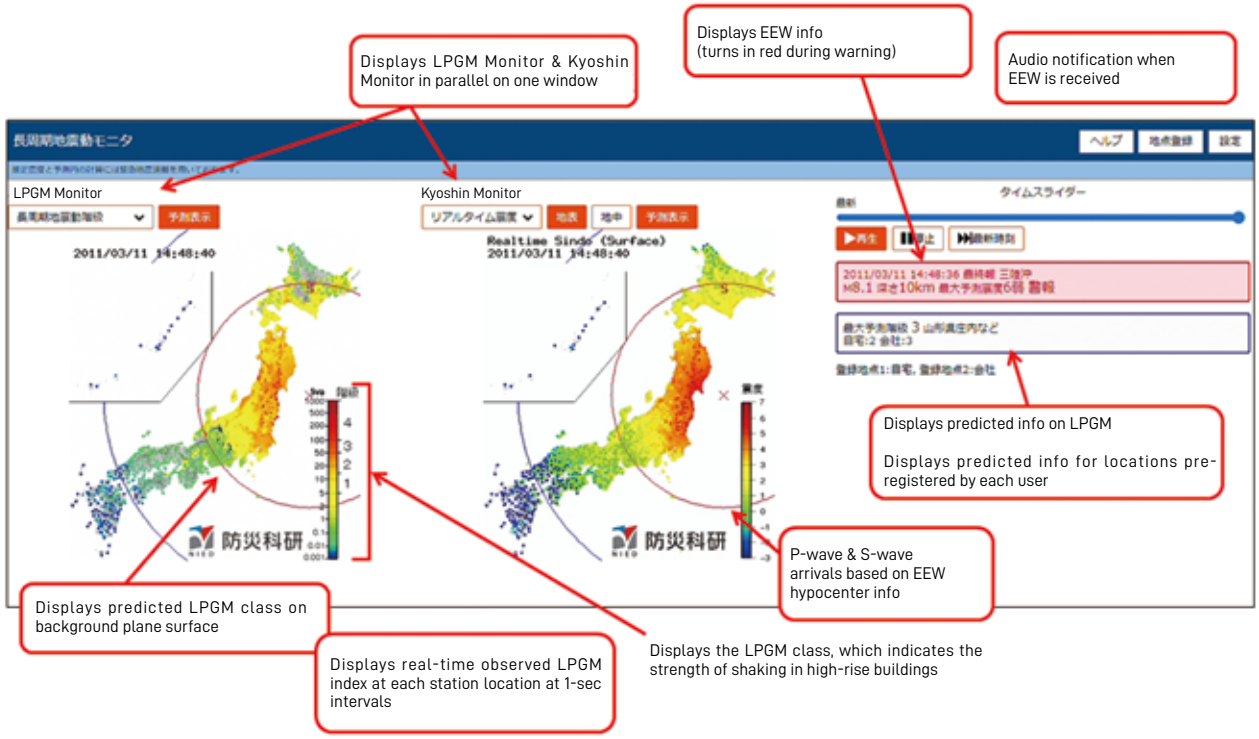
*1: Monitoring of Waves on Land and Seafloor.

NIED's real-time prediction method of Long-Period Ground Motion improves on JMA's Earthquake Early Warning

In the 2011 Tohoku earthquake, high-rise buildings in Tokyo and Osaka, which were located on sedimentary basins approximately 400 km and 700 km from the epicenter, respectively, shook violently. The shaking of the buildings caused damage to interior materials and fire doors, and many people were trapped in emergency-stop elevators. This remote damage was caused by the Long-Period Ground Motion (LPGM) excited by large earthquakes such as the Tohoku earthquake.

From February 1, 2023, the Japan Meteorological Agency (JMA) added the LPGM class to its announcement criteria so that the earthquake early warning (EEW) is issued even when there is a possibility of damage from LPGM. For real-time prediction of LPGM, JMA uses the method developed by NIED. This method was developed based on a large amount of high-quality ground motion data from MOWLAS, and can predict LPGM as quickly as the existing EEW for seismic intensity. In addition, the subsurface structure model based on NIED's Japan Seismic Hazard Information Station (J-SHIS) makes it possible to predict LPGM anywhere in Japan, taking into account the structure of the site.

NIED itself has developed a prediction system that implements this method. The "LPGM Monitor" visualizes real-time predicted and observed information on a map and updates the information every second, which is available to anyone on the web. In addition, NIED provides digital data of the predicted and observed information via the "LPGM Index API".



LPGM Monitor to obtain real-time predicted info on LPGM (https://www.lmoni.bosai.go.jp/monitor/)

The use of MOWLAS observation data and related information products is expanding year by year to various stakeholders

For the public

Through its "Kyoshin Monitor," NIED transmits information on current seismic shaking in Japan observed by MOWLAS. This information is also sent out on Yahoo! JAPAN and "MDA Situational Indication Linkages," a system for displaying various maritime conditions operated by the Japan Coast Guard.

For private companies

Observation data are used by railroad operators for train control, as well as by telecommunication companies and electric power companies. In addition, data provided to the NPO Japan Geoparks Network are used to create the "NIED Earthquake Map!" and "NIED Quake Monitor!" to monitor seismic activity around us.

For government institutions

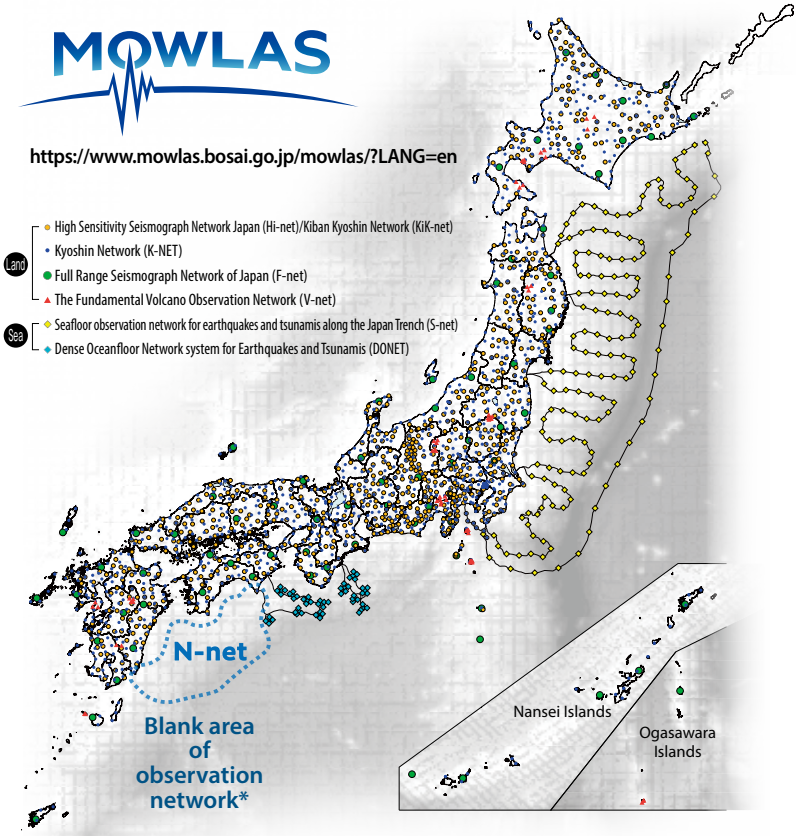
Observation data are utilized as the basic data for creating the "National Seismic Hazard Maps for Japan" by the Headquarters for Earthquake Research Promotion. The JMA also uses the data for earthquake early warnings, tsunami information, seismic intensity information, hypocenter determination, and volcanic observation. In March 2020, data from S6 (sub-system installed to the east of the Japan Trench) were added, which marked the start of the application of observation data for the whole of S-net.

For Municipalities

S-net and DONET observation data are used in Wakayama, Mie, and Chiba Prefectures for immediate tsunami prediction. In Chiba Prefecture, NIED has obtained license for a tsunami forecasting and distributed tsunami height and inundation area forecast information to four cities and towns since July 2022.

For Researchers

NIED contributes to elucidating seismic/tsunami/phenomena and volcanic activity.



*Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net) is under construction in the ocean area (off Kochi Prefecture to Hyuga-nada) where no observation network has been established in the anticipated seismic source region of the Nankai Trough Earthquake. It will be completed in FY2024.

Stakeholder Interview

"We make an effort to work as a partner of NIED in earthquake and tsunami DRR"

Director-General,
Seismology and
Volcanology
Department, Japan
Meteorological Agency

AOKI Gen

Since the 2011 off the Pacific Coast of Tohoku Earthquake, the Japan Meteorological Agency (JMA) has been studying the evaluation and communication of shaking in high-rise buildings caused by long-period seismic motions that cannot be assessed by seismic intensity. As a result, the JMA decided to utilize the technology developed by NIED to predict long-period seismic motions and began announcing prediction information on long-period seismic motion classes using an earthquake early warning system on February 1, 2023.

In addition, the JMA utilizes data from land observation networks such as Hi-net, K-NET, KiK-net, and F-net operated by NIED, and ocean observation networks such as DONET and S-net for earthquake and tsunami observations. The data from these observation stations enabled us to promptly announce earthquake information, such as the Earthquake Early Warning, and update Tsunami Warnings.

Earthquake early warning systems have become part of society's infrastructure. To protect the lives of the people of Japan, we look forward to NIED's further research and development. We will work to utilize observation data more effectively and advance various types of information.

TOP PRACTICE REPORT 03 **Advanced Research Facilities**

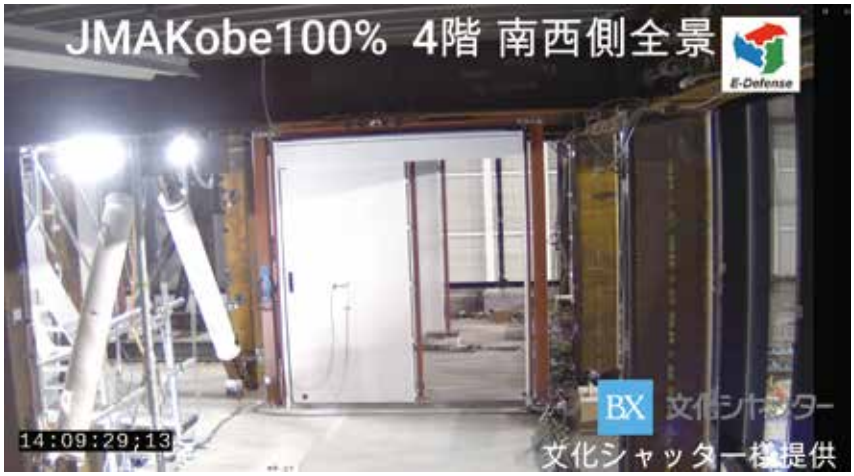
NIED promotes collaboration and co-creation between industry, academia, and government through experimental facilities that realistically reproduce hazards

Experimental research that realistically reproduces potential disaster phenomena (hazards) is indispensable for developing prevention strategies for large-scale disasters. NIED has experimental facilities that have the world's only characteristics. By promoting the use of these facilities, we encourage collaboration and co-creation between industry, academia, and government, thereby contributing to the development of DRR science and technology.

Building sensing and alert system experiments were conducted by shaking a 10-story building

In February 2023, at E-Defense, we conducted an experiment in which a building sensing and alert system was installed on a full-scale 10-story steel-frame office building specimen. Sensors and LEDs were built into the building's exterior material (curtain wall). The sensors estimate building deformation based on the shaking detected by the sensors, and the LEDs light up to alert the user according to the degree of deformation. The purpose of the experiment was two-fold: to evaluate earthquake damage and damage costs by learning the dynamic characteristics of the building (shaking period and ease of subsidence) and to develop a system that visibly communicates the damages and is helpful for evacuation behavior and emergency assessment of the degree of danger. In this experiment, four joint research projects were conducted by companies and universities. In addition, the space inside the building was rented out in nine cases. These joint research projects and space rentals effectively utilized approximately 90% of a building's interior space.

LEDs emit light to alert the user.



The interior space was also utilized.

The world's only experimental facilities that realistically reproduce hazards enable performance verification testing

The reproduction and observation of "extreme conditions" caused by hazards are essential for DRR science and technology research. NIED has experimental facilities that realistically reproduce hazards, enabling advanced research on earthquakes, heavy rainfall, and snow and ice hazards. In addition to the research led by NIED, we contribute to the implementation of science and technology in society through co-creation by industry, academia, and government and through utilization by private companies such as manufacturers.

Miki (Hyogo) Reproducing earthquake ground motions in three dimensions. ["E-Defense" (Three-Dimensional Full-Scale Earthquake Testing Facility)]

The destruction process of full-scale structures can be investigated in detail by reproducing the earthquake shaking in three dimensions (back and forth, left and right, and up and down). The facility is one of the world's largest and most powerful, with an area of 20 m x 15 m and a maximum structural weight of 1,200 t. It can reproduce the seismic intensity of 7 shakes, equivalent to the Great East Japan Earthquake. It is also used to evaluate the seismic performance of housing and industrial infrastructure and to verify countermeasures.

https://www.bosai.go.jp/study/edefense.html

[Joint research, funded research, facility lease, and own research in FY2022: Four projects]

Tsukuba (Ibaraki) Generating realistic heavy rain. [Large-scale Rainfall Simulator]

It is one of the world's largest and most capable rainfall testing facilities. It can reproduce everything from drizzle to torrential rainfall, exceeding 50 mm for 10 min (300 mm for 1 hour). This facility is widely used for research on heavy rainfall, flooding, and landslides and for verifying drones and automated driving technologies.

https://www.bosai.go.jp/study/rain.html

[Joint research and facility lease in FY2022: 12 projects]

Shinjo (Yamagata) Reproducing snow crystals that closely resemble natural snow. [Cryospheric Environment Simulator]

Snowfall, landings, avalanches, snowstorms, and other phenomena in the cryosphere can be reproduced, and experiments can be conducted even in mid-summer. It is the only facility in the world equipped with equipment reproducing snowfall in a crystalline form similar to natural snow. In addition to clarifying snow and ice phenomena, this facility is widely used in the industry to verify the performance of materials for electric wires and signs directly related to life in snowy regions.

https://www.bosai.go.jp/study/snow.html

[Joint research and facility lease in FY2022: 23 projects in total]

Videos introducing the facilities and experiments using these facilities are available on the YouTube channel of NIED.

https://www.youtube.com/user/C2010NIED

Information is shared and utilized across organizations to contribute to the realization of prompt and effective disaster management

During a disaster, a wide variety of information is generated, including the extent of damage, evacuation status, recovery support situation, information collected by the national government, municipalities, and infrastructure companies, and the analysis of observation data by each organization. NIED has built a system to aggregate information across agencies and organizations and share it in an easy-to-use format for disaster response and other purposes.

SIP4D is incorporated into the Basic Disaster Management Plan

The Shared Information Platform for Disaster Management (SIP4D), developed by NIED, collects information necessary for disaster response from various sources, converts it into an easy-to-use format for appropriate sharing by related organizations, and provides it quickly. In the May 2021 revision of the Basic Disaster Management Plan, SIP4D was designated as a national framework for sharing disaster information. Its functions will be incorporated into the next Integrated Disaster Management Information System of the Cabinet Office, which will be operational from FY2024. In 2021, SIP4D won the R&D 100 Awards, the "Academy Awards of Innovation."

At the end of FY2022, SIP4D connected 26 prefectures and two ordinance-designated cities, and in the case of Typhoons Nanmadol and Talas in 2022, evacuation center information from the 20 connected prefectures was shared through SIP4D's information integration processing.

Basic Plan for Disaster Risk Reduction describes the use of SIP4D and ISUT.

Part 2: Management common to each disaster
Chapter I: Disaster prevention
Section 6: Preparation for prompt and smooth disaster emergency response and recovery/rehabilitation.

2. Collection and communication of information and development of an emergency response system

In order to share information, the national government (including the Cabinet Office), public organizations, and municipalities shall strive to aggregate DRR information that should be shared across all institutions into a common system (Integrated Disaster Management Information System) and SIP4D (Shared Information Platform for Disaster Management).

Chapter II: Disaster emergency measures
Section 2: Collection and communication of information and establishment of activities system

6. Activities system of the country

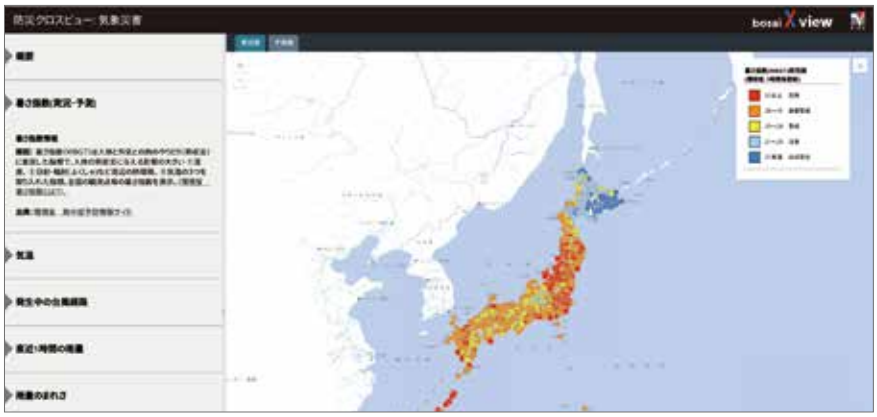
(3) Dispatch of staff

In the event that large-scale damage is anticipated, the national government [(including the Cabinet Office) shall immediately dispatch a Cabinet Office survey team by helicopter, etc., as necessary, to promptly grasp the extent of damage and provide support to the affected municipalities. At that time, the national government (Cabinet Office) shall dispatch ISUT (Information Support Team) consisting of the national government (Cabinet Office) and National Research Institute for Earth Science and Disaster Resilience, etc., to assist municipalities in disaster response by using SIP4D to collect and organize disaster information and provide it on a map. When dispatching staff, the health management of dispatched staff and the wearing of masks, etc., should be thoroughly implemented.

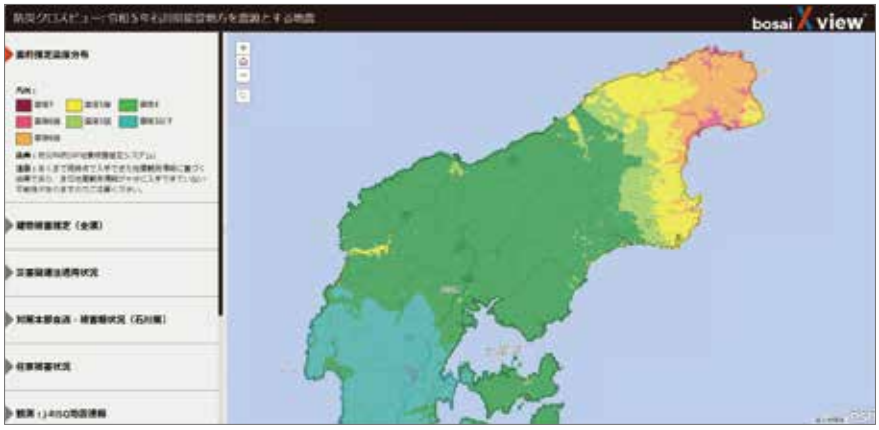
NIED is enhancing real-time delivery of information via "bosaiXview"

NIED operates "bosaiXview" (pronounced "bosai cross view"), which provides information on hazards and risks, forecasts and estimates, disaster occurrence, recovery status, and past disaster records in an overlaid form when there is a threat of a disaster or when a disaster occurs (the site was renamed from NIED Crisis Response Site in 2021).

In the warning phase, the sites for storm floods and snow damage are open to the public, providing information on heavy rainfall and flood warnings, including information on the rarity of heavy rainfall and similar typhoon routes during the flood season and information on snow and ice disaster warnings during the winter period, including snow depth estimates, snow-load signals, and caution information on falling snow and avalanches due to snow melting. After the disaster, in 2022, the following disasters were reported: an earthquake in the Noto region of Ishikawa Prefecture at approximately 15:08 on June 19; volcanic activity at Sakurajima; heavy rainfall from August 3; Typhoon Nanmadol and Typhoon Talas; and in 2023, an earthquake centered in the Noto region of Ishikawa Prefecture on May 5, heavy rainfall from July 7, 2023, and other disasters. In FY2023, we also started providing "heat index" information on disasters caused by heat waves.



Heat index information for heat stroke prevention



The estimated seismic intensity distribution of the earthquake centered in the Noto region of Ishikawa Prefecture in 2023 over a broad area

The estimation of inundation depths due to heavy rainfall since July 7, 2023 (Akita City), based on information from SNS and other sources

TOP PRACTICE REPORT 05 Contribution to Disaster Management Practice in the National Government

NIED contributes to disaster management practice in the national government with SIP4D and ISUT, specified in the Basic Disaster Management Plan

The SIP4D developed by NIED and the Information Support Team (ISUT), dispatched jointly with the Cabinet Office, was specified in the Basic Disaster Management Plan. They have made steady progress in their contributions to disaster management practices. We also cooperated in drills organized by the Cabinet Office and municipalities from the study stage and are working to unify situational awareness through SIP4D and ISUT.

NIED also conducts disaster surveys and provides support and information to the governments and municipalities

NIED's SIP4D (see p.23) is connected to the disaster information systems of many prefectures.

ISUT-SITE, a website that visualizes information distributed by SIP4D, is a standard viewer used at local disaster management headquarters. ISUT-SITE was established to provide remote information support for the heavy rainfall on August 3, 2022, Typhoon Nanmadol and Typhoon Talas, and heavy snowfall during winter.

In FY2022, NIED conducted 16 disaster surveys and provided support, information, and cooperation with the national government and municipalities, amounting to 620. The information provided to the national government and committees included the Headquarters for Earthquake Research Promotion, Nankai Trough Earthquake Assessment Committee, Coordinating Committee for Earthquake Prediction, and Coordinating Committee for Prediction of Volcanic Eruption.

Many examples of long-term cooperative relationships have been established through municipal agreements. 358 agreements were concluded during the seven years of the 4th Mid-to-Long-Term Plan (FY2016-2022).

■ Conducting and supporting disaster investigations, etc.

16 cases (FY2022)

■ Number of agreements with municipalities, etc.

358 cases
(total number of cases in FY2016-2022)

■ Provision of information and cooperation with national government and local municipalities, etc.

620 cases (FY2022)

On March 17, 2023, Suita City, Osaka Prefecture, and NIED signed a collaboration and cooperation agreement to promote technological development and demonstration research to build a resilient society. (Left: HAYASHI Haruo, then President of NIED; Right: GOTO Keiji, Mayor of Suita City)

As a member of ISUT, NIED provides information aggregation support at the disaster management headquarters

In the event of a significant disaster, the ISUT is dispatched to local disaster management HQs to provide information to help unify situational awareness by compiling various types of information and creating maps. Although no ISUT members were dispatched in FY2022, in FY2023, a total of eight members were dispatched to the Ishikawa Prefectural Government Office for the earthquake that struck the Noto Peninsula of Ishikawa Prefecture on May 5, 2023, and worked there for four days (they also worked during the Noto Peninsula earthquake of 2024 on January 1, 2024).

Even when not dispatched to a disaster site, the NIED provides helpful information to municipalities and other organizations for disaster response through SIP4D (see p.23) and ISUT-SITE (a website that provides information to a limited number of organizations such as local governments).

The Basic Disaster Management Plan also specifies using the SIP4D and ISUT. NIED members participate in joint drills with the national government, prefectures, and organizations.

Briefing disaster information to Ishikawa Prefectural officials (The night of May 5, 2023, Ishikawa Prefectural Office)

Medical activity training assuming a large-scale earthquake (September 30, 2023, Ehime Prefectural Office)

ISUT Dispatch Results (as of November 30, 2023)

Year	Disaster name	Activity period	Location
FY2018	Earthquake in the Northern Osaka Prefecture on June 18	Jun.18-21, 2018	Osaka Prefectural Government
	Heavy Rain Event of July 2018	Jul.7-Aug.6, 2018	Hiroshima Prefectural Government
	2018 Hokkaido Eastern Iburi Earthquake	Sep.6-28,2018	Hokkaido Government
FY2019	Heavy Rain from the End of June 2019	Jul.4-5, 2019	Kagoshima Prefectural Government
	Heavy Rain Event of August 2019	Aug.28-Sep.4,2019	Saga Prefectural Government
	Typhoon Faxai	Sep.10-Oct.3,2019	Chiba Prefectural Government
	Typhoon Hagibis	Oct.13-Nov.15,2019	Miyagi Prefectural Government, Fukushima Prefectural Government, Tochigi Prefectural Government, Saitama Prefectural Government, Chiba Prefectural Government, Nagano Prefectural Government
FY2020	Heavy Rain Event of July 2020	Jul.4-Aug.7,2020	Kumamoto Prefectural Government, Kagoshima Prefectural Government
	2021 off Fukushima Earthquake of February	Feb.14-16,2021	Fukushima Prefectural Government
FY2021	Heavy rain event centered in the Tokai and southern Kanto regions from July 1	Jul.3-13,2021	Shizuoka Prefectural Government, Atami City Hall
	Heavy Rain Event of August 2021	Aug.15-22,2021	Saga Prefectural Government
	Earthquake with epicenter off the coast of Fukushima Prefecture	Mar.16-18,2022	Fukushima Prefectural Government, Miyagi Prefectural Government
FY2023	Earthquakes in the Noto Region, Ishikawa Prefecture in 2023	May.5-8,2023	Ishikawa Prefectural Government

Training of NIED staff

In preparation for ISUT dispatches, NIED staff members also undergo periodic drills. In addition to initial response drills for members of the Center for Comprehensive Management of Disaster Information to immediately gather and begin responding in the event of a disaster, drills are also conducted with the participation of staff from various departments, including administrative staff, making this an "all-NIED" effort.

TOP PRACTICE REPORT 06

Dissemination of Research Results and Utilization of Intellectual Property

Promoting the dissemination of R&D results by utilizing patents and know-how

NIED promotes the dissemination of R&D results based on the needs of society and industry by utilizing patents and know-how through its Intellectual Property Policy (established in March 2017). The Institute actively spreads and implements intellectual property in society, including copyrighted works, know-how, and value-added information products that combine information with observation data and secures patents that help create innovation and future development in the DRR science and technology field. In addition, we are making efforts to disseminate our research results through Results Briefing Sessions, presentations, web content such as videos, and open experiments and are receiving increasing coverage in mass media.

NIED is encouraging the stakeholders to utilize its patents

NIED actively publishes information on obtained patents, making them available on its website. Six patent applications were filed, 11 patents were registered, and 24 patents and others were licensed in FY2022 (see the transition of patent income on page 50). In FY2023, NIED distributed patent abstracts at the Disaster Resilience Co-Creation Seminar (see p.17-18). We set up an intellectual property consultation corner at the venue to encourage stakeholders to use NIED patents.

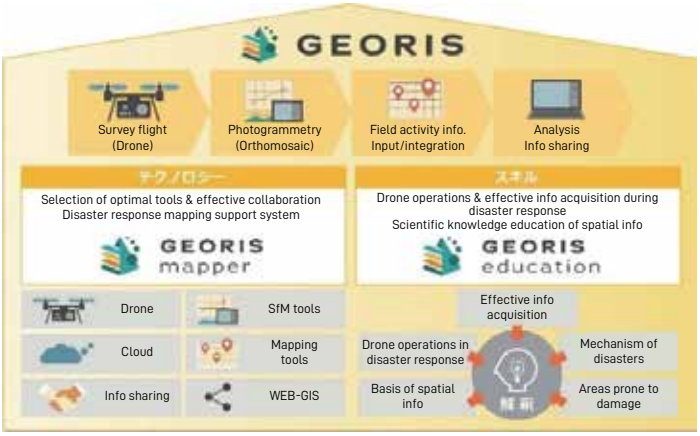
At the FY2023 Disaster Resilience Co-Creation Study Group Seminar, an intellectual property consultation booth (left) and a collection of patent abstracts were distributed (right).

NIED is actively communicating to society its research and development results

In FY2022, NIED held a Results Briefing Session in February 2023 to present its latest research results and activities under the theme "Connecting with Information to Change Disaster Response." In FY2019-2022, we invited journalist IKEGAMI Akira as a special guest commentator to join the discussion from a perspective other than the researcher's. From FY2020 to FY2022, the conference was held in a hybrid format, with both on-site and online deliveries, owing to the COVID-19 pandemic.

The presentation of results held in February 2023

Collaboration with private companies to develop the GEORIS service, a disaster response drone solution



Overview of GEORIS disaster response drone solution

As part of our research and development of technology for understanding disaster situations in the initial response to disasters, we have developed a drone disaster response solution, "GEORIS," which establishes and systematizes a scientific knowledge system for the safe operation of drones in disaster sites and the interpretation of acquired information. As an initiative for the social implementation of the results of this research, we launched the "Local Production for Local Disaster Prevention Project" in the town of Jinsekikogen, Hiroshima Prefecture, in 2019, which aims to use drones for disaster prevention and mitigation, and train residents to become leaders (drone pilots) to solve local issues. To expand on the results of this project, we collaborated with PERSOL PROCESS & TECHNOLOGY CO., LTD., a participating organization in the project and an expert in drone technology and process design. The program provides education and knowledge training to disaster site personnel in municipalities and other organizations.

In FY2021-2022, with competitive funding from the Fire and Disaster Management Agency, NIED developed "GEORIS mapper," a solution system that utilizes drones and Web-GIS (Geographic Information System) for disaster information collection by fire departments, leading to accurate and quick decision-making in the field.

Additionally, in FY2022, the NIED provided GEORIS education, a drone education program for disaster response, to the Japan Ground Self-Defense Force (JGSDF), where instructors and educational training materials were created. Currently, the education and dissemination of the program throughout the JGSDF are underway. We will continue to provide services to local governments, firefighting organizations, and private infrastructure companies to promote the social implementation of disaster situation assessment technologies at disaster sites.

Flight plan to assess the situation at the training site
(Cooperation: Kamaishi Fire Department)

Education and training for drone utilization
(Cooperation: Japan Ground Self-Defense Force)

Videos of research introductions, results, and posters are available online

Each researcher made videos and posters available on the NIED website to make the research content and results familiar to as many people as possible. This project began when a face-to-face presentation of research results could not be held due to the COVID-19 pandemic and was updated approximately once a year. The videos are also available on YouTube. https://www.youtube.com/C2010NIED.

The media coverage of NIED has been increasing

In addition to press releases, media coverage of NIED has increased by providing opportunities for the media to cover open experiments. In FY2022, NIED received 993 media mentions. In FY2023, as the COVID-19 pandemic ended, we began holding meetings where President TAKARA Kaoru and the researchers gave face-to-face presentations to the press.

Strengthening Global Collaboration and Cooperation to Improve International DRR and Resilience

NIED is actively working to improve the resilience of societies and promote the integration of interrelated issues of disaster reduction, SDGs, and climate change adaptation through collaboration and cooperation with domestic and international research institutions related to DRR to gain knowledge from overseas and share research results with the international community. NIED also focuses on cooperation for the "build back better" of disaster-affected areas overseas and human resource development.

Through the activities of JHoP, NIED contributes to building a resilient and sustainable international society

JHoP is a network of 17 universities, research institutes, and practitioners related to DRR. It engages in a wide range of activities, including cooperation with the Japanese government, to build a resilient and sustainable society domestically and internationally. NIED serves as the secretariat and actively promotes its activities.

In September 2023, NIED and JHoP co-hosted the International Conference on Science and Technology for Sustainability 2023 - Transforming Society to Become Resilient and Sustainable Beyond Catastrophic Disasters (hosted by the Science Council of Japan). At the conference, participants from 12 countries and regions reflected on what Japan had experienced and learned in the 100 years since the Great Kanto Earthquake and the experiences of countries and areas affected by massive earthquakes, tsunamis, and giant cyclones. The Tokyo Statement of 2023 was compiled and disseminated to share and disseminate the conference's outcomes to the international community.

At the International Conference on Science and Technology for Sustainability 2023 Speakers and members of the Science Council of Japan and JHoP

Cooperation to Build Back Better in Disaster-Affected Areas Abroad

As advocates of the Sendai Framework for Disaster Reduction, NIED has been promoting efforts to cooperate and build back better in disaster-affected areas overseas. Regarding the earthquake in southeastern Turkey on February 6, 2023, NIED, in cooperation with academic societies, universities, and research institutes in Japan and Turkey, conducted a damage survey on-site and is researching to strengthen resilience in future disasters.

JHoP issued a statement recommending that Japan share its experiences and lessons learned regarding earthquakes, act to solve problems and provide assistance.

Damage assessment in Turkey

NIED is expanding its collaboration network with overseas research institutions and deepening cooperation

NIED has concluded cooperative Memorandums of Cooperation (MOCs) with many overseas DRR research institutes and other organizations to promote research cooperation and the global development of DRR science and technology.

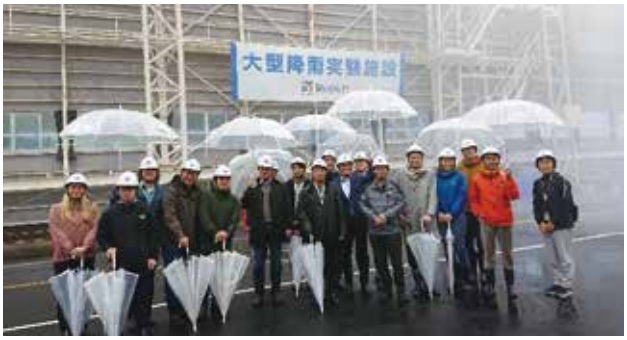
In March and November 2023, the National Science and Technology Center for Disaster Reduction (NCDR) Taiwan and NIED held workshops on issues common to both organizations, such as earthquakes, meteorological disasters, and information sharing during disasters.

At the 3rd Workshop with NCDR, Taipei. Opening remarks by President TAKARA

In FY2022, NIED newly concluded three MOCs for comprehensive cooperation with overseas disaster reduction-related organizations, promoting research cooperation in specific disaster-related fields and broad cooperation across fields, including human resource development.

NIED has been cooperating with the Norwegian Geotechnical Institute (NGI), mainly in snow and ice disaster prevention, and recently concluded an MOC for natural disasters in general. With NGI, we are also involved in the international joint research project "GEOMME" to conduct joint training programs for Japanese, Norwegian, and Korean researchers in Japan.

With Italy CIMA (International Center for Environmental Monitoring CIMA Research Foundation), we concluded an MOC for research cooperation on meteorological disasters, including floods and droughts, and the effects of climate change, in addition to our existing collaboration on snow and ice disaster prevention.



Acceptance of GEOMME Project training

In addition, an MOC was signed with the GNS Science of New Zealand for cooperation on all aspects of geohazards. The signing ceremony was hosted by the New Zealand Ministry of Business, Innovation, and Employment (MBIE), which concurrently held workshops on geohazard monitoring, volcanoes, hazard/risk modeling, and risk information for decision-making.

Signing Ceremony of MOC with CIMA

Signing Ceremony of MOC with GNS Science

NIED fosters young human resources in cooperation with domestic and foreign institutions

NIED accepts trainees from developing countries and cooperates with the Japan International Cooperation Agency (JICA) and other organizations. It provides training in a wide range of topics. In addition, it cooperates with the Malaysia-Japan International Institute of Technology (MJIIT), dispatches lecturers, and accepts students for study tours to share the Japanese knowledge of DRR with researchers and engineers overseas.

We also plan to host international conferences for young researchers from the international human resource development perspective. We plan and host a special session at every Tsukuba Conference, a forum where young researchers from industry, government, and academia discuss global issues.

In 2023, we invited a speaker from NCDR, Taiwan, to hold Catastrophic Disaster Preparedness and Response" sessions.

Tsukuba Conference Special Session "Catastrophic Disaster Preparedness and Response" speakers

TOP PRACTICE REPORT 08 Human Resource Development

NIED is actively developing human resources through the Collaborative Graduate School system degree program

NIED is proactively participating in the University of Tsukuba's degree program run by the Resilience Research and Education Promotion Consortium through the Collaborative Graduate School system and is working to foster young researchers who will play a leading role in DRR in the future.

NIED participates in the University of Tsukuba's graduate degree program through the Collaborative Graduate School system

NIED has joined the "Resilience Research and Education Promotion Consortium" established in 2017 by the University of Tsukuba and 11 companies and research institutions in Tsukuba City and the surrounding areas are implementing a new degree program, the "Doctoral Program in Risk and Resilience Engineering," at the University of Tsukuba Graduate School, starting in 2020. The consortium aims to develop human resources with research and practical skills to respond flexibly to unforeseen events and changes in modern society and maintain, provide, and recover the required social functions.

NIED signed an agreement* with the University of Tsukuba to participate in the program on a proactive and sustainable basis. As of October 2022, three NIED researchers and four students (including two working students) have pursued their degrees through this program. We strive to develop high-end human resources through this program through doctoral programs.

Degrees will be key to realizing a resilient society through advanced knowledge and skills. By FY2022, two graduate students had received their Ph.D. through the Risk and Resilience Engineering Degree Program. Through this program, we strive to develop high-end human resources with doctoral degrees, who will play a key role in realizing a resilient society through advanced knowledge and technology.

* Collaboration agreement in education research between the University of Tsukuba and Collaborative Graduate School established in the Resilience Research and Education Promotion Consortium

Risk and Resilience Engineering Degree Program

Disaster risk and resilience theory

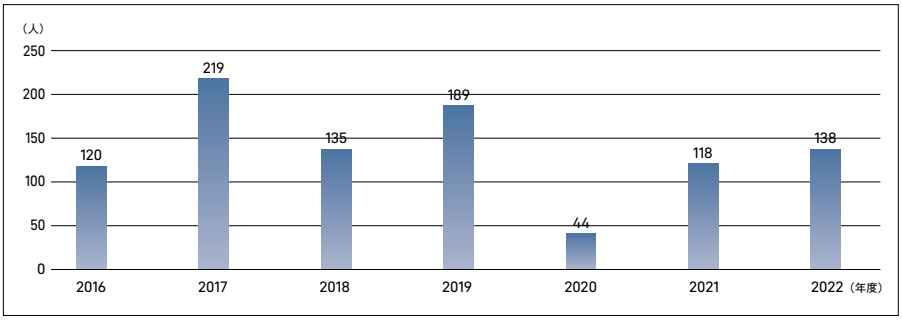
KATA (form of essence) covering various types of natural disasters, the lecture will provide an overview from individual disaster risk assessment to disaster response technologies to improve resilience. Specifically, the course will provide an overview of earthquake and tsunami disasters (risk assessment, disaster control measures, observation technology, and simulation technology), volcanic and ground disasters (risk assessment and disaster control measures), and wind, flood, and snow/ice disasters (risk assessment, disaster control measures, and information sharing/utilization technology), as well as comprehensive strategies to improve resilience. The course will also provide comprehensive strategies to improve resilience, including practical examples of how such strategies have been implemented in times of peace and disasters.

Collaborative Graduate School systems and internships are also available

Based on the Collaborative Graduate School system at the University of Tsukuba, Nagaoka University of Technology, Hokkaido University, and Tohoku University, graduate students are accepted at NIED, with researchers from the institute as their supervisors. Two graduate students agreed to participate in the FY2022.

Since FY2017, NIED has also accepted students for internship programs, with 12 students in FY2022.

The graph below shows the number of researchers, trainees, internships, etc., accepted during the 4th Mid-to-Long-Term (FY2016-2022); the total for the seven years was 963, exceeding the numerical target of 560.



Number of researchers, trainees, internships, etc. accepted during the 4th Mid-to-Long-Term target period.

NIED dispatches its staff as lecturers to educational institutions and local public organizations

We dispatched our staff as lecturers to educational institutions, the national government, municipalities, and NPOs to disseminate DRR education and provide practical support during disaster response. Two hundred forty-six lecturers were dispatched in FY2022.

The outreach project (DRR science class in collaboration with the BELLMARK FOUNDATION and the Girls Scouts of Japan), which started in FY2018, was conducted five times in FY2022, including three times at three elementary schools, once at a special support school, and once at a Girl Scout organization. Online implementation is now available for special-support schools.

DRR Class at Kyoto Prefectural School for the Blind (July 2022)

NIED Contributed to the book "Knowledge and Preparation for Disaster Resilience Science and Technology"

In July 2023, NIED cooperated with Shimizu Shoin Co., Ltd, a publisher and distributor of textbooks and educational books, publishing "GEO PEDIA: Knowledge and Preparation for Disaster Resilience Science and Technology." The book has four chapters: "What is Disaster and Disaster Risk Reduction?" "Science for Prediction," "Science for Prevention," and "Science for Response." It can be considered an "introduction to DRR science and technology" for everyone, from junior high and high school students to adults. Under the supervision of USUDA Yuichiro, Director-General of the Center for Comprehensive Management of Disaster Information, NIED, and Professor of the Cooperative Graduate School of the University of Tsukuba, many researchers from all research divisions of the NIED collaborated on this book.

FUNDAMENTALS

Promotion of Basic Research and Fundamental R&D

We introduce the aspirations and research results of our researchers who engage in basic research and fundamental R&D through interviews with them.

For a safe and secure society that is sustainable and resilient to disasters

01

P.35～36

Seismology

Interview ❶

Chief Researcher, Earthquake and Tsunami Research Division
Network Center for Earthquake, Tsunami and Volcano

KUBOTA Tatsuya

Research Theme : Understanding Earthquake and Tsunami mechanisms

02

P.37～38

Development of Disaster Situation Analysis and Sharing System

Interview ❷

Deputy Director-General, Disaster Information Research Division

TAGUCHI Hitoshi

Research Theme : Satellite One-Stop System
Multi-sensing Data Continuous Damage Analysis System

03

P.39～40

Initial disaster response and disaster situation assessment

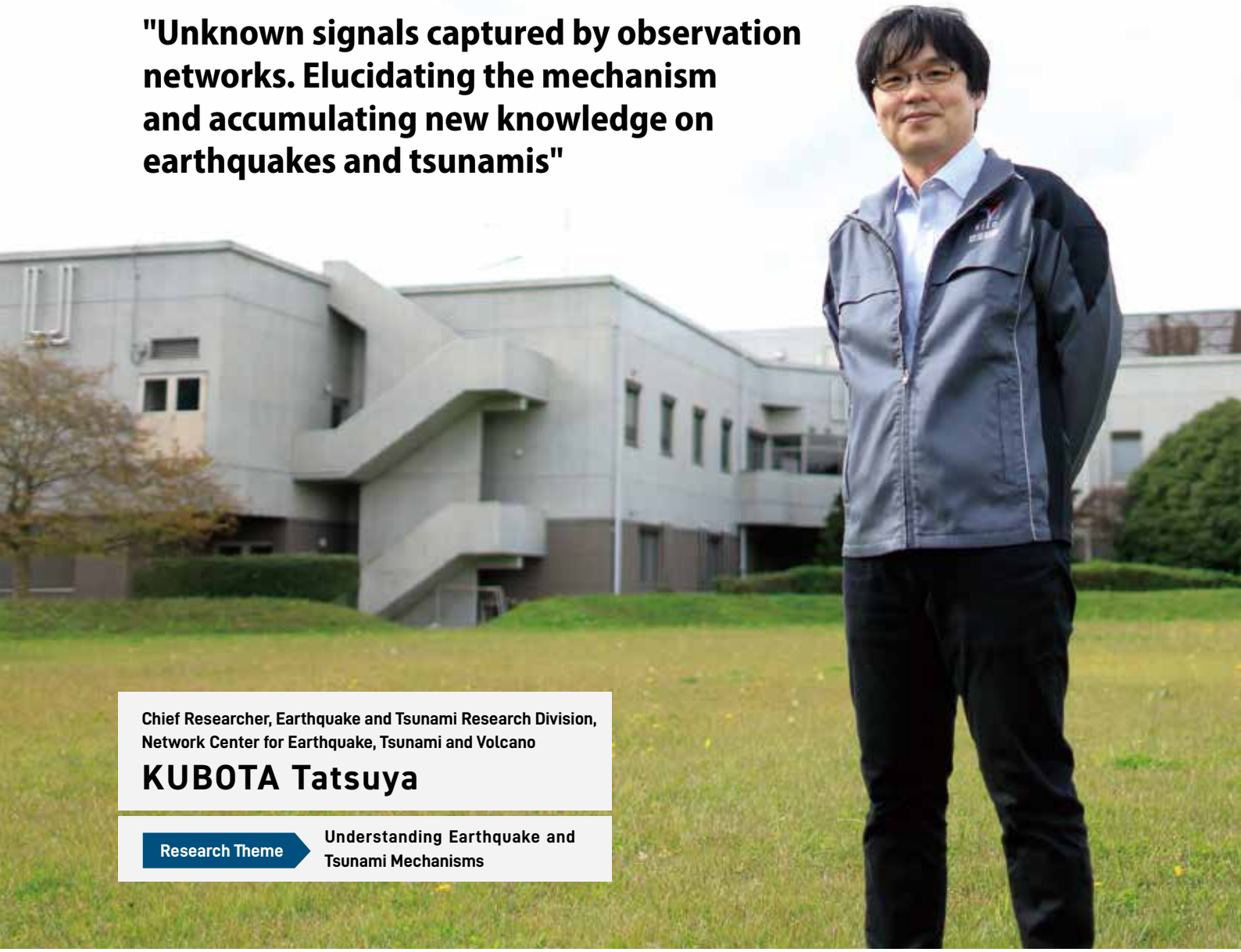
Interview ❸

Chief Expert Researcher, Multi-hazard Risk Assessment Research Division/Head, Disaster Information Library

UCHIYAMA Shoichiro

Research Theme : Drone Applications in Initial Disaster Response

"Unknown signals captured by observation networks. Elucidating the mechanism and accumulating new knowledge on earthquakes and tsunamis"



Chief Researcher, Earthquake and Tsunami Research Division, Network Center for Earthquake, Tsunami and Volcano
KUBOTA Tatsuya

Research Theme Understanding Earthquake and Tsunami Mechanisms

Observational data show signals that cannot be explained by conventional knowledge

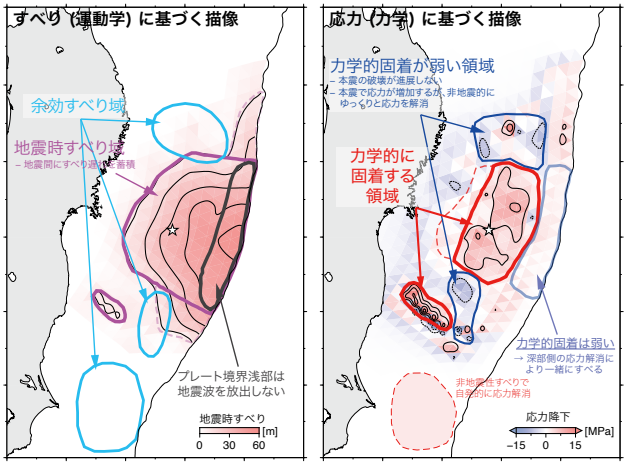
My main research theme is to elucidate the mechanisms of massive earthquakes by utilizing various data obtained from observation networks such as NIED's MOWLAS Observational data, which provide fundamental information about the nature of earthquakes and tsunamis. By accumulating such information, I am conducting research to clarify the mechanism of how earthquakes like the 2011 off the Pacific Coast of Tohoku Earthquake (Tohoku Earthquake) occur.

From the observational data, we often see an enigmatic signal that cannot be explained by our conventional knowledge. The tsunami signal recorded during the January 2022 eruption of the Hunga Tonga–Hunga Ha'apai volcano is a case in point. Our research that clarified the mechanism of its generation and growth was published in the journal "Science." One of the most enigmatic features of the tsunami was that the tsunami reached the Japanese coast earlier than predicted by conventional methods. When I saw this phenomenon, I thought it was similar to the "meteorological tsunami" caused by an atmospheric low-pressure system, which I had worked on with my collaborators in 2020. The analysis of Tonga data reveals that the tsunami in Tonga was excited by an atmospheric Lamb wave, a kind of wave propagating in the air, which was generated by a volcanic eruption.

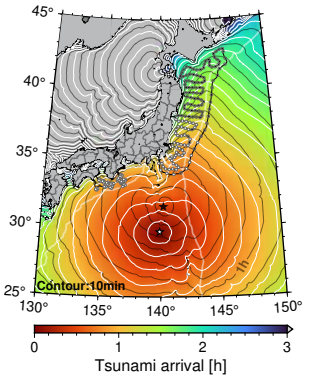
Using data and computational analysis to pinpoint unknown phenomena

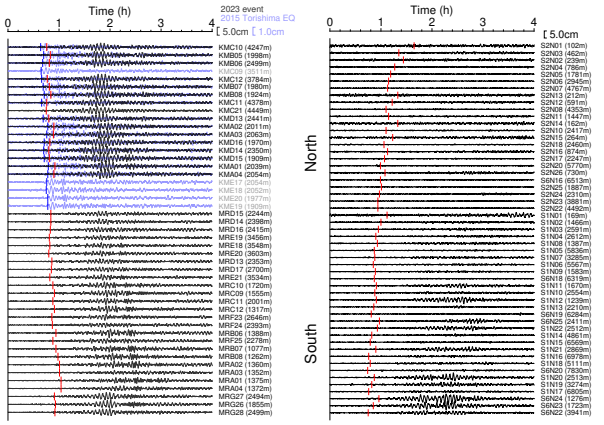
In October 2023, a significant tsunami was observed widely along the Japanese Pacific coast during seismic activity around Torishima Island in the Izu-Bonin Islands. The tsunami had larger amplitudes than those expected from the magnitude of the earthquake. Subsequently, we began research, and the mechanism of the mysterious tsunami occurrence is being revealed. Thus, unknown signals often appear in the data from observation networks, leading to new scientific discoveries and knowledge.

In addition, to elucidate the mechanism of the Tohoku Earthquake, we have been analyzing observational data to examine the mechanism of the extremely large slip along the plate boundary off Miyagi Prefecture, how it spread to the plate boundary regions off Iwate and Fukushima, and how the tsunami was generated. Through these research activities, we will elucidate the whole picture of the Tohoku Earthquake and aim to utilize the findings to predict the Nankai Trough Earthquake and other possible future earthquakes.



Schematic interpretation of the generation of the Tohoku Earthquake. (Left) Interpretation based on the slip along the plate boundary. (Right) Perspective of the earthquake generation based on the mechanics and the stress.
This study suggests the different nature of interplate slip and plate mechanical locking between the regions off Miyagi, Iwate, and Fukushima.





Waveforms of DONET and S-net ocean-bottom pressure gauges of the October 9, 2023 earthquake near Torishima Island

(Left) Locations of DONET and S-net observation stations. White circles indicate the pressure gauge observation stations whose waveforms are plotted in the figure below. The white star indicates the epicenter of the October 9, 2023 earthquake, and the white contour lines indicate the arrival time of the initial tsunami wave expected from the seafloor bathymetry every 10 minutes.
(Bottom) Ocean-bottom pressure waveforms (black line) at DONET (left) and S-net (right). Observation station names and water depths are shown on the right. After removing the tide, a band-pass with a passband of 100-500s was applied. The horizontal axis shows the elapsed time since the earthquake. The red line indicates the tsunami arrival time expected from the seafloor topography. The DONET waveform (blue line) from an earthquake on Torishima Island in 2015 is also compared.

Promoting worldwide NIED's advanced observation network and research

When I was an undergraduate student, I joined a seismology laboratory to study earthquakes. In March 2011, at almost the end of my undergraduate, the Tohoku Earthquake occurred. After entering the master's program, I spent most of my laboratory life taking research vessels heading to the ocean off the coast of Tohoku, where the earthquake occurred, to install and retrieve ocean-bottom seismometers and tsunami gauges and acquire the data of aftershocks. Because of this experience, I became interested in the mechanisms of massive earthquakes.

As NIED has extensive observation networks with many observation stations, we can obtain a larger amount of data from more stations than the observations like those done when I was a student. The accessibility to such a rich dataset is a significant advantage of researching at NIED. Based on my experience of the observation, it is difficult to continue the observation without missing data; therefore, I always thank and respect the people involved in the operation of observation facilities.

Another advantage of working at NIED is that it is easy to interact with researchers in Tsukuba outside NIED. Thanks to the good observation facilities and research environment, I can keep conducting good research.

02

FUNDAMENTALS

Development of Disaster Situation Analysis and Sharing System

Interview with a researcher who challenges disasters ❷

"Developing systems that rapidly identify disasters through co-creation with various sensing technologies, from earth observation satellite to consumer electronics"

Deputy Director-General
Disaster Information Research Division
TAGUCHI Hitoshi

Research Theme Satellite One-Stop System Multi-Sensing Data Continuous Damage Analysis System

"Satellite One-Stop System" to quickly grasp the disaster damage areas

Satellite imagery provides a bird's eye view of the situation in disaster-stricken areas. However, for satellite images to be used effectively in disaster response, it is essential to take pictures of the disaster area immediately after a disaster strikes when there is still little information available. Although there are restrictions on where and when images can be captured from satellites, many small commercial satellites have recently been launched, increasing the possibility of obtaining well-timed images of disaster-stricken areas.

The "Satellite One-Stop System" was developed to maximize the use of such satellites and to speed up the four-step process of (1) determining the imaging location and selecting the appropriate satellite for imaging, (2) analyzing the disaster, (3) generating information products that will help assess the damage, and (4) distributing information products through the Shared Information Platform for Disaster Management (SIP4D) and other means. We accumulated practical examples of actual disasters, such as the Heavy Rain Event of July 2020 and Typhoon Nanmadol in 2022, and are applying them to further technological development.

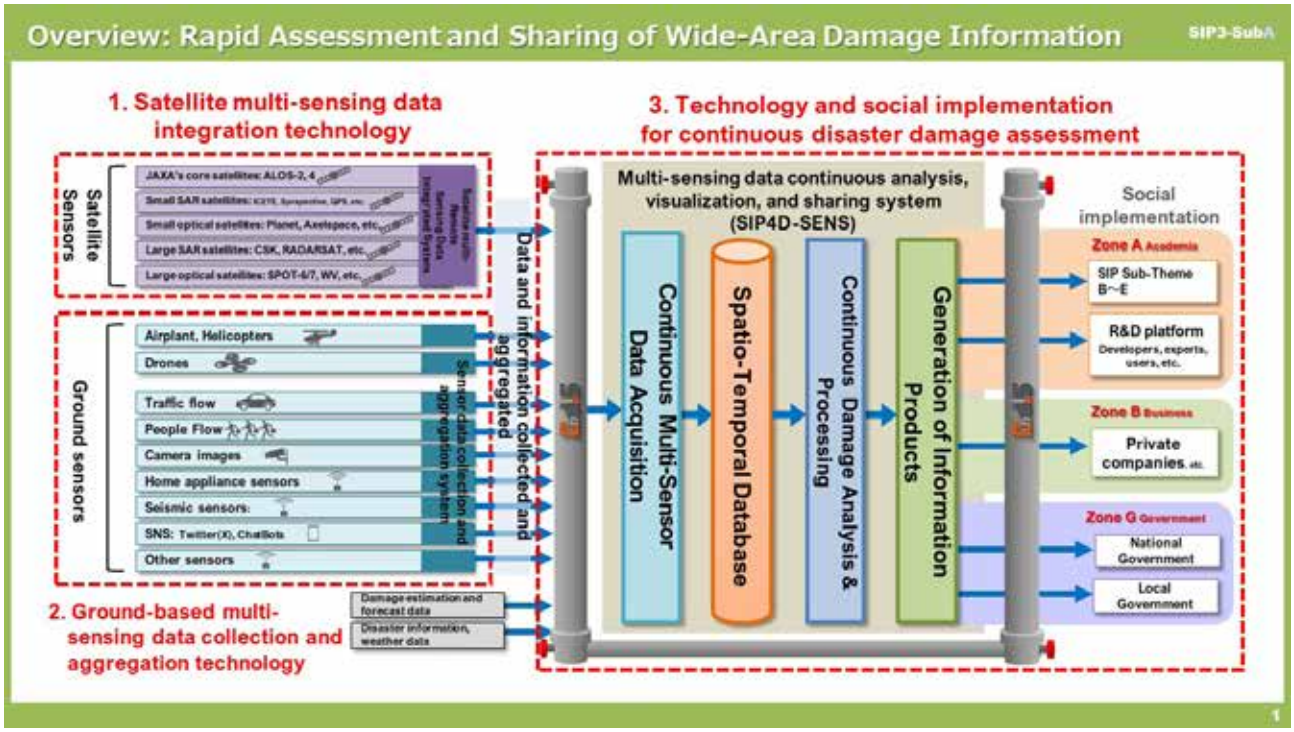
Although there are issues to be addressed, such as the establishment of a system and budget for utilizing satellite images in the event of a disaster, we are working to improve the accuracy of observations and increase the effectiveness of the system in disaster response, such as by obtaining observations within "two hours" after the occurrence of a disaster, as required by the government, to implement the system in society.

"Multi-sensing data continuous damage analysis system" that utilizes a variety of sensors such as home appliances

The "Multi-Sensing Data Continuous Damage Analysis System" is the successor project* to the Satellite One-Stop System and will be implemented from FY2023. We are developing an information system that can always know the status of damage when we want to know it by utilizing the various sensors that exist in daily life.

For example, suppose that a sensor in a home appliance detects an electricity cutoff when an earthquake occurs. In this case, a power outage or other problem may have occurred. In addition, cell phones and in-vehicle sensors can be used to monitor the flow of people and vehicles. If a road used during standard times is not used, the possibility that the road has been cut off due to flooding or heavy snowfall can be highlighted.

Disaster response personnel must be aware of the extent of damages. In addition to satellite imagery, we are currently researching the use of various sensors not limited to DRR applications. We are working on creating a system that can constantly monitor the status of disasters in real-time.



*This research is being conducted as part of Sub-theme A, " Rapid Assessment and Sharing of Wide-Area Damage Information," under the 3rd phase of the Strategic Innovation Program (SIP) " Development of a Resilient Smart Network System Against Natural Disasters" (Research Promotion Corporation: NIED) of the Council for Science, Technology and Innovation, Cabinet Office, Government of Japan.

As a national research institute, NIED promotes co-creation and aims for social implementation of the system

To develop a one-stop satellite system, we approached and collaborated with universities, research institutes, and the private sector. DRR became the representative organization for the research project, resulting in a wide range of co-creation, not only in technological development but also in joint patent applications, demonstration experiments, disaster response, and coordination of system collaboration. Collaboration with the private sector is also essential for developing a multi-sensing data continuous damage analysis system. Such collaboration, as well as a national research institute, is also necessary in research.

In addition, because NIED has a Mid-to-Long-Term Goal and Plan goal and plan, research results in line with its mission are quickly evaluated and, through external funding projects, can be evaluated as something that will be used worldwide, making it easier to implement in society. These are the advantages of conducting research at national institutions.

03 FUNDAMENTALS

Initial disaster response and disaster situation assessment

Interview with a researcher who challenges disasters ❸

"We will develop new technologies. It is essential to work in the field until they are utilized, thereby changing the future of disaster responses."

Chief Expert Researcher, Multi-hazard Risk Assessment Research Division/Head, Disaster Information Library

UCHIYAMA Shoichiro

Research Theme Drone Applications in Initial Disaster Response

Accelerating information capability by using drones to explore the disaster site

In the immediate aftermath of a disaster, firefighters and local government officials have traditionally relied on information visible from the ground. Drones can provide a bird's eye view of a situation, but flying a drone alone cannot be utilized for disaster response. Therefore, we have developed a drone disaster response solution called "GEORIS," which combines technology to systemize photographing, analyzing, and creating search support maps by overlaying other map information with an education program for personnel who can use drones in disaster response.

The "GEORIS education" program has already been implemented by the Kamaishi Fire Department, Kobe City Fire Department, Japan Ground Self-Defense Force, and other organizations to increase the number of organizations capable of autonomous, high-level disaster response from the perspectives of safe operation, spatial information science, and natural disaster science. In FY2021, we began working with private-sector organizations to expand the use of drones in disaster responses throughout Japan.

Aiming for the future of DRR, we will continue to be involved with disaster sites and communities

Even if a new tool, such as a drone, is suddenly introduced at a life-threatening disaster site, it is difficult to know how to use it and change the existing way of doing things. We focused on integrating drone technology with existing disaster response methods.

Spreading new solutions in society requires a deeper understanding of the essence of technology. In disaster response, the spirit is to know what happened quickly, safely, and reliably. Therefore, we need to understand the disaster characteristics of each region and the current state of disaster response. Then, we generate ideas for integrating new technologies with existing practices and confirm the effectiveness of the new technology through verification tests, supporting those in charge of the organization in changing the activities to date.

We need to be a companion until we can confirm the effectiveness of the new technology through demonstration and until those in charge of the organization decide to change their existing activities. This involves identifying the steps necessary for the latest technology to be utilized in disaster response and demonstrate a process that will change the future of DRR.

We are "watering" drone initiatives to make them useful in society. We believe that society will change only when all parties involved share the awareness of "creating the future" rather than simply "creating and expanding" drone technology.

A drone crew analyzes and processes images taken by the drone to create an ortho image (photomap) of the disaster area in the demonstration experiment (Courtesy of Kobe City Fire Department)

A drone surveying the damage to houses in a landslide disaster area where the risk of secondary disaster was confirmed to be low in the experiment. (Courtesy of Kobe City Fire Department)

To overcome disasters and ensure our country's survival for the next 100 years

One motivation for these efforts is the sense of crisis. In recent years, disasters caused by typhoons and torrential rains have become more severe and frequent, and national-level catastrophic disasters such as the Nankai Trough Earthquakes and earthquakes that directly hit the Tokyo metropolitan area are expected to occur. As a national research institute, NIED can work from the perspective of which technologies are helpful for Japan and how changes can improve society.

Currently, I also serve as the head of the Disaster Information Library, which archives records of disasters in various regions. People in disaster-stricken areas often say, "We have never had a disaster like this. However, it is a natural tendency for similar disasters to occur repeatedly in similar areas and under similar climates. One of the roles of NIED is to share such information widely and use it in disaster response.

I want to contribute to creating a society that can overcome future disasters and aim to build a system that seamlessly links DRR to daily life.

Engaged in basic research that will drive the co-creation of DRR science and technology

At NIED, we engage in basic research on DRR science and technology for all hazards, such as earthquakes, tsunamis, volcanic eruptions, windstorms, torrential rains, heavy snowfalls, and landslides, and all phases before and after disasters occur. Our researchers have published numerous papers, which are highly valued in various fields along with our efforts in society.

NIED's research activities, including numerous awards, have been highly evaluated in various fields.

Okada Award of the Japan Weather Association

SHIMIZU Shingo, Project Director, Research Center for National Disaster Resilience, received the Okada Award from the Japan Weather Association for his contribution to the mitigation of heavy rainfall disasters through the improvement of observation and forecasting techniques for quasi-stationary linear precipitation systems. Project Director SHIMIZU was the Principal Investigator of the "Development of a New Observation and Forecasting System for quasi-stationary linear precipitation systems " project under the Strategic Innovation Program (SIP) of the Cabinet Office, Government of Japan.

The 2022 Onuma Award of the Hokushinetsu Branch of the Japanese Society of Snow and Ice

ITO Yoichi, Chief Expert Researcher of Snow and Ice Research Division, received the 2022 Onuma Award of the Hokushinetsu Branch of the Japanese Society of Snow and Ice for his contribution to elucidating avalanches' internal structure and dynamics.

Japan Society of Civil Engineers (JSCE) Innovative Technique Award

AOI Shin, Director-General, Network Center for Earthquake, Tsunami and Volcano received the FY2021 JSCE Innovative Technique Award with his collaborators for "Development and Implementation of Earthquake Early Warning for Shinkansen Utilizing Ocean Bottom Seismometer".

The Japanese Society of Snow and Ice Technology Award 2022

ADACHI Satoru, Chief Expert Researcher of Snow and Ice Research Division, won the 2022 Technology Award from the Japanese Society of Snow and Ice for his development and application of measurement technology for wet snow samples using MRI for snow and ice."

Good JIBAN's Day Award 2022

SENNA Shigeki, Chief Expert Researcher of Multi-hazard Risk Assessment Research Division, received the Grand Award of the "Good JIBAN's Day Award 2022". This award was established by the Jibannet Holdings Co., Ltd. in 2018. SENNA developed and patented a microtremor exploration device, microtremor array exploration method, and microtremor observation system related to the "Microtremor Array Exploration Method" and is diverting the results of his research to the private sector for use in earthquake DRR.

2021 Paper Award of the Japan Association for Earthquake Engineering

SENNA Shigeki, Chief Expert Researcher of Multi-hazard Risk Assessment Research Division, earned the 2021 Paper Award of the Japan Association for Earthquake Engineering for his paper on the mechanism of zonal subsidence in Aso Caldera caused by the 2016 Kumamoto Earthquake.

Selected for Significant Contribution to Science and Technology 2022 (The Researchers with Nice Step)

KUBOTA Tatsuya, Chief Researcher, Network Center for Earthquake, Tsunami and Volcano, was selected as one of the significant contributors to Science and Technology as "NISTEP Selection 2022 (The Researchers with Nice Step)".

Best Presentation Award at the 2022 Japan Association for Earthquake Engineering Conference.

DOHI Yuji, Chief Expert Researcher of Multi-hazard Risk Assessment Research Division, was awarded the 2022 Best Presentation Award of the Japan Association for Earthquake Engineering for estimation of integrated probabilistic tsunami hazard for four ocean areas based on long-term assessment of subduction zone earthquakes - along the Chishima Trench, Japan Trench, Sagami Trough, and Nankai Trough."

The Cold Region Technology Conference Cold Region Technology Award (Scientific Award).

Director-General Nakamura Kazuki of Snow and Ice Research Center received the Cold Region Technology Award (Scientific Award) at the 38th Cold Region Technology Conference for improvement of the system for predicting surface avalanche hazard caused by low-pressure snowfall.

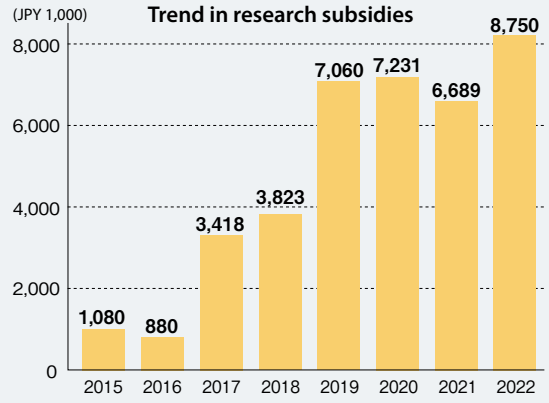
The Seismological Society of Japan Young Scientist Award

KUBOTA Tatsuya, Chief Researcher, Network Center for Earthquake, Tsunami and Volcano, received the Seismological Society of Japan Young Scientist Award 2022 for "Study on Earthquake, Tsunami, and Volcanic Phenomena Using Ocean-bottom Pressure Data Considering Solid-Fluid Coupled Earth."

NIED publishes many research results, including those attained through research subsidies.

Research Grants

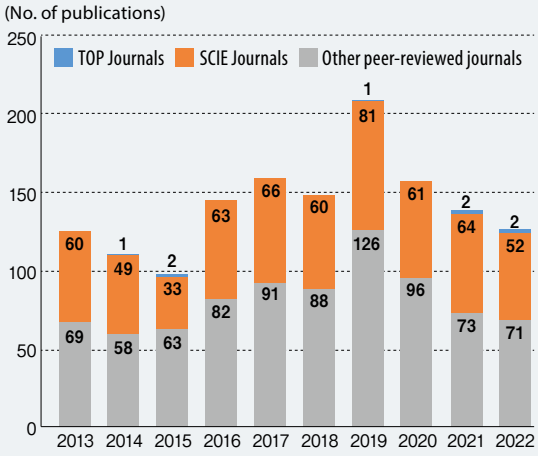
DRR's research is supported by government operation grants, commissioned research, and KAKENHI (Grants-in-Aid for Scientific Research) for Scientific Research (p.49); research grants from private organizations are also an essential funding source. In FY2022, we promoted research by utilizing grants from the Japan-Taiwan Exchange Association, the Japan Landslide Society, and other organizations.



Number of publications

Each researcher at the NIED writes approximately one paper per year. In FY2022, 125 papers will be published. A paper on a tsunami forecast system using DONET, published in JDR, will become the most-cited paper in the journal in 2022, contributing significantly to the creation of new knowledge.

Definition in this integrated report	
TOP Journals	Authoritative scientific journals such as Nature, Science, with stringent peer review, and which are said to only include only one tenth of a submitted paper.
SCIE Journals	Highly credible and strictly selected journals compiled in Web of Science
Other peer-reviewed journals	Journals not included in TOP/SCIE journals, mainly compilations of academic papers.



Creating an environment in which young researchers and other researchers can play an active role

NIED supports young researchers in improving their R&D management skills in both project execution and the gradual acquisition and execution of external funding from Grants-in-Aid for Scientific Research (KAKENHI) and other sources.

Through efforts such as (1) disseminating information on open competitions that match the research content, (2) discussing the direction of research and development with researchers, (3) providing consultation before applying, (4) briefing sessions on the external funding system, (5) correcting applications for external funding by external experts, in-house researchers, and administrative staff, and (6) exchanging opinions with young researchers, we encourage academic research by individual researchers while also providing support to the creation and development of excellent scientific technology. Through these efforts, we will strive to build a resilient society by creating superior DRR science and technology while encouraging academic research by individual researchers.

NIED continues to evolve, both as a core DRR institute for science and technology for DRR and as a hub for co-creation

Leaning lessons from many past disasters in Japan and in order to rebound from coming disasters, NIED has expanded the scope of its research to encompass hazard prediction to prevention, response and recovery. In future, NIED will continue to lead the development of science and technology for DRR through cross-disciplinary co-creation between natural sciences, engineering and social science.

1959 Ise Bay Typhoon

The Ise Bay Typhoon can legitimately be described as Japan's worst flooding disaster in history, causing catastrophic damage including 5,098 fatalities/missing persons, 40,862 houses destroyed or washed away, 113,068 partially destroyed houses and 363,611 inundated houses.

Jan. 1963 – Showa 38 Heavy Snow –
Apr. 1963 National Research Center for Disaster Prevention (NRCDP) established as a national research institute under the jurisdiction of the Science and Technology Agency [Ginza, Tokyo]
Jun. 1964 – Niigata Earthquake –
Dec. 1964 Institute of Snow and Ice Studies established [Nagaoka]
Aug. 1965 Marine Observation Tower completed [Hiratsuka]
Jun. 1967 Strong Motion Earthquake Observation Council established
Jun. 1967 Hiratsuka branch established
Oct. 1969 Shinjo branch established
Jun. 1970 Large-scale Earthquake Simulator completed (The first research facility in Tsukuba Science City)
Mar. 1973 Iwatsuki Crustal Activity Observatory completed
Mar. 1974 Large-scale Rainfall Simulator completed
Apr. 1978 HQs of NRCDP moved from Tokyo to Tsukuba Science City
Mar. 1984 Kanto and Tokai Crustal Activity Observation Network formed
Mar. 1988 Doppler Radar completed
Jun. 1990 Institute's name changed to "National Research Institute for Earth Science and Disaster Prevention"

As a National Research Institute

1963 Research institute established

Triggered by the damage inflicted by the Ise Bay Typhoon, National Research Center for Disaster Prevention (NRCDP), the predecessor to NIED, was established as an institute for researching science and technology for DRR.

Mar. 1996 Sagami-Bay Sea Bottom Earthquake Observatory completed
Jun. 1996 Operation of K-NET (Kyoshin Network) started
Mar. 1997 Cryospheric Environment Simulator completed [Shinjo]
Apr. 1997 Construction of Hi-net (High Sensitivity Seismograph Network Japan), KiK-net (Kiban Kyoshin Network), and F-net (Full Range Seismograph Network of Japan) started
Mar. 2000 Multi-parameter radar system completed
Jan. 2001 Jurisdiction of NIED changed to MEXT after reorganization of the ministries

1995 Southern Hyogo Prefecture Earthquake (Great Hanshin-Awaji Earthquake)

In response to the Great Hanshin-Awaji Earthquake, as a new initiative in the fields of natural science and engineering, NIED began construction of the fundamental earthquake observation network and the E-Defense (3-D Full-Scale Earthquake Testing Facility).

E-Defense
(3-D Full-Scale Earthquake Testing Facility)

2011 Great East Japan Earthquake

Following the Great East Japan Earthquake disaster triggered by the 2011 off the Pacific Coast of Tōhoku Earthquake, NIED constructed Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net).

Ocean area from off the coast of Hokkaido to Boso Peninsula

Observation units of S-net

Apr. 2001 Independent Administrative Agency NIED established
Earthquake Disaster Mitigation Research Center (EDM) transferred to NIED from RIKEN [Miki]
The 1st mid-term objectives and plan launched

Oct. 2002 Kawasaki Laboratory established as an additional branch of EDM [Kawasaki]

Apr. 2003 EDM moved to Kobe

Oct. 2004 Hyogo Earthquake Engineering Research Center [Miki]

Apr. 2005 Operation of Three-Dimensional Full-Scale Earthquake Testing Facility (E-Defense) started [Miki]

As an Independent Administrative Agency

Apr. 2006 The 2nd mid-term objectives and plan launched

Mar. 2007 Kawasaki Laboratory closed down

Mar. 2008 Marine Observation Tower at Hiratsuka Experiment Station closed down

Apr. 2010 Operation of V-net (The Fundamental Volcano Observation Network) started

Mar. 2011 EDM closed down

Apr. 2011 The 3rd mid-term objectives and plan launched

Aug. 2011 Construction of S-net (Seafloor observation network for earthquakes and tsunamis along the Japan Trench) started

Apr. 2013 Snow and Ice Research Center reorganized (Shinjo branch changed to Shinjo Cryospheric Environment Laboratory)

Sep. 2014 — Mt. Ontake erupted —

Oct. 2014 Research Center for Reinforcement of Resilient Function established

Apr. 2015 Institute's name changed to National Research Institute for Earth Science and Disaster Resilience

Apr. 2016 - The 4th mid- and long-term objectives and plan launched
- Innovation Center for Meteorological Disaster Mitigation established
- Center for Integrated Volcano Research established
- DONET (Dense Oceanfloor Network system for Earthquakes and Tsunamis) transferred to NIED from JAMSTEC

Apr. 2017 Research Center for Enhancing Metropolitan Resilience established

Nov. 2017 Integrated operation of Monitoring of Waves on Land and Seafloor (MOWLAS) began

Apr. 2018 SIP Program Management Office established

Dec. 2018 Research Center for National Disaster Resilience established

Feb. 2019 - Construction of Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net) started
- Announcemnt of NIED's Identity

Apr. 2019 Headquarters of Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis established

Jul. 2020 Headquarters of Innovation Co-Creation established

Nov. 2021 I-Resilience Corporation established as a joint venture company

Oct. 2023 Establishment of Collaborative Research Center for Advanced Resilience Technology

As a National Research and Development Agency

2016 Kumamoto Earthquake

At the Kumamoto Earthquake Onsite Disaster Management Headquarters, the Shared Information Platform for Disaster Management (SIP4D) was used for the first time ever by utilizing the results of R&D for DRR in the field of social science. These activities subsequently led into ISUT (Information Support Team).

Governance and compliance for NIED

NIED is one of the National Research and Development Agencies whose purpose is to improve science and technology by conducting primary and fundamental research and development on DRR science and technology, following the seven-year mid-to-long-term goals set by the competent minister (Minister of Education, Culture, Sports, Science, and Technology). Under the decision-making system of the President, whom the competent minister appoints, an Executive Vice President assists the President, and a General Auditor, whom the same minister appoints, audits the corporation's operations. Internal controls are established as part of governance under this structure, whereby, under the president, duties are conducted by observing laws and ordinances based on Mid-to-Long-Term Goals and systems put in place for efficient and practical achievement of NIED's mission as a national research and development agency.

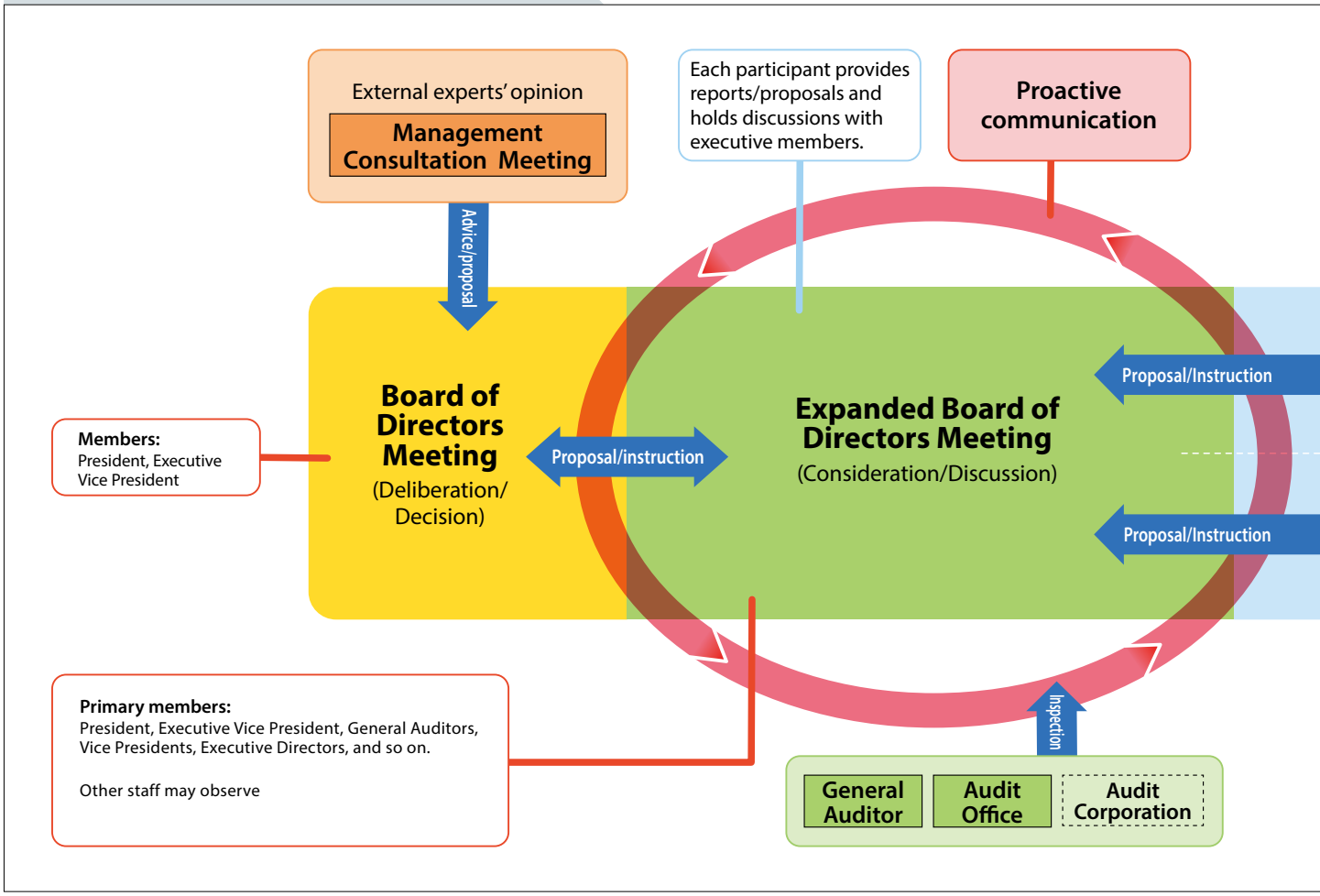
Initiatives and operations for governance

NIED establishes a management system under which the Strategic Planning Department, General Affairs Department, Basic research divisions, and Fundamental R&D centers are established. Headquarters and offices under the president's direct supervision were established under this system. (Refer to the organizational diagram of P56).

Furthermore, in addition to holding regular meetings with the board of directors, NIED convenes management consultation meetings with external experts and liaison coordination meetings to coordinate items related to business operations and various committees to deliberate matters of high importance.

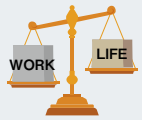
In addition, the "Opinion Exchange between the President and Staff" is held for interactive communication between the President and staff. The budget allocation hearings are held to promote various projects, thereby ensuring appropriate management.

Initiatives and operations for governance at NIED



Internal Control and Compliance Initiatives

Under the President's leadership, NIED's direction and mission are thoroughly communicated and unified, and awareness is raised to maximize R&D results. In addition, through the expanded board of directors meetings, the status of the execution of the institute's operations was monitored, and the intentions and instructions regarding internal control and compliance initiatives were shared. In addition to identifying and flexibly addressing risks in organizational processes, internal and General Auditor audits are conducted, and advice is provided to the President and others on business operations.



Promotion of Health Management

- Declaration of promotion of health management in January 2021
- Appointment of health promotion leaders in each department and regular meetings
- Enhancing training to improve health literacy

Realization of a comfortable work environment

- Institutionalization of teleworking
- Introduction of web conference and business chat tools
- Promotion of paperless conferences and development of systems for this purpose
- Review of work procedures, efficiency improvement, and countermeasures against the decline in camaraderie and cooperativeness

Promotion of Branding

- Develop public relations and branding promotion plan
- Create integrated report
- Strengthen internal branding

Promotion of "visualization"

- Utilize time and attendance management systems, safety confirmation systems, financial accounting systems, business support systems, etc.
- Promote visualization of budget execution, budget allocation policies, individual schedules, etc.
- Started full-scale operation of NISE (Researcher Information System), which is helpful for visualization of research achievements.

Effective promotion of risk management and compliance

- Implementation of the PDCA cycle based on the risk management plan
- Review and enhancement of prevention plan for unauthorized use of public research funds
- Implementation of organizational conflict of interest management
- Establishment of an ethical review system for research involving human subjects
- Performance of periodic compliance awareness-raising activities such as training and awareness surveys

Each department
(Consideration/ Coordination/ Preparation of draft)

- Strategic Planning Department
- General Affairs Department
- Basic research divisions
- Fundamental R&D centers

Liaison and Coordination Meeting
(Consideration/Coordination/ Preparation of draft)

Each committee
(Consideration/ Coordination/ Preparation of draft)

- Risk Management Committee
- Crisis Management Exploratory Committee
- Personnel Committee
- Health and Safety Committee
- Contract Review Committee, etc.

Taking into consideration of important matters for operational administration based on relevant regulations of each committee to make recommendations based on the results. Functions as secretariat in response to draft plans from each section.

Board of Directors Meetings and Expanded Board of Directors Meetings

The meeting is held regularly to hold deliberations and make decisions for essential items related to basic operational policy and business execution, as well as for crucial matters requiring decisions by management. Furthermore, an Expanded Board of Directors Meeting is held for an in-depth discussion on items placed on the agenda at Board of Directors Meetings and for significant matters regarding the management of NIED.

Management Consultation Meeting

By convening management consultation meetings composed of external experts, NIED can obtain exterior recommendations and proposals from objective, specialist, and wide-ranging perspectives. As well as using these to grasp operational business issues and to deliberate solutions,NIED is committed to bringing a higher level of efficiency and transparency of operations.

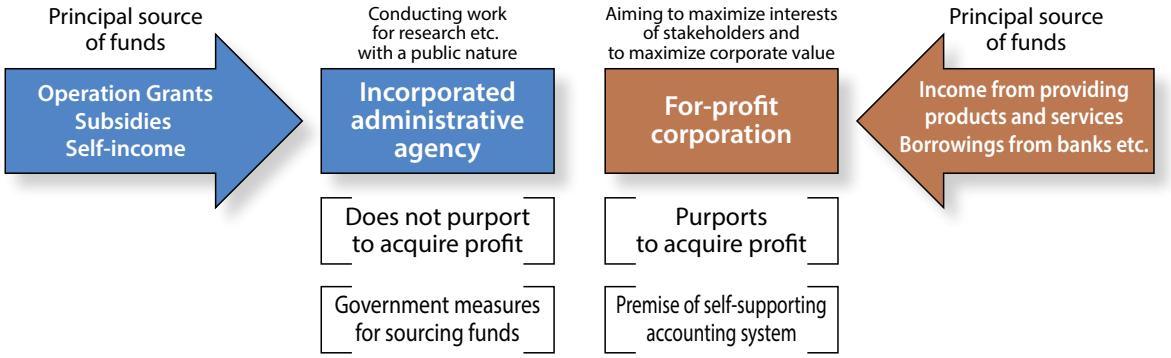
Liaison and Coordination Meeting

This meeting is held monthly to share awareness of issues among administrative and research divisions. We use it to communicate and coordinate the smooth execution of the Institute's work necessary to achieve the Mid-to-Long-Term Plan and to share and exchange views on NIED's future role and awareness of issues to improve our work.

Accounting system for Incorporated Administrative Agencies

Accounting is different from a for-profit enterprise, emphasizing publicness

National Research and Development Agency is an incorporated administrative agency that carries out business/work with a public element, does not pursue profit as an objective, and does not presuppose a self-supporting accounting system, such as a for-profit enterprise or a joint-stock corporation. Thus, while it conforms to corporate accounting principles, its accounting differs from that of a for-profit enterprise.



Formulating a system for profit and loss equilibrium

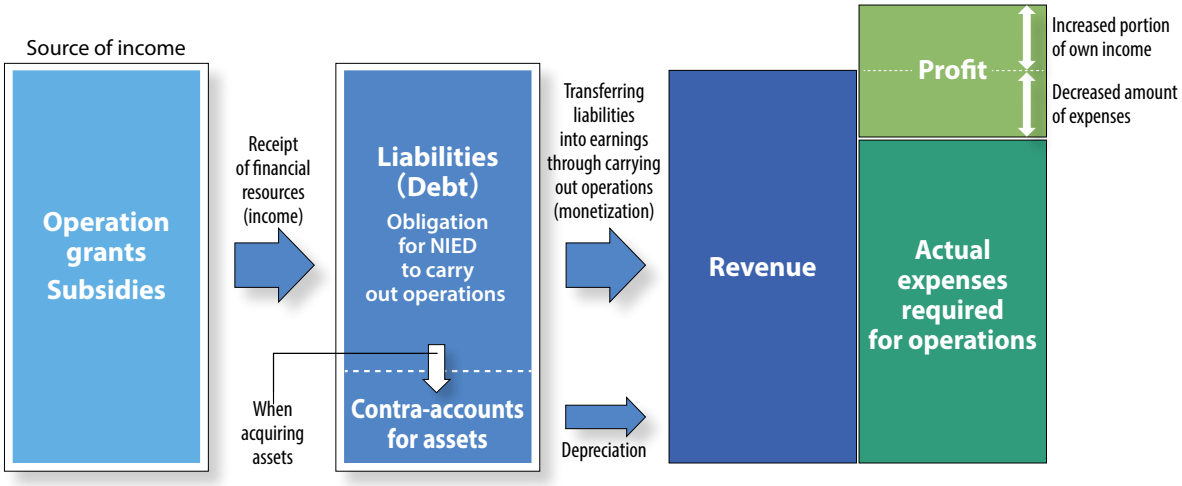
Because National Research and Development Agencies are public, do not aim to make a profit, and do not presuppose a self-supporting accounting system in terms of the relationship between financing measures such as operation grants and subsidies, in principle, a system is formulated to ensure profit and loss equilibrium.

For example, when operation grants or subsidies are received, NIED deems it responsible for implementing a project and books this as a liability (debt). Then, by implementing projects using these as a financial source, it is deemed that the obligation has been fulfilled, and accounting is processed to transfer liabilities into earnings.

Similarly, in cases where NIED has acquired assets using operation grants and subsidies as financial sources, they are transferred to contra-accounts for assets, and by taking away the same amount consequent to depreciation costs and transferring liabilities into earnings, profit and loss are balanced out.

In addition, profits are generated in cases where costs are curtailed through increased self-income and management efforts, including cost reduction. A portion of the profit approved by the Minister of Education, Culture, Sports, Science and Technology can be used in the following fiscal year.

Accounting flow for incorporated administrative agency

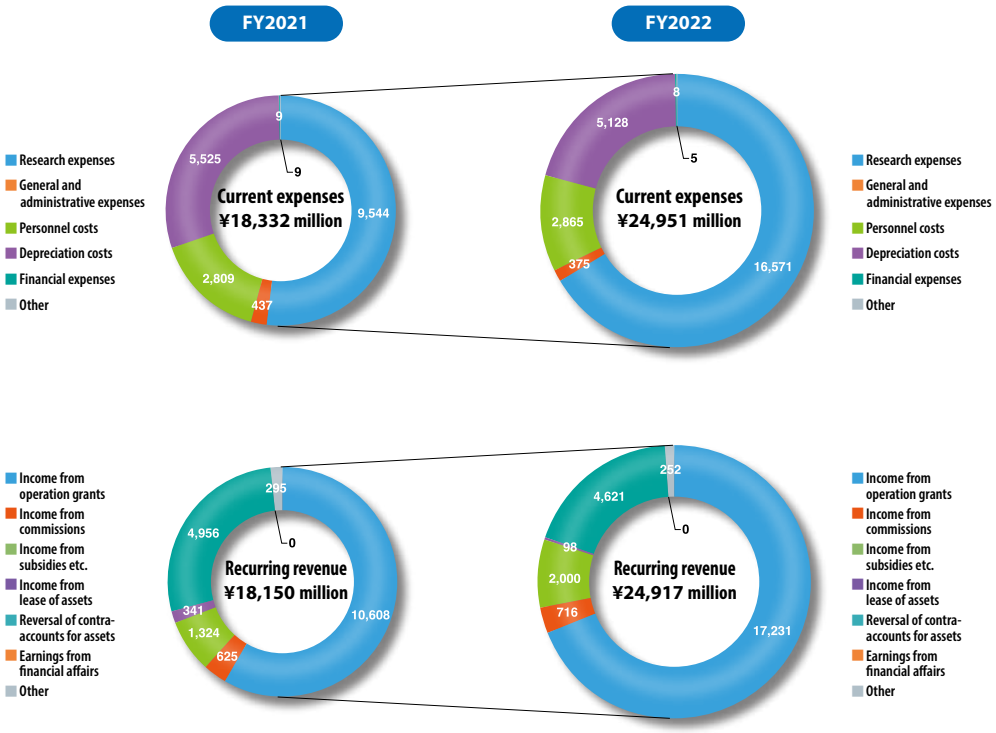


Expenses and Revenues

This section compares the amounts of expenses and revenues for FY2021 and FY2022.

In terms of expenses, they totaled 24,951 million yen, an increase of 6,619 million yen from the end of the previous fiscal year. This is mainly due to the rise in expenses for the "Strengthening National Resilience (Disaster Prevention and Mitigation)," one of the tasks of the second phase of the Strategic Innovation Program (SIP) of the Cabinet Office, for which NIED serves as the Agency Managed.

In terms of revenue, 24,917 million yen was recorded, an increase of 6,767 million yen from the end of the previous fiscal year. This was mainly due to an increase in operation grant income due to increased expenditures financed by the operation grant due to the SIP Phase 2 commission fee.



Status of major costs (FY2022)

NIED has set up three segments for each group of projects: "promotion of R&D," "formation of a core institution," and "corporate common activities. "The figures reported in the financial statements are disclosed on a segment-by-segment basis.

Promotion of R&D (¥4.98 billion)

The item covers costs for the following nine projects.

- Advanced earthquake and tsunami forecasting technologies project
- Research on mega earthquake generation process
- Research on multidisciplinary evaluation of volcanic activity
- Research and development to enhance the resilience of social infrastructure
- Developing technology to predict water-related disasters based on multi-sensing
- Research on combining risk monitoring and forecasting technologies for mitigation of increasingly diverse snow disaster
- Research on hazard and risk assessment
- Research for the effective creation, distribution, and usage/application technologies of disaster information
- Research on the scientific clarification of disaster processes and effective disaster management

Formation of a core institute (¥ 19.10 billion)

The item covers costs for the following six projects, which expedite the strengthening of NIED's function as a core institute for innovation in science and technology for DRR.

- Promotion of industry-academia-the government cooperation as a core institute
- Operation/promotion of joint usage of observation networks/experimental facilities/information infrastructure
- Contribution to DRR governance
- Operation/promotion of joint usage of observation networks/experimental facilities/information infrastructure
- Contribution to DRR governance
- Global expansion of R&D
- Human resource development
- Dissemination of R&D results/facilitating use of intellectual property

Corporate Common (¥871 million)

The item covers expenses for administrative departments such as the General Affairs Department.

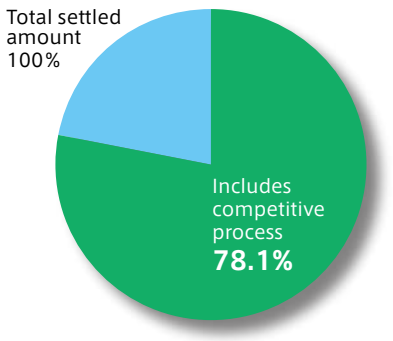
Main income sources (FY2022)

In addition to operation grant from the government, NIED is operated through income from commissions and income from leasing facilities, as well as self-income including income from patents.

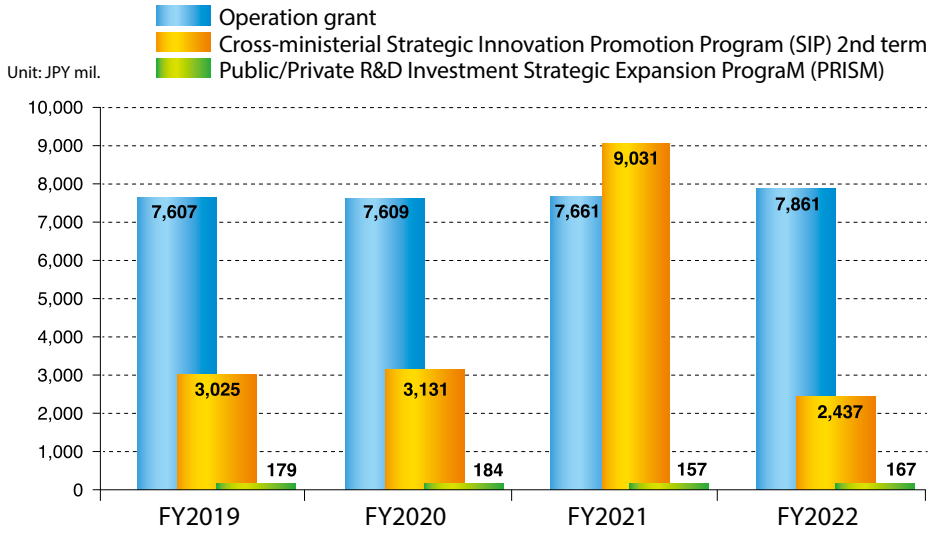
The majority of income from commissions comes from funds acquired following a competitive process

The bulk of income from commissions for FY2022 was obtained through competitive processes screened by government agencies, fund distribution organizations, and foundations. The ratio of income obtained through competitive processes is 78.1%.

Ratio of income from commissions obtained through competitive process



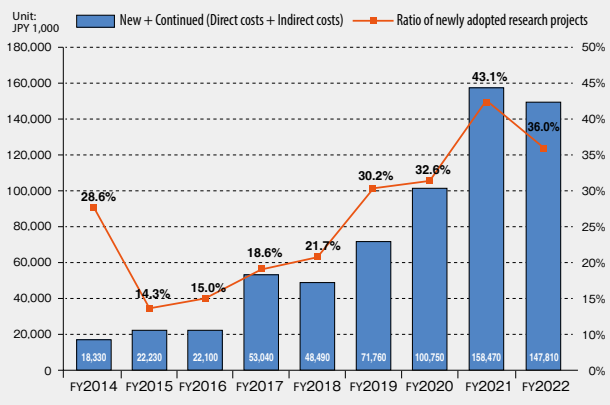
Transition of operation grant



Grants-in-Aid for Scientific Research" which is not shown in the financial statements

KAKENHI (Grants-in-Aid for Scientific Research) is a "competitive research fund" for research development, and the Ministry of Education, Culture, Sports, Science and Technology grants original and pioneering research. Grants-in-Aid for Scientific Research are treated as deposits and, therefore, do not appear on financial statements. As a result of the efforts made to obtain Grants-in-Aid for Scientific Research in the Mid-to-Long-Term Plan starting in FY2016, the rate of new grant applications in recent years has been much higher than the national average*1, and the rate of new applications in FY2022 was 36.0%.

Transition of amount of KAKENHI acquired

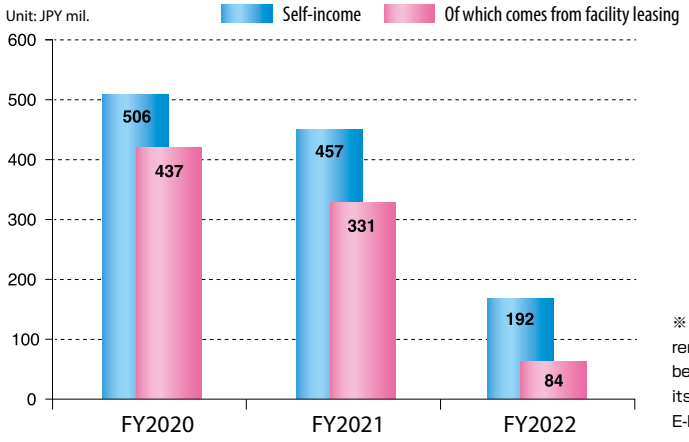


*1 The national average rate of new grant applications in FY2022 was 28.6%.

Majority of self-income is made up of income from leasing facilities.

The majority of NIED's self-income comes almost entirely from the leasing of facilities.

Transition of self-income together with income from leasing facilities



※ In FY2021 and 2022, rental income was low because NIED conducted its own experiments at E-Defense.

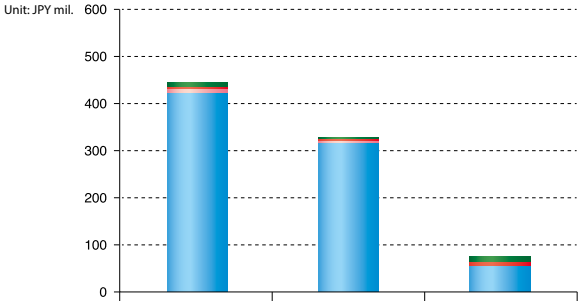
Income from leasing facilities

NIED promotes the use and application of its advanced research facilities.

In terms of leasing income by facility, E-Defense (three-dimensional full-scale earthquake testing facility) acquires the most amount of self-income, playing an instrumental role in assessing housing and industrial infrastructure. NIED is similarly actively promoting the use and application of other facilities.

E-Defense (Hyogo)

Transition of leasing income by facility



	FY2020	FY2021	FY2022
Cryospheric Environment Simulator	8	2	13
Large-scale Rainfall Simulator	4	5	9
Large-scale Earthquake Simulator	8	4	0
E-Defense	417	319	62
Total	**437** (mil.)	**330** (mil.)	**84** (mil.)

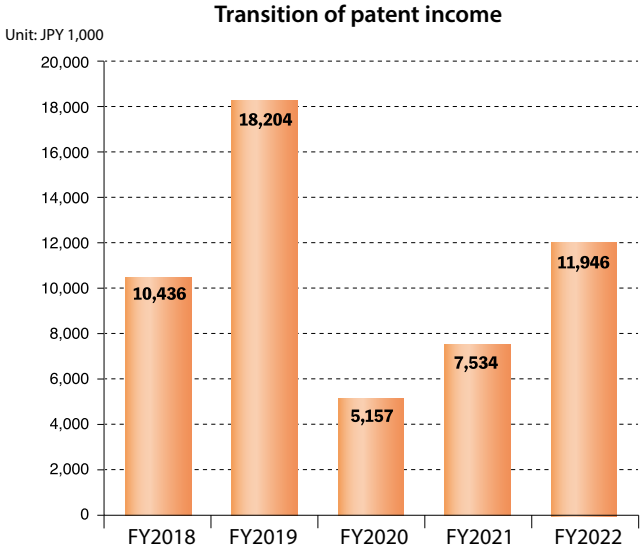
* IIn FY2021 and 2022, rental income was low because NIED conducted its own experiments at E-Defense.
* Related to rounding off of fractions, total amount does not match total income from leasing facilities.

Patent Income

NIED promotes the utilization of research results and steadily generate patent-related income.

In recent years, NIED has been steadily generating patent-related income. This is mainly due to the fact that our patents on microtremor observation and real-time seismic intensity measurement are being utilized by several private companies.

Transition of patent income



Balance Sheet

The balance sheet is a report that shows the balances of all the corporation's assets, liabilities, and net assets to clarify its financial position at the end of the accounting period (March 31).

(1) Assets are the essential property for conducting business. The balance at the end of FY2022 was 67,636 million yen, a decrease of 7,844 million yen from the end of the previous fiscal year. This is mainly due to the depreciation of research assets developed with funds from operation grants and subsidies.

(2)The amount of "Liabilities" is the portion of the financial resources granted to implement a project that has not yet been implemented (debt) or an obligation to provide certain assets or services to others. In NIED, the main contents are the balance of operation grants and subsidies that have been carried over to the next fiscal year due to the flexible execution of projects to achieve higher results by the progress of research and development and liabilities in anticipation of assets recorded by the profit-and-loss mechanism.The balance at the end of FY2022 was 32,690 million yen, a decrease of 6,941 million yen from the end of the previous fiscal year. This is mainly due to decreased depreciation of research assets (liabilities instead of assets), which were funded by operation grants, subsidies, and other sources.

(3)Net assets are the sum of the amount invested by investors and profits generated from the organization's activities. The balance at the end of FY2022 was 34,946 million yen, a decrease of 902 million yen from the end of the last fiscal year. Although there was an increase due to the acquisition of research assets developed with subsidies for facility improvement, the balance has decreased due to the depreciation of research assets developed.

Balance Sheet (Indicates financial situation as of settlement day (3/31)) (Unit: JPY1,000)

	FY2021	FY2022	Increase (Decrease)
1. Assets	75,479,642	67,635,991	(7,843,650)
I Current Assets	10,902,725	5,214,983	(5,687,742)
Cash and deposits	10,631,269	4,932,745	(5,698,524)
Uncompleted commissioned research disbursements	17,818	26,051	8,233
Prepayment	4,650	0	(4,650)
Prepaid expenses	12,575	0	(12,575)
Account receivable	164,660	179,322	14,662
Contra-accounts for bonus reserves	71,753	76,865	5,112
II Fixed Assets	64,576,916	62,421,009	(2,155,908)
1.Tangible fixed assets	63,661,521	61,571,314	(2,090,207)
Buildings	9,837,092	9,409,057	(428,035)
Structures	16,542,609	12,704,981	(3,837,629)
Machinery	5,754,078	4,967,240	(786,838)
Motor vehicles and transport equipment	3,468	2,436	(1,032)
Tools, equipment and fixtures	4,742,861	5,023,486	280,625
Land	17,839,565	17,839,565	0
Construction in progress	8,941,847	11,624,549	2,682,702
(Depreciation amount for current term)	8,361,682	6,979,227	(1,382,455)
(Impairment loss for current term)	0	0	0
2.Intangible fixed assets	288,554	240,588	(47,966)
Patent rights	11,320	14,747	3,428
(Depreciation amount for current term)	2,600	2,879	280
Trademark rights	7,317	6,289	1,028
(Depreciation amount for current term)	876	1,028	152
Telephone subscription right	4,916	4,160	(756)
Software	232,291	184,463	(47,828)
(Depreciation amount for current term)	148,766	117,064	(31,702)
(Impairment loss for current term)	0	0	0
Intellectual property rights in progress	11,794	8,568	(3,226)
Software in progress	20,917	22,362	1,444
3.Investments, other assets	626,841	609,107	(17,735)
Shares of affiliate	16,328	16,759	431
Long-term prepaid expenses	0	0	0
Deposits	3,300	0	(3,300)
(Depreciation amount for current term)	0	0	0
Money on deposit	74	74	0
Contra-liabilities for retirement benefit reserves	607,139	592,273	(14,866)

(Unit: JPY1,000)

	FY2021	FY2022	Increase (Decrease)
2. Liabilities	39,631,709	32,690,350	(6,941,359)
I Current liabilities	11,200,063	5,393,811	(5,806,251)
Operating expenses grants liabilities	7,580,709	0	(7,580,709)
Received facilities costs	13,317	8,306	(5,011)
Received subsidies etc.	9,625	87,219	77,594
Received donations	22,398	31,355	8,957
Arrears	3,032,717	4,779,726	1,747,009
Advance received	66,872	49,457	(17,415)
Withholdings	72,332	49,721	(22,611)
Bonus allowances	71,753	76,865	5,112
Short-term lease debt	330,340	311,162	(19,177)
II Fixed liabilities	28,431,646	27,296,538	(1,135,108)
Contra-accounts for assets	27,336,397	26,485,326	(851,071)
Assets funded by operational grants	2,282,264	2,481,801	199,537
Encumbrance for assets-subsidy for operation	12,474,405	9,829,002	(2,645,403)
Encumbrance for assets donated	3,609,053	2,531,310	(1,077,743)
Assets funded by donations	28,827	31,051	2,223
Construction in progress funded by operational grants	8,473	3,717	(4,756)
Construction in progress funded by subsidies for facilities	809	0	(809)
Construction in progress funded by subsidies	8,932,566	11,606,642	2,674,076
Construction in progress funded by donations	0	1,804	1,804
Reserves for retirement benefits	607,139	592,273	(14,866)
Long-term deposited donations	10,000	18,000	8,000
Long-term lease debts	478,111	200,939	(277,172)
3. Net Assets	35,847,933	34,945,642	(902,291)
I Capital stick			
Government investment	58,902,885	58,902,885	0
II Capital surplus	(23,713,031)	(24,581,299)	(868,268)
Capital surplus	63,484,030	64,586,772	1,102,742
Accumulated amount for other administration costs	(87,197,061)	(89,168,071)	(1,971,010)
Accumulated depreciation amount	(78,302,002)	(80,124,353)	(1,822,351)
Accumulated impairment loss	(261,090)	(225,404)	35,686
Accumulated difference in retired and disposed assets	(8,633,969)	(8,818,314)	(184,345)
III Retained earnings	658,079	623,947	(34,132)
Reserve fund carried over from the previous mid-term objectives period	433,349	326,027	(107,322)
Reserves	299,504	224,730	(74,775)
Unappropriated retained earnings (minus is total loss for current period)	(74,775)	73,190	147,965
IV Valuation and translation adjustments	0	109	109
Valuation difference on stocks of subsidiaries and affiliates	0	109	109

Statement of Administrative Costs

The Statement of Administrative Costs is a report that presents "administrative costs" (i.e., costs incurred to produce business results) (input information) in comparison with business results (output information) from the perspective of providing information that contributes to the appropriate evaluation of the performance of independent administrative agencies.

In addition to the costs on the income statement, other administrative costs include depreciation equivalents of depreciable assets that are not shown on the income statement but are subject to "Article 87 Accounting for Costs Associated with Specific Assets" (*).

Account statement for administrative costs (From April 1, 2022 to March 31, 2023) (Unit: JPY)

Ⅰ Costs on Profit and Loss Statement		
Research expenses	24,068,890,100	
General and administrative expenses	869,953,643	
Financial expenses	7,610,718	
Miscellaneous losses	5,016,813	
Total costs on Profit and Loss Statement		24,951,471,274
Ⅱ Other Administrative Costs		
Depreciation amount	1,969,030,133	
Sales and retirement difference amount	1,979,623	
Total other administrative costs		1,971,009,756
Ⅲ Administrative costs		26,922,481,030

Income Statement

The income statement is a report that shows research activity expenses (costs) and the financial resources (income) available to them to clarify the status of operations during the accounting period (April 1 to March 31).

(1) Ordinary expenses totaled 24,951 million yen, an increase of 6,619 million yen from the end of the previous fiscal year. This increase is mainly due to increased outsourcing expenses financed by the operation grant.

(2) Ordinary income totaled 24,917 million yen, an increase of 6,768 million yen from the end of the previous fiscal year. This increase was mainly due to a rise in operation grant income, which was accompanied by an increase in expenditures financed by the operation grant.

Statement of Income (to clarify operational circumstances for the relevant FY)

(Unit: JPY1,000)

	FY2021	FY2022	Increase (Decrease)
1. Current expenses	18,332,402	24,951,471	6,619,070
Research expenses	17,422,167	24,068,890	6,646,723
Personnel expenses	2,277,165	2,272,792	(4,373)
Business consignment expenses	7,372,548	13,226,659	5,854,111
Communications expenses	963,936	985,550	21,614
Depreciation	5,499,774	5,103,622	(396,152)
Provision for bonuses	58,690	63,244	4,554
Retirement benefit expenses	42,663	58,431	15,768
Expenses	1,207,391	2,358,592	1,151,201
General and administrative expenses	891,621	869,954	(21,668)
Personnel expenses	413,690	442,282	28,593
Business consignment expenses	169,677	177,318	7,642
Communications expenses	3,177	3,182	5
Taxes and dues	68,447	926	(67,521)
Depreciation	24,872	24,540	(331)
Provision for bonuses	13,063	13,621	557
Retirement benefit expenses	3,357	14,265	10,908
Expenses	195,340	193,819	(1,520)
Financial expenses	9,304	7,611	(1,693)
Interest paid	8,982	7,611	(1,371)
Loss on valuation of shares of subsidiaries and associates	322	0	(322)
Miscellaneous losses	9,309	5,017	(4,292)

	FY2021	FY2022	Increase (Decrease)
2. Recurring revenue	18,149,712	24,917,339	6,767,627
Revenue from operating expense grants	10,607,788	17,230,562	6,622,774
Government commissioned income	293,443	332,498	39,055
Other commissioned income	331,907	383,293	51,386
Subsidies for facilities	35,080	147,736	112,657
Revenue from subsidies etc.	1,288,889	1,851,994	563,105
Revenue from donations	317	1,770	1,453
Revenue related to contra-accounts for bonus reserves	71,753	76,865	5,112
Revenue related to contra-accounts for retirement benefit reserves	46,020	72,696	26,676
Reversal of contra-accounts for assets	4,956,324	4,620,761	(335,562)
Property leasing income	340,987	97,970	(243,017)
Financial income	0	322	322
Income from reversal of loss of valuation on stocks of subsidiaries and affiliates	0	322	322
Miscellaneous income	177,205	100,871	(76,334)
(Recurring profit (Loss))	(182,689)	(34,132)	148,557
3. Current net income (Loss)	(182,689)	(34,132)	148,557
4. Reversal of reserve fund carried overfrom the previous mid-term objectives period	107,915	107,322	(592)
5. Current gross income (Loss)	(74,775)	73,190	147,965

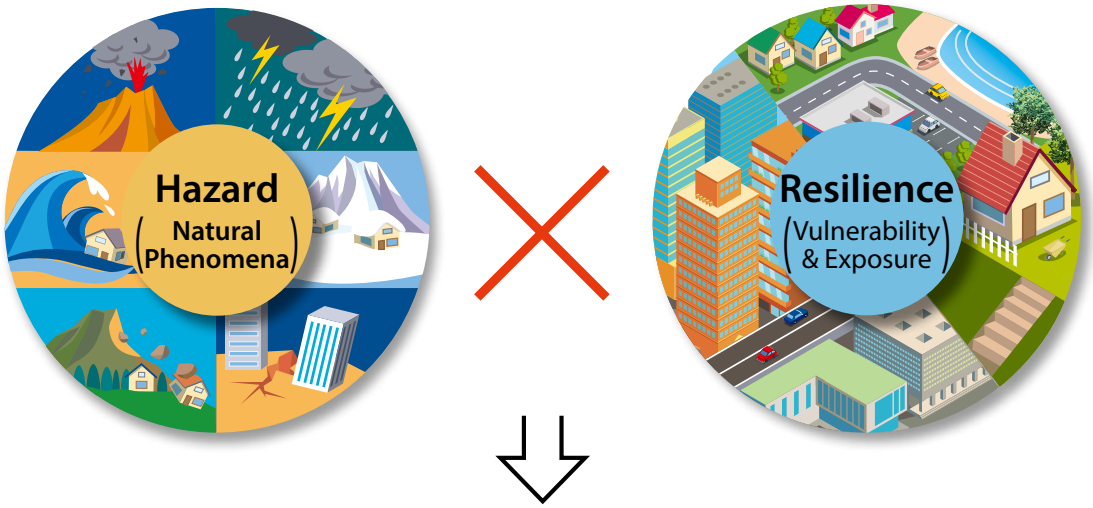
For a deeper understanding of NIED's activities.

"Disaster"

Phenomena that occur at the intersection of hazards (natural phenomena) and the disaster resilience of society.

The word "disaster" tends to conjure up a threat from actual hazards (natural phenomena) such as earthquakes, tsunami, volcanos, violent winds, torrential rains, snowstorms, typhoons, landslides and so on. However, the amount of damage that these hazards cause (becoming a disaster) depends enormously on the level of disaster resilience of society. This is why NIED promotes research on both hazards and the disaster resilience of society.

Even for the same hazard(natural phenomena), the amount of damage differs greatly depending on the disaster resilience of society.



Disaster

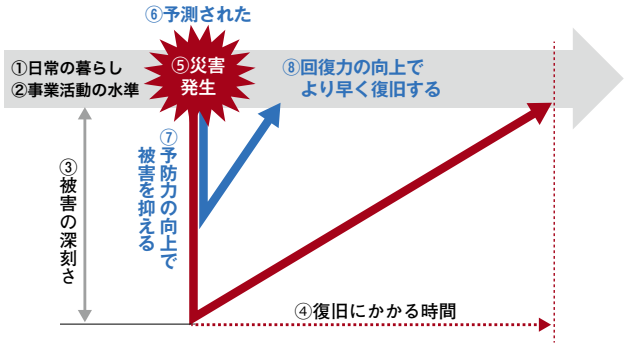
Damage is sustained when the hazard overwhelms the disaster resilience of society. The scale of the "disaster" largely depends on the disaster resilience of society.

“Resilience”

Comprehensive resilience encompassing prediction/prevention capabilities with recovery strength.

In order that livelihoods are not devastated by the threat of natural hazards, it is vital to approach disasters both from the aspect of “damage prevention and mitigation to the absolute minimum (prevention capability)”, and “swift recovery” after the disaster has occurred (recovery strength).

The comprehensive actions will enhance “resilience”.



① Daily life
② Business activities
③ Severity of disaster
④ Time required for recovery
⑤ Disaster occurs
⑥ Predicted
⑦ Mitigating damage by enhancing prevention capability
⑧ More swift recovery through improving recovery strength

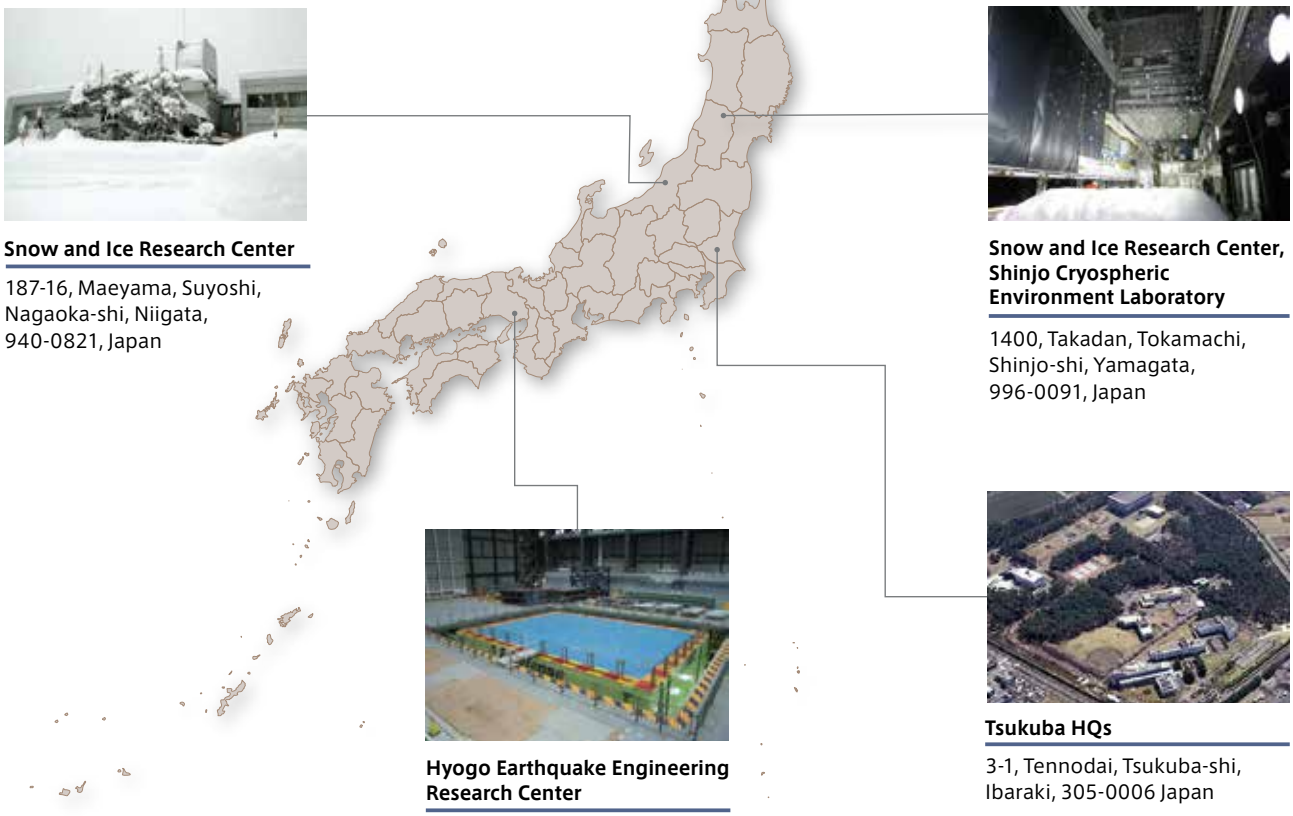
Innovation in Earth Science and Disaster Resilience

OVERVIEW [Institute Information]

Facts

Institute name	**National Research Institute for Earth Science and Disaster Resilience**
Abbreviation	**NIED**
Board members As of December 2023	**President : TAKARA Kaoru** **Executive Vice President : ASO Takayuki** **General Auditor : KOSUGI Kenji, JINNO Norie** (part-time) ※ FY2022 President : HAYASHI Haruo Executive Vice President : ANDO Yoshiaki General Auditor : SATO Takeshi, JINNO Norie (part-time)
Employees	**343** (including 163 researchers, 180 clerical staff) **As of March 31, 2023** (FY2022)
Annual budget	**7.86 billion yen** (Operation grant) FY2022
Jurisdiction	**Ministry of Education, Culture, Sports, Science and Technology** (MEXT)

NIED HQs and Research Centers



Snow and Ice Research Center

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1400, Takadan, Tokamachi,
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Hyogo Earthquake Engineering Research Center

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Tsukuba HQs

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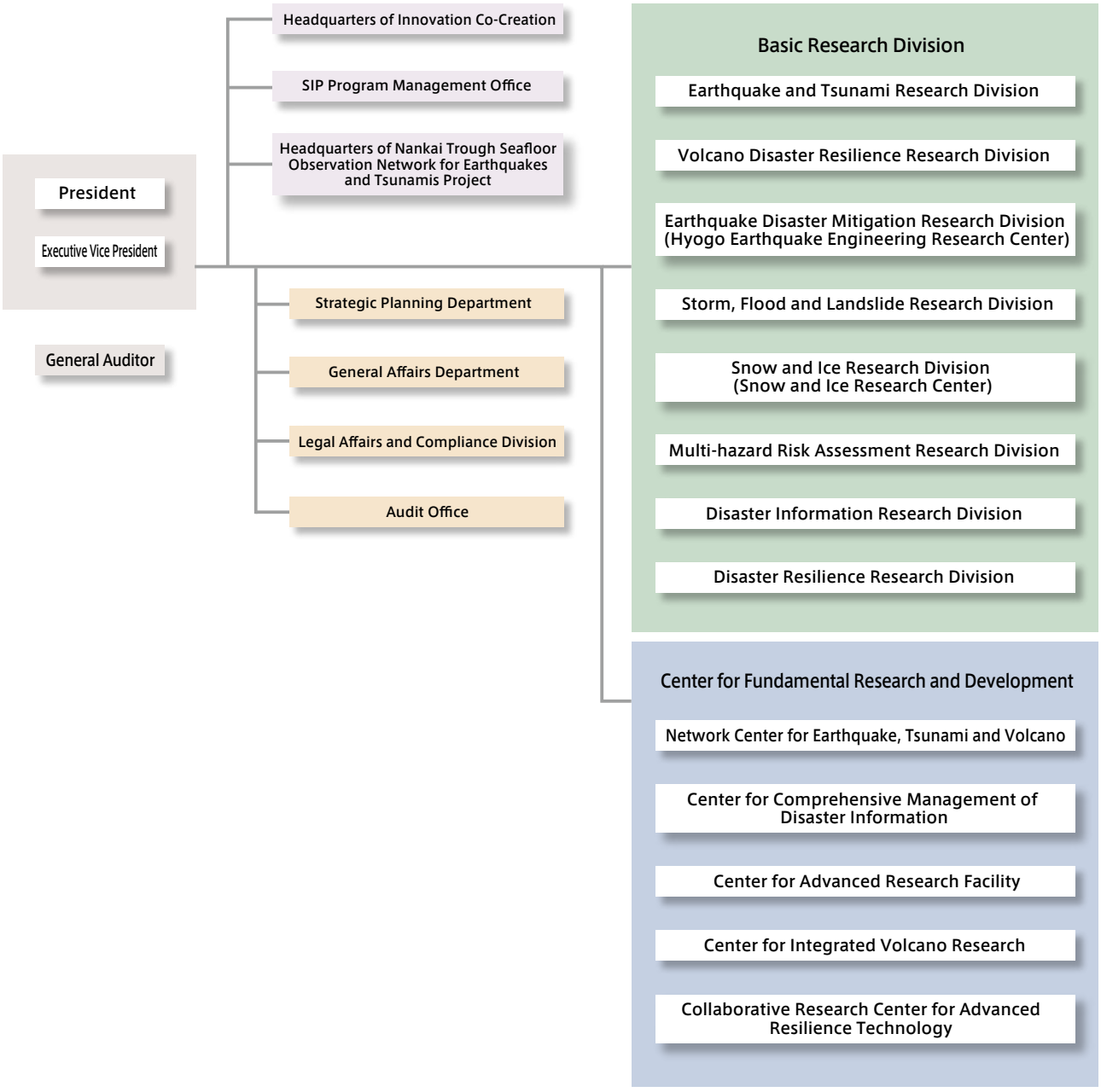
Organizational Chart

As of December 2023



* Until FY2022, the Center for Fundamental Research and Development had Research Center for National Disaster Resilience as its research project center.
* Collaborative Research Center for Advanced Resilience Technology was established on October 1, 2023.

https://www.bosai.go.jp/e/

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SCIENCE FOR RESILIENCE

NIED 防災科研

Date published: March 15, 2024