SCIENCE FOR RESILIENCE

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NIED 防災科研

President

TAKARA KAORU

As a Core Research Institute for Disaster Science and Technology Advancing Research and Development for Social Implementation

Natural hazards are occurring more frequently with greater intensity worldwide, driven by factors such as climate change and rapid urbanization. These hazards continue to pose serious risks to communities and economies. In today's interconnected world, disasters occurring in one country can also have significant impacts on societies and economies across national borders. Strengthening resilience against disasters has therefore become a shared global priority.

Since its establishment in 1963, the National Research Institute for Earth Science and Disaster Resilience (NIED) has been dedicated to advancing science and technology that contribute to disaster risk reduction and management. As a core research institution for disaster science and technology in Japan, NIED promotes research and development guided by its mission, "Science for Resilience." For example, NIED owns and operates nationwide observation networks for earthquakes, tsunamis, and volcanic activity, as well as world-leading large-scale experimental facilities, including E-Defense and the Large-Scale Rainfall Simulator. These research platforms provide a robust foundation for advancing disaster science and generating knowledge that can be applied to our society.

Building a disaster-resilient and sustainable society requires comprehensive approaches that address all hazards and all phases of the disaster management cycle—prediction/prevention, emergency response, and recovery/reconstruction. Recognizing this need, NIED has been advancing research and development in close collaboration with the government, academia, the private sector, and communities. Through international collaborative research, researcher exchange, and the sharing of scientific knowledge, NIED remains committed to contributing to the safety and security of people and society and to the advancement of disaster risk reduction and management both in Japan and abroad.

Missions in Four Research Areas

Department of Catastrophic Geohazard Research

Aims to elucidate the mechanisms of disaster occurrence and prepare for future catastrophic national crises, including the Nankai Trough Earthquake, the Tokyo Metropolitan Earthquake, and large-scale volcanic eruptions.

Department of Urban Disaster Resilience Engineering

Explores approaches to enhancing the disaster resilience of social infrastructure and developing sustainable urban environments by utilizing E-Defense and numerical shaking table simulations.

Department of Extreme Weather Disaster Research

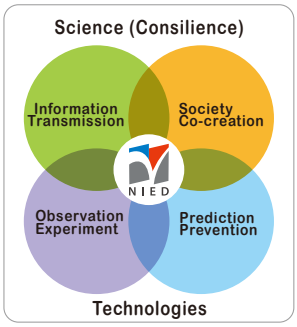
Conducts observations, experiments, and predictions of extreme weather events that are becoming more frequent due to global warming, and develop strategies to effectively mitigate water-related, sediment, and snow and ice disasters.

Department of Transdisciplinary Research in Disaster Risk Reduction

Collaborates with society to create, share, and utilize effective disaster information, advance scientific understanding of damage and recovery processes, and contribute to enhancing overall societal disaster risk reduction capabilities.

Vision of NIED

NIED addresses Japan's societal challenges in a comprehensive manner and, from a long- term perspective, promotes advanced and internationally oriented research while fostering human resources. We also advance co-creation with society and lead activities on a nationwide scale. Furthermore, as a designated public institution under the Basic Act on Disaster Management, we work in cooperation with 106 other designated public institutions nationwide, all 47 prefectures, and municipalities across Japan, contributing to the security of people and society from the perspective of disaster science and technology.



DRR Science & Technology
Safety assurance of human & society

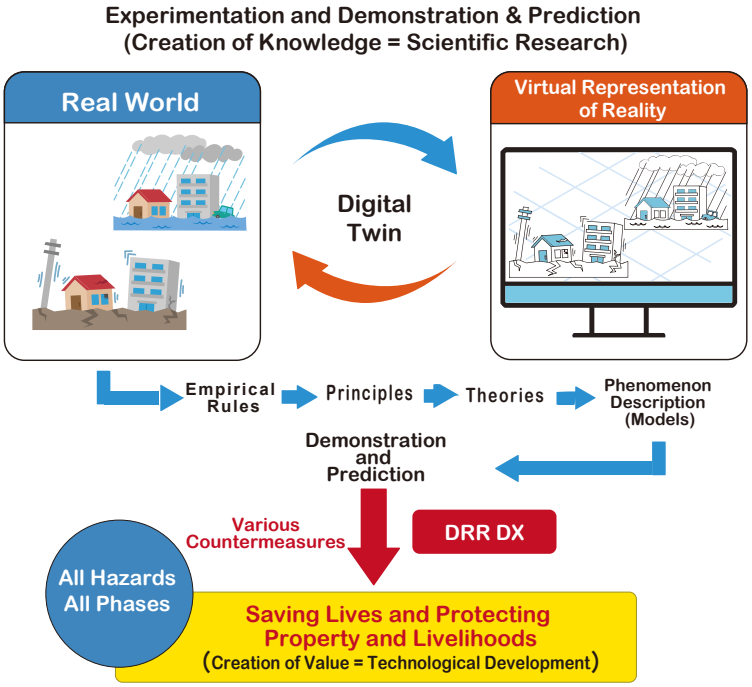
NIED and Research & Development

NIED regards research as "the creation of knowledge" and development as "the creation of value". Science represents "the accumulation of created knowledge", while technology refers to "the various means of creating value". Based on this perspective, we conduct both scientific research and technological development.

We observe and experiment with the natural and social environments of the "real world" in order to understand them accurately and to derive underlying principles and theories. Based on these findings, phenomena are modeled and described. These models represent the real world in a digital space, or cyberspace, forming a "virtual representation of reality." The integration of the real world and its digital representation is known as a "digital twin."

Models are validated using observational and experimental data to demonstrate their reliability and usefulness, enabling the prediction of future phenomena. Based on these predictions, various measures can be taken. Through science and technology, we work to save lives and protect property and livelihoods.

Rather than addressing disaster-related challenges separately within individual fields of disaster science and technology, we contribute to disaster risk reduction across all hazards and all phases by integrating knowledge based on the concept of digital twins. In doing so, we utilize the approach of Disaster Risk Reduction DX (digital transformation).



Facts

Institute name	National Research Institute for Earth Science and Disaster Resilience
Abbreviation	NIED
Board Members	President : TAKARA Kaoru
	Executive Vice President : SHINDO Kazumi
	General Auditors : KOSUGI Kenji, NEMOTO Yuko (part-time)
Employees	344 (including 157 researchers)　As of April 2025
Budget	13.8 billion yen　As of April 2025
Ministry in charge	Ministry of Education, Culture, Sports, Science and Technology (MEXT)

NIED HQs and Research Centers

Snow and Ice Research Center

(Nagaoka, Niigata Prefecture)

Snow and Ice Research Center, Shinjo Cryospheric Environment Laboratory

(Shinjo, Yamagata Prefecture)

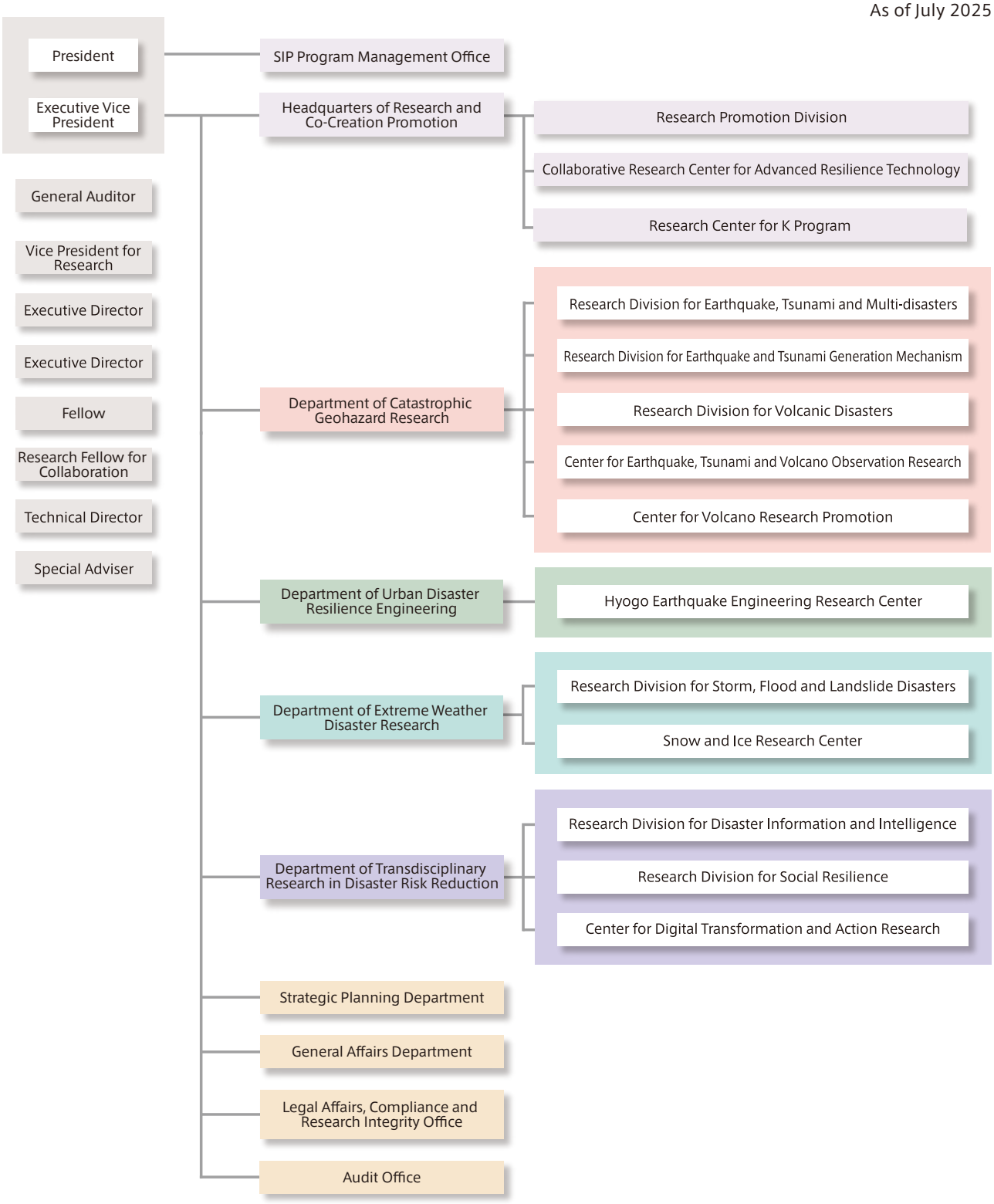
Hyogo Earthquake Engineering Research Center

(Miki, Hyogo Prefecture)

Tsukuba HQs

(Tsukuba, Ibaraki Prefecture)

As of July 2025



Ibaraki Large-scale Rainfall Simulator

One of the World's Largest Experimental Facilities for Simulating Heavy Rainfall and Strong Winds

Established in 1974, this facility is one of the world's largest and most capable rainfall experimental facilities. It can reproduce a wide range of precipitation conditions—from light rain to extreme rainfall exceeding 300 mm per hour—while accurately simulating natural raindrop size distribution and falling velocity.

The facility consists of five experimental areas, each measuring 44 m × 72 m, allowing experiments to be conducted according to specific research needs.

In 2025, a new strong-wind generation system capable of producing wind speeds exceeding 25 m/s was installed, enabling research and development under more realistic combinations of rainfall and wind conditions. The facility can also reproduce debris flows traveling down slopes, which have become increasingly common in recent heavy rainfall disasters.

This facility contributes to a wide range of fields across both the public and private sectors, including performance evaluation of countermeasures for landslide disasters and inundation/flood control, as well as sensor performance testing for drones and autonomous vehicles.

Hyogo Three-Dimensional Full-Scale Earthquake Testing Facility "E-Defense"

Simulating Full-Scale Structural Failure Caused by Earthquakes

E-Defense, the Three-Dimensional Full-Scale Earthquake Testing Facility, is one of the world's leading research facilities capable of conducting full-scale collapse experiments on actual structures. It is equipped with a three-dimensional shaking table measuring 20 m by 15 m, which can reproduce seismic motions recorded during major earthquakes, including the 1995 Kobe Earthquake and the 2011 Tohoku Earthquake. This enables damage evaluation experiments on structures such as ten-story buildings, residential houses, and interior furnishings. The experimental results are utilized to clarify the failure mechanisms of RC buildings and wooden houses, evaluate seismic performance, verify the effectiveness of countermeasure technologies, reproduce ground failure, and analyze indoor damage. Some experiments release their data and video footage to the public, contributing to the validation of numerical simulation technologies and serving as valuable materials for disaster risk reduction education.

E-ディフェンス

"E-Defense" is the nickname for the Three-Dimensional Full-Scale Earthquake Testing Facility. The letter "E" stands for "Earth," while "Defense" reflects the aspiration to prevent disasters on a global scale and to advance research and development that protects lives and property.

■ The Large-Scale Rainfall Simulator, E-Defense, and the Cryospheric Environment Simulator are available for collaborative research and facility rental. For details, please visit our website. https://www.bosai.go.jp/e/facilities/

Yamagata

Cryospheric Environment Simulator

World's Only Facility Reproducing Near-Natural Snow

One of the world's largest experimental facilities, it can reproduce a wide range of snow and ice phenomena, including snowfall, snow accretion, avalanches, and blizzards. It is also the world's only shared-use facility equipped with a system capable of generating snow crystals that closely resemble those found in nature. By controlling air temperature, snowfall, rainfall, wind speed, and solar radiation within the cold room (low-temperature chamber), the facility enables laboratory-scale reproduction of diverse winter snow and ice phenomena and environments. It is used to deepen understanding of various processes and disaster mechanisms in the cryosphere. Because the facility is available year-round, including during the summer, it is widely utilized not only for scientific studies but also for industrial applications, such as evaluating the performance of materials used for power lines, road signs, and other infrastructure essential to daily life in snowy regions.

Ibaraki

Giant Rock Friction Apparatus

Understanding Earthquake Generation Mechanisms through Realistic Earthquake Simulation

The apparatus enables the reproduction and investigation of fault frictional slip—the fundamental cause of earthquakes—under laboratory conditions. A rock specimen measuring 7.5 m in length and 0.5 m in width is placed beneath another specimen measuring 6 m by 0.5 m. The upper specimen is pressed downward while one side is pushed horizontally to induce slip. Both the normal and shear loading systems are extremely powerful, each capable of applying forces equivalent to lifting approximately 1,200 tons, making the apparatus one of the largest of its kind in the world in terms of both scale and loading capacity. Rock friction data from near-natural-scale experiments and the resulting friction laws are used in computer simulations to help improve earthquake occurrence forecasting.

Ibaraki & Others

Severe Storm Observing System

Observation of Cumulonimbus Cloud Lifecycle

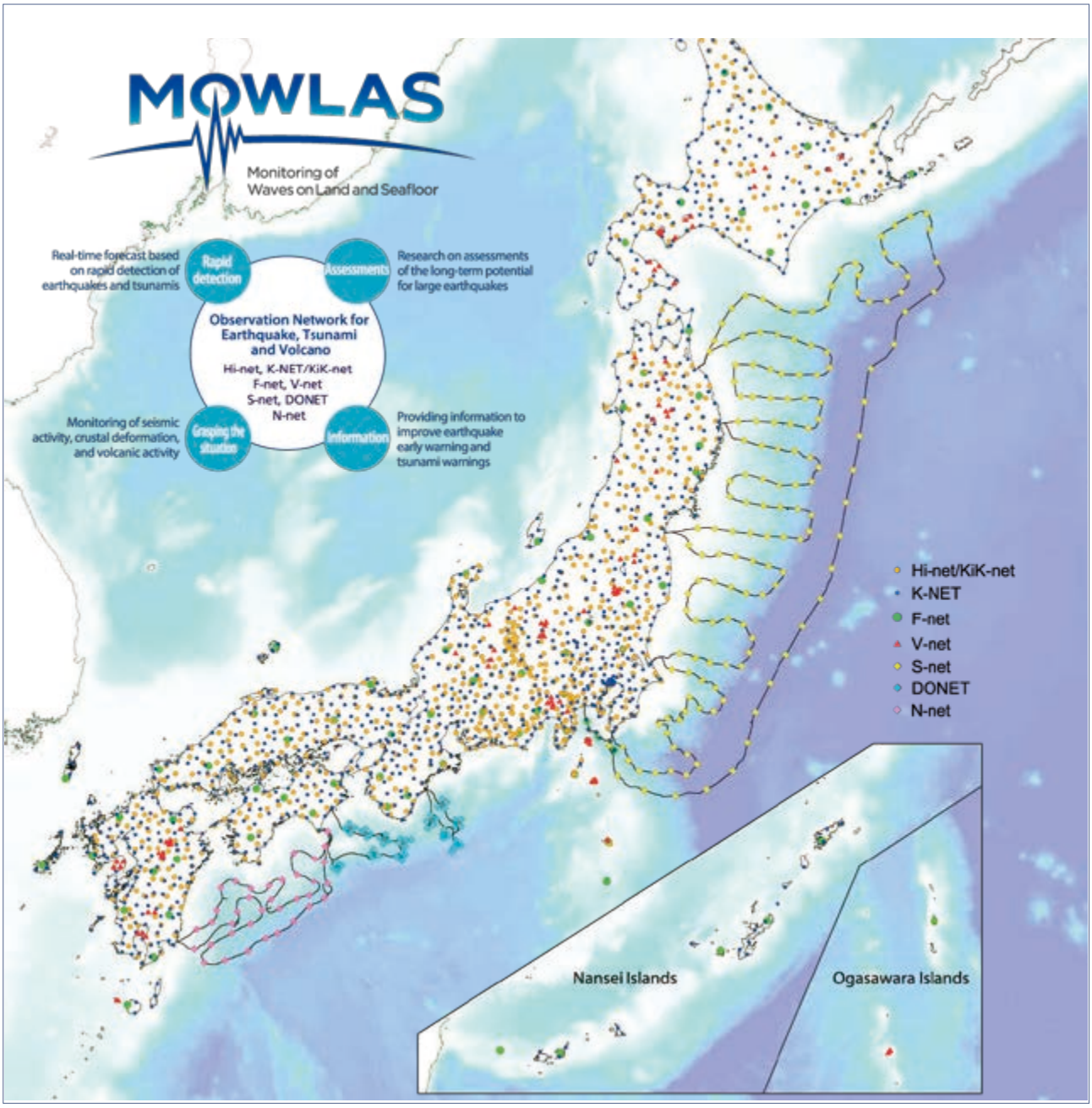
Research and development to deliver timely and accurate monitoring and information on band-shaped heavy rainfall areas, localized heavy rainfall, hail, lightning, damaging wind gusts, and tornadoes using Severe Storm Observing Systems such as microwave radiometers, high sensitivity cloud radar, X-band MP radar, and lightning sensors. The X-band MP radar observation technology developed by NIED has been transferred to the Ministry of Land, Infrastructure, Transport and Tourism and implemented in the nationwide XRAIN network, enabling the monitoring of localized heavy rainfall.

Nationwide Observation Network for Earthquakes, Tsunamis, and Volcanoes across Land and Sea

Acquiring High-Quality Observation Data in Real Time

NIED operates MOWLAS (Monitoring of Waves on Land and Seafloor), which integrates of eight observation networks (Hi-net/KiK-net, K-NET, F-net, V-net, S-net, DONET and N-net) covering all land and sea in Japan. Approximately 2,200 observation stations are installed nationwide, and acquiring data in real time to support the earthquake early warning system and the emergency stop system for the Shinkansen trains during earthquakes.

Center for Earthquake, Tsunami and Volcano Observation Research
https://www.mowlas.bosai.go.jp/?LANG=en



Hi-net/KiK-net

High Sensitivity Seismograph Network Japan (Hi-net) can detect very weak ground motions and consists of about 800 observation stations. Kiban Kyoshin Network (KiK-net) is deployed alongside Hi-net.

K-NET

Kyoshin Network (K-NET) can record strong ground motions that can cause damage and consists of over 1,000 observation stations. It was established after the 1995 Kobe Earthquake.

F-net

Full Range Seismograph Network of Japan (F-net) is broadband seismograph network consisting of about 70 stations nationwide, accurately measure ground motion over a wide frequency range.

V-net

The Fundamental Volcano Observation Network (V-net) is an observation network established at 44 volcanoes to support eruption forecasting and volcanic disaster risk reduction.

S-net

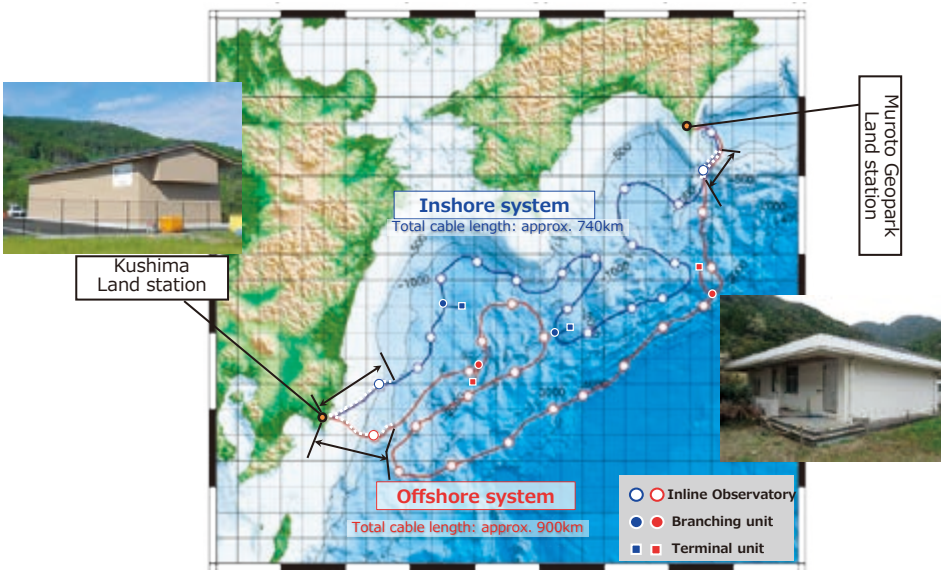
Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net) consists of 150 observation units installed on the seafloor off the Pacific coast of Japan and monitors seafloor earthquakes and tsunamis.

DONET

Dense Oceanfloor Network system for Earthquakes and Tsunamis (DONET) monitors seafloor earthquakes and tsunamis at 51 locations from the Kumano-Nada to off the Kii Peninsula.

N-net

The Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net) consists of observation units equipped with seismometers and pressure gauges installed at 36 locations on the seafloor from off Kochi Prefecture to the Hyuganada, covering part of the anticipated seismic source region of the Nankai Trough Earthquake. N-net provides real-time, continuous observation of earthquakes and tsunamis in this region. Similar to S-net, N-net connects its observation units via submarine fiber optic cables, enabling wide-area coverage. At the same time, it incorporates the expandability of DONET, forming a hybrid cabled observation system. With N-net, direct detection of earthquakes occurring in the monitored area can be achieved up to approximately 20 seconds earlier, and tsunamis up to approximately 20 minutes earlier, compared with conventional observation systems.

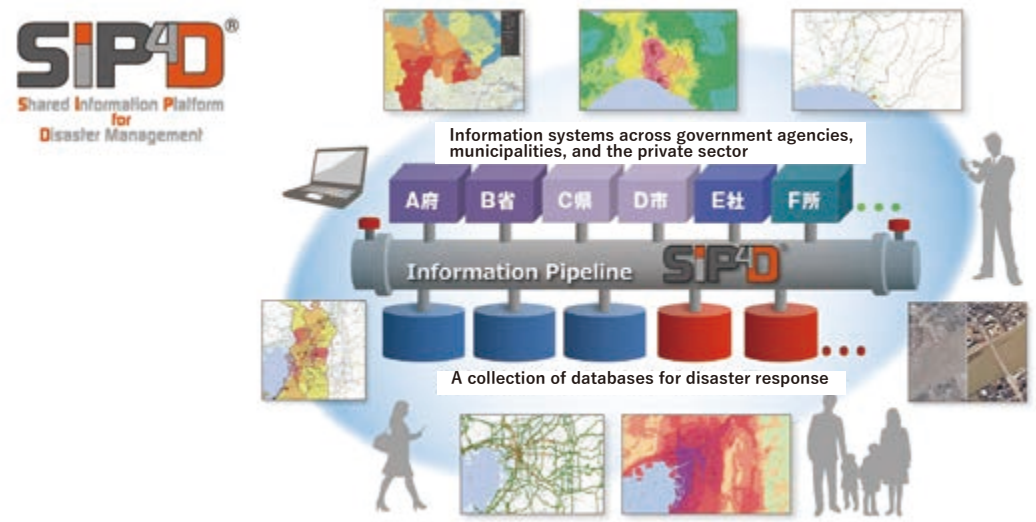


Infrastructure for information sharing, distribution, and utilization

SIP4D | Shared Information Platform for Disaster Management

System Enabling a Common Operational Picture for Disaster Response

Effective disaster response requires that relevant organizations appropriately share essential information—such as the extent of damage, response activities, and recovery status—and establish a common operational picture to guide coordinated actions. SIP4D (Shared Information Platform for Disaster Management), developed by NIED, is a key technology that links disaster-related information systems operated by national ministries and agencies, local governments, and other organizations. By enabling mutual data sharing across these systems, SIP4D facilitates integrated and effective utilization of disaster information. In 2024, SIP4D technology was adopted and implemented in the Cabinet Office's new Comprehensive Disaster Prevention Information System (SOBO-WEB), marking its practical implementation. We continue to advance SIP4D through further enhancement and new research initiatives. During disasters, we also disseminate publicly accessible information through "bosaiXview", which leverages SIP4D to support improved disaster resilience across society.



ISUT | Information Support Team

Collaborative Team for Information Sharing and Utilization During Disaster Response

In the event of a major disaster, NIED works in collaboration with the Cabinet Office as the Information Support Team (ISUT), dispatching personnel to on-site disaster response headquarters. By utilizing SOBO-WEB and SIP4D, ISUT aggregates and shares information required by organizations operating on the ground as well as those providing external support, and prepares and supplies essential maps for response activities.

Both research and administrative staff participate in ISUT deployments, and regular training is conducted to ensure readiness. Through close engagement with disaster response operations and by working alongside frontline organizations, NIED conducts action research to understand how disasters occur and evolve, identify the challenges faced by society, and translate these insights into research and development that strengthens disaster resilience.

1959.9	Ise Bay Typhoon
1963.1	Showa 38 Heavy Snow
1963.4	National Research Center for Disaster Prevention (NRCDP) established in Tokyo
1964.6	Niigata Earthquake
1964.12	Institute of Snow and Ice Studies established in Nagaoka
1965.8	Marine Observation Tower established in Hiratsuka
1967.6	Strong Motion Earthquake Observation Council established
1967.6	Hiratsuka branch established
1969.10	Shinjo branch established
1970.6	Large-scale Earthquake Simulator established (The first facility in Tsukuba Science city)
1971.11	Loam Slope Experiment Accident occurred in Kawasaki
1973.3	Iwatsuki Crustal Activity Observatory established
1974.3	Large-scale Rainfall Simulator established in Tsukuba
1978.4	NRCDP HQs moved from Tokyo to Tsukuba Science City
1984.3	Kanto and Tokai Crustal Activity Observation Network formed
1988.3	Doppler Rader completed
1990.6	NRCDP renamed National Research Institute for Earth Science and Disaster Prevention (NIED)
1995.1	Kobe Earthquake
1996.3	Sagami-Bay See Bottom Earthquake Observatory established
1996.6	Operation of K-NET (Kyoshin Net) began
1997.3	Cryospheric Environment Simulator established (Shinjo)
1997.4	Construction of Hi-net (High sensitivity seismograph network), KiK-net (Kiban Kyoshin-net) , and F-net (Broad-band seismograph network) began
2000.3	Multi-parameter radar system completed
2001.1	NIED came under MEXT following government reorganization
2001.4	Independent Administrative Agency NIED established
2001.4	Earthquake Disaster Mitigation Research Center (EDM) transferred to NIED from RIKEN
2002.10	EDM Kawasaki Laboratory established
2003.4	EDM moved to Kobe
2004.10	Hyogo Earthquake Engineering Research Center established in Miki
2025.4	Operation of Three-Dimensional Full-Scale Earthquake Testing Facility (E-Defense) began
2007.3	EDM Kawasaki Laboratory closed
2008.3	Hiratsuka Marine Observation Tower closed
2010.4	Operation of V-net (The Fundamental Volcano Observation Network) began
2011.3	Tohoku Earthquake
2011.3	EDM closed
2011.11	Construction of Seafloor observation network for earthquakes and tsunamis along the Japan Trench began
2013.4	Snow and Ice Research Center reorganized (Shinjo branch changed to Shinjo Cryospheric Environment Laboratory)
2014.9	Mt. Ontake erupted
2015.4	NIED became National Research and Development Agency
2016.4	Kumamoto Earthquake
2016.4	DONET (Dense Oceanfloor Network system for Earthquakes and Tsunamis) transferred to NIED from JAMSTEC
2017.11	Integrated operation of Monitoring of Waves on Land and Seafloor (MOWLAS) began
2019.2	Construction of Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net) began
2021.11	I-Resilience Corporation established as a joint venture company
2023.10	Collaborative Research Center for Advanced Resilience Technology established
2024.1	Noto Peninsula Earthquake
2024.10	Organizational restructuring
2025.6	N-net completed

Research on Technology for Integrated Analysis and Advanced Application of Disaster Information

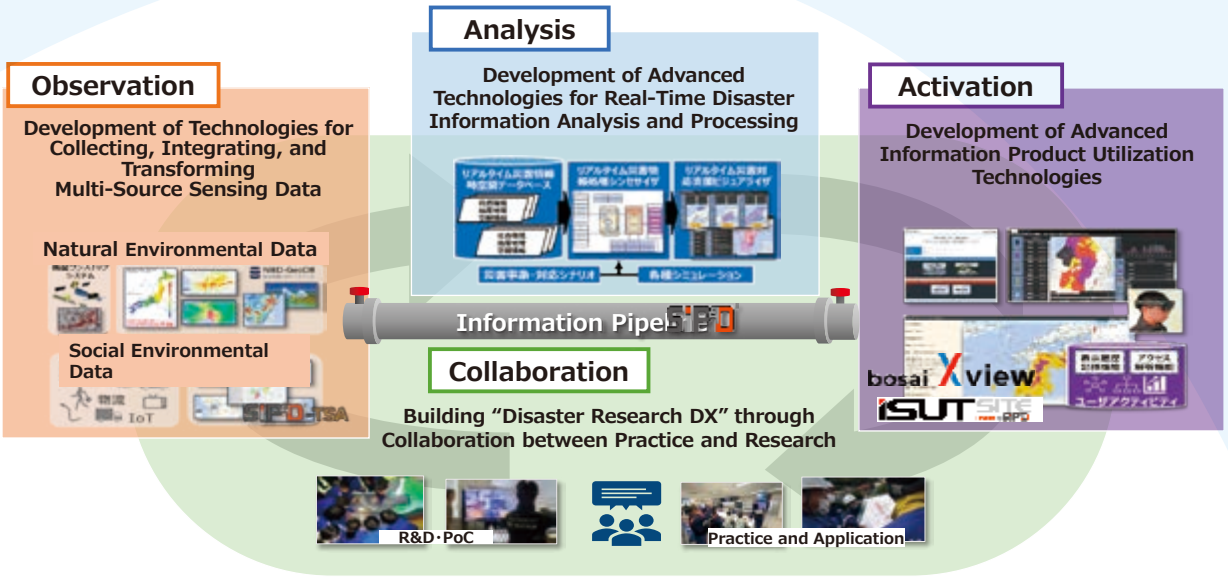
NIED aims to promote digital transformation (DX) in the disaster risk reduction field, driven by the utilization of information to enhance societal resilience. To achieve this goal, we will engage in four research themes.

Observation
In the area of observation, we develop technologies that go beyond the field of disaster risk reduction, enabling the real-time collection and aggregation of diverse natural and social environmental data as geospatial information, while integrating and converting it into an analysis ready format.

Analysis
In analysis, we advance technologies to perform integrated analytical processing in real time by leveraging collected and aggregated geospatial information, while generating information products in an agile manner through the utilization of simulation technologies.

Activation
In activation, we develop advanced utilization technologies that enable the interactive use of generated information products across diverse terminals and devices, thereby supporting coordinated actions, countermeasures, and collaborative decision-making.

Collaboration
In collaboration, we establish a collaborative framework between disaster management practitioners and researchers to advance R&D in observation, analysis, and activation, ultimately achieving Disaster Resilience Research DX that enables identifying and solving challenges through the leveraging of information products.



TAGUCHI Hitoshi,
Project Director
(Research Division for Disaster Information and Intelligence)

NIED has consistently advanced research rooted in real-world disaster management, notably through the development of SIP4D (Shared Information Platform for Disaster Management) and the establishment of ISUT (Information Support Team) in collaboration with the Cabinet Office. Our R&D approach—which involves collaborating with diverse organizations both within and beyond the disaster-risk reduction field to identify and resolve critical challenges—is the very embodiment of the "Integration of Knowledge." Through these initiatives, as a core institution for disaster science and technology, we aim to drive Digital Transformation (DX) across the disaster management field and ultimately enhance societal resilience as a whole.

Research and Development Regarding Hazard and Risk Assessment

NIED conducts comprehensive research on hazard and risk assessment for natural hazards using scientific knowledge and data on the natural and social environment, with the aim of supporting appropriate decision-making in disasters.

1 **Development of hazard and risk assessment platform for earthquakes and tsunamis**
NIED develops hazard and risk assessment methods that take uncertainties into account for megathrust earthquakes, where past experience and knowledge are limited, and builds a hazard and risk information platform to support the use of research outcomes.

2 **Creation and utilization of multi-hazard risk information**
We develop a multi-hazard risk assessment method that takes regional characteristics and the diversity of hazard occurrence into account, based on a multi-hazard event catalog and landslide topographic distribution maps, using data analysis and simulation technologies.

3 **Development of multi-scale damage estimation and situation assessment technologies**
To support decision-making for disaster response immediately after an earthquake, NIED develops a system that integrates various types of observational data to estimate damage at multiple scales, from wide areas to critical facilities and infrastructure.

4 **Deployment and international expansion aimed at the social implementation of research outcomes**
We create new markets and co-creation mechanisms in the field of disaster risk reduction and promote the standardization of hazard and risk assessment models through activities of the Global Earthquake Model (GEM), an international non-profit organization.

To sustainably strengthen the resilience of society and reduce disaster risk, all parts of society, including the national government, municipalities, companies, communities, and individuals, need to understand risks and prepare for them. This project conducts comprehensive research on hazard and risk assessment of natural hazards to help anticipate and prepare for future disasters. In this context, hazard means potentially damaging phenomena such as seismic shaking and tsunamis, and risk means the possibility of damage occurring in society when exposed to those hazards.

NAKAMURA Hiromitsu,
Project Director
(Research Division for Earthquake, Tsunami and Multi-disasters)

Research and Development on Advancing Disaster Response DX through Integrated Knowledge

1 Research and development of disaster response simulation technologies for decision-making support

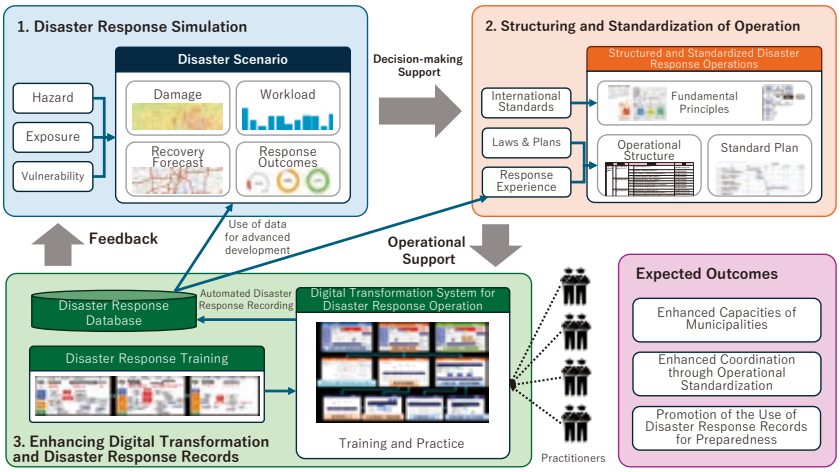
To support decision-making for various disaster response actions, NIED develops simulation technologies that integrate hazard and risk information with natural disaster science, as well as social science knowledge related to emergency response, recovery, and reconstruction. By utilizing data from SIP4D and various digitalized response-related information, these technologies enable concrete analyses such as disaster process forecasting, estimation of required workloads, and evaluation of the effectiveness of response measures. Through this work, we advance research and development to support more reliable decision-making.

2 Research and development on the structuring and standardization of operations to facilitate disaster response and inter-organizational coordination

To facilitate disaster response and coordination among the involved organizations, we are conducting research and development based on international standards. Specifically, we work on the standardization of organizational structures, management methods, information management, operating procedures, human resource development, and support systems for disaster response by administrative agencies. By clarifying role sharing and operational procedures across departments and organizations, and by making effective use of limited resources, we aim to build a framework that enables all stakeholders to respond in a coordinated manner.

3 Research and development on the continuous enhancement of disaster response capabilities through DX and the enrichment of disaster response records

We enhance disaster response capabilities through the use of digital technologies. Specifically, we develop cloud-based systems to support disaster response operations while enabling the automatic accumulation of disaster response records. By leveraging these records, experiences gained from actual disaster responses and training exercises are fed back into the development of disaster response simulation technologies and the standardization of disaster response practices. Through this cycle, we promote DX in disaster response and achieve the continuous improvement of disaster response capabilities.



SUZUKI Shingo,
Project Director
(Research Division for Social Resilience)

During disasters, municipal officials are required to reliably carry out large-scale, long-term, and unfamiliar response operations that differ significantly from their routine duties. At present, disaster response practices are not sufficiently standardized, and differences in response approaches among officials and organizations can hinder operational efficiency. Looking ahead to a society facing catastrophic national crises amid population decline and a decreasing number of experienced personnel, we aim to build an effective disaster response framework through the systematization of knowledge and the use of digital technologies.
In this project, we integrate practical disaster response data with specialized expertise to develop advanced decision-making support simulations and to clearly standardize operational processes. These components are implemented as a cloud-based DX system. By utilizing this system in practical training exercises and other settings while continuously accumulating data, we establish a sustainable mechanism for steadily strengthening disaster response capabilities.

Research and Development of Measures to Build Sustainable Resilience through Investigation of Disaster Processes

1 Research on the actual conditions of community recovery and reconstruction

To prepare for unprecedented disasters such as the Nankai Trough Megathrust Earthquake, it is essential to learn from the past and apply those lessons to the future. In order to build an intellectual infrastructure that supports the rapid and sustainable recovery of local communities, NIED conducts comprehensive investigations into post-disaster conditions, including livelihood recovery, infrastructure restoration, regional economic revitalization, and community reconstruction. Through these efforts, we empirically and multidimensionally clarify the processes and realities of community recovery and reconstruction following disasters.

2 Research on methods for evaluating disaster resilience

To reduce increasingly complex and diverse disaster risks in local communities, it is essential to build communities that can recover quickly from disasters. To scientifically and quantitatively clarify the extent to which communities can "prepare for", "withstand", "recover from", and "adapt to" disasters, we conduct research and development on evidence-based methods for evaluating disaster resilience that comprehensively capture recovery and adaptive capacities.

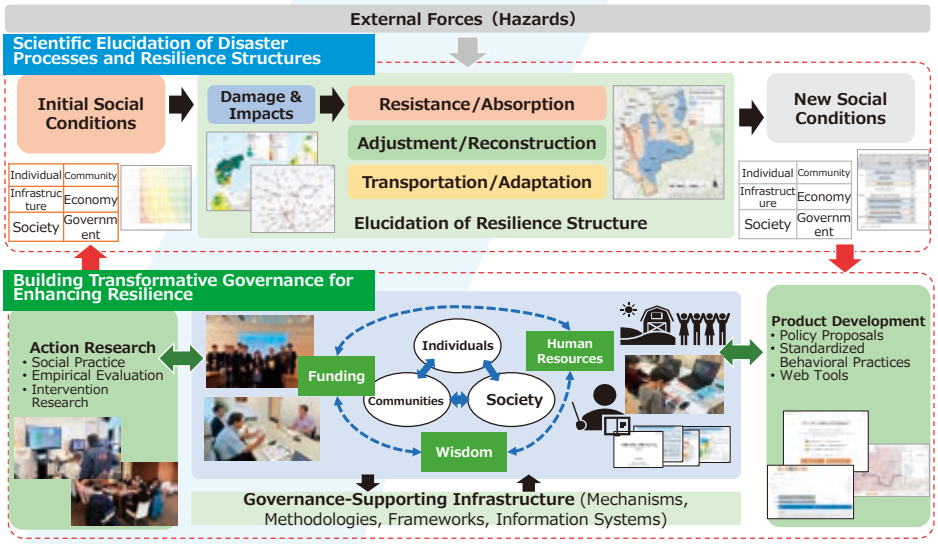
3 Research on methods for developing disaster support human resources

In the face of complex and successive disaster risks, core personnel who support community resilience are increasingly expected to play a central role. We conduct research and development on methods for cultivating disaster support personnel who possess the responsiveness and judgment needed to address unforeseen situations, serve as key actors within local communities, and function as catalysts for regional resilience by connecting diverse areas of expertise.

4 Research and development of the YOU@RISK disaster information products

We conduct research and development on YOU@RISK , a suite of disaster risk information products that can be utilized in community-based disaster preparedness activities, disaster education at elementary and junior high schools, as well as business continuity planning (BCP) by companies.

YOU@RISK



Disasters do not merely take lives and property; they also profoundly transform our daily lives and society. Disaster preparedness is achieved not only by strengthening buildings and infrastructure, but also by enhancing resilience among individuals, communities, and society, as well as by strengthening institutions, mechanisms, and culture. Through collaboration with citizens, communities, companies, and local authorities, NIED scientifically clarifies the causal relationships between preparedness, response, and recovery efforts and their impacts. Building on this knowledge, we propose effective disaster risk reduction measures, education, and policies.

YI Tai-Young,
Project Director
(Research Division for Social Resilience)

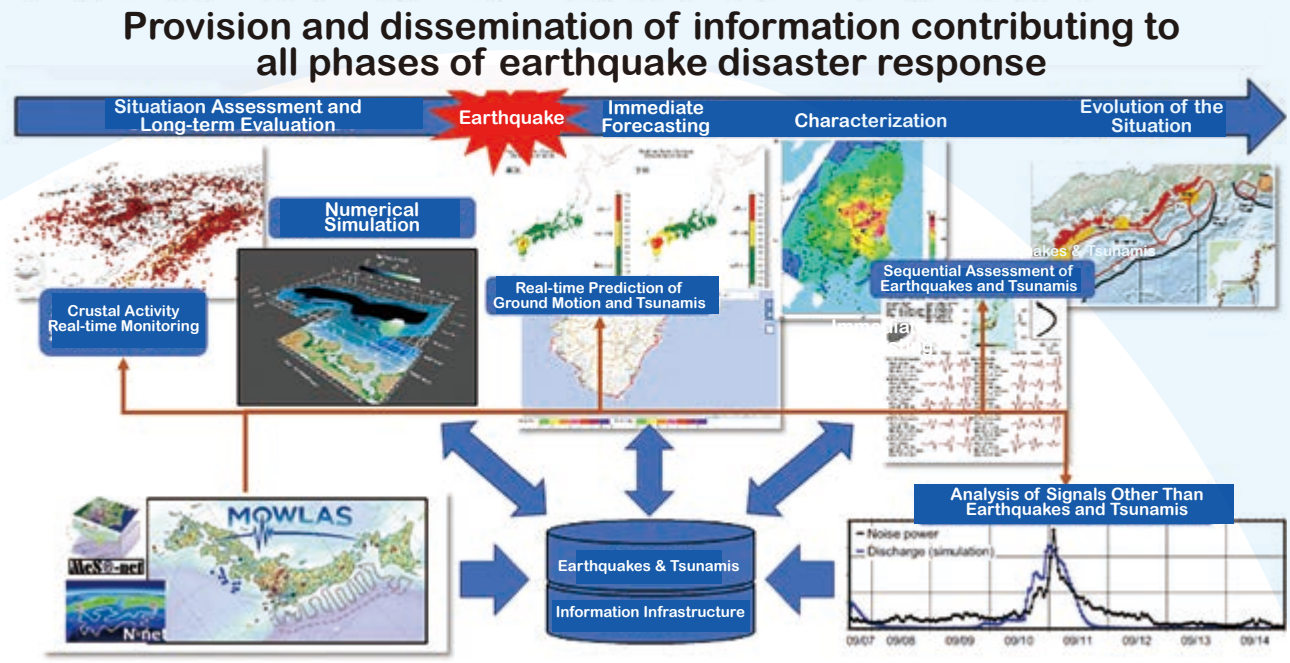
Development of Technologies for Immediate and Sequential Assessment of Earthquakes and Tsunamis

In addition to the "immediate" and "continuous" monitoring systems developed during its 4th mid-term plan, NIED will advance "sequential" monitoring that seamlessly integrates the two without temporal gaps. Through this effort, NIED will conduct research and development to enhance the prediction of earthquakes and tsunamis and to strengthen capabilities for disaster damage mitigation.

1 Data obtained from MOWLAS and N-net, completed in 2025, will be analyzed and evaluated immediately following a major earthquake. Based on this analysis, source parameters, as well as the characteristics and propagation of seismic ground motion and tsunamis, will be determined and sequentially estimated without temporal gaps.

2 By developing technologies to detect and identify non-seismic and non-tsunami signals captured by MOWLAS and other monitoring systems, we enhance the accuracy of earthquake and tsunami monitoring and support the assessment of various natural hazards. We further integrate these results into an advanced cyber-based database that enables cross-referencing and comprehensive analysis of diverse datasets.

3 The results will be widely disseminated through websites and other platforms, and observation and forecast information before, during, and after major earthquakes will be shared and coordinated with relevant organizations both within and outside the institute.



KUNUGI Takashi,
Project Director
(Research Division for Earthquake, Tsunami and Multi-disasters)

This research leverages observational data to enhance earthquake and tsunami disaster risk reduction. By providing and disseminating information products that support all phases of earthquake and tsunami disaster management, it contributes to strengthening societal resilience.

Research and Development for Comprehensive Understanding of Earthquake Generation and Forecasting

NIED aims to enhance earthquake forecasting by comprehensively understanding earthquake generation mechanisms through the integration of experiments, observations, and theory.

1 **What mechanical conditions can generate earthquakes?**

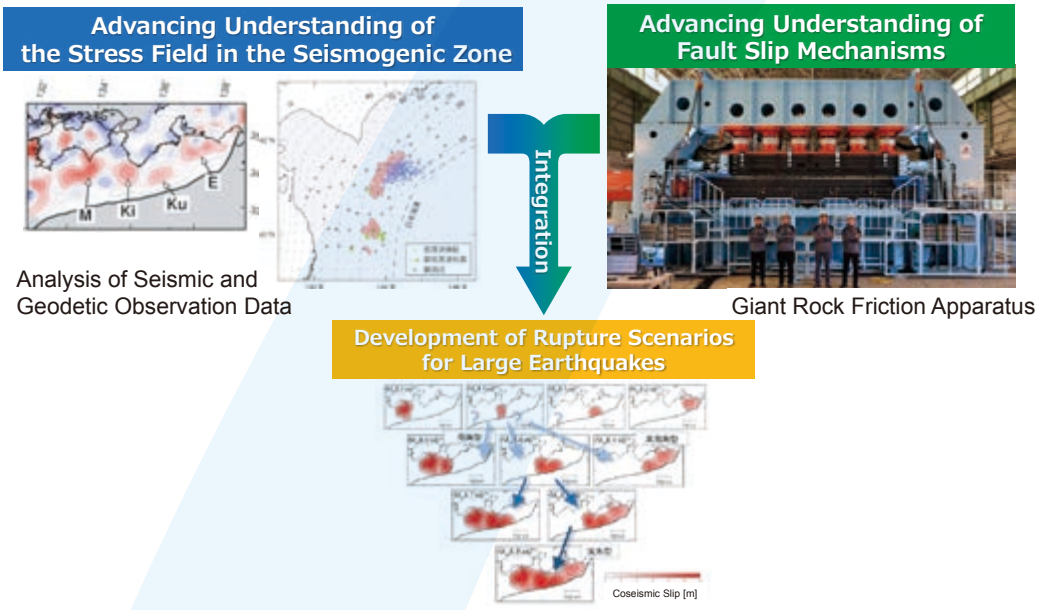
Earthquakes occur due to slip on faults underground. To better understand the stresses acting on faults and the stress field within the seismogenic zone, we develop advanced methods to analyze seismological and geodetic data and construct models of earthquake generation.

2 **How do faults slip?**

The style of earthquake occurrence strongly depends on how the fault slips. Therefore, it is essential to investigate the frictional properties of rocks that govern fault slip. For this purpose, we have newly developed one of the world's largest experimental facilities, enabling us to investigate rock friction properties at a scale close to natural faults. Using the facility, we conduct research to better understand the physical mechanisms of earthquake occurrence.

3 **What kind of large earthquakes are likely to occur in the future?**

To better assess the occurrence of future large earthquakes, it is necessary to develop methods based on mechanics in addition to empirical approaches. Using knowledge derived from rock friction experiments and field observation data analysis, we develop advanced methods to create earthquake rupture scenarios, including the cases for consecutive earthquake sequences.



Research Division for Earthquake and Tsunami Generation Mechanisms https://quaketm.bosai.go.jp/index.en.html

Based on historical documents, geological surveys, and seismological and geodetic observations, some progress has been made in the long-term evaluation of future large earthquake occurrence. Although we cannot predict with certainty when and where a major earthquake will occur, more detailed scenarios of future large earthquakes are essential. Through this research project, we are working to deepen our understanding of the mechanisms causing large earthquakes, develop new methods to better evaluate earthquake occurrence based on this knowledge, and provide more realistic scenarios for large earthquakes that may occur in the future.

SHIOMI Katsuhiko,
Project Director
(Research Division for Earthquake and Tsunami Generation Mechanisms)

Research and Development for Enhancing Resilience in Regional Areas through E-Defense and Research Infrastructure

NIED aims to transform society to establish resilience in regional areas through developing assessment technologies for damage and risk.

1

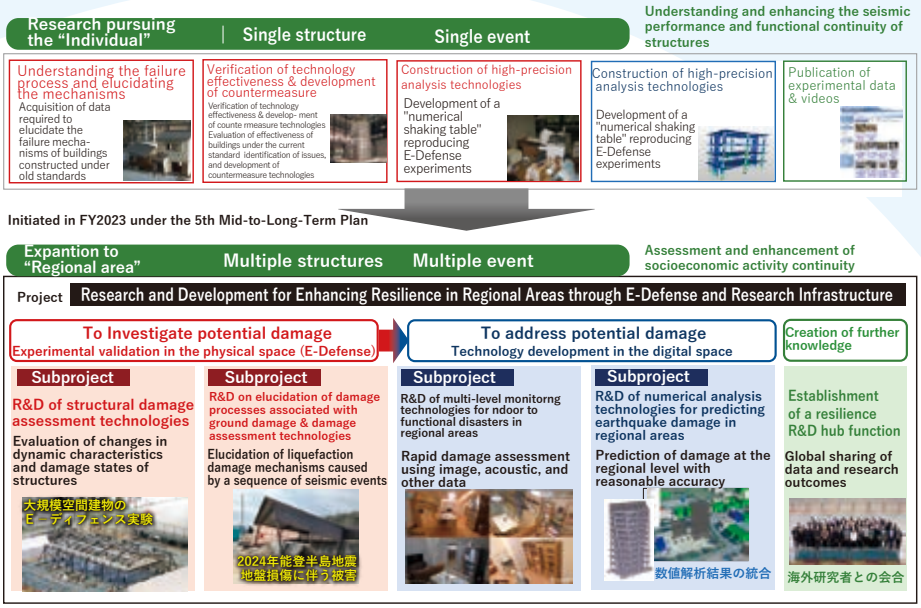
Ensuring the continuity of socioeconomic activities in regional areas

At the Hyogo Earthquake Engineering Research Center, we conduct research and development to strengthen societal resilience against future large earthquakes. This work leverages E-Defense, one of the world's largest experimental facilities capable of reproducing strong earthquake shaking. E-Defense enables the evaluation of seismic damage to buildings, building interiors, and ground conditions, as well as the effectiveness of countermeasure technologies, by subjecting full-scale structures to strong shaking up to failure. Since the facility began operations in 2005, our research has focused on the behavior of individual structures subjected to single earthquakes. This project expands that focus to regional areas, where infrastructure and buildings form the foundation of socioeconomic activity, and conducts research aimed at ensuring the reliable continuity of activities even after major earthquakes.

2

Identifying and Addressing Potential Earthquake Damage in Regional Areas

To enhance resilience in regional areas against earthquake disasters, it is crucial to identify the potential damage that may be caused by large earthquakes impacting society. We are developing methods for pre-earthquake damage prediction, post-earthquake damage estimation, and recovery resource assessment for high-rise buildings and large-span structures used as evacuation shelters. For the ground supporting urban buildings and infrastructure, we investigate the cumulative processes of ground deformation, including liquefaction, during mainshocks and aftershocks. In addition, to explore effective measures for preventing such damage, we aim to construct a digital twin for regional-scale damage prediction, centered on the numerical simulation technology known as the "numerical shaking table." To support this effort, we are developing a numerical analysis platform capable of efficiently performing large-scale urban simulations with appropriate accuracy. Furthermore, to reflect real-world conditions in the digital twin, we are advancing monitoring technologies to comprehensively assess the extent of damage.



E-Defense https://e-defense.bosai.go.jp/en/

TABATA Kentaro,
Project Director
(Hyogo Earthquake Engineering Research Center)

The experimental results and insights obtained through this project, as well as from E-Defense experiments on full-scale structures, including measurement data and video records, constitute unique and highly valuable resources that should be widely shared. By sharing these findings, we seek to deepen sustained collaboration with researchers and engineers worldwide, encouraging the generation of new knowledge and innovative ideas. Through such collaborative and co-creative efforts, we strive to enhance societal disaster resilience.

Research and Development on Improving the Ability to Predict, Prevent, and Respond to Volcanic Disaster

1 Development of forecasting technology for volcanic activity

NIED develops technologies for forecasting volcanic activity by utilizing data from the Fundamental Volcano Observation Network (V-net), remote sensing technologies, geological and geochemical surveys, and other sources. In addition to research on individual volcanic phenomena, we enhance our forecasting capabilities by advancing methods to assess trends in volcanic activity based on the "state of volcanic activity," an integrated understanding derived from diverse datasets.

2 Promotion of data and knowledge integration

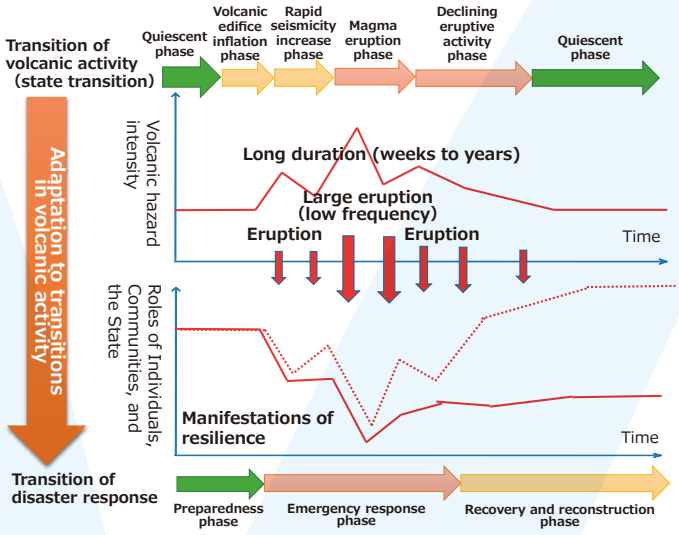
Various data and simulation results related to pyroclastic flows and lava flows will be integrated into the JVDN system (Japan Volcanological Data Network). Furthermore, through the JVDN system and the concept of the "state of volcanic activity," we promote the integration of data and knowledge in volcanology.

3 Disaster response

Accurately forecasting ash fall and lava flows remains challenging, as their distribution varies significantly depending on wind conditions, topography, and other factors. In the event of an eruption, a system has been established through the JVDN platform to rapidly collect and share ashfall survey data. Building on this system and related technologies, we develop information products to support decision-making during disasters and enhance response capabilities.

4 Strengthening collaboration

As a core research institute in disaster risk reduction science and technology, we contribute to strengthening collaboration through the JVDN system and related initiatives.



By adjusting societal conditions (e.g., exposure levels) in response to changes in the state of volcanic activity, the threat and risk posed by eruptions can be reduced (Figure). NIED promotes research to enhance disaster risk reduction capability by clarifying the relationship between volcanic activity and societal conditions, utilizing social data such as exposure and vulnerability information.

Research Division for Volcanic Disaster
https://kazan.bosai.go.jp/en/

Next Generation Volcano Research
https://kazan-pj.bosai.go.jp/next-generation-volcano-pj-2019-jun

JVDN System Website
https://jvdn.bosai.go.jp/portal/en/

Volcanoes provide significant benefits, including tourism and hot spring resources, yet they also pose hazards that can cause long-term disruption to communities living in surrounding areas. A resilient society in the face of volcanic disasters is one that understands volcanic risks and takes appropriate measures in response to changes in volcanic activity and associated threats. We advance research to strengthen forecasting, prevention, and response capabilities in order to realize such a resilient society.

UEDA Hideki,
Project Director
(Research Division for Volcanic Disaster)

Enhancing Societal Resilience to Snow-Related Hazards through Advances in Observation and Prediction Technologies

NIED conducts research on the following two themes to ensure a safe and comfortable winter life in Japan.

1

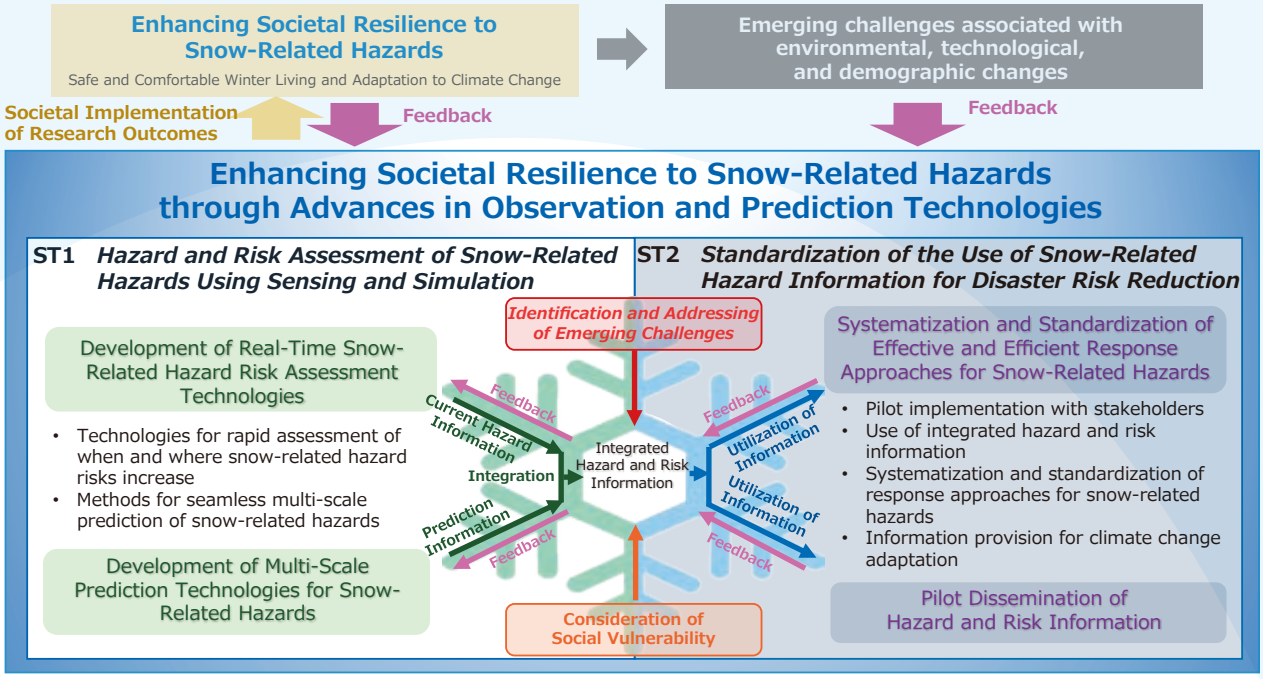
Hazard and risk assessment of snow-related disasters using sensing and simulation

This subtheme aims to advance technologies for sensing and simulating phenomena associated with snow-related hazards. By integrating sensing technologies with numerical simulation models, we will develop methods for hazard and risk assessment that can address diverse snow disasters and their potential impacts. In addition, by incorporating the effects of social vulnerability—an aspect that has not been sufficiently considered in previous studies—we will also develop approaches for generating hazard and risk information that can provide a scientific basis for disaster risk reduction measures.

2

Standardization of the use of snow related hazard information for disaster risk reduction

In collaboration with stakeholders such as national and local governments and private-sector organizations, this subtheme promotes the practical use of hazard information on snow and ice disasters. We will conduct pilot dissemination of information products generated by the research and explore effective and efficient approaches for disaster response using such information. Through these activities, we aim to systematize and standardize practical response approaches and identify emerging challenges that will be fed back into the research.



Snow and Ice Research Center https://www.bosai.go.jp/seppyo/e/

YAMAGUCHI Satoru,
Project Director
(Snow and Ice Research Center)

In recent years, snow hazards have posed increasingly serious challenges to social activities. Extreme weather events associated with climate change are becoming more frequent, and heavy snowfall events caused by phenomena such as the Japan Sea Polar Air Mass Convergence Zone (JPCZ) have intensified and become more frequent. At the same time, vulnerability to snow has become more evident due to factors such as limited financial resources, depopulation and aging in rural areas, shortages of labor for snow removal, and transportation disruptions caused by snowfall associated with south-coast cyclones in regions that do not usually experience heavy snowfall. To enhance resilience to snow hazards, reduce these risks, and support climate change adaptation under changing social conditions, this project will advance research aimed at enabling efficient and effective responses to snow hazards based on scientific knowledge.

Research and development for monitoring and forecasting techniques to mitigate weather-related disasters

To strengthen resilience to extreme weather events, NIED conducts the following research and development initiatives.

1

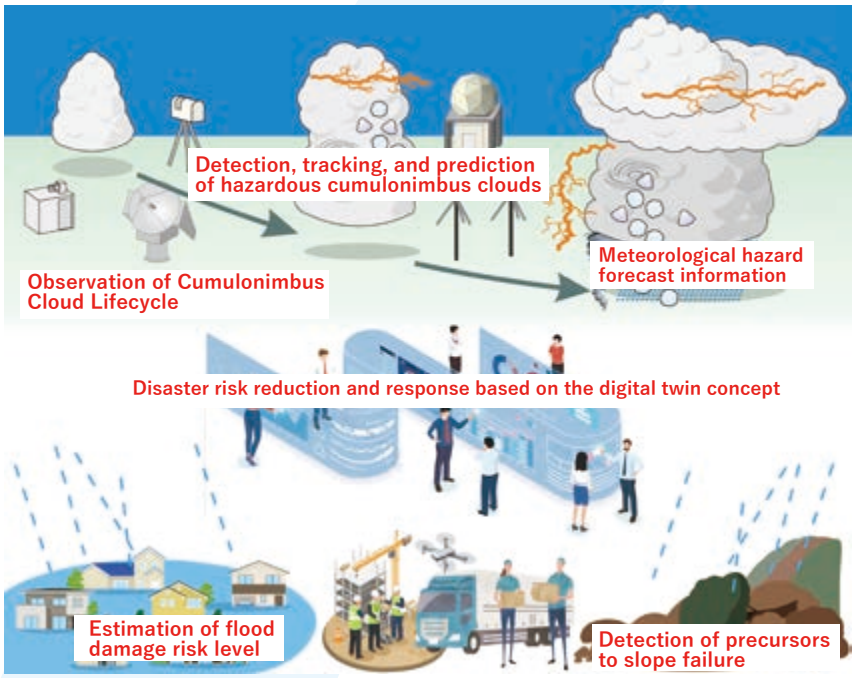
Detecting, tracking, and forecasting hazardous cumulonimbus clouds

Extreme weather events such as quasi-stationary bandshaped precipitating systems (Senjo-Kousuitai), localized heavy rainfall, tornadoes, hailfall, and lightning are associated with well-developed cumulonimbus clouds. Accurate forecasting of these clouds requires observations capable of capturing early signs of their development, numerical weather prediction models that can explicitly resolve convective systems, and data assimilation techniques that effectively integrate observational data into these models. Building on previously developed technologies, including cloud radar for detecting cumulus clouds before they develop into cumulonimbus clouds and cloud scale data assimilation methods, this project advances observation systems capable of detecting lightning discharges other than cloud-to-ground strikes, as well as improving high-resolution numerical weather prediction. Through these efforts, we aim to provide more advanced and reliable weather forecast information.

2

Development of information products for mitigating flood and landslide disasters

We develop efficient and accurate methods to estimate flood risk by extracting flood-prone watersheds. In addition, we develop a flood damage risk assessment and triage system that supports both immediate post-disaster response and preparedness planning. For landslide disasters, we conduct field observations and experiments using the Large-scale Rainfall Simulator, a facility with the world's largest rainfall area and sprinkling capacity. By advancing observation technologies that can detect precursor phenomena of slope failure, we provide information to support timely disaster response. In addition, we develop technologies that use satellite data and other sources to rapidly generate information on the location and scale of landslides occurring over wide areas.



In recent years, the frequency of short duration intense rainfall events has increased, and damage from floods and landslides has become more frequent and severe. To strengthen societal resilience to extreme weather, it is essential to advance monitoring and forecasting technologies for extreme weather and water related disasters, and to generate information products that support optimized disaster response. This research project promotes the reduction of weather-related disaster risks through the development and effective utilization of such information products.

MAESAKA Takeshi,
Project Director
(Research Division for Storm, Flood and Landslide Disasters)

Advancing Disaster Science, Technology and Innovation through International Collaboration

Global Disaster Risks and the Role of Science

Natural hazards transcend national borders and affect human lives, societies, and economies around the world. As climate change progresses and disasters become more frequent and severe, the importance of international collaboration in disaster risk reduction continues to grow.

Building on its scientific expertise and experience in disaster science and technology, the National Research Institute for Earth Science and Disaster Resilience (NIED) promotes international collaboration through joint research, researcher exchanges, and participation in international initiatives. Through these activities, NIED contributes to the advancement of disaster science and the sharing of knowledge that supports disaster risk reduction.

NIED's International Collaboration in Disaster Science

NIED's international engagement aims to strengthen disaster resilience both in Japan and globally. By working with overseas research institutions and international organizations, NIED promotes the exchange of scientific knowledge and experience while expanding opportunities for collaborative research and dialogue.

NIED operates advanced research infrastructure that supports international collaboration, including nationwide observation networks for earthquakes, tsunamis, and volcanic activity, as well as world-leading large-scale experimental facilities such as E-Defense and the Large-scale Rainfall Simulator. These research platforms provide a robust foundation for advancing disaster science and generating knowledge that can be applied in society.

NIED places emphasis on cooperation in the Asia-Pacific region, where many countries face similar disaster risks including earthquakes, volcanic activity, typhoons, floods, and landslides, and where collaborative efforts contribute to disaster risk reduction. NIED also collaborates with research institutions in Europe, North America, and other regions to develop international research partnerships that bring together diverse scientific perspectives and disaster experiences.

How to Access NIED's Latest Information on International Collaboration

Website

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

X

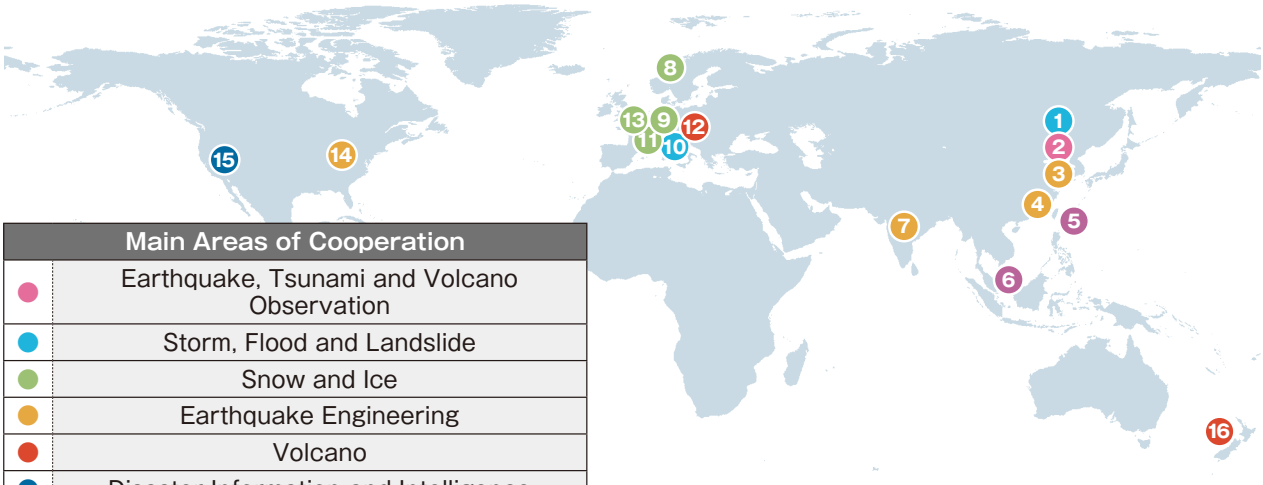
https://x.com/NIED_en

YouTube

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

Global MoC Partnerships

NIED concludes Memoranda of Cooperation (MoC) with research institutes, universities, and other organizations around the world to promote sustained research collaboration and exchange.
The map below shows major partner institutions that have concluded Memoranda of Cooperation with NIED.



Main Areas of Cooperation
Earthquake, Tsunami and Volcano Observation
Storm, Flood and Landslide
Snow and Ice
Earthquake Engineering
Volcano
Disaster Information and Intelligence
Comprehensive Cooperation

World map source: Created using the Elevation (Version 1) data from the Geospatial Information Authority of Japan website (https://www.gsi.go.jp/kankyochiri/gm_global.html).

No.	Country/Area	Partner Institutions	Main Areas of Cooperation
1	Korea	Weather Radar Center of the Korea Meteorological Administration (WRC/KMA)	Storm, Flood and Landslide/ Snow and Ice
2	Korea	Korea Institute of Geoscience and Mineral Resources (KIGAM)	Earthquake, Tsunami and Volcano Observation
3	Korea	Pusan National University (PNU), Seismic Research and Test Center (SESTEC)	Earthquake Engineering
4	Taiwan	National Center for Research on Earthquake Engineering (NCREE)	Earthquake Engineering
5	Taiwan	National Science and Technology Center for Disaster Reduction (NCDR)	Comprehensive Cooperation
6	Malaysia	Universiti Teknologi Malaysia (UTM)	Comprehensive Cooperation
7	India	Indian Institute of Technology Hyderabad (IIT Hyderabad)	Earthquake Engineering
8	Norway	Norwegian Geotechnical Institute (NGI)	Snow and Ice
9	Switzerland	WSL Institute for Snow and Avalanche Research (SLF)	Snow and Ice
10	Italy	University of Basilicata (UNIBAS)	Storm, Flood and Landslide
11	Italy	International Centre for Environmental Monitoring CIMA Research Foundation (CIMA)	Snow and Ice
12	Italy	National Institute of Geophysics and Volcanology (INGV)	Volcano, Earthquake
13	France	French National Research Institute for Agriculture, Food and Environment (INRAE)	Snow and Ice
14	USA	Purdue University, on behalf of its Natural Hazards Engineering Research Infrastructure (NHERI)	Earthquake Engineering
15	USA	Environmental Systems Research Institute, Inc.(Esri)	Disaster Information and Intelligence
16	New Zealand	New Zealand Institute for Earth Science Limited (ESNZ)	Volcano, Multi-disasters

Collaborative Frameworks for Disaster Science

NIED promotes international collaboration in disaster science through frameworks such as the Japan Hub of Disaster Resilience Partners (JHoP) and ICoE-Coherence, strengthening international partnerships and advancing collaboration in disaster science and technology.
NIED also participates in international research networks such as IRDR and the Global Alliance of Disaster Research Institutes (GADRI), sharing research outcomes and contributing to discussions on disaster science and policy.

Japan Hub of Disaster Resilience Partners (JHoP)

NIED serves as the host institution of the Japan Hub of Disaster Resilience Partners (JHoP) and promotes interdisciplinary and international research collaboration among universities, research institutes, and practitioner organizations in Japan.

JHoP is a collaborative network that brings together scientific knowledge on disaster-related challenges and enhances cooperation across disciplinary and sectoral boundaries. Through the participation of twenty member institutions, the network connects diverse areas of expertise and serves as a platform linking knowledge from academia, government, and local communities.

JHoP also functions as a hub in Japan for international collaboration under the Integrated Research on Disaster Risk (IRDR) programme, connecting Japanese research communities with global disaster risk reduction initiatives.

ICoE-Coherence: An IRDR International Centre of Excellence

Under the IRDR programme, jointly led by the International Science Council (ISC) and the United Nations Office for Disaster Risk Reduction (UNDRR), JHoP has been recognized as an International Centre of Excellence (ICoE), designated as ICoE-Coherence.

ICoE-Coherence promotes dialogue and collaboration among researchers and practitioners worldwide in order to advance coherent approaches that integrate disaster risk reduction (DRR), climate change adaptation (CCA), and sustainable development (SDGs).

JHoP
防災減災連携研究ハブ
Japan Hub of Disaster Resilience Partners

Established in 2019

ICoE
COHERENCE | JAPAN

Established in 2021

Highlights of International Activities

Kaoru Takara, President of NIED, delivers opening remarks at the Partner Event of APMCDRR 2024, Manila, Philippines (14 October 2024).

Co-creation Research Forum on exploring industry–academia–government collaboration for strengthening disaster resilience in ASEAN and Japan(19 August 2025).

Academic Forum: "The Future of Global Disaster Risk Reduction" co-organized with the Science Council of Japan (9 December 2025).

Joint field survey with NCDR, Taiwan, near the collapsed slope in the upper Taroko Gorge, Hualien County (20 January 2026).

Dialogue on STI cooperation between Kaoru Takara, President of NIED and H.E. Satvinder Singh, Deputy Secretary-General of ASEAN for the ASEAN Economic Community Secretariat (3 February 2026)

Memorandum of Cooperation signed with the National Institute of Geophysics and Volcanology (INGV), Italy, to strengthen collaboration in seismology and volcanology (12 February 2026)

Cooperation with ASEAN for Strengthening Safety and Security through Disaster Science and Technology

MATSUURA Shohei
Deputy Director-General
Strategic Planning Department

Shared Disaster Risks in Japan and ASEAN

Japan and the ASEAN region face numerous common and shared disaster risks. Both are located along the Pacific Ring of Fire and within the typhoon corridor extending from the Western Pacific through the South China Sea, toward the Indochina Peninsula. Consequently, both regions are highly susceptible to earthquakes, tsunamis, volcanic eruptions, typhoons, extreme rainfall, floods and landslides.

Rapid urbanization and climate change amplify exposure and vulnerability, making disaster risks more complex. In many countries, economic development and urbanization in hazard-prone areas further increase potential disaster impacts on society and infrastructure. These hazards arise from similar physical processes, and the scientific and technological requirements for disaster risk reduction (DRR)—such as observation, analysis, modeling and risk assessment—also share many common elements.

Japan–ASEAN Policy Frameworks for Disaster Cooperation

At the 28th Japan–ASEAN Summit in October 2025, Prime Minister Takaichi and ASEAN leaders reaffirmed disaster management and response remains a key priority areas for cooperation.

Prior to the Summit, cooperation in disaster risk reduction (DRR) had advanced through ministerial-level discussions under the ASEAN-Japan Disaster Management Work Plan (2021–2025). The plan identifies priority areas such as disaster risk assessment, early warning systems, emergency response, recovery and reconstruction and capacity development, while emphasizing the effective use of science and technology.

Workshop at the Institute of Geological Sciences (IGS), Vietnam Academy of Science and Technology (VAST), Hanoi, Vietnam

NIED's Ongoing Research Collaboration in ASEAN

The National Research Institute for Earth Science and Disaster Resilience (NIED) has been conducting collaborative research with partners in several ASEAN countries.

For example in the Philippines, NIED has worked with the Philippine Institute of Volcanology and Seismology (PHIVOLCS) to strengthen earthquake and volcano monitoring, , utilizing observation data for risk assessments to enhance evidence-based decision-making..

In Malaysia, NIED collaborated with government agencies and local universities to analyze rainfall patterns, terrain and geological characteristics and past disaster records to develop advanced hazard information systems for landslides and floods.

In Thailand, NIED conducted research to introduce Area Business Continuity Management (Area-BCM) in industrial zones in Ayutthaya Province, which were severely affected by the 2011 Floods.

Toward Stronger Regional Cooperation

NIED has longbeen actively contributing to regional initiatives, including the Science, Technology and Innovation Platform for Disaster and Climate Resilience (ASPDCR) under the ASEAN Committee on Science, Technology and Innovation (COSTI). Through dialogue among researchers, policymakers and practitioners, the activities have consistently promoted knowledge exchange and capacity building, facilitating the co-creation of technologies and methodologies aimed to address regional DRR challenges.

Through such engagement, collaboration in disaster science and technology between Japan and ASEAN is set to deepen further, fostering regional resilience through the continuously generating shared knowledge and innovation.

Field visit during a joint landslide research project (Kundasang area, Malaysia)

International Collaboration in Volcanic Disaster Research

Sharing Knowledge on Global Volcanic Activity and Disaster Risk Reduction

FUJITA Eisuke
Director, Research Division for Volcanic Disaster

Overview

There are about 1,500 active volcanoes in the world. Some erupt almost daily, while others erupt only once every several decades, centuries, or even millennia. Sharing observational data and experience is therefore essential for improving volcanic disaster
risk reduction.

Recognizing common patterns in eruption precursors and eruption styles, together with lessons learned from past responses, provides important guidance for anticipating volcanic activity and improving disaster preparedness. Based on this understanding, we promote international collaboration to share knowledge on volcanoes in Japan and around the world.

Asian Consortium of Volcanology (ACV)

Asia is one of the most volcanically active regions in the world. Indonesia alone has about 130 active volcanoes, and the Philippines also hosts well-known volcanoes such as Mayon and Taal.

Following the IAVCEI Scientific Assembly held in Kagoshima in 2013, the Asian Consortium of Volcanology (ACV) was established to promote the sharing of scientific knowledge and disaster risk reduction experience in volcanology, foster young researchers through training and collaborative projects, and advance international cooperation.

Since 2015, ACV has organized field camps at volcanoes in Japan, Indonesia, Taiwan, and the Republic of Korea. These activities bring together young researchers and engineers to exchange knowledge on volcanic observation and disaster mitigation while strengthening regional collaboration in Asia.

Asian Consortium for Volcanology (ACV)
3rd Field Camp , Mount Merapi, Yogyakarta, Indonesia

International Workshops on Volcanic Disaster Mitigation Strategies

International Workshop on Strategies for Volcanic Disaster Mitigation 2025. Lecture by Prof. Freysteinn Sigmundsson, University of Iceland.

Since 2003, NIED has co-organized the biennial International Workshop on Mitigation Strategies for Volcanic Disasters with the Mount Fuji Research Institute of the Yamanashi Prefectural Government. The 2023 workshop focused on the impacts of large-scale eruptions on urban areas, including massive ashfall and disruption of urban functions.

In 2025, NIED participated in a workshop held in Iceland. Discussions covered volcanic activity assessment and response measures, including lava flow mitigation through the construction of protective barriers, as well as coordination among universities, meteorological agencies, and civil protection authorities. These discussions provided valuable insights relevant to volcanic disaster management in Japan.

International Collaboration

Italy, like Japan, is a volcanically active country. NIED collaborates with the Italian National Institute of Geophysics and Volcanology (INGV) on studies of active volcanoes, including the Campi Flegrei caldera near Naples.

NIED has also launched a JST-SICORP project on urban risk assessment for volcanic ashfall hazards with Earth Sciences New Zealand (ESNZ). By combining infrastructure impact assessment tools with ashfall simulations for Mount Fuji, the project supports ashfall response planning in Japan.

Beyond individual research projects, NIED participates in international volcanic research networks, including the World Organization of Volcano Observatories (WOVO) and its database WOVOdat, the Volcano Observatory Best Practices (VOBP) network, and the UN initiative Early Warnings for All (EW4All).

Through these collaborations, NIED promotes knowledge sharing on volcanic activity and disaster risk reduction and will continue advancing research to develop more effective strategies for volcanic disaster mitigation.

Pozzuoli, a port town in the Campi Flegrei volcanic area, Italy. Uplift of the ground has created a visible gap between the quay and the sea level.

Disaster Research Cooperation with NCDR (Taiwan)

Science and Technology Collaboration Following the Noto Peninsula and Hualien Earthquakes

NAGAMATSU Shingo
Director, Research Division for Social Resilience

Background of Cooperation

Japan and Taiwan face similar disaster risks, including earthquakes, heavy rainfall, and landslides. Based on these shared challenges, NIED and Taiwan's National Science and Technology Center for Disaster Reduction (NCDR) have strengthened research cooperation in recent years. Since signing a memorandum of cooperation in 2020, the two institutions have strengthened collaboration through annual workshops, researcher exchanges, and other joint research activities.

Joint Research and Field Investigations

Annual workshops held alternately in Japan and Taiwan provide opportunities to share research results and discuss future collaboration. Following discussions between the two institutions, joint field investigations were conducted after the Noto Peninsula Earthquake in January 2024 and the Hualien Earthquake in April 2024. In both regions, researchers examined earthquake impacts and secondary hazards such as landslides and infrastructure damage. The findings were compiled into a joint report that will support future collaborative research.

Future Cooperation

In March 2025, the memorandum of cooperation between NIED and NCDR was renewed. The two institutions will continue joint research, researcher exchanges, and information sharing, while also conducting rapid joint investigations following major disasters. Through this cooperation, they aim to advance disaster science and strengthen disaster resilience in the Asia-Pacific region.

Joint field visit to areas affected by the Noto Peninsula Earthquake

Working Together for a Resilient Future International Collaboration in the G20 Hackathon 2025

Shakti P.C.
Chief Expert Researcher
Research Division for Storm, Flood, and Landslide Disasters

The G20 Hackathon Program 2025, organized under the G20 Research and Innovation Working Group (RIWG), was an international initiative aimed at promoting open innovation and collaborative research on global challenges. Hosted during the South African G20 Presidency, the program brought together multidisciplinary teams to develop data-driven solutions for disaster risk reduction, climate resilience, and sustainable urban development using Earth observation technologies

As a member of the Japanese team, I had the honor of participating in a project titled "Current and Future Flood and Informal Settlement Mapping – Response to the Hackathon Theme and Vision for the Future." The project explored approaches to improving flood-risk assessment and mapping of vulnerable urban areas.

In this project, I analyzed historical gridded rainfall data spanning 43 years (1983–2023) across South Africa. By examining spatial and temporal rainfall variability, I produced analytical outputs and visualizations that supported the team's hydrological modeling and flood-mapping framework. The analysis was conducted using the Digital Earth Africa Sandbox, a cloud-based platform providing access to satellite data and analytical tools.

The team's work contributed analytical insights and data visualizations supporting flood-risk assessment and mapping of vulnerable urban areas in South Africa.

This international collaboration provided valuable experience in applying Earth-observation data and data-driven approaches to flood-risk analysis. The experience also highlighted the importance of international scientific collaboration in addressing complex disaster and climate challenges and advancing more resilient and sustainable societies.

Team members:
Prof. Kenichiro Kobayashi (Saitama University, team leader); Dr. Narumasa Tsutsumida (Saitama University); Dr. Yasuyuki Maruya (Kyushu University); Shakti P.C. (NIED); and experts from Pacific Consultants Co. Ltd.
Coordination and facilitation:
Mr. Shu Matsumoto, Ms. Saori Utsunomiya, and Mr. Kazuhisa Yoshida (Cabinet Office of Japan), who facilitated the participation of the Japanese team in the program.

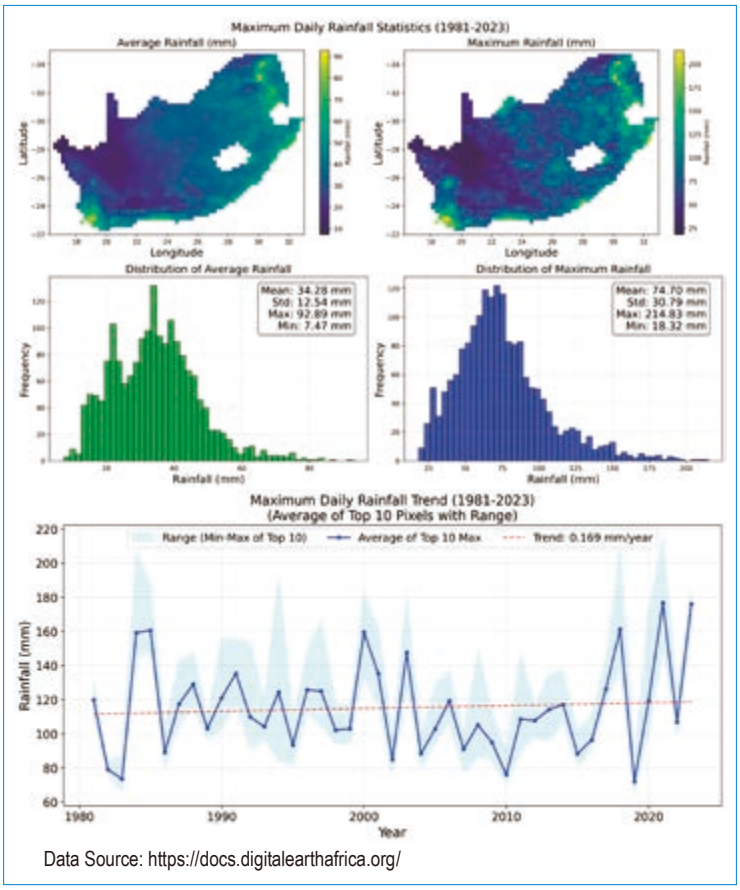


Fig. Long-Term Rainfall Trend and Variability over South Africa (1981–2023)

SCIENCE FOR RESILIENCE

Earthquakes, 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.

SCIENCE FOR RESILIENCE

NIED 防災科研

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

NIED's X (formerly Twitter): https://twitter.com/NIED_en

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National Research Institute for Earth Science and Disaster Resilience