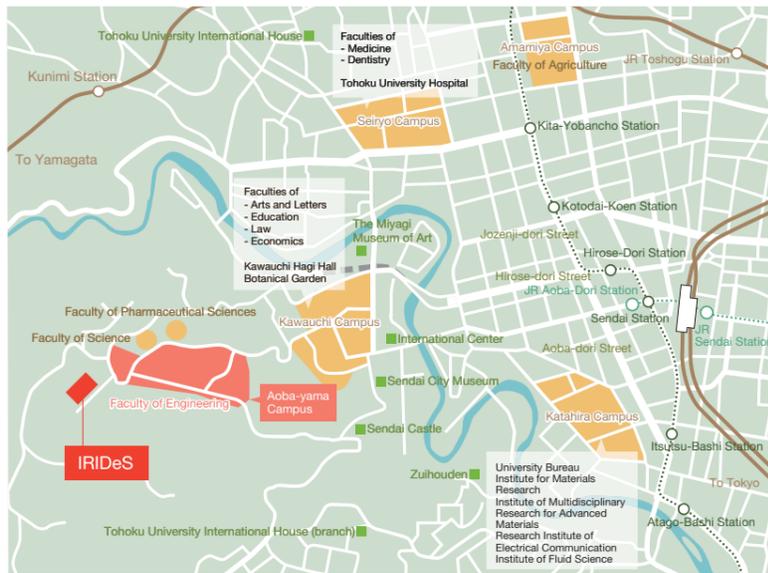


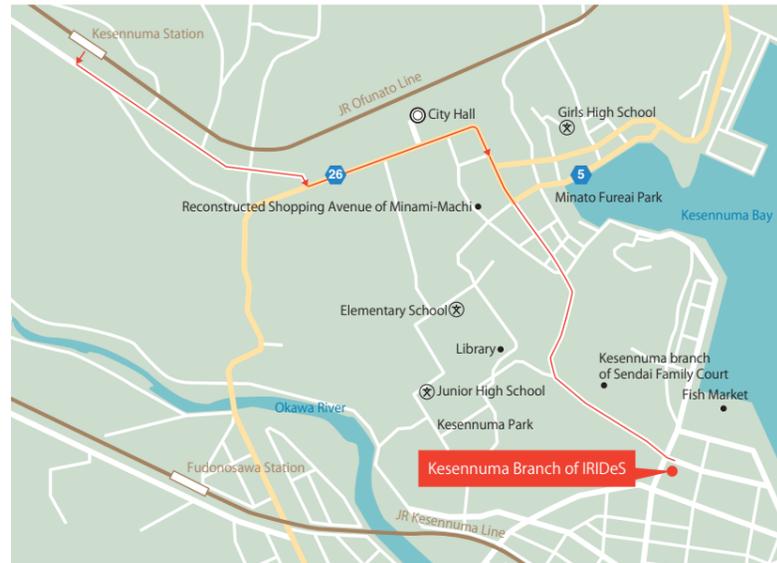
IRIDeS



IRIDeS

International Research Institute
of Disaster Science

IRIDeS Kesennuma Branch



Enhancing disaster resiliency and
preparing for mega disasters.



TOHOKU
UNIVERSITY



IRIDeS background

Establishment of a new research institute prepared for disasters of low frequency and high consequences based on experiences of the 2011 Japan disaster.

In 2007, in order to promote the interdisciplinary research on disaster prevention and disaster mitigation in the society, Tohoku University gathered a team of experts from 19 faculties and established "The Research Group on Disaster Prevention and Management". In Tohoku region, the earthquake known as the Miyagi offshore earthquake had been predicted as high as 99% probability of occurrence in 30 years, the highest in the world. In order to be prepared for this earthquake, Tohoku University integrated the ongoing efforts related to disaster prevention and mitigation from its social, science and engineering departments. Researchers from various specializations, engineering, earth science, psychology, information science, economics, medicine, and history were enrolled. However, the Great East Japan Earthquake Disaster occurred in the middle of this activity. Function of municipalities were affected by the great tsunami and the nuclear power plant accident which also polluted the environment and damaged the national reputation causing a disrupt of the lifestyle in the community. It was clear that against such low frequency great disaster, the traditional disaster prevention and disaster mitigation measures were not enough. After the earthquake, with the participation

of many more scholars, the actual members of over 50 experts, not only deployed a multidisciplinary survey and research on field, but also assisted on the reconstruction of the disaster affected areas. Tohoku University established the "International Research Institute of Disaster Science" as a new integrated interdisciplinary research team to overcome the low frequency great disaster and to use the lessons learned and experiences from the historical global great disasters. The research institute will be a leader in the disaster science related interdisciplinary research of the world, also supported by a national and international network with other research institutions. Using an interdisciplinary approach, we are focusing on the examination and understanding of the mechanism of the Great East Japan Earthquake, the research on countermeasures for the low frequency great disasters and the Tokai, Tonankai and Nankai Earthquakes. In addition, with an emphasis on the historical perspective to strengthen cooperation in all aspects and with affected local governments, a plan for recovery and reconstruction for future disaster prevention and disaster mitigation will be proposed based on the lessons learned.

The second stage of the International Research Institute of Disaster Science (IRIDeS), Tohoku University



Fumihiko Imamura,
Prof. and Director of IRIDeS

The Tohoku earthquake occurred in the Pacific Ocean at JST 14:46 on March 11th, 2011 and the following tsunami left the region devastated. Some twenty thousand people became victims. Not only houses/buildings and infrastructure were heavily damaged, but also the coastal environment/ ecosystem and landscape were widely impacted and severely changed. Furthermore, due to the explosion of the nuclear reactors at Fukushima Dai'ichi, many people from a large area around the reactors have been forced to evacuate from their homes. This is the multi-phase-disaster after the 2011 earthquake, which had never been experienced before.

Immediately after the disaster, Tohoku University established the institute for disaster reconstruction and re-generation research in April 2011, with the aim to lead the revitalization of Japan. One of the major projects was to initiate and enhance international research of Disaster Science. As a result, on April 1st, 2012 a new research institute named the International Research Institute of Disaster Science (IRIDeS) was founded to study the mechanisms which caused this earthquake and tsunami to enable more reliable evaluation of hazards and damage. Scholars from thirty eight fields who shared high ideals and a strong sense of urgency, came together in 7 divisions from both the humanities and the natural sciences, to participate in a multi-disciplinary and multi-layered approach to lead the studies of disaster science. IRIDeS brought together the expertise of Tohoku University to contribute to the reconstruction and rebuilding of disaster-affected areas.

We have also worked to provide relief aid within the disaster area, and to gather accurate information about the damage caused. We initiated a Digital archive project in collaboration with several partners in order to compile data, information, and records related to the 2011 Tohoku Earthquake and tsunami.

Moreover, we have cooperated with research institutions both within Japan and overseas to actively promote the most advanced research in the world in several fields of natural disasters; the digital archive with the Reischauer Institute of Japanese studies at Harvard University, the disciplinary science of disaster with the University of Hawaii at Manoa and disaster risk reduction with IRDR of University College London, and remote sensing for disaster management with DLR (Deutsches Zentrum für Luft- und Raumfahrt). Furthermore, the international program hub, APRU-IRIDeS multi-hazard program, was initiated to harness the collective capabilities of APRU (The Association of Pacific Rim Universities) universities for cutting-edge research on disaster risk reduction (DRR) and recovery, share strategies to cope with campus disaster risk, and contribute to international policy making processes on DRR.

We continue to share what we have learned with the world at large, and together, we work to build a world that is disaster resilient. We cannot achieve this alone. I ask you for your support and cooperation in this endeavor.

Fumihiko Imamura, Prof. and Director of IRIDeS . April 1st, 2014

Tohoku University Efforts before 2011

Development of disaster prevention technologies

- Earthquake and Tsunami prediction and modeling technologies
- Developing early warning technologies
- Enhancing seismic performance of structures

Interdisciplinary Disaster Prevention Research (countermeasures against the off-Miyagi earthquake)

- Disaster Control Research Center, Graduate School of Engineering : Research collaborations with Ministry of Land, Infrastructure and Transport, Tohoku Regional Development Bureau / Miyagi Prefecture / Sendai City
- Graduate School of Science and Graduate School of Engineering : Comprehensive Agreements with Sendai city and the Headquarters for Disaster mitigation research[in 2006]
- Establishment of the research group on disaster prevention and management in Tohoku University (19 faculty members related to humanities and science fields)[in 2007]

2012 ~

The 2011 Great East Japan Earthquake Disaster

- Complex mega disaster involving the megathrust earthquake, great tsunami and the nuclear power plant accident
- Revealed the limits and weaknesses of the state of the art of Science and Technology systems



Establishment of the International Research Institute of Disaster Science IRIDeS

- Rebuilding the disaster mitigation technologies based on the experiences and the lessons from the Great East Japan Earthquake and Tsunami Disaster
- Promotion of Science to support the affected areas
- Enhancing disaster-resiliency and performance of multiple-fail-safe systems in regional and urban areas
- Comprehensive study on the 2011 Tohoku earthquake and tsunami disaster
- Development of next-generation tsunami warning system for mega-earthquakes
- Establishing disaster medicine and medical health care system towards catastrophic natural disasters
- Developing the digital archive to share the lessons and the post-disaster reconstruction activities in regional and urban areas



Development

- 2006 Conclusion of the agreement with Sendai City regarding disasters
- 2007 Organization of Tohoku University Research Group on Disaster Prevention and Management, which consists of 19 research fields from humanities and sciences
- 2012 Foundation of IRIDeS, which consists of 7 research divisions and 38 research fields from social and engineering sciences
- 2013 Initiation of the conclusions of the agreement with damaged municipalities / Set up of IRIDeS Kesennuma City Satellite Office

Agreements

- | | |
|--------------------|--|
| 8th February 2013 | Tagajo City |
| 25th June 2013 | Watari Town |
| 12th July 2013 | Iwanuma City |
| 13th July 2013 | Kesennuma City (Branch opened on 1st October 2013) |
| 21st August 2013 | Higashi-Matsushima City |
| 24th December 2013 | Yamamoto Town |
| 9th January 2014 | Sendai City |
| 7th February 2014 | Rikuzen-Takata City |

Preamble

Having experienced the catastrophic disaster in 2011, Tohoku University has founded the International Research Institute of Disaster Science (IRIDeS). Together with collaborating organizations from many countries and with broad areas of specializations, the IRIDeS conducts worldleading research on natural disaster science and disaster mitigation. Based on the lessons from the 2011 Great East Japan (Tohoku) earthquake and tsunami disaster, IRIDeS aims to become a world centre for the study of disasters and disaster mitigation, learning from and building upon past lessons in disaster management from Japan and around the world. Throughout, the IRIDeS will contribute to on-going recovery/reconstruction efforts in the affected areas, conducting action oriented research, and pursuing effective disaster management to build sustainable and resilient societies. IRIDeS innovates the past paradigm of Japan's and world's disaster management to catastrophic natural disasters, hence to become a foundation stone of disaster mitigation management and sciences.

Mission of IRIDeS

Disaster mitigation management aims to reduce or avoid the potential losses from natural hazards, to assure prompt assistance to victims, to achieve rapid and effective recovery, and to build disaster-resilient and sustainable societies, by five stages of the disaster management cycle; Mitigation, Preparedness, Response, Recovery and Reconstruction. The action-oriented research of the IRIDeS is a pursue of each point in the cycle, integrating and universalizing scientific discoveries to be dedicated to the world. IRIDeS creates a new academia of disaster mitigation that subsumes the lessons from the 2011 Tohoku earthquake and tsunami disaster and the findings of the world-leading research into our societies with the aim of establishing social systems capable to respond promptly, sensibly and effectively to natural disasters, withstanding the adversities with resiliency, passing and exploiting the lessons to the forthcoming disaster management cycles.

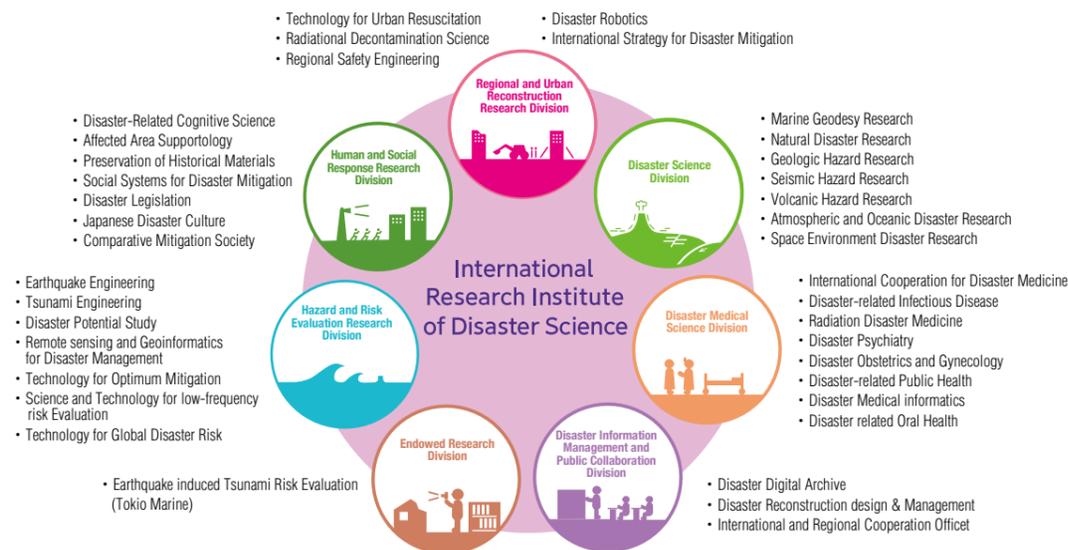
Visions of IRIDeS

Enhancing the cooperation with the local municipalities and governments in the affected areas, and contributing to their recovery and reconstruction efforts, the IRIDeS conducts the action-oriented research. We aim to create disaster-resilient societies to overcome the complex and diverse processes of forthcoming natural disasters, not

only by preventing but also preparing and responding to them, and achieving recovery and renovation, hence to engender the culture of disaster-resiliency incorporating into our social systems. The action-oriented research of the IRIDeS focuses on;

- 1 Investigating the physics of global scale natural disasters such as mega-earthquakes, tsunamis and extreme weather
- 2 Reconstructing disaster response and mitigation technologies based on the lessons of the 2011 Tohoku earthquake and tsunami disaster
- 3 Inventing "Affected Area Supportology" in the aftermath of natural disasters
- 4 Enhancing disaster-resiliency and performance of multiple-fail-safe systems in regional and urban areas
- 5 Establishing disaster medicine and medical service systems towards catastrophic natural disasters
- 6 Designing disaster-resilient societies and developing the digital archive system to pass the lessons from the disasters

Organization of IRIDeS



Logo mark



English name

IRIDeS
Iris, *Iris laevigata* or Japanese Iris
Symbol of hope and nobility

Logo meaning

It is the deformed image of the Japanese character of disaster (災, *wazawai*) turned upside down, based on the idea of Japanese saying "Turn your misfortune to good account". It represents our mission of learning the lessons from the 2011 Tohoku earthquake and tsunami disaster and pursuing effective disaster management to build sustainable and resilient societies. Iris is the symbol of "hope" and "dignity".

Projects	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Comprehensive study on the 2011 Tohoku earthquake and tsunami disaster	Seafloor geodetic measurements	Generation mechanisms of the 2011 Tohoku earthquake and tsunami		Technology enhancement of early detection of earthquakes and tsunamis by GPS seafloor geodetic measurements			Early tsunami detection by offshore tsunami monitoring and seafloor geodetic measurement			
Digital archive system of natural disasters	Stochastic analysis of seismic activities and crustal movement			Standardization of metadata structure of the digital archive	Disaster education program using the disaster digital archive		Establishing the world standard of disaster digital archives	Utilization of the disaster digital archives for disaster response		
Robotics for disaster management				Enhancement of disaster-rescue robotics and contribution disaster relief		Development of sensing technologies for disaster response		Robotics for compound disaster management		
Radioactive decontamination science				Developing radioactive decontamination technologies disaster relief		Establishment of radioactive decontamination science		Enhancement of radioactive decontamination technologies		
Assessment of the impact of the 2011 Tohoku earthquake and tsunami disaster			Assessing the structural damage by the strong ground motion	Elucidating the damage mechanisms of the 2011 Tohoku earthquake and tsunami disaster	Next-generation warning system		Development of next-generation earthquake-tsunami warning system for mega-earthquakes			
Development of sensing and monitoring technologies for early earthquake and tsunami warning system			Developing tsunami fragility curves and structural vulnerability assessment	Remote sensing approach for assessing the impact of the earthquake and tsunami	Disaster recovery and reconstruction monitoring by remote sensing		Enhancing disaster-resiliency and performance of multiple-safe systems in regional and urban areas			
Inventing "Affected Area Supportology" in the aftermath of natural disasters			Cognitive processes underlying human perception of and behavior against risks	Developing new approaches to locating and preserving historical materials on lessons from the historical disasters		Establishing technologies of preserving cultural heritage and historical materials for passing the lessons from the catastrophic disasters		Optimization of disaster relief logistics for wide-area regional cooperation of disaster management		
Establishing disaster medicine and medical service systems towards catastrophic natural disasters			Establishing the logistic and operation of the catastrophic disaster relief activities	Fact findings and monitoring of urban development process in the disaster recovery	Legislation for disaster-prevention and relief	Visualizing and monitoring the process of decision making in post-disaster reconstruction		Establishing Affected-Area Supportology and its implementation		
Development of new disaster mitigation systems for catastrophic natural disasters			Establishing disaster psychiatry for the recovery from the disaster-related mental health problems	Reducing risks of disaster-related infectious disease	Requirements analysis for disaster medical informatics	Establishing disaster-related public health	Establishing disaster medical informatics	Integrating emergency medical health care system and disaster medical informatics for catastrophic disaster response		
			Technology development towards comprehensive disaster mitigation systems			Establishing the design of comprehensive disaster mitigation systems		Enhancing the feasibility of comprehensive disaster mitigation systems and its implementation		

Lessons learned from the 2011 Tohoku earthquake tsunami disaster
Contribution to the post-disaster recovery and reconstruction towards disaster-resilient societies

This division reconstructs disaster prevention/mitigation technologies on the basis of synthesis of lessons obtained from the 2011 Great East Japan (Tohoku) Disaster and analysis of the disaster generation mechanisms. The deformation and regional destruction processes of the earthquake and tsunami are investigated by the integration of the observed data, frontal development of remote sensing technologies, and advancement

of numerical simulations. The existing prevention/mitigation systems are examined on the effectiveness for the mega hazards and innovated. Through the application of our findings to the area of high possibility in mega disaster occurrence, this division aims for the contribution to enhance the preparedness for the risk reduction and early recovery.

Earthquake Engineering

We aim to reduce the disaster resulting from an earthquake in regions. The activities at the Earthquake Engineering Research Field are oriented to earthquake disaster mitigation measures from the points of view of "Incentive" and "Real-time" Disaster Prevention Engineering (IDPE and RDPE). IDPE is based on the optimization theory, and RDPE use real-time hazard information.



Tsunami Engineering

The Tsunami Engineering Laboratory aims to clarify huge tsunamis and damage process in Tohoku coast area, and to develop integrated technologies for reducing tsunami disaster by structure and non-structure measures.



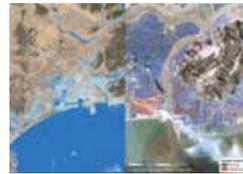
Disaster Potential Study

Disaster Potential Study Laboratory aims to develop efficient measures against tsunamis, high waves, storm surges, and floods for disaster risk reduction and climate change adaptation in coasts and rivers.



Remote sensing and Geoinformatics for Disaster Management

With use of modern computing power, we develop a new framework to search and detect the impact of natural disaster by integrating real-time computing, damage/loss estimation models, remote sensing and geoinformation techniques.

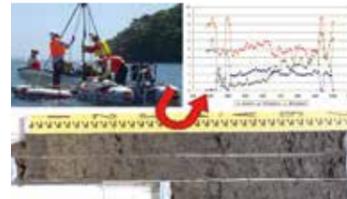


Technology for Optimum Mitigation

To address the issues regarding large displacements in long-period structures subjected to long-period/long-duration ground motions, we are developing new promising energy dissipation devices that effectively reduce response displacements without deterioration of floor response accelerations by utilizing an effective mass device capable of generating large apparent mass with small physical mass, or a magneto-rheological fluid damper controlled by rate-independent damping algorithm.

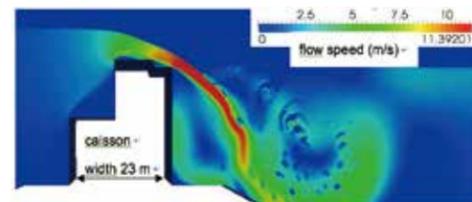
Science and Technology for low-frequency risk Evaluation

The LFRE dedicates the interpretation and evaluation of the geologic records of low-frequency risks such as large-scale earthquakes, tsunamis and volcanic eruptions, to contribute for the mitigation and prevention of the enormous disasters in collaboration with earth sciences, coastal engineering and historical science.



Technology for Global Disaster Risk

The Technology for Global Disaster Risk Laboratory utilizes field measurements, numerical simulations, and laboratory experiments to determine the causes of failure of hydraulic and coastal structures during disasters such as tsunamis, typhoons, hurricanes, and river floods, so that these structures can be designed more robust in the future. To further the goal of developing resilient infrastructure, we seek to foster cooperation among hydraulic, coastal, geotechnical, and structural engineers, as well as urban planners.



CFD simulation of jet overtopping Kamaishi breakwater 31 minutes after quake in 2011(profile view)



The disaster cycle and revival is reevaluated from a historical point of view, and it is proposed the construction of a society aware beforehand of the disaster. The needs of the affected area are presumed accurately, and the planning technology for swift and effective supports from external area is offered utilizing the existing resources and knowledge to the utmost. Considering the difference in culture and history in the regions and countries,

the construction method of the social system having disaster response skills is proposed, based on human's disaster cognition and action mechanism as well as disaster response power of industry, government, academia and nonprofit sectors. Furthermore, we investigate the methodology to protect the regional history and culture from a disaster and to deliver them to the next generation.

Disaster-Related Cognitive Science

In this research field, we conduct basic research on the cognitive processes underlying human perception of and behavior in complex physical and social environments. We apply the outcome of such research to develop systems for disaster prevention, mitigation, and restoration that are friendlier to human's cognitive mechanisms.



Affected Area Supportology

It is important to provide swift and effective support for survival, recovery and reconstruction, from outside the affected area. We are conducting the following studies: 1) Facts and lessons in the relief for good logistics in large disaster, 2) Emergent medical support and transportation of affected people, and 3) Development of utilization methodology of people's location data.



Preservation of Historical Materials

There is a wealth of historical materials, documents, art objects, implements and other items, held privately throughout Japan. Each of these objects is a unique record of people's lives within that region. We will conduct research based on our ongoing experience in actual practice to develop new approaches for locating and preserving historical materials, and the organizational and social structures necessary to implement these, so that we can protect these materials from disasters and pass these cultural resources on to future generations.

Social Systems for Disaster Mitigation

This research field will propose policies and disseminate information from the disaster-affected area, aiming to revival of industry and increase the regional resilience, by studying the vision of local industry and economy such as industrial location of all Tohoku and new ideas in fields like agriculture, fisheries, manufacturing, as well as by researching how to improve disaster response power in view of business continuity and the method of wide-area disaster support.



Panel discussion "The disaster prevention efforts by industry, academic, government and local residents in northeastern Japan" (December 2013)

Disaster Legislation

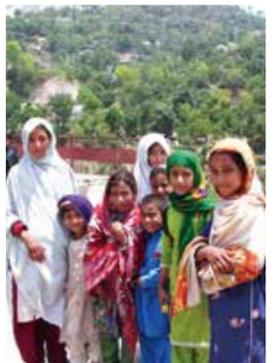
We must research the problems of present disaster-prevention laws that should be revised compared with the realities of the East Japan great earthquake according to investigation of its actual conditions.

Japanese Disaster Culture

To learn the legacy of the Japanese culture and way of life against natural disaster for constructing disaster-resilient societies

Comparative Mitigation Society

In disaster-affected places, policies and planning are aiming to guide rebuilding more resilient and robust. To better achieve this goal, we internationally research policies and plans developed and implemented during recovery phase in different social, cultural and economic settings. Through identifying issues and gaps between goals and realities, we aim to come up with key planning/policy features and systems that support recovery with more resilience against future disasters.



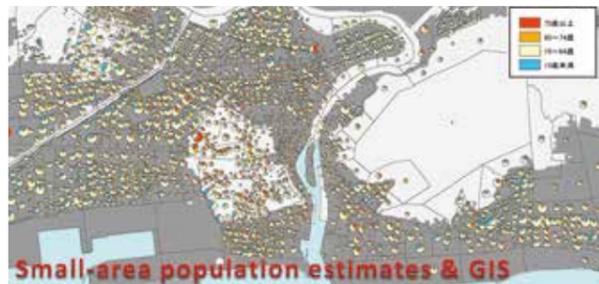


The affected area is making a recovery from the disaster. To achieve this goal, we need the following 4 things;
 1. Research studies and measuring methods to grasp the situation of affected areas appropriately
 2. Methods of decontamination and reconstruction to change affected areas into the spaces where people can live comfortably
 3. Technologies for planning the reconstruction of the affected area as a sustainable place

4. Developing technologies of disaster prevention and mitigation to ensure the safety of the rebuilt area
 It is necessary for us to carry out these plans with active promotion of international cooperation and medium or long term strategies. This division has 5 sections to study and develop them. We study especially focusing on "reconstruction" of affected area.

Technology for Urban Resuscitation

This division focuses on planning theory and the development of planning formatting technologies to rebuild the affected areas especially in urban spaces. In addition, to achieve these goals, we study the development of social systems and management methods.



Radiational Decontamination Science

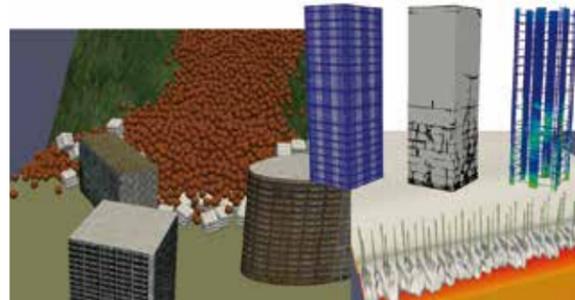
In addition to radioactive material contamination monitoring, we work on the elucidation and solution of the problem of contamination by a radioactive material. We promote the following research;
 1) Why is radioactive cesium not in tap water?
 2) How can be decontamination of the contaminated soil carried out?



We washed contaminated soil with water and after 30 seconds took out it. We carried out this process three times and then the activity of soil decreased 1/25. The washed soil could be returned to its original place.

Regional Safety Engineering

This division is devoted to provide innovative ideas and technologies for improving the safety and durability of regional and urban areas, and the resilience against various kinds of disasters and hazards. For that purpose, we are establishing multi-layered-coupled numerical simulation methods for multi-physics phenomena of structures, grounds and fluids, clarifying the mechanism of the degradation processes and strength responses, and developing optimal design techniques for practical disaster-prevention.



Disaster Robotics

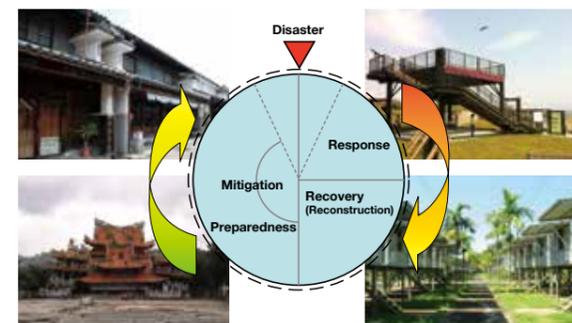
This laboratory promotes research and development of robotics and related technologies that contributes wide range of disaster management including search & rescue and disaster response.



International Strategy for Disaster Mitigation

Our goal is to plan more practical international strategies for disaster mitigation/post-disaster recovery and to develop international frameworks that enable the strategies. In order to clarify existing problems and make recommendations to the world for future disaster reduction, International Strategy for Disaster Mitigation Research Laboratory is researching on the relationship between disaster management and urban/regional space inside and outside of the country, through case studies of vulnerable areas including disaster-experienced cities.

Spatial Design Elements on Disaster Life Cycle



Natural disaster is a consequence of the dynamic activity of the planetary earth, which is driven by energies from the sun and the Earth's interior. Therefore understanding the generation mechanism of itself is important to estimate short and middle-

to-long term risks and hence to mitigate damages. We deal with wide-range of global natural hazard, such as great earthquake and resulting tsunami, volcanic eruption, climate change, space hazard, and so on.

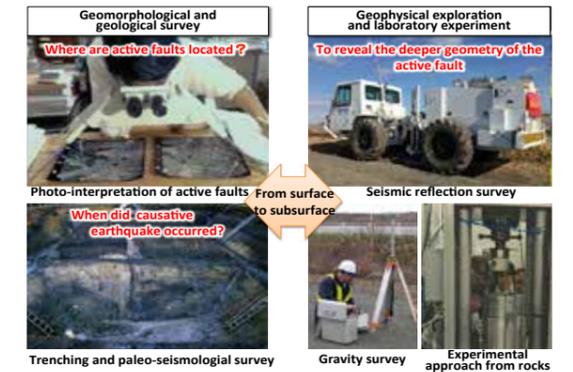
Marine Geodesy Research

Promote following research to elucidate stress distribution around the plate boundaries where large earthquakes and tsunamis occur:
 1) Seafloor geodetic surveys along subduction zones
 2) Development of advanced technology for seafloor geodetic measurements
 3) Evaluation of spatio-temporal variation of the stress distribution around plate boundaries based on land and sea geodetic data



Geologic Hazard Research

To reveal surface geometry, morphological characteristics and mode, evolution of active fault, and earthquake source process. We promote scientific research of active fault from surface to deep subsurface in cooperation with Dept. Earth Sci., Tohoku Univ. Outcomes of our study contribute to risk assessment of onshore active fault as basic data, and also have important role in a local plan for disaster prevention and disaster mitigation.



Seismic Hazard Research

Promote not only the study on generation mechanism of interplate earthquakes but also the improvement of prevention method against infrequent great disasters such as forthcoming Tonankai-Nankai earthquakes in cooperation with the Research Center for Prediction of Earthquakes and Volcanic Eruptions, Graduate School of Science.

Volcanic Hazard Research

We are making the following studies for clarifying the fundamental processes of volcanism and for forecasting volcanic hazards.
 1) Deep structure and origin of active volcanoes on the Japan Islands and the whole Earth;
 2) Relationship between volcanism and dynamics of the Earth's interior;
 3) Earthquake and volcano interactions and short-term and long-term predictions of volcanic hazards.

Atmospheric and Oceanic Disaster Research

Promote the following researches to clarify phenomena in the atmosphere-ocean-land system and evaluate hazards:
 1) Global climate change and extreme weather events
 2) Mechanism of occurrence of severe atmospheric phenomena
 3) Global warming effects on regional climate

Space Environment Disaster Research

In order to make a bridge between research and operation, we promote scientific and engineering studies to reduce space environment risks on the activities in space. Main research items are following: 1) studies on measures to ensure the safe and sustainable use of space and 2) space hazard prediction with assessment of forecast tools.





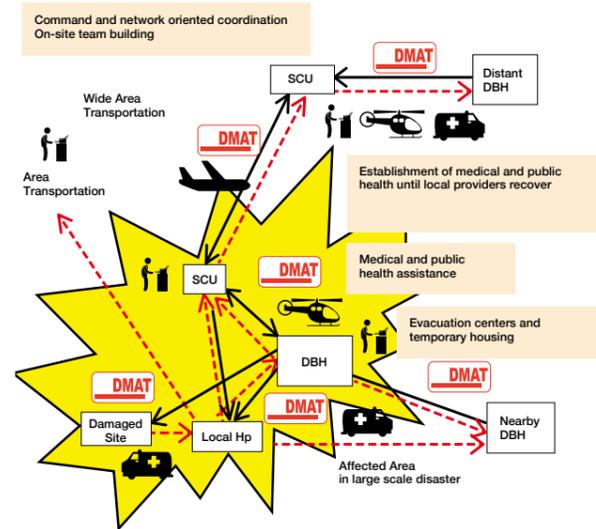
In this division, countermeasures and disaster prevention schemes are studied to establish international standards for application in the acute and chronic phases of a widespread major disaster. In cooperation with the risk research and human/social support research divisions, the division is involved in construction of infrastructure for emergency medicine in a major disaster, medical research for infections in disaster areas, establishment

of radioprotection standards for nuclear hazards, research on remission or decrease of disaster stress, establishment of international standards for countermeasures against the impact of disasters on mothers and children, proposals for maintenance of the healthcare system after a major disaster, and establishment and international standardization of a disaster medical information system.

International Cooperation for Disaster Medicine

This research field collects and analyzes the medical and public health needs and actual support in Great East Japan Earthquake to establish the efficient cooperation system of domestic and international medical management. Establishment, education and spread of disaster medical and public health care is another mission. Reorganization and revitalization of devastated broad area will be a model of recovery from large scale disasters.

Medical management in large scale disaster



Disaster-related Infectious Disease

We focus on infectious diseases which we have to prepare for outbreak in post disaster period. Through our research we will investigate natural history of infectious disease outbreak from both cell level and behavioral level.

Radiation Disaster Medicine

Our laboratory evaluates radiation doses and radiation effects in humans, analyzes the management of radiation exposure from nuclear hazards and medical procedures, and develops diagnostic imaging systems for use in disasters.



Disaster Psychiatry

The major aims of our department are: 1) to integrate multi-faceted basic and clinical research approaches to identify social, psychological, and biological factors involved in the pathophysiology of and recovery from disaster-related mental health problems; 2) to develop useful tools for the prevention, screening, diagnosis, and treatment of disaster-related disorders; and 3) to provide useful information for improving mental health in communities affected by disasters.

Disaster Obstetrics and Gynecology

The objectives of this field are to establish international standards for disaster countermeasures by analyzing the impacts of a disaster on mothers and children, and to perform a long-term study of the effects of disasters on obstetrics and gynecology-specific diseases.

Disaster-related Public Health

To propose the emergency medical health care system for great disasters in large areas. This research field is currently in preparation.

Disaster Medical informatics

Our aim is to develop useful medical information system in disaster cycle with the integration of disaster medical science and information technologies.

Disaster related Oral Health

We have developed the computerized matching system for identification of victims during large scale disasters. Our current activity is mainly collecting the baby tooth in Fukushima and detecting radioactive agents, 90Sr and 137Cs, in collaboration with the School of dentistry.



The division aims to support for reconstruction/revival and the cooperation to prevention and reduce disaster in Japan and overseas and to collect all available data for situation and restoration /revival information focusing on the 2011 Tohoku great earthquake and tsunami. One of typical topics at the division is the design of new disaster resilience society and collecting lessons learned. First, digital archive of Michinoku Shinrokuden which fills and goes away is started to record data for the 2011 great Tohoku earthquake and tsunami. Based on

these, the support for planning of the reconstruction and the recovery program in a damaged area is developed, and the contents considering history and culture, environment, and industry especially are practiced, supporting agreement formation with citizens. Moreover, since it contributes to enforcement of future disaster prevention and disaster reduction strategy, a related meeting for coordination is planned and it becomes the international organization as a core of cooperation.

Disaster Digital Archive

We are 1) collecting and archiving the disaster related information and data (digital and non-digital), 2) developing and establishing the digital archive system, and 3) promoting utilization of the system and archiving data in collaboration with industry-academia-government-citizen.

Disaster Reconstruction design & Management

We research and practice disaster mitigation and prevention to build up community which is integral to the society, aiming at making the community sustainably resistant to disasters, beautiful and comfortable.



International and Regional Cooperation Office



The goal of the International Cooperation Office is to strategically introduce cutting-edge IRIDeS research findings to society, including government, disaster-affected municipalities, research institutes, private sector, international organizations such as the United Nations and Non-Governmental Organizations. The Office aims at Tohoku recovery enthusiastically through planning domestic and international events and conferences.

We also educate talents for the "science for global safety", an academic attempt to systematically organize various studies regarding safety, which have been developed within different specialized domains, according to their space, time and social aspects from a global perspective, placing disaster prevention/mitigation for natural disasters and other risks as the central pillars. This program is constructed based on the three viewpoints of "Understanding" "Creating" and "Living" supported by collaborations among researchers in science, engineering and humanities and social sciences.

Endowed Research Division



The endowed Research Division is initiated and managed by the donation from a company etc. for the purpose to strengthen the education and research in the university. Now, tsunami risk

evaluation and assessment proposed by Tokio Marine Co.ltd is started for three years.

Earthquake induced Tsunami Risk Evaluation (Tokio Marine)

The methodology evaluating earthquake induced tsunami risk is developed with tsunami hazard such as wave heights and arrival time, in consideration of the vulnerability in society or disaster prevention ability. And synthetic risks of having added occurrence probability further are examined as well.



Emergency disaster surveys after the foundation of IRIDeS

Efforts of our surveys and research include the 2011 Great Japan Earthquake, as well as other natural disasters inside and outside the country. Immediately after severe natural disaster, we organize emergency survey teams by our faculties and dispatch them to the affected areas. The survey team inspects damages and makes interviews from evacuees

in the shelters and facilities of the disaster management of local governments. The purpose of the emergency survey is to collect various kinds of information and data on current situation of the disaster, which is indispensable for rescue, recovery and reconstruction.

● Intranational disaster survey

Emergency survey of the August 2013 rainstorm and landslide in Akita and Iwate Prefectures (14th – 15th August, 2013)

● International disaster survey

Emergency survey of the January 2013 flood in Jakarta, Indonesia (10th – 13th February, 2013)

Emergency survey and analysis of the disaster mechanism in Philippines due to the storm surge by Typhoon Haiyan (January, 2014 ~, ongoing)

Brief reports of the previous emergency surveys are available at:

http://irides.tohoku.ac.jp/topics_disaster/index.html/

IRIDeS rapid survey team for Akita and Iwate heavy rainfall disasters in August 2013

A heavy rainfall caused by a stationary front occurred in northern Japan on August 9, 2013. The event resulted in flooding, landslides and sediment flows due to heavy rainfall, and 8 persons were killed or missing in Akita and Iwate prefectures by the event. IRIDeS dispatched a rapid survey team consisting of 8 members from 4 disciplines from August 14-15, 2013 to evaluate the hazard and damage and to gather information from the local governments.

The team investigated the damage to infrastructure such as roads, railways, bridges and river embankments and collected information on flooded houses. Also, flood warning and evacuation information during the event were assessed by interviews with local residents and local governments. Further analysis and investigation of the event will be conducted in order to prevent and mitigate future disasters due to heavy rainfalls, which are expected to increase under a changing climate during the 21st century.



IRIDeS fact-finding mission to Jakarta, February 10-13, 2013

On January 15, 2013, heavy monsoon rains resulted in severe flooding in Jakarta city, West Java, Indonesia, which as of January 31 had resulted in 40 deaths, 45,000 refugees, and terrible economic damage. From February 10 until February 13, 2013, an IRIDeS fact-finding mission consisting of five researchers visited Jakarta to make an initial assessment of the January 2013 flood, which made headlines due to its inundation of the country's presidential palace and its wealthy urban center, where unexpected casualties occurred. The team began to build relationships with national and local agencies and community organizations responsible for the city's flood preparation and response, and gathered data necessary for understanding the flood and for constructing a hydrologic/hydraulic model of the city's drainage system. The team also visited neighborhoods and interviewed residents affected by the flood, collected water quality samples of

floodwaters and water in the city's drainage canals, visited sites of hydraulic structures along the drainage canals, and visited industrial parks to assess their flood protection measures.



Emergent IRIDeS team investigations about the Typhoon Haiyan disaster in Nov. 2013

Typhoon Haiyan (Yolanda) with the recording strong wind and rainfall made several landfall and caused a devastating damage to the Philippines. The coastal area was struck also by remarkably high storm surge resulting in more than 6000 lost and more than 30,000 injured. More than 3.9 million people evacuated.

IRIDeS dispatched the first investigation team from Dec. 3-7 for gathering information from governmental, hospital and research organizations in Manila. Then, the secondary team consisted of three sectors with 13 members dispatched from Jan. 16-25, 2014. They explored the Typhoon Haiyan damage with the help from local counterparts and translators.

IRIDeS is planning to dispatch further investigating teams for reconstruction in February and March.

Disaster medical science team made the map of hospitals in the area and visited each hospital to inquire the type of hazard affecting in-patients and medical workers, the effect on the disease spectrum including mental health and hospital functions, preparedness and the support receiving capacity including communication, education and training. They visited the base camp of Red Cross and the housing (barrack and tents) area of affected people to see how water and food supply, sanitary condition and disease prevalence. It is important to understand the primary health care system in Philippines. In Manila, IRIDeS presented the lessons and current concept of disaster medical management in the technical discussion on making hospitals/health facilities safer in disasters. The Secretary and the members of Department of Health, WHO and Department of Public Work and Highways (DPWH) attended the meeting and discussed how we can achieve safe hospitals not only structurally but non-structurally and functionally.

Hazard and Damage Evaluation team estimated the actual height of storm surge according to the physical and verbal evidences in the affected area. They measured the damages of ships flown onto the coast, the houses, sea wall and coconut trees and the effect of storm surge and returning waves. Comparison of estimated damage from remote sensing by satellite images and actual measurements will

validate and increase the accuracy of remote sensing. DPWH and architects from University of Philippines collaborated the exploration, measurements and investigation of the structural/non-structural damage to buildings including hospitals. The 300 km/h wind and heavy rain damaged the roofs and ceilings and destroyed the function even the building was not flooded by storm surge. In the latter half of stay, damages of coastal line in East Samar were measured, too. The supply of materials and human resource are far from sufficient, but the peoples warmly welcomed us as an international investigating team and the smile of children made our heart warm.



Project Research

The IRIDeS promotes publicly-offered project research with collaborating organizations from many countries and with broad areas of specializations. The aims of these research projects are not only to contribute to on-going recovery/reconstruction efforts in the affected areas but also to

conduct world-leading research on natural disaster science and disaster mitigation. FY2013 specific projects (intramural leading research) are as follows:

Development of next generation earthquake early warning system with structural health monitoring function

Chief Researcher / Prof. Masato Motosaka
Professor, Earthquake Engineering, Hazard and Risk Evaluation Research Division.

Interdisciplinary analysis on the 1611 Keicho Oshuu earthquake tsunami and its making result a public

Chief Researcher / Prof. Fumihiko Imamura
Tsunami Engineering, Hazard and Risk Evaluation Research Division.

Verification of Rapid Mapping of Damage Estimation in Disaster Relief Activities

Chief Researcher / Prof. Shunichi Koshimura
Remote Sensing and Geoinformatics for Disaster Management, Hazard and Risk Evaluation Research Division.

What is zest for living?: cognitive-scientific analysis of behavior in disaster

Chief Researcher / Assoc. Prof. Motoaki Sugiura
Disaster-Related Cognitive Science, Human and Social Response Research Division.

New disaster prevention strategy based on behavioral science

Chief Researcher / Assoc. Prof. Shunsuke Managi
Social Systems for Disaster Mitigation, Human and Social Response Research Division.

Tectonic Geomorphology and Subsurface along the Western Margin of Yamagata Basin by Using Seismic Reflection Profile, Northeast Japan

Chief Researcher / Prof. Toshifumi Imaizumi
Geological Hazard Research, Disaster Science Division.

Reconstruction of long-term crustal movement based on altitude and age of uplifted terraces and subsided basins along the coastal Tohoku region, northeast Japan, to understand the process of strain accumulation and release associated with mega-thrust earthquakes

Chief Researcher / Assist. Prof. Yuichi Niwa
Natural Disaster Research, Disaster Science Division.

Effect to disaster infection towards human security

Chief Researcher / Prof. Toshio Hattori
Disaster-related Infectious Disease, Disaster Medical Science Division.

Basic Research to establish effective support system for disaster-related psychiatric disorders

Chief Researcher / Prof. Hiroaki Tomita
Disaster Psychiatry, Disaster Medical Science Division.

A study of the effects of the great disaster, subsequent stress and severe changes in living environment on gynecology-specific diseases

Chief Researcher / Prof. Kiyoshi Ito
Disaster Obstetrics and Gynecology, Disaster Medical Science Division.

Analysis of Internal Radiation Exposure History in Humans using Teeth

–Radiation Dose Evaluation using deciduous teeth lost by children resident in Fukushima and Miyagi Prefectures
Chief Researcher / Assist. Prof. Toshihiko Suzuki
Disaster Medical Informatics, Disaster Medical Science Division.

Research and Practice on the regeneration design for the disaster-affected urban area of Ishinomaki city

Chief Researcher / Prof. Yasuaki Onoda
Disaster Reconstruction design & Management, Disaster Information Management and Public Collaboration Division.

Integrating the action-oriented research outcomes of the IRIDeS into international disaster risk reduction policy making processes

Chief Researcher / Prof. Yuichi Ono
International Regional Cooperation Office, Disaster Information Management and Public Collaboration Division.

Visit the below URL to learn about other research activities.
http://irides.tohoku.ac.jp/topics_project/index.html/

Participation in the UN World Conference on Disaster Risk Reduction

The Third UN World Conference on Disaster Risk Reduction to be held in Sendai, 14-18 March, 2015, is a good opportunity for the IRIDeS to disseminate outcomes of practical research on disaster science. It is our responsibility to share knowledge and wisdom as well as lessons learned from the Great East Japan Earthquake and Tsunami with

supporters from all over the world. We will provide a great deal of substantial inputs to the negotiation process of the conference, participate in public forum, and contribute to assist recovery of Tohoku by bridging a potential gap between the UN large conference and disaster-affected areas in innovative manners.

Books & Publication



Analyze the Great East Japan Earthquake Disaster

(View the below URL to place on order)

http://irides.tohoku.ac.jp/media/files/archive/IRIDeS_publication2013.pdf

Others

- Annual Report, International Research Institute of Disaster Science, Tohoku University, 2012.
- Annual Report, Research Group on Disaster Prevention and Management, Tohoku University, 2011.
- Annual Report, Vol. 11, Disaster Control Research Center, Tohoku University, 2011.

IRIDeS QUARTERLY

Japanese Vol.1~5
English Vol.1~3

IRIDeS Report

Vol.1 (Japanese only)
Vol.2

Meeting opportunities in IRIDeS

IRIDeS will hold conferences and meetings on a regular basis, in order to share and disseminate our research progress and outcomes, and to promote research collaboration and integration.

Agenda of Extended meeting

- **IRIDeS Now** The research progress and outcomes to be shared in IRIDeS.
- **IRIDeS Friday forum** Academic seminar of IRIDeS researchers.
- **The Great East Japan Earthquake Disaster Watcher** Follow up seminar on the post-disaster activities and efforts.

IRIDeS Friday forum

A forum of regular presentations and discussions is provided in order to share the information of research activities and collaborations at the IRIDeS. This forum also reports emergency disaster surveys. The annual meeting to project researches is included the forum and is held on July.

Further information is also posted on the website

Activity Reports <http://irides.tohoku.ac.jp/topics/index.html>

Future plans <http://www.dcrc.tohoku.ac.jp/archive/>