Tohoku University International Research Institute of Disaster Science NEWSLETTER

Conveying the results of practical disaster prevention research from TOHOKU to the World.

IRIDeS Quarterly

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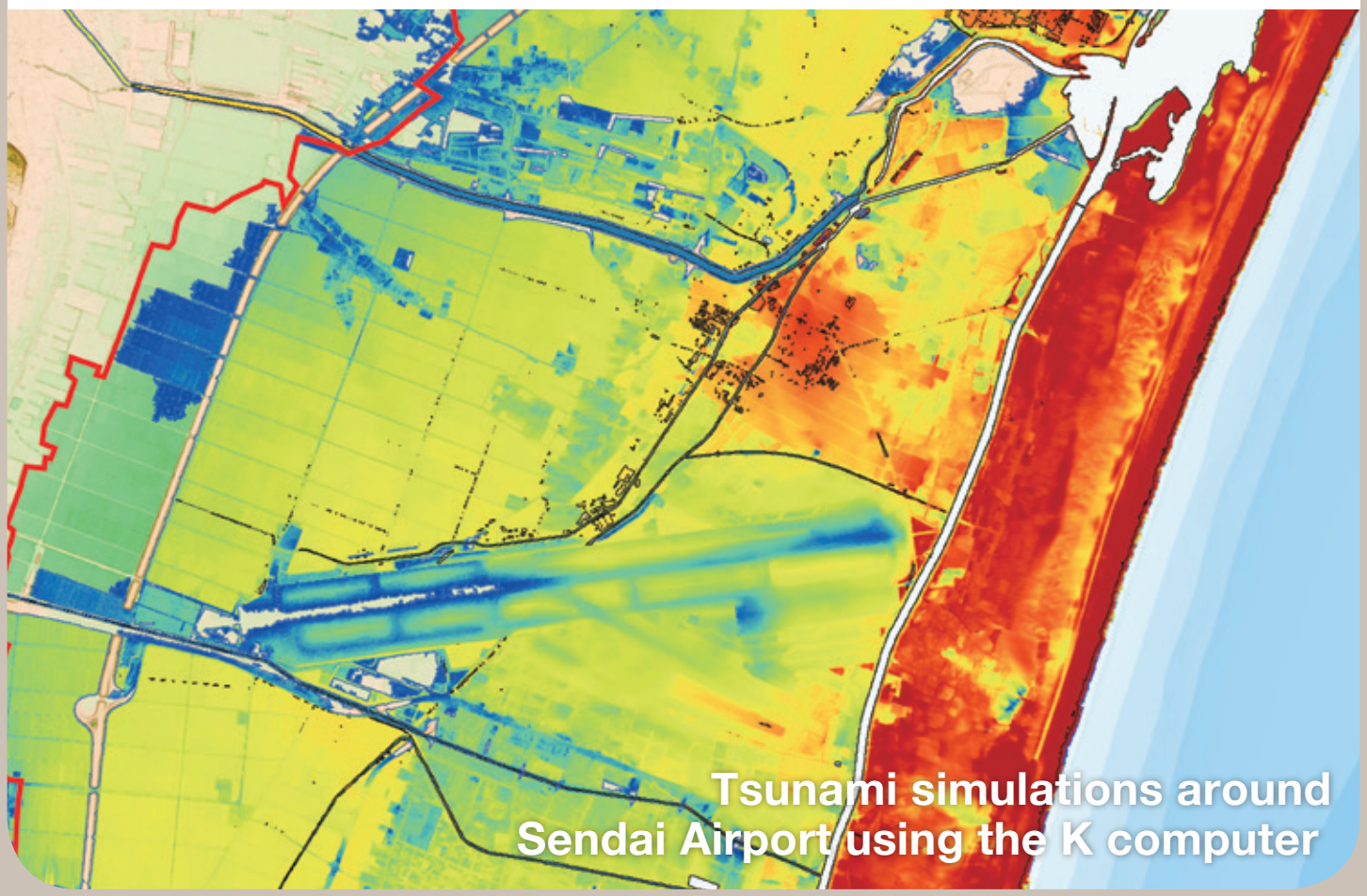
Special Interview

Situation of the IRIDeS Emergency Investigation Team

News

Looking Back on the Third UN World Conference on Disaster Risk Reduction



Tsunami simulations around Sendai Airport using the K computer

Science and Technology for Low-frequency Risk Evaluation and Tsunami Engineering Laboratories use the K computer to conduct numerical modeling regarding sediment transport for more precise simulation.

New disaster risk reduction studies tailored to society from the Tohoku disaster region.

The Tohoku University International Research Institute of Disaster Science (hereinafter referred to as “IRIDeS”) conducts research by gathering 37 fields of study in seven divisions that transcend the border between physical and social sciences. IRIDeS promotes “practical disaster risk reduction studies" that can be useful in society and people’s lives. IRIDeS aims to utilize its comprehensive knowledge to contribute to the recovery of disaster-affected areas and building a society that can withstand disasters.

Hazard and Risk Evaluation Research Division

Building disaster-resilient society
by exploiting lessons from the 2011
Tohoku earthquake and tsunami disaster

Human and Social Response Research Division

Researching the culture and history of
domestic and international disasters,
disaster cognition, and disaster mitigation/
recovery measures

Regional and Urban Reconstruction Research Division

Developing and researching various
technologies to create communities
where people can live with peace of mind

Disaster Science Division

Revealing the mechanisms behind
disasters to forecast hazards

Disaster Medical Science Division

Multifaceted evaluation and
enhanced preparedness for health and
medical care during disasters

Disaster Information Management and Public Collaboration Division

Enhancing the record of the earthquake
and assisting urban reconstruction

Endowed Research Division

Enriching disaster research
with private sector donations, etc.

Third UN World Conference on Disaster Risk Reduction Transmitting Future Disaster Prevention Polices from Sendai

The Third UN World Conference on Disaster Risk Reduction was held around Sendai city on March 14 to 18th, 2015. Representatives from 187 countries participated in fruitful debate. This culminated in the adoption of the Sendai Framework for Disaster Risk Reduction 2015-2030, which defines a global policy for disaster risk reduction for the next 15 years. The framework includes the following seven targets that each country should achieve.

1) Substantially reduce global disaster mortality
2) Substantially reduce the number of affected people globally
3) Reduce direct disaster economic loss
4) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities
5) Substantially increase the number of countries with national and local disaster risk reduction strategies
6) Substantially enhance international cooperation to developing countries
7) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people

A significant achievement of the conference was the clear listing of concrete targets. By clearly listing these targets, each country is more easily able to include disaster risk reduction in their government policies.

In the Sendai Framework for Disaster Risk Reduction 2015-2030, measures for disaster risk reduction implemented before a disaster occurs are extremely important for reducing fatalities, affected people, and economic losses. They will also play an extremely important role when countries invest in disaster risk reduction.

Related events such as the public forum were also a great success. Study tours of disaster areas and forums that invited people who directly experienced the Great East Japan Earthquake received full crowds. Enabling local residents to interact with people from around the world was a major achievement of the conference.

Main conference of the Third UN Conference on Disaster Risk Reduction

Promoting the presence of IRIDeS as an academic institute and continuing future actions for disaster risk reduction

Ever since Sendai city stood as a candidate for holding the WCDRR, Tohoku University has been working together with the city to assist its selection. The university issued reviews analyzing efforts for the Hyogo Framework for Action before the conference, and provided its campus as a location for holding public forums, etc. during the conference. This enabled Tohoku University and IRIDeS to promote their presence to the world.

There were two other main achievements. The first achievement was IRIDeS being able to properly fulfill its role as an academic institution. IRIDeS actively promoted the inclusion of concrete targets in the framework adopted at the conference. We welcome the seven targets included in the Sendai Framework for Disaster Risk Reduction 2015-2030 and will continue our activities to promote their adoption.

The second achievement was being able to promote cooperation between industry, government, academia, and the private sector through the conference. IRIDeS started the Miyagi Disaster Prevention/Reduction Round Table Conference in cooperation with the Kahoku Shinpo Publishing Co. in April, 2015. I hope this can further strengthen the links forged during the WCDRR.

Introduction to Related Events Held by IRIDeS

The Great East Japan Earthquake Memorial (Tohoku Forum for Creativity)

The forum was held on 10 March only a few days before the WCDRR, but was attended by more than 400 people. It was an extremely valuable opportunity to transmit university knowledge and debates, with events including a symposium with leading experts in disaster risk reduction from both Japan and overseas. "The Great March Eleventh (3.11) Tsunami: Remembering for the Future" 3D documentary movie was one archive project for passing on lessons learned from the disaster to future generations. It was easy to understand for the general public, and left a lasting impression.
(Comments here and below are from Director Imamura)

International Forum for promoting Education on Disaster Resilience "Development of a Resilient Community and Improving Disaster Education and Regional Disaster Preparedness"

This forum was held for the purpose of transmitting experiences and lessons related to disaster prevention education to the world, and was attended by representatives of major institutions in Japan that are involved in disaster prevention education. It enabled important knowledge to be transmitted by exhibiting examples of efforts conducted over Japan and in the Tohoku region, such as the Kakeagare! Nippon project and the "Yui" pocket handkerchief project for disaster reduction. The conference ended on a meaningful note with the adoption of the Sendai Declaration on disaster prevention education, which promotes cooperation between Japan and other countries.

Tohoku University Guided Tour

This tour introduced the research results and research facilities of IRIDeS to about 20 national representatives participating in the main conference. We introduced our latest facilities and six researchers gave reports on the research they are conducting in their specialized fields. The tour was joined by people from various regions, including Chile, Hong Kong, and Europe. Participants expressed their desire for similar facilities and to deepen their links with countries overseas, etc.

Announcement on the Establishment of a Global Center for Disaster Statistics

Tohoku University and the United Nations Development Programme (UNDP) conducted a joint press conference on the establishment of a "Global Centre for Disaster Statistics" at IRIDeS. This center will aim to contribute to disaster risk reduction over the world via disaster statistics, which plays an important role in the action framework adopted during this conference. We will efficiently collect and archive data while utilizing the know-how we have built up over the years.

Associate Professor
Shuji Moriguchi
Regional and Urban Reconstruction Research Division
Regional Safety Engineering
Specializes in geotechnical engineering and landslide disasters. Received his doctorate in engineering from the Gifu University Graduate School of Engineering in 2005.

Assistant Professor
Haorile Chagan-Yasutan
Disaster Medical Science Division
Disaster-related Infectious Disease
Specializes in infectious disease. Received her medical doctorate in infectious disease from the Tohoku University School of Medicine in 2011.

Assistant Professor
Shuichi Kure
Hazard and Risk Evaluation Research Division
Disaster Potential Study
Specializes in hydrology. After graduating from the Department of Civil Engineering, Faculty of Science and Engineering at Chuo University, assumed his current position after working as a postdoctoral researcher at the University of California, Davis.

Assistant Professor
Xin Wang
Hazard and Risk Evaluation Research Division
Earthquake Engineering
Specializes in earthquake engineering. After receiving her master's degree at Southeast University in China, received her doctorate in engineering from the Graduate School of the Aichi Institute of Technology.

Special Interview

How should an emergency investigation team face disasters?

The IRIDeS emergency investigation team is a multidisciplinary task force that surveys local areas when a disaster occurs. The team operates all over the world. In addition to disasters in the Tohoku region, the team has recently been surveying the aftermath of typhoon Haiyan in the Philippines and the Yunnan province earthquake in China. Young members working in the emergency investigation team got together to discuss the future of emergency investigation.

Interdisciplinary research combining the physical and social sciences. Utilizing the strengths of IRIDeS to investigate disasters in Japan and around the world.

Conducting the research required for different fields according to the situation in disaster areas

Associate Professor Shuji Moriguchi ("Moriguchi"): First of all, what is your opinion about the necessity of quickly entering sites? I specialize in landslide disasters. Since the conditions of slopes can immediately change due to the weather, etc., I want to enter sites as soon as possible.
Assistant Professor Shuichi Kure ("Kure"): I agree. My research focuses on floods, and it is necessary to quickly enter sites while the situation is the same as when the disaster occurred, in order to discover how water overflowed from the river and caused a flood.
Assistant Professor Xin Wang ("Wang"): I specialize in the structure of buildings. Since buildings are torn down in order to proceed with reconstruction, I have to conduct my surveys at least before that happens. Since the information that I want to know is often not covered by press photography and reports by other researchers, I want to visit the actual sites to confirm the local culture and status of buildings.
Assistant Professor Haorile Chagan-Yasutan ("Haorile"): Infectious diseases often increase about several months after a disaster occurs, so I go to the site at around that time. As Professor Wang says, it is important to assess the situation with one's own eyes. Since the situation of medicine and lifestyles differs according to the country, it is necessary to conduct investigation according to the situation of each area.
Moriguchi: Yes, it is important to understand the local situation. The assistance that we want to provide sometimes differs from what the local people want. Professor Kure, how did this affect things when you

focused your research on typhoon Haiyan?
Kure: Let me see. What the people in the disaster area wanted was practical technology, such as methods for installing tin roofs that can withstand strong winds, rather than academic survey results. Some of the structures that were destroyed were made of hollow steel frames, which made me think about the meaning of conducting academic surveys in such places for the purpose of advancing research. Since the financial situation of the country and the disaster awareness of citizens are closely related, academic surveys and research results often differ from the local needs.
Wang: I agree. The local financial situation is the key to reconstruction. Even when international aid agencies provide the local government with a meaningful proposal, that proposal may be abandoned due to a balance between money and priorities. Sometimes a social approach can help more than a scientific approach.

Providing concrete results to local areas based on detailed surveys

Kure: The survey of typhoon Haiyan has only now, almost two years after the disaster, started to contribute to the community from a sociological perspective. Immediately after the disaster, we conducted detailed interviews with about 600 residents, regarding the situation at the time and evacuation efforts, etc. Since the survey brought back painful memories, it was difficult for both the residents and the researchers, but that survey is now assisting local disaster prevention. This is a successful example of an interdisciplinary survey assisting local reconstruction in addition to academic papers.
Moriguchi: That is good. I think that might be the way that IRIDeS can give back to the community, thanks to its low barriers between the arts and science. Since academic research often takes a long time until it can be utilized, it is also important to think about how to communicate the necessity of surveys to local residents.
Wang: Since I often conduct my surveys by entering houses and buildings affected by a disaster, I try to explain things in a polite and easy to understand manner. Since research into earthquake resistance directly contributes to the safety of housing, I make an effort to get people to understand this.
Haorile: Professor Wang's research is also useful for the construction of hospitals. In addition to constructing safe buildings, discovering what kind of structures can reduce damage to expensive machinery is also extremely important for medical staff. Since IRIDeS is an institute that can easily implement such cooperation, I hope that we can produce more and more concrete results.
Moriguchi: What people want us to do is providing information that is useful for local people and can contribute to the community, rather than simply going to retrieve academic information. We need to conduct surveys while constantly thinking about what kind of output we should provide.
Wang: It is important for us to think about how we can utilize the ability of IRIDeS. When conducting surveys overseas, it is also important to secure an accessible route in advance. For example, since I was born in China, it is easy for me to connect with local research institutes in China, etc. Professor Haorile also has links with the Philippines, etc.
Haorile: That's right. IRIDeS is an international institute. Developing relations during normal times to bridge differences can enable smooth surveying when a disaster occurs. I hope we can utilize local networks and technology to provide surveying and assistance while sharing roles. This will hopefully enable us to share goals with local people so we can proceed in the same direction.
Kure: I hope we can cultivate the ability of individuals to meaningfully integrate the arts and sciences and conduct interdisciplinary surveys, so we can contribute to the disaster areas with valuable survey and research results. I think it is important that we exchange not only reports on survey results but also opinions on evaluations, issues, and the meaning of surveys.
Moriguchi: We have been able to share some valuable opinions today. Thank you very much.

Feature-1

Monitoring volcanic activity in Tohoku based on geodetic data

"Volcanoes may have been activated due to the Tohoku-oki earthquake"

●Surveying a volcano and installing observation devices

Professor
Satoshi Miura

Disaster Science Division
Volcanic Hazard Research

Specializes in geodesy. Graduated from Tohoku University in 1981. Doctor of science. Worked as an assistant professor at the Faculty of Science and an associate professor at the Graduate School of Science at Tohoku University, and as a professor at the Earthquake Research Institute at the University of Tokyo, before assuming his current position. A member of the Coordinating Committee for Prediction of Volcanic Eruption and members of the Volcanic Disaster Prevention Councils for active volcanoes, including Mt. Zao in all Tohoku prefectures.

Monitoring the activity of Zao, which has little data from the past

Volcanic activity in various areas such as Ontake, Hakone, Zao, Azumayama, and so on attracts public attention. Professor Satoshi Miura is on the frontline of monitoring volcanic activity. He specializes in geodetic observation, and watches long-term GPS data, etc. "We have installed five seismographs and six GPS receivers for detailed observation around Mt. Zao, which has been activated in the last few years." says Prof. Miura.

Volcanic tremors were observed at Mt. Zao in January, 2013. Volcanic earthquakes and tremors have been intermittently observed since then, and a Near-crater Warning was announced by the Japan Meteorological Agency (JMA) on April 13th, 2015. What we want to know is when and in what way Mt. Zao will erupt. However, Prof. Miura says that the prediction of Zao volcano is particularly difficult. "For volcanoes with a long eruption interval such as Mt. Zao, we have little data and it is difficult to know physical processes of eruptions. Most recently, a small-scale phreatic eruption occurred in 1940, but at that time we did not have the observation technology we do today, and accurate and detailed data does not remain. The last large-scale magma eruption occurred around the 13th century. We cannot know how that eruption occurred. I will keep my eye on the volcano so that we do not miss the signals of forthcoming eruption."

The government and research institutes cooperate in data collection

GPS receivers to observe crustal deformation have been installed all over the country by the Geospatial Information Authority of Japan since the Great Hanshin Earthquake with a spatial interval of about 20 km. Denser observation networks have been established around volcanoes by academic institutes such as universities. Tohoku University deploys GPS around activated volcanoes, mostly in the Tohoku region.

A Volcanic Alert Level 2 (Near-crater Warning) of Mt. Azuma was announced by JMA in December, 2014, and volcanic earthquakes suddenly increased in January, 2015. The GPS data started to show volcanic inflation pattern of deformation. "As a result of analyzing the data, we could also estimate a pressure source at the depth of approximately 3 km. Since Mt. Azuma has experienced many small-scale eruptions and earthquakes, we must continue to be vigilant." Prof. Miura also says that it is highly possible that the recent increase in volcanic activity is related to the occurrence of the Great Tohoku-oki Earthquake. "Five M9 class earthquakes besides the Tohoku-oki earthquake occurred around the world since 1950, followed by large eruptions within several years. Since magma is supplied from a place deep underground, it can sometimes take years until it rises to the surface. We cannot become lax even if four years have passed, and we must keep monitoring on volcanoes."

Continuing observation and analysis for disaster prevention and mitigation

The Great Tohoku-oki Earthquake brought about great changes in scientific research. Before the earthquake, scientific research institutes including national institutes focused on forecasting earthquakes and volcanic eruptions, but after the earthquake, the contribution for disaster prevention and mitigation has been regarded as important. "After the earthquake, we have started to conduct research more focused on social requirements. Science is a field that is not widespread amongst the general public. That is why it is extremely important to transmit the results of research. I hope we can effectively utilize opportunities for conducting lectures and gathering information from the media to convey useful knowledge to the general public."

Furthermore, if we can make geophysical observations more precise, we can more accurately know the timing and scale of eruptions. "I want to continue steady data collection and analysis in the future. I think there are many areas where research has not progressed. Observation data is just rows of figures as it is. We have to think about how to extract the data we want to see and model it. Also, about how we can make that model useful for disaster prevention and mitigation. I want to continue deepening my research so that I can transmit the status of volcanoes in an easier manner to understand."

Feature-2

Supporting disaster-affected children through education

"Deeping understanding about positive aspects of the community and reconstruction through town watching and map making"

●Reconstruction map created by the fourth year students of Kazuma Elementary School in Ishinomaki city (2012)

Associate Professor
Aiko Sakurai

Disaster Information Management and Public Collaboration Division
Disaster Reconstruction Design & Management

Specialized in international education development and disaster education. Completed her master's degrees at Keio University (in political science) and Columbia University (in public policy), and doctorate at Kobe University, Conducts practical researches in Japan and overseas in a field of education, especially on girls education and post-disaster education recovery

Disaster recovery education for children in post-disaster phase

The Great East Japan Earthquake taught us a lot of lessons such as importance of disaster education. The most important role of education is to cultivate the ability to make decisions and protect oneself during a disaster. Another important role is to learn from the lessons of the disaster to prepare for the next disaster.

Professor Sakurai has been assisting Kazuma Elementary School in Ishinomaki city and conducting a research since April, 2012. The school area is about 1 km away from the coast on the east side of the city. Although many houses were badly damaged by the tsunami, the school buildings were only inundated with about 1 cm above the first floor, and classes could have been reopened at the same place as before the earthquake. The students are creating reconstruction maps that convey the current status of reconstruction their community in a wall newspaper format.

"When I first approached Kazuma Elementary School, I wasn't sure what we could do the best." says Prof. Sakurai. "The children are survivers from the disaster. Upon talking with their teachers and thinking about what to do, we decided to help the children to create reconstruction maps to enable them to feel proud of their community that is recovering from the disaster and keep this feeling of fondness into the future."

Vacant lots can be defined as the beginning of reconstruction

The fourth year students create the reconstruction maps during their periods of integrated studies. The children are divided into groups and walk around the areas. By interviewing local residents and making observations, they discover and record places damaged by the tsunami, locations under repair, locations newly built after the earthquake, and locations that they find attractive. "We wanted the disaster experienced children to think about what reconstruction was, and to grow fond of their town." says Prof. Sakurai.

On the maps, the children indicate the locations they discover with colored stickers. For example, blue indicates locations that were built after the 3.11, red indicates locations that seem dangerous, orange indicates locations preparing for reconstruction, and gold indicates fun locations or locations the children are proud of fun. "We positioned vacant lots as positive places where the rubble has been cleared away and reconstruction could start." says Prof. Sakurai.

After completing their maps, the children invite local residents to give a presentation. Some residents said that the children's interviews gave them encouragement. These children played a role in connecting school and local residents.

The program modified year by year according to children's situation

This is the fourth year of the program. In the second year, the program emphasized to encourage children to find changes from the previous year.

In the third year, something unexpected happened. Despite the construction steadily proceeding, red stickers indicating dangerous locations increased on the maps. "The students in that year were pre-school age at the time of disaster when the Great East Japan Earthquake occurred. They had little memory of what the town was like before the disaster. Some of the children thought that vacant lots were dangerous locations once they knew the places struck by the tsunami." explains Prof. Sakurai.

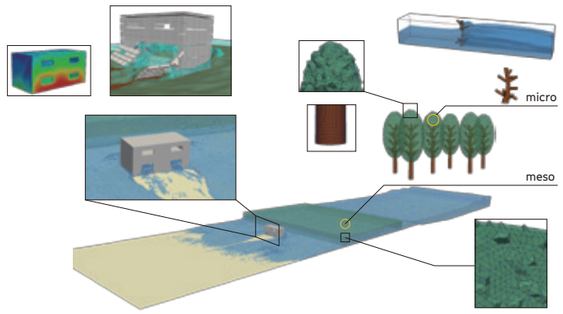
"As months and years pass after the disaster, it is more important to learn what the disaster was while providing mental care. I believe these changes were found because the program has been continued at Kazuma Elementary School."

The program for creating reconstruction maps started at Kazuma Elementary School is planned to be expanded to another six schools in Ishinomaki city this year. This will be a long-running project for learning from the disaster experiences.

Feature-3

Real simulations that consider the strength of buildings

"Applying multi-scale analysis methods to disaster simulations"



●A new method making waves in conventional analysis research

By dividing the spatial scale of coastal forest into branch, tree and forest band scales, the proposed method of multiscale analysis enables us to evaluate the result of micro scale 3D simulations as a resistance for meso scale flows and then to predict the effect of fluid force on buildings.

Professor
Kenjiro Terada

Regional and Urban Reconstruction Research Division
Regional Safety Engineering

Specializes in computational dynamics mechanics and material dynamics characterization. After graduating from Nagoya University, completed his doctorate at the graduate school of the University of Michigan. Worked as an associate professor in the Department of Civil and Environmental Engineering at the School of Engineering at Tohoku University, before assuming his current position.
Received the Kawai Medal from the Japan Society for Computational Engineering and Science in 2014.

A new method making waves in conventional analysis research

In recent years, disaster simulations have been showing remarkable progress. These simulations may bring to mind video of tsunamis approaching the coastline and water weaving its way through the gaps between buildings. Professor Terada is championing a brand new approach in this field. Prof. Terada proposes a method that realizes multi-scale analysis. This type of analysis is mainly used in analyzing the strength of structures, and it considers the "micro" material properties of buildings to perform "macro" simulations, such as the collapse of buildings. Prof. Terada has applied this method of multi-scale analysis, which has until now mainly only been used in the field of structural dynamics, to the field of disaster simulation.

"For example, say we are simulating the resistance of a forest planted for tide prevention. Multi-scale analysis would break down the forest to look at the strength of individual tree branches. By figuring out how much the branches of the forest can resist the pressure of a tsunami, we can more realistically calculate the resistance of the entire forest. Of course we cannot actually perform such a precise simulation. That is why we utilize the concept of homogenization to perform calculations based on an average of the material properties for a certain range."

A multidisciplinary approach for real simulations

Up until now, disaster simulations have been conducted separately within various fields. For example, the field of tsunami engineering conducts simulations on the flood depth and flood area, and the field of structural engineering conducts simulations on how buildings collapse due to seismic waves. Although these fields both conduct disaster simulations, there was not much cooperation between them. Prof. Terada believes that these fields must employ a multidisciplinary approach to cooperate technically in order to conduct simulations that more closely reflect reality. "The experience of the Great East Japan Earthquake taught us that disaster simulations are very important and they are becoming ever more necessary. On the other hand, we also realized that we do not have sufficient systems and tools for conducting them. We must systematically survey how much of the technology required for simulating a complete tsunami we have in Japan, and what we are still lacking."

If the multidisciplinary simulations conducted by Prof. Terada continue to evolve, we will become able to check in more detail how much damage will occur if an earthquake occurs in a location such as the Nankai trough.

Promoting visualization to widely convey research results

However, there is still a long way to go for this research. Disaster simulations have an astronomically large number of factors that must be considered. "Buildings alone feature many types of materials, but when analyzing damage from an earthquake and tsunami, it is also necessary to consider the properties of the ground and tsunami. We want to sincerely and truthfully reproduce the conditions, but it is quite difficult to do so. I believe it is important to first consider the uncertainties involved and produce a wide range of computational results."

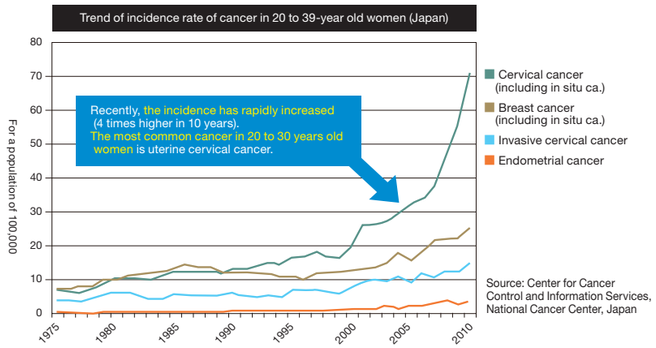
Prof. Terada says that he wants to research the effect that the concentration of rubble included in a tsunami has on the destruction of buildings. He plans on confirming these relationships by conducting numerical tests by putting rubble inside tanks of water.

Another thing he wants to focus on is visualization. Numerical simulations are simply collections of formulas and data unless they are visualized. Even if they contain important numerical data for researchers, they cannot be easily understood by the general public. "We are also considering a method for effectively showing people computational results using a multidimensional visualization system, etc. In order to contribute to society with the results of our research, it is important to convey these results in a manner that is easy to understand." Prof. Terada will continue his challenge to realize uncompromising simulations.

Feature-4

Protecting women's health with large-scale and long-term surveys

"Researching the relationship between disasters and women's health from the perspective of gynecology"



●Transition of cancer occurrence in women aged 20 to 39 (Japan)

Professor
Kiyoshi Ito

Disaster Medical Science Division
Disaster Obstetrics and Gynecology

Specializes in gynecological oncology, gynecological pathology, and gynecological examinations. Graduated from Tohoku University. Doctor of medicine. Worked as a guest researcher in pathology at the George Washington University, as the head of the Center for Clinical Cytology, Miyagi Cancer Society, and as an associate professor in gynecology at Tohoku University, before assuming his current position. A board member of the Japanese Society of Clinical Cytology and a representative of the Japan Society of Obstetrics and Gynecology.

Disaster obstetrics and gynecology for long-term protection

When a disaster occurs, childbirth is one aspect of obstetrics and gynecology that gets particular attention. Emergency response is required to provide safe childbirth in a situation where normal medical treatment is not available. Gynecology actually plays an important role in doing so. "What is important in gynecology when a disaster occurs is long-term follow-up observations. We need to properly assess the risks of women's bodies in disaster areas over a longer span of five to ten years," says Professor Ito, who focuses his research on disaster obstetrics and gynecology.

After the Great East Japan Earthquake, Prof. Ito focused his research on the screening rate for cervical cancer and female-specific symptoms such as abnormal bleeding. The screening rate in coastal regions has been dropping after the earthquake. "Reconstruction has not been going smoothly for medical institutions."The Miyagi Cancer Society and Tohoku University have been cooperating to dispatch mobile examination cars to regions with few medical institutions. Prof. Ito has been surveying the situation of these screenings and investigating possible measures. "Recently we are also trialing the latest screening procedures for identifying carriers of the 'human papillomavirus', which causes cervical cancer. I hope we can increase the number of screenings."

Conducting large-scale analysis of female-specific symptoms

Another thing that Prof. Ito is involved with is the large-scale analysis of female-specific symptoms, such as irregular menstruation and abnormal bleeding. He analyzed the data for around 100,000 people in areas including coastal regions and surveyed whether women experienced abnormal bleeding before and after the earthquake. Prof. Ito found that the ratio of women at an age to have their period that experienced abnormal bleeding did not increase after the earthquake, but the ratio of menopausal women with abnormal bleeding did increase.

"The fact that abnormal bleeding increased in menopausal women was unexpected. Another thing I noticed was that about 30% of women before menopause have symptoms of irregular menstruation and abnormal bleeding. This might be the first survey in Japan to be conducted on such a large scale. Not only was I able to survey health during a disaster, but I was also able to gain new knowledge about women's health at normal times."

This survey is expected to be utilized for the stockpiling of menstrual sanitary products for disasters. "The stockpiling of menstrual sanitary products is calculated by assuming that women from the ages of 10 to 50 will have their period seven days a month, but the result of this survey indicates that this may be insufficient. We will have to reconsider these numbers."

The relationship between women's health and stress during a disaster

Another thing that Prof. Ito wants to focus on in the future is the long-term health impact of stress hormones that are secreted due to the stress of a disaster, etc. This is a field that requires more research, as in recent years there have been papers published that indicate that stress hormones are closely related to the long-term health (prognosis) of cancer patients. "There is a complicated relationship between female hormones, male hormones, and stress hormones, and there is a risk that a drop in female hormones due to the stress of a disaster may adversely affect women's health."

Prof. Ito says that this survey requires trends to be assessed in the long term. "Miyagi prefecture is a region where screenings are so commonplace. The Miyagi Cancer Society has accumulated almost 50 years of data, and we can compare the data after an earthquake with the data from normal times. I want to effectively utilize this data to clarify how disasters affect the female body via fundamental and epidemiological research. Up until now, research into disaster medicine and treatment has focused on emergency response. However, I believe that the concept of "build back better" applies to health in much the same way as with town planning. I will steadily continue my research so that I can pass on its benefits to everyone."

News & Topics

Research Result 1

Using the K computer for numerical modeling of tsunami sediment transport

Reproducing geomorphological changes caused by the tsunami in Rikuzen-Takata and Sendai cities

Assistant Professor Daisuke Sugawara is involved in tsunami simulations that include sediment transport and topographic changes. In conventional tsunami simulation, only water dynamics, such as waves and currents, are taken into account.

Resolving changes of flow due to inclusion of debris and sediments, and change of topography by tsunami are the challenges for detailed simulation for improved hazard assessment.

Such simulations have not widely been performed because of the requirement for increased computational resources and complexity of the numerical method that needed to be validated by data.

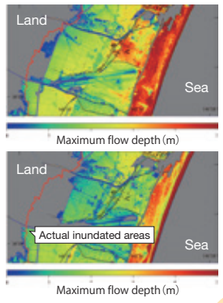
Dr. Sugawara and colleagues carried out the simulations of tsunami sediment transport, using the K supercomputer, which is the fastest supercomputer in Japan. The research includes improvement of the numerical model and validation of the results based on datasets from the 2011 Great East Japan Earthquake.

"As a result, we developed a numerical method to simulate what happened at the time of the 2011 tsunami. In addition, comparison of the simulations with and without sediment transport showed that the former simulation has a higher precision."

The first study area was Arahama, Sendai City, and now our work covers Rikuzen-Takata and many other places. "Advance of the research will benefit for urban development and disaster prevention planning."

This research holds many possibilities for disaster reduction, and its future results are promising.

●Maximum inundation height approx. two hours after the tsunami arrived



The top diagram calculates tsunami and soil movement, and the bottom diagram calculates only tsunami flooding. The precision of predictions improves when soil movements are also considered.

Assistant Professor
Daisuke Sugawara
Hazard and Risk Evaluation Research Division
Science and Technology for Low-frequency Risk Evaluation

Research Result 2

Possibility of a rodent epidemic in 2020. Seeking a way to coexist with rodents from past documents.

In the past few years, reports of rodent damage have been increasing in Miyagi and Yamagata

Research associate Yasuda's theme of research is rodents. Until recent times, rodent epidemics were a major kind of disaster. The last time widespread damage was caused by rodents was in the 1950s and 1960s. A brown rat epidemic started on Hiburijima and Toshima islands in Ehime prefecture, spread to the Shikoku and Chugoku regions, and then continued all the way to Kansai.

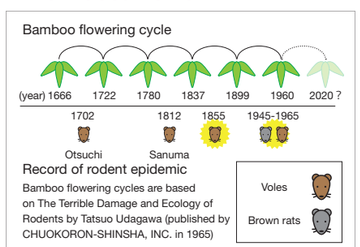
As well as damage to agriculture, tragic accidents such as infants being bitten to death by rats occurred. There are also records remaining in documents from the Edo period. There was a large rodent epidemic in 1855, where food such as wheat and rice were severely damaged.

Currently, Ms. Yasuda is focused on the cyclic nature of these epidemics. It is said that they occur once every 60 to 100 years, and one theory states that they are linked to the fruiting of bamboo. 60 years from 1960 would be the year 2020.

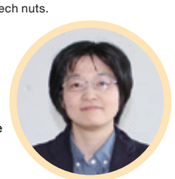
In recent years, there have been reports of small-scale damage and large numbers of dead rodents in Sendai city and Shinjo city. Ms. Yasuda says that we are not so familiar with rodents if we live in cities, but this is just because we do not notice them.

"Records of rodents from before the Edo period remain, but since towns have become urbanized and received sewerage systems, people have focused on brown rats, and have come to think that swarming rodents are the ones that are menacing. The problem is that rodents are in places where people live. It is difficult to completely eliminate them, but I want to learn a way for people to coexist with rodents from our past history."

●Rodent epidemic cycle predicted from documents



Rodent epidemics occur every 60 to 100 years. It is debated that damage tends to increase when there are bountiful harvests of bamboo fruit and beech nuts.



Research associate
Yoko Yasuda
Human and Social Response Research Division
Preservation of Historical Materials

Research Result 3

Research into the housing reconstruction after the eruption of Mount Merapi in Indonesia

Community housing relocation lessons that can also be utilized in the reconstruction of Japan

Assistant Professor Elizabeth Ann Maly conducts research into land use and housing reconstruction after disasters around the world.

This time she has collected theses regarding housing reconstruction after the eruption of Mount Merapi in Indonesia.

Mount Merapi is an extremely active volcano that erupts once every few decades. Despite this, the local people feel affection towards the volcano as well as fear, because of the positive effect its eruptions have on agriculture.

Prof. Maly started her research after the large eruption in 2010. This eruption hit a radius of more than 25 km with volcanic ash and fiery winds, causing 350 people to die and many buildings to be destroyed. The flow of debris traveled downriver and engulfed some villages entirely.

"The region received terrible damage, but housing reconstruction is proceeding extremely smoothly," says Prof. Maly. In this area with a strong sense of community, housing relocation was conducted on a village basis. One distinctive feature is the support provided by facilitators that specialize in relocation. This enabled relocation work including disaster prevention and earthquake resistance to succeed. Another is the housing provided by the government. The government provided the minimum size of housing required for people to live and then left further construction and renovation up to the residents.

"This is a good example of role sharing between government and local residents. I am continuing this research as I believe it may also provide some lessons for Japan."

●Reconstruction housing used in the area around Mount Merapi

The government provides core houses of about 36 m2, and local residents expand them with extra rooms and wooden decks, etc.

Assistant Professor
Elizabeth Ann Maly
Human and Social Response Research Division
International Disaster Resilience

Research Result 4

The ria coastline south of Miyako was found to be created by submergence

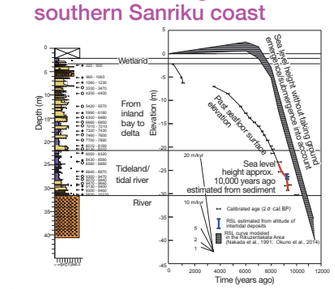
Understanding the speed of submergence may enable earthquake forecasts

Assistant Professor Yuichi Niwa conducts research into the emergence and submergence of land. He released results of a survey* stating that the ria coastline of southern Sanriku, which was thought to have been emerging, has actually been tending to submerge for the past 10,000 years. These results have attracted attention.

"Ria coastlines are generally thought to be submerging coastlines, but Sanriku was said to have been emerging in the long term due to its coastal topography. However, tide level records of the Sanriku coast indicate that it has been submerging for the past few decades at the rapid rate of several mm to ten mm a year. The mystery of the contradiction between a ground level that emerges in the long term but submerges in the short term was unexplained for a long time. After finding out that the entire Sanriku coastline submerged due to the earthquake, I decided to conduct a local survey in order to solve the mystery. I discovered no evidence of emergence at the ria coastline south of Miyako. This made me suspicious, so I started a drilling survey." In the drilling survey conducted at the Rikuzentakata plain, the ground was moving at a rate of about 1 mm a year at a scale of 10,000 years. Although this was somewhat different to the speed of submergence over the past few decades, it was found that the ground has also been tending towards submergence.

"In the future, I want to research how the speed of submergence affects earthquakes," says Prof. Niwa. If we can discover the relationship between earthquakes and the speed of submergence, we will be able to predict earthquakes from the movements of the ground. Further progress in this research is promising.

●Diagram indicating the tendency towards submergence in the southern Sanriku coast



The entire Sanriku coast was interpreted to be emerging in the long term but these results indicate that the southern Sanriku coast may have been submerging in the long term

Assistant Professor
Yuichi Niwa
Disaster Science Division
Natural Disaster Research

* "Holocene sedimentary facies, sediment accumulation rate and coastal subsidence estimated from a sediment core in the Rikuzentakata Plain, northeast Japan" by Niwa et al. (2014). Japan Association for Quaternary Research, 53, 311-322.

Activities

Visiting local areas on an equal footing with residents to assist the creation of new communities and widely convey the real situation of Fukushima

Associate Professor Michimasa Matsumoto has been conducting fieldwork along the coast of Fukushima prefecture since 2008. Since the earthquake, the area has been facing complex problems due to the accident at the Fukushima Daiichi Nuclear Power Station, in addition to damage caused by the tsunami and the earthquake. "Hearing surveys conducted at evacuation sites revealed that local communities were mostly non-functioning even before the earthquake occurred. In particular, the communication channels of community organizations hardly functioned during the evacuation from the nuclear accident. Rather than restoring these communities, we have to consider the situation before the earthquake occurred and think about how we can restore the communities for the future."

In the Usuiso area of Iwaki city, Prof. Matsumoto participated in the Usuiso Reconstruction Committee, where he provided advice on the decision-making process. "In Usuiso, more than one in seven people died due to the tsunami. In such areas facing a variety of problems, I believe it is necessary to participate on an equal footing with local residents and give advice based on scientific knowledge." In the future, Prof. Matsumoto wants to focus on areas such as Tomioka town in Futaba district, which residents are having trouble returning to. "The people of Fukushima are working hard to continue their lives, in a good way. I want to convey the actual situation in Fukushima without passing it through any kind of filter."

Associate Professor
Michimasa Matsumoto
Inter-Graduate School Doctoral Degree Program on Science for Global Safety

Researcher Introduction

Saving people with medicine

"My life's work is identifying the fundamentals of why there are unhappy and painful things in the world and solving this problem. I am currently focusing on disaster medicine and genomic research. After the earthquake, I started a three-generation cohort study. I believe that researching how the stress placed on a mother during a disaster affects an unborn child is extremely important. This third-generation cohort study is the first in the world to investigate the genetic information of a family, without limiting itself to only the relationship between mother and child. I would like to keep a watchful eye on how the earthquake affects not only the people that directly experienced it, but also the people who have yet to be born."

Professor
Shinichi Kuriyama
Disaster Medical Science Division
Disaster-related Public Health

Pushing forward with research in subduction zone geodynamics

"After graduating from high school, I attended a language school in Canada and started studying geology at the University of Victoria. When I was a third year student, I became more interested in geodynamic, and I continued my education as a graduate student and have been engaged in research projects on subduction zone geodynamics.

I was in the United States when the Great East Japan Earthquake struck. I was shocked by the scale of the disaster and hoped to be part of the recovery and reconstruction effort. One of my research objectives is to provide a better understanding of the physical conditions that cause earthquakes and arc volcanism, and it is rewarding to be able to contribute to practical disaster prevention studies.

In June, I am moving to the United States to work as an assistant professor at the University of Minnesota. My husband and I are also expecting our first child in August, and I am excited about our new journey."

Assistant Professor
Ikuko Wada
Disaster Science Division
Marine Geodesy Research

Awards

1

2015 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology

The series of activities related to the "Michinoku Shinrokuden" Great East Japan Earthquake archive project were awarded the Prize for Science and Technology (for the Science and Technology Promotion Category) for the 2015 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology.

Professor **Fumihiko Imamura**
Associate Professor **Akihiro Shibayama**
Assistant Professor **Shosuke Sato**
Disaster Information Management and Public Collaboration Division, Disaster Digital Archive

2

2015 Prize for Best Writing from the Architectural Institute of Japan (AIJ)

The Displacement Control Design of Buildings co-authored with professor emeritus Norio Inoue of Tohoku University and published in December 2012 has been selected to receive the 2015 prize for best writing from AIJ.

Professor **Koju Ikago**
Hazard and Risk Evaluation Research Division
Technology for Optimum Mitigation

3

Research into loss of beaches awarded the Intelligent Cosmos Encouragement prize

Associate Professor Udo was awarded the 14th Intelligent Cosmos Encouragement prize for her comprehensive research into the loss of beaches. Her research involves comprehensively evaluating coastal hazards while considering the risk of climate change, to identify the risks of losing beaches on a national scale. She also developed optimization methods for dealing with these risks.

Associate Professor **Keiko Udo**
Hazard and Risk Evaluation Research Division
Disaster Potential Study

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