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 Usuizao area of Iwaki city, Prof. Matsumoto participated in the Usuizao Reconstruction Committee, where he provided advice on the decision-making process. “In Usuizao, 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 Fukushima district, which 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.”

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 child, 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 Medicine 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 tsunami, 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.”

Professor Ikuko Wada
Disaster Science Division
Marine Geodesy Research

Awards

1. 2015 Commendation for Science and Technology by the Minister of Education, Culture, Sports, and Technology
   The series of activities related to the “Mishimizu Shinkokin” 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
   Assistant Professor Akhiro Shibayama
   Assistant Professor Shosuke Sato

2. 2015 Prize for Best Writing from the Architectural Institute of Japan (AIJ)
   The Displacement Control Design of Buildings co-authored with professor emeritus Norits Isobe of Tohoku University and published in December 2012 has been selected to receive the 2015 prize for best writing from AIJ.
   
   Professor Koju Ikago
   Assistant Professor Shosuke Sato

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
   Assistant Professor Ikuko Wada

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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.
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 economic losses
4. Substantially reduce disaster damage to critical infrastructures and disruption of basic services, among them health and educational facilities
5. Reduce the number of shelters and temporary housing units needed after disasters
6. Substantially enhance international cooperation to prevent disasters
7. Substantially enhance international cooperation to develop communities where people can live with peace of mind

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.

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 conducted a joint press conference with the city of Sendai 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 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)

Introduction to Related Events Held by IRIDeS

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

This 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 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 Kaisakagakuen Project and the “Hui” 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.

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.

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.
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 Xin Wang (“Wang”): First of all, what is your opinion about the necessity of quickly entering sites? 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 sites 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 entered houses and buildings affected by disasters?

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. My existing 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.

Wang: 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. 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.

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 surveys 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.
Volcanic activity in various areas such as Ontake, Hakone, Zao, Azumayama, and so on attracts public attention. Professor Satoshi Miura on the frontlines of monitoring volcanic activity 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 activity and tremors have been intermittently observed since then, and a Near-ear strain 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 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 15th century. We cannot know how that eruption was, but I will keep an eye on the volcano so that we do not miss the signals of forthcoming eruption.” Volcanic activity in various areas such as Ontake, Hakone, Zao, Azumayama, and so on attracts public attention. Professor Satoshi Miura on the frontlines of monitoring volcanic activity 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 activity and tremors have been intermittently observed since then, and a Near-ear strain 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 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 15th century. We cannot know how that eruption was, but I will keep an eye on the volcano so that we do not miss the signals of forthcoming eruption.”
Feature-3
Real simulations that consider the strength of buildings

“Applying multi-scale analysis methods to disaster simulations”

In recent years, disaster simulations have been showing remarkable progress. These simulations prepare us to face the force 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 utilizes 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.

Feature-4
Protecting women’s health with large-scale and long-term simulations

“Researching the relationship between disasters and women’s health from the perspective of gynecology”

When a disaster occurs, childbirth is one aspect of obstetrics and gynecology that particularly requires a proactive emergency response 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 situations 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 that Prof. Ito wants to focus on is visualization. Numerical simulations are simple 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 visual design system. 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.

Disaster obstetrics and gynecology for long-term protection

When disaster occurs, childbirth is one aspect of obstetrics and gynecology that particularly requires a proactive emergency response to provide safe childbirth in a situation where normal medical treatment is not available. Prof. Ito focused his research on the screening rate for cervical cancer and female-specific symptoms such as abnormal bleeding. He analyzed the data for around 100,000 people in areas including coastal regions and surveyed women who 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.

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Conducting large-scale analysis of female-specific symptoms

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The fact that abnormal bleeding increased in menopausal women was unexpected. Another thing that he noticed was that about 30% of women before menopause have symptoms of irregular menstruation and 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 cervical cancer at an early stage.”

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 link between health and 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 conditions 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.”
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.

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, 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 inclusion of debris and sediments, and topographic changes. In conventional tsunami simulation, only water dynamics, as waves and currents, are taken into account. In recent times, increased computational resources and performed because of the requirement for detailed simulation for tsunami simulation, only water dynamics, as waves and currents, are taken into account. In addition, comparison of the simulations with and without sediment transport showed that the former simulation has a higher precision.

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Activities

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Researcher Introduction

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Situated on the third UN World Conference on Disaster Risk Reduction

Special Interview

The Situation of the IRIDeS Emergency Investigation Team

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.