

## ■ Information ■

IRIDeS has an exhibition space to introduce our research activities to the public. It is also equipped with the largest 3D screen among Japanese research institutes. Upon request, IRIDeS screens the 3D documentary film "The Great Tsunami in Japan: reflecting on the 2011 disaster" (80min/25min, Japanese/English). The film was created by NHK Media Technology and supervised by IRIDeS Director and Professor Fumihiko Imamura, to pass on memories and experiences of the Great East Japan Earthquake and Tsunami.



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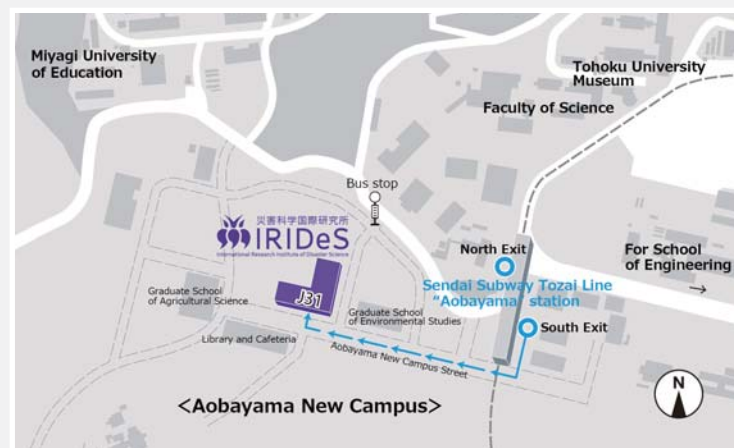
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## Editor's Note

Since April 2016, the IRIDeS newsletter has appeared in renewed form as *IRIDeS NEWS*. Along with the print version, you are also encouraged to check out our website: <http://irides.tohoku.ac.jp/irides-news/>

(Natsuko Chubachi, IRIDeS Public Relations Office)

Published in March, 2017

Conveying the results of practical disaster prevention research from TOHOKU to the world

# IRIDeS

## NEWS

International  
Research  
Institute of  
Disaster  
Science,  
Tohoku  
University

2017



## Pick up!

< Features > 2016 Kumamoto Earthquake / 2016 Fukushima Earthquake and Tsunami

< Academic Research >

Handing Down Disaster Memories / Collaboration of Brain Science and Disaster Risk Reduction

< Feature Photographs > Affected Tohoku Areas today



## Fifth Anniversary of IRIDeS



Director of IRIDeS  
Professor Fumihiko Imamura

Coming April, 2017 will be the fifth Anniversary of International Research Institute of Disaster Science (IRIDeS), Tohoku University. Since the establishment of IRIDeS in April, 2012, we have carried out academic research and practices in order to support affected areas, collaborating with domestic and international organizations. We also established an IRIDeS Satellite Office in Kesennuma, Miyagi, which was heavily damaged by the Great East Japan Earthquake and Tsunami, so that we can contribute to the City becoming disaster resilient.

Also, we have put effort to linking locals and the world. In terms of The Third UN World Conference on Disaster Risk Reduction held in Sendai in March 2015, we cooperated with formulating the "Sendai Framework for Disaster Risk Reduction 2015-2030", and made suggestions from an academic point of view. In addition, the first "World Bosai Forum / International Disaster Risk Conference in Sendai" will be held in November 2017, as an industry-government-academia-citizen collaboration for disaster risk reduction, and IRIDeS is playing a part of its Executive Committee. The forum aims to make Sendai/Tohoku a leading place of Bosai (disaster risk reduction), bridging disaster areas and the world.

Our efforts have been recognized and I was honored to receive the 2016 Disaster Prevention Achievement Award from the Prime Minister. We will continue our efforts to develop an original IRIDeS model, considering local needs of affected area most important.

In this year, new buildings are going to start operation in the Aobayama New Campus of Tohoku University. We are planning to hold public events for citizens. We greatly appreciate your continuous support.

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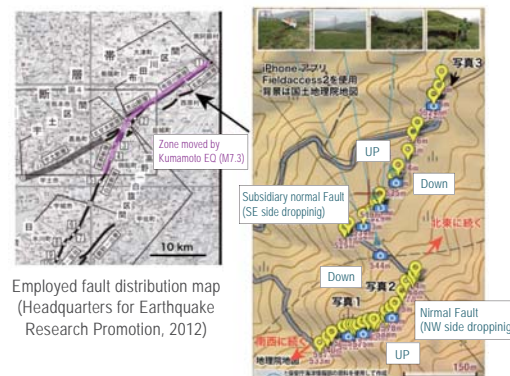


Figure 1

## Feature 1



On April 14, 2016, earthquakes with the maximum magnitude of 6.5 hit Kumamoto. On April 16, more earthquakes occurred with the maximum magnitude of 7.3, which expanded damages further. IRIDeS researchers took actions right after its occurrence, collecting and analyzing data and conducting field surveys, based on their own specialties. IRIDeS NEWS is going to introduce some of our activities.

Photo 1

### Oblique Slip Deep Underground, Strike-slip Fault and Normal Fault Running Parallel Approximately Two Kilometers Apart on Surface – May Be the First Case of Slip Partitioning in Japan-

After the urgent field survey from April 15, Professor Shinji Toda and Assistant Professor Shinsuke Okada, specialized in active fault, went to Kumamoto again together with other researchers to continue their research from April 22 to 25. As a result, a normal faulting rupture was also discovered in the Futagawa fault zone, and it indicates that an oblique slip occurred deep underground but a strike-slip fault and a normal fault running parallel approximately two kilometers apart on the earth's surface were identified.

According to the survey and analysis of the research team including Professor Toda, it can be estimated that the fault branched from the underground to the surface, and the oblique slip underground was dissolved by both the strike-slip and dip-slip on surface. This is technically called slip partitioning (Figure 2). Though there have been several reports of this occurrence in earthquakes overseas, there is a high possibility that it is the first time such a case was recognized in Japan. The idea that the Futagawa fault zone has a normal fault element, is consistent with the fact that the fault zone is situated on the southern edge of the Beppu-Shimabara rift zone.

\*Normal fault is a fault where the ground moves vertically under extensional strain.

During the field survey conducted on April 24, a normal fault stretching for more than approximately two kilometers was found on the west side of Tawarayama mountain in Nishihara Village (Figure 1, Photos1-3). Dip-slip from the normal fault had a maximum of 1.5 meters, with the north-west side dropping. This is not a sliding cliff resulting from landslides, but a normal fault continuing from the earthquake source fault which caused the earthquake.

Note: Following intermittent surveys until June, 2016 revealed that this normal fault stretches out for approx. 10km. Detailed survey results were published in Earth, Planets and Space in November, 2016 (Toda et al., 2016: <http://earth-planets-space.springeropen.com/articles/10.1186/s40623-016-0560-8>, selected as an Earth, Planets and Space 2016 highlighted paper )

On the other hand, in Nishihara Village, a right-lateral strike-slip fault crosses the body of the Ogiribata Dam, causing an approximately 1.5 meter right-lateral strike-slip (Photos 4, 5). Therefore, it can be said that a right-lateral strike-slip and a normal fault are running parallel, approximately two kilometers apart (Figure 2).

\*A precertification is required to enter the above investigated area (Komori Pasture).

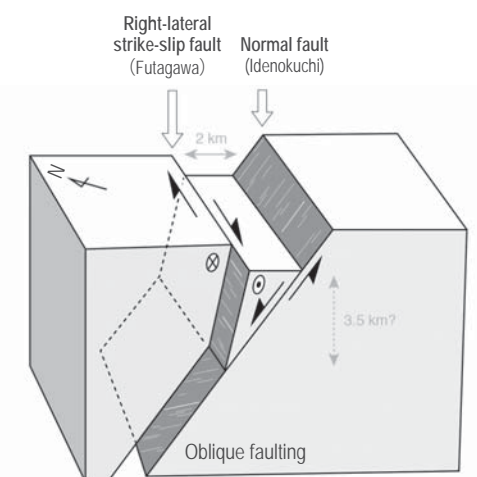


Figure 2





Regular meeting held at Taketa Medical Association Hospital in Taketa City, Oita Prefecture, which became the headquarters and gathering place for Tohoku block DMAT. Welcomed by Oita DMAT, a total of eight teams from Iwate, Yamagata, Miyagi and Fukushima prefectures, including Tohoku University DMAT, gathered to discuss the condition of the regions affected by the disaster, which change every moment, and the areas and details of their activities.

## Carried out Medical Assistance in the Regions Affected by the 2016 Kumamoto Earthquake as a Member of Tohoku University DMAT

DMAT (disaster medical assistance team) is a team of medical professionals, consisting of doctors, nurses and logistics experts who have gone through special training, which engage in rapid-response activities after disasters, to save as more lives as possible. Responding to the 2016 Kumamoto Earthquake, Assistant Professor Hiroyuki Sasaki of IRIDeS went to the site as a member of Tohoku University Hospital DMAT which is one of the teams in Tohoku Block DMAT, and took part in activities from April 17-19, 2016.

From the morning of April 18, Assistant Professor Sasaki, with other team members, based in Aso Medical Center, Kumamoto Prefecture, carried out emergency transportation of elderly people in nursing homes in Minamiaso Village who were ill, to medical institutions. The special nursing home which they went to support had accepted elderly who were in neighboring nursing homes that were damaged by the earthquake, besides the usual residents; however, the facility lacked electricity and water, and was operating with only about half of the staff than usual for several reasons, including the collapse of the Aso Ohashi bridge. DMAT including Assistant Prof. Sasaki and the head of the nursing home discussed and concluded that the facility may fall into a dangerous situation in a few days if the circumstances did not change, and decided to transport residents who were in especially serious conditions to medical institutions. Fifteen people out of the approximately 140 residents were taken to a hospital in Oita Prefecture by an ambulance of the emergency fire response team.

It is said that not being able to get involved with medical assistance in nursing homes at an early stage was one of the issues that arouse from the Great East Japan Earthquake in 2011. This time, DMAT collected information and carried out medical assistance when needed. Tohoku block DMAT was able to get involved promptly, by making use of the experience and lessons from the Great East Japan Earthquake.

### Kumamoto Earthquake

#### ▶ Many Other Experts of IRIDeS Took Actions

Besides the above activities, many other IRIDeS experts conducted surveys, research and activities regarding the 2016 Kumamoto Earthquake, in areas of expertise including landslide, building damages, company damages, interuniversity coordination, victim's behaviors, health, and potential tsunamis. Briefing sessions open to the public were held four times at IRIDeS, with many participants including journalists and disaster risk reduction experts each time. The Kumamoto survey results will be compiled by the end of March, 2017.



Collapsed Aso Ohashi Bridge (photographed during a field survey)

#### ▶ Students Reported Their Volunteer Activities in IRIDeS

The Center for Service Learning and Extracurricular Activities, Institute for Excellence in Higher Education, Tohoku University, sent Tohoku University student volunteers to disaster areas of Kumamoto earthquake, in association with Kumamoto University. Their activities were reported to and shared with the public at two gatherings held in IRIDeS, on May 26 and July 4, 2016. Student volunteers, including Kohei Nishizuka, junior of Faculty of Education, Yumiho Hatakeyama, sophomore of Faculty of Arts and Letters, talked about their activities in Kumamoto which they conducted with lessons learned from their volunteering in Tohoku disaster areas. IRIDeS Director Prof. Fumihiko Imamura sent cheer to this young generation who bridges Tohoku and Kumamoto disaster areas.



Students talking about their experiences

### Other Activities

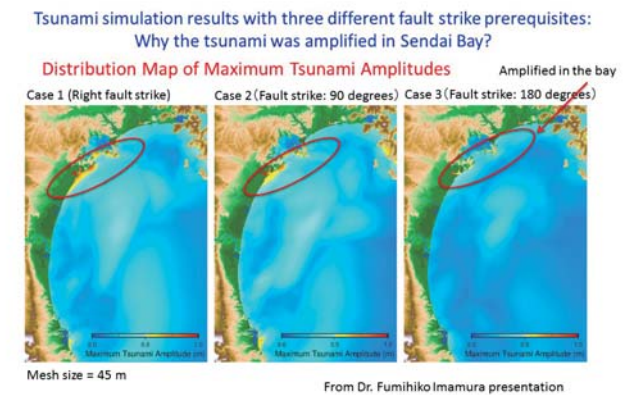
## Feature 2

### Emergency Investigation and Analysis of the Fukushima Prefecture Offshore Earthquake and Tsunami

An earthquake with a maximum seismic intensity of 5-lower (M7.4), having its hypocenter in the ocean of Fukushima Prefecture, occurred on November 22, 2016. It was accompanied by a tsunami.

The researchers at IRIDeS took immediate action following the earthquake and conducted a survey and analysis whose findings were released at a briefing session held one month later on December 22.

- ▶ Professor Fumihiko Imamura summarized the distinctive features of the occurrence and the dissemination of this tsunami, explaining the mechanism by which the tsunami was amplified in Sendai Bay in particular, based on results obtained from tsunami numerical analysis (simulation). Professor Imamura pointed out that it was difficult to reproduce the wave-height distribution at this instance by carrying out simulations while changing the direction of the fault strike to angles such as 90 degrees and 180 degrees, and that there were areas such as Sendai Bay where the tsunami this time was high. He recommended that the spatial grid for the analysis be set at a finer mesh than 500 m.



- ▶ Associate Professor Suppasri Anawat and his team reported the findings of on-the-ground tsunami and damage surveys undertaken in areas for which tide-level measurement records were unavailable. At Tsukihama Public Beach (Higashimatsushima City, Miyagi Prefecture), the tsunami reached 4.0 m, exceeding the estimated tide level (T.P. +0.3 m). While the relationship between the external force of the tsunami and the damage inflicted by it matched that observed in the past, further improvement in damage estimates will continue to be an issue in the future.



- ▶ Professor Shinji Toda explained that "There are numerous faults in the land-side plate of the offshore area of Fukushima due to seamount collisions and subduction. Stimulated by [the Tohoku Earthquake of] March 11 [2011], the earthquake activity has intensified since then. Though five and a half years have passed, this earthquake is another example of the same." At the same time, Professor Toda pointed out that "This earthquake should not simply be explained away as an aftershock of the 2011 Tohoku Earthquake. Even though it occurred in the ocean, it can be characterized as an inland earthquake caused by active faults existing in the land-side plate, and it will receive ongoing attention in the future."

- ▶ Research Associate Yoshi Abe laid out the issues from evacuation perspective. While positively noting that most people began evacuating promptly, he also pointed out that there were evacuation bottlenecks and cases where evacuation was not accomplished. He also focused on the fact that during this earthquake, the public tsunami advisory in Miyagi Prefecture had been switched to a stronger tsunami warning, resulting in discrepancies in local authorities' ways of handling of tsunami warnings. Research Associate Abe identified the greater practical usage of real-time tsunami measurement information as one area for future improvement.

This earthquake and tsunami, with their hypocenter in the ocean of Fukushima Prefecture, saw their first warnings being issued after four years in the areas struck by the Tohoku 2011 tsunami. This briefing session illuminated that there still are issues to be resolved in a wide range of areas, including measurement and evacuation.



## How Have the Disaster Survivors Thought of the Dead and Passed on Their Experiences?

“The next disaster happens when people have forgotten about the last one.” Passing on disaster lessons to the next generation is one of IRIDeS’s missions. Based on field studies on disaster monuments, festivals, and ceremonies all over Japan, the folklorist Professor Shuichi Kawashima has been examining how these are utilized to pass on disaster recollections.

Human and Social Response Research Division  
Professor **Shuichi Kawashima**



### Case 1: Nagasaki City’s Nenbutsu-kou Manju (steamed buns)



Children participating in “Nenbutsu-kou Manju” (photographed by Prof. Kawashima in 2015)

In 1860, a fatal landslide occurred in the Sanzengouchi district of Otaomachi, in Nagasaki Prefecture. To commemorate the dead, there is a custom in the district of distributing a type of steamed bun called “Nenbutsu-kou Manju” on the 14th of every month, 14th being the date on which those who had died in the disaster were discovered. No particular explanation of why the buns are handed out on that day is available, and the original meaning of the ceremony has become relatively obscure. However, although the event has, so to speak, become a custom, the food fascinates

children in particular. Professor Kawashima considers that children who receive steamed buns on a regular basis learn the true meaning of the custom and learn about disaster at a certain stage. This knowledge then feeds into disaster prevention in the locality. The fact that this district saw no fatalities in the torrential rains that occurred here in 1982 has drawn a good deal of attention.

### Case 2: The Jizo-bon festival of Osaka

The Jizo-bon Festival is held on August 23, 24 every year at Osaka’s Taisho Bridge, to commemorate the victims of the 1854 earthquake and tsunami. There is a stone monument with inscriptions detailing the past tsunamis, named “Jizo-san” [a Buddhist deity who protects children]. Every year, inscriptions are made in black ink. In the process, people come to understand and learn about the circumstances of the time the disaster happened. Offerings are made to the dead and then distributed in the district. Local people believe that because they hold a memorial service for the dead at the Jizo-bon Festival, the dead do not curse or haunt them. At the same time, those who receive the offerings learn about past tsunamis without having experienced them. Jizo-bon is largely a children’s festival and promotes disaster prevention education right from childhood.



Inscriptions in black ink in the festival (photographed by Professor Kawashima, in 2015)

In Japan, death in a disaster is seen as abnormal, and those lost in disasters have been offered memorial services for long. According to Prof. Kawashima, the inner motives of the people offering these services are actually those of achieving secular benefits through religious practice and avoiding being cursed or haunted by the dead. Yet, caring for the dead leads people to envision disasters that happened in the past.

### Commemorative monuments and memorial monuments are similar but different

Prof. Kawashima also points out that while commemorative monuments and memorial monuments for tsunamis tend to be confused with each other, they are different. Commemorative monuments are generally built by the local administration. They assume a timeline running straight from the past into the future, and as such, they bear messages addressed to the future, intended to educate future generations about past events and enable them to learn from those events. Memorial monuments, on the other hand, are built as a result of prayers for the repose of the souls of the disaster victims, and they assume a recursive, circular timeline. They are built to address the people of the past. Commemorative monuments tend to be forgotten with the passage of time, but memorial monuments, through their regular cycle of annual ceremonies, turn people’s minds toward the victims of disasters. Prof. Kawashima believes that memorial monuments have a greater impact in transmitting awareness about disasters to subsequent generations. There are also cases of memorials being built as commemorative monuments but ending up being treated as memorial monuments.



A commemorative monument to 1933 Sanriku Tsunami, in Fudai Village, Iwate, treated as a memorial monument (Photographed by Prof. Kawashima in 2016)

### Thinking of the dead is the key to handing down the memory of disasters

Because people forget things, they come up with ways to preserve their memories. In order to achieve effective disaster prevention, it is not enough to just understand the physical phenomena. We need to have an in-depth awareness of how people live their lives. How have people who survived a disaster thought of the dead? How have they passed on their experiences of the disaster? Finding answers to these questions can offer us clues on how to pass on the memories of past disasters to future generations. Looking at the customs commemorating the dead from disasters all over Japan, Prof. Kawashima intends to shed further light on them from the perspective of disaster prevention.

## Exploring “the Power to Live with a Disaster” with Brain Science

IRIDeS is an interdisciplinary institute on disaster science where specialists with different academic backgrounds work together, such as engineering, medicine, physical science, social science and humanities. Among the interdisciplinary studies conducted in IRIDeS, this article is going to focus on the research by Professor Motoaki Sugiura who has merged brain science and disaster risk reduction, most likely for the first time in the world.

Human and Social Response Research Division  
Professor **Motoaki Sugiura**



### About the research on “the power to live” by Professor Sugiura

Prof. Sugiura is a medical doctor and also is a specialist of brain science. Brain science is a study field where various specialists of different backgrounds, such as psychology, instrumentation engineering, and medicine, work together to explore themes such as relations between human behaviors and brain functions. Brain science often puts a question on humanities and then leads to an answer with scientific technologies, and thus is interdisciplinary by nature. In the area of brain science, however, there were few studies which focused on natural disasters.

Prof. Sugiura stepped into the area of disaster research when he joined a collaborative study held by Tohoku University Research Group on Disaster Prevention and Management which was the predecessor of IRIDeS. In 2011, the Great East Japan Earthquake occurred, whereby he decided to address the fundamental question, from his brain science standpoint, to explore “the power to live” of human beings which lets people think and act proactively and coexist with others in extreme situations.

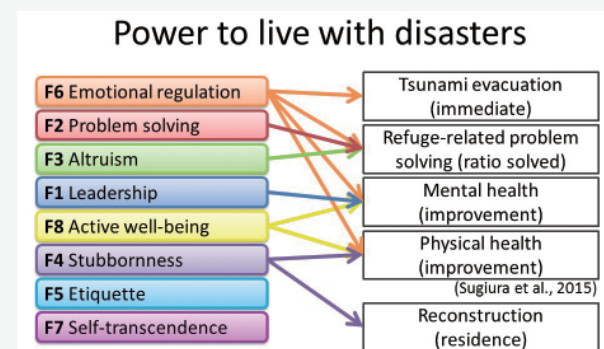


Figure: Eight factors of “power to live”

Prof. Sugiura conducted a questionnaire survey, with Professors Fuminiko Imamura and Toshiaki Muramoto and Assistant Professor Shosuke Sato, to 1,412 disaster victims in Miyagi Prefecture who were affected by Great East Japan Earthquake. Based on the survey analyses, the research team found that human characteristics, ways of thinking and habits which are useful to survive a disaster can be categorized into eight factors of “power to live,” such as “leadership,” “problem solving” and “altruism,” and that each factor of the power correlates to specific experiences to overcome crises and difficulties at various stages of the 2011 disaster, such as ones in tsunami evacuation, in shelters and on health conditions (see Figure). This finding was published in the international journal of PLOS ONE which is renowned especially in the area of medicine, stirring up discussions.

Now Prof. Sugiura is developing the research further, to investigate what part of the brain is associated with each factor of the power to live. He began to find, for example, that individuals who have the factor “emotional regulation” may be ones who can control not to let unpleasant information enter his/her brain, though it is still a hypothesis.

According to Prof. Sugiura, it is concluded that amount of each “power to live” is associated with differences in individual brain activities. But he has not discovered yet why the amount of each “power to live” varies among individuals, that is, why there are people for whom a certain part of brain of whom works actively to increase a certain power to live, and why there are people who are not like them.

“Is the power to live destined by his/her genes from birth, or is it possible to cultivate his/her strong power to live, by providing suitable environment and training?” It is an important question to be explored in science. Prof. Sugiura says that figuring out the relations between the brain and “the power to live” further may contribute to development of human beings who have more power to live and who are indomitable in face of a disaster.

### Future

Prof. Sugiura used to be a literary youth as a high-school student and was deeply interested in human truth. As a researcher, he does not want to stop at just finding how human beings are, but he would like to go one step further, proposing how human beings should be, as well as ideal education and resource cultivation for human beings.

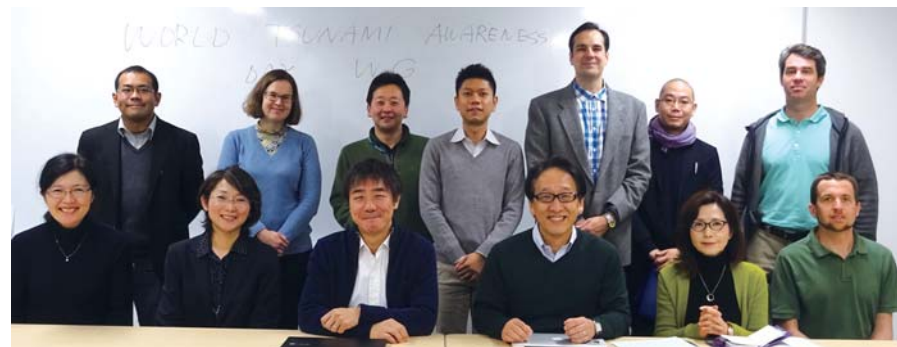
“What is a human being?” is the fundamental question which humanities have pursued. Languages and tools to explore that question have developed lately. From the 1980s, with developments of technologies such as PET and MRI, it became possible for brain science to conduct experiments and measurements and its method and data have advanced quickly.

Prof. Sugiura’s merging brain and disaster sciences, and his method collecting data from questionnaire survey for exploration of power to live, are too novel to be understood easily in the traditional academic world, and thus can be a challenge. It is the lifework of Prof. Sugiura, however, to illuminate the whole picture of power to survive a disaster, using brain science.



A measurement using MRI





World Tsunami Awareness Day working group

## IRIDeS Activities in the World in Commemoration of the First “World Tsunami Awareness Day”

In December 2015, the UN General Assembly passed an unanimous resolution to recognize November 5 as “World Tsunami Awareness Day,” in tribute to the episode of “Inamura-no-Hi”: On November 5, 1984 (of older calendar) during the Edo period, a great tsunami occurred after the Ansei Nankai earthquake. They say that Goryo Hamaguchi, a businessman of present-day Hirokawa Town in Wakayama Prefecture, realized the real danger of the tsunami and set fire to just-harvested rice straw, to alert his fellow villagers and to make them evacuate, saving their lives. Responding to this UN adoption, IRIDeS has formed the World Tsunami Awareness Day working group, and conducted many domestic and international activities to commemorate World Tsunami Awareness Day, contributing to world disaster risk reduction.

### IRIDeS and University of Hawaii Co-hosted a Pre-event for “World Tsunami Awareness Day”



From September 15 to 17, 2016, IRIDeS co-hosted “Communicating Disaster Science” as a pre-event of “World Tsunami Awareness Day” with University of Hawaii, Manoa (UHM) which concluded the academic agreement with Tohoku University. The event was held at a UHM campus in Honolulu, USA, and aimed to share lessons from the Great East Japan Earthquake with the world, developing international cooperation in the area of disaster risk reduction.

Dr. Denise Eby Konan, Dean of the College of School of Social Sciences of UHM, gave an opening speech, and the IRIDeS Director Dr. Fumihiko Imamura sent a vide message to the participants, saying “It is our pleasure to contribute to world tsunami risk reduction, together with people in Hawaii”. Afterwards, former students of Sendai Ikuei Gakuen High School, who received warm supports in Hawaii right after the Earthquake, expressed their appreciation for Hawaii people.

The keynote lecture by Prof. Shunichi Koshimura from IRIDeS pointed out risks of car evacuation and of overreliance on hazard maps, which received much attentions from the audience. Other IRIDeS presentations include the following: Research Associate Mari Yasuda carried out a session on disaster risk reduction education for Hawaii school teachers; Assistant Prof. Volker Roeber discussed coastal levee; Assistant Prof. Liz Maly talked about handing down disaster memories, with graduate students of G-Safety program, Tohoku University and the director of Pacific Tsunami Museum in Hilo, Hawaii. Also, IRIDeS and UHM scholars and Tohoku and Hawaii journalists hold an roundtable discussion regarding media-academia collaboration in disaster risk reduction.

Finally, an English version of 80-min documentary film “The Great Tsunami in Japan: Reflecting on the 2011 Disaster” (produced by NHK Media Technology, academically supervised by Dr. Imamura) was screened, as its film’s premiere outside Japan. Three hundred seats of the auditorium became almost full, and the film earned applause afterwards. A Hawaii viewer made a comment, “The film is really powerful. It is also precious as it shows what’s happened in English to international audience.”



Keynote lecture  
Prof. Shunichi Koshimura



Screening of “The Great Tsunami in Japan”

## A Global Analysis and Visualization of Tsunami Hazards over the Last 400 Years

At the timing of “World Tsunami Awareness Day”, the research team of Professor Fumihiko Imamura, Associate Professor Anawat Suppasri and others released a report, to analyze and map out tsunamis caused by earthquakes in the world over the last 400 years. The report was released to the public, including on websites of IRIDeS and the United Nations Office for Disaster Risk Reduction (UNISDR).

This research focused on occurrence and propagation of 94 cases of tsunami caused by earthquakes in the world over the last 400 years, and calculated tsunami characteristics including height distribution, fluid force and arrival time of each tsunami. There were significant regional differences found between a distribution map of the maximum tsunami heights during the period of “1970-2016” and those of “1600-1969.” It implies that, in the last 40 years, major tsunami damages were only from the 2004 Indian Ocean tsunami and the 2011 Great East Japan tsunami. When the research scope becomes stretched back to 400 years ago, however, it shows that tsunami damages occurred in much broader areas, including Lisbon, Chile and the west coast of U.S.A. (Figures 1, 2, and 3). In addition, this study indicated that damaging power of tsunami and flow velocity do not necessarily correspond to tsunami height. Being cautious only about tsunami height may result in unexpected damages, such as building washout in unexpected places.

There were academic papers that mapped out tsunamis in a limited geographical area such as Indian Ocean. This report was seemed to be the first attempt to analyze and visualize past tsunamis all over the world, using WEB-GIS. It is also considered for the first time that focusing on geographical differences of tsunamis of different time periods and that releasing research outcomes to the public.

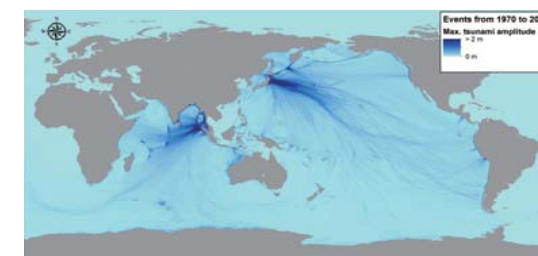


Figure1 : Distribution map of the maximum tsunami heights, 1970-2016 (Pacific and Indian Oceans)

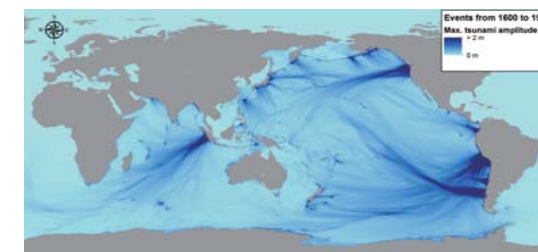


Figure2 : Distribution map of the maximum tsunami heights, 1600-1969 (Pacific and Indian Oceans)

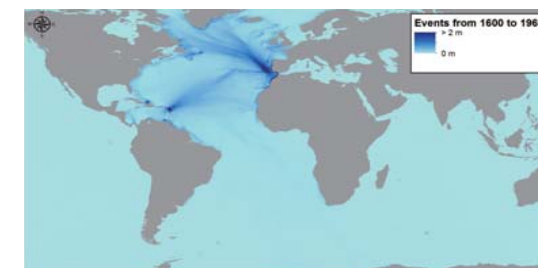


Figure3 : Distribution map of the maximum tsunami heights, 1600-1969 (Atlantic Ocean)

### Disaster Risk Reduction Education, Linking Banda Aceh, Indonesia– Sendai, Japan– Ishinomaki, Japan



At Aceh Tsunami Museum, Banda Aceh

On November 24, 2016, Associate Professors Aiko Sakurai and Akihiro Shibayama from IRIDeS and others visited Aceh Tsunami Museum, Indonesia, and conducted an internet conference to connect three different places: Banda Aceh and two disaster areas of Tohoku, Japan (Sendai and Ishinomaki). This internet conference was carried out as a part of “School Safety Forum Centering on Disaster Risk Reduction Education,” held in Sendai, and the Forum was co-organized by IRIDeS International Collaborating Center of Disaster Education Research and Implementation and by Miyagi Prefectural Education Board.

Two high school students from Aceh, Lisa and Jurnnairis, who experienced the 2004 Sumatra earthquake and tsunami, called on importance of tsunami evacuation and of handing down disaster experiences to next generations. Their message was sent via the internet to approx. 700 participants who gathered at the Forum in Sendai, and also to 150 high school students from 16 countries who were participants of “World Tsunami Awareness Day -High School Students Summit- at Miyagi Study Tour” in Ishinomaki. After the internet conference, Associate Professor Sakurai and others gave a lecture on tsunami disaster risk reduction for 70 high school students of Banda Aceh.



Receiving a message from Banda Aceh in Sendai



## Students and Faculty from Foreign Universities Visit Areas Affected by the Disaster – Experiences of the APRU Summer School –

On July 21, as part of the APRU Multi-Hazard Summer School, hosted by IRIDeS, approximately 40 university students and faculties visiting IRIDeS from overseas went on a field visit to the cities of Natori and Tagajo, both affected by the Great East Japan Earthquake. This article is a report of this field visit written by a member of the IRIDeS Public Relations Office who accompanied the tour.

### What is APRU? What is the Summer School?

APRU is the abbreviation for the Association of Pacific Rim Universities. The organization was established in 1997, aiming to foster cooperation among leading research universities in the region, to resolve issues of major importance to the Pacific Rim community, including disaster risk reduction. As of today, APRU consists of 45 universities, with Tohoku University as one of them, in 16 regions. As part of the APRU program, IRIDeS, with Associate Professor Takako Izumi taking the central role, has hosted the Summer School in July every year, in which graduate students and faculty from foreign countries come to learn about the lessons from the Great East Japan Earthquake, disaster risk reduction (DRR) and international DRR strategies. In 2016, it was held for the fourth time.



Associate Professor  
Takako Izumi

### Field visit Morning : Natori City

Participants departed from Sendai City at 8:30 in the morning by bus, arriving in Natori City. Mr. Hitoshi Miura from the Natori City Office became the guide, explaining in detail about the City of Natori, the situation during the disaster, and reconstruction process in the bus. On the day of the disaster, Natori was impacted by an earthquake with a seismic intensity of six upper on the Japanese scale, and the first wave of the tsunami reached the city about one hour after the earthquake. In particular, the Shimomasuda and Yuriage areas near Sendai Airport were heavily damaged.



Mr. Miura



Climbing up Hiyoriyama



Memorial monument  
(height of the monument is the same as the height of the tsunami)

During the visit, the participants got off the bus to see Hiyoriyama hill and the memorial monument. As the debris has been removed, it is now difficult to imagine how it was during the disaster. However, with the explanation, "The height of the monument built just beside Hiyoriyama is the same as the height of the tsunami," we looked at the stone monument higher than the summit of Hiyoriyama, and imagined how it was when Hiyoriyama was engulfed completely by the muddy water of the tsunami.

Then the participants moved to see the Kitakama sea wall, the Suzuki residence, a private home which the remains have been preserved as a disaster memorial, and Mitazonokita housing complex, where disaster public housing has been built. Citizens who lived near the coast and lost their homes by the tsunami, a total of 162 households, have relocated collectively. The participants asked various questions, such as how residents are living, and how heavily damaged the area was just after the disaster.



Mitazonokita  
housing complex



Suzuki Residence, a disaster memorial



Kitakama Sea Wall

### Field visit

#### Afternoon : Tagajo City

To begin the afternoon course, we travelled to Tagajo City which was also severely damaged by the earthquake and tsunami. First, we visited the disaster public housing in Sakuragi, and listened to the explanations by Mr. Hiroshi Suzuki, formerly the manager of the Construction Department of Tagajo City. This public housing complex was built making use of the disaster experience in 2011; the first floor has a pilotis structure with no residential space, the buildings have tsunami evacuation stairs, and there are stockpiles to be used in case of disasters. Furthermore, there are facilities for children and the elderly to live together in the community. In the meeting place of the public housing, the participants communicated with the residents. Participants asked many questions, as it was a precious opportunity to be able to listen to the voices of the residents directly.



Residents answering questions



At Tagajo High School

We moved to Miyagi Prefectural Tagajo High School, our final destination. Tagajo High School established a Disaster Science Department in April 2016, and has also concluded a Memorandum of Understanding (MoU) with IRIDeS. At Tagajo High School, the high school students made a presentation in English on how the school was when the earthquake and tsunami occurred, and the kinds of DRR activities they have carried out. Afterwards, the high school students and participants in each table took part in group work. In the table the writer sat, participants from Hawaii, India, Philippines, and Myanmar talked about the kinds of disasters that frequently occur in their country, and DRR education in each country, and exchanged ideas with high school students. Finally, the participants applauded loud for the students of Tagajo High School.

### The following are some participants the writer met during the field visit.



#### Ms. Bi Jurong

originally from Sichuan Province, China, and now a Master's student in the National University of Singapore.

"I began to strive to study DRR after experiencing the Great Sichuan Earthquake in 2008 when I was a junior high school student, having seen many people lose their lives. I am now studying civil engineering, and am especially interested in reclaimed land. I decided to participate in this Summer School on the recommendation of my advisor."



#### Ms. Noor Diyana Fazan Ahmad

Ph.D. student in Universiti Putra Malaysia, studying community disaster preparedness.

"Japan is known for DRR based on local communities, and the Summer School has been a very good learning experience. I would like to participate again, if I have the chance."



#### Mr. John Wilson

Ph.D. student in University of California Davis, conducting research on computer simulations of earthquakes. He has participated in last year's Summer School as well.

"During last year's Summer School, residents were moving into the disaster public housing. It was a valuable experience to be able to ask questions to the residents of the public housing, which started this year."

Thank you for  
participating!



saigaiken

### After experiencing the field visit

The writer was able to understand why the APRU Summer School has been highly appreciated. Participants of the Summer School listen to lectures on DRR for two days intensively, and after taking part in group work, go on a one day field visit. This tour was carried out with the full cooperation of the cities of Natori and Tagajo (both have concluded MoUs with IRIDeS), and there were also opportunities to communicate with local people. It is a diverse and action-oriented program that was realized with the close collaboration among the research and education institution, local governments and local communities.

The participants were majoring in areas such as civil engineering, architecture, geology and geography, and already have knowledge in DRR. The writer was able to feel the eagerness of the participants to try to deeply understand the Great East Japan Earthquake as well as DRR activities in general in Japan, while comparing the situation with that of their own country, to make use of this experience in the future. The Summer School was also an excellent place for international exchange, as participants from various countries actively exchange ideas and opinions. It was not surprising that the 2016 Summer School had the highest number of participants from the most number of countries as ever.



# Activities

## Activity 01

### Extended GIS for Disaster Risk Reduction

Regional and Urban Reconstruction Research Division  
Professor **Kenjiro Terada**, Visiting Professor **Masaaki Sakuraba**,  
Associate Professor **Shuji Moriguchi**, and Assistant Professor **Shinsuke Takase**

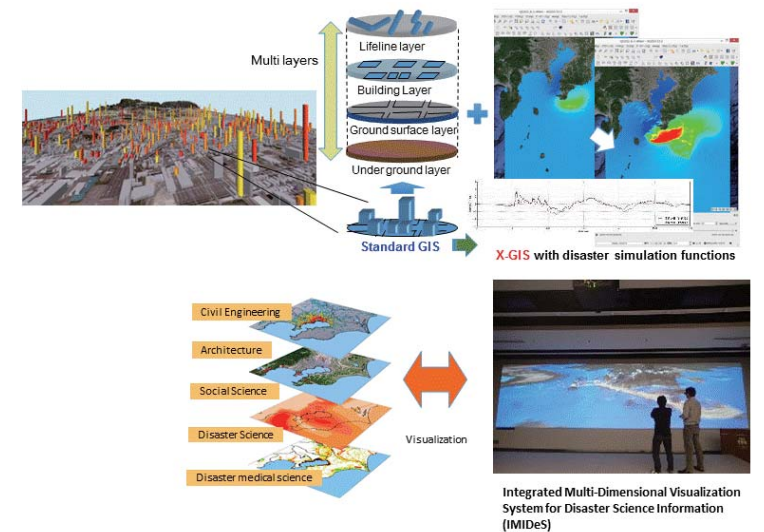


By layering positional data and related information on top of maps, geographic information systems (GIS) make it possible to analyze and visually comprehend this type of information. GIS have developed rapidly in the recent years, thanks to increasing speeds and declining costs of computing. Along with the specially appointed Professor Masaaki Sakuraba (Visiting) of Nippon Koei Co. Ltd., Professor Kenjiro Terada, Associate Professor Shuji Moriguchi and Assistant Professor Shinsuke Takase of IRIDeS have been working to embed more enhanced disaster simulation capabilities in GIS, thus developing a system for disaster prevention.

As an instrument enabling visualization of locational information on disaster prevention facilities and people in need of aid in times of disaster, GIS has already become an essential tool in the field of disaster prevention. Efforts to combine GIS with numerical simulation are already being made. For example, flood hazard maps have been created, combining numerical simulations, by specialists using GIS information. However, up to the present GIS and numerical simulations have been used separately, and while there have been cases where the data they generate has been exchanged after the event, there have been few attempts to use the two in combination. It has also been pointed out that the areas of engineering, science, social science, and medicine are increasingly becoming specialized even within the discipline of Disaster Science and that there is need for an integrated interdisciplinary approach.

Working with this thought, Professor Terada and the group have begun to develop an “X-GIS” (extended GIS/eXtended GIS) system, allowing the simultaneous management and analysis of multifaceted disaster information by embedding numerical disaster simulation functions for earthquakes, tsunamis, landslides, and so on in GIS. The aim is to ultimately contribute to disaster damage ascertainment, disaster prevention, area recovery, and community development by integrating different types of disaster information and making it visible on the 3D screen at IRIDeS, allowing the different information to be grasped simultaneously.

Professor Terada and the group have already completed the basic specifications for X-GIS software, and as their next step they are now ready to launch a pilot research program limited to tsunami damage. Professor Terada says that “If possible, we want to make our achievements available to the public for free in the future, in a format in which people can freely use and customize as they like.” There is no other example in the world of GIS software being developed with an intention to embed a variety of sophisticated numerical simulation technologies and disaster related database; given its universal applicability and user-friendliness, we can expect it to be a cutting-edge disaster prevention tool.



## Activity 02

### Working on Tsunami Evacuation Plans along with the Local Community

Inter-Graduate School  
Doctoral Degree Program on Science for Global Safety  
Assistant Professor **Kazuya Sugiyasu**



Working especially from the perspective of tsunami evacuation, Social Engineering (Urban Planning) specialist, Assistant Professor Kazuya Sugiyasu, is involved in creating local disaster prevention plans. He has been involved in projects in places such as Iwaki City, Fukushima Prefecture, working in cooperation with local communities, other IRIDeS researchers, and other workers in the field of disaster risk reduction. Using tsunami hazard maps, he examines the effectiveness of evacuation plans, sets evacuation sites and routes, and offers proposals to improve strategies for giving guidance. In his work, he uses the latest technology, such as the GPS Logger, to record scientific data from sources such as electric automobiles and people's movements at set time intervals and carries out evacuation drills in collaboration with the community.

Evacuation by car from a tsunami was not sanctioned officially until before the Tohoku Earthquake. However, since 2011, various local authorities have started considering evacuation by car as a possible option, while continuing to recognize evacuation by foot as the rule. Evacuation sites have also been reconsidered. Assistant Professor Sugiyasu and his colleagues are involved in factoring these changes into local disaster prevention plans.

Using urban planning techniques, tsunami hazard maps have undergone the process of collating and visualizing information on evacuation plans, evacuation sites, flood ranges, etc. Spurred by the Tohoku Earthquake, rapid progress is now being made to distribute tsunami hazard maps in areas across the country; this activity had been falling behind while preparing them. At the same time, the risk of over-reliance on hazard maps is also coming to be recognized. Assistant Professor Sugiyasu himself states the following about the tsunami hazard maps he uses in preparing disaster prevention plans: “While they make it easier for

people to get a mental image of the disaster, they do have the drawback of tending to create a fixed image in people's minds. The maps are created based on a specific scenario; it is possible for an actual disaster to go beyond the scenario's conditions. We really have to bear that in mind, and make skillful use of those maps.”

“There are many handy tools out there, including hazard maps, but they only start to show their effectiveness once the user knows how they work. For local disaster prevention plans, what is important is not just the hard infrastructure such as flood embankments but also soft infrastructure such as evacuation drills and the importance of communicating with the community.” Assistant Professor Sugiyasu emphasizes that it is important to work from the perspective of creating a fusion between engineering skills and people skills.

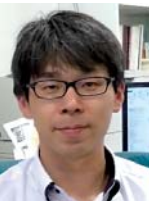


Reviewing an evacuation drill conducted, using a hazard map, in Iwaki City.

## Activity 03

### Japan's Distinctive Approach to Preserving Historical Materials: Presentation at a Conference Held in Canada on the Restoration of Cultural Properties

Human and Social Response Research Division  
Assistant Professor **Masashi Amano**



Fifty years have passed since the major floods at Venice, Italy. The year 1966 was a turning point in the restoration of cultural properties. In May 14–17, 2016, a joint Canadian–American conference on the restoration of cultural properties was held in Montreal, with countermeasures for disasters as the theme. Along with his group, Assistant Professor Masashi Amano of IRIDeS (specializing in the field of preservation of historical materials) gave a presentation on the distinctive way in which the conservation and preservation of historical materials has developed in Japan.

In Europe and America, restoration specialists are generally in charge of rescuing historical materials during disasters, and it is them who carry out work on the ground. In Japan, however, history researchers are also expected to play this role. Another difference is that while most historical materials in Western countries are stored in locations such as public archives and museums, in Japan, the bulk of such materials are privately owned by members of the general public.

Japanese history researchers frequently undertake fieldwork and have close links with the local community. Thus, in cases where historical materials have been damaged, they can move swiftly to rescue them in coordination with local people. In addition, they have often done restoration work on materials in cooperation with members of the community acting as volunteers. In Western countries, on the other hand, clearly defined roles are laid out for historians, museum staff, librarians and archivists, conservation staff, restorers, and so on, making a very different system from Japan's approach to disaster prevention with regard to cultural assets. As a result, it has been observed that the approach taken by Japanese history researchers up to the present has been to adopt a cross-disciplinary role as “responders.” Assistant Professor Amano and his group's presentation threw into relief the differences between Japan and the West regarding the restoration of historical materials, and it was received with deep interest by the conference participants.



Assistant Professor Amano and others at the conference

As the approach to the conservation and maintenance of materials developed by Japan's network of history researchers has progressed in its own distinctive fashion, challenges faced by them through disasters such as the Kobe and Tohoku earthquakes have also become clear. Historical researchers have played a leading role in the work that has been carried out until now in Japan; however, their work may become even more effective by being undertaken together with specialists in related fields such as restoration, conservation, and architecture. Going forward, Assistant Professor Amano and his colleagues have expressed a desire to search for effective approaches to collaborate and present their progress at future conferences in a form that will address concerns and draw further interest from overseas.



# Affected Tohoku Areas Today

In late April, 2016, we visited Rikuzentakata City, Iwate Prefecture, and Kesennumua City and Minamisanriku Town, Miyagi Prefecture, all of which were heavily affected by the Great East Japan Earthquake in 2011. Engineering works to reconstruct these places are ongoing everywhere. It is difficult to imagine the original townscapes before the disaster.

## Rikuzentakata

According to Urban Development and Improvement Division of the Reconstruction Bureau, Rikuzentakata City, the first coastal levee in contact with the sea has already been finished (3 meters above sea level, which is measured from T.P. (Tokyo Peil) in Japan), and approximately 95% of work has been completed to construct the second levee that stands landward (T.P. + 12.5m). The photo on the right is of the second levee. The city has a plan to plant pine trees between the two levees, so that they can reconstruct their renowned pine forest. Land raising sites for proposed urban districts have been almost completed.



The place where the former JR Rikuzentakata Station used to be



The 2<sup>nd</sup> levee being constructed



Hirota Bay and a levee



## Shishiori District, Kesennuma City

Shishiori District, Kesennuma is located on the deepest part of Kesennuma Bay. Construction of disaster recovery public housing is proceeding in the district that was completely burnt down by a fire that followed the tsunami. New gas stations and convenience stores will open one after another alongside the arterial roadway that was newly rebuilt on a different route after the disaster. Many marine product processing factories have been rebuilt on the coastal land in Shishiori District, just as the old days, and some of them started operating already.



Public housing in the background



The place where the large fishing trawler used to be



BRT of JR Shishiorikarakuwa Station



## Shizugawa District, Minamisanriku Town

Most of the city districts have been raised. The frame of the public disaster prevention office of Minamisanriku Town stands as if it was buried in these raised lands. "Sun sun shopping village," the town's largest temporary shopping arcade located in Shizugawa District, is planning to move to the raised land area in front of the disaster prevention office, with some new businesses. They are preparing for its new opening on March 3, 2017, after "sun sun" (meaning "sun-soaked," but "sun" is also a homonym of "three" in Japanese)



Shizugawa, Minamisanriku



The public disaster prevention office



Minamisanriku Town



## We visited Taro, Miyako, Iwate in June 2016.

Urban Districts of Taro were completely destroyed by a mega tsunami in March, 2011.

The district had remained vacant, surrounded by coastal levees raised approx. 70cm higher. But Taro Baseball Ground was finally completed in April 2016.



When we visited, a junior high school baseball tournament was being held. Echoing cheers in the town sounded like a cheering song for the town and people who are recovering from the disaster.

As a group relocation project for disaster mitigation, the Sanno housing development is moving to a higher ground area that was leveled by clearing a mountain forest at 40-50m elevation, northeast of its original location. This higher ground has 159 housing plots and 71 disaster public housing units, and is now witnessing a construction boom. People have already started living there. As of June 1, 2016, 299 individuals or 123 households already resided there. Public facilities such as a fire station, a police box and a day care have been completed in this development.



Right now, for shopping, residents need to rely on mobile vendors or have to go down to retail stores or convenience stores alongside Route 45, but evacuated stores that are in business temporarily in roadside stations or in Greenpia Taro alongside the highway are planning to move into the development. According to the Regional Development Division of Taro, now there are three buses a day, but the number is going to be increased with population growth.