TOHOKU UNIVERSITY




2019

Report of the APRU-IRIDeS Multi-Hazards Program Summer School

IRIDeS International Research Institute of Disaster Science

APRU

Report of the APRU-IRIDeS Multi-Hazards Program 2019 Summer School

22-25 July 2019

Tohoku University

Sendai, Japan

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Background

The 7th APRU (Association of Pacific Rim Universities) Multi-Hazards Summer School was held at Tohoku University on 22-25 July 2019. Nearly 60 participants from 11 countries participated in the event to learn the lessons-learnt and experience from the 2011 Great East Japan Earthquake and Tsunami, the recovery efforts in the affected areas and discuss the contribution of academia in the implementation of the Sendai Framework for Disaster Risk Reduction (SFDRR).

The Association of Pacific Rim Universities (APRU) is a network of 51 premier research universities from 18 economies around the Pacific Rim. The International Research Institute of Disaster Science (IRIDeS) in Tohoku University was established in April 2012 as a new integrated interdisciplinary research team aiming at conducting world leading research on natural disaster science and disaster mitigation leaning from and building upon past lessons in disaster management from Japan and around the world. IRIDeS also provides secretariat services as the regional program hub to the MH Program.

The APRU-IRIDeS Multi-Hazards (MH) Program was established in April 2013. The Pacific Rim region has high risks to natural disasters and the universities and research institutes in the region are expected to contribute to reducing disaster vulnerability and risks and strengthening disaster management capacity to tackle these challenges. The Program aims to harness the collective capabilities of APRU universities for cutting-edge research on disaster risk reduction (DRR) as well as contribute to international policy making processes on DRR. The Summer School is one of the key activities under the MH Program.

The key activities of the MH Program include:

- Organization of the annual summer school
- Organization of the annual APRU MH Symposium
- Foster collaboration in disaster research and information/data sharing between APRU universities
- Contribute to DRR discussions at international and regional levels and to a policy making process.

The need for and importance of science and technology application in disaster risk reduction has been strongly emphasized especially in the Sendai Framework for Disaster Risk Reduction (SFDRR) adopted in 2015 at the UN World Conference on Disaster Risk Reduction. It underlined the importance of the role of academia in focusing on the disaster risk factors, increase research for regional, natural and local application, support action by local communities and support the interface between policy and science for decision-making. It is extremely important for academia to work with different stakeholders to play such key roles.

This summer school is designed to learn from the experience of local government, NGO as

well as academia and include the lectures not only from the natural science aspect but also the social science aspect to enable the participants to understand the diversified elements of DRR. The IRIDeS continues to host the MH program and contribute to strengthening the disaster science research and contribute to discussions at international and regional levels to make an influence on DRR strategy and policy in the region.

Acknowledgement

IRIDeS as the main organizer of this summer school would like to extend a sincere appreciation to the participants and speakers from different sectors who shared wonderful experiences and knowledge regarding DRR issues from different perspectives. Their involvement and participation made a great contribution to the success of this event. In addition, IRIDeS received tremendous support from the APRU secretariat based in Hong Kong as well as Tohoku University. The organizer is also grateful for valuable suggestions and advices provided by the faculty members of IRIDeS on the program development and planning.

Lastly but not least, this summer school was never implemented without hard works and considerable support by the International Strategy for Disaster Mitigation Division of IRIDeS and the Global Engagement Division, Tohoku University.

OPENING REMARKS

Prof. Hideo Ohno

President of Tohoku University

It is a great pleasure for me to welcome you to Tohoku University for "the APRU-IRIDeS Multi-Hazards Summer School."

It has been eight years already since the Great East Japan Earthquake and Tsunami happened on March 11, 2011. Tohoku University has also been playing an important role in the response and recovery process. In order to contribute to the recovery and provide any technical support to the process, the International Research Institute of Disaster Science (IRIDeS) was established in Tohoku University. It aims to share our knowledge and experience globally gained from a wide range of interdisciplinary research, and to contribute to building a resilient society against natural disasters. IRIDeS also launched the Multi-Hazards Program together with Association of Pacific Rim Universities (APRU) in April 2013. Since then, IRIDeS has become the program hub and coordinates the program activities. This summer school is one of the major events under the Multi-Hazards Program.

Natural disasters have been serious concerns for many years especially in Asia. We have already observed the increase of the number and scale of natural disasters especially due to climate change, urbanization, population density, environmental degradation and so on. In order to tackle these global challenges, three important international agreements were adopted in 2015, namely, the Sustainable Development Goals (SDGs), the Paris agreement, and the Sendai Framework for Disaster Risk Reduction. In particular, the Sendai Framework was adopted at the UN World Conference on Disaster Risk Reduction held here in Sendai in 2015. It is an international blue print which states major national actions in disaster risk reduction and encourages the involvement of all the stakeholders. The support and contribution by universities and academia is strongly needed to implement the Sendai Framework based on a variety of interdisciplinary research and the application of science and technology. We are expected to support action by local communities and authorities as well as support the interface between policy and science for decision-making.

In November 2017, Tohoku University in collaboration with Sendai City organized "World Bosai Forum" that brought more than 900 attendees from 42 countries. It provided a platform for discussions and information exchange among disaster exerts through more than 50 sessions on various topics. We believe it is crucial to maintain discussions on new ideas and solutions among various stakeholders, share the experience and lessons learned, and address the voices and needs of communities and citizens. The second World Bosai Forum will be organized on 9-12 November this year. I do hope many of you will join this important event and share your research findings with us.

Tohoku University was selected as a "National Designated University" in 2017: only five universities in Japan were appointed as a recognition of the university's abilities to lead and shape global education and research. In particular we promote the organization for the

advance studies in four areas – Materials science, Next-generation medical care, Spintronics, and Disaster science. Tohoku University recognizes the importance of disaster science research and are determined to become a global leader in this field.

To conclude, I would like to thank the APRU secretariat for their kind support and cooperation. I wish you every success in this summer school program.

Prof. Fumihiko Imamura

Director and Professor of Tsunami Engineering, IRIDeS, Tohoku University

Good morning. My name is Fumihiko Imamura, Director of the International Research Institute of Disaster Science (IRIDeS), Tohoku University. It is my great pleasure to welcome you to IRIDeS and to give the opening remarks at the Association of Pacific Rim Universities (APRU)-IRIDeS summer school.

We are grateful to have so many students and faculty members as participants in this opportunity to learn from each other's disaster experiences and research. The Great East Japan Earthquake and Tsunami that happened in 2011, unfortunately, imposed great damage on this region. As a professor of tsunami engineering, I, together with my colleagues, made tremendous efforts to develop a new model to forecast and contribute to building a resilient city using various structural and non-structural measures in collaboration with the private sector, governments, and communities. Unfortunately, these efforts are not sufficient. This means that there is much work to do for us to improve disaster risk reduction measures in Japan.

In addition, I believe it is extremely important to share these experiences and lessons learned from the 2011 disaster globally, especially in the Asian region, which is very prone to natural disasters. In this sense, this summer school is a great opportunity to share knowledge and experiences and to solicit your ideas and feedback for future disaster management through this four-day summer school, which includes a field visit.

IRIDeS was established in 2012 after the 2011 disaster and it has a unique concept that aims to conduct interdisciplinary research. We have nearly 60 faculty members from science, engineering, humanities, social science, as well as medical science working together beyond each research area to produce a scaled-up outcome. In addition, we conduct action-oriented research and work very hard to make the best use of research results to enable communities to use them practically. To contribute to these objectives, we have been organizing the World Bosai Forum every two years since the 2015 United Nations World Conference on Disaster Risk Reduction to share our research results and discuss the challenges with various stakeholders. Nearly 150,000 participants have joined the event from all over the world to discuss important issues on disaster mitigation.

Thank you very much again for your participation in and support for this summer school. I hope the summer school will be fruitful and you will enjoy the discussions.

Thank you very much.

Ms. Tina Lin

Senior Program Officer, International Secretariat, Association of Pacific Rim Universities (APRU)

Dear President Ohno, Professor Imamura, Professor Izumi, dear colleagues and summer school
participants.

Good Morning, on behalf of APRU Secretary General, Dr. Chris Tremewan and Policy & Programs Director Ms. Christina Schönleber, I am most delighted to welcome researchers, students and practitioners from Japan and across the Asia Pacific region to the 7th Annual Multi-Hazards (MH) Summer School hosted by the International Research Institute of Disaster Science (IRIDeS) here at Tohoku University.

APRU is very proud of their long standing and close partnership with the colleagues and experts at Tohoku University. Together, we set up the APRU MH Hub in 2013 to drive forward the mission help address the challenges relating to disaster risk reduction (DRR) in the region.

The aim of the APRU MH Hub is to harness the research capabilities in DRR of APRU member universities around the Pacific Rim to address the shared threats of earthquakes, tsunamis, typhoons and other natural disasters that threaten this region. As part of this highly important work, IRIDeS has set up and is hosting regular Summer Schools and Campus Safety Workshops, and promoting APRU annual MH Symposium.

Over the past 7 years, our esteemed colleagues from the MH Program Hub, led and coordinated by Professor Imamura, Professor Takako Izumi, and supported by its international Core Group have greatly contributed to shaping the international decision and policy making process for DRR. The Program brings impactful findings to regular program activities, joint publications, as well as to a much boarder constituency such as United Nations and Asia-Pacific Economic Cooperation (APEC).

APRU consider capacity building across the region a key objective of this process, including informing future leaders about key challenges of the Asia-Pacific region to guide their thinking to address these through research, policy development and on the ground impact.

This MH Summer School is a very important APRU activity for having you as experts and future leaders of the region to gain latest knowledge and insights from the perspective of multidisciplinary stakeholders engaged in DRR.

Later during this summer school, I will present to you in more depth how the APRU works with our member universities and external partners to achieve and support policy impact across a number of programs such as this MH Program and Hub.

Once again, I would like to thank Tohoku University and IRIDeS for their dedication and expertise in continuing to develop the MH Program and achieving such far-reaching impact. I wish you all a fruitful and highly-engaging week.

PRESENTATIONS

Overview of the International Research Institute of Disaster Science (IRIDeS), Tohoku University

Kiyoshi Itoh

Deputy Director / Professor, IRIDeS, Tohoku University

Tohoku University was founded in 1907 and is the third oldest university in Japan. IRIDeS is the newest research institute of Tohoku University. IRIDeS was established in April, 2012, approximately one year after the 2011 Great East Japan earthquake.

In 2007, prior to the 2011 disaster, some Tohoku University researchers had formed a multidisciplinary research group to cope with an earthquake off the coast of Miyagi Prefecture which was foreseen to occur in the near future. The reality of the 2011 disaster far exceeded all predictions, however, and the group was unable to respond adequately. Tohoku University undertook a major expansion of the group to learn lessons from the disaster, resulting in the establishment of IRIDeS.

IRIDeS aims at both the revival of Tohoku Disaster areas and the reduction of disaster worldwide. We have two key words. One is "multidisciplinary." Scholars in humanities, sciences, social sciences, engineering and medicine collaborate actively. The other key word is "Practical Disaster Prevention Research." Our ultimate objective is to contribute to the actual society.

In IRIDeS, there are 7 Research Divisions and 37 Research Fields. To date we have conducted numerous studies which can be categorized by "the disaster cycle": "understand and prepare for a disaster," "respond to the disaster after it occurred," "recover from the disaster," and finally, "mitigate future disasters through DRR education." We also emphasize forging links with diverse stakeholders, both domestically and internationally, as researchers alone cannot realize safer and more resilient society.

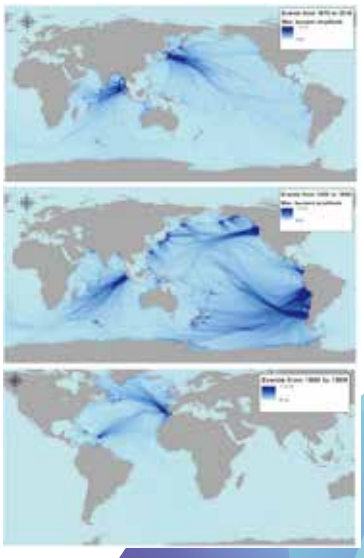
Organization of IRIDeS

There are 180 members including:

- *53 researchers and 30 researchers with concurrent appointments*
- *9 specially appointed visiting professors*
- *2 senior researchers*
- *70 lab workers/technical assistants/secretaries*
- *16 administrative staff*

(as of June 2019)

IRIDeS forging links with diverse stakeholders



It has been 8 years since the Great East Japan Earthquake……

"Disaster"

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IRIDeS
International Research Institute of Disaster Science

IRIDeS members have been working hard to "turn the disaster into happiness"

Disaster Risk Reduction: Japan as a disaster-prone country and learning from past disasters

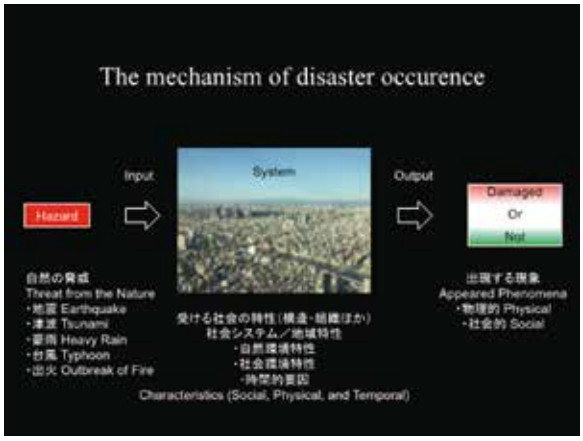
Osamu Murao

Professor, IRIDeS, Tohoku University

Japan is one of the disaster-prone countries, having earthquakes, tsunamis, volcanic eruptions, typhoons, heavy rains, or floods. The presentation given by Prof. Murao at the Multi-Hazards Summer School 2018 was about Japanese disaster risk reduction experiences, consisted of the following five topics:

1) How do you evaluate urban disaster risk?
2) Disaster Life Cycle
3) Sendai Framework and "Build Back Better"
4) 1934 Hakodate Great Fire
5) Japan as a Disaster-prone Country and Learning from the Past Disasters

The presentation started with a question, "How do you evaluate urban disaster risk?" and explained urban disaster risk with definitions of "hazard," "vulnerability," and "exposed value." The second topic focused on "Disaster Life Cycle," an idea to deal with disaster management with sequential phases, "emergency response," "recovery," "mitigation," and "preparedness." Then Sendai Framework for Disaster Risk Reduction, which was adopted at the third World Conference on Disaster Risk Reduction 2015, was explained, with Build Back Better concept as the third topic. Japanese people have learnt many things from those disastrous experiences to make societies safer. The presentation introduced the 1934 Hakodate Great Fire and how the disaster changed the urban fabric in the process of post-disaster recovery, followed by other important recovery cases in Japanese history.



International strategy for disaster risk reduction: implementation of the Sendai framework for disaster risk reduction (SFDRR)

Takako Izumi

Associate Professor, IRIDeS, Tohoku University

It is well-known that a major portion of the disaster management budget was spent during the post-disaster phase, such as disaster response and recovery, and not for the pre-disaster phase, such as disaster mitigation and preparedness. However, since the 2004 Indian Ocean tsunami and the adoption of the Hyogo Framework for Action (HFA) in 2005 at the UN World Conference on Disaster Reduction, people have gained more interest in and a better understanding of disaster mitigation and preparedness.

For instance, after the enactment of the HFA, countries' DRR efforts have increased, with the understanding that disasters harm the GDP and national growth. Because of the tremendous economic loss following a disaster, it takes a long time to recover from its damage; therefore, investing in DRR is extremely important and has to be strengthened. While a certain level of improvement in this field was observed, it was obvious that further DRR efforts were needed, and better involvement and collaboration by various stakeholders were indispensable.

In 2015, the SFDRR was adopted at the UN World Conference on DRR in 2016. It emphasized the importance of applying science and technology in DRR, along with scientific evidence-based policy and decision-making. To achieve the goals of DRR, academia and universities would play a critical role; in the SFDRR, the roles of academia are stated as follows:

1) Focus on disaster risk factors and scenarios,
2) Increase research for regional, national, and local application,
3) Support action by local communities and authorities, and
4) Support the interface between policy and science for decision-making.

In the science and technology application process, the following are extremely important.

a) The fact that science and technology cannot solve everything, as they have limitations and constraints. How would one fill these gaps? Through human behavior, education-based actions, and social science–based awareness.
b) Interdisciplinary research (combination of natural and social sciences).
c) Working together with other stakeholders especially with practitioners. (Knowledge should not be monopolized by academia. Technology and tools have to be "usable.")
d) Strengthening capacity development and empowerment for future DRR experts (government officials, community leaders, etc.).

From Hyogo Framework for Action to Sendai Framework for DRR

IRIDeS

Background of HFA

- The Indian Ocean Tsunami in December 2004 increased the interest in and awareness on DRR.
- The awareness and knowledge on tsunami was no sufficient. Lack of early warning system.
- Five priority of actions:
  (1) Governance: ensure that DRR is a national and local priority;
  (2)Risk identification: identify, assess and monitor disaster risks and enhance early warning;
  (3)Knowledge: use knowledge, innovation and education to build a culture of safety and resilience;
  (4)Reducing the underlying risk factors;
  (5)Strengthen disaster preparedness for effective response.
- It emphasized "DRR is everyone's business". All the stakeholders need to get involved in DRR. It is not a task of only governments and other humanitarian organizations.

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Priorities for action in the Sendai Framework for Disaster Risk Reduction

1. Understanding disaster risk;
2. Strengthening disaster risk governance to manage disaster risk;
3. Investing in disaster risk reduction for resilience;
4. Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

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Role of academia in the Sendai Framework for Disaster Risk Reduction

Academia, scientific and research entities and networks to

1) *focus on the disaster risk factors and scenarios,*
2) *increase research for regional national and local application,*
3) *support action by local communities and authorities, and*
4) *support the interface between policy and science for decision-making*

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Recovery after the great East Japan Earthquake and Tsunami of 3.11.2011

Elizabeth Maly

Associate Professor, IRIDeS, Tohoku University

The 3.11 Great East Japan Earthquake and Tsunami was a massive, complex disaster—including earthquake, tsunami, and nuclear meltdown—causing devastation in the Tohoku region. The disaster struck and recovery is occurring within the multiple contexts of society, geography, and disaster history in Japan and the affected region. 8 years after the disaster, community and housing recovery is underway, but challenges remain.

Ongoing Town and Housing Recovery

Vulnerable to many and frequent disasters, Japan also has established laws, policies and precedents for disaster recovery. However, the scale of GEJE, and the corresponding recovery was unprecedented, and the national government created a Reconstruction Agency, and a menu of 40 recovery projects fully funded by the national government. Municipal governments are responsible for making the recovery plans for their towns, choosing from these projects. Most municipal governments' recovery plans include collective relocation for disaster mitigation (which includes providing lots for private housing reconstruction as well as public housing) (Figure 1) and construction of disaster recovery public housing (Figure 2). As of May 2018, preparation was complete for 89% of 18,000 planned residential lots, and as of April 2018, 96% of 30,553 planned units of public housing were completed.

More complicated recovery in Fukushima

Because of the nuclear meltdown at Fukushima Daiichi Nuclear Power Plant, radioactive contamination has led to long term displacement for evacuees. Compared to Iwate and Miyagi Prefectures, which suffered the most severe tsunami damage, the situation and challenges faced by evacuees in Fukushima is complex. In the first few years after the nuclear meltdown, two of the differences that show additional challenges for Fukushima evacuees are shown in Figure 3.

1) The higher number of "indirect deaths" compared to direct tsunami deaths, reflecting the stress and negative impact of multiple, prolonged, and uncertain evacuation. 2) The large number of people who evacuated outside their home prefecture. This leads to more complications to provide and access support. In addition, since the Japanese government makes a distinction between "official" evacuees (who are from areas with official evacuation orders) and "voluntary" evacuees (who decided to evacuate away from their hometowns although these areas have been designated "safe"). As the evacuation zones are revised, people from these areas will lose their access to government support. Even after evacuation orders are lifted, few people return. For example, in Okuma Town, where the evacuation order was lifted for 40% of the town area in April 2019, only 3.5% of residents returned (Mainichi Shimbun, 4/10/2019).

Overall Characteristics and Challenges for Tohoku Recovery

- Recovery in coastal areas of Tohoku faces various challenges, including the fact that the disaster area is not uniform, but rather made up of large cities and small towns, areas that have merged with other municipalities. Adapting standard recovery policies to local conditions was/is difficult.
- Socially, the Tohoku region was also facing the situation of population aging even more rapidly than Japan

overall; in some places, disaster is speeding up the process, as young people may not move back to former hometowns.

- Before the GEJE, many households in the disaster area traditionally lived in large single family detached homes. It is difficult to rebuild in a similar way on their own, or by using government –supported housing recovery programs. The resulting change in living environments could be especially difficult for elderly residents to adjust to.
- The reliance on relocation to high land areas is difficult for many reasons, including the fact that housing relocation programs do not include any other uses, making it impossible to recreate mixed use pre-tsunami communities with integrated housing, businesses, and shops.
- Large scale investment in infrastructure relocation (mountaintop cutting, land preparation) is disproportionate to future residential population, the futures of new residential areas may not be sustainable in the future.

Some of the additional challenges for recovery in Fukushima are compounded by the Japanese recovery policies, planning and programs based on the principles of hometown recovery (furusato recovery), in which relocation projects carried out within individual towns. This logic of hometown recovery also informs the methods of support for housing and life in the interim/temporary phase, and does not support the situation of long-term, scattered, distant, uncertain displacement of nuclear evacuees. Issues faced by nuclear evacuees and their former/current/future communities may not be solvable using the Japanese recovery schema. These unsolvable problems in Fukushima are not only a result of an inadequate Japanese recovery schema, but rather are a wicked problem with no correct answer. In this case, the goal should be to improve the situation, which in this case means to improve the lives of the evacuees as much as possible.

Figure 1. (left) Recovery planning, which relocates residential uses to highland areas. Residential lots for private rebuilding by homeowners are provided for sale or rent, as well as Disaster Recovery Public Housing.
Figure 2. (Right) Public Housing is provided in multi-family apartment style buildings, as well as single family detached houses in more rural areas such as fishing villages.

FUKUSHIMA: MORE COMPLICATED SITUATION

Damages from the Great East Japan Earthquake

	Casualties			Evacuees (as of 7/29/2016) + May 2019		Damaged houses (as of 9/12/2016)		Inundated area
	Direct (12/9/2016)	Missing (12/9/2016)	Indirect (kanrenshi) + Dec 2018	Within pref	Outside pref	Totally damaged	Partially damaged	
Iwate	4,673	1,123	467 459	2,718 18,788	989 1,390	19,507	25,528	58 km²
Miyagi	9,540	920	928 920	1,594 33,970	4,085 5,930	83,000	387,258	327 km
Fukushima	1,613	197	2,250 2,038	11,293 47,850	31,736 40,982	15,194	222,441	112 km²
Total	15,893	2,556	3,472	147,772		121,739	1,019,466	561 km²

Original data sources: Reconstruction Agency (2016b, 2016c), National Police Agency of Japan (2017), Fire and Disaster Management Agency (2017)
Updates: From Dec. 2018 and May 2019 Reconstruction Agency

Figure 3. Additional challenges for Fukushima evacuees compared to those from Iwate and Miyagi prefecture are reflected by the higher number of "indirect deaths" compared to direct tsunami deaths, and the large number of people who evacuated outside their home prefecture.

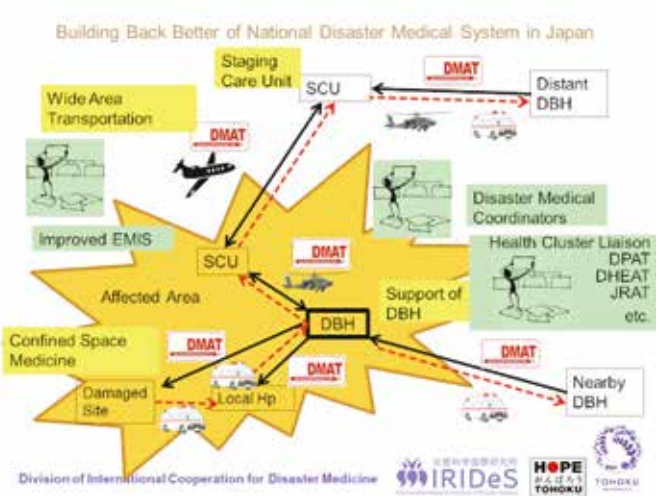
Medical and Public Health Needs in Disaster

Shinichi Egawa, M.D., Ph.D., F.A.C.S

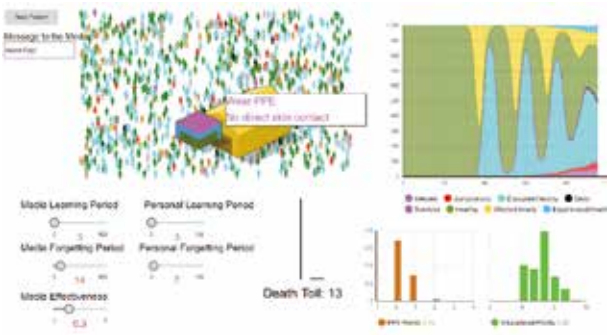
Professor, IRIDeS, Tohoku University

Sendai Framework for Disaster Risk Reduction (DRR) described for the first time as a DRR framework that disaster affects health. Sendai Framework aims to reduce a) mortality, b) affected people, c) direct economic loss by implementations of d) infrastructure, e) national and local strategies, f) international cooperation, and g) multi-hazard early warning system. Sendai Framework targets to reduce the damage to critical infrastructures, i.e. hospitals and schools. These movements are because of the imperative of health as a fundamental human right. Heath cluster is one of the DRR clusters to improve preparedness and efficient response.

After 1995 Great Hanshin Awaji Earthquake, Japan has established national disaster medical system including Disaster Base Hospitals, Disaster Medical Assistance Team (DMAT), Staging Care Unit and Transportation System, Emergency Medical Information System (EMIS) and Disaster Medical Coordinators. This system helped many lives in 2011 Great East Japan Earthquake (GEJE), 2016 Kumamoto Earthquake and 2018 West Japan Floods. However, every disaster has difference in medical and public health needs. Especially after GEJE, the change of medical needs in non-communicable diseases and mental health were more remarkable rather than trauma. This was because of resilient buildings, aging of the community and focusing more on mental health. Additional improvements of the national disaster medical system include the nation-wide implementation of disaster medical coordinators (Egawa 2017), improvement of EMIS function and various liaisons for children, hemodialysis patients, Disaster Psychiatry Assistance Team (DPAT), Japan Rehabilitation Assistance Team (JRAT), Disaster Health Emergency Assistance Team (DHEAT) and so on. Those teams join the medical coordination sector in the prefectural disaster headquarters in the periodical disaster drills co-organized by Cabinet Office of Japan assuming South Trough Earthquake in near future. Thus, flexibility and preparedness of medical and public health response is mandatory. Academia can contribute by research and development to improve disaster medicine. One of the methodologies is simulation modeling of disaster situation. Agent-based or system dynamics simulation provides a better insight of disaster situation without actual damage. For example, Ebola Virus Disease is a highly infectious and lethal disease and its outbreak claimed tens of thousands of lives in West Africa in 2014. I created an agent-based simulation model, that can change the parameters related to the length of people's and media's memory. By varying the parameters, the outcome (outbreak of the disease and resulting death toll) changes from 0 to 414 in a town of 1,000 population. Identifying the factors related to the vulnerability or coping capacity of the society can be validated using actual data.

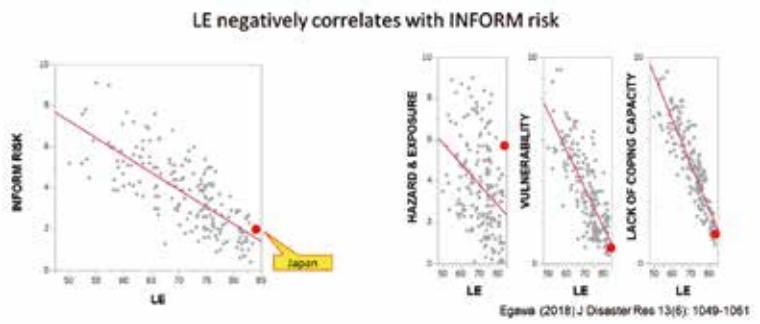


I also analyzed the correlation between life expectancy (LE) and the INFORM disaster risk index according to the hypothesis "healthy society is a resilient society against disaster" (Egawa 2018). LE negatively correlates



with the INFORM risk. Japan is a country with high risk of natural hazards, but Japan has high LE, less vulnerability and more coping capacity. The effort to make the LE high is not the task of health sector alone. Economical development, resilient and functional infrastructure, good road and communications assuring the accessibility to the health system and human development totally makes the LE high and INFORM risk low. Several health related risk indices in INFORM risk correlates with the LE negatively suggesting that social determinants of health also correlates with disaster risk.

In conclusion, DRR should be people-centered and the collaboration of health and all other DRR clusters is the best way to protect people's physical and mental health understanding the change of health risks in disaster.



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Towards disaster risk reduction city – Tagajo ~Disaster-resilient city~

Takumi Fujimura

Bureau of Reconstruction Promotion, Office of Mayor, Tagajo City

Tagajo City is located in the eastern region of Miyagi Prefecture near Sendai City, about 12 kilometers away from central Sendai, with a population of 62,000. Tagajo City was greatly damaged by the Great East Japan Earthquake and Tsunami in 2011. The tsunami hit the city approximately one hour after the earthquake. The highest wave reached 4.6 meters. One-third (662 ha) of the city was inundated by water, and about 12,000 people fled to evacuation sites such as schools.

A severe and inconvenient evacuation life started. As a result of the tsunami, a total of 188 precious lives were lost, and over 11,000 houses were destroyed in the city. Factories and offices in the industrial area were almost totally destroyed. Before the Great East Japan Earthquake and Tsunami, it was estimated that there was a 99% probability of an earthquake within 30 years off the coast of Miyagi Prefecture. Therefore, citizens were relatively prepared for earthquakes, and most were aware of how terrifying tsunamis were. At the same time, however, most people knew that Tagajo City was never affected by tsunamis in the past, and thus adopted the mentality that Tagajo would be unaffected even after the large-scale tsunami warning was issued. As a result, some people did not evacuate quickly, and others who evacuated by cars were caught in traffic jams, causing many injuries and loss of lives.

There are four major points in the DRR city strategy.

1. “Developing a disaster-resilient city.” Four strategies have been drawn up, centering on the construction of infrastructure.
2. “Increasing DRR capability based on self-help and mutual help.” Two strategies have been implemented so that citizens and local communities can cope with disasters by themselves, rather than depending fully on local administrations.
3. “Sharing disaster experience.” The aim of this strategy is to pass on the experience of disasters accurately to future generations so that they are not forgotten.
4. “DRR technology.” This is a strategy that enables companies to maximize their strength and be involved in projects that only regions damaged by the disaster can engage in, enabling these areas to turn the disaster experience into something productive and positive.

Under the four goals, eight implementation strategies were established.

Strategy 1: “Building multiple barriers for tsunami.”

Although sea walls will be constructed along the coast as a result of the damages seen in the 2011 disaster, these are only sufficient to cope with tsunamis that will strike once in 100 years. Therefore, when a huge tsunami that occurs once in 1,000 years strikes, overflow and flooding will result. This strategy aims to overcome this situation by considering evacuation as the basic policy, even though multiple barriers will be built. Specifically, main projects include the development of evacuation announcement facilities to send information accurately and swiftly, the construction of evacuation roads, the designation of temporary escape buildings to rescue people who are unable to evacuate, and the building of barriers to reduce the force and

speed of tsunamis.

Strategy 2: “Developing earthquake-resilient city.”
This strategy aims to increase earthquake-resistant roads and bridges, and to promote the retrofit of wooden buildings to make them earthquake-resistant.

Strategy 3: “Minimizing flood damage.”
There is a higher risk of flooding due to the fact that the ground has sunk after the Great East Japan Earthquake and Tsunami, and due to a recent trend of heavy rain in a short period of time. To overcome this problem, projects such as the development of a rainwater draining system and the construction of new rainwater drain pumps have been planned.

Strategy 4: “Developing a disaster response system.”
During the Great East Japan Earthquake and Tsunami, the number of people who evacuated was far greater than previously estimated. Thus, evacuation support was insufficient. By reflecting on that experience, we have reviewed our disaster response system.

Strategy 5: “Enhancing self-help ability.”
The aim of this strategy is to enable citizens themselves to prepare for disasters. Paired with Tohoku University’s International Research Institute of Disaster Science, we have developed the DRR handbook that outlines measures on how to cope with and prepare for disasters. We have been holding classes for citizens making use of this handbook.

Strategy 6: “Strengthening community DRR capacity.”
This strategy aims for the improvement of DRR capacity, as well as mitigation of local communities by such tactics as voluntary emergency drills.

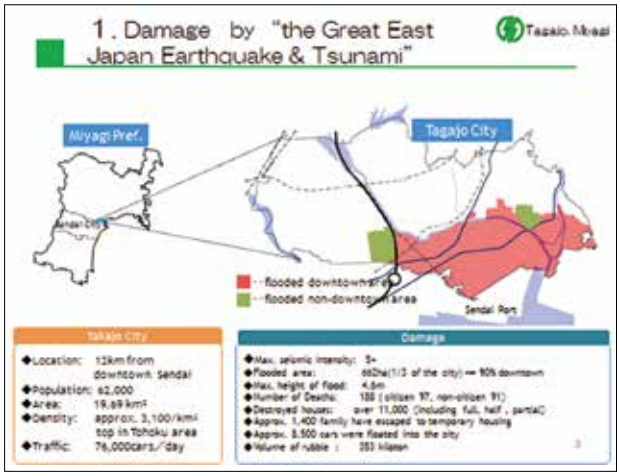
Strategy 7: “Sharing disaster experience.”
Many pictures of the 2011 disaster were taken, and it is crucial to preserve and compile those records carefully, and to share it with future generations.

Strategy 8: “DRR Research Park Program.”
This strategy seeks to promote DRR technology development as well as the accumulation and creation of industries using DRR technology by utilizing space created from factories damaged by the earthquake.

As well as to promote the DRR city strategy, the city felt the need to enhance urban development to accomplish recovery and reconstruction. For this reason, the Tagajo City Library was built, combining

restaurants, a book store, childcare center and a parents' support center. The aim is to create the best cultural hub in the Tohoku region.

Tagajo City experienced tremendous loss due to the tsunami. To change the way of thinking from negative to positive to promote urban development, the city will go on with strong determination to carry out DRR measures and reconstruction.



Disaster Prevention Learning in Elementary School after the Great East Japan Earthquake

Kiyoshi Araake

Principal, Kouya Elementary School in Watari town

After the 2011 great East Japan earthquake and tsunami, our school has been implementing DRR methods and education in our daily activities. It has been eight years since the disaster, and because most of the young people today do not remember it, using topics or terms that are familiar to them is important, as that would make them understand that it might also happen to them in the near future.

For example, to attract their attention, the class started with the words "There was a big disaster some time ago in Miyagi prefecture—yes, where we live now," like an old story was being told. This is an easier and more effective approach for students to learn DRR in the regular curriculum, as DRR elements are introduced in each grade level or in regular subjects. Several facts about tsunamis were shared in class, such as how they cover a distance of 100 meters in 10 seconds, which is as fast as Olympic runners so that students gain a better understanding of tsunamis and, thus, prepare for them. This teaches the students that they cannot win a race against a tsunami the same way they cannot win against an Olympic sprinter. This way, students realize that once a tsunami hits, they will get caught in it. In math class, the students placed rulers on their own bodies to understand how high a 30-centimeter wave is; even a small tsunami of that height can wash people away. Simultaneously, the students also felt how strong the water pressure is in their swimming classes during the summer.

DRR education can be integrated into regular subjects such as math (recognizing magnitude), science (water action), and social studies (geography and the Japanese constitution). Furthermore, some emotional stories regarding the disaster were shared with the students so they feel the agony of the whole experience. An example of this was when a digital camera with priceless memories was lost when it was washed away by the tsunami. Another was when my brand-new car was lost because of the raging waters. Moreover, appreciative statements were also shared in class, such as the expression of gratitude for relief aid and to volunteers after the 2011 tsunami. It is important to encourage children to develop the initiative to support others during disasters and to offer a helping hand to their friends when they are in trouble. Although the objective of our DRR education is to "protect lives," it also aims to promote a healthy mind-set among children through education.

In the 2011 earthquake and tsunami, vast amounts of private property were lost, and people were forced to live under difficult conditions. However, at the same time, people tried to get creative to survive under these inconvenient and difficult circumstances. Students who did not experience the 2011 disaster were taught that tremendous recovery efforts made it possible for people to return to their normal lives, which is extremely precious.

As the class ended, stories of recent disasters, such as the heavy rains and flooding in West Japan, were shared, and our students expressed sympathy and encouragement to children in the affected areas, who are currently going through a difficult time.

Memories of the disaster（Mar.13）

First supplies delivered on the 3rd day

- Bread　　Evacuees

145 ÷ 870

（How much can each person eat ?）

Memories of the disaster（Mar.13）

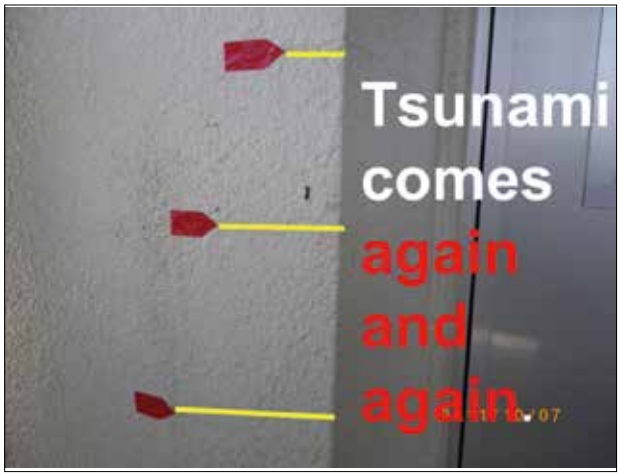
First supplies delivered on the 3rd day

This is the amount one person could eat each day.

The school had protected us from the big earthquakes.

It finished resistance construction in 2010.

But, it couldn't beat Tsumami



Nowcasting and Forecasting Major Earthquakes

John Rundle

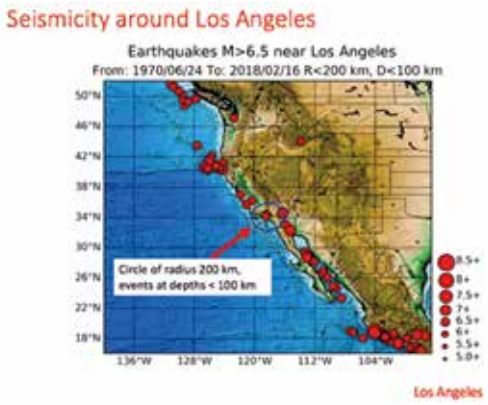
Distinguished Professor, University of California, Davis, USA

Nowcasting, Forecasting and Prediction – What's the Difference?

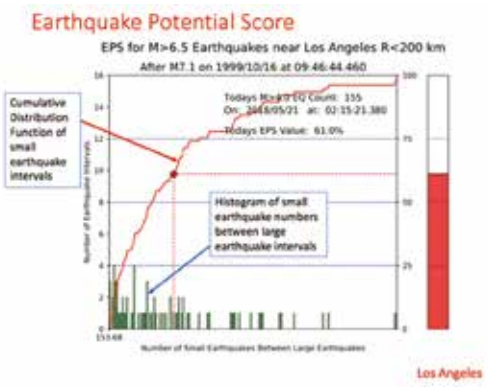
- A nowcast is a determination of the current state of a complex dynamical system using indirect means. An example of a nowcast is: "A region in a circle of radius 100 km around Sendai is 30% through its earthquake cycle for a magnitude 6 earthquake."
- A deterministic prediction can be defined as a deterministic statement that can be verified by a single observation. An example of a prediction is: "There will be a magnitude 6 earthquake next week in Sendai within 100 km of Sendai."
- A probabilistic forecast can be defined as a statement of probability that requires multiple observations to establish a confidence level. An example of a forecast is: "There is a 40% chance of a magnitude 6 earthquake within 200 km of Sendai during 2019."

Nowcasting

Nowcasting is a term originating from economics and finance. It refers to the process of determining the uncertain state of the economy or markets at the current time by indirect means. We apply this idea to seismically active regions, where the goal is to determine the current state of the fault system, and its current level of progress through the earthquake cycle. In our implementation of this idea, we use the global catalog of earthquakes, using "small" earthquakes to determine the level of hazard from "large" earthquakes in the region.

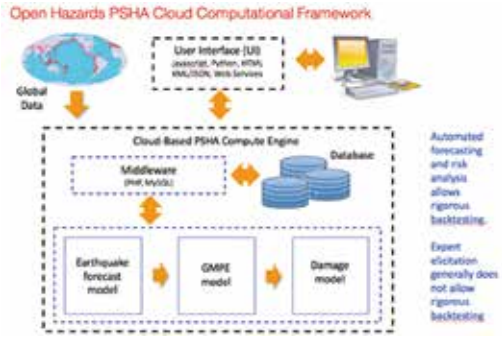


Our method does not involve any model other than the idea of an earthquake cycle. Rather, we define a specific region and a specific large earthquake magnitude of interest, ensuring that we have enough data to span at least ~20 or more large earthquake cycles in the region. We then compute the earthquake potential score (EPS) which is defined as the cumulative probability distribution P(n<n(t)) for the current count n(t) for the small earthquakes in the region.



From the count of small earthquakes since the last large earthquake, we determine the value of EPS = P(n<n(t)). EPS is therefore the current level of hazard, and assigns a number between 0% and 100% to every region so defined, thus providing a unique measure. Physically, the EPS corresponds to an estimate of the level of progress through the earthquake cycle in the defined region at the current.

Forecasting



This lecture reviewed and discussed a currently operating real time earthquake forecast for California and the world. The forecast method was described in terms of the standard model of elastic rebound theory of earthquakes, and also provide a guide to its use and interpretation of results. The forecast methodology includes both a forecast and a residential damage estimator The basic forecast method was then reduced to practice and is currently online at www.openhazards.com. A mobile app ("QuakeWorks") implementing the forecast can be downloaded from the Apple App Store.

The earthquake forecast provides a computation of the probability of a major earthquake occurring in a user-defined region over the next 3 months, 1 year, or 3 years. Magnitude ranges of earthquakes calculated for the forecast are M= >5, >6, >7, and >8. The forecast probabilities, which can change very rapidly in time, make use of a real-time seismic catalog comprised of the USGS earthquake catalog, updated with the 30-day real time feed. Calculations are performed daily at about 21:30 Pacific Time and are then updated on the web site at about midnight Pacific Time.

Both prospective and retrospective ("backtesting") have been performed on the general forecast methods to determine accuracy and reliability, yielding a 1-year accuracy of about 80%-85% in space and time. Testing has used standard methods of forecast validation and verification developed in other fields. The forecast is extensible, and is used as input to a standard ground motion algorithm, which is then used as input to a published structural damage model. The damage model assumes that structures conform to the International Building Code applicable at the time they were built.

The resulting calculations allow the user to obtain an estimate of the probability of an earthquake, the resulting peak ground acceleration, and the likely damage to residential structures having specified properties.

GROUP WORK DISCUSSION

GROUP WORK

The following questions were given to the groups:

1) Develop a DRR project proposal that applies and uses your research results/findings. It has to include both natural science and social science perspectives.
2) Who needs to get involved in project implementation? What are their roles in the project?

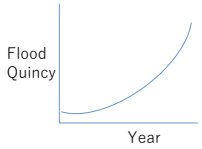
GROUP1

Group:1

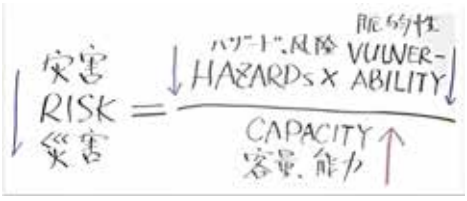
INTEGRATIVE DISASTER REDUCTION

case study flood in CHINA

BACKGRAND



⇨ Need solution!!!



Objective: Reduce the Risk

Methodology: R=Hazard ×Vulnerability / Capacity

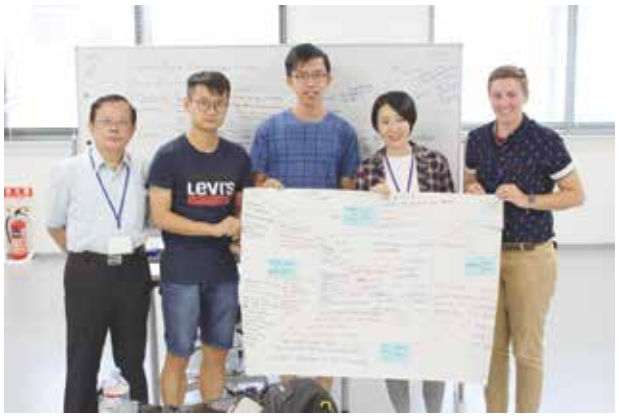
Activity:

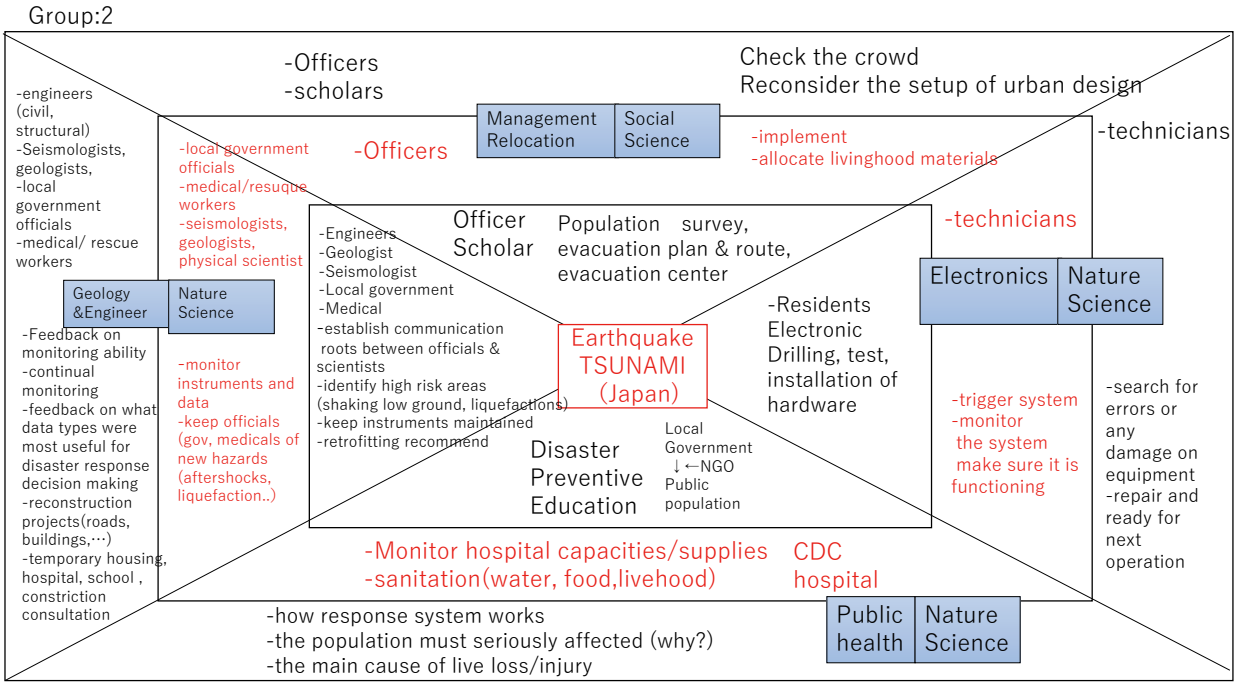
①definition of flood in china →data of occurrence, mapping the data(analysis with suffers)
→data from the government, community
date of rainfall→data from climate center
date of infrastructure →data from governs
date of land use change

②definition of vulnerably→social vulnerably→interactive to the community, data of demographic profile from the government
physical vulnerably→ street, people live

③definition of capacity→policy roles related to disaster/flood
date from the central government +local government
date of facilities rollup to disaster program from gorvenment
local program related to disaster

GROUP2




Group:2
-Officers
-scholars
Check the crowd
Reconsider the setup of urban design
-engineers (civil, structural)
-Seismologists, geologists,
-local government officials
-medical/ rescue workers
Management Relocation
Social Science
-technicians
-local government officials
-medical/resuque workers
-seismologists, geologists, physical scientist
-Officers
-implement
-allocate livinghood materials
Officer Scholar
Population survey, evacuation plan & route, evacuation center
-technicians
-Engineers
-Geologist
-Seismologist
-Local government
-Medical
-establish communication roots between officials & scientists
-identify high risk areas (shaking low ground, liquefactions)
-keep instruments maintained
-retrofitting recommend
Geology &Engineer
Nature Science
Electronics
Nature Science
-Residents
Electronic
Drilling, test, installation of hardware
Earthquake TSUNAMI (Japan)
-Feedback on monitoring ability
-continual monitoring
-feedback on what data types were most useful for disaster response decision making
-reconstruction projects(roads, buildings,…)
-temporary housing, hospital, school , constriction consultation
-monitor instruments and data
-keep officials (gov, medicals of new hazards (aftershocks, liquefaction..)
Disaster Preventive Education
Local Government
↓←NGO
Public population
-trigger system
-monitor the system make sure it is functioning
-search for errors or any damage on equipment
-repair and ready for next operation
-Monitor hospital capacities/supplies
-sanitation(water, food,livehood)
CDC hospital
-how response system works
-the population must seriously affected (why?)
-the main cause of live loss/injury
Public health
Nature Science

GROUP3

Group:3

DEVELOPING MANILA INTO A SUSTAINABLE & RESILIENT CITI

Background:
-frequently suffering from natural disasters
-highly populated
-no city wide plans natural disasters

Researchproblems:
-infrastructure?
-education?
-awareness?
-sustainability?

Objectives:
- ↑ sustainability of actions
- ↑ cooperation of different sectors

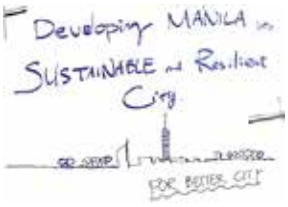
RESILIENCE CYCLE

Government
↓
Multi-stakeholder
↓
Public Participation

-Resourcefulness
-Robustness
-Redundancy

Pre-disaster

-Disaster simulation (observation strength)
-Enough Health Resources
-Skillful human resources
-Education
-Redundant infrastructure
-Communication system



Post-disaster

・Recovery
-Local government
-Citizen

-Evacuation
-Infrastructure improvement
-Relocation
-Psychologically care
-Benefit associations

During-disaster

・Response
-Local government
-Citizen(safe and Mutual(～)

-Evacuation site construction
-Suitable nutrition food ,clean water
-Quarantine
-Protection
-Message delivery

GROUP4

Group:4-1

SEDRP 7 Targets

1. Disaster mortality
2. No-of affected people
3. Economic loss
4. Infrastructure damage
5. DRR national/local strategy
6. International cooperation
7. FWS and DR information

4 Priorities

1. Understanding disaster risk
2. Strengthening disaster risk governance to manage disaster risk
3. Investing in DRR for resilience
4. Enhancing disaster preparedness for effective response and Build back better for effective response and to Build back better in recovery, rehabilitation & reconnection.

Group:4-2

Framework for an Early Warning System in the Cordillera Region in the Philippines (landslide and typhoon)

1.Risk Mapping and Assessment □
-Understand the risks to properly mitigate it
-Based on high-quality simulations, site investigation, post data, local knowledge, etc.
Involved: National government ,local government ,academia, NGOs, local leaders.

2.Insuranace ※
-Government should corporative with insure companies to sell the catastrophe policies.
-Government responsible for claims and compensation.
-Insurance companies responsible for selling policies by their own sales channels.
Involved: government, Insurance companies

3.Early warning systems ○
-Using satellites we gain weather information, we can forecast rainfall and humidity, minimize the use of sensors and reduce costs.
-Establish a central of date processing
Involved National government, International agencies, academia, local government.

4.Sageline studies ☆△
-Sociological (ethnic minority population, local language, culture, role of women and elder in DRR)e use of ---
Infrastructure
-Economic(solove it live hood)
Involved local government, academia, NGOs, elder local community

5.Development of a communication strategy ☆△
-Use local language
-"bath ngaw"(bells,siren

-landlines
Involved: local media, local DRRM council, local community leaders, academia, national govt (department of science &technology)

6.Development of a evacuation plans □
-Based on the hazards. The characteristics of population including minorities, communities strategies.
-Find the safe zones and develop evacuation
Involved: National government ,local government ,academia, NGOs, local leaders. Community members, private sectors.

7.Education of local communities ☆※○
-Conduct of seminars, capacity building trainings.
-Develop pamphlets(using local language, and in the active and contact)
Involved: Local community leaders, academia(resherchrs),NGOs,local community members, local disaster risk reduction and management council.

Group member
*Yixuan Wang△
*Yang Hangyi ※
*Yui Numazawa○
*Joanna Laddaran☆
*Ruben Vargas□

GROUP5

Group:5-1

STUDY FRAMEWORK

・Global Framework

SDG's

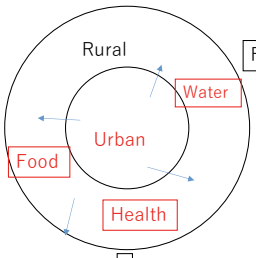
SEDRR goal2

The New urban Agn. Strengthening urban-rural linkage

DRR & CCA
Urban-Rural Nexus

Climate Change → Drought

Climate Change → Food



LOCAL LEVEL APPLICABILITY

Framework Development

Members	Hazard Focus	Priority	Key actors
①Vibhas	Floods & Drought	Water security	Local gov, community
②Rolando	Floods & Drought	Food security	"
③Suju	Multi hazards	Disaster statistics	Research org.
④Naresh	Earthquakes	Resilient city	Local gov, community
⑤Abdul	Multi hazards	Health & wellbeing	Local gov, Hospital etc.
⑥Zainul	Floods	Community refill	Local gov, community

*stakeholders
・Local municipalities
・Community groups
・Department of Health/Hospital
・Schools /Institutes
・Department of water, drainage, irrigation
・NGO's
・Community Wellbeing Organization

Group:5-2

DRR & CCA PLAN

Strengthening Food & Water security through city Region perspective

Flood
Water contamination→Flood quality
→Disease outbreak

Drought
Water shortage→Food production
→Food & nutrition security

Key actors	Key areas of intervention	Specific strategy	Policy recommendation
Local gov,	Policy coordination	Local strategy plan Zoning plan Public awareness	Establish an independent body to ensure Urban-Rural cohesion
Community Org. (NGOs,CSOs,NPOs)	Collaborative Eng. Improve solidarity Improve partnership	Improve production methods Improve water efficiency Producer-consumer relationship	Collaborative Food Alliances
Healthful, academia/Researcher	Preventive, Promotion, Durative & Rehabilitation ・Research→inactive water, food/security	・Education awareness ・Strengthening the collaboration among health sector . doctor, epidemiologist ,nurse ・Temporary health fallings ・Cor & chns research data ・Community risks to the local government & community ・Suggesting innovative solutions	Guideline for emergency situation -health wellbeing's(handbook) -Academia-policy engagement

GROUP6

Group:6

OBJECTIVE

IMPROVE THE PREPARATION SYSTEM AND IMPLEMENTION ON TSUNAMI DRIVEN BY SUBMARINE LANDSLIDE ON SUNDA STRAIT,INDONESIA

Hazard Disaster

- Early warning system
  - Citizen
  - Tourist
  - Government
    - International
    - National
    - Local
  - NGO
  - Local sectors
  - Industry
- Public information/knowledge,education
  - Tsunami
  - Disaster Civil
  - recalling memories about future disaster
- Assessment disaster response
- Build the new building that acceptable standard for disaster

Work Together between agencies

Situation-Sunda stuit Tsunami Dec 22,2018 21:20 utc+7
Highest =13m high,Ave 6m high
Background-mortality 429 people,Injured-1,530people,many mortalities in 709 Tourists=tourism area,Destroyed-500 permanent, semi-permanent Bldgs.
Assessment-Many people died-lost of damage,:potential for “slow onset tunami →submarine landslide because of volcano.
Recommendations-
New building-re-development especially on tourism area
More many rules to diverse power of the tunami

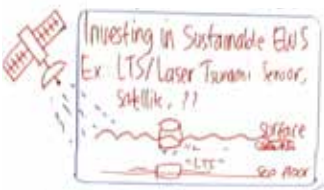
GROUP7

Group:7

BACKGROUND

Uufunctioning EWS
"Buoy"in Sunda strait
Tsunami
- Cause: stden, not well maintain
- Impact: worse the damage

DRR PROJECT



INVESTING IN MORE SUSTAINABLE EWS

Understand
- existing technologies compare & Asean gaps(new development)
- Disaster mechanisms & hazards
- Feasibility, acceptability,& social impacts
- Financial considerations

Plan

Do
Implement
- most effective technology
- Financial plan

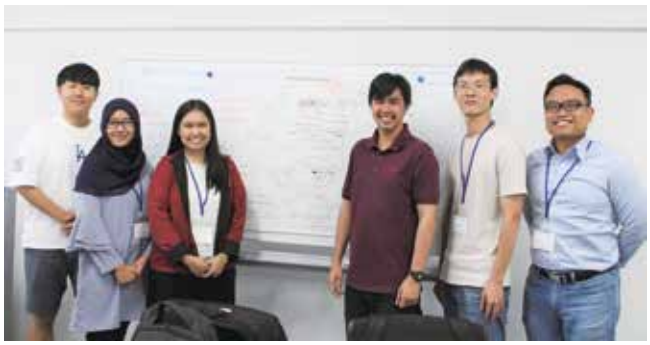
Coordinate
- with local and national stakeholders

Communicate
- with national to local government to improve be repairing procedures

Check
Evaluate
- Effectiveness of EWS
- Health &Social impacts
- Implementation challenges and successes

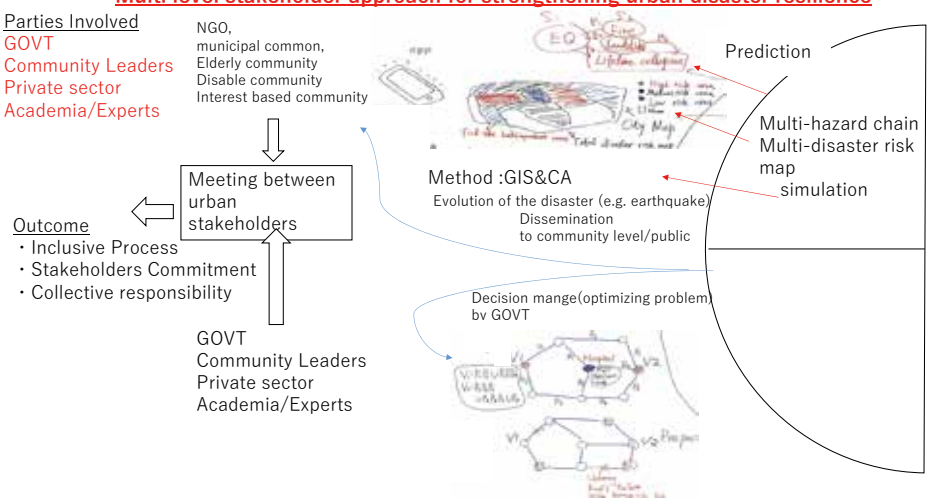
Act
Modify
- EWS to meet national &local needs
- EWS to accommodate worst case scenario

GROUP8



Group:8-1 **Title:**

Multi level stakeholder approach for strengthening urban disaster resilience



Group:8-2 **OUTPUT of STAKEHOLDER MEETING**

	Preparedness	Response	Recovery	Mitigation
-Government	*Build evacuation center *Making Integrated Roadmap *Evacuation & Monitoring *Strengthening vulnerable & faileness *Zoning plan	*Communication & Coordination *Dispatch rescue team	*Build back better(BBB) *Committed to community Participation on recovery process	*Making a hazard map *Preparing drilling for community *Provide disaster education curriculum for school
-Private sector	*BCP *Finance stocking *Finance evacuation center & possible	*Provided emergency food/ stockpile	*Provide heavy equipment for reconstruction *Provide investment for (BBB)	
-Community	*Shared information *Increase social capital *Provide feed to Govt. plan	*Following the plan *Collecting data of members(Vulnerable member)	*CO-production of recovery policy	*Update local knowledge
-Experts/NGO	*Updating data collection *Provide recommendation for Govt. *Building capacity of community to prepare disaster	*Provide information *Collection data of impact or disaster	*Promote technology + innovations for recovery	*Disseminate local knowledge

FIELD TRIP

Field trip with the participants to Arahama Elementary School and Onagawa Town on 24 July 2019

The participants joined the field trip to the areas affected by the Great East Japan Earthquake and Tsunami in 2011. The places include the Arahama Elementary School in Sendai City and Onagawa Town. At Onagawa town, the session of Tohoku Ecosystem-Associated Marine Sciences (TEAMS) was conducted by TEAMS, TUMSAT, UNESCO and IRIDeS.

< Arahama Elementary School, Sendai city>

< Session of Tohoku Ecosystem-Associated Marine Sciences (TEAMS)>

Title of the session: Restoration and maintainance of sustainable and rich coastal seas through Sciences: How does Tohoku Ecosystem-associated Marine Sciences Project communicate coastal stakeholders toward restoration of coastal ecosystems from multiple-hazardous events?

Lecturer group: Hiroshi Kitazato (TUMSAT) and Yuri Oki (TUMSAT, TEAMS), Soichiro Yasukawa (UNESCO), Akihiro Kijima (Tohoku Univ., TEAMS)

Aims of the session: Coastal areas are one of the most highly populated zones of the world. Because, traffic systems and fisheries are well developed along the coasts. On the other side, multiple disastrous events frequently take place at the areas. More than half of the world populations, thus, are concentrate into the coastal zone. We need to know what kind of both natural and societal systems play to sustain coastal lives.

Coastal ecosystems are sustained by material transportations of both terrestrial and marine realms. River systems that are flown from surrounding mountainous lands transport both sediments and nutrients into coastal seas. Nutrients and sediment particles are also brought from open seas by the offshore and/or long shore currents. These material cycles basically sustain coastal ecosystems.

According to these material cycles at coastal areas, gradual distribution of coastal habitat exists along coasts. These ecosystems are lead ground, salt marsh, tidal flat, sea grass meadows, sandy beach and others. It calls ecotone. Each ecosystem has own ecological function each other.

Northeastern coast of the Japanese Islands are rich in nutrients, diverse and big in biomasses of marine organisms. This is because the area is one of the biggest fishing fields in the world.

On March 11, 2011, big Earthquake and Tsunamis hit northeast Japan and washed coastal systems out from coastal areas including fishery systems. For the aims to monitor recovery processes of disturbed marine ecosystem and transfer useful information to the local stakeholders, we have been made researches on mappings of marine environments and organisms, recover of marine aquaculture systems, interviews with local peoples for social analyses and small workshop meetings with local fishermen, divers and scientists.

During the workshop, we plan to show conceptual ecological models of coastal systems, world tendency of disaster risk reduction movements, and showing a couple of success stories how scientists transfer / share their knowledge together with local citizens. Details are shown in the following agenda.

Agenda:

Keynote 1: Visualization of coastal ecosystems through “habitat mapping” data accumulation toward sustainable managements of coastal ecosystems (Hiroshi KITAZATO, TUMSAT)

Keynote 2: Current global activities of ecosystem-based Disaster Risk Reduction (Eco-DRR) research (Soichiro YASUKAWA, UNESCO) (remote presentation through Skype or Zoom from Paris)

Keynote 3: Lessons from success stories at the Tohoku Areas (Yuri OKI, TUMSAT-TEAMS)

Case study 1: Sustainable oyster aquaculture at Togura, Minami-Sanriku Town, Miyagi Prefecture

Case Study 2: Sea-wall construction with protecting coastal ecosystems (Ecotone) at Okirai Bays, Iwate Prefecture

Case Study 3: Accumulation of local knowledge through workshops with coastal fishery peoples (including Ama divers) and scuba divers. Onagawa, Miyagi Prefecture and Toba, Mie Prefecture

Visit Onagawa Field Research Center, Tohoku University guided by Prof. Akihiro KIJIMA (Tohoku Univ.-TEAMS)






<Onagawa Station>

ANNEX I: APRU-IRIDeS Summer School Program

22-23, 25 July: Seminar at the IRIDeS building on the Aobayama New Campus, Tohoku University

24 July: Field trip to Arahama elementary school and Onagawa Town

22 July

Lessons learnt from the 2011 Great East Japan Earthquake and Tsunami

08 : 30 — 08 : 45	Registration (please be seated by 8:50am)
09 : 00 — 09 : 15	Opening Welcoming address by President Hideo Ohno (Tohoku University) Welcoming address by Prof. Fumihiko Imamura (IRIDeS) Opening remarks by Ms. Tina Lin (APRU secretariat)
09 : 15 — 09 : 25	Group photo
09 : 25 — 09 : 55	"Overview of the International Research Institute of Disaster Science (IRIDeS), Tohoku University" by Prof. Kiyoshi Itoh (IRIDeS)
09 : 55 — 10 : 30	Movie [Great Tsunami]
10 : 30 — 10 : 50	Coffee break
10 : 50 — 11 : 50	"Disaster Risk Reduction: Japan as disaster-prone country and learning from past disasters" by Prof. Osamu Murao (IRIDeS)
11 : 50 — 13 : 00	Lunch
13 : 00 — 14 : 00	"International strategy for risk reduction: Implementation of the Sendai Framework for Disaster Risk Reduction (SFDRR) by Prof. Takako Izumi (IRIDeS)
14 : 00 — 15 : 00	"Recovery after the great East Japan Earthquake and Tsunami of 3.11.2011" by Prof. Elizabeth Maly (IRIDeS)
15 : 00 — 15 : 15	Coffee break
15 : 15 — 16 : 15	"Medical and Public Health Needs in Disaster" by Prof. Shinichi Egawa (IRIDeS)
18 : 30 —	Reception at Hotel Metropolitan Sendai

23 July

Role of different stakeholders: Academia, Local government and NGO

09 : 00 — 09 : 20	"APRU Introduction" by Ms. Tina Lin (APRU secretariat)
09 : 20 — 09 : 30	"APRU Multi-Hazards Program" by Prof. Takako Izumi (IRIDeS/APRU Multi-Hazards Program)
09 : 30 — 10 : 45	"Towards disaster risk reduction city -Tagajo ~disaster resilient city~" by Mr. Takumi Fujimura (Tagajo City)
10 : 45 — 11 : 00	Coffee break
11 : 00 — 12 : 00	"Beyond the disaster: what CSOs in Japan learned from Tohoku experience" by Mr. Goh Igarashi (AAR Japan)
12 : 00 — 13 : 00	Lunch
13 : 00 — 14 : 00	"Disaster Prevention Learning in Elementary School after the Great East Japan Earthquake" by Mr. Kiyoshi Araake (Kouya Elementary School)

14 : 00 — 14 : 30 Coffee break
14 : 30 — 16 : 00 Group work 1: Learning from each other: Poster presentation (including coffee break)
16 : 00 — 17 : 00 Group presentation

24 July: Field trip

Arahama Elementary School and Onagawa Town

25 July

Seminar and Group work

09 : 00 — 10 : 00 "Nowcasting and Forecasting Major Earthquakes" by Prof. John Rundle (University of California, Davis)
10 : 00 — 11 : 00 "Strategy for the New Stage of Hydro-Met Disasters in Japan" by Prof. Kuniyoshi Takeuchi (University of Yamanashi)
11 : 00 — 11 : 15 Coffee break
11 : 15 — 12 : 15 "The severe weather and the large decadal typhoon rainfall increase in Taiwan" by Prof. Hung-Chi Kuo (National Taiwan University)
12 : 15 — 13 : 00 Lunch
13 : 00 — 14 : 00 "Climate Change and Disasters" by Dr. Riyanti Djalante (UNU)
14 : 00 — 14 : 30 Coffee break
14 : 30 — 15 : 30 Group work 2:

1) Please develop a DRR project proposal that applies and uses your research results/findings. It has to include both natural and social science perspectives.
2) Who needs to get involved in the project implementation? What are their roles in the project?

15 : 30 — 15 : 45 Coffee break
15 : 45 — 16 : 30 Group presentation
16 : 30 — 16 : 45 Closing

ANNEX II: List of Participants

	Name	Title	University location	University/Organization
1	Hongyi Yang	Master Student	China	Fudan University
2	Yaxiong Chen	Master Student	China	Wuhan University of Technology
3	Hongqian Xu	Master Student	China	Wuhan University of Technology
4	Yaping Ma	Lecturer	China	Wuhan University of Technology
5	Wei Lyu	Associate professor	China	Wuhan University of Technology
6	Danhui Fang	Associate professor	China	Wuhan University of Technology
7	Ke Wu	PhD Student	China	Wuhan University of Technology
8	Liwei Liu	Student	China	University of Science and Technology of China (USTC)
9	Longping Tang	Master Student	China	University of Science and Technology of China (USTC)
10	Dun Jia	PhD Student	China	University of Science and Technology of China (USTC)
11	Yat Long Hung	Student	China	The Hong Kong University of Science & Technology
12	Louise Wen Fong Kwok	Student	China	The Hong Kong University of Science & Technology
13	Bindu Pabasara Embuldeniya	Master Student	China	The Hong Kong University of Science & Technology
14	Avinia Ismiyati	Master Student	Indonesia	Universitas Indonesia
15	Muhammad Rizqy Septyandy	Lecturer	Indonesia	Universitas Indonesia
16	Alin Halimatussadiah	Assistant professor	Indonesia	Universitas Indonesia
17	Abdul Kadir	OSHE UI -Occupational	Indonesia	Universitas Indonesia
18	Syamsul Bachri	Lecturer	Indonesia	State University of Malang
19	Vibhas Sukhwani	PhD Student	Japan	Keio University
20	Ruben Rodrigo Vargas Tapia	Master Student	Japan	Kyoto University
21	Shuxian Feng	Master Student	Japan	Meiji University
22	Tingchao HE	PhD Student	Japan	Nagoya University
23	Fangyu Yan	PhD Student	Japan	Osaka University
24	Yixuan Wang	Master Student	Japan	Osaka University
25	Gusti Raganata	Master Student	Japan	The University of Tokyo
26	Minami Yamamoto	Student	Japan	The University of Tokyo
27	Bowei Ke	Master Student	Japan	Tokyo institute of Technology

	Name	Title	University location	University/Organization
28	Naresh Subedi	Master Student	Japan	Tokyo institute of Technology
29	Yui Numazawa	Student	Japan	Tohoku University
30	Shuka Endo	Student	Japan	Tohoku University
31	Wu Haotian	PhD Student	Japan	Tohoku University
32	Shiori Nakamura	Student	Japan	Miyagi Gakuin Women's University
33	Hina Kumagai	Student	Japan	Miyagi Gakuin Women's University
34	Nao Kurosu	Student	Japan	Miyagi Gakuin Women's University
35	Miyu Sato	Student	Japan	Miyagi Gakuin Women's University
36	Nur Zainul Arifin	PhD Student	Malaysia	University of Malaya
37	David Paul Grinlinton	Professor	New Zealand	The University of Auckland
38	Keiko Kano	Researcher	New Zealand	
39	Maricor Conwi Dayandante	Master Student	Philippines	Philippine School of Business Administration-Manila
40	Joanna Rose Telles Laddaran	Master Student,University Extension Speciallist Ⅱ	Philippines	University of the Philippines Institute for Small-Scale Industries
41	Glennis Suminguit Uyanguren	PhD Student ,Head, Training and Entrepreneurship Education Division	Philippines	University of the Philippines Institute for Small-Scale Industries
42	Neil Dela Cruz Grimaldo	Researcher,Extension & Professional Staff	Philippines	University of the Philippines Institute for Small-Scale Industries
43	Matthew Travis Martinez Alcantara	Master Student, Faculty	Philippines	University of the Philppines Diliman
44	Rolando Agustin Tagaban	Administrative Officer V	Philippines	University of the Philppines Diliman
45	Ahmad Tashrif Bin Sarman	Research Associate	Singapore	National University of Singapore
46	Sung-Ju Yea	Master Student	South Korea	Seoul National University
47	Seong-Hyun Lim	Graduate Student	South Korea	Seoul National University
48	Satoki Tsujino	Post-Doc.Researcher	Taiwan	National Taiwan University
49	Calvin Liusnando	Student	Taiwan	National Taiwan University
50	Hung-Pin Ben Huang	Professor	Taiwan	National Taiwan University
51	Farman Ullah	COLABS Exchange Student	Thailand	Asian Institute of Technology
52	Bottreypich Cassey Chap	Student	USA	University of California,Davis
53	Rebecca Ann Fildes	PhD Student	USA	University of California,Davis
54	Rikki Peck	DNP	USA	University of Washington

	Name	Title	University location	University/Organization
55	Haylea Ariel Hannah	PhD Student	USA	University of Washington
56	Nicole Ann Errett	Lecturer	USA	University of Washington
57	Gail C Johnson	Lecturer	USA	University of Washington
58	Mayumi Anne Willgerodt	Associate professor, Vice-Chair	USA	University of Washington
59	Tina Lin	Senior Program Officer	China	APRU Secretariat
60	Takumi Fujimura		Japan	Tagajo City
61	Go Igarashi	Programme Manager	Japan	AAR Japan
62	Kiyoshi Araake	Principal	Japan	Kouya Elementary School
63	Kuniyoshi Takeuchi	Professor Emeritus	Japan	University of Yamanashi
64	Hung-Chi Kuo	Professor	Taiwan	National Taiwan University
65	Riyanti Djalante	Academic Programme Officer	Japan	United Nations University
66	Soichiro Yasukawa	Programme Specialist	France	UNESCO
67	Hiroshi Kitazato	Specially appointed professor	Japan	Tokyo University of Marine Science and Technology (TEAMS)
68	Yuri Oki	Researcher	Japan	Tokyo University of Marine Science and Technology (TEAMS)
69	Akihiro Kijima	Professor Emeritus	Japan	Tohoku University (TEAMS)
70	Fumihiko Imamura	Director/Professor	Japan	Tohoku University (IRIDeS)
71	Kiyoshi Itoh	Deputy Director/Professor	Japan	Tohoku University (IRIDeS)
72	Osamu Murao	Professor	Japan	Tohoku University (IRIDeS)
73	Takako Izumi	Associate Professor	Japan	Tohoku University (IRIDeS)
74	Elizabeth Maly	Associate Professor	Japan	Tohoku University (IRIDeS)
75	Shinichi Egawa	Professor	Japan	Tohoku University (IRIDeS)
76	Sébastien Penmellen Boret	Associate Professor	Japan	Tohoku University (IRIDeS)
77	Kazuya Sugiyasu	Assistant Professor	Japan	Tohoku University (IRIDeS)
78	Julia Gerster-Damerow	Researcher	Japan	Tohoku University (IRIDeS)
79	John Rundle	Distinguished Professor/ Visiting Professor	USA/Japan	University of California,Davis/Tohoku University (IRIDeS)

IRIDeS
International Research Institute of Disaster Science

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