

Review:

Capacity Building for Disaster Risk Reduction: A Long-Term Program of the IRDR International Centre of Excellence at Taipei (ICoE-Taipei)

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This paper provides a review of the capacity-building program of the Integrated Research for Disaster Reduction International Centre of Excellence at Taipei (IRDR ICoE Taipei) for disaster risk reduction (DRR) since 2011. We present the reasoning, motivation, organizing philosophy, and framework on why and how we have created and run this program, before illustrating its content, including workshop or training course (i.e., Advanced Institute (AI)), seed grant project, follow-up special session of conferences, special issue for publication, and online Master Forum series during the COVID-19 pandemic. We also highlight the efforts, notable results, and achievements of the ICoE Taipei on its long-term capacity-building program on DRR, including 14 in-person (in and outside of Taiwan) and 4 online AIs and 31 seed grant projects in 2011–2022.

Keywords: disaster risk reduction, capacity building, IRDR, ICoE Taipei

1. Introduction

The concept of “Disaster Risk Reduction” (DRR) has been emphasized in the last few decades to safeguard human life as well as for a more sustainable society and Earth. Worldwide, the United Nations has taken the lead in initiating and conducting tasks for DRR at the governmental level. For instance, the United Nations Office for DRR was created in 1999 for this mission, in particular, to implement a global strategy [1,2]. In 2015, the agreement of the “Sendai Framework for DRR (2015–2030)” was established by international governments, which is another important milestone that sets specific priorities for action.

Among the actions and tasks for the DRR, “Capacity Building” appears to be one of the important key components. Capacity-building for DRR is commonly referred to as the process of enhancing the knowledge, skills, and resources of individuals, organizations, and communities

to effectively prepare for, respond to, and recover from disasters. This involves developing and strengthening the ability of people and institutions to assess and manage disaster risks, reduce vulnerability, and increase resilience. Capacity building for DRR has been considered to be critical to reducing the impact of disasters, especially in vulnerable communities.

To fulfill societal needs and requirements, the International Science Council (ISC) established the Integrated Research for Disaster Reduction (IRDR) program in 2010, with three research objectives: (1) to deal with the characterization of hazards, vulnerability, and risk, (2) to understand decision-making in complex and changing risk contexts, and (3) to reduce risk and curb losses through knowledge-based actions. Based on these goals, the IRDR set up a mission to develop trans-disciplinary, multi-sectorial alliances for (1) in-depth, practical DRR research studies and (2) the implementation of effective evidence-based disaster risk policies and practices.

Under the IRDR framework, several International Centres of Excellence (ICoEs) have been gradually established and are widespread in different countries. Each ICoE has its own agenda and focus points. The ICoE Taipei, which was established in 2010, is the first one of its kind (the total number grew to 17 in 2022). Over the years, the ICoE Taipei has considered itself as a regional hub for connecting people for integrated research on DRR, particularly in East and Southeast Asia. It has organized or held different types of activities, such as symposiums, workshops, training courses, seed grant projects, online Master Forums, special sessions in conferences, collaborative research, and so on. In summary, the ICoE Taipei has been primarily involved in “capacity building” on DRR.

This paper aims to review the capacity-building program of the ICoE Taipei since 2011. We have summarized the program, including motivation, organization, a complete list of different workshops and training courses (i.e., Advanced Institute (AI)), seed grant projects, special sessions in conferences, and publications. We also highlight some notable achievements of the ICoE Taipei in its



Table 1. AIs (training courses) related to DRR organized by the ICoE Taipei since 2011.

Name of AI	Theme	Attendee	Place
2011 Cities at Risk	Climate Change Risk in Asian Coastal Cities		Taipei
2012 AI-FORIN	Forensic Investigations of Disasters		Taipei
2012 AI-DATA	Data for Coastal Cities at Risk	22	Taipei
2014 AI-WSS	World Social Science Fellows Seminar	21	Taipei
2015 AI-DRR&LM	Disaster Risk Reduction and Loss Mitigation	23	Taipei
2017 AI-KBA	Knowledge-Based Actions for DRR	17	Taipei
2017 AI-SOCD	DRR for Slow-Onset Climate Disaster	22	Taipei
2018 AI-SOCD	Slow-Onset Climate: heat stress	20	Taipei
2018 AI-LRRTS	Landside Risk Reduction	30	Taoyuan
2018 AI-EHRA	Earthquake Hazards and Risk Assessment in East Asia	31	Taipei
2019 AI-EEW	Earthquake Early Warning in East Asia	25	Taipei
2019 AI-LIHM	Landslide Investigations and Hazards Mitigation	30	Hanoi (Vietnam)
2019 AI-Hi-ASAP	Health Impacts and Air Sensing in Asian Pollution	21	Taipei
2019 AI-ACV	Asian Consortium of Volcanology	31	Taipei
2020 AI-Hi-ASAP	Health Impacts and Air Sensing in Pollution	24	Online
2021 AI-Hi-ASAP	Health Impacts and Air Sensing in Pollution	50	Online
2021 AI-KBA	Knowledge-Based Actions for DRR	42	Online
2022 AI-Hi-ASAP	Health Impacts and Air Sensing in Pollution	26	Online
2023 AI-APHISA	Air Pollution and Health Impacts in South-East Asia	20 (expected)	Vietnam
2023 AI-Hi-ASAP	Health Investigation and Air Sensing for Asian Pollution	25 (expected)	Taipei
2023 AI-NHH	Natural Hazard of Himalaya	20 (expected)	India

capacity-building program on DRR since 2011.

2. History of the Capacity-Building Program of the ICoE Taipei

The history and evolution of the capacity-building program of the ICoE Taipei can be divided into four periods: (1) 2010–2014, (2) 2015–2019, (3) 2020–2022, and (4) 2023. In the following sections, we briefly present the history and evolution of the major components of the ICoE Taipei’s capacity-building program, including the AI (training course), seed grant project, special sessions at conferences, and the online Master Forum series.

2.1. Period of 2010–2014

In the early years of the ICoE Taipei, the Centre sought to find its role in the ISC’s IRDR program. Three components gradually became its focus and mission: (1) to promote international exchange activities, (2) to implement international training courses, and (3) to initiate and fund regional cross-country research teams. Bearing this in mind, the ICoE Taipei began its capacity-building program by organizing one international training course in 2011 and two in 2012. In 2012, the ICoE Taipei renamed its capacity-building training course, such as the 2012 AI-FORIN (AI on Forensic Investigations of Disasters) (Table 1).

In addition, the ICoE Taipei initiated the seed grant program in 2014, stemming from previous discussions and

suggestions from its Scientific Advisory Board members. The seed grant program, which is essentially treated as a follow-up of the AI training courses, is, thus, considered to be within the entire package of the capacity-building program of the ICoE Taipei. The first seed grant program was announced following the second World Social Science Fellows seminar held in Taipei in 2014.

Notably, the SysTem for Analysis, Research and Training (START), a non-profit organization founded in 1992 to strengthen capacities for global environmental change science in Africa and Asia, was the main partner in helping the ICoE Taipei co-organize the international training course.

2.2. Period of 2015–2019

This was a period of growth, during which the capacity-building program of the ICoE Taipei expanded. The year 2015, indeed, marked a global milestone for DRR, as the agreement of the “Sendai Framework for DRR 2015–2030” was endorsed by the global leaders at the governmental level.

The ICoE Taipei organized one, two, three, and four training courses, respectively, in 2015, 2017 [3, 4], 2018 [5–7], and 2019 [8, 9]. The research themes were also expanded to a variety of disasters and risks, including not only knowledge-based actions and implementations but also understanding different kinds of natural disasters, such as air pollution, heat stress, earthquakes, landslides, floods, and volcanic eruptions. These natural hazards occur in many places around the world but more fre-

Table 2. Seed grant projects related to DRR funded by the ICoE Taipei since 2014.

AI/Seed grant	Title of projects	Leading PI/Country
2014 AI-WSS	1) Integrating Knowledge in Disaster Risk Reduction	Simone Athayde / USA
	2) Multi-Scale Policy Implementation for Natural Hazard Risk Reduction	Karianne de Bruin / Norway
	3) Communication Influences on Decision-Making in Disaster Recovery & Reconstruction	Kuan-Hui Lin / Taiwan
	4) Building More Resilient Megacities in the Developing World	Fabiola S. Sosa-Rodriguez / Mexico
2015 AI-DRR&LM	1) Strengthening Community Resilience: The Case of Coastal and Island Communities in the Philippines	Ven Paolo Valenzuela / Philippines
	2) Web-Based Decision Support System for Hazard Mitigation, Coastal Planning under Storm Surge in Ho Chi Minh & Chennai Cities	Nguyen Hong Quan / Vietnam
	3) Socio-Ecological Resilience as a Sustainable Development Strategy under the context of Emerging Disaster Risks for Rural Settlements in Different Geo-Climatic Zones of India	Sameer M. Deshkar / India
	4) Strengthening Community Resilience on the Coastal and Isolated Islands of Indonesia: A Case Study in the Mentawai Islands – West Sumatera	Agnes Patongloan Rahmat Pratomo / Indonesia
2017 AI-KBA	1) Evidenced Based Analysis of Flood Risk Management and Social Vulnerability – A System Approach in Sakon Nakhon Province, Thailand	Indrajit Pal / Thailand
	2) Earthquake Resilient Communities in ASEAN Region: A Transdisciplinary Approach	Khamarrul Azahari Razak / Malaysia
	3) Developing Indicators for Resilience of Micro Small Medium-sized Enterprises (MSMEs) in Asia	Ranit Chatterjee / Japan
	4) Developing Humanitarian Aid Distribution Process Information System Framework for ASEAN Countries	Mohamad Syazli Fathi / Malaysia
2017 AI-SOCD	1) Building Urban Resilience: A Systems Approach to Analyzing Social and Personal Health Risks of Jeepney Commuters and Drivers to PM2.5 in Metro Manila, Philippines	Melliza Cruz / Philippines
	2) Interface Between Science-Based Data and Policy Action to Improve the Existing Mandalay City Waste Management: Ambient Air Monitoring, Air Impact Assessment, Personal PM2.5 Exposure, Health Risk Assessment, Awareness and Mitigation Measures	Ohnmar Tin Hlaing / Myanmar
	3) The Influence of Biomass Burning on High Concentration of PM2.5 in Selected Areas in Southeast Asia	Mohd Talib Latif / Malaysia
	4) Urban Transportation-Related Air Quality and Their Impact on Human Health	Wiwiek Setyawati / Indonesia
2018 AI-SOCD	1) Examining the Heat Stress Impact on the South Asian Vulnerable Urban Population – A System Thinking Approach (SPIN)	Zareena Begum Irfan / India
	2) Health and Environmental Vulnerability of Smallholder Rice Farmers to Extreme Climate: A Comparison Study on Agroecology	Vivien How / Malaysia
2018 AI-LRRTS	1) Integration of Geoscience Methods to Investigate Slope Stability: Case Study Over Doi Tuong Area, Hoa Binh Province, Vietnam	Duy Thong Kieu / Vietnam
	2) Community Based Landslide Hazard, Vulnerability Assessment and Risk Reduction Plan – A Study on Selected Communities from India, Sri Lanka and Malaysia	Kapil Ghosh / India
	3) Impact of climate change, Land Use Land Cover, and Socio-Economic Dynamics on Landslides in South and East Asia	Raju Sarkar / Bhutan
	4) Building Resilience Against Landslide Disaster Risk in Nepal: A Disaggregated Examine from Site Specific to Region	Suresh Chaudhary / Nepal
2018 AI-EHRA	1) Contemporary Earthquake Potential Analysis along the Central and Nepal Himalaya	Sumanta Pasari / India
	2) Develop Seismic Vulnerability Map on Bandung Area, West Java Indonesia	Anggun Mayang Sari / Indonesia

Table 2. Seed grant projects related to DRR funded by the ICoE Taipei since 2014 (continued).

AI/Seed grant	Title of projects	Leading PI/Country
2019 AI-Hi-ASAP	1) Health Impact of PM2.5 Exposure to the Street Vendors in the Highly Polluted Mega City (Dhaka, Bangladesh) – A Pilot Study	Abdus Salam / Bangladesh
	2) Assessment of the Emissions of Street Cooking Activities in Bangkok and Subsequent Effects on Ambient PM2.5 and Human Health	Nguyen Thi Kim Oanh / Thailand
	3) Characterization of Urban Community Exposure to Particulates Air Pollution and Their Health Response in Klang Valley Region, Malaysia	Mazrura Sahani / Malaysia
	4) Fine Particulate Matter (PM2.5) and Risks of Cardiorespiratory Diseases: A Panel Study in Ho Chi Minh City Using Low-Cost Sensors	To Thi Hien / Vietnam
2020 AI-Hi-ASAP	1) Exposure of PM2.5 Pollution and Health Indicators of the City Communities Including Factory Workers, Salespersons and Residents at Selected Industrial, Commercial, and Residential Areas in Yangon City: A Solution-Oriented Pilot Study Using Low Cost Sensors on Ambient, Community Source Including Both Indoor and Outdoor Along With Personal Activity Contribution	Ohnmar May Tin Hlaing / Myanmar
	2) Associations of Indoor PM2.5 Concentrations and Heart Rate Variability in Selected Households in Metro Manila, Philippines	Maria Obiminda L. Cambaliza / Philippines
	3) Exposure of School Children to Particulate Matter in High Traffic and Industrial Area, Malaysia	Murnira Othman / Malaysia

quently cause drastic disasters in Southeast Asia. The ICoE Taipei, thus, identified Southeast Asia as the focal point for strengthening capacity building for DRR.

It is worth mentioning that we also organized a training course outside Taiwan in 2019. For instance, the 2019 landslide investigation and hazard mitigation (AI-LIHM) was conducted in Hanoi, Vietnam [8]. With 40–50 participants exclusively from Vietnam and 10, 5, and 1 lecturers from Taiwan, Vietnam, and Japan, respectively, this training course intended not only to transfer scientific knowledge and technology to the Vietnamese people but also to have a first glance and focus on landslides and flood-related hazards in Vietnam.

The seed grant program continued to grow during this period. Most of the AI (training course/workshop) was followed by a seed grant program, each funding 2–4 one-year research projects in the theme associated with the training course (**Table 2**).

After several years of operating the AI and the related seed grant project, in 2019, the ICoE Taipei organized a special session at the annual meeting of the Asia Oceania Geosciences Society (AOGS). The idea is to encourage the awardees of the seed grant projects to (1) present their results and discoveries, (2) gather for discussion among the different seed grant projects, and (3) showcase the efforts and achievements of the capacity-building program on DRR in Southeast Asia. At AOGS2019, the presenters of our special session were awardees of the seed grant projects followed by the 2017 AI-SOCD (DRR for slow-onset climate disaster).

From an administrative point of view, the ISC's ROAP (Regional Office in Asia Pacific) replaced the role of the START in 2017, as the main partner of the ICoE Taipei, in helping to organize international training courses and manage seed grant projects.

2.3. Period of 2020–2022

This was a difficult and dire period during the COVID-19 pandemic. In the three years (2020–2022) of travel restrictions and pandemic concerns because of COVID-19, the ICoE Taipei shut down all in-person international activities.

We had to cancel a few pre-planned in-person training courses in and outside Taiwan. Subsequently, the AI switched to virtual videos and online training courses. Concerning the low efficiency and high difficulty, only a small number of online AIs were held each year during this period: one [10], two, and one in 2020, 2021, and 2022, respectively (see **Table 1** for details). Our experience showed much lower efficiency at many levels with the virtual online video course, despite attempts to improve the content and type of the training course year-by-year. Without face-to-face communication and back-and-forth discussions, participants, including attendees as well as lecturers, felt a lack of personal engagement. It is difficult, if not impossible, to come up with a preliminary seed grant project among the attendees at the online AI.

Facing difficulties in organizing and holding an in-person AI during the COVID-19 pandemic, we created an “online Master Forum series” in 2020 [11]. The ICoE Taipei invited internationally well-established scholars and experts in DRR to give an online talk. The first speaker was Professor Gordon McBean, former President of the ISC. We felt that this kind of master's forum could fulfill the needs of the public during the pandemic. Thus, we organized three more online Master Forums each in 2020, 2021, and 2022, respectively.

As for the seed grant program, we called for proposals following the AI (2020 AI-Hi-ASAP) held online in 2020 and funded three seed grant projects.

The pandemic also hit the ISC's ROAP, which started

to limit its function with the ICoE Taipei near the end of 2021 and finally terminated the office by the end of 2022.

2.4. Period of 2023 and Beyond

Thanks to the world beginning to ease the COVID-19 restrictions, the ICoE Taipei has restarted its in-person capacity-building program this year (2023). We plan to organize three AIs in 2023 one each in Vietnam, India, and Taiwan, respectively. New seed grant proposals are also planned to follow these AIs. For in-person special sessions at the annual meeting of AOGS2023, we submitted two sessions (IG02-Natural Hazards and Disaster Risk and IG08-Identification, Mapping, Monitoring, and Forecasting of Landslide and Erosion Processes), also aiming to encourage the previous Advanced Institutes attendees, particularly the recipients of the seed grant project, to join these two sessions. We hope that 2023 marks the year in which the capacity-building program of the ICoE Taipei restarts a new page for the future.

3. Highlights of the Capacity-Building Program

3.1. Highlights of AI

As mentioned above, AI refers to a series of training courses or workshops of the capacity-building program of the ICoE Taipei for DRR. We aim to have different levels and categories of attendees trained together, for instance, from academic scholars to civil engineers and governmental officers, and from senior professors to early career young professionals and graduate students. The ICoE Taipei's AI intends to have a diverse group of people to put different perspectives in the same room for discussion. The ICoE Taipei also emphasizes encouraging young and/or early career professionals or students to attend and join the capacity-building program (Fig. 1).

AIs generally comprise a variety of activities, including (1) lectures, (2) poster sessions, (3) hands-on practice, (4) group discussions, (5) field excursions, (6) institutional visits, and (7) final group presentations (Figs. 2 and 3). Depending on the discipline and training techniques, not all the activities are adopted in every AI. An AI usually lasts for 5–7 days. We invited multiple international scholars or experts to provide lectures. Although a large portion of them are usually local (Taiwan) or from East Asia, lecturers from Western countries are quite common. The number of attendees varies mostly from 15 to 30 for each in-person AI (up to 50 for online AIs).

In summary, from a statistic point of view, since 2011, the ICoE Taipei has financially supported over three hundred attendees in fourteen in-person and four online AIs. In terms of geographic distribution, a large proportion of the attendees came from Southeast Asian countries (Fig. 1).

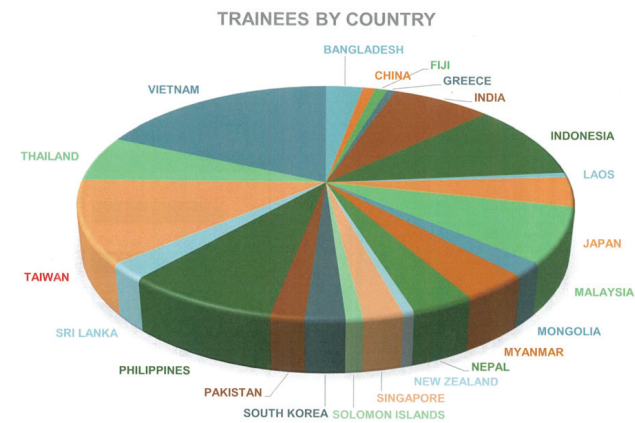
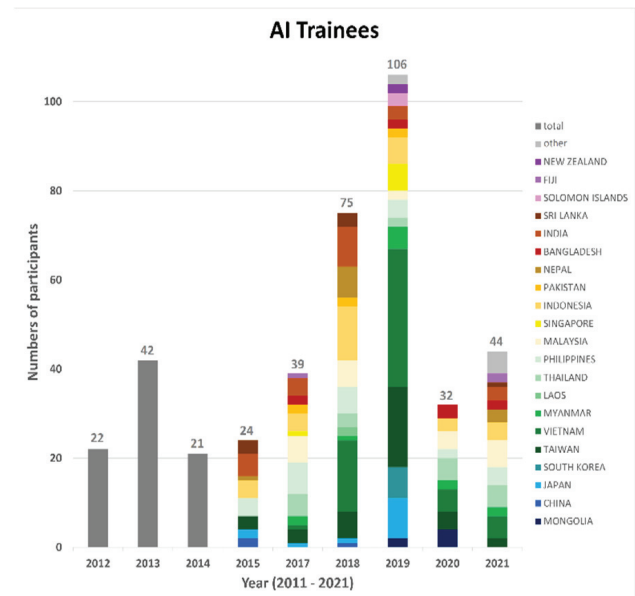


Fig. 1. Numbers of attendees of AIs each year in 2012–2021. A pie diagram showing the countries of attendees coming from. Note that the attendees were mostly from Southeast Asia.

3.2. Highlights of Seed Grant Projects

The seed grant project is a 1-year research project for a pilot study. The project must be team-orientated and is encouraged to include members from multiple countries. Although we emphasize young early career scientists as the priority target, the overall quality of the proposal and its potential impact on DRR are always the most important criteria in the selection process.

Since 2014, the ICoE Taipei has called for 9 seed grant proposals following an AI and funded a total number of 31 seed grant projects. Each seed grant project was required to send the ICoE Taipei its final report, which we found to be generally well-written with interesting results. We also hope that recipients of the seed grants can use this limited financial aid to help develop their professional careers.

The special session proposed by the ICoE Taipei at AOGS2019 (the annual meeting of the AOGS) was designed to be a follow-up event for the recipients of the



Fig. 2. Several major activities of the ICoE Taipei's AI. Upper left: lecture. Upper right: poster. Lower left: field trip. Lower right: institutional visit.



Fig. 3. Major activities of the ICoE Taipei's AI. Left: Hands-on practice for air-pollution detection. Right: Group discussion.

seed grants from 2017 AI-SOCD (DRR for slow-onset climate disaster). This session entitled “AS35 Regional Collaborative Research on Air Pollution Sensing and Health in Asia” comprised six oral talks, whereas three research teams presented their results from the aforementioned seed grant program.

3.3. Highlights of Master Forum Series

During the period of the COVID-19 pandemic (2020–2022), we organized four talks of the online Master Forum series (Figs. 4 and 5). (1) The first talk, “Rebuilding from COVID-19 to Achieve Global Agenda 2030,” was provided by Dr. Gordon McBean (profes-



Fig. 4. Two seminars of the Online Master Forum series held by the IRDR ICoE Taipei in 2020.



Fig. 5. One seminar of Online Master Forum series held by the IRDR ICoE Taipei each in 2021 and 2022.

son of Western University, Canada and former President of the ISC) in September 2020. (2) The second talk, “COVID-19 Containment and Economic Revitalization: Taiwan Model for Mitigation of Pandemic Disaster,” was provided by Dr. Chien-Jen Chen (Research Fellow of Academia Sinica, then the Vice President of Taiwan) in December 2020. (3) The third talk, “What Expertise do You Need to Tackle Complex Interdisciplinary Problems?,” was given by Professor Gabriele Bammer (Australian National University) in May 2021. (4) The fourth talk, “A Framework for Global Risk Science: Priorities, Production and Debates,” was given by Dr. John Handmer (Professor of RMIT University, Australia and former chair of the Science Committee of IRDR) in February 2022.

Similar to many other online seminars held during the COVID-19 pandemic, the Master Forum was broadcast through online platforms such as YouTube. People were welcomed not only to participate during live-streaming sessions but also to access the seminar later on YouTube. During the live seminar, participants were encouraged to post their question(s), which would be answered by the speaker in the Q&A session, followed by a general one-hour talk.

Statistically, for each seminar of the Master Forum series, we usually had approximately 100–300 people online for the live session, and 200–600 viewers viewed the filmed video later on YouTube.

4. Concluding Remarks and Prospective

In this paper, we review the capacity-building program of the IRDR ICoE Taipei on DRR, a long-term signature program of the Centre since 2010. We present the history of the capacity-building program, which evolved from organizing training courses/workshops (i.e., AI) to creating follow-up programs, including the seed grant program, special sessions at international conferences (e.g., AOGS), and a special issue of a scientific journal (e.g., *Journal of Disaster Research*). Due to COVID-19 restrictions on in-person activity, the training course was shifted to online mode, which we also added to the Master Forum series to enrich some plausible learning experiences and provide opportunities for more communication. Geographically, we chose to focus primarily on the attendees in Southeast Asia for convenience and efficiency. As for the general outcomes, we organized 18 AIs, providing training workshops to over 400 participants, particularly young and early career scientists from over 20 countries from 2011–2022.

In 2023 and beyond, the ICoE Taipei will restart the in-person activities of the capacity-building program, notably the AI. We anticipate continuing to make significant contributions to help reduce DRR. In addition, the ICoE Taipei is seeking possibilities to expand its missions to meet the overall global DRR agenda. In addition to IRDR, we would be pleased to collaborate with other global organizations, such as the Future Earth Knowledge-Action Network on Emergent Risks and Extreme Events.

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Selected Publications:

- J.-C. Lee, H.-T. Chu, J. Angelier, J.-C. Hu, H.-Y. Chen, and S.-B. Yu, "Quantitative analysis of co-seismic surface faulting and post-seismic creep accompanying the 2003, Mw = 6.5, Chengkung earthquake in eastern Taiwan," *J. of Geophysical Research*, Vol.111, No.B2, B02405, 2006. <https://doi.org/10.1029/2005JB003612>
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Academic Societies & Scientific Organizations:

- The American Geophysical Union (AGU)
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2013-2013 Deputy Dean, Office of R&D, National Central University
2016-2017 Director of Center for Space and Remote Sensing Research,
National Central University
2017-2021 Director of S&T Division, Bureau de représentation de Taipei
en France
2017- Distinguished Professor, National Central University
2022- Convener, Earth Science Division, National Science and Technology
Council
2022- Executive Director of IRDR ICoE-Taippei

Selected Publications:

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