

Typical landscape of the north coast of São Paulo state:



# GADRI ACTIONS

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Landslides in Vila do Sahy village, São Sebastião municipality in February 2023 (Source: Tiago Queiroz/ Estadão Conteúdo)



Dear Members,

Greetings!

This edition of the newsletter covers various activities.

Prof. Masato Kobiyama, Hydraulic Research Institute, Federal University of Rio Grande do Sul, Brazil shares a detailed report on the largest 24-hour rainfall event ever recorded in Brazil in February 2023 which resulted, sadly, in nearly 60 deaths. The report covers the disaster area, characteristics triggering the tragedy, rainfall amount and intensity and much more information. While climate change remains a usual culprit for such disasters, our attention is also driven to mismanagement in society, economical and unstable local geology that vulnerable communities are forced to live.

From NCDR, Prof. Wei-Sen Li, Secretary-General, shared a brief report on the flagship International Training Workshop on Humanitarian Assistance and Disaster Relief (HADR) for Raising Youth Leadership this year. This year's international training workshop was held in Hualien, Eastern Chinese Taipei from 25 to 28 August 2023.

Under the GADRI Lecture Series, GADRI Secretariat organized six lectures by visiting professors: Dr. Kaushal Keraminiyage, University of Salford, UK; Prof. Daniel Aldrich, Global Resilience Institute, Northeastern University, Boston, MA, USA; Dr. Subir Sen, Department of Humanities and Social Sciences, Indian Institute of Technology Roorkee, India; Dr. Caroline Gevaert, Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Netherlands; Prof. Charles Scawthorn, Visiting Researchers, University of California, Berkeley, USA; and Prof. Khalid Mosalam, PEER, USA.

GADRI Secretariat also welcomed a new member from the health sector, Prof. Sachiko Kanbara and her team from the Kobe City of College of Nursing, Disaster Nursing and Global Nursing Section, Kobe City University of Nursing;

We hope you will enjoy the newsletter. Do not hesitate to share any news items that you would like us to share with the GADRI community.

We wish you all a very Happy Christmas and best of luck, happiness, peace and joy during the New Year.

Hirokazu Tatano and Everyone at the GADRI Secretariat

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# Disaster news from Brazil – Heavy Rainfalls in February 2023

Prof. Masato Kobiyama, Hydraulic Research Institute, Federal University of Rio Grande do Sul, Brazil

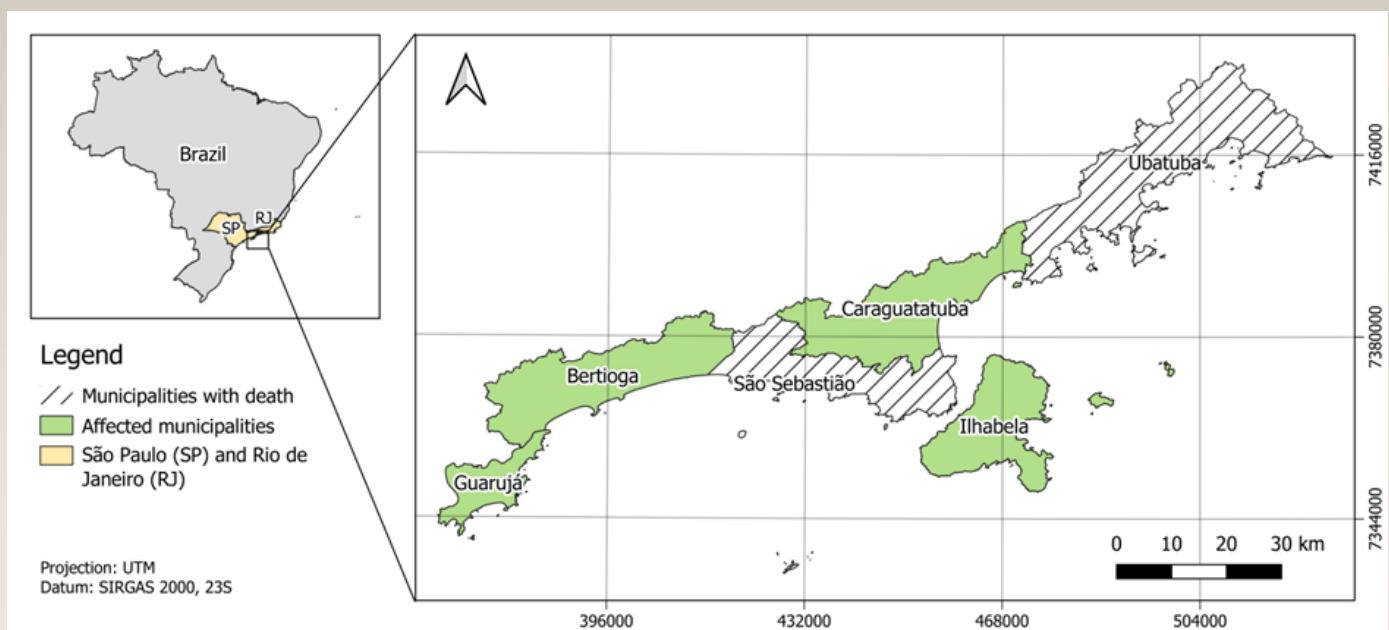
**The largest 24-hour rainfall event ever recorded in Brazil killed 65 people along the north coast of São Paulo state during the Carnival season.**

## 1. Introduction

Brazil is a vast country with a wide variety of climates. Although there exist some semi-arid areas, annual rainfall in the country is very high overall. Due to the frequent occurrence of hydrological disasters, hydrometeorological observations have been carried out at the national level for a long period of time. Until recently, the largest 24-hour rainfall ever recorded in the country was 404.8 mm measured in Florianopolis municipality, southern Brazil, on November 15th, 1991. This largest value

was changed to 534.4 mm on March 20th, 2022 in Petrópolis municipality, Rio de Janeiro state.

However just under a year later, the maximum was changed again. A heavy rain event that reached 682 mm in 24 hours on February 5th-6th, 2023 caused a disaster with 65 dead, 1815 homeless, and 2251 temporarily-displaced people along the north coast region of São Paulo state (Figure 1).

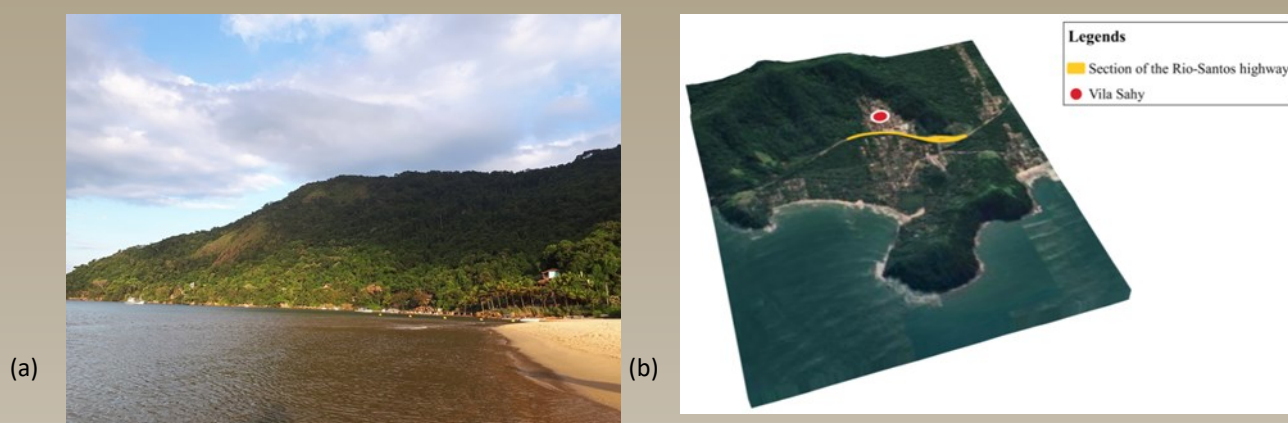


**Figure 1** – Locality of the north coast region of São Paulo state and its constituent municipalities. Two municipalities drawn with diagonal lines are those that have lost human lives in the disaster. Note that normally Guarujá is not a part of this region.

## 2. Disaster Area

The north coast region of São Paulo state is made up of the municipalities of Ubatuba, Caraguatatuba, Ilhabela, São Sebastião and Bertioga (Figure 1). It is the region that borders Rio de Janeiro state. And that is where the best beaches in the state are located: many are breathtaking. Figure 2

shows one typical scene of this place where there are few plane places between the sea and the steep hillslopes covered by the Atlantic Forest. Some characteristics of the component municipalities are described in Table 1.



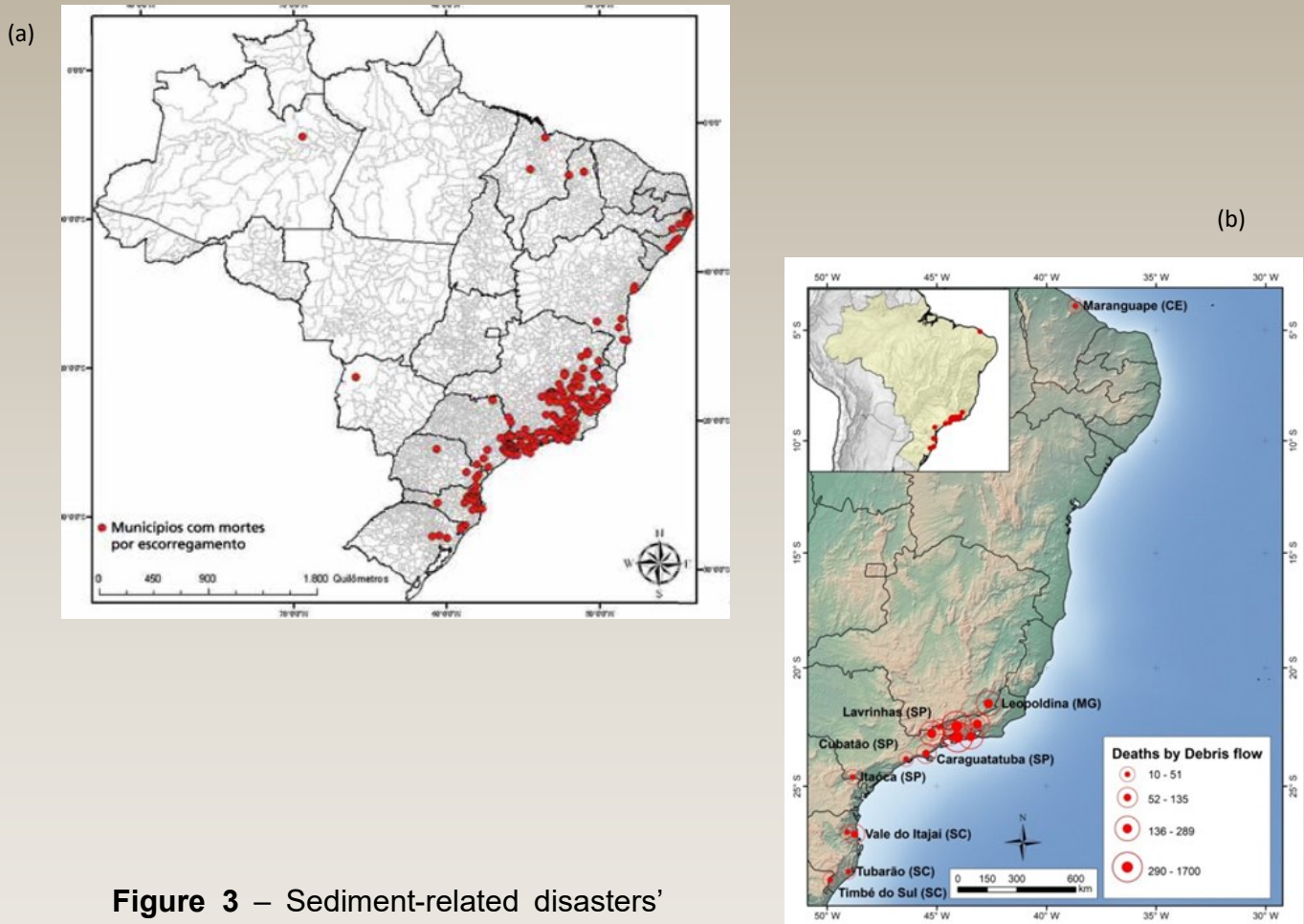
**Figure 2** – Typical landscape of the north coast of São Paulo state: (a) Photo of steep hillslope with few beaches; and (b) 3D-image of São Sebastião municipality region with Vila do Sahy village.

**Table 1** – Characteristics of the municipalities of the north coast region of São Paulo.

Municipality	Area (km <sup>2</sup> )	Population (2021)	HDI (2013)
Ubatuba	708.105	92,819	0.751
Caraguatatuba	484.947	125,194	0.838
Ilhabela	346.389	36,194	0.756
São Sebastião	402.395	91,637	0.772
Bertioga	490.148	66,154	0.730
Guarujá*	142.589	320,459	0.751
Obs.: * The municipality of Guarujá is not considered a part of the north coast region.			

Souza et al. (2018) demonstrated that a slope distribution of the north coast is 20.33% (< 2%), 3.29% (2-5%), 19.14% (5-15%), 42.57% (15-30%) and 14.68% (> 30%). Their report on a slope distribution of the region clearly indicates that there are very few flat or safe areas in this region. At such flat or safe areas, wealthy hotels and exclusive residential areas have been constructed. On the other hand, though many of the hillslopes that occupy most of the region are covered with Atlantic Forest which is legally protected, some of them are illegally occupied by a lot of houses.

The Atlantic forest is especially prone to landslides because the soil layer is not so deep and the rocks commonly have fractures. The region, at the same time, encompasses most of the larger Brazilian cities and tourist centers, where landslides disasters have been concentrated in recent years. Figure 3 shows municipalities with records of deaths due to landslides during the period 1988 to March 2011 and locations of large disasters with debris flows during the period 1900-2014. Most of them are located in the Atlantic Forest region (Brazilian coastal region).



**Figure 3** – Sediment-related disasters' distribution in Brazil: (a) Municipalities with records of deaths due to landslides during the period 1988 to March 2011 (Source: Carvalho and Galvão, 2016); (b) Locations of large disasters with

debris flows in Brazil during the period 1900-2014 (Source: Kobiyama et al., 2019)



On the coast of São Paulo, the Serra do Mar is predominantly characterized by an escarpment, a kind of huge step between the coastal plain and the plateau, clearly demonstrating a mountain environment. Especially on the north coast, as the case of São Sebastião, the Serra do Mar practically collapses onto the seafront, which makes the coastal area very narrow. This characteristic could be decisive for this tragedy. There is nowhere to run for evacuation. The lower region easily receives the sediments that violently descend from the steep hillslopes (Figure 4).



**Figure 4** – Mud and debris covering residents' area in São Sebastião municipality in February 2023 (Source: São Sebastião City Hall)



**Figure 5** – Typical locality of simple houses just beside hillslopes in São Sebastião in February 2023 (Source: Amanda Perobelli/Reuters)

With the construction of the Brazil's Route BR-101 between Bertioga and São Sebastião municipalities (Figure 1), the local communities living just near the sea were displaced by force, and the beaches were occupied by closed subdivisions (an illegal urban plan at that time) aimed at the implementation of summer houses for the very high-income

population. The poor population, whether former local communities or those who came to work for construction, had to occupy the foothills of the mountains, the areas geologically formed by the accumulation of soil and rocks caused by landslides. Therefore, such areas could be affected by

Here it is necessary to say that above-mentioned constructions are not about demonizing tourists or high-income businesses. Cities are made up of this diverse

ecosystem, and the resources derived from this economy are crucial, including in supporting public policy.

### 3. Rainfall characteristics triggering the tragedy

There was a forecast of a rainfall quantity of around 200 mm between February 18th (Saturday) and 19th (Sunday), 2023. Though the rainfall of 200 mm per 24 hours was already high, the actual one was even much higher. On February 18th, the most intense cold front during the last 54 years arrived from the south of the continent. There was a transport of heat and humidity coming from the Amazon region. These two dynamics met in the low atmospheric pressure zone. This low pressure caused

the increase of wind coming from the sea. Thus, this event dragged moisture and raised sea levels. Rising sea levels hampered surface runoff into the sea. All these factors led to the highest 24-hour rainfall recorded in Brazil.

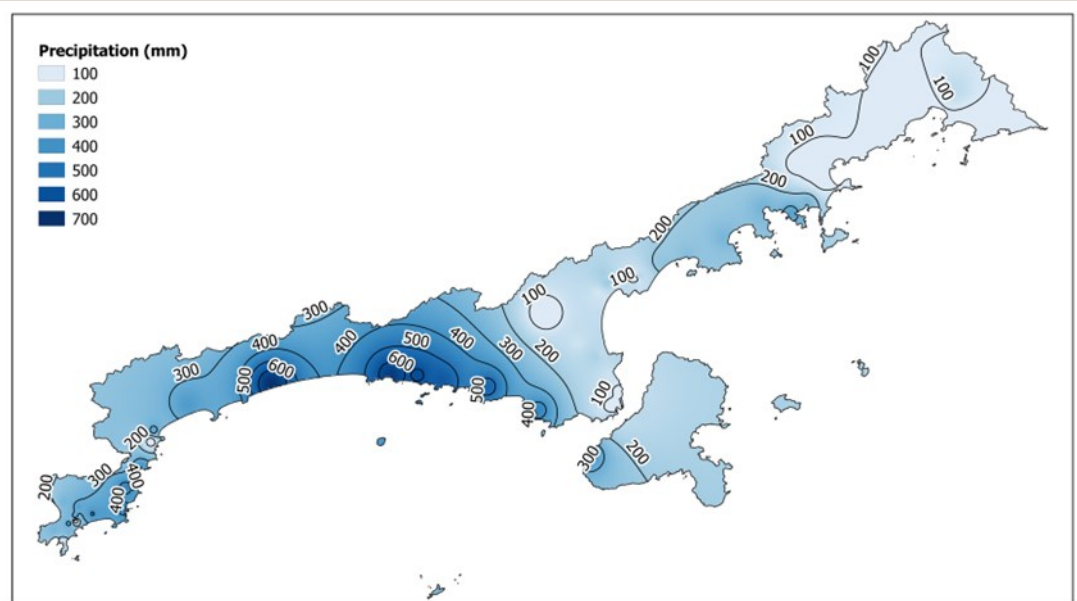
Table 2 presents the rainfall in 24 hours in several municipalities on the north coast of São Paulo. Since the mean monthly rainfall for February is 225 mm in this region, it can be said that the rainfall quantity of this event was extremely high.

**Table 2 – Rainfall during 24 hours in the north coast region of São Paulo state**

Municipality	24-hour rainfall (mm)	Death
Bertioga	682	0
São Sebastião	626	64
Guarujá	388	0
Ilha Bela	337	0
Ubatuba	335	1
Caraguatatuba	234	0

The 24-hour rainfall distribution can be seen in Figure 6. The extreme rainfall was very concentrated in Bertioga and São Sebastião municipalities. Here it should be noted that in Caraguatatuba a heavy rainfall event in March 1967 (584.8 mm in 48 hours) caused flash floods and debris flows, and killed 487 people.

**Figure 6 – Spatial distribution of 24-hours rainfall in the north coast of São Paulo during the period February 18th to 19th, 2023.**



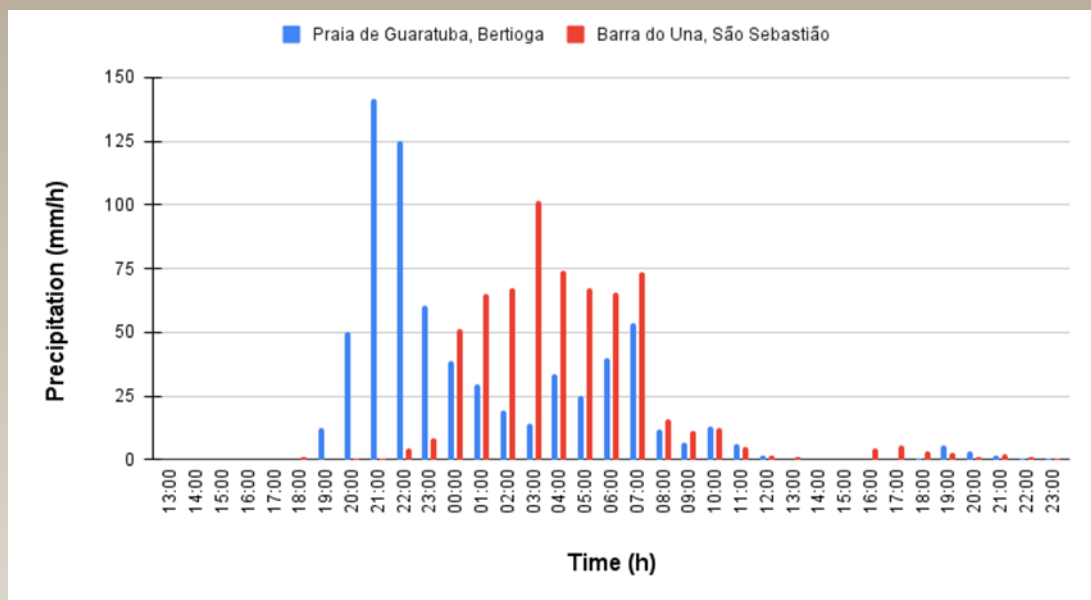
#### 4. Principal factors causing disaster

As with any natural disaster, there are many factors involved in this disaster. However, here are three key points that seem decisive, being that one is related to natural phenomena and the other two are social issues.

##### 4.1. Rainfall amount and intensity

Figure 7 demonstrates hyetographs obtained at two rainfall gauge stations: Praia de Guartuba (Bertioga municipality) and Barra do Una (São Sebastião municipality) which are both maintained by the Brazilian Center for Monitoring and Early Warnings of Natural Disasters (*Centro Nacional de Monitoramen-*

*to e Alertas de Desastres Naturais – CEMADEN*). It was observed that in Bertioga, an extremely intense rainfall event occurred with 273 mm in 2 hours and 25 mm in 10 minutes on February 18th at night. On the same day overnight, Bertioga received more than 400 mm of rain for 6 hours.



**Figure 7** – Hyetographs obtained at two rainfall gauge stations: Praia de Guartuba (Bertioga municipality) and Barra do Una (São Sebastião municipality) from February 18th 13:00 to 19th 23:00.

If only this rainfall factor is observed, the present disaster can be easily considered “purely natural-hazard-induced disaster”, i.e., “natural disaster”. However, we need to see other factors which attributes to a local society.



## 4.2. Carnival season

Here base on the report of Casemiro and Matos (2023) and Xavier (2023), the actions of several organizations are chronologically presented.

- On February 13th, the CEMADEN started to issue bulletins describing the high risk of "hydrological events" in the region.
- On the 16th (Thursday), 48 hours in advance, the CEMADEN sent a disaster forecast warning about "very intense rainfalls with the potential to cause disasters" to the federal government and the State Civil Defense Agency (SCDA) of São Paulo, including the possible locations of the disaster. On the same day, the website of this Agency warned that heavy rain would be expected over the weekend: "Highlights and attention to the north coast where accumulations up to 250 mm can be recorded". This kind of warning is unusual. In this way, the coastal areas of São Paulo were attracting attention anyway. However, the SCDA gave no warning to the local city offices.
- On the 17th (Friday), at 00:52 am, the SCDA sent the first SMS alert to the cell phones of only 34,000 people registered in its system on the north coast. The bureaucratic message, however, spoke only of "isolated rain" in Ubatuba and nearby areas without reference to the disaster risk on the hillsides of Vila do Sahy village.
- On the 17th, even in the morning, the CEMADEN held a meeting with the Brazilian Center for Risk and Disaster Management (*Centro Nacional de Gerenciamento de Riscos e Desastres* – CENAD) and with the SCDA. Therefore, the incident was well anticipated and had been notified to the competent authorities and local authorities. The CEMADEN sent a list of all danger areas, including Vila do Sahy, but the disaster's magnitude was not well predicted.
- On the 18th (Saturday), the CEMADEN issued more than 60 alerts for Ubatuba, Ilhabela, Caraguatatuba and São Sebastião municipalities, etc. At noon, the SCDA sent an SMS to the population about heavy rain in the region. It should be noted that the state governor later admitted that the SMS messages sent to part of the population had no effect. Residents, however, reported that they were not alerted by the SCDA and were not asked to leave their houses even in the face of the danger of landslides. Here it should be noted that the entire state of São Paulo, including the north coast region, does not have siren's systems in hazard areas. As a result, all the population have been dependent upon the notifications of the state and municipal Civil Defense agencies.
- Around 11 pm, the storm was already quite intense, and the municipal Civil Defense of São Sebastião tried to reach Vila do Sahy, but there was no longer any access due to landslides. The SCDA sent an SMS saying that there was "persistent rain on the north coast" and warned the population to be aware of "the walls' inclination and cracks" and, if necessary, to leave the place. At this time, however, there was no shelter set up by the SCDA or any guidance as to where the population should go.

- On the 19th (Sunday), at 2:00 am, the rain was very intense, and many landslides began to take place in the north coast region. Several locations were already without electricity and internet or cell phone signal. At 3:00 am, the SCDA sent a new SMS to people registered by cell phone, advised the population to be aware of "the walls inclination and cracks", but did not mention anything about the risk of landslides. Here it should be noted that in the north coast region, only about 12% of 288,000 residents were registered in the SCDA's system.
- At 6 am, a new SMS from the SCDA, saying rain, wind and lightning, asked people to leave the place in case of "the walls' inclination and cracks". However, it did not mention landslides yet. At this moment, there were already dead and missing people buried alive.

Note that this tragedy occurred during the Carnival season, one of the busiest times for tourism in Brazil. This lack of communication may have happened by chance, or the announcement may have been made out of consideration for the risk of keeping tourists away from the city during the carnival season. In any case, the above-mentioned lack of information transmission increased the damage. According to the announcement of the São Sebastião city hall, 500 thousand people had been expected for the four days

of the Carnival. Then the heaviest rainfall in history hit the north coast of Sao Paulo over the Carnival weekend. Therefore, many tourists who were not familiar with the local geography died in this tragedy.

Thousands of tourists went down to the beaches to enjoy the Carnival in the north coast. Only in São Sebastião municipality with less than 100 thousand inhabitants, there were almost 500 thousand people on Saturday. The SCDA did nothing to prevent or at least discourage this. City halls on the north coast did nothing, either. The radios, televisions and internet did not advise against moving this huge population towards the point where the flash flood and debris flow would occur. In fact, the alert was given, but nobody was interested. No one recognized the seriousness of the matter. Furthermore, it should be noted that nobody knew what to do after the alert. This is due to the lack of training each citizen.

Because of these disasters, on Sunday several municipalities canceled festivities that were planned and the rains kept tourists away from the beaches. However, landslide deposits on roads made it difficult for tourists to leave the north coast. This situation further increased the disaster magnitude.

If this historic downpour had occurred outside of the carnival season, the disaster might not have been so severe.

### **4.3. Remarkable and deep-rooted social problems in historical background**

One of the major and most serious problems in Brazil is the irregular and illegal land-occupation of hazard areas. This problem requires the analyses of different factors, including the vulnerability of several types associated with the populations that occupy these spaces.

The area most affected by the disaster is the Vila do Sahy village which is typical of such

land-occupations. This village emerged in the 1980s as an occupation by needy immigrants from the Brazilian Northeast region seeking job opportunities. The houses in Vila do Sahy are simple and located close to very steep slopes (Figure 8). Residents work mainly in condominiums, luxury houses, and high-end hotels in the region.

The occupation is irregular because it is located within an environmental protection area. This village is a "frozen" area, i.e., where new land-occupations are prohibited.

The freezing took place in 2009. However, expansion of the area (village) continues even today.

**Figure 8** – Very simple houses destroyed by landslide in Vila do Sahy village, São Sebastião municipality in February 2023 (Source: Rovená Rosa/ Agência Brasil)



Schmidt (2023) reported that the City Hall of São Sebastião has received at least four warnings about the risks of landslides and floods in the municipality since 2013. The first warning came in 2013 when the State University of Campinas (UNICAMP) investigated the expansion of risk areas in the São Sebastião municipality and detailed the landslides hazard areas.

The second took place in 2018 when the Institute of Technological Research (*Instituto de Pesquisas Tecnológicas* – IPT) conducted a survey and pointed out 52 areas that were at risk of landslides in São Sebastião. Their report showed that in São Sebastião there were 161 houses in areas of high risk for landslides and 2,043 houses in areas of medium or low risk for landslides. The mayor of São Sebastião commented: "People do not leave these areas, and stay. Talking is easy. When we start the demolition program, the popular commotion is enormous, the pressure is violent" (UOL, 2023). This mayor's comment clearly implies that the whole society with each resident's

force has been increasing its vulnerability.

The third was associated to an inspection by the State Public Ministry of São Paulo which conducted on November 11th, 2020, evaluated a plan of the São Sebastião municipality to urbanize and legalize the situation of properties in the area, and identified works and areas at risk of landslides in Vila do Sahy. Then, the Public Prosecutor's Office filed a lawsuit against the City Hall to demand measures. In this way, the City Hall should fulfill its duty to urbanize several villages, to legalize the situation of the properties, and to increase the security of the properties, especially in Vila do Sahy. However, its actions are much smaller than what they are charged with. For example, the City Hall adopted measures to minimize risks to the population regarding possible floods; meanwhile, the biggest problem in hazard areas is surely landslides (Figure 9). In 2020, the State Public Ministry concluded that Vila do Sahy village would be an announced "true tragedy" (Schmidt, 2023).





**Figure 9** –Landslides in Vila do Sahy village, São Sebastião municipality in February 2023 (Source: Tiago Queiroz/Estadão Conteúdo)

Finally, as the forth warning, in 2022, the Housing and Urban Development Company of the State of São Paulo (*Companhia de Desenvolvimento Habitacional e Urbano do Estado de São Paulo* – CDHU) suggested that

families occupying Vila do Sahy should be relocated to a neighboring area which is out of the landslides hazard areas.

It seems that there are problems not only on the administration's side, but also on the residents' side. In other words, disasters have become a more serious social problem in the study region, because disaster education has not been disseminated in both sides.

## 5. Final remarks

Many scientists have linked this historic rainfall event to climate change. While effect of climate change may be clear and undeniable, its consequence, i.e. disaster especially with 65 deaths could have resulted from mismanagement in society. In the north coast region of São Paulo, occupation of the steep hillside practically began due to the regional geography where there are very few flat and safe areas. In the case of São Sebastião, with the growth of residential subdivision and developments aimed at tourists, people, especially the less wealthy, are being expelled to more fragile places, with less infrastructure and larger steepness.

Any disasters have various causes. The larger the disasters' magnitude, the more complex the combination of causes that can occur. This unexpected combination makes it difficult to prevent larger disasters. In the tragedy of the north coast of São Paulo in 2023, such a combination could be: unstable local geology + increasingly frequent heavy rains + ignoring weather and civil defense warnings + lack of urban planning + inability to provide security to communities that have

historically been displaced to unsafe areas. Thus this combination indicates urgent necessity to carry out huge quantity of actions for the Disaster Risk Reduction (DRR).

Since January 2019, 35% of Brazilian municipalities have faced emergency situations or public calamities due to storms, landslides, flash floods or floods (Unterstell and Margulis, 2023). This current situation naturally improve DRR at the nation's level. Indeed, the CEMANDEN has been showing its better execution in terms of institutional action (alert system performance in the country). This must result from a lot of experiences due to the frequent occurrences of disasters and their warnings' actions.

On the other hand, state and local governments have not practiced as often as CEMADEN in recent years. According to Unterstell and Margulis (2023), today, a gap exists in the inability to link state-of-the-art information generated by centers of excellence related to climate and disaster risk issues such as CEMADEN to actual action by state and local governments.

These states and local governments often lack real-world experience and are unable to act appropriately in an emergency. This strongly underlines the urgent need for simulated behavioral training and risk management awareness rising at the local and state government level.

Similar to the tragedy of Petrópolis municipality in Rio de Janeiro state in 2022 (Kobiyama, 2022), many people did not know

where to go at the moment of emergency in the north coast of São Paulo in 2023. Precisely for this reason, it is necessary to have regular awareness and training for residents.

Considering all of the above, it seems that there is no solution other than persistently continuing disaster education for the general public as well as state and local governments.

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# GADRI Lecture Series

## Modelling Barriers and Enablers to Participatory Risk-Sensitive Urban Developments in Sri Lanka

### Lecture by Dr. Kaushal Keraminiyage

Dr. Kaushal Keraminiyage, Associate Professor, Centre for Disaster Resilience, School of Science Engineering and Environment, University of Salford, UK was visiting the Kyoto University to lecture at the Intensive Courses offered by ILAS, Kyoto University Kyoto as a "Distinguished Visiting Professor". He took the opportunity to contribute a lecture to the GADRI Lecture Series as well. The lecture was delivered to DPRI students and faculty members on 12 September 2023.

#### Abstract:

Urban developments inherently contribute to increased disaster risks. Hence, it is important to adopt risk sensitive development strategies in helping global disaster risk reduction attempts. While communities play a significant role in recognising the local risk sensitivity, despite their lived experience in surviving local hazards, in most cases, local disaster risk mitigation and development plans seem to be developed predominantly through a top-down approach. This study, using Sri Lanka as a case study, investigated the barriers to effective community participation in the decision-making process of risk sensitive urban developments and thereby developed an interpretive logic model to establish an understanding of why they occur and how each barrier is interlinked. The study employed a Grounded Theory Methodology (GRM), followed by the Total Interpretive Structural Modelling (TISM) and Matrix Impact of Cross Multiplication Applied to Classification (MICMAC) analysis.



#### Brief Biography:

Dr Kaushal Keraminiyage is an Associate Professor (Reader) in disaster risk reduction and smart communities at the Centre for Disaster Resilience, School of Science Engineering and Environment at the University of Salford, UK. He is also currently a visiting professor at the Kyoto University, and an experienced researcher with a good publication profile and funded research projects. Having secured external and internal funding from funding bodies such as EPSRC, and EC, he has led a number of research projects as a principal investigator and a co-investigator.

Dr Keraminiyage has supervised and graduated more than 15 doctoral students successfully and he is currently supervising PhD students in the broad research areas of Disaster Resilience and Construction Management. He has also examined (as the external or the internal examiner) more than 20 Doctoral theses. His specialism is in Disaster Induced Resettlements, Resettled and Host Community Integration, Community Resilience to Disasters, Agile Communities for Disaster Response and Sustainable and Resilient Urban Developments.



# How Social Infrastructure Builds Resilience?

## Lecture by Prof. Daniel P. Aldrich



During his visit to the Disaster Prevention Research Institute (DPRI), Kyoto University, Uji Campus, Kyoto, Japan, Prof. Daniel Aldrich, Department of Political Science and School of Public Policy and Urban Affairs, Director, Security and Resilience Studies Program, and Co-Director, Global Resilience Institute, Northeastern University, Boston, MA, USA, delivered a lecture to the students and faculty of DPRI on 3 August 2023.

### Abstract:

Much of our policy process focuses on the role of physical infrastructure, that is, structures that hope to mitigate the impact of shocks and disasters such as floods, terrorism, and crime. But a growing body of evidence suggests that social infrastructure—the places and spaces that build and maintain connections, such as libraries, parks, and pubs - hold greater potential to blunt the impact of such events. Using qualitative and quantitative evidence from cases around the world, Aldrich pushes us to appreciate how the modest and often underappreciated field of social infrastructure should be front and center as we confront wicked problems

including polarization and disinformation.

### Brief Biography:

An award winning author, Aldrich has published five books including *Building Resilience* and *Black Wave*, more than 90 peer-reviewed articles, and written op-eds for the New York Times, CNN, HuffPost, and many other media outlets. He has spent more than 5 years in India, Japan, and Africa carrying out fieldwork and his work has been funded by the Fulbright Foundation, the National Science Foundation, the Abe Foundation, the Rasmussen Foundation, and the Japan Foundation, among other institutions. In 2021 he was Klein Lecturer at Northeastern University.



# An Assessment of Economic Impact due to Disasters: The case of India

## Lecture by Assoc. Prof. Subir Sen



During his visit to the Disaster Prevention Research Institute (DPRI), Kyoto University, Uji Campus, Kyoto, Japan, Dr. Subir Sen, Associate Professor, Department of Humanities and Social Sciences, Indian Institute of Technology Roorkee, Roorkee, India, delivered a lecture to the students and faculty of DPRI on 3 August 2023.

### **Abstract:**

India remains highly vulnerable to extreme events occurring at repeated intervals such as floods, cyclones, and droughts. According to the latest estimates of the United Nations Office for Disaster Risk Reduction (UNDRR), about 300 disaster events are reported in the country over the past two decades which led to an estimated USD 79.5 billion direct economic losses, approximately 76,000 deaths and over 1 billion people affected including those who were left homeless following the disaster. Notably, natural hazard-induced disasters may be of two categories based on the specific characteristics they demonstrate. First, are the fast onset disasters like floods, cyclones, earthquakes

that occur rapidly, after-effects stay for a relatively short period, impact a particular location or geography and leads to property damages and loss of human lives and livelihood. The onset and end time of such disaster events are quick and measurable in general. The slow onset disasters, on the other hand, are events like droughts. The characteristics, causes, nature and the ability drought events to harm the individuals along with the impact on economic growth remains complex issues in comparison to the fast onset disasters. Droughts often have no particular time of arrival or ending and may spread over a small or a large geographic area. Though, droughts do not cause any direct property damages, but can adversely affect the individuals, community and the overall economic growth of the affected region. Therefore, most of the times, it becomes difficult to identify their severity and the loss and damages they cause. Contrary to the general belief, there are empirical evidences to suggest that slow onset disasters (like droughts) may severely damage an economy than the fast onset disasters. Another difference between the fast and slow onset disasters is the sectors which are adversely affected. For example, droughts impair the agricultural sector of the economy, although it has indirect impact on the secondary and tertiary sectors due to the inter-linkages between these sectors.

On the contrary, the fast onset events can adversely affect not only the agricultural sector but also the manufacturing and service sectors. With more visible destruction, intensity as well as the public and media attention, the government and policy-makers remain more concerned towards the fast onset events than the slow onset disasters.

Interestingly, the existing disaster management policies in India treats both these types alike raising a serious concern towards the disaster management approach and practices. Although different ministries manage different disasters, the policy (in form of Disaster Management Act, 2005 and National Disaster Management Plan, 2016) guiding them remains the same

Given the different mode and impacts of natural disasters on the economy and its sub-sectors, it would be interesting to analyse the fast and slow onset disasters impact separately along with overall impact of natural disasters. The present study attempts to analyse the relationship between natural disasters and economic growth for a sample of selected 25 Indian states. Using augmented panel vector autoregression (PVARX), the dynamic responses of the economic indicators (e.g. state GDP) to disaster shocks would be generated to identify the disaster impact not only in the year of the event but also in following years. The fast onset disasters are represented by flood events while droughts would proxy for the slow onset disasters. In case of fast onset disasters (floods), yearly as well as 5 years cumulative impact would be estimated and for the slow onset disasters (droughts) 3 years average impact would be estimated. The outcome of the analysis may prove to be helpful for the policy makers in both central and the state governments to

formulate the appropriate disaster management policies for the respective disaster types.

**Keywords:** Natural Disasters, Economic Impact, Panel Data Analysis, Disaster Risk Reduction, India.

### **Brief Biography:**

Subir Sen is Associate Professor in the Department of Humanities and Social Sciences and Joint Faculty in the Centre of Excellence in Disaster Mitigation and Management (COEDMM) at the Indian Institute of Technology Roorkee. He obtained is PhD in Economics from the Institute for Social and Economic Change, Bangalore with fellowship under the "Reserve Bank Scheme of Endowment of Professorial Chairs and Research Fellowship". His research areas are Economics of risk and uncertainty, Insurance economies, and Economics of climate change and natural disasters. In recent years, he has grown interest in the field of sustainability and the concept of circulating and ecological sphere. He worked at TERI University, New Delhi and Madras School of Economics, Chennai before joining IIT Roorkee. He received distinguished awards such as JSPS-ICSSR Joint Research Project, First Prize under Japanese Outstanding Research on Development (ORD) from Global Development Network (GDN) in 2015, subsidy for PhD. thesis from the Association Internationale pour l'Etude de l'Economie de l' Assurance (the Geneva Association) and scholarship for participation in Lindau Nobel Laureate Meeting 2008, to mention a few. He contributed to sponsored research by the Govt. and International agencies like Ministry of Agriculture, Govt. of India, IRDAI, SANEI, APN, DST-CHORD, IFC, World Bank Group and UK NERC.



He contributed to sponsored research by the Govt. and International agencies like Ministry of Agriculture, Govt. of India, IRDAI, SANEI, APN, DST-CHORD, IFC, World Bank Group and UK NERC. He presented his research in different national and international conferences and has few publications to his credit. He served as a Member of the Board of Governors, Asia Pacific Risk and

Insurance Association (APRIA) for the period 2019-2022 and is currently Secretary of the Indian Society for Ecological Economics (INSEE). His research has appeared in journals such as Natural Disasters, Climate and Development, International Journal of Disaster Risk Reduction, Economics of Disasters and Climate Change, among others.

## Accelerating Earth Observation Services for Resilient Development - the Digital Earth Partnership

Lecture by Dr. Caroline Gevaert

During her visit to the Disaster Prevention Research Institute (DPRI), Kyoto University, Uji Campus, Kyoto, Japan, Dr. Caroline Gevaert, Assistant Professor, Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Netherlands, delivered a lecture to the students and faculty of DPRI on 5 October 2023.

Dr. Gevaert was introduced to DPRI by Prof. Charles Scawthorn. Both, Prof. Scawthorn and Dr. Gevaert were attending the Science and Technology in Society (STS Forum held at the Kyoto International Conference Center from 1 to 3 October 2023.

**Abstract:** The Digital Earth Partnership aims to enhance the resilience of vulnerable countries and communities to climate change and natural hazard disasters through greater access to and adoption of frontier earth observation tools & services. Climate resilient development is especially reliant on stakeholders' abilities to use accurate and timely information about our



changing climate, environment and livelihoods, for risk aware insights and risk reduction actions. Through knowledge building and partnership development, Digital Earth focusses on providing demand driven data services for spatial monitoring, decision support, and risk management activities prompted by client governments and their beneficiaries: activities that are locally appropriate, affordable, actionable, scalable, and sustainable.

The presentation will demonstrate projects that contribute towards these goals: partnerships between universities to enhance the local knowledge ecosystem on disaster resilience (the Resilience Academy), obtaining information on vulnerability and exposure together with communities (Ramani Huria and Digital Public Works) and integrating information derived from Earth Observation into World Bank operations and policy making (the World Settlement Footprint).

**Brief Biography :** Caroline Gevaert is Assistant Professor in Geoinformatics at the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente (the Netherlands) and international consultant for the World Bank. She is member of the Dutch Young Academy of Sciences, one of the 15 global experts selected to review the UN Global Sustainable Development Report 2023, and a leading expert on Responsible AI for sustainable development. She has scientific

publications with >100 co-authors across 24 countries, and has presented at conferences on five continents, including three presentations at the first UN-GGIM World Congress in China. Through her position at the World Bank, Caroline advises on how to use these technologies in operations. Example projects include: the Resilience Academy - a partnership between universities in Tanzania and Europe to co-develop tailored local solutions for resilience; Ramani Huria - a largescale participatory mapping program where hundreds of Tanzanian students mapped the city of Dar es Salaam; using drones to get accurate terrain models for flood mapping; and recommendations on Responsible AI for Disaster Risk Management.



# Recent Research Activities: An overview and Extended Q&A Dialogue

## Lecture by Prof. Charles Scawthorn

Prof. Charles Scawthorn delivered a lecture to the Disaster Prevention Research Institute (DPRI), Kyoto University faculty and students during his visit to DPRI on 22 November 2023. His presentation covered the following topics.

- Resilient Infrastructure Grids
- Fire following earthquake and its mitigation
- Determining water distribution system pipe replacement given random defects
- Effect of major stress events on buried pipe
- Optimizing wildfire risk reduction measures
- A building classification system for multi-hazard risk assessment

Prof. Scawthorn provided an overview of the research purpose, methods, and findings for each of the topics mentioned above. The lecture was followed by an extended question and answer session. At the request of the audience, Prof. Scawthorn shared two papers published on the topics.

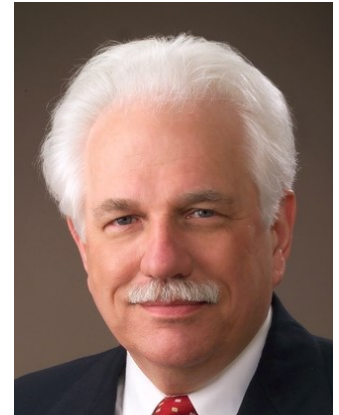
- The Influence of Natural Hazards on Urban Housing Local, Charles Scawthorn, et.al., Journal of Urban Economics 11, 242-251 (1982)
- Volume VII, Special Structures and Critical Facilities – Urban Design, Socioeconomic Issues and Public Policy – Lifelines: Utility and Transportation Systems, Proceedings of the Eight World Conference on Earthquake Engineering, San Francisco, California, USA, 21-28 July 1984

### **Brief**

Professor Scawthorn is internationally recognized as an authority for the analysis and mitigation of natural and technological hazards. He retired in 2008 as Professor and

### **Biography:**

head of the Earthquake Disaster Prevention Systems Laboratory, at Kyoto University (Japan), has been a Visiting Professor at Stanford, Beijing Normal, and Waseda (Tokyo) Universities, and is now a Visiting Researcher, at Univ. California at Berkeley. He is a consultant to the global insurance industry, the World Bank, the Asian Development Bank, local/state/federal agencies, and Global 1000 corporations. Dr. Scawthorn is a graduate of the Cooper Union, holds an M.S.C.E. degree from Lehigh University, and received his D.Eng. from Kyoto University.





# PEER Overview & NLP Approach for Rapid Earthquake Reconnaissance

Lecture by Khalid Mosalam

Prof. Khalid Mosalam, Director, Pacific Earthquake Engineering Research (PEER) Center, University of California, Berkeley, USA is visiting DPRI, Kyoto University. He took the opportunity to deliver a lecture to DPRI faculty and students on the PEER Overview and NLP Approach for Rapid Earthquake Reconnaissance on 1 December 2023.

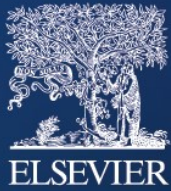
## **Abstract**

The presentation focused on the activities of the Pacific Earthquake Engineering Research (PEER) Center and the speaker's research group on reducing the harmful effects of earthquakes and other natural hazards on the built environment and communities. The presentation started with an overview of PEER, its mission, vision, major projects, research directions, impacts on practice, and experimental facilities and related activities. This was followed by the three pillars of vision-based, vibration-based, and text-based Structural Health Monitoring, powered by the worldwide trend of the expansion of sensor installation on different elements of the built environment, and a well-integrated usage of AI technologies with domain knowledge. Finally, details are provided on recent Natural Language Processing (NLP) methods and their applications for both virtual and field reconnaissance following natural hazards. These efforts support the "Building Resilience through Reconnaissance" objective of the Structural Extreme Events Reconnaissance ([StEER](#)) Network, which PEER actively collaborates with to improve sustainability and community resilience.

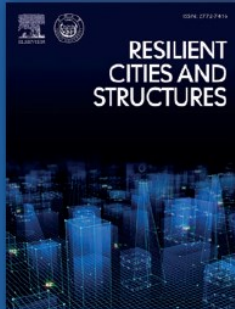
## **Biography**

[Mosalam](#) obtained his BS and MS from Cairo University and his PhD from Cornell University in Structural Engineering. In 1997, he joined the Department of CEE, UC-Berkeley where he is currently the Taisei Professor of Civil Engineering, Director of the [PEER Center](#), and Associate Director for Earthquake Hazard of the [StEER Network](#). He conducts research on performance & health monitoring of structures including data analytics using different AI approaches. He is active in assessment and rehabilitation of essential facilities, including building energy efficiency and sustainability. He is the recipient of 2006 ASCE Huber Civil Engineering Research Prize, 2013 UC-Berkeley Chancellor Award for Public Services, 2015 EERI Outstanding Paper Award, 2020 ASCE Best Journal Paper in Materials and Structural Response, and 2021 Hojjat Adeli Award for Innovation in Computing. He is a Corresponding Member of the Academia de Ingeniería México, and an Elected Fellow of ASCE. He was a Visiting Professor at Kyoto University, Japan, METU, Turkey, NTU, Singapore, and Tongji University, China. Mosalam teaches courses in FEM, Structural Analysis, Structural Dynamics, Design of RC and PC Structures, and Experimental Methods in Structural Engineering.





FREE  
TO JOIN



# RESILIENT CITIES AND STRUCTURES

## Academic Forum Series

The College of Civil Engineering, Tongji University and Elsevier invite you to join their free *Resilient Cities and Structures (RCS)* Webinar Series. Each talk is associated with an *RCS* journal paper (or within the journal's scope) which includes fundamental research, innovative technologies, and engineering applications in resilient cities, infrastructure, structures, and resilience-based management by an eminent scholar selected by the editorial board.

In the meantime, the College of Civil Engineering, Tongji University and Elsevier invited everyone to join their free Resilient Cities and Structures (RCS) Webinar Series. Each talk organized was associated with an RCS journal paper (or within the journal's scope) which includes fundamental research, innovative technologies, and engineering applications in resilient cities, infrastructure, structures, and resilience-based management by an eminent scholar selected by the editorial board.

The eminent professor was no other than Prof. John van de Lindt, Harold H. Short Endowed Chair Professor in the Department of Civil and Environmental Engineering at Colorado State University; and a Member of the Board of Directors of GADRI, who delivered the webinar under the Resilient Cities and Structures – Measuring the Resilience of a Community Based on Four Areas of Community Stability: An interdisciplinary Approach to Measurement Science.

The webinar was held on 14 December 2023 from, 8:30-9:30 EST New York; 13:30-14:30 GMT London; and 21:30-22:30 CST Shanghai.

These webinar series are co-supported by

**International Joint Research Laboratory of Earthquake Engineering and the Earthquake Resiliency Committee, Seismological Society of China.**

### Abstract:

Resilience is the ability to prepare for, adapt to, and recover rapidly from hazards such as earthquakes, hurricanes, tornadoes, or floods. The ability to model a community necessitates combining models from different disciplines including the interfaces, propagation of uncertainty, and ultimately the measurement of resilience metrics across physical systems, households, social institutions, and the economy.

The presentation will begin with a brief overview of a recent Resilient Cities and Structures Special Issue entitled “Integrated Modeling of Cities to Improve Natural Hazards Resilience” guest co-edited by John W. van de Lindt, Andre R. Barbosa, and You Dong. This will be followed by a brief summary of the state of the research in interdisciplinary resilience modeling of communities and cities developed by the U.S. National Institute of Standards and Technology-funded Center for Risk- Based Community Resilience Planning.

## Brief Biography:



**Dr. John W. van de Lindt** is the Harold H. Short Endowed Chair Professor in the Department of Civil and Environmental Engineering at Colorado State University. Over the last two decades van de Lindt's research

program has focused on performance-based engineering and test bed applications of buildings and other systems for earthquakes, hurricanes, tsunamis, tornadoes and floods. He has led data collection efforts following hurricanes, earthquakes, floods, and tornadoes with the most recent being the December 2021 Midwest tornado outbreak. Professor van de Lindt is the Co-director for the National Institute of Standards and

Technology-funded Center of Excellence (COE) for Risk-Based Community Resilience Planning headquartered at Colorado State University in its ninth year. A major portion of the COE is to develop a computational platform IN-CORE to enable communities to measure their resilience to natural hazards. He serves as the Past Chair of the Executive Committee for the American Society of Civil Engineer's (ASCE) Infrastructure Resilience Division, current Chair of the ASCE Technical Administrative Committee of the Structural Engineering Institute and has published more than 450 technical articles and reports, including 230 journal articles. He currently serves on a number of journal editorial boards including Resilient Cities and Structures, and is the Editor-in-Chief for the ASCE Journal of Structural Engineering.

## 2023 International Training Workshop at the National Science and Technology Center for Disaster Reduction (NCDR)

NCDR resumed the flagship International Training Workshop on Humanitarian Assistance and Disaster Relief (HADR) for Raising Youth Leadership this year. NCDR, Chinese Taipei will held the training workshop in Hualien, Easter Chinese Taipei from 25 to 28 August 2023. NCDR provided three full scholarships to MSc. Students at the Disaster Prevention Research Institute (DPRI), Kyoto University.

### Overview of the Course:

With the vision of "Root in Technology, Build International Connections , and Lead the Future", the 2023 ITW focussed on strengthening youth leadership on HADR and disaster risk reduction. During the training, all participants acquired basic knowledge of disaster risk management to meet future challenges. Through scenario-based designed program, the brainstorming sessions were conducted to address importance of teamwork to solve proposed situations and challenges

during the training. Various on-site operations and action-oriented approaches were aimed at empowering future leaders with skills such as situation assessment, decision-making, operations, coordination, and deployment. Participants also enjoyed hands-on experience in utilizing information systems, constructing provisional shelters, operating water purification equipment, utilizing mobile kitchens for meal preparation, engaging in tabletop exercises, and designing a camp for temporary settlements.





## Courtesy Visit by the Croatian Centre for Earthquake Engineering, University of Zagreb



A delegation headed by Prof. Josip Atalic, Head of HCPI, Associate Professor in the Department of Engineering Mechanics of Faculty of Civil Engineering University of Zagreb and head of the new branch office **Croatian Centre for Earthquake Engineering.**, paid a courtesy visit to the Disaster Prevention Research Institute (DPRI), and the Global Alliance of Disaster Research Institutes (GADRI) Secretariat, Uji Campus, Kyoto University on 13 September 2023.

The group was greeted by Prof. Ryosuke Uzuoka, Vice-Director, DPRI, Kyoto University, and Prof. Hirokazu Tatano,

Secretary-General, GADRI; and Professor, DPRI, Kyoto University.

After presentations on DPRI and the Croatian Centre for Earthquake Engineering and the University of Zagreb, they were given a detailed tour of the DPRI research facilities— especially of the Centrifuge Lab and the Earthquake Simulation Lab.

The Centre for Earthquake Engineering and the University of Zagreb is currently processing an application for the membership of GADRI which is initiated by Prof. Atalic.



## New Members



### **Kobe City of College of Nursing Disaster Nursing and Global Nursing Sec-**

Dr. Sachiko Kanbara and her Team at the Kobe City University of Nursing joined the GADRI Community.

"The Kobe City University of Nursing opened in April 1996, and the Kobe City University of Nursing Graduate School opened in April 2000, both to train nursing professionals with advanced clinical skills and educators, researchers, and administrators, and to further promote nursing research. The School of Nursing encompasses the areas of basic nursing, disaster nursing, and global nursing. The undergraduate curriculum includes courses such as "Disaster Prevention" and "Disaster Nursing I & II." The Graduate School of Nursing offers a

"Certified Nursing Specialist Course in Disaster Nursing" within its master's program and a "Global Health and Disaster Nursing" course as part of its doctoral program.

Our research interest primarily lies in the domain of Disaster Nursing and Global Nursing, pivotal components within the Fundamental Nursing Science Field. We endeavor to cultivate a multifaceted approach in our research and educational programs, focusing on disasters and global health challenges to induce transformative advancements in nursing practices.

Visit the website for further details:



**Planning and Development Research Foundation, Inc., University of the Philippines, Diliman, Quezon City, Philippines**

It includes mainstreaming Disaster Risk Reduction (DRR) and Climate Change Adaptation and Mitigation (CCAM) in policy formulation; Institutional development, urban and rural land-use and development planning; and public infrastructure and housing among others. Essentially, our organization Programs, Projects, and Activities (PPAs) are geared towards disaster risk reduction management thematic areas (i.e., Disaster preparedness, response, rehabilitation and recovery and prevention, and mitigation). Further, we also deal with the PPAs related to climate change action plan priority areas (i.e., food Security, water security, ecological and environmental stability, human security, climate friendly industries and services, sustainable energy, and knowledge and capacity development). In addition sustainable development goals 2030 (i.e., no poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, inequality, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace and justice strong institutions, and partnerships to achieve the goal) are also part of our researches.



## National Crisisonomy Institute Chungbuk National University

Established in 2006, Republic of Korea's first Crisisonomy specialized research institute:

- Conducting research for the academic advancement and providing education for the training of experts of Crisisonomy
- Collaborates and cooperates with central government agencies, local government, research institutions, and NGOs to develop policies and provide consulting services related to Crisisonomy
- Currently consists of 1 director, 5 full-time researchers, 11 student researchers, 8 associate researchers, and 1 administrative staff member.



أكاديمية ريدان  
Rabdan Academy

### Rabdan Academy , Abu Dhabi

Rabdan Academy is a government-owned world-class education institution established to coordinate and enhance learning outcomes for organisations and individuals in the Safety, Security, Defence, Emergency Preparedness and Crisis Management (SSDEC) Sectors. The Academy was officially established under Law No. 7 for 2013, issued by the late Sheikh Khalifa bin

Zayed Al Nahyan and is accredited by the UAE's Commission for Academic Accreditation (CAA) of the Ministry of Education. The Academy is the first higher education institution in the world specialised in the SSDEC domain that achieves top '5 star' ratings in the 2 categories of Teaching and Employability under the QS Stars University Rating System.

As a unique institution, the Academy provides learning in a dual approach, combining academic and vocational education in one place, whilst recognising prior learning and experience and providing accredited and transferable credit from course to course and job to job.



RMIT University is a public research university in Melbourne, Australia with campuses in Australia, Vietnam and Spain, which collaborates with communities and universities in the Asia-Pacific and throughout the world. RMIT's Disaster Research Network (DRN) addresses the increasing need for research, innovation, and partnership to support disaster prevention, preparedness, response, and recovery in Australia and internationally. Drawing together over 80 researchers from a broad range of disciplines, the RMIT Disaster Research Network takes a multi-disciplinary approach to disaster research, working together with practitioners and communities to strengthen resilience and research impact. RMIT's disaster research capabilities connect across three interlocking themes: Resilient Infrastructures and Environments, Resilient Communities and Governance, and Whole-of-Society Resilience.





Association française pour la prévention des catastrophes naturelles et technologiques (AFPCNT)

A network of networks organized in an Association of more than 200 members, involving most of the French civil society segments and part as such of the National DRR Platform. Highly qualified as well as young scientists are members and interact with practitioners of all sectors, public and private. Networking efforts are developed with similar organizations, as well as in neighboring (eg. DE), and francophone countries (North and West Africa), sometimes involved as such in EU research projects.

Within the 15 staff members of the association, two of the staff members are in a PhD process, under scientific supervision of academic members and practitioners. The Scientific Council is composed of about 15 members of all disciplines Its chair person is Research Director at CNRS. About 20 academics are members of the association.



The Evidence Aid's newsletter covers. Crises of all varieties, from war to climate change, to earthquakes and pandemics, are impacted by the actions, inactions, and decisions of those in power. Evidence Aid, to save both lives and livelihoods impacted by such crises, provides decision-makers with up-to-date, available evidence to make informed, science-based decisions during disasters.

The improvement and preparedness of one sector is especially impertinent. Health

systems' resilience, particularly in conflict or crisis-affected settings, is essential to [saving lives](#). Each month's newsletter will focus on several relevant updates and Evidence Aid summaries related to the delivery of emergency care services in crisis settings, including a recently-delivered [webinar](#) with the [Pan American Health Organization](#) (PAHO), and the impact of participation of conflict-affected communities in enhancing health system governance.

If you don't already receive the newsletters directly and would like to, please email: [info@evidenceaid.org](mailto:info@evidenceaid.org).



# GADRI Members

Established in March 2015, the Global Alliance of Disaster Research Institutes support the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) and the work of the Scientific and Technical Advisory Group of the United Nations Office for Disaster Risk Reduction (UNDRR).

In line with its vision, GADRI strives to deepen the understanding of disasters and find implementable solutions to achieve disaster resilience; i.e. human, technical system and infrastructure resilience,

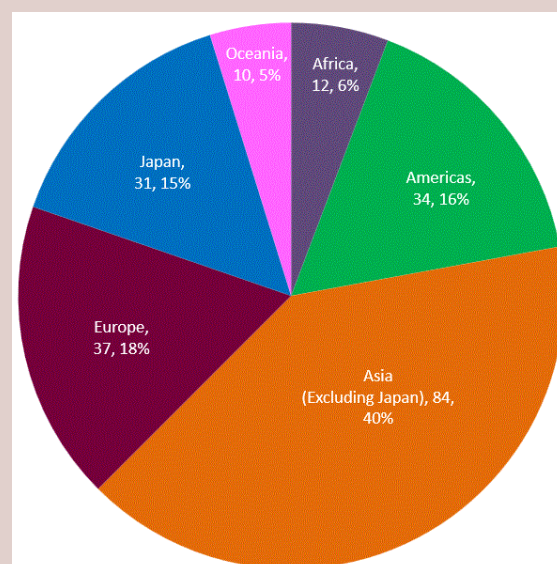
survivability and well-being, by integrating knowledge and technologies from around the world. Over 200 institutions have joined GADRI. GADRI membership is free; and completely voluntary and non-binding.

GADRI Secretariat is currently headquartered and hosted by the Disaster Prevention Research Institute (DPRI), Kyoto University, Japan.

To join GADRI, please contact the GADRI Secretariat: [secretariat-gadri@dpri.kyoto-u.ac.jp](mailto:secretariat-gadri@dpri.kyoto-u.ac.jp)

Geographical Distribution of GADRI as of 31 December 2023

Area	Members	Economies
Africa	12	7
Americas	34	8
Asia (Excluding Japan)	84	23
Europe	37	13
Japan	31	1
Oceania	10	2
<b>Total Institutes</b>	<b>208</b>	<b>54</b>
	<b>55 economies</b>	



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Secretariat

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