14° IDRiM

Abstract

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Conference:

Disaster-Resilient Communities for Life

Cartagena de Indias
August 28, 29, and 30-2024

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UNGRD
Unidad Nacional para la Gestión del Riesgo de Desastres

IDRiM
FOR A SAFER WORLD

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Abstract Proceedings of the 14th IDRIM International Conference: Disaster-Resilient Communities for Life

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IDRiM 2024

August 28, 29, and 30

National Unit for Disaster Risk Management
International Society for Integrated Disaster Risk Management
Kyoto University
Disaster Prevention Research Institute (DPRI)

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National Unit for Disaster Risk Management-UNGRD

It is a Special Administrative Unit of the Executive Branch at the national level, attached to the Administrative Department of the Presidency of the Republic. Its purpose is to direct the implementation of disaster risk management, address sustainable development policies, and coordinate the operation and ongoing development of the country's National System for Disaster Risk Management (SNGRD).

UNGRD
Unidad Nacional para la Gestión del Riesgo de Desastres

Mission

The UNGRD directs, guides, and coordinates Disaster Risk Management in Colombia, strengthening the capacities of public, private, community, and general society entities with the explicit purpose of contributing to improving people's quality of life and promoting sustainable development through risk awareness, risk reduction, and the management of disasters associated with natural, socio-natural, technological, and unintentional human-caused phenomena.

Vision

By 2030, the UNGRD will be recognized as the institution that coordinates, articulates, and strengthens the SNGRD in understanding disaster risk, incorporating Integrated Risk Management into Colombian culture, reducing risk, preparing for emergency responses, and providing timely and appropriate responses and guiding disaster recovery processes with a focus on resilience and sustainable development, thereby reducing risk conditions, losses, and costs associated with disasters.

Society for Integrated Disaster Risk Management – IDRiM

The Integrated Disaster Risk Management Partnership (IDRiM) was officially launched on 15 October 2009 in Kyoto, Japan, at the 9th IIASA-DPRI Forum on Integrated Disaster Risk Management, with the participation of over 100 international experts, practitioners, and individuals from more than 20 countries working in the field of disaster risk management.
The formation of the IDRiM Society was based on a long history of fruitful collaboration between the Disaster Prevention Research Institute (DPRI) of Kyoto University and the International Institute for Applied Systems Analysis (IIASA). It was further promoted by numerous national and international organizations, including Beijing Normal University (BNU), the International Institute of Earthquake Engineering and Seismology (IIEES), the National Institute of Earth Science and Disaster Prevention Research (NIED), the United Nations International Strategy for Disaster Reduction (UNISDR), and the Joint Research Centre of the European Commission (JRC/EC), among others.

The founding members of the IDRiM Society are Prof. Norio Okada (DPRI), Dr. Aniello Amendola (IIASA), Dr. Peijun Shi (BNU), Dr. Joanne Bayer (IIASA), Prof. Hirokazu Tatano (DPRI), Dr. Mohsen Ghafory-Ashtiani (IIEES), Dr. Reinhard Mechler (IIASA), and Dr. Ana María Cruz (DPRI).

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Introduction

The Integrated Disaster Risk Management Society (IDRiM) was officially established on October 15, 2009, in Kyoto, Japan. Since then, it has held international conferences in various countries, bringing together the scientific community interested in integrated disaster risk management worldwide. In 2024, the conference was held in Latin America for the first time, providing a unique opportunity to bring together global experts on integrated disaster risk management and enabling their interaction. Thus, the National Unit for Disaster Risk Management (UNGRD) organized the 14th annual international IDRiM conference with the IDRiM Society, Kyoto University, and the Disaster Prevention Research Institute (DPRI). Cartagena de Indias was the epicenter of the 14th edition of the Conference, entitled "Disaster-Resilient Communities for Life." This conference's focus reflects the government's overall vision of "Colombia, a Global Power for Life," which aims to lay the foundation for Colombia to emerge as a global leader in the collective pursuit of life, humanity, and the environment. The conference focused on integrated disaster prevention and mitigation, emergency response, and disaster recovery. It urged the scientific community to consider new perspectives beyond traditional risk management concepts, which appear insufficient to address emerging risks and uncertainties. Scheduled for two and a half days, from August 28 to 30, the conference provided a collaborative platform for knowledge exchange. IDRiM2024 in Cartagena was a unique space to foster dialogue and share experiences in the field. Under IDRiM's motto, "I dream, you dream, we all dream for a safer world," 2024 was the year in which Colombia envisioned a safer and more integrated country and region.

Attendees included researchers, academics, industry professionals, undergraduate and graduate students, public officials, government collaborators, non-governmental organizations, planners, and leaders. We also had the participation of the local and regional community. Participants presented their work in parallel sessions, posters, and special sessions. This year's attendance was the highest in the conference's history, setting a precedent for future meetings. IDRiM2024 has established itself as the most successful edition, with the largest participation of diverse stakeholders, enabling rich and enriching interactions.

Objective and relevant topics

The 14th Annual Conference of the International Society for Integrated Disaster Risk Management (IDRiM 2024) sought to explore cutting-edge knowledge, innovative solutions, and best practices in disaster risk management. It featured presentations covering case studies, research findings, emerging technologies (some region-specific), and innovative approaches to integrated disaster prevention and mitigation, emergency response, and disaster recovery. The event covered a wide range of topics and areas, providing a broad perspective for participants with diverse interests in current issues. It focused on four key thematic areas that addressed the most critical aspects of disaster risk management, resilience, and climate change adaptation.

Understanding Disaster Risk: In this first area, key issues such as climate justice, emerging risks, risk perception, and natural hazard modeling were analyzed. Experts discussed the importance of understanding the various factors that contribute to community vulnerability and how climate change is altering risk patterns. Advanced modeling tools and innovative approaches to identifying and anticipating hazards were explored to improve preventive and mitigation strategies at the local, national, and international levels.

Strengthening Disaster Risk Governance: This topic focused on how governance policies and structures can improve community resilience. Emphasis was placed on community participation, highlighting the importance of involving local populations in decision-making and developing solutions tailored to their contexts. Additionally, models of international cooperation that have been effective in disaster management were discussed, and inclusive approaches that prioritize considering the most vulnerable groups in planning and response processes were highlighted.

Investing in Risk Reduction for Resilience: In this section, participants discussed the urgent need to invest in disaster risk reduction as a key strategy for strengthening long-term resilience. Emerging technological innovations, such as the use of drones, artificial intelligence, and big data in disaster management, were discussed, along with resilient infrastructure capable of withstanding the stresses imposed by natural disasters. Furthermore, the importance of early warning systems, which can save lives and mitigate damage, was highlighted, emphasizing the need for these systems to be accessible, effective, and tailored to the specific needs of the most vulnerable communities.

Preparedness and Effective Response: The conference also focused on key strategies for effective disaster response, with a particular emphasis on post-disaster recovery and resource management during times of crisis. Best practices for ensuring a rapid and sustainable recovery were discussed, particularly regarding the efficient distribution of resources, coordination between local authorities and international actors, and the restoration of essential services to affected communities. In addition, topics related to planning for recurring disasters were addressed, as well as the role of economic resilience in emergency response.

Sessions

Day 1: August 28

Session 1. Climate Justice, Climate Change, and Emerging Risks
Session 2. Communication and education in DRM
Session 3. Exploring coastal marine hazards
Session 4. Risk perception, human behavior, and culture
Special Session 1: Introduction to the Scorecard Tool: Addendum for Multi-Hazard Early Warning Systems at the Local Level
Special Session 2. Diverse and Inclusive Voices, a Resilient Future. The State of Equality, Inclusion, Diversity, and Gender in the Face of the Climate Crisis and the Growing Number of Compound Disasters Worldwide
Special Session 3. Uncovering Risk Dynamics with Impact Chains: A Practical Session on Participatory Risk Analysis
Session 5. Geohazard modeling and forecasting
Session 6. Communication and education in DRM
Session 7. Risk identification, risk assessment, and evaluation of systemic and complex risks
Session 8. Risk perception, human behavior, and culture
Special Session 4. Resilient Colombia: Preparation and anticipatory action against the ENOS phenomenon, implementation of the National Network of Forest Brigades, and the ALERCOM System
Session 9. Natech Risk Management Perspectives
Session 10. Artificial intelligence, science, technology, and innovation
Session 11. Floods, rivers, and coastal erosion
Session 12. Risk perception, human behavior, and culture
Special Session 5. Continuing Implementation Science: Progress Update and Forward-Looking Suggestions
Special Session 6. The Benefits and Challenges of Transnational Research and Collaboration: Case Studies from the Field

Day 2: August 29

Session 13. Initiatives for resilient communities
Session 14. Artificial intelligence, science, technology, and innovation
Session 15. Risk identification in rural and urban environments
Session 16. Water resources and territorial planning
Special Session 7. From Natech Risk Management to Risk Governance to Build Territorial Resilience
Special Session 8. Economic Impact of Disasters in a Rapidly Changing Business Environment
Special Session 9. Am I at risk if an earthquake occurs?
Poster session

Session 17. Differential approaches to DRM
Session 18. Financial Assurance and Protection for DRR
Session 19. Community Participation and NGOs
Session 20. Adaptive capacity and vulnerability reduction to environmental and climate risks
Special Session 10. Community with Science: How to build a better relationship between society and science for disaster risk reduction
Special Session 11. Hospitals resilient to health emergencies and disasters, and emergency medical teams
Special Session 12. Digitizing paper-based participatory risk maps with the Sketch Map tool
Special Session 13. IDRiM Young Scientists Forum

Day 3: August 30

Session 21. Amazonia, indigenous and local communities
Session 22. Preparing for a Multi-Hazard Response
Session 23. Effective resource management and logistics coordination
Session 24. Early Warning Systems
Special Session 14. DesignSafe Training Session
Special Session 15. What is community-based resilient housing?
Special Session 16. Information Systems in Disaster Risk Management: Experiences from Antioquia and Medellín
Special Session 17. Collaborative Mapping and Multisectoral Networks: Promoting Inclusive Local Disaster Risk Management

Event figures

The event had 1,549 registrations and 1,032 in-person participants.
Participation of 30 of the 32 departments of Colombia, including:
Antioquia, Bolivar, Norte de Santander, Valle del Cauca, Boyaca, Santander, Cundinamarca, Risaralda, Sucre, Quindio, Valle, Guaviare, Atlantico, Caldas, Vichada, Cesar, Cauca, Magdalena, Huila, Putumayo, Choco, Meta, Caqueta, La Guajira, Nariño, Amazonas, Cordoba, Casanare, Guaviare and Vaupes.

Likewise, 200 municipalities in the country attended this international conference.
International participation comprised more than 20 countries, including Japan, Austria, the United States, Sweden, Brazil, Romania, India, the Netherlands, the United Kingdom, Canada, Chile, Germany, Italy, Argentina, Ghana, Australia, and others.
For the opening events, keynote addresses, panel discussions, and awards ceremony, the event enabled online participation, with many online participants, as shown below:

Date	Name	Link	Reproductions
10/28/2024	Event opening	https://www.youtube.com/watch?v=haExfzycLdE	1313 views
08/28/2024	Early warnings for everyone	https://www.youtube.com/watch?v=qFK-kcBG57M	318 views
08/29/2024	Investing in Risk Manage-ment	https://www.youtube.com/watch?v=qFK-kcBG57M	364 views
08/29/2024	Keynote Talks Day 2	https://www.youtube.com/watch?v=AjNJ2feZcFo	389 views
08/30/2024	Comprehensi-ve fire mana-gement	https://www.youtube.com/watch?v=DDkttsBOOCU	655 views
08/30/2024	Awards and closing cere-mony	https://www.youtube.com/watch?v=EtTv1vtIRPM	317 views
		Total views:	***3.356***

Images of the conference are available at the following link: https: //drive.google.com/drive/folders/19OvUOo25oAo-CDOxWcBPCrIkit02AI3J?usp=sharing

Program

14° IDRiM CARTAGENA, COLOMBIA
DISASTER RESILIENT COMMUNITIES FOR LIFE
August 28th to 30th 2024

UNGRD Unidad Nacional para la Gestión del Riesgo de Desastres

IDRiM FOR A SAFER WORLD

First day								
TIME (COL) Aug 28th	**TIME (CET) Aug 28th**	**TIME (JST) Aug 28th/29th**	**On-site Registration**					
8:00-8:30	15:00-15:30	22:00-22:30						
8:30-9:00	15:30-16:00	22:30-23:00	**Opening Ceremony** **Master of Ceremony** **Greeting: Ana Maria Cruz, President, IDRiM Society** **Greeting: Ana Milena Prada, UNGRD Risk Knowledge Deputy Local organizer** **Welcome: Carlos Carrillo, UNGRD Director** **(Special Guests: Ghisliane Echeverry- IDEAM, Julio Fierro-SGC, Diego Carrero-IGAC, Dorotea Cardona-Humboldt Institute, Capitán de Navío Alexis Grattz Bonilla-DIMAR)**					
9:00-9:45	16:00 - 16:45	23:00-23:45	**KEYNOTE SPEECH 1:** Climate Change and Climate Change Adaptation **Angelika Planitz; German Poveda; Chair:** Christian Euscátegui					
9:45-10:15	16:45-17:15	23:45-00:15	**PANEL DISCUSSION I: Water-centered planning** (Joana Pérez, Óscar Puertas, Paola Miranda)**; Chair:** Didier Tavera- National Federation of Departments					
10:15-10:45	17:15-17:45	00:15-00:45	Group Photo Coffee Break and stands					
TIME (COL) Aug 28th	**TIME (CET) Aug 28th**	**TIME (JST) Aug 28th/29th**		**First day Parallel Sessions I**				
				Room 1 (Barahona 1) **Session 1. Climate justice, climate change, and emerging risks** **Chair: Diego Carrero (IGAC)**	**Room 2 (Barahona 2)** **Session 2. Communication and education on DRM** **Chair (Hamilton Bean, University of Colorado Denver)**	**Room 3 (Barahona 3)** **Session 3. Exploring marine and coastal hazards** **Chair: Yoshio Kajitani (Kagawa University)**	**Room 4 (Barahona 4** **Session 4. Risk perception, human behavior, and culture** **Chair: Genta Nakano (Kyoto University)**	**Room 5 (Arsenal room):** **Special Session 1**	**Room 6 (Secretaría General room)** **Session 6. Special Session 2 and 3**
10:45-12:15	17:45 - 18:15	00:45-2:15	10:45–11:00	Preliminary study of isotopy of surface waters and soils in the Chingaza moor and Bogotá river – Jimmy Alejandro Muñoz Rocha – In person	Study of Disaster Prevention Learning Materials Using Historical Disaster Records – Soichiro Kurosawa – In person – YSS	Exploring morphological processes and the hazards that determine risks and resilience along the coastal barrier of Salamanca (Colombia). – Nelson E. Murillo Gómez – In person – YSS	Enhancing Tsunami Risk Communication through Map App Utilization Considering Residents' Background – Akihiro Suzuki – In person YSS	**Special Session 1:** Introduction to the Scorecard Tool: Addendum for Multi-Hazard Early Warning Systems at the local level	**Special Session 2:** Diverse and Inclusive Voices, a Resilient Future. The status of Equality, Inclusion, Diversity, Gender in the Face of Climate Crisis and Increasing Number of Compound

			11:00–11:15	Evolution and challenges of risk management in territorial planning instruments in Colombia – Marco Gamboa Ramírez – In person	A Review of What Matters in Climate Change Education based on Experiences in England – Mark Ashley Parry – In person – YSS	Possible instability of the continental slope and shelf off Cartagena de Indias - Bolívar, Colombia – Olga P Bohórquez-Orozco – In person	Collaborative Governance to Manage Sea Level Rise Hazards: A Tourism Case Study from the Basque Country in Spain – Giuseppe Aliperti – Online	– Cristobal López Maciel – UNDRR - Regional Office for the Americas and the Caribbean – By invitation only - In person	Disasters Worldwide - Funda and García Express interest in attending here
			11:15–11:30	Evaluation of the effect of climate change on flooding by tropical cyclones on the islands of San Andrés, Providencia and Santa Catalina – Wilmer Rey Sánchez – Virtual	Incorporation of risk management and climate change in the school curriculum, San Bartolomé de La Florida Educational Institution (N) 2006-2024 – Néstor Muñoz – In person	The Role of Catastrophe Models like the Florida Public Hurricane Loss Model in Ensuring Disaster Resilient Communities – Jean-Paul Pinelli – In-Person	Art as a platform for disaster risk communication, education, and awareness: developing a framework for art-driven responses to disasters – Florence Lahournat – In-person		
			11:30–11:45	Flood simulation and evaluation of traditional flood control measures: the case of the Ranchería River delta. – Jose Fragozo Arevalo – In person YSS	Educational strategies for disaster risk management at the National Pedagogical University Kennedy headquarters in Bogotá Colombia – Dario F. Tuta Romero – Online	Advances and challenges in accurate storm surge forecasting in San Andrés and Providencia – Claudia Urbano Latorre – In person	Understanding Climate Change Impacts in the UK: Insights from Public Perception Surveys – Mark Ashley Parry – In person		
			11:45–12:00	Advances in the understanding of isotopic variation in precipitation as a result of climate changes – Ana Milena Velásquez – In person	The Potential of Letters as a Disaster Prevention Communication Tool – Ryoga Ishihara – In person	Assessment of numerical modeling in simulating storm-induced coastal flooding in data-sacred areas– Case study: Belize – Thandar Tun Zin – Online YSS	Associations between Quality of Life and Disaster Risk Management: Replication of Taiwan Social Change Survey studies, in Kinki region, Japan – Ryo Ashida – In person – YSS		Rescheduled to Aug 29th Special Session 3: Unveiling Risk Dynamics with Impact Chains: a practical session on participatory risk analysis – Federica Romagnoli – United Nations University – In person Express interest in attending here
			12:00–12:15	Evaluation of Flood Events and Water Shortage in the Bogotá River Basin Under Climate Change Scenarios – Dairo S. Muñoz Pinzón – Online	Early education in risk management is the key to real awareness – María I Garzón González – In person	Storm Surge Prediction in San Andrés and Providencia: Integration of SIPSEM into Risk Management Strategies – Claudia P. Urbano-Latorre – In person			

TIME (COL) Aug 28th	TIME (CET) Aug 28th	TIME (JST) Aug 28th/29th		First day Parallel Sessions II					
				Room 1 (Barahona 1): Session 5. Geohazards modeling and forecasting Chair: Héctor Pérez (SGC)	Room 2 (Barahona 2): Session 6. Communication and education on DRM Chair: Hamilton Bean (University of Colorado Denver)	Room 3 (Barahona 3: Session 7. Risk Identification, risk assessment, and systemic and complex risk assessment Chair: Jorge Alpala (UNGRD)	Room 4 (Barahona 4): Session 8. Risk perception, human behavior, and culture Chair: Dorotea Cardona (Instituto Humboldt)	Room 5 (Arsenal room): Special Session 1	Room 6 (Secretaría General room): Special Session 3 and 4
12:15-13:45	18:15 - 18:45	2:15-3:45	12:15–12:30	Monitoring System for Risk Scenarios due to landslides movements SIMER – Edward A. Guerra Valencia – In person	Initial Preparation for Tsunamis in the Gulf of Urabá through an Environmental Education Process: Sapzurro, Chocó Caribe (Colombia), La Miel (Panama) and Turbo, Antioquia (Colombia). – Carlos A. Ríos-Uribe – In person	Disaster risk management and its relationship with the environment, planning, climate change, business continuity, technological risk in organizations in Colombia – Didier F. Pedreros – In person	Risk perception and community resilience: Challenges and responses to tropical cyclones in the insular area of the Colombian Caribbean – Samuel Alberto Castro González – In person	Introduction to the Scorecard Tool: Addendum for Multi-Hazard Early Warning Systems at the local level – Cristobal López Maciel – UNDRR - Regional Office for the Americas and the Caribbean – In person	...continued **Special Session 3:** Unveiling Risk Dynamics with Impact Chains: a practical session on participatory risk analysis – Federica Romagnoli – United Nations University – In person
			12:30–12:45	Implementation of a geotechnical classification system in the evaluation of risk due to landslides. Case study: rural connection road section in the Municipality of Carepa, Antioquia – Juan C. Guzman Martinez – In person	Action Research using the Community Strategy Planning Tool for Tsunami Evacuation – Takashi Sugiyama – Online	Integration of socio-ecological benefits as added value to the current approach to risk assessment and analysis in developing countries – Humberto C Tavera Quiroz – In person	Perception of the role of natural protected areas in disaster risk management: Chingaza National Natural Park Case – Betty Pedraza – In person		
			12:45–13:00	Methodological proposal for the evaluation of seismic vulnerability in low-income municipalities – Carlos E. Alvarado Flores – In person	Everyday-life preparedness as embedded learning – Kaori Kitagawa – In-Person	Deterministic and probabilistic analysis of fire action in steel structures with a focus on structural safety – Myriam Rocío Pallares Muñoz – In person	Disaster risk perception and preparedness index: tools for disaster risk reduction and building resilient communities. – Srahyrlandy Díaz – In person – YSS		**Rescheduled from Aug 29th** **Special Session 4:** RESILIENT COLOMBIA: Preparation and anticipatory action

			13:00–13:15	Occurrence and social impact of disasters: Case of landslides in Mexico – Srahyrlandy Díaz – In person - YSS	Seismic risk assessment for the city of Santiago de Cali, Colombia – Nathalie García-Millán – In person	Tools for chemical risk management in Colombian organizations – Angélica M. Carrasquilla Rodríguez – In person	Effects of climate change and the El Niño Phenomenon on labor productivity in Colombia – Johan A. García – In person YSS		against the ENSO phenomenon, implementation of the National Network of Forestry Brigades and the ALERCOM System – Jairo Bárcenas Sandoval – PNUD-MADS – In person Express interest in attending here
			13:15–13:30	Evaluation of the Incidence of Soil Cover and Geological Materials on the Erosive Dynamics of the Combia Creek Subbasin, Pereira, Risaralda – Alejandro Alzate Buitrago – In person	National policy on disaster risk management: key elements of the second update – Isabel Arboleda – In person	Unravelling the complex interactions among risk components through impact chain methodology: an application to Vaia storm study case – Federica Romagnoli – In person – YSS	The importance of Geoscientific studies in risk management – Julio Fierro, Servicio Geológico Colombiano – In person		
			13:30–13:45	Multi-Risk Instruments for Emergency Response: A multi-hazard and multi-risk assessment of the European Solidarity and Emergency Aid Reserve – Stefan Hochrainer-Stigler – In person	The incorporation of young people in disaster risk mitigation in the Americas and the Caribbean – Maria Del Mar Moreno – Online – YSS	Stochastic risk evaluation of volcanic ash hazards from large Sakurajima eruptions – Haris Rahadianto – Online YSS	Volcanic risk studies in Colombia: Beyond mathematical modeling – John Makario Londoño Bonilla – In person		
13:45-14:45	18:45 - 19:45	3:45-4:45	Lunch						
14:45-15:15	19:45-20:15	4:45-5:15	**KEYNOTE SPEECH 2: Early Warnings for All, Barbara Tapia, World Meteorological Organization** (Opening: Ghisliane Echeverry, Director IDEAM)						
15:15-15:55	20:15-20:55	5:15-5:55	**PANEL DISCUSSION II:** Early warning systems: a path for community participation in risk management (Carolina García, Barbara Tapia, Natalia Contreras, Genta Nakano) **Chair:** Sandra Martinez						
15:55-16:30	20:55-21:30	5:55-6:30	Coffee Break and stands						
				First day Parallel Sessions III					

TIME (COL) Aug 28th	TIME (CET) Aug 28th	TIME (JST) Aug 28th/29th		Room 1 (Barahona 1) Session 9. Natech Risk Management perspectives Chair: Zoltán Török (Babes-Bolyai University)	Room 2 (Barahona 2) Session 10. Artificial intelligence, science, technology, and innovation Chair: Michinori Hatayama (Kyoto University)	Room 3 (Barahona 3) Session 11. Flooding, river and coastal erosion Chair: Zoraida Piedraita (Minambiente)	Room 4 (Barahona 4) Session 12. Risk perception, human behavior, and culture Chair: Lina Dorado (Red Cross Colombia)	Room 5 (Arsenal room): Special Session 5	Room 6 (Secretaría General room): Special Session 6
16:30-18:00	21:30-22:00	6:30-8:00	16:30–16:45	Supporting Natech Risk management and governance in Colombia: changes in risk awareness using a serious game approach – Lina Parra – Online YSS	Free Access Remote Sensor Applications in Disaster Risk Management – Jorge A Alpala – In person – YSS	Assessment of physical vulnerability to flooding under land use change scenarios – Yelena Hernández-Atencia – In person	Community diagnosis methodologies for strengthening resilience to floods in Colombia - RAI project case study – Natalia Muñoz – In person	**Special Session 5:** Implementation Science continued: Progress update and forward-looking suggestions – Norio Okada – Kyoto University – Hybrid Express interest in attending here	**Special Session 6:** The Benefits and Challenges of Cross-National Research and Collaboration: Case Studies from the Field – Hamilton Bean – University of Colorado Denver – Hybrid Express interest in attending here
			16:45–17:00	Natech events in Colombia, a review from the ANLA and UNGRD databases – Rafael Amaya-Gómez – In person	Mapping climate services for disaster risk management: a systematic review and research gaps from a policy process perspective – Aboubacar Issaka Ousman Gaoh – Online – YSS	The rise in sea level and its link with coastal erosion in the Caribbean Costa Rican – Jose F. Valverde – In person	Analysis of historical-cultural constructions on socio-natural hazards and social vulnerabilities. Elements for risk management in Colombia – Yolanda T. Hernández – In person		
			17:00–17:15	Monte Carlo-Markov Chain Modeling for Estimating Industrial Downtime of Storage Tanks in Earthquake-Induced Natech Events: An Alternative Approach to Industrial Disaster Risk Assessment – Peiyin Jiang – Online – YSS	Free Access Remote Sensor Applications in Disaster Risk Management – Jorge A Alpala – In person – YSS	Vulnerability to floods in a community in northern Colombia: The case of Villa Fátima, Riohacha, La Guajira – Jhonny I. Pérez-Montiel – In person	Living under the shadow of the Galeras Volcano: Sociocultural perception of risk in the rural community of Genoy (Pasto, Colombia) – Luis Alberto Martínez Sierra – Online		

			17:15–17:30	Wind vulnerability model for components of refinery plants or industrial facilities: a preliminary study – Nahuel Bonfante – In person – YSS	Use of new and emerging Geospatial technologies to improve official statistics in Colombia and their potential use in disaster risk management – Raul E Ospina Villalobos – Online	Analysis of the flood level on the coast of the municipality of Ciénaga-Magdalena, as an element for control, administration and management of the risk of flooding due to marine dynamics – Cristian M. Hincapie Lopera – In person	Vulnerability analysis models for comprehensive risk management – Jorge I. López Jaramillo – In person			
			17:30–17:45	Transboundary Accident Risk Hot-Spot Analysis for Tailings Ponds using GIS – Zoltán Török – In person	New methodologies for disaster risk management in essential structures in the department of Sucre – Susana Barrios – Online YSS	Identification and prioritization of sectors with evidence of river erosion in the Magdalena River, Colombia – Alvaro Parra – Online	Managing disasters in a context of armed conflict: Historical lessons from the Colombian case – Oscar A. Gómez – Online			
			17:45–18:00	The Development of Regional Risk Assessment Methodology for Natech Events: In the Case of Earthquake-triggered Baijiu Spills - Yiwen PAN - Online	Methodology to estimate earthquake damage in buildings using drones – Michel Bolaños Guerrero – In person	Characterization of flood hazards as support for territorial planning: Case study of populated centers Mojana Region Colombia – Nelsy Verdugo R – Online				
18:30-20:30	22:30-1:30	8:30-10:30		**Inaugural Reception and traditional dance performance**						

Second day

TIME (COL) Aug 29th	TIME (CET) Aug 29th	TIME (JST) Aug 29th/30th	
8:15-8:30	15:15-15:30	22:15-22:30	**Greetings: Ana Milena Prada**
8:30-9:30	15:30-16:30	22:30-23:30	**Investing in Disaster Risk Management** **KEYNOTE SPEECH 3. Yasuhide Okuyama:** Disaster Resilient Communities for Life: Why do we need economic analysis of disasters? **KEYNOTE SPEECH 4. Luis Gamarra:** Resilient Recovery and Disaster Risk Reduction: Reflections and Challenges **KEYNOTE SPEECH 5. Paul Kovacs:** Striving for transformative increases in resilience

9:30-10:00	16:30-17:00	23:30-00:00	**PANEL DISCUSSION III** (Luis Gamarra, Paul Kovacs, Jairo Bárcenas) **Chair:** Hirokazu Tatano						
10:00-10:30	17:00-18:30	00:00-00:30	Coffee Break and stands						
TIME (COL) **Aug 29th**	**TIME (CET)** **Aug 29th**	**TIME (JST)** **Aug 29th/30th**	**Second day Parallel Sessions I**						
				Room 1: **Session 13. Initiatives for Resilient Communities** Chair: Dorotea Cardona (Humboldt Institute)	**Room 2:** **Session 14. Artificial intelligence, science, technology, and innovation** Chair: Jairo Bárcenas (UNDP)	**Room 3:** **Session 15. Risk identification in rural and urban environments** Chair: Sandra Mendoza (UNGRD)	**Room 4:** **Session 16. Water resources and land use planning** Chair: Ana Milena Prada (UNGRD)	**Room 5 (Arsenal room):** **Special Session 7**	**Room 6(Secretaría General room):** **Special Session 8 and 9**
10:30-12:00	18:30-19:00	00:30-2:00	10:30–10:45	Strengthening Resilience in Higher Education: A Focus for the Americas and the Caribbean Region – Víctor García / Luis Martínez / Carlos García-Ocampo (REDULAC) – In person	Design early warning system for vegetation cover fires in the municipality of Valledupar using remote sensors – Eric Perico – In person – YSS	National Seismic Risk Model of Colombia – Monica Arcila & Héctor Pérez – In person YSS	Evaluating climate change vulnerability and risk management strategies for water security in coastal Colombian vulnerable communities – Samuel D. Pinto Argel – In person – YSS	**Special Session 7:** From Natech Risk Management to Risk Governance for Building Territorial Resilience – Ana María Cruz – Disaster Prevention Research Institute, Kyoto University – Hybrid 1. Marie-Ange Baucher from OECD, France, and Elisabeth Krausmann, Joint Research Centre, European Commission, Italy: “Managing Risks From Natural Hazards to Hazardous Installations (Natech) - A Guide for Senior Leaders in Industry and	Rescheduled from Aug 28th **Special Session 8:** Economic Impact of Disasters in a Rapidly Changing Business Environment – Yoshio Kajitani – Kagawa University – Hybrid Express interest in attending here
			10:45–11:00	Experiences in building resilience and sustainable actions from the Colegio Mayor de Antioquia University Institution – Edna Margarita Rodríguez-Gaviria – In person	Volcanism in central and southwest Colombia: origin, evolution, hazard, volcanic soils and geotourism – Laura Sánchez-Torres – Online		The fluvial-torrential avenue of Mocoa, Putumayo and its lessons and learnings for territorial planning – Saira P. Romo – In person		
			11:00–11:15	Reflections on measuring disaster resilience at community scale: lessons from applying the flood and climate resilience measurement tool – Reinhard Mechler – In person	Implementation Science for Disaster Risk Reduction – A Critical Review – Subhajyoti Samaddar – In person	Use of Qualitative Methodologies for Understanding Risk in Road Infrastructure – Leidy Jaramillo/Carlos A. García-Ocampo – In person	Water security and resilient cities: comparison between the cases of Brazil, Colombia and Mexico – Francisco Fabbro Neto – Online		

			11:15–11:30	Multi-temporal evaluation of community resilience to disasters due to technological risk in commune 10 of the municipality of Dosquebradas – Nicolás Giraldo Hernández – In person YSS	Digitalization of Participatory Mapping in Integrated Disaster Risk Management - Potential and Limitations of the Sketch Map Tool for Humanitarian Organizations – Anne Schauss – Online	Green Digital Transition: Integrating Carbon Neutrality for Sustainable Tourism Development - SORZABAL-ONLINE	Recharge of lentic systems in paramo areas case study: Origin of the recharge of the Laguna Negra system located in the Oceta paramo from the development of a conceptual hydrogeological model – Sebastian F. Alvarado Amezquita – In person – YSS	Public Authorities." 2. Maria Camila Suarez Paba, UNGRD, Colombia: "Perspectives of Natech risk governance in Colombia." 3. Dimitrios Tzioutzios, and Nicola Paltranieri, NTNU, Norway: "Strengthening Energy Systems and Critical Infrastructure: Key Takeaways from Natech2024." 4. Luke Hanst from Portland State University, United States: "Oregon's Critical Energy Infrastructure Hub: Translating Research and Policy into Rule and Implementation." 5. Yezid Nino, United Nations Office for Disaster Risk Reduction – Regional Office for the Americas and the Caribbean: Title (tbc) 6. Xiaolong Luo, IDMR, Sichuan University, China: "Climate Change Impacts on Natech Risk." Express interest in attending here	
			11:30–11:45	Promoting disaster preparedness and resilience by co-developing disaster risk stakeholder support tools for managing the systemic risks associated with multi-hazards – Funda Atun – In person	Hybrid Monitoring System for Assessment of Thermal Effects on Concrete Bridge Girders – José M. Benjumea – In person	Evaluation of the response of a hospital system to disasters – Luisa F. Pulido Santos – In person YSS	Logic of care in inter-disaster phase: Managing a civilian disaster volunteer center at water-related disaster-prone area in Japan – Ryo Tsuchida – Online – YSS		**Special Session 9:** Am I at risk if an earthquake occurs? – Ana Beatriz Acevedo Jaramillo – Universidad EAFIT – In person Express interest in attending here
			11:45–12:00	Resilient Colombia: Preparation and anticipatory action against the El Niño Phenomenon and implementation of the National Network of Forestry Brigades – Jairo Barcenas –	Technologies for community disaster risk management – Hugo Marmol & Jairo Bárcenas – In person	Monitoring of geophysical variables (seismic, electrical, magnetic and gas records) in the Andean and national presence headquarters of the National University of Colombia (UNAL) through the UNAL Geophysical Network – Carlos Alberto Vargas Jiménez – In person	Internal forced displacement due to environmental factors, a new legal paradigm in the Colombian state – Zaida Camila Rincón – In person		
12:00-13:00	19:00-20:00	2:00-3:00	Lunch							

13:00-14:00	20:00-21:00	3:00-4:00	**Poster session**					**Rescheduled from Aug 29th** **Special Session 3: Unveiling Risk Dynamics with Impact Chains: a practical session on participatory risk analysis** – Federica Romagnoli – United Nations University – In person Express interest in attending here
TIME (COL) **Aug 29th**	**TIME (CET)** **Aug 29th**	**TIME (JST)** **Aug 29th/30th**	**Second day Parallel Sessions II**					
				Room 1: **Session 17. Differential approaches of DRM** **Chair: Jeisson García (UNGRD)**	**Room 2:** **Session 18. Financial assurance and protection for DRM** **Chair: Kakuya Matsushima (Kyoto University)**	**Room 3:** **Session 19. Community engagement and NGOs** **Chair: Sandra Martínez (UNGRD)**	**Room 4:** **Session 20. Adaptive capacity and reducing vulnerability to environmental and climate risks** **Chair: Joana Pérez (UNGRD)**	**Room 5 (Arsenal room):** **Special Session 10 and 11**	**Room 6 (Secretaría General room):** **Special Session 12 and 13**
14:00-16:00	21:00-22:00	4:00-6:00	14:00–14:15	Villa B a scenario of socio-environmental impacts after the floods in Sucre 2010 – Lila Y. Correa Cazado – In person – YSS	A simple model of the excess-of-loss insurance contract for a government in a disaster-prone country – Muneta Yokomatsu – Online	Territorial Planning, Public Policy Management and Urban Agenda: resilience of cities and their territories in the context of climate change and socio-environmental vulnerabilities – Maria Galleno de S, Oliveira – Online	Gauging and understanding environmental knowledge in ecosystem services conservation – Tlou D. Raphela – Online	**Special Session 10:** Community with Science - How to build a better relationship between society and science for disaster risk reduction – Genta Nakano – Disaster Prevention Research Institute, Kyoto University – Hybrid Express interest in attending here	**Special Session 12** Digitalizing Paper-based Participatory Risk Mapping with the Sketch Map Tool – Anne Schauss – Heidelberg Institute for Geoinformation Technology (Germany), Colombian Red Cross, Bogotá (Colombia), Universidad Nacional de Colombia sede Manizales (Colombia) – Hybrid (PC Required) Express interest in attending here
			14:15–14:30	Awareness on Women's Empowerment and the Role of Theatre: A Study in a village of West Bengal, India – Debkalpa BasuDas – Online – YSS	An empirical analysis about risk financing measures and the post-disaster business recovery process – Kakuya Matsushima – In person	Analysis of Individual Name-based Tsunami Evacuation Drill Data from both Qualitative and Quantitative Perspectives – Hiroki Tateyama – Online – YSS	Capacity Building for DRR in the Built Environment in Latin America and the Caribbean (BERLAC) – América Bendito – Online		

			14:30–14:45	The differential ethnic approach as a strategy to reduce disaster risk in Colombia – María del Mar Moreno Gómez – Online YSS	Definition of seismic risk transfer strategies in municipalities of Colombia – Jairo A. Valcárcel Torres – In person	Community Participation in Disaster Risk Reduction: Emic and Etic Perspectives – Subhajyoti Samaddar – In person	Sustainability-oriented risk management: A route to improve the quality of life in small cities – Graciela Peters G – In person		
			14:45–15:00	Memorializing disaster: community dynamics and memorial spaces. The case of Storm Xynthia in La Faute sur Mer, France – Florence Lahournat – In-person	Managing Sovereign Climate Risk in Vulnerable Developing Countries Smart Support Guidance for Donors and Policy Makers – Qinhan Zhu – Online	Perspectives and practices of youth, a cooperation proposal for education on knowledge of disaster risk management in Colombia – Juan Esteban Castrillón Casas – In person – YSS	Challenges of Coastal Adaptation: Ecosystem-Based Approach in the Colombian Caribbean – Johan C. Casadiego Estévez – In person – YSS		
			15:00–15:15	Role of Civil Defence organization in community capacity building during pre-disaster phase: A Study of India – Kartic Sharma – Online – YSS	Study on the interference mechanism among multi-hazard integrated risk, economy, and population based on multi-source data – Yun Chen – Online	Disaster risk management, a fundamental strategy in sustainability management – Mauricio Serna Yepes – In person YSS	Ungovernable social production housing, three decades of exclusion – Claudia Patricia Coca Galeano – In person	**Special Session 11:** Resilient Hospitals against Health Emergencies and Disasters, and Emergency Medical Teams – – World Health Organization (WHO)-Pan American Health Organization (PAHO)-Ministry of Health – Hybrid Express interest in attending here	**Special Session 13:** IDRiM Young Science Forum – Mark Ashley Parry – Northumbria University – Hybrid Express interest in attending here
			15:15–15:30	Disasters and their impact on violence against women: A correlational analysis for the Peruvian case 2014 – 2021 – Héctor Javier Bendezú Jiménez – Online	SURA Regional Resilience Methodology – Juan D. Rendón – In person	Characterization of the social dynamics related to the occurrence of forest fires and participatory contributions for their reduction in the department of Vichada, Colombia – Alejandra Reyes Palacios – In person	Assessment of the Ripple Effect of Supply-side Capacity Loss Caused by the Compound Hazards: Flood Disaster and COVID-19 – Lijiao Yang – Online		
			15:30-15:45	Community Maps: a participation tool in Disaster Risk Management – Evelin Langebeck – In person – YSS	Estimating the economic impact of Taal Volcano Eruption using Electricity consumption – Ma. Flordeliza P. Del Castillo – Online – YSS	Knowledge management, prevention and risk reduction at the local level, using GIS tools and practical actions at the bioengineering level for mitigation. – Edgar Armando Malpica Correa – In person	Usefulness of Disease Surveillance Data in Enhanced Early Warning of the Cholera Outbreak in Southwest Cameroon, 2018 – Reine Kadia – Online – YSS		

			15:45-16:00			The digitization of community cartography with the Sketch Map Tool in the Vulnerabilities and Capabilities Analysis (AVCA) of the Colombian Red Cross – Eduard G. Ruiz – In person	SIATA: two decades of innovation in early warnings for Medellín and the Aburrá Valley – Luz J. Mejía-Chavarriaga – In person		
16:00 - 16:30	22:00-23:30	6:00-6:30	Coffee Break and stands						
16:30-16:50	23:30-23:50	6:30-6:50	**KEYNOTE SPEECH 6 Virginia Murray: UNDRR/ISC Hazard Information Profiles – building engagement with disaster resilient communities**						
16:50-17:10	23:50-24:10	6:50-7:10	**KEYNOTE SPEECH 7 Aniello Amendola: The Milky Way - Risk and Literature** **Chair:** Carlos Carrillo, Director, UNGRD						
17:10-17:25	24:10-24:25	7:10-7:25	**Questions and discussion Keynotes 6 and 7**						
17:25-17:30	24:25-24:30	7:25-7:30	**Closing of Second day**						
17:30-18:30	24:30-00:30	7:30-8:30	**IDRiM General Assembly**						
Third day									
TIME (COL) **Aug 30th**	**TIME (CET)** **Aug 30th**	**TIME (JST)** **Aug 30th/31 st**	**KEYNOTE SPEECH 8: Towards sustainable fire regimes: an ecological approach.** **Juli Pausas**						
8:00-8:30	15:00-15:30	22:00-22:30							
8:30-9:10	15:30-16:10	22:30-23:10	**PANEL DISCUSSION IV: Integrated Fire Management: Living with fire on a burning planet** **Juli Pausas, Laura Ponce, Marcos Quiroga; Chair: Maria Constanza Meza Elizalde - Hybrid**						
9:10-9:40	16:10-16:40	23:10-23:40	Coffee Break and stands						
TIME (COL) **Aug 30th**	**TIME (CET)** **Aug 30th**	**TIME (JST)** **Aug 30th/31 st**	**Third day Parallel Sessions I**						
9:40-11:10	16:40-18:10	23:40-1:10		**Room 1:** **Session 21. Amazonia, indigenous and local communities** **Chair: Evelin Langebeck (UNGRD)**	**Room 2:** **Session 22. Preparedness for multi-hazard response** **Chair: Laura Salgado (UNGRD)**	**Room 3:** **Session 23. Effective resource management and logistics coordination** **Modera: Claudia Rodríguez (IDIGER)**	**Room 4:** **Session 24. Early warning systems** **Chair: Barbara Tapia (WMO)**	**Room 5 (Arsenal room):** **Special Session 14 and 15**	**Room 6 (Secretaría General room):** **Special Session 16 and 17**

			9:40–9:55	Community maps for risk management with an ethnic focus – Evelin Langebeck – In person – YSS	What prevents people from early evacuation? In case of Licungo River basin, Mozambique – Shingo Nagamatsu – In person	Model building for developing effective countermeasures against supply chain risks on the global economy: A Case of the Japanese Automotive Industry – Yasuhiro Akakura – In person	EWS as an instrument for disaster risk management – Stephania Suarez – In person		
			9:55–10:10	Indigenous cultural practices for reducing the risk of wild fires – Amazonia +, Bibiana Bilbao – In-person	Theoretical Classification for Business Continuity Strategy: Consideration from Japanese Companies – Yohei Chiba – In person	The truths when applying emergency and contingency plans, the enigmas of budgetary value: emergency due to water shortage in the city of Yopal – Luz Mireya Patiño Salcedo – In person	Participatory monitoring to strengthen the early warning system community responses to floods and flash floods in mountainous regions. Manizales ravine case study, Manizales. – Maria J. Henao Salgado – In person – YSS	**Special Session 14:** DesignSafe training session – Jean-Paul Pinelli – Florida Tech – In person Express interest in attending here	**Special Session 15:** Information systems in disaster risk management: experiences from Antioquia and Medellín – DAGRAN, DAGRD – In person Express interest in attending here
			10:10–10:25	Disaster risk reduction strategy with a differential ethnic approach for the Awá and Pastos indigenous peoples, in the Department of Nariño, Colombia – Andrés Velásquez Sánchez – Online	Knowing the risks of my territory allows me to safeguard lives, Oi, oi, the tsunami can come – Liner Fabiola Salazar Torres – Online	Modeling Food Supply Dynamics in Disaster Refugee Camps: A System Dynamics Approach – Elyn Solano Charris – In person	Early warning system of the department of Risaralda, technical/technological component – Juan C. Berrio – In person		
			10:25–10:40	Collaborative Research Action “Tropical Forests: Global Implications and Pressing Actions” (FORESTS 2024) - Belmont Forum – Hilario Espinosa – Online	From local to national; of emergency response and effective rehabilitation – Carlos E. Matiz Ramírez – In person	Articulation of emergency business plans with Mutual Aid Committees, an effective alternative for risk management governance in micro territories. – Londer Guiovanny Camargo Garcia – In person	Forecasting, Evaluation and Mitigation of Tsunami Risk on the Colombian Pacific Coast, Contribution to Risk Management – Ronald E Sánchez Escobar – In person		

			10:40–10:55	Biodiversity, People and Territories - Reinaldo Lourival, Executive Director of the - Terra Brasilis Institute for Socio-Environmental Development	The recurrence of the "ends of the world" for marginalized groups in climate disaster and recovery contexts: perspectives on gentrification and displacements – Augusto Cesar Oyama – In person – YSS	Implementation of Prevention and Response Strategies to Interface Forest Fires in Cerro Quitasol de Bello - Antioquia – Hernan D. Acosta Gonzalez – In person	Early Warning System to prevent Floods and Landslides Movements – Peru Project – Johann Alexander Vera Mercado – In person YSS	**Special Session 16:** What is resilient housing with a community focus? – Manuela Pinilla Rodríguez – Build Change – In person Express interest in attending here	**Special Session 17:** Collaborative mapping and multi-sector networks: let's promote inclusive local disaster risk management – Juan Arellano Valdivia – Humanitarian OpenStreetMap – In person Express interest in attending here
			10:55–11:10		Economic Impacts of Complex Disasters Affecting the Twin Ports of Los Angeles and Long Beach – Adam Rose – Online		Tsunami breaking boundaries: lessons learned from the Hunga Tonga - Hunga Ha'apai tsunami of January 2022 – Paola Quíntero – In person		
11:10-11:40	18:10-18:40	1:10-1:40	STANDS							
11:40-12:00	18:40-19:00	1:40-2:00	Awards Ceremony							
12:00-12:15	19:00-19:15	2:00-2:15	IDRiM2025 Host							
12:15-12:30	19:15-19:30	2:15-2:30	**Closing Ceremony**							
12:30-13:00	-	-	LUNCH BOX							
14:00-16:00	21:00-23:00	4:00-6:00	**YSS and community forum** **Addressing Local Ethnic Resilience: Local Governments and Ethnic Communities**			**First Meeting of Departmental Coordinators of Disaster Risk Management**				

FIRST DAY

AUGUST 28, 2024

Session 1:

Climate Justice, Climate Change, and Emerging Risks

Chair: Diego Carrero (IGAC)

Preliminary isotopic study of surface waters and soils in the Chingaza moorland and the Bogotá River

Jimmy Alejandro Muñoz[1*], Maribel Moreno, Ana Milena Velásquez[1], Andrea Rocha[1], Mayda Arrieta[1], Sergio Gaviria

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The city of Bogotá currently faces a drinking water shortage, affecting approximately 10 million inhabitants. Understanding the dynamics of water and soil in the main tributaries, such as the Chuza Reservoir and the Bogotá River, is crucial for developing effective policies and regulations to protect these ecosystems. Over the last decade, isotopic tools such as H-2 and O-18 isotopes have been utilized to enhance understanding of the water cycle components and improve assessment of water quantity, quality, and sustainability. The C-13 isotope is used as a biomarker because it provides information on environmental and climatic conditions, soil type and moisture, and the type of vegetation that developed in these study areas. N-15 is used as a source tracer to differentiate anthropogenic contaminants in soils. The Colombian Geological Survey conducted a visit to the Bogotá water supply system (Chingaza - Bogotá River), where soil and surface water samples were collected to obtain a preliminary analysis of the isotopic behavior of both matrices within this system during the wet season. Approximately 19 liquid water samples were collected for δ 2 H and δ 18 O isotopes, and 6 soil samples were collected for C-13 and N-15 isotope analysis.

The results obtained from δ 2 H and δ 18 O of the collected samples present the same isotopic characteristics with values ranging from -74.6 to -81.2 mUr for δ 2 H and from -11.69 to -10.25 mUr for δ 18 O, which leads to think that the temporality and origin of the water is the same. The rainwater samples present a high local recycling process, where successive evaporations and precipitations of the analyzed water are experienced and one water sample presented a marked evaporation process, which makes it located below the meteoric lines. It is observed that the results of carbon isotopic ratios in soils are located between -27.43 ‰ ± 0.28 ‰ and -23.84 ‰ ± 0.25 ‰, which allows to distinguish the type of plant material from which the analyzed organic matter was derived, since isotopic signatures between -30 ‰ and -24 ‰ for δ 13 C are corresponding to plants that were formed through the C3 formation cycle or Calvin Cycle. The nitrogen isotopic results (δ 15 N) between 3.3‰ ± 0.1 ‰ and 5.2 ‰ ±

0.1 ‰, allow us to conclude that they are within the typical isotopic ratio range for samples corresponding to plants that were formed using the C3 photosynthetic cycle or Calvin Cycle (Glaser, 2005) (Raghumani, 2021).

Keywords: Isotopic ratios, deuterium, meteoric line, water cycle, Chingaza.

Evolution and challenges of risk management in Colombia's territorial planning instruments

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Risk management in planning in Colombia dates back to the late 1980s, almost simultaneously with the issuance of Decree Law 919 of 1989, which organizes the National System for Disaster Prevention and Response, and Law 9 of 1989 on comprehensive development plans, which states that municipalities must reserve the necessary land for the relocation of settlements at risk, establishes the possibility of expropriating lots for the relocation of these settlements, and creates the need for municipalities to carry out an inventory of human settlements that presented a high risk.

The enactment of Law 388 of 1997 brought about a significant change in territorial planning, and this law implicitly integrated the regulations of the National Environmental System and the National Planning System. However, the scope of risk management in the new instruments, known as Territorial Planning Plans, was unclear. It simply noted the need to assess hazards, vulnerability, and risk. Still, it did not define which phenomena and how they would be incorporated, beyond stating that high-hazard zones were protected areas and the need to relocate settlements at unmitigated risk.

In 2014, Decree 1807 was issued on the incorporation of risk management into planning. For many, this was a necessary rule to avoid anarchy in the process of agreeing on plans with environmental authorities. For others, it was a technically demanding rule that made it even more expensive and difficult for municipalities and districts to review their planning instruments.

Over this time, significant technical advances have been made. We have moved from applying heuristic methods in hazard zoning to using primarily statistical, deterministic, and probabilistic methods, among others. The SGC has methodologies for hazards caused by landslides and torrential floods, but, above all, management has ceased to be an exclusive subject of earth sciences and civil engineering, moving toward a multidisciplinary approach. There is still a long way to go; we need to integrate other hazards and phenomena, primarily technological ones, and perhaps we should focus more on vulnerability in the new stages of land-use planning.

Keywords: Risk management, land use planning.

Assessment of the impact of climate change on tropical cyclone flooding on the islands of San Andrés, Providencia, and Santa Catalina

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Due to the geographic location of the San Andrés, Providencia, and Santa Catalina (SPSC) archipelago, this part of Colombian territory is the most exposed to flooding by tropical cyclone (TC) storm surge. Among the hazards associated with TCs, flooding typically causes the most significant damage. This study evaluates the effect of climate change on storm surge inundation in the SPSC archipelago. A hydrodynamic model was deployed to model storm surge and TC inundation, with a maximum spatial resolution of 30 m in flood-prone areas. The model was surface forced with synthetic TC wind and pressure fields generated for both past and future climates under climate change scenarios, considering the shared socioeconomic trajectories emanating from the Sixth Report of the Intergovernmental Panel on Climate Change. This methodology enabled the generation of synthetic storm surge and TC inundation scenarios for these islands, each of which was assigned a corresponding probability of occurrence.
Preliminary results include storm surge inundation maps of the CT with associated return periods, both for past and future climates, as well as the identification of areas with human settlements exposed to flooding. Additionally, flood maps will be displayed, considering adaptation measures for disaster risk reduction and integrating local socioeconomic considerations, as these are essential for successful implementation.
The results of this work provide decision-makers with tools to design and implement coastal flood protection measures.

Keywords: Storm surge, Tropical cyclones, Archipelago of San Andrés, Providencia and Santa Catalina, Numerical modeling.

Flood simulation and evaluation of traditional flood control measures: the case of the Ranchería River Delta

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A simulation of a flood event of the Ranchería River (RR) is presented, in its final stretch known as the delta, adjacent to the urban area of Riohacha, La Guajira. Two-dimensional hydraulic modeling was implemented using IBER software. Flood events were identified through a goodness-of-fit analysis, and a daily hydrograph was reconstructed for an event during the rainy season in September 2011. The effect of a wall as a flood control measure was evaluated. The results confirm the vulnerability of the Villa Fátima community in this area to RR flooding. The evaluation of the wall as a containment alternative reveals that these types of structural measures do not always produce the expected effects; on the contrary, in some cases, they generate adverse effects, such as increased hydraulic risk (Juárez et al., 2021). It was found that the construction of the wall would alter the dynamics of flood distribution in the RR delta, increasing water levels to other unaffected areas or with minimal effects on the alternative without a wall. Another potential side effect of building this wall is that, in less minor events, it could prevent flooding, generate a false perception of security, and lead to increased housing settlement in the area near the structure. This increases the number of exposed assets and people, thereby increasing the risk of flooding (Pérez et al., 2018). The results highlight a paradigm shift that has been discussed in recent years: implementing ecosystem-based measures, first considering the conservation of river dynamics and natural spaces, to manage floods and other types of disasters in a sustainable manner that benefits ecosystems and the human environment (Huang et al., 2020; Juárez et al., 2021).

Keywords: Simulation, Floods, Flood, IBER, Flood control.

Advances in the understanding of isotopic variation in precipitation due to climate change

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In recent years, stable isotopes in water (oxygen-18 (18O) and deuterium (2H)) from precipitation and water vapor, as well as second-order parameters (e.g., deuterium excess, hereafter d-excess= 2H-8* 18O; Dansgaard, 1964), have provided reliable and novel data for studies of isotopic variation in precipitation due to climate change, the construction of local meteoric lines, the development of hydrogeological studies, and the generation of global circulation models (GCMs) for paleoclimate studies (Haese et al., 2013; Dittmann et al., 2016). At the CAN headquarters of the Colombian Geological Survey (SGC) in Bogotá DC, monthly precipitation has been collected since June 2022 and weekly rainfall since March 2024 using a Palmex type collector. Stable isotope analysis of rainwater was performed at the facilities of the Nuclear and Geochrological Research Group of the Directorate of Nuclear Affairs - SGC using a LWIA-45-EP analyzer from Los Gatos Research (ABB Ltd, Canada) by Off-Axis ICOS laser spectroscopy.

Using data on the isotopic ratios of $\delta^{2}H$, $\delta^{18}O$, and d-excess precipitation, we aim to analyze interannual and seasonal isotopic variations in Bogotá, in combination with rainfall data. The objectives are: a) to understand the isotopic change in precipitation during dry and wet seasons, b) to understand the variation in the local meteoric line due to climatological anomalies, and c) to understand the possible atmospheric moisture transport mechanisms involved in isotopic changes.

Keywords: Isotopy, Deuterium excess, Precipitation, Moisture transport, Climate change.

Assessment of Flooding and Water Shortage Events in the Bogotá River Basin Under Climate Change Scenarios

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Climate change and extreme events, such as the El Niño-Southern Oscillation (ENSO), pose critical challenges to the sustainability of water resources. In the Bogotá River basin, located in Cundinamarca, Colombia, these events cause drastic fluctuations in precipitation patterns, alternating between periods of intense rainfall and severe droughts. During La Niña episodes, heavy rainfall increases the risk of flooding, while El Niño induces droughts that decrease reservoir levels and river flows, leading to water rationing. This study evaluates flooding and water shortage events in the Bogotá River basin in the context of extreme climate change scenarios. To this end, methodologies used to assess the robustness and resilience of logistics systems were adapted to the region's water system, including the implementation of a multi-objective linear programming (LP) model. This model is essential for representing the 22 hydrographic subbasins, 25 river monitoring stations, and 9 reservoirs that regulate both river levels and water supply to the population. The study's findings reveal deficiencies in the system's robustness and resilience, underscoring the urgent need to develop and implement strategies that enhance the system's capacity to withstand extreme conditions. These improvements are crucial to ensuring the water system's operability and sustainability in the face of adverse climate scenarios.

Keywords: Climate change, Water shortage, Flood, robustness, resilience.

Session 2.

Communication and education in DRM

Chair:
Hamilton Bean
(University of Colorado Denver)

Study of Disaster Prevention Learning Materials Using Historical Disaster Records

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The records of historical disasters often contain information about events that are difficult to understand empathetically today. These events have a learning effect that brings to light "The Hidden Problems," which are issues that are rarely addressed in disaster education due to their unique characteristics. However, anyone can be a stakeholder in a disaster. This study aims to create innovative disaster education materials that leverage the revealing effects of historical disasters and develop an educational theory that contributes to raising awareness and activating discussion of "The Hidden Problems." Most disaster education practices have focused on events that can be sympathetically understood in the present day, drawing on historical disaster records to raise learners' awareness of disaster prevention. This study focused on events that are difficult to comprehend empathetically in the present day, as documented in historical disaster records, which have been less frequently discussed in past disaster education. Since the conditions surrounding disasters in historical times differed significantly from those of today, many historical disaster records contain descriptions of events that are unfamiliar to people today. The gaps between the present day and such events have the effect of bringing "The Hidden Problems" to the surface.

Keywords: Disaster education, learning materials, historical disasters

A Review of What Matters in Climate Change Education based on Experiences in England

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Climate change, a dire 21st-century challenge, poses a global threat to humanity, including in the United Kingdom. Education stands as a crucial tool for combating and adapting to its impacts. However, global provision of climate change education varies, with some regions lacking formal programs. In England, climate change education was introduced into the national curriculum in 1995, typically for students aged 11 and above. Yet, the academization of schools from the early 2000s granted schools the choice to omit climate education, resulting in an overall lack of clarity on its extent among the youth. This lack of information is amplified by teachers who feel ill-equipped or uncomfortable addressing what they perceive as contentious topics. The ethical dilemma deepens when teachers opt not to broach or provide incomplete information on climate change to students. It is worth noting that most of the public and teachers express a desire for climate change education in schools, with many advocating for its expansion. However, this paper brings to the fore a range of core principles and queries that are all too frequently overlooked in addressing what really matters in climate change teaching and learning, as informed by the case of the United Kingdom and more widely.

Keywords: Climate change, Education, United Kingdom

Incorporation of risk management and climate change into the school curriculum, San Bartolomé de La Florida Educational Institution (N) 2006-2024

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The experience of incorporating risk management and climate change into the school curriculum at the San Bartolomé Educational Institution in the municipality of La Florida, Nariño, Colombia, began in 2005 after the reactivation of the Galeras Volcano. From then on, in 2006, it was structured transversally, that is, across all areas of the curriculum, with the different components of volcanic hazards. Subsequently, another series of hazards that have occurred in the territory and may potentially occur again were identified, including tectonic earthquakes, torrential floods, landslides, thunderstorms, intense rains, and droughts, among others, with the recent addition of the topic of climate change. In 2018, a "risk management and climate change" area was structured from preschool (dimension) to 11th grade, considering the following axes: knowledge, reduction, disaster management, and climate change. The institution has become the only educational institution in the country and Latin America to offer these topics within its curriculum with a defined schedule. This has led to the transfer of advances to national and international levels, seeking to generate a culture of self-care, resilience, and solidarity. Consequently, a series of teaching tools, methodologies, and research processes have emerged, connecting parents, authorities, and local, regional, and national entities. The institution has participated in seven versions of the National Biennial of Children and Youth Living Near Volcanoes, organized by the Colombian Geological Service. It has also been involved in robotics processes for seismic monitoring with the support of the Nariño Traveling Techno-Academy, the Pasto Seismological and Volcanological Observatory, and the Colombian Geological Service. In addition, the use of Artificial Intelligence in these processes demonstrates that "knowing is reducing."

Keywords: Risk management, Climate change, School curriculum, Education, ICT.

Educational strategies for disaster risk management at the National Pedagogical University, Kennedy Campus, Bogotá, Colombia

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This paper presents a study conducted within the scope of Environmental Education for Disaster Risk Management as part of the Environmental Education Learning Community research group at the National Pedagogical University of Colombia (UPN). The objective of this study was to evaluate how environmental education, a discipline that strives to ensure a better future, can prepare for emergencies at the Kennedy campus. This research aims to question and problematize the perception of disaster risk among members of the educational community. Three specific objectives were achieved: (1) To identify the UPNK community's conceptions of disaster risk management; (2) To design a disaster risk matrix for the UPNK campus; and (3) To develop a risk reduction booklet focused on phenomena such as earthquakes and fires. The following question was developed as a guiding principle for the research: What is the relevance of training the UPNK community in disaster risk management? The qualitative methodology adopted was participant observation through interviews, web-based questionnaires, and participation as a member of the emergency brigade in various drills and events to generate an analysis of the community's needs and interests regarding DRM. As a partial result, the community's different perceptions were captured, and a risk matrix was designed with a focus on the structural level and institutional preparedness. Strengths and opportunities for improvement were identified, which contribute to the project's progress.

Keywords: Environmental Education; Risk Management; Kennedy City; National Pedagogical University.

The Potential of Letters as a Disaster Prevention Communication Tool

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Disaster preparedness education in schools not only benefits children and students but also has a ripple effect on the people around them. There is great potential to improve the disaster preparedness of the entire community as children pass on the lessons they learn from disaster education to their families and communities. However, the medium for this has not been well studied.

This presentation reports on the diffusion effect of school disaster preparedness education using "letters" as the medium in school disaster preparedness education. The results suggest that when children communicate what they have learned in school disaster preparedness education to their "loved ones" through letters, it is likely to lead to an increase in the readers' awareness of disaster prevention and their willingness to implement disaster prevention measures. Based on a series of results, the effect of propagating disaster prevention to readers through letters is presented as a "model of propagating disaster prevention through letters," and the potential of letters as a disaster prevention communication tool is explored.

Keywords: Letter, Disaster Preparedness Education, Transfer of Learning

Early education in risk management is the key to real awareness

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The educational experience is an adaptation of the children's song "Resuscitation Song," created by Raquel Palacio Villazón (Asturias, Spain) and adapted by teacher María Isabel Garzón González, who serves as the emergency manager at Campus B of the Ricaurte IED School in Bogotá. This experience aims to instill the value of solidarity in children by providing them with the opportunity to help others, thereby breaking down the barrier of indifference to the needs of others. The idea arose from my interest in training as a first responder for several years. While searching for an activity to educate and train children on emergency prevention and response, I searched online for music related to prevention. I found the "Resuscitation Song," from which the idea of implementing it at the institution took shape, taking advantage of the great motivation that gesture music generates in children, as it has been proven that this method significantly enhances knowledge acquisition. It was declared an outstanding experience by IDIGER. The video has garnered over 1,000 views on YouTube: **https://youtu.be/2O4U10JQclQ.**

Keywords: CPR, Awareness, Education, Support.

Session 3.

Session 3. Exploring coastal marine hazards

Chair:
Yoshio Kajitani
(Kagawa University)

Exploring morphological processes and the hazards that determine risks and resilience along the coastal barrier of Salamanca (Colombia)

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This study aims to characterize the morphological evolution and the main associated coastal hazards that operate at the scale of extreme and medium-term events along the Salamanca bar, which is a declared RAMSAR site and has highly vulnerable physical and housing infrastructure. At a medium-term (decadal) scale, we analyze satellite images from the last 40 years to characterize the evolution of the coast, the associated coastal sediment budget, and the pattern responsible for sediment transport. At this scale, the barrier has experienced intense coastal retreat, with erosion rates gradually decreasing over time. For the last period analyzed, 2009–2019, the maximum erosion rates have exceeded -20 m/year, putting commercial roads between cities at risk. The expansion of the road in the coming years and the development of protection works generate additional pressure on the systems; however, the future effects of coastal dynamics and associated coastal responses remain uncertain. This erosion is induced by a wave climate concentrated in a NE-directed arc with a main net pattern of coastal sediment transport directed towards the west, generating an accumulation of sediments (western corner) that could create risks in the port access channel, from Barranquilla. At the extreme event scale, we estimate hazards by evaluating the potential for storm-induced erosion and flooding, using 86 storm events identified during the study period. The western area of the barrier exhibited greater susceptibility to flooding, with return times of less than one year, resulting in ecosystem deterioration. Additionally, potential erosion was also a concern in the western and central sectors. The cumulative contribution of hazards operating at both scales poses various challenges affecting infrastructures, ecosystems, and communities along the Salamanca barrier. It is crucial to recognize that these effects may not only come from natural dynamics but could also be influenced by anthropogenic interventions, with more substantial cumulative impacts.

Keywords: shoreline changes, erosion, flooding, storms.

Possible instability of the continental slope and shelf against Cartagena de Indias - Bolívar, Colombia

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Cartagena de Indias (DT), with nearly 2.3 million inhabitants, including both residents and tourists, is a historic Colombian city and a UNESCO World Heritage Site, founded almost 500 years ago.
Several studies indicate that Cartagena is subsiding at a faster rate than global climate-related sea level rise, with 41% of this subsidence related to vertical geological movements (1). Another study revealed an interplate-coupled, or "locked," region offshore Cartagena with the potential to generate an Mw 8 earthquake and tsunami, with an estimated seismic recurrence of approximately 600 years (2). These studies have modeled coastal subsidence based on GPS data, tide gauges, and satellite images of the coastal zone of Cartagena and its surroundings.

Thanks to 30 m bathymetric information (3), 12.5 m digital terrain models (4) and anaglyphs, it has been identified that on the continental slope off Cartagena there is a block displaced vertically about 1300 m and limited by two lineaments, one of them with an approximate EW orientation that coincides with the "blocked region" mentioned in the second study; it is also possible that the unseated block is a consequence of a previous earthquake and a paleo-tsunami, whose data will have to be collected considering the presence of deposits associated with tsunamis along the coast. These observations lead us to hypothesize that the area above is unstable, affected by possible faults that cross not only the continental slope but also the platform.

For these reasons, it is proposed to establish an observatory for morphodynamic studies in Cartagena. This is necessary to mitigate the associated natural hazards and risks, and to help identify appropriate solutions and recommendations for updating the land-use plan, thereby ensuring the well-being of residents, tourists, and investors.

Keywords: Morphodynamics, Earthquakes, Tsunami, Geological faults, Observatory

The Role of Catastrophe Models like the Florida Public Hurricane Loss Model in Ensuring Disaster-Resilient Communities

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We will introduce the established state-of-the-art catastrophe model, the Florida Public Hurricane Loss Model (FPHLM), and describe recent advances in hurricane risk modeling for residential buildings, including both low-rise and mid-to-high-rise buildings. The FPHLM, like many other cat models, was primarily developed for insurance purposes. In the vulnerability module of the FPHLM, a component-based methodology compares wind-induced loads on external components against their strength capacity to produce estimates of external damage. At the same time, it utilizes the physics of rainwater ingress, distribution, and propagation to provide the basis for projections of interior and contents damage (Wei et al., 2024; Silva de Abreu et al., 2020). The model combines estimates of wind speed, debris impact, impinging rain, surface runoff, driven rain, envelope defects and breaches, interior water distribution and propagation, and component cost analyses to project damage to the envelope, interior, and contents. The model is extended to time-related expenses (TRE), also known as additional living expenses (ALE) or business interruption cost (BIC) (Wei et al., 2023).

The FPHLM is a multi-hazard model (Wei et al., 2024) with an independent module that projects losses due to combined wind, debris impact, and rain (Pita et al., 2016; Johnson et al., 2018) and another module that projects losses due to coastal and inland floods (Paleo-Torres et al., 2020). A third module, which projects losses due to tree falls, is in development. The losses from the different hazards can be combined.

The discussion will describe some of the challenges associated with developing these vulnerability models, including the sources of uncertainty and their propagation. We shall discuss how a component-based approach, grounded in the physics of the problem for the vulnerability modeling of exterior, interior, and contents damage, and TRE can facilitate the evaluation of resilience strategies for entire communities, including the length of recovery times, the amount of debris generated, and the cost effectiveness of mitigation measures (Paleo-Torres et al., 2022). These models can also be used to investigate the impact of sea level rise and climate change. Not only can insurers use these models to project losses, but

emergency managers and urban planners can use the damage projections and recovery times to characterize the resilience of coastal communities. The discussion centers on the case of hurricanes, but it could be extended to any other type of catastrophe model.

Keywords: Catastrophe model, damage, mitigation, resilience

Advances and challenges in accurate storm surge forecasting in San Andrés and Providencia

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At the Caribbean Oceanographic and Hydrographic Research Center (CIOH), I carry out the operational implementation in forecast mode of the Mike21 model (a 2D coastal and marine modeling software developed by DHI), which allows simulating sea level rise due to storm surges in the insular area of San Andrés, Providencia, and Santa Catalina, given their high vulnerability to the hazard of hurricanes. The model is configured with an unstructured mesh, which involves non-rectilinear grids, which improves flexibility and accuracy in the representation of coastal environments. Given the size of the islands, a variable spatial resolution was established, ranging from 20 m in shallow waters to 10 km in deep water areas, with high-resolution topobathymetry (~5 m) provided by the CIOH's National Hydrographic Service.

Coastal water spreading is significantly sensitive to surface wind forcing and astronomical tides, especially during hurricanes. Therefore, the model is forced with atmospheric variables (sea level pressure and wind) from four different sources: 1. GFS (Global Forecast System), with a spatial resolution of 0.25° and a 6-hour time resolution. 2. HWRF (Hurricane Weather Research Forecast Model), with a spatial resolution of 0.015° and a 6-hour time resolution. 3. Parametric winds, generated with track, forward speed, internal and external pressure, are extracted from the HWRF model. 4. HMON (Hurricanes in a Multi-scale Ocean-coupled non-hydrostatic model), with a spatial resolution of 0.02° and a 6-hour time resolution. Tides are generated from the 10 principal harmonics for the island area. The calibration was performed using records from the tide gauge located in San Andrés, for March 2022, with a correlation of 58.52% and a root mean square error of 0.0053 m.

Keywords: Storm surge, Numerical modeling, Mike21, Forecast

Assessment of numerical modeling in simulating storm-induced coastal flooding in data-scarce areas– Case study: Belize

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Numerical modeling is effective and can save cost and time in disaster prediction and risk resilience endeavors, particularly in areas where acquiring geometrical data is challenging and in-situ tests encounter difficulties within data-sacred areas. In this study, the TUFLOW model was utilized for the accessibility and reliability in providing predictions for wind and wave fields in coastal communities facing data scarcity. In addition, this study aims to fulfill the data requirements for designing the existing society and future coastal infrastructure development by predicting wave fields during storm conditions. In this research, we identified Belize City, Belize, as the focus, which was previously impacted by severe Hurricane Lisa. The study examined the computation of significant wave heights, dominant wave directions, and peak wave periods using TUFLOW. The analysis encompassed both normal wind conditions and storm conditions during Hurricane Lisa in November 2022. The results were plotted and compared across a two-dimensional geographic framework, utilizing 6-hour time step. Each output plot displays significant wave heights, dominant wave directions, and peak wave periods along Belize coastal regions. The trends and numerical values of the storm surges and wave heights calculated by the TUFLOW model demonstrate reliable results not only in simulating the wave climate but also in analyzing wave transmission, diffraction, and reflection concerning potential or existing coastal defense structures, such as breakwaters and dikes, for disaster prevention and mitigation measures. Through the practical and consistent application of this study, the TUFLOW model facilitates wave simulation along select segments of coastal regions in Belize, providing insights for future disaster prevention strategies.

Keywords: Numerical modeling, TUFLOW model, Wave heights, Disaster prevention, Risk resilience

Storm surge prediction in San Andrés and Providencia: Integrating SIPSEM into risk management strategies

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The General Maritime Directorate (DIMAR), through the Caribbean Oceanographic and Hydrographic Research Center (CIOH), has developed, within the SIPSEM project (Integrated Forecasting System for Maritime Safety), tools for predicting marine weather at the national and local levels and its influence on navigation and maritime activities, to safeguard human life at sea and carry out safe operations for decision-makers and the maritime community.
The integration of SIPSEM with storm surge forecasting is crucial for providing information that contributes to risk management, as it enables the anticipation and mitigation of the adverse impacts of extreme weather events on coastal communities, thereby reducing vulnerability and improving disaster response capacity.
A significant differentiating factor in forecast generation is the high level of detail at the island level of San Andrés and Providencia, in addition to the use of an ensemble methodology that allows combining multiple numerical model outputs, improving accuracy and reducing uncertainty in regional and local climate predictions for variables such as waves and sea level rise. Furthermore, understanding the tendency for hurricanes to evolve rapidly has been crucial to improving storm surge forecasts. Hurricanes can quickly intensify due to atmospheric and oceanic factors, such as rising sea temperatures and changes in wind structure. This intensification can result in more severe storm surges, leaving little time for authorities and coastal communities to adequately prepare. Thus, the ability to anticipate rapid changes in hurricane intensity and trajectory is essential for issuing early warnings and making informed decisions that protect vulnerable populations.

Keywords: Forecast, Storm surge, Tropical cyclones, San Andrés and Providencia, Numerical modeling

Session 4.

Risk perception, human behavior, and culture

Chair:
Genta Nakano (Kyoto University)

Enhancing Tsunami Risk Communication through Map App Utilization Considering Residents' Background

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The Sendai Framework for Disaster Risk Reduction 2015–2030 aims to significantly enhance accessibility to disaster risk information as a global objective, and to this end, hazard maps are created worldwide. Furthermore, emphasis is placed on supporting the development of disaster risk information and hazard maps as a critical area of Japan's international cooperation efforts. Traditionally, hazard maps provide information on the magnitude of risks and hazards, including the probability of earthquakes, floods, or tsunamis, on paper maps. However, disparities in map-reading skills have been observed due to individual experiences and customs, as well as regional variations in map representations. Through disaster prevention awareness activities in the city of Playas, Ecuador, a region located along the Pacific coast and encompassing large areas with elevations of 10 meters or less, where tsunami risk is projected, this study highlighted the need for a tsunami risk communication method tailored to residents' map-reading skills. Despite high participation in disaster prevention activities and awareness of disaster preparedness among residents, survey results revealed low rates of hazard map dissemination, limited knowledge of tsunami risks, and inadequate map-reading skills. Taking advantage of the widespread use of smartphones, a test mapping application was developed using Google Maps to depict current locations, shelters, and evacuation routes, and projected inundation areas. Experimental validation within projected inundation zones demonstrated a significant improvement in tsunami risk perception, particularly with hazard maps and mapping applications, with the latter being more effective. However, no significant improvement in evacuation awareness was observed during the experiment, suggesting the need for efforts to strengthen evacuation awareness alongside the dissemination of risk information. Furthermore, the experiment suggested a preference for landscape photographs over conventional map representations, indicating their potential effectiveness in conveying evacuation routes.

Keywords: Tsunami, Hazard mapping, Hazard communication, Map reading skills, Map application

Collaborative Governance to Manage Sea Level Rise Hazards: A Tourism Case Study from the Basque Country in Spain

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This ongoing study examines the adaptation dynamics of coastal tourism destinations, specifically the Basque coast in Spain, in response to increasing exposure to sea-level rise (SLR) hazards. Utilizing the Mental Models approach, the research compares the perspectives of experts and non-experts on the SLR adaptation process. Through a literature review, four primary themes related to SLR hazards were identified, and the study offers recommendations for managing these issues.

The preliminary findings suggest that adaptation measures developed for long-term SLR-exposed areas can be applied to coastal tourism destinations newly facing this threat. The key to successful adaptation is the active involvement of stakeholders, particularly tourism firms. To achieve this, investment in research and education is critical, as stakeholders often possess limited knowledge of the risks. Effective risk management requires tailored information that aligns with the social and cultural context of the community, fostering greater engagement.

Stakeholder participation from the outset is essential for enhancing preparedness. The government plays a central role in facilitating collaboration and defining clear responsibilities. While tourism firms show a willingness to collaborate and accept operational restrictions, they are unlikely to act as "ambassadors" for the adaptation process. Collaborative governance, however, can stimulate greater interest and involvement by addressing factors like seasonality and providing financial support when needed.

The study's results highlight the importance of building a sense of community among stakeholders through collaborative initiatives. Despite its focus on Zurriola Beach, the findings can inform broader SLR adaptation strategies in similar coastal areas. However, the study acknowledges its limitations, including its narrow geographical scope and the need for further research on other stakeholders, regions, and cross-cultural differences. Future studies may also explore the empirical development of collaborative governance to enhance the adaptation process in coastal tourism destinations.

Keywords: Risk Information; Collaborative Governance; Climate Change; Sea Level Rise; Tourism Destination.

Art as a platform for disaster risk communication, education, and awareness: developing a framework for art-driven responses to disasters

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Whereas art has long been a powerful tool for expression and communication, its potential in disaster risk communication remains relatively unexplored. In recent years, however, more attention has been given to art projects, particularly community-based ones, as well as artistic productions in reaction to disasters, notably in the fields of literature, performing arts, and pop culture.

Considering art about disaster- or in response to disaster – first calls for considerations of the modality of its emergence. Or in other words: what causes art to be produced, created, or organized in the wake of disasters?
As a first step in a larger project focused on art as a potential platform for risk communication, this paper attempts to answer this question by mapping out the different types of artistic expressions emerging after a disaster and creating a typology based on the motivations.
This initial framework will guide a discussion regarding the potential roles and impacts of diverse artistic responses (including visual arts, performance arts, and literature) to disasters, as catalysts for risk communication, education, and public awareness. Finally, this paper will address the challenges of creating integrated approaches to risk communication, to which art – encompassing artistic productions at large - can hopefully contribute.

Keywords: Risk communication, Risk awareness, Art, Community, Holistic approaches

Understanding Climate Change Impacts in the UK: Insights from Public Perception Surveys

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In recent years, the United Kingdom (UK) has observed several extreme meteorological events, with some attributing this to the impact of climate change. This paper explores the perceptions of the climate change impacts within the UK, utilizing pragmatist research that integrates a mixture of methods to capture a comprehensive understanding of this multidisciplinary (social environment) issue. A primary component of the study involved a detailed questionnaire conducted between March and September 2017, which used both open and closed questions to gather the views of civil society on climate change, including its impacts. Additionally, data from the Department of Business, Energy and Industrial Strategy (BEIS) surveys conducted in March 2019 and March 2020 were used to create an annual snapshot, allowing for the identification of trends.

The findings reveal a significant perception among the British public that climate change is already affecting the UK, with increased awareness of extreme weather events, such as heatwaves and flooding. However, the data indicate a general and growing awareness of the immediate and future risks posed by climate change. Additionally, the study highlights that recent lived experiences, such as extreme weather events, significantly influence public perception. Events such as the February 2019 heatwave and the severe winter flooding in early 2020 both served to heighten public awareness of climate change impacts, playing a role in shaping the perception of climate change risks. However, there are notable variations in perception across different age groups, with younger individuals less likely to recognize specific impacts compared to older generations.

Therefore, this study highlights the importance of enhancing public awareness and developing adaptive strategies to mitigate and adapt to the adverse effects of climate change.

Keywords: Climate change, Education, United Kingdom

Associations between Quality of Life and Disaster Risk Management: Replication of Taiwan Social Change Survey studies, in the Kinki region

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Previous studies have found that the higher the level of Quality of Life (QoL) or well-being, the more desirable behaviors people may exhibit, including disaster preparedness actions. However, other variables, such as culture and risk perception, may have varying effects on both. Therefore, a cross-national comparison would help disentangle this complex mechanism, but no studies have investigated these relationships, especially at the cross-national level. This study revisited the survey in Taiwan and took a simple Quality of Life (QoL) measurement as an indicator of well-being. Structural Equation Modelling provided the analysis of the relationships among QoL, Trust in government (TG), Disaster experience (EX), Disaster risk perception (RP), and Preparedness behavior (PB). Furthermore, the present study compared its results with those from a survey conducted in the Kinki region, Japan, by the authors. Moreover, the presentation will also report the differences in the relationships between different groups according to respondents' gender or marital status, so that more specific measures can be discussed. The preliminary results indicate that QoL had a positive impact on PB in both samples, although the extent of this impact differed. Furthermore, the relationship between RP and QoL was negative in Taiwan's sample, while it was insignificant in the Kinki region's sample. One possible explanation for this difference is that Taiwan had experienced severe disasters relatively recently before the survey, whereas the Kinki region had not. Therefore, in the Taiwan sample, the experience and risk perception (or awareness) might have had a certain impact on QoL, while their damaging effect on QoL might have been mitigated in the Kinki region as time passed. However, the cross-sectional design of this study does not allow for the conclusion of such a causal relationship. Therefore, future studies would need to explore and confirm the associations with a longitudinal and/or in-depth qualitative approach. (299 words)

Keywords: Quality of Life, Preparedness behavior, Risk perception, Disaster experience, Multi-regional comparison, Structural Equation Modelling

Session 5.

Session 5. Geohazard modeling and forecasting

Chair:
Héctor Pérez (SGC)

SIMER Mass Movement Risk Scenario Monitoring System

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The Administrative Department of Disaster Risk Management (DAGRD) is responsible for developing mechanisms to monitor natural hazards, defining prevention actions, issuing early warnings in geotechnical monitoring, and leading research on risk management and disaster management within the municipality. Since 2020, the DAGRD has implemented the SIMER Risk Scenario Monitoring System for landslides. To date, it comprises a total of 21 critical sites, monitored by 54 instruments. This geotechnical monitoring system operates using inclinometers and piezometers, which are periodically analyzed by the DAGRD using the respective SIMER methodology. This has allowed for decisions based on disaster risk management. Success stories include the return of 14 families to the Villa Guadalupe neighborhood, as well as other city initiatives, such as issuing necessary alerts for the execution of engineering studies and designs, and implementing risk reduction measures. These results allow us to present how the analysis and statistical processing of deformation, velocity, and acceleration data obtained through conventional inclinometry define ranges and action protocols for timely decision-making before, during, and after the materialization of risk scenarios. Furthermore, we consider this methodology as a starting point for developing a proposal that enables, through data analysis, the construction of risk thresholds and action protocols for threatening mass movement phenomena.

Keywords: Geotechnical instrumentation; Landslides; Disaster risk management; SIMER.

Implementation of a geotechnical classification system for landslide risk assessment. Case study: Rural connection road section in the Municipality of Carepa, Antioquia

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The sustainability and stability of road infrastructure projects currently underway in Colombia have been affected by the hazard of landslides, resulting in economic and human losses. Considering the complexity of predicting and selecting prevention and mitigation projects, land-use modifications are currently underway in the Urabá region due to population growth and infrastructure projects, necessitating the updating of land-use planning (LUP) systems and their coordination with risk management policies. Therefore, the need to incorporate risk management as a tool for territorial protection and accessibility is highlighted. This research implements a geotechnical classification system for zoning and landslide susceptibility assessment in the rural sector of the Municipality of Carepa, Antioquia. The physical model (HSQI) incorporates variables related to slope morphology and hydrogeological conditions, estimating the probability of occurrence and the intervention methods, considering susceptibility and criticality under stability conditions. The results enable prioritizing and classifying the road section through geotechnical zoning and exploration to determine stability methods, which can be incorporated to utilize nature-based measures and solutions. The conclusion is drawn on the applicability of the classification system as an input for planning, feasibility, and sustainability in road infrastructure projects. This seeks to strengthen response and sustainable planning capacities from a risk management perspective, considering population dynamics and infrastructure development projections in the Urabá region, which presents significant resilience challenges in terms of community response and ownership in the face of natural events, whose impacts and recurrence of disasters are current and latent problems.

Keywords: Slope stability, Road infrastructure projects, Susceptibility to landslides, Risk management, Slope quality index.

Methodological proposal for the assessment of seismic vulnerability in low-income municipalities

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Colombia is located within the Pacific Ring of Fire's area of influence, and therefore, the occurrence of earthquakes has historically generated significant human and economic losses. In recent decades, detailed research and studies to determine the hazard and vulnerability conditions of exposed elements have been conducted in only a few departmental capitals and municipalities, due to the high costs associated with such studies. Knowledge of seismic risk at the municipal level in Colombia, particularly in lower-income municipalities (categories 5 and 6), has been limited by the lack of simplified methodologies that allow for assessing hazard and vulnerability based on data at semi-detailed scales, to obtain risk scenarios that provide authorities with technical information to make decisions focused on reducing human and economic losses.

A semi-quantitative (semi-c) methodology is proposed for fifth- and sixth-category municipalities, especially those in areas of intermediate and high seismic hazard, which account for 81% of the country's total. The methodology provides indicative estimates of the local seismic response of the terrain and the vulnerability of buildings that typically occupy urban land (municipal seats and population centers), at scales of 1:10,000 or higher.

The methodology has four stages: the first is the collection of information and preparation of basic and thematic cartographic inputs; the second is the evaluation of the threatening event by calculating the seismic-geotechnical hazard index (IGH); the third focuses on the characterization and calculation of the vulnerability index (IV) of the homes; and the fourth is the generation of cartographic products for zoning the seismic response and the vulnerability of the homes in the study area.

Keywords: Seismic vulnerability, Seismic risk, Methodology, Semi-quantitative

Occurrence and social impact of disasters: Case of landslides in Mexico

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It is common to hear the phrase, "those who do not know their history are condemned to repeat it." Indeed, being aware of the historicity of natural events is fundamental not only to date such events but also to determine their causes and effects. It is a first step in the estimation of recurrence, that is, the possibility of the events occurring again under similar conditions, as well as the localization of areas with a high risk of disaster. The United Nations (UN, 2005) identifies the development and improvement of relevant databases as a key priority for capacity building in developing countries (Taylor et al., 2015).

Landslide inventories are significant. They are vital for hazard analyses. This study presents a methodology for estimating the social impact of disasters with an emphasis on landslides in Mexico. Although landslide monitoring studies exist in specific areas of the country, no historical catalog has been published that provides a basis for spatial-temporal analysis and determining the impact in terms of loss of human life. The reported events were categorized as the following types of displacements: fall, landslide, and complex movement and flow; data were standardized and stored using SPSS software. Additionally, estimates were produced to determine the number of people who may have been affected by landslides in 2019, based on their relationship to marginalization levels at the national level, as detailed by the National Population Council (CONAPO). Marginalization degrees represent the exclusion of a population from development due to socioeconomic inequalities, which manifest as low income, lack of education, inadequate health, and limited access to basic services. It was found that localities with high and very high marginalization levels account for nearly half of the landslides over 82 years. This study presents new findings on the spatial distribution of events and the affected populations, making a valuable contribution to the study of landslides in Mexico.

Keywords: Landslides, Inventory, Risk, Historicity, Population

Assessment of the Impact of Soil Cover and Geological Materials on the Erosion Dynamics of the Combia Creek Sub-basin, Pereira, Risaralda

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The global hazard of landslides is associated with urban occupation of lands with environmental restrictions, the strong dynamics of land-use changes, the expansion of agricultural and livestock frontiers, as well as the execution of infrastructure works, the properties of geological materials, and the climate of each region. Based on these premises and based on the mapping, cartography, and characterization of erosion processes in the Combia Creek sub-basin, municipality of Pereira, Risaralda, the aim is to establish the relationship between the different land covers and the type of lithological units that outcrop in this territory, which act as conditioning agents for the occurrence of landslides. For this purpose, the Combia Creek sub-basin was selected due to its high erosion rate, the dynamics of land-use and land-cover changes, and the variety of outcropping geological materials, in addition to its proximity and agricultural importance about the municipal seat. A total of 175 landslides were georeferenced and characterized, and the geological, land cover, and land-use information associated with the mapped landslides was spatialized using Geographic Information Systems (GIS). Once the information was spatialized and statistically processed, a close relationship was established between the geological materials, the different land covers, and the number of identified landslides. Some of the most relevant findings highlight the high susceptibility to landslides in areas with steep slopes and high rainfall rates, where basic volcanic, porphyritic, and volcano-sedimentary rocks are exposed, and where coffee and pastureland predominate in various associations. It was found that the nature of the geological materials plays an important role in the erosional dynamics of the territories, in addition to steep slopes and local rainfall patterns.

Keywords: Mapping of erosion processes; Landslides; Geographic Information Systems; Susceptibility; Land use and land cover

Multi-Risk Instruments for Emergency Response: A multihazard and multi-risk assessment of the European Solidarity and Emergency Aid Reserve

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Natural-hazard-related disasters are on the rise and have a significant impact on both the public and private sectors. This trend is also evident in the European Union and different mechanisms and instruments exist on the Pan-European level to deal with such events. One such instrument is the European Union Solidarity Fund (EUSF), which provides funding to governments following natural disaster events. Recently, the EUSF has expanded its scope to include public health emergencies and was merged with the Emergency Aid Reserve to form the Solidarity and Emergency Aid Reserve (SEAR). It therefore became a multi-hazard as well as multi-risk instrument to assist countries during the emergency phase of events. As different types of hazards and risks draw from the same fund, there is a question of how they affect the fund and what capitalization levels need to be assumed to make the fund sustainable, or in other words, how to fund assistance to affected countries in a sustainable manner. Consequently, it is important to understand which hazards the fund is most exposed to and whether there are regional differences within Europe. To address these questions, we take a risk-based approach and estimate capitalization levels required for major hazards, as well as risks, including regional differences at the Pan-European level. In doing so, we discuss and suggest possible ways forward in meeting identified challenges, especially regarding risk reduction and public-private partnerships considerations that could enhance current and future resilient levels of both the fund itself and the countries it supports.

Keywords: Multi-Hazards, Multi-Risks Instrument, European Union Solidarity Fund, Solidarity and Emergency Aid Reserve, Risk perspective.

Session 6.

Communication and education in DRM

Chair:
Hamilton Bean
(University of Colorado Denver)

Initial Tsunami Preparation in the Gulf of Urabá through an Environmental Education Process: Sapzurro, Chocó Caribe (Colombia), La Miel (Panama) and Turbo, Antioquia (Colombia)

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Tsunami preparedness should consider environmental education processes with rural coastal communities in Colombia and Panama, on both the Caribbean and Pacific coasts of Latin America. Strengthening coastal community participation is essential for tsunami and natural hazard preparedness. The initial environmental education process for tsunami preparedness in Sapzurro (Colombia), La Miel (Panama), and Turbo (Colombia) is described. Environmental education with a transformative optimistic perspective based on Paulo Freire's critical pedagogy contributes to tsunami preparedness. Strengthening the community is our goal.

Keywords: Tsunami Preparedness, Environmental Education, Paulo Freire's Critical Pedagogy, Transformative Optimism.

Action Research using the Community Strategy Planning Tool for Tsunami Evacuation

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In order to properly evacuate from a tsunami, it is important to develop an evacuation strategy in advance. For this purpose, many studies have been conducted to examine the evacuation strategy based on the assumption of the impact of the tsunami disaster, speed of information dissemination to residents, and the setting of moving time. The common feature of many of these studies is that they simulate evacuation behavior under fictitious conditions, such as evacuation speed and evacuation routes. On the other hand, it is necessary to study evacuation strategies using actual movement data to examine issues related to tsunami evacuation in a more realistic manner; however, few studies have been conducted from this viewpoint. In this study, a tool, "Nigetore-View," was developed to analyze tsunami evacuation strategies by using the actual movement data of residents in a drill. The effectiveness of the tool was verified by action research in Miyazaki and Kochi prefectures. The results of the study suggest the necessity of developing disaster prevention plans that consider the evacuation behavior of elderly residents in Miyazaki City, Miyazaki Prefecture, and Kuroshio Town, Kochi Prefecture, where tsunami damage is expected to occur due to a Nankai Trough earthquake. The results suggest that "Nigetore-View" can be used to develop a tsunami evacuation strategy that meets the needs of municipalities with an aging population.

Keywords: Tsunami Evacuation, Disaster Prevention Education, Information and Communication Technology, Nankai Trough earthquake, Special Early Warning Information.

Every day-life preparedness as embedded learning

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This paper reports the recent updates on 'everyday-life preparedness (EP)' drawing on the works of Takenouchi et al. (2024) and Tanaka et al. (2024) as well as an empirical case study I conducted. Coined by Yamori (2011) as 'seikatsu bosai' in Japanese, EP is promoted as an innovative reinforcement for existing disaster risk reduction (DRR) and climate change adaptation (CCA) measures in communities. 'Everyday life' does not mean engaging in DRR activities every day. Rather, it is to embed DRR thinking and practice in daily life. The original EP focused on such thinking and practice without referring to DRR. For example, an opportunity for residents to get to know each other, such as a community event, can be seen as EP, given that building social capital is considered a key to a resilient community. I undertook some case analyses applying the first-generation framework in the 2019 paper. Takenouchi et al. and Tanaka et al. broaden such perspectives of EP to encompass community activities that are explicitly designed for DRR purposes, as long as they are embedded in daily life. The second-generation EP now has a variation. By combining the two generations' EP frameworks, I examine the case of a community in action that engages in a variety of EP activities. A tentative suggestion is the embeddedness of EP entails 'community-based' and 'participatory' approaches that have been mainstreamed in DRR projects. Conversely, then, shifting to explore how to embed DRR thinking and practice in daily life may be a way forward for community-based and participatory DRR.

Keywords: Everyday-life preparedness [seikatsu bosai], Community-based DRR, Participatory approach, Embeddedness.

Seismic risk assessment for the city of Santiago de Cali, Colombia

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Within comprehensive disaster risk management, knowledge of seismic risk (identification of its components, risk estimation, and risk communication) is essential for developing earthquake prevention, mitigation, and response strategies. Effective risk assessment requires the collaboration of risk modelers and decision-makers to ensure that the results are tailored to the region's specific needs and can be used to define strategies for earthquake preparedness, response, and recovery. Seismic risk assessment requires the collaboration of an interdisciplinary team that understands the local geology and seismic activity, the characteristics and number of existing buildings and their inhabitants, and the seismic vulnerability of buildings based on construction practices. The results of this assessment must be communicated and shared with the various stakeholders involved in disaster risk management, including the relevant authorities.

This study presents the results of a seismic risk assessment for the city of Santiago de Cali, Colombia, carried out as part of the TREQ project (Training and Communication for Earthquake Risk Assessment, github.com/gem/treq-riesgo-urbano/tree/main/Cali) in collaboration with the city's risk management managers. The results include risk profiles that highlight vulnerable areas of the municipality and provide information necessary for defining financial protection schemes, as well as possible response scenarios for different types of earthquakes. The information in the profiles was jointly determined by risk modelers and local authorities, thus facilitating their understanding and use in decision-making. This information has been shared with local authorities and other relevant stakeholders, enabling the identification of areas for improvement and an understanding of the impact of specific policies on seismic risk reduction in the city.

Keywords: Seismic risk, Seismic risk reduction, Seismic scenarios

National Disaster Risk Management Plan (PNGRD), a territorial and national development strategy for the years 2015-2030

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The National Disaster Risk Management Plan (PNGRD) is the country's roadmap for sectors and territories to coordinate and mobilize resources (financial and human) to understand, prevent, and reduce risk, manage disaster situations, and address the challenges posed by climate variability and climate change. In compliance with regulatory provisions, the Plan was adopted by Decree 308 of February 24, 2016. The first update of this instrument corresponded to the programmatic component of the PNGRD, adopted by Decree 1478 of 2022. However, it was necessary to carry out another update process to ensure that the programmatic component of the PNGRD would be implemented in a manner aligned with the objectives of the National Development Plan (PND) 2022-2026: Colombia, a Global Power for Life. This demonstrates how the National Unit for Disaster Risk Management created spaces for discussion, feedback, and consensus-building on the plan, ensuring the participation of sectoral, territorial, and community stakeholders. In this process, a set of approaches was recognized that must be incorporated into the development of disaster risk management to ensure a comprehensive intervention process. It also promoted community participation and the strengthening of risk governance as key elements in effectively reducing our risk conditions. As a result, Decree 0978 of 2024 was issued, which will serve as the roadmap for implementing the country's disaster risk management policy over the next four years.

Keywords: Update, Intervention, Management, Reduction, Risk.

Involving youth in disaster risk mitigation in the Americas and the Caribbean

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Emergencies and disasters in Latin America and the Caribbean have a profound impact on the region's sustainable development. It is therefore crucial to integrate all sectors of society into mitigation, preparedness, response, and recovery strategies. However, certain age groups, especially young people, have historically been underrepresented in disaster risk management, despite their significant potential to contribute from various sectors. In response, the Youth Network for Disaster Risk Reduction in the Americas and the Caribbean was created. This initiative aims to mobilize and empower young people in disaster risk prevention and mitigation through subregional representation strategies, presence in related forums, capacity-building initiatives, and institutional support from various sectors. This research focused on systematizing the network's experience during its first year of operation. Facilitators and barriers encountered were examined to identify effective practices and operational challenges, and recommendations were proposed to improve its future functioning. Preliminary results highlight the adaptability and enthusiasm of young people, as well as the need to improve communication with other key stakeholders in disaster management. The analysis reaffirms the importance of young people in promoting a more resilient and sustainable approach to disaster management in the region. We conclude that by removing structural barriers and fostering more inclusive participation, young people can play a vital role. Transformative in disaster risk reduction in the Americas and the Caribbean. Additionally, this research is expected to serve as a guiding model for future similar initiatives, providing a clear framework for the effective inclusion of youth in disaster risk management.

Keywords: Disaster risk reduction, Youth network, Americas, Caribbean, Resilience.

Session 7.

Risk identification, risk assessment, and evaluation of systemic and complex risks

Chair:
Jorge Alpala (UNGRD)

Disaster risk management and its relationship with the environment, planning, climate change, business continuity, and technological risk in Colombian organizations

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In Colombia, the issue of emergency, contingency and disaster risk management in organizations is addressed from various areas: Occupational Health and Safety (Decree 1072 of 2015); Environment (Decree 1076 of 2015); transportation of hazardous materials (Decree 1079 of 2015); risk management plans for public-private entities (Decree 2157 of 2017), plus several other regulations depending on the sector to which the entity responds (mining and energy, education and school, hospitals, industrial, construction, transportation, etc.), which can expand the range of regulations to be complied with from between 8 and 25 of different rank (laws, decrees, resolutions, directives, guides, etc.). In this context, it is essential to adequately answer the question: How do each of these standards interrelate, and how should an organization understand their approach so that it doesn't get lost in a welter of documents, requests, and oversight entities, reviewers, audits, and follow-up? The author's experience in organizations spanning over 20 years, across all sectors and at all levels, is summarized in this talk, which showcases examples and highlights the most notable achievements, conclusions, and recommendations for organizations in Colombia.

Keywords: Disasters, environment, plan, emergencies, contingencies.

Integrating socio-ecological benefits as added value to the current approach to risk assessment and analysis in developing countries

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In many developing countries, such as Colombia, risk management is based on a combination of preventive and reactive approaches. The former includes barriers and flood control works, and the latter, emergency measures in the event of failure of these infrastructures. Although this method can be effective under certain territorial planning conditions, it may not be so in complex socio-ecosystems such as inland deltas, for example, La Mojana in Colombia. These territories require an adaptive approach that views flooding not only as a hazard but as an opportunity to strengthen socio-ecological relationships and support nature-based economies (Zischg, 2018; Associated Programme on Flood Management, 2009b). Is the current risk management model relevant to addressing the challenges of climate-resilient development, as suggested by the latest IPCC report? Strategies focused solely on probabilistic flood damage may ignore crucial aspects, such as the socio-ecological benefits that communities derive from floodplains. These benefits are evident in systems with seasonal land-use configurations, from which multiple socioecological benefits are derived (Juarez-Lucas et al., 2019). This research aims to contribute to the academic debate by emphasizing the importance of quantifying not only the expected damages from flood events but also the socioecological benefits associated with these water levels. It is proposed that the resulting interventions should promote long-term transformative adaptation without compromising ecosystem integrity. This comprehensive approach could provide a more robust basis for planning and risk management decisions in similar contexts.

Keywords: Risk management, Inland deltas, Socio-ecological benefits, Climate-resilient development

Deterministic and probabilistic analysis of fire action on steel structures with a focus on structural safety

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The analysis of the action and behavior of structures under the hazard of fire is of vital importance for structural safety, considering that this is a complex phenomenon fraught with uncertainties and may involve significant levels of risk to people. A comprehensive analysis of fire action in steel structures entails a spatiotemporal evaluation of fire as a structural stress, a transient thermal analysis of the fire's impact, and an assessment of the structure's behavior under fire. Study alternatives include deterministic and probabilistic approaches to problem analysis. This article presents deterministic and probabilistic approaches to analyzing steel structures under fire conditions, assessing structural safety, and incorporating criteria for reasonable risk thresholds. The background for this study is based on the authors' knowledge and experience from their doctoral studies in structural fire engineering and reliability analysis, as well as on the state of the art and experience from the authors' research projects. The two approaches are implemented through the analysis of a steel beam subjected to a fire situation, with the corresponding steps necessary to determine the structural response. This requires the use of finite element models and Monte Carlo simulations implemented using APDL code within the ANSYS finite element program. The study's results present the thermo-structural behavior of the beam, the calculation of the probability of failure, and its corresponding structural reliability index, serving as a reference for incorporating risk thresholds that can be considered reasonable or acceptable. The study demonstrates that the probabilistic approach to analyzing structures under fire conditions offers tools for assessing structural safety and provides criteria for incorporating performance improvements in the event of fire hazards.

Keywords: Structural fire engineering, Structural safety, Probabilistic fire analysis, Deterministic fire analysis, Ansys.

Tools for chemical risk management in Colombian organizations

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The increase in industrialization and the global growth of industrial sectors that utilize chemicals have led to increased exposure to substances and agents with hazardous characteristics, often unknown to the workers and organizations that use them, which can result in an underestimation of the risk and its materialization. Although in Colombia for several years, specific regulations have been developed for the identification and control of products with the potential to trigger emergencies, to prioritize them and develop prevention and intervention actions, it is common to see in the country's media how the gaps in chemical risk management come to light and, consequently, emergency situations arise that compromise not only large industries but also academic institutions and Colombian homes. The main objective of this proposal is to recognize how, by identifying the hazards associated with chemical products, their characteristics, the nature of the operations, and risk assessment, it is possible to have a broad and detailed view, leading to the creation of strategies for chemical risk management and enabling effective emergency prevention in organizations and the construction of a knowledge-based culture of preparedness and response.

Keywords: Hazardous substances, Chemical industry, Emergency identification.

Unravelling the complex interactions among risk components through impact chain methodology: an application to Vaia storm study case

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Climate-related hazards and risks are systemic and multifaceted, becoming increasingly complex in multi-risk contexts. As climate change intensifies extreme weather events, multi-risks and multi-hazards are expected to become more frequent. Concurrently, social and human variables influence vulnerability and exposure, affecting the ability of socio-environmental systems to cope with future climate-related risks.
The risk science community recognizes the interconnected nature of risk, yet current methodologies for risk analysis and assessment fall short in addressing these complexities. To advance risk science, EURAC Research, in collaboration with other partners, has developed a conceptual framework called Impact Chains (IC). This framework systematically and comprehensively represents interactions among risk components, such as hazards, exposure, and vulnerability. It allows for the identification of specific risk pathways within given geographical and temporal contexts.

IC's versatility enables its use in analyzing both current and future risks through various methodologies, including participatory processes, scenario development simulations, and retrospective disaster analysis (e.g., forensic analysis). Within the EU Horizon Europe "PARATUS" project, IC was applied to analyze multi-risk events. This contribution presents the theoretical foundation of the methodology and its practical application in examining the Vaia windstorm.

The Vaia windstorm, which struck Italy in 2018, involved high-intensity rainfall and intense wind gusts. The application of IC demonstrated its potential to capture the diversity of risk components, vulnerabilities, and risk drivers, highlighting the importance of connections between physical and social elements.

This study underscores the need for advanced methodologies like IC to understand and manage the complex dynamics of climate-related risks. By providing a comprehensive analysis of multi-hazard events, IC can inform better risk management and adaptation strategies, enhancing the resilience of socio-environmental systems in the face of escalating climate challenges

Keywords: Multi-risk analysis, Impact Chains, Extreme Weather Events, Climate-related Risks

Stochastic risk evaluation of volcanic ash hazards from large Sakurajima eruptions

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The forthcoming decades pose a significant challenge in volcanic risk management, particularly regarding the high probability of a major eruption at Sakurajima volcano within 25 to 30 years. Ash fallout from such eruptions poses a hazard to public health, agriculture, transportation, and infrastructure on both local and global scales. This necessitates a re-evaluation of countermeasures and response strategies. However, the inherent uncertainties in predicting eruption scenarios complicate the development of comprehensive preparation plans, as the range of possible scenarios is vast and its specific impacts are largely unknown due to the rarity of such events in the last century. Therefore, the innovative approaches are essential to enhance our understanding of potential impacts of future eruption scenarios, enabling more effective planning and mitigation strategies. Here, we illustrate the geographical distribution of ashfall and the probability of different levels of ash deposition under various eruption scenarios, using extensive monitoring data from continuous eruptions since 1955. We synthesized these results into risk curves and probabilistic maps, which serve as effective tools for visualizing and quantifying the impacts of ash dispersal from each eruption scenario. The risk curves can clearly depict of the likelihood of various impact levels, aiding in understanding of the most probable scenarios and their consequences. Our results provide a solid foundation for developing emergency response plans, ensuring effective resource allocation, planning robust evacuation plans, and implementing appropriate protective measures. Overall, our study advances volcanic risk assessment and preparedness by providing a more nuanced and comprehensive understanding of the potential impacts of massive ash fallout from various large-scale eruptions. This approach facilitates more targeted and effective planning and response strategies, ultimately enhancing the resilience of communities, economies, and ecosystems at risk of volcanic disasters.

Keywords: Risk assessment, Volcanic ash hazards, Volcanic eruption, Sakurajima volcano.

Session 8.

Risk perception, human behavior, and culture

Chair:
Dorotea Cardona
(Humboldt Institute)

Risk perception and community resilience: challenges and responses to tropical cyclones in the Colombian Caribbean island region

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The Caribbean and island coast of Colombia faces a high vulnerability to the impact of tropical cyclones, as evidenced by Hurricane Iota in 2020, which caused considerable damage not only to infrastructure but also to the emotional and social health of the inhabitants of the archipelago of San Andrés, Providencia, and Santa Catalina. This disaster underscored the importance of understanding risk perception and community resilience in formulating effective recovery and mitigation strategies. This study focused on analyzing risk perception and community needs through a semi-structured survey conducted during the dissemination of the preliminary results of the study on risk management guidelines for the worship facilities plan for the island of San Andrés. The participatory workshop, held in August 2022, provided a platform for assessing risk perception among the religious community and gathering their needs and input. The survey results revealed that risk perception is high among members of this community, who emphasized the urgent need to restore basic services, such as electricity, drinking water, and communication, after a disaster. Furthermore, social cohesion and mutual support were identified as essential for community resilience, enabling residents to cope with and overcome post-disaster crises. In response to the identified needs, several guidelines were developed to strengthen social cohesion and community mental health. These guidelines include:

- Prepositioning essential resources: Ensure the availability of humanitarian aid, portable water purification stations, satellite phones, and charging stations for electronic devices in places such as churches.

- Community training programs: Offer training in crisis management, medical and psychological first aid, and family reunion programs, in coordination with the mental health services of the departmental health department and religious and community leaders.

This participatory, community-centered approach provides a solid foundation for developing culturally sensitive and effective risk management strategies, improving island community preparedness and resilience to tropical cyclones.

Keywords: Social fabric, Colombian Caribbean coast, disaster risk management, resilience, mental health.

Perception of the role of natural protected areas in disaster risk management: Case of Chingaza National Natural Park

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The community approach enables us to recognize the differential impact of disasters on territories and based on collective memory and experiences, to deconstruct, construct, and reconstruct risk management strategies tailored to each biocultural context. To conduct a diagnosis with the inhabitants of the area of influence of the Chingaza National Natural Park regarding their knowledge of the various natural phenomena and hazards identified in the territory, a perception survey was conducted using a qualitative approach. This allowed us to identify the benefits of a protected area in reducing disaster risk. Subsequently, an analysis was conducted within the framework of strengthening the culture of prevention in the face of risk and its effective communication, considering psycho-emotional and socio-cultural differences. Here, we present the beliefs of strategic stakeholders in the territory, including Ecotourism Service Providers, members of the Municipal Disaster Risk Management Councils of the 11 municipalities bordering the park, and some families with whom Conservation Agreements have been signed, regarding the importance of páramo and Andean Forest conservation in disaster risk reduction. As a result, the foundations for understanding natural phenomena and socio-natural disasters were recognized based on experiences, knowledge of the páramo, confirmed ideas, and the collective imagination. Likewise, the impact of co-responsibility on preparing an effective, efficient, organized, and planned response to strengthen resilience and reduce vulnerability was examined in their belief systems.

Keywords: Socio-natural disasters, Protected area, Co-responsibility, Community approach, Resilience.

Disaster Risk Perception and Preparedness Index: Tools for Disaster Risk Reduction and Building Resilient Communities

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This research presents a methodology for measuring risk perception, knowledge, and preparedness by constructing two indices. These indices aim to provide input into the perception and understanding of populations located in at-risk areas for the design and implementation of risk reduction and climate change adaptation measures, such as early warning systems. The study was conducted in four districts of the city of Cali, Colombia, where the Smart and Community Early Warning System (SATIC) was developed. It was designed based on the identification of variables to be measured through questionnaires with on-site information collection. 407 randomly selected individuals over the age of 18 who resided in the territories participated. Data analysis was performed using SPSS statistical software, employing descriptive measures and the Kruskal-Wallis test to assess differences between groups. The results highlight the complexity of risk perception, influenced by various variables beyond direct emergency experience. Factors such as sociodemographic characteristics and education level influenced knowledge and preparedness for emergencies, and an interesting finding was that the occurrence of disasters is not correlated with a high perception of risk. This study contributes to a deeper understanding of the factors that influence risk perception and the implementation of strategies tailored to the specific needs of each community, aiming to reduce the loss of human life associated with disasters or emergencies. Likewise, it preserves community knowledge for the collective development of disaster risk reduction measures, aiming for safer and more resilient territories.

Keywords: risk perception, risk reduction, emergencies, communities, index.

Effects of climate change and the El Niño phenomenon on labor productivity in Colombia

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Climate change, as well as climate variability phenomena such as El Niño, have negative consequences for both the environment and people, and threaten labor productivity. The 1.5°C global temperature increase projected for the end of the century is expected to cause a 2% increase in the percentage of working hours lost due to heat stress by 2030. Therefore, this study aimed to calculate the loss of labor productivity in Colombia due to the heat stress caused by both the increase in the Earth's average temperature and heat waves resulting from events such as El Niño. First, projections were made of the labor force, wages, and number of workers for the year 2030. With this information, it was calculated that, by that year, a 1.5°C increase by the end of the century entails a cost of 11.6 trillion pesos associated with the reduction in working hours. The agricultural and construction sectors were also analyzed, considering that these jobs are not performed in the shade, which doubles the loss of working hours. Regarding the effect of El Niño, the study used Desbureaux (2019) as a basis, considering the average wages reported in both the formal and informal sectors. Thus, it was estimated that the total lost wages for the informally employed population amounts to 2.88 trillion pesos, while for the formal sector it would reach 838 billion pesos. These values were also calculated for the country's main cities. Finally, the study also addressed the main causes of heat stress, additional health consequences, and provides a series of recommendations for both workers and organizations to address this problem.

Keywords: Climate Change, El Niño, Heat Stress, Labor Productivity.

The importance of geoscientific studies in risk management

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Abstract not available

Volcanic risk studies in Colombia: Beyond mathematical modeling

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Disaster risk management for volcanic eruptions in Colombia currently lacks regulations for preparing volcanic hazard and risk studies that focus on land use planning. The Colombian Geological Service (SGC) has among its functions the obligation to "provide information on geological hazards and physical risks to the competent authorities and the community for planning, land use, and risk management purposes." In particular, the SGC has compiled information on volcanic hazards for decades. However, volcanic risk studies have not been conducted in Colombia. Recently, the National Unit for Disaster Risk Management (UNGRD) commissioned a probabilistic volcanic risk study for the Galeras Volcano (VG) (Nariño). According to the SGC, this study underestimated the risk, particularly the medium risk, by not considering additional information or the current state of the VG, which shows evidence of new magma intrusions. As a result of this situation, and considering the results of the deterministic studies of volcanic hazard prepared by the SGC for the VG, an adjustment was made to the results of the risk study contracted by the UNGRD, where the probabilistic and deterministic results were combined, like that used to determine the physical limit of water rounds already regulated by a decree in Colombia, obtaining a risk map that can be used as input in the territorial planning plans in the municipalities affected by volcanic activity in the VG. This work demonstrates that, beyond the results of mathematical volcanic risk models, it is important to combine information from different sources to generate inputs that enable more accurate decisions based on geoscientific evidence.

Keywords: Disaster risk management, volcanic eruption, volcanic risk map, probabilistic risk, Galeras volcano.

Session 9.

Natech Risk Management Perspectives

Chair:
Zoltán Török
(Babes-Bolyai University)

Supporting Natech Risk management and governance in Colombia: changes in risk awareness using a serious game approach

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Natural hazard-triggered technological events with the consequent release of hazardous materials are known as Natech. Natechs have the potential to cause severe and extensive impacts in large areas, leading to huge economic and environmental damages (Kiyohara K, A.M. Cruz, 2016). These events constitute a complex - high uncertainty problem for disaster risk management DRM and governance, requiring for many stakeholders to be involved (Aven & Renn, 2010). To develop and implement effective disaster risk reduction DRR measures, risk awareness and communication among stakeholders need to be addressed (OECD, 2015). It has been proven that top-down (e.g. lectures, exhibitions (Charrière et al., 2017) and bottom-up approaches (e.g. getting knowledge from communities) can achieve knowledge transfer, but are not enough to bring stakeholders together for discussion. Nowadays, it is well accepted that DRM, governance and DRR strategies need to be discussed, and more participation is required. Participatory approaches such as focus groups or serious gaming (Aleksandra Solinska-Nowak et al., 2018; Fleming et al., 2020) can be helpful for raising awareness, bringing stakeholders together, and providing a space to build trust. The aim of the study is to develop a better understanding of the Natech risk management and governance problem in Colombia, by looking closer at the stakeholder's roles in the process, by conducting serious gaming workshops. A game named EGNARIA, developed by Tzioutzios (2022), was selected as a tool, and it helped to produce some changes in risk awareness and stakeholders' trust in themselves and others. The goal was to understand how the process was carried out and identify ways to possibly improve it, to support DRM and DRR. This work will show that the workshops using serious gaming lead to immediate significant changes in risk awareness, risk perception and risk communication behaviors, and proved to be suitable to promote the dialogue.

Keywords: risk management, risk governance, stakeholders' involvement, risk communication, serious gaming.

Natech events in Colombia: a review from ANLA and UNGRD databases

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Colombia is a country experiencing a variety of natural hazards, such as landslides, earthquakes, floods, and lightning, among others, which can trigger technological events such as fires, explosions, or toxic releases, known as Natech events. The affected infrastructure can be fixed, as in the case of industrial facilities where hazardous substances are stored, handled, or processed, but transportation systems such as pipelines, tanker trucks, or maritime transport can also be severely affected. In Colombia, there are several databases that report the occurrence of containment losses that resulted in a technological event derived from various causes, as in the case of ANLA, as well as information from territorial entities compiled by the UNGRD in its Annual Emergency Consolidation. This work seeks to analyze the information available in these databases to investigate the registration of Natech events, their main causes, and consequences. To this end, we propose the use of keywords, data processing tools, and data categorization to review databases that pose additional challenges because they are not fully structured.

Keywords: Natech Events, ANLA, UNGRD, Data Analysis

Monte Carlo-Markov Chain Modeling for Estimating Industrial Downtime of Storage Tanks in Earthquake-Induced Natech Events: An Alternative Approach to Industrial Disaster Risk Assessment

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This study investigates the dynamics of earthquake-triggered Natech (Natural hazard-triggered technological disasters) accident chains in chemical tank farms, with a particular focus on domino effects and resultant operational downtime. We introduce a novel methodological framework utilizing the Monte Carlo-Markov Chain approach to model Natech-induced downtime, thereby enhancing the management and risk assessment of such disasters. The methodology is enriched by an accident propagation event tree, informed by the available Probit Models in the literature, and a mathematical model for assessing escalation factors, such as thermal radiation and shockwave overpressure. Furthermore, we integrate restoration curves adapted from HAZUS (Federal Emergency Management Agency, 2022) into our damage assessment model. This model quantifies the downtime and consequences post-accident, providing essential insights into industry disaster resilience. The Cosmo refinery tank farm in Osaka's Sakai area serves as a case study, showcasing the practical application of our model in a real-world setting and underlining the necessity of dynamic analysis in regions susceptible to earthquakes. The impact of seismic hazards was calculated using the NGA-sub (Next-Generation Attenuation for Subduction) model (Parker et al., 2022), which simulates the potential effects of the Japan Nankai Trough Earthquake. Our findings underscore the significant differences in downtime based on tank anchorage, with anchored tanks showing considerably less downtime (1.962 days annually) compared to unanchored tanks (3.598 days annually). These insights highlight the profound impact of primary accident severity on subsequent accident chains and the potential benefits of preventive measures. Overall, this research not only broadens our understanding of the implications of Natech events but also advocates for more robust emergency response mechanisms to enhance industrial safety and preparedness in disaster-prone areas. In addition, the downtime in industrial areas vulnerable to coastal disasters can serve as a critical component of hazard maps, providing valuable references for risk management by enterprises and governments in the future.

Keywords: Downtime, Domino Effects, Monte Carlo-Markov Chain, Tank Accidents, HAZUS

Wind vulnerability model for components of refinery plants or industrial facilities: a preliminary study

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The authors, with support from the Wind Hazard and Infrastructure Performance Center (WHIP-C), are developing wind vulnerability models for extensive industrial facilities, such as refinery plants. This research presents several challenges, as these facilities are distributed over large plots of land, which can exhibit significant variations in wind speeds, surface friction, and topography. At the same time, they can have a large variation in infrastructure components, including power stations, pipe racks, tanks, warehouses, cranes, towers, etc. The authors propose to decompose the facilities into few sub-systems for which they can use conventional risk models: i.e., one site, one hazard, one vulnerability. Then they shall combine (not necessarily add) the models based on the intercorrelations between the sub-systems. In this so-called "Lego" approach, typical vulnerability components could be plugged in and interconnected, like Lego blocks, to produce an aggregated wind vulnerability of the whole system. The authors shall report on the preliminary results of the research, which involve an extensive literature review, consultations with experts, and the prioritization of certain sub-systems for in-depth analysis. Key topics include understanding wind-related damage, determining the most vulnerable equipment, exploring sources of contaminant leaks, reviewing existing specifications and mitigation plans, and developing component-based wind vulnerability models for tanks and pipe racks. The research aims to enhance preparedness and to assess the risk in the face of wind hazards for industrial facilities. Special attention is given to the link between wind hazard and Natech accidents (i.e. technological disasters triggered by a natural event, in this case a windstorm). Catastrophic wind events can result in failures of industrial components which in turn can lead to release of toxic substances and failure of safety systems. Proper modeling of the wind vulnerability of industrial plants should lead to better management of the Natech risk.

Keywords: Damage, Vulnerability, Industrial Facilities.

Transboundary Accident Risk Hot-Spot Analysis for Tailings Ponds using GIS

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The growing global demand for minerals such as lithium, nickel, and cobalt—key components of electric vehicles—will inevitably lead to more intensive mining activities and higher quantities of extractive waste generated and deposited. Historical accidents involving the sudden release of massive amounts of tailings from storage ponds have demonstrated the destructive and polluting potential of these events. An analysis of over 300 historical accidents from the DanubeTMF project shows that most failures occurred at functioning or abandoned tailings ponds, often resulting in transboundary pollution. Based on the Tailings Risk Index (TRI) method—a semi-quantitative approach for classifying tailings ponds by hazard and risk, where the TRI is the sum of the tailings hazard index and exposure index—this study proposes enhancing the exposure index further. This enhancement involves developing an automated GIS tool to analyze the exposed population and water bodies downstream from the tailing's ponds, and to identify hot spots where a major release of tailings could lead to transboundary pollution consequences. The GIS tool was tested on tailings ponds in Romania and South Africa, both countries with a long history of mining, numerous tailings ponds, and a few unfortunate accident cases. The results show that a low number of tailings ponds could generate transboundary pollution. This information will be used in future work for a more detailed, quantitative risk analysis of these ponds using 2D-flow and Computational Fluid Dynamics models to quantify the consequences and risks.

Keywords: GIS, Risk hot-spot, Tailings risk index, Transboundary pollution.

The development of a regional risk assessment methodology for Natech events: In the case of Baijiu spills triggered by earthquakes

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Earthquakes can impact and damage various industrial equipment across broad geographical areas, leading to Natech events. These events pose significant threats to human lives, properties, and the ecological environment. Therefore, it is vital to mitigate the impacts of such events. However, formulating risk reduction strategies requires addressing key scientific questions of clarifying their accident-inducing mechanisms. Currently, research related to the risk management of earthquake-triggered Natech events primarily focusing on the stability and reliability assessment of critical industrial equipment. It often relies on complex mathematical methods to describe physical processes of equipment damaging, resulting in significant computational resource consumption and rendering it challenging to apply to reginal-scale risk assessment. Therefore, there is an urgent need to develop a regional Natech risk assessment methodology from the perspective of accident-inducing mechanisms. In China, Baijiu (Chinese liquor with high alcohol content) serves as a cultural symbol and the Baijiu industry thrives, particularly in the southwestern China. To ensure the production of flavourful Baijiu, distilleries often employ traditional storage containers, ceramic jars, to store Baijiu. However, frequent seismic events in this region easily damage the fragile ceramic jars, leading to Baijiu spill events and exposing surrounding communities to the fire and explosion risk. Therefore, this study sets out to clarify the physical process of Baijiu spills triggered by earthquakes, analyse the seismic response characteristics of Baijiu ceramic jars, and thereby reveal the accident-inducing mechanisms of earthquake-triggered Baijiu spill events based on real cases supplemented by shaking table tests. Subsequently, combining deep learning methods and Monte Carlo simulation, a rapid regional-scale risk assessment method for earthquake-triggered Natech events is constructed. With the support of the developed rapid regional-scale Natech risk assessment method, key hazard areas for earthquake triggered Baijiu spill events can be identified, providing a theoretical basis for targeted Natech risk reduction strategies development.

Keywords: Natech, Earthquake, Baijiu, accident induction mechanism, Natech risk assessment at regional scale.

Session 10.

Artificial intelligence, science, technology, and innovation

Chair:
Michinori Hatayama
(Kyoto University)

Yet another early-AI-era project: Visualizing post-disaster refuge areas and exploring needs and standards with AI- generated imaging

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In the realm of disaster management, the design and functionality of post-disaster refuge areas play a critical role in ensuring the safety and well-being of communities during the immediate aftermath of a catastrophic event. This research explores a novel approach by leveraging AI image generators, to produce visual representations of these refuge areas after an earthquake. Literature highlights a gap in post-emergency recovery studies, particularly in the utilization of visualization technologies to address broader aspects of recovery planning and community simulation (Zhu and Li, 2021). This exploration investigates whether; by embracing AI, we can effectively portray the dynamic nature of post-disaster temporary refuge areas. The current methodology employs a multifaceted approach to image generation, starting with verbal prompts and later incorporating photos of existing open-air public spaces designated as post-earthquake refuge areas. AI-generated images could serve as design prototypes for usability, accessibility, and community engagement, allowing for the exploration of various spatial configurations, signage systems, spatial layouts, and the dynamic presence of individuals within these public spaces. Incorporating visualization strategies could provide an avenue for future research, facilitating the exploration of the spatial and temporal characteristics of infrastructure recovery and community reconstruction in the aftermath of disasters. In a broader context, the integration of AI technology in visualizing refuge areas presents a promising avenue for informed decision-making, policy formulation, and community engagement in disaster management, fostering more adaptable and responsive community landscapes.

Keywords: Disaster, AI, refuge areas, visualization

Mapping climate services for disaster risk management: a systematic review and research gaps from a policy process perspective

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Climate services (CS) are vital for mitigating and managing the impacts and risks associated with climate-induced disasters. While evidence over the past decade underscores their effectiveness across various domains, maximizing their potential necessitates the identification of emerging priority areas and existing research gaps for future research agendas. As a contribution to this effort, this paper employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology to review the state of the art in climate services for disaster risk management. A comprehensive search across five literature databases combined with a snowball search through ResearchRabbit was conducted and yielded 242 peer-reviewed articles, book sections, and reports from 2013 to 2023 after the screening processes. The literature focusing on climate-induced disasters primarily concentrates on floods, droughts, and food insecurity. Major climate services addressed included early warning systems, (sub)seasonal forecasts, and impact-based warnings. Grounded in the policy processes theoretical perspective, the focus identified three prevailing policy-oriented priority areas: (i) development of climate services, (ii) use-adoption-uptake, and (iii) evaluation of climate services. In response to the limitations of the prevailing supply-driven and top-down approach to promoting climate services, co-production emerges as a critical aspect of the identified priority areas. Despite the extensive research in the field, more attention is needed, particularly pronounced in the science-policy interface perspective, which is pivotal to effective

policy processes. Thus, future research agendas may delve into this critical aspect given its importance to institutions and climate services capacity, to better improve development and enhance the integration of climate services into disaster risk management.

Keywords: Climate services, Disaster risk management, policy process, Science-policy interface, institutional analysis

Open-access Remote Sensing Applications in Disaster Risk Management

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A remote sensor is a device or instrument that collects information about objects or areas at a distance, without requiring direct physical contact with them. Remote sensors can be installed on satellites, airplanes, drones, and other aerial or ground vehicles. This technology has become a rapidly growing industry, with the remote sensing market estimated to reach $18.6 billion by 2025. Although much of the information obtained with this technology is only accessible through financial agreements, several agencies and entities have released data, offering it for free. This facilitates its exploitation and use by scientists, governments, and organizations worldwide, significantly enhancing the capacity for disaster prediction, prevention, and response. This presentation focuses on showcasing freely available online applications and query tools for viewing, downloading, and processing remote sensing data. The case studies presented cover floods, droughts, forest fires, landslides, earthquakes, volcanic eruptions, hurricanes and storms, tsunamis, environmental pollution, desertification, and pests and diseases in the country. Finally, the availability of these resources in the cloud democratizes access to advanced technologies, enabling institutions and communities with limited resources to benefit from complex analyses, predictive models, early hazard detection, post-disaster damage assessment, and preventive action planning. This approach not only optimizes the use of data for informed decision-making but also fosters global collaboration and information sharing, improving disaster preparedness and response.

Keywords: Sensor, remote, management, risk, disaster.

Use of new and emerging geospatial technologies to improve official statistics in Colombia and their potential use in disaster risk management

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For DANE, as the entity responsible for official statistics in Colombia, and in compliance with the Statistics Law, it is stated that these statistics must be made available so that they can be used by state entities in public policy documents, plans, programs, and projects. It is important to promote the use of cutting-edge technologies for their production. Thus, with the use of geospatial technologies, sufficient and high-quality information must be available in various fields, such as disaster risk management. The use of geospatial information for disaster risk management is a topic that has already been addressed in multiple forums at the United Nations. It is stated that access to high-quality geospatial information on disaster risk must be facilitated. Likewise, within the Sendai Framework and Colombia's national disaster risk management plan, the importance of this information is highlighted at different stages of risk management. Therefore, we aim to demonstrate the progress made in how statistical and geospatial information is a key element within the disaster risk management cycle. We will begin by explaining the relevance of implementing global geospatial information frameworks and the integrated statistical information framework in developing geospatial tools that support the stages of the statistical process. We will then discuss how the use of geospatial tools helps improve official statistics, concluding with the promotion of such information within disaster risk management. We want to emphasize the importance of using official statistics from a geospatial context within disaster risk management, not only for the identification of prediction models but also in all stages of this important work.

Keywords: Statistics, Geospatial Information, Geovisors, Geoportal, Management

New methodologies for disaster risk management in essential structures in the department of Sucre

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Previous studies indicate that approximately 100 seismic events with magnitudes between 4.0 and 4.9 occur annually in Colombia, 10 events between 5.0 and 5.9, and 1 event between 6.0 and 6.9. Therefore, it is important to highlight that 87% of the population resides in areas with high to intermediate seismic hazards, with Sucre located entirely within an intermediate seismic hazard zone (AIS, 2010). This situation and environment represent a warning condition for the authorities and institutions responsible for seismic risk management in the department. A 2007 study of 1,500 buildings in the central Sincelejo-Sucre area revealed significant seismic vulnerability in buildings important for disaster management and response. These findings underscore the deficiencies in risk management in Sucre, as vital structures are at risk of collapse during or after a seismic event. Based on the above, this study proposes a methodology based on operational modal analysis (OMA) for risk management in buildings of this type. The proposal includes a low-cost wireless monitoring system featuring MEMS (Micro-electromechanical) triaxial accelerometers, which connect to Raspberry Pi-type microcontrollers that serve as acquisition systems. Signal processing utilizes modal identification and Bayesian algorithms for modal analysis and uncertainty assessment in estimating dynamic parameters. Validation is achieved through laboratory-scale ambient vibration testing with a reference sensor network. The proposed method is important for the early implementation of preventive, maintenance, and reinforcement plans for buildings essential to the community.

Keywords: Structural health monitoring – Modal identification – Risk management – Low-cost sensor network – Damage identification – Bayesian inference.

Methodology for estimating earthquake damage in buildings using drones

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The research presented here is a new structural engineering tool for estimating building damage by comparing two data sets, one before and one after the occurrence of earthquakes. This methodology compares geometric simplifications of buildings whose most intuitive analysis parameter is the drift of plane surfaces. The geometric simplification is performed from 3D point clouds obtained by pairing 2D images captured by Unmanned Aerial Systems, commonly known as drones. The methodology was formulated through laboratory simulations using small-scale models and validated with controlled tests of a prototype of a real six-story building at a scale of 1:4. A geometric simplification technique for buildings was developed, which serves as the basis for comparing displacement deformation that results in damage. Finally, the methodology was implemented in an urban area with synthetic damage simulation. Automated geometric simplification of buildings (GEOMETRICALLY SIMPLIFIED BUILDINGS - GSB) was developed and applied to buildings of typologies that can be satisfactorily represented with a hexahedron, where millions of points are summarized into eight corner points and six normal vectors. The results primarily, but not exclusively, allow the determination of the deformations of these hexahedrons in terms of surface drifts. The technique can be applied to compare two data sets to assess damage from earthquakes and hurricanes, as well as to evaluate changes in building inventories. The technique has achieved an accuracy of one percent difference with the exact drifts and can be used with a single data set for seismic vulnerability studies. The methodology was successfully implemented in an urban area, yielding satisfactory results with levels of accuracy and precision comparable to those obtained during validation.

Keywords: Damage, Earthquakes, Drones, Point clouds, Geometric simplification.

Session 11.

Floods, river, and coastal erosion

Chair:
Zoraida Piedraita
(Ministry of Environment)

Assessment of physical vulnerability to flooding under land use change scenarios

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This paper presents a research project carried out in the Combeima River basin in Colombia (South America). This project evaluated the impact of land-use changes on flooding regimes and physical vulnerability from 1976 to 2017, utilizing hydrological and hydraulic modeling, as well as the implementation of flood vulnerability assessment methodologies. This study supported reports confirming that land-use changes impact the behavior of direct runoff in watersheds and their relationship with the vulnerability of structures near surface watercourses. To achieve these objectives, the research focused on: i) evaluating the effect of land-use changes on physical vulnerability under flooding regimes; ii) proposing an assessment of physical vulnerability based on soil property variations (v); iii) testing the scalable behavior of physical vulnerability, considering Hu, CN, and v as scales. Furthermore, simple broad vulnerability scaling was tested. The results indicate that incorporating variables related to soil and stream hydraulic properties enhances vulnerability assessment in land-use change scenarios, making this approach particularly helpful for planners in decision-making processes.

Keywords: Physical vulnerability, land use change, flood assessment, soil hydraulic properties, scale behavior.

Rising sea levels and their link to coastal erosion in the Costa Rican Caribbean

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Among the most significant consequences of climate change on coastal systems is sea level change, which serves as a reference framework or baseline upon which various coastal processes operate at different temporal and spatial scales, such as coastal erosion. However, for the Costa Rican Caribbean, a current value for the rate of level change was not available, so research was proposed to update it. For the selected tide gauge station, the available data corresponding to the period 2009 to 2021 are analyzed through a time series analysis and a rise rate of 8.61 mm/year is obtained by decomposing the series. However, by including the data from the GNSS station, I can calculate an absolute rate of 4.28 mm/year. This high rate is influencing the processes of coastal retreat in the South Caribbean of Costa Rica, which have recently led to the loss of coastal vegetation, including mangroves, and have even caused the retreat of forest sectors in Cahuita National Park. This retreat leaves coastal communities exposed to seawater flooding and sand erosion, which is creating a socio-environmental crisis.

Keywords: Sea level, Climate change, coastal erosion, coastal hazards, time series.

Flood vulnerability in a community in northern Colombia: The case of Villa Fátima, Riohacha, La Guajira

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In Colombia, numerous vulnerable communities exist, particularly in rural areas and on the outskirts of cities. This is the case of the Villa Fátima neighborhood in Riohacha, La Guajira, which suffers constant flooding mainly due to the overflowing of the El Riíto branch of the Ranchería River. To determine vulnerability to flooding, social, economic, and environmental information was collected using the ODK (Open Data Kit) application. This information was analyzed in terms of exposure, fragility, and resilience, using a multicriteria analysis. This information was processed according to the methodology proposed by CENEPRED (2014), adapted to Colombian regulations established by PNGRD & UNGRD (2012). According to the results, the population is in a situation of high and medium social vulnerability, with 56% and 44% of the population, respectively. In the economic dimension, the population was identified as being in a situation of high and medium vulnerability, with 16% and 61% of the population, respectively. In the environmental dimension, the population is highly and moderately vulnerable, with 46% and 21% of the population, respectively. Overall, the population studied is highly vulnerable, with 31% and moderately vulnerable, with 69%. Assessing vulnerability is essential when determining risk from any natural or man-made hazard.

Keywords: flood, vulnerability, social dimension, economic dimension, environmental dimension.

Analysis of the flood level on the coast of the municipality of Ciénaga-Magdalena, as an element for control, administration and management of flood risk due to marine dynamics

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This study proposes a comprehensive approach to analyzing flood elevation along the coast of the municipality of Ciénaga-Magdalena, as a key tool for controlling, administering, and managing flood risk due to marine dynamics. The methodology is based on the flood elevation equation, which involves variables such as waves, mean sea level, astronomical tide, and meteorological residual. The research is divided into two main stages. In the first stage, an oceanographic characterization and numerical modeling are performed. The global TPXO9 model is used to obtain the astronomical tide, complemented by the analysis of data from nearby tide gauges to determine the meteorological residual. This allows the construction of mean and extreme sea level regimes. In addition, the wave characterization extracted from the WAVEWATCH III (WW3) model is integrated into the SWASH model, which solves the flood elevation on beaches, considering the interaction between wave conditions and topography. In the second stage, flood results are processed, and a vulnerability and risk analysis is conducted. Coastal flood maps are generated for each climatic period in the Colombian Caribbean. Subsequently, physical and social vulnerability and hazard preparedness are determined, integrating geographic, topographic, geological, land-use, and population distribution information obtained from the 2018 DANE census. Finally, the area's most at risk from flooding are determined at the block level. This study not only provides valuable information for coastal flood risk management but also contributes to the development of integrated coastal zone management strategies, the prevention and mitigation of marine-based hazards, and climate change adaptation in vulnerable coastal regions.

Keywords: Coastal flooding, Coastal vulnerability, Flood elevation, Risk management, Numerical modeling.

Identification and prioritization of sectors with evidence of fluvial erosion in the Magdalena River, Colombia

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River erosion can be defined as the wearing away and shedding of material from the bed and banks of rivers caused by the action of water currents. In Colombia, river erosion has gained relevance in recent years, as large-scale events with severe impacts have been recorded, such as the one that occurred in Tacamocho, a municipality in Córdoba (Bolívar), along the Magdalena River, where river erosion destroyed more than 60% of the population. This establishes the importance of conducting studies to understand the phenomenon and identify its most frequent locations as a first step toward developing methodologies for risk assessments. In this paper, we analyze the available information on river erosion of the Magdalena River within the National Disaster Risk Management System to identify sectors with evidence of the phenomenon. These are then compared with the geology, geomorphology, erodibility of the terrain, and its location within the riverbed, thus allowing for prioritization. The lower Magdalena River basin is identified as having the highest number of sectors with evidence of fluvial erosion, with 68 sectors. Of these, 48 are high-priority, 19 are medium-priority, and 1 is low-priority. We conclude that integrating available information with a geological, geomorphological, and soil erodibility analysis, as well as its location along the riverbed, generates informative results on the hazard of fluvial erosion, aimed at identifying and prioritizing sectors that require more detailed and rigorous studies. We recommend that territories and decision-makers in sectors identified and prioritized for fluvial erosion incorporate the phenomenon into their municipal or departmental risk management mechanisms.

Keywords: River erosion, Magdalena River.

Flood Hazard Characterization as a Support for Land Use Planning: Case Study of Population Centers in the Mojana Region of Colombia

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The process of characterizing flood hazards occurring in a geographic area involves recognizing the water dynamics of the natural system in a specific socioeconomic context. It is important to recognize flow patterns through an analysis of historical records of hydroclimatic variables and to identify the alterations that have occurred in the regime as a result of the prevailing use and occupation processes in the corresponding drainage basins. Mathematical modeling tools for hydrological processes are a strategic ally that allows for the analysis of the broad and varied spectrum of hydrological responses under boundary conditions determined by the behavior of water inputs. These can be estimated based on hydrological records or estimated for those basins not instrumented with rainfall-runoff transformations, which must be evaluated to ensure their representativeness. In this case study, characterized by a highly complex system of pipes and marshes that interact throughout a hydrological year, hydrological and hydraulic modeling strategies are analyzed to characterize flood hazards in the vicinity of the population centers that make up the Mojana core. The result is flood hazard categorizations based on the calculation of water depths and flow velocities. Flood hazard scenarios are presented for the main population centers in the Mojana region.

Keywords: Flood hazard, Hydrological modeling, Hydraulic modeling

Session 12.

Risk perception, human behavior, and culture

Chair:
Natalia Muñoz
(Colombian Red Cross)

Community assessment methodologies for strengthening flood resilience in Colombia – RAI project case study

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The Z Zurich Foundation and the Colombian Red Cross Society have partnered to implement a pilot project in ten communities at risk of flooding located in Soacha (Cundinamarca), Barranquilla (Atlántico), and Copacabana (Antioquia). The project aims to develop and measure the success of actions that promote the strengthening of community resilience to flood events. The diagnostic phase of the project applied the Community Climate Resilience Measurement (CRMC) approach, developed by the Zurich Flood Resilience Partnership, in combination with the participatory research methodology: Extended Vulnerability and Capacity Analysis (AVCA), created by the International Federation of Red Cross and Red Crescent Societies (IFRC). The preliminary results present CRMC as an innovative tool for gathering the evidence needed to assess community resilience. Combined with AVCA, this tool enabled an understanding of the strengths and weaknesses of community capacities to respond to and recover from flood events, as well as the identification, prioritization, and planning of interventions required for community strengthening through a participatory process. Additionally, it was identified that the use of these methodologies has the potential to foster community participation, guiding actions toward disaster risk reduction and climate change adaptation.

Keywords: Expanded Vulnerability and Capacity Analysis (AVCA), Community Resilience, Community Climate Resilience Measurement (CRMC), Flood Risk Management and Climate Change Adaptation.

Analysis of historical and cultural constructs related to socio-natural hazards and social vulnerabilities. Elements for risk management in Colombia

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The cultural constructions and interpretations that individuals make of hazardous phenomena and their vulnerability conditions constitute a broad field of knowledge for risk management. The perceptions, imaginaries, and feelings of populations settled in risk zones demonstrate the need to consider differential approaches to the construction of policies and strategies that seek to mitigate risk and project safer and more sustainable territories. Despite valuable advances in risk knowledge, technological advancements, and a regulatory framework focused on risk reduction, a cyclical pattern of disasters is evident in Colombia. Therefore, it is pertinent to advance risk knowledge to understand the cultural interpretations that communities make about the phenomena that affect them. This knowledge constitutes a relevant input for comprehensive risk management and the strengthening of co-responsibility strategies in its management. Accordingly, the primary objective is to present an analysis of the imaginaries and perceptions of populations residing in areas affected by hazardous phenomena, such as volcanic eruptions, floods, and landslides, in various regions of the country. The primary outcome is a conceptual model that enables the integration of local and scientific knowledge, grounded in cultural constructions of hazard, vulnerability, and risk. This perspective enriches discussions about understanding nature and allows us to approach the non-binary visions that build communities in relation to their environments.

Keywords: Ethnography, social imaginaries, hazardous phenomena.

Living under the shadow of the Galeras Volcano: sociocultural perception of risk in the rural community of Genoy (Pasto, Colombia)

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Culture and society are inevitably connected. This interaction produces a sociocultural configuration, expressed symbolically and physically through specific practices such as risk perception. Culture can characterize, generate identity, distinguish each society, and represent the traits of a people or region. This is the result of social interaction between human beings who share similar situations in a specific territory. The rural community of Genoy (Pasto, Colombia) is located 4.5 km from the Galeras Volcano crater, in the "Zava" High Volcanic Hazard Zone, exposed to all volcanic hazards and threats due to its proximity and is markedly vulnerable. However, the sociocultural perception of risk among its inhabitants, sustained by memories passed down through generations, broadly characterizes Galeras as a good, friendly, noble, guardian, and protective volcano that has never caused harm. This is the result of popular knowledge passed down through generations, supported by narratives, Catholic religious beliefs, and visions that combine not only history but also myth. This is a rural territory inhabited by a community of peasants and indigenous people who have built close ties of community life, ancestrally and deeply rooted in the land, with a strong social fabric. They are grateful for the volcano, which, in their historical memory, rooted in their culture, is considered "harmless," as its eruptions have not harmed them. They love and respect it, and are grateful for its qualities as a friend, provider of water, food, and fertile soil, which, in their opinion, allow them to live "well" alongside their neighbors. Therefore, its image is fraternal and kind, and its activity is met with admiration and respect, with little fear. This perception likely increases their vulnerability, as their actions and behaviors make it difficult to manage risk and prevent the effects of a potential disaster. This paper is the result of a doctoral thesis.

Keywords: Perception, Socioculture, Risk, Galeras Volcano, Genoy-Pasto.

Vulnerability analysis models for comprehensive risk management

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Vulnerability is understood as the internal risk factor of a subject or system exposed to an adverse event, corresponding to its intrinsic predisposition to be affected or susceptible to loss. It is the estimated degree of damage or loss to an element or group of exposed elements because of the occurrence of a phenomenon of a given magnitude or intensity. The risk management approach based on the intervention of vulnerability components involves constructing a working tool for the adoption of mitigation strategies, applicable to risk management plans at various levels and across different processes. The initial work applied at the local level led to the development of a methodology for risk assessment based on the variables that make people, resources, and processes vulnerable. Initially, emphasis was placed on assessing individual and global vulnerability from the perspective of production processes, with the application primarily oriented toward the business sector and, to some extent, the community sector. These initial applications served as the basis for establishing social vulnerability variables, which were used to construct the sociogram to be applied as a tool for characterizing communities at risk from natural, technological, or man-made events, as a support tool for disaster risk management programs. The application of these analytical instruments highlighted the need to create new tools that would allow for addressing other processes specifically, such as critical operational positions for control centers and high-risk companies, critical facilities, public health, and environmental health.

Keywords: Vulnerability analysis models.

Managing disasters in the context of armed conflict: Historical lessons from the Colombian case

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Disaster management in contexts of armed conflict has received increasing attention from the international community. One motivation is the convergence of vulnerability and poverty, which hinders efforts to promote the security and development of societies and their disadvantaged populations. Also relevant is the work that the disaster community has been doing to develop multi-hazard systems for risk management, within which armed conflict adds a level of complexity. However, attention to date has focused on critical cases and short-term visions of the interaction between conflict, disasters, and their management. With more than a century of experience, the Colombian case provides a complementary perspective on the evolution of institutions for disaster response, recovery, prevention, and preparedness within the context of a protracted internal armed conflict. The article provides an overview of the history of conflict and disasters in the country, then focuses on the most significant episodes in the interaction of hazards and their institutions, specifically: 1) the initial role of response actors, 2) the possibility of pioneering work in both prevention and response, 3) the complementarity of institutions responsible for peace and disasters, and 4) the evolution of the technological hazards. The article concludes with some general observations, emphasizing that disaster management, rather than being a niche public policy, offers opportunities to catalyze comprehensive conceptions of human security and promote their sustainability.

Keywords: armed conflict, history of disasters, multi-hazard systems, institutions, governance, human security.

SECOND DAY

AUGUST 29, 2024

Session 13.

Initiatives for resilient communities

Chair:
Dorotea Cardona
(Humboldt Institute)

Fortaleciendo la resiliencia en la educación superior: un enfoque para la región de las Américas y el Caribe

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In the field of higher education, the IESLAC/DRR project has focused on integrating Disaster Risk Reduction (DRR) in Latin America and the Caribbean. During the 2016-2019 period, significant progress was made, including research, the creation of DRR units, and the development of the University Facility Safety Index (ISIU). This project, promoted by the Network of Universities of the Americas and the Caribbean for Disaster Risk Reduction (REDULAC/DRR), developed a series of activities that have contributed to the development of human resources and the implementation of the Sendai Framework in Higher Education Institutions (HEIs) in the region. The importance of sustainability and resilience in the face of disasters and climate change is highlighted within these institutions. This study addresses the general problem of the lack of focus on disaster resilience in HEIs. The main result reveals that the integration of DRR into the curriculum and the training of risk managers have strengthened institutions' capacity to address natural and anthropogenic hazards. This represents a significant advance compared to the previous situation, where resilience was not a priority. In a broader context, these results contribute to strengthening resilience in the region, promoting sustainability and preparedness for future challenges. The accessibility of the article is improved by providing a clear and concise overview for scientists from diverse disciplines.

Keywords: Sustainability, Resilience, Higher Education, Americas and Caribbean Region.

Experiences in building resilience and sustainable actions from the Colegio Mayor de Antioquia University Institution

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Higher Education Institutions in Colombia play a crucial role in Disaster Risk Management processes through their mission activities, providing services in science and technology to enhance the capacities of various institutions and territories across the country. A compilation of significant experiences from the Colegio Mayor de Antioquia University Institution located in Medellín, Colombia, is presented. As a public Higher Education Institution, certified in High Quality (2020), and a member of the National Disaster Risk Management System according to Law 1523 of 2012, By which the National Disaster Risk Management Policy is adopted. Other provisions are issued (2012) in its article two, the Colegio Mayor de Antioquia University Institution shares with different public, private and community entities, the responsibility of developing and executing disaster risk management processes within the framework of its powers, its scope of action and its jurisdiction. At the Colegio Mayor de Antioquia University Institution, through the Institutional Program on Disaster Risk Management (Rectoral Resolution 269 of 2021), actions have been promoted aimed at incorporating disaster risk management transversally in the different processes of institutional development, in order to comply with regulatory requirements and guarantee safety standards for the development of the different institutional activities (Institutional Policy on Disaster Risk Management under Agreement 023 of 2022 of the Board of Directors).

Keywords: Disaster Risk Management, higher education in disaster risk management, resilience, inclusion, and sustainable actions in higher education.

Reflections on measuring disaster resilience at community scale: lessons from applying the flood and climate resilience measurement tool

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In order to understand and foster community disaster resilience in terms of process and outcome, a decade ago, the Flood Resilience Alliance, as a science-practice partnership, developed the Flood Resilience Measurement for Communities (FRMC) tool. This systems-based approach and tool measures resilience through various indicators organized into a set of so-called capitals or capacities (human, natural, physical, social, financial) through various stakeholder-oriented data collection methods such as household surveys, focus groups and key informant interviews. Resilience scores serve to identify 'success' in terms of systemically building resilience as taken forward by the NGO partners of the Alliance through community-led action. With implementation in more than 400 communities across more than 30 countries this indicator-based approach developed as a science-practice effort is one of the most widely applied community-based resilience measurement tools - with many valuable lessons learnt. Over the years, the focus has shifted from single-hazard disaster resilience to multi-hazard climate resilience, now encompassing a set of hazards including floods, wildfires, and heat. We report on the journey taken to develop further, apply and validate the tool. This includes examining the systems view taken for deriving the resilience concept and studying its usefulness for working towards change in terms of community resilience outcomes as well as informing DRR and CCA policy at higher decision-making scales. Finally, we end with reflections on the implications of the shift in focus from disaster to climate resilience and the various resilience drivers studied and modified through interventions implemented.

Keywords: disaster resilience, community, measurement, science-practice.

Multitemporal assessment of community resilience to technological risk disasters in commune 10 of the municipality of Dosquebradas

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Communities' perceptions of technological events are a fundamental part of understanding disaster risk management. In 2011, a Natech event occurred in the municipality of Dosquebradas (Villa Carola neighborhood), resulting in 33 human, physical, and material losses, overwhelming institutional and community response capacities. This chapter describes the application of the ARC-D tool to measure and evaluate multitemporal community resilience to disasters. A qualitative approach was applied to community-territory interaction and a quantitative approach to data processing. A facilitated focus group survey was used for community discussion, assessing four thematic areas. The tool was administered through a prior resilience assessment and piloted for adjustment to the focus group. A low level of resilience was found in the pre-event (2011) phase, with a greater emphasis on poor risk understanding, as opposed to the higher component corresponding to social cohesion in the territory. The post-event (2021) phase achieved a medium level of resilience, with better results in strengthening governance to manage disaster risk, reflected in its most notable component, the participation of women. It is concluded that Commune 10 of Dosquebradas improved its community resilience capacities to technological risk disasters from 30.08% to 60.18%, highlighting the increase in community participation, social organization, and the adoption of a culture of risk prevention. Territorial and local authorities are encouraged to understand communities' risk perceptions in order to focus their policies, strategies, and decision-making tools appropriately.

Keywords: Community disaster resilience, technological risk, ARC-D tool, disaster risk management, multitemporal resilience analysis, risk perception.

Promoting disaster preparedness and resilience by co-developing disaster risk stakeholder support tools for managing the systemic risks associated with multi-hazards

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Not having publicly available tools for developing and quantifying impact chains for compounding multi-hazard events and their cascading impacts is one of the major challenges in Disaster Risk Management. The available loss assessment tools are often not within reach of first and second responders and local authorities, and their data requirements may be overly complicated for the stakeholders to obtain within the time they have to make decisions. In this framework, the overall objective of the PARATUS project is the co-development of a web-based simulation and information service for first and second responders and other stakeholders to evaluate the impact chains of multi-hazard events with particular emphasis on cross-border and cascading impacts. This presentation provides an overview of the project and the disaster risk stakeholder hub. The DRS-Hub will have two major blocks: an information service that provides static information (regularly updated) and simulation service, which is a dynamic component where stakeholders can interactively work with the tools in the platform. The information service is expected to contain several components: a terminology WIKI and links to other platforms developed by EU Horizon Europe projects with similar objectives; an impact chain WIKI which contains the standardized impact chains for a number of historical disasters, and which can be queried by users on several aspects; a module linking to hazard and exposure datasets and modelling results; a tool guiding users to various resources on risk reduction measures, and climate adaptations, and a tool to link to relevant datasets of the case study sites. The simulation service includes a suite of tools that users can utilize to develop new hazard and risk information for their specific area, as well as to create future scenarios and explore risk reduction alternatives. The following tools are foreseen: an impact chain builder, where users can develop their own impact chain of past events, or possible future disaster events, which is used as a basis for quantifying direct damage and prioritizing secondary losses in different sectors; the FastHazard tool which will provide fast estimations of multiple hazards and can be used as basis for risk reduction planning; the RiskChanges tool for the quantification of losses; a resilience indicator tool; a tool for developing future scenarios and risk reduction alternatives; an impact-based forecasting tool; a component for serious games for training with the other simulation tools; and a tool for collaborative planning. The exact number of components, and the final structure of the platform will be

determined iteratively through a series of stakeholder consultations, following a user-centred design. The platform will be designed in a flexible way to be able to cater for stakeholders that work in different sectors, geographic setting, and interacting hazards, and at the same time to address (a number of) their needs for analysing the impact of compounding and multi-hazard events, with cascading impacts.

Keywords: Multiple risks, Co-development, Systemic risk

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Resilient Colombia: Preparation and Anticipatory Action for the El Niño Phenomenon and Implementation of the National Network of Forest Brigades

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Colombia is located in the Intertropical Convergence Zone and is therefore directly affected by the dynamics of the ENSO phenomenon: droughts, rising temperatures, and forest fires, which impact the population, property, infrastructure, biodiversity, livelihoods, service provision, and/or environmental resources. Regarding forest fires, according to the National Unit for Disaster Risk Management [UNGRD, 2024], there is evidence of 5,478 forest fires that affected 225,036 hectares during the 2014-2016 period, and for the 2022-2023 period, 3,629 forest fires were reported, affecting 205,031 hectares. Consequently, it is necessary to implement strategies that allow the development of territorial resilience capacities to prevent and reduce recurring impacts caused by the ENSO phenomenon. For this reason, MINAMBIENTE, in collaboration with UNDP, implemented the project "Preparation and Anticipatory Action for the El Niño Phenomenon and Implementation of the National Network of Forest Brigades." In coordination with Community Action Organizations, 80 Community Forest Brigades were formed nationwide, receiving technical training from volunteer fire departments and being equipped with personal and technological protective equipment for prevention, reporting, information collection, and first response to disaster risk scenarios caused by forest fires. They also can transfer knowledge through social appropriation activities focused on transmitting a message of forest fire prevention to the community, linking members of the Municipal Disaster Risk Management Councils to these processes through channels that allow for informed decision-making.

Keywords: ENSO phenomenon, territorial resilience, forest brigades, forest fires

Session 14.

Artificial intelligence, science, technology, and innovation

Chair:

Jairo Bárcenas

(UNDP)

Design of an early warning system for vegetation cover fires in the municipality of Valledupar using remote sensors

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In recent decades, an increasing number of forest fires have affected the Serranía del Perijá, generating negative consequences for the economy, society, and the environment. By 2004, the number of hectares consumed by forest fires in the Caribbean region reached 200,000 hectares, and this figure is expected to increase due to atmospheric warming and low rainfall. (MARIA FANNY MONDRAGÓN LEONEL, 2013). The prototype was developed to mitigate the risk of high forest fire incidence by utilizing an early warning system that incorporates remote sensors, geographic information systems, and historical data. The study showed that the area's most at risk are those with the highest wind speeds, lowest rainfall, and greatest temperature increases during the months of December, January, February, and March. On the other hand, it was observed that the vegetation most prone to fire spread is weedy pastures, wooded or cleared pastures, and shrubby areas. It is worth highlighting the creation of two dashboards monitoring hot spots and fire activity in the municipality of Valledupar. The first displays data on hotspots in the Department of Cesar. Hot spots are updated every three hours, providing faster visibility of changes and access to the necessary data regarding the various hot spots generated within the area. The second, through an interpolation tool, enables the prediction of potential hotspots. This system will provide the municipality with a real-time fire hazard zoning map, enabling potential fires in the city of Valledupar to be visualized and allowing risk management entities to respond accordingly.

Keywords: Risk Management, Prediction, Interpolation, Reclassification, Dashboard.

Volcanism in central and southwestern Colombia: origin, evolution, hazard, volcanic soils, and geotourism

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The active volcanic arc in Colombia originates from the subduction of the Nazca Plate beneath the South American Plate. This geological process has given rise to numerous volcanoes with diverse compositions and eruptive styles. The presence of these volcanoes influences the perception and understanding of volcanic hazards, agricultural development, and geotourism in nearby communities. This study focuses on two volcanic fields: the Guamuez-Sibundoy Monogenetic Volcanic Field, located in the south of the country, which hosts at least 20 volcanoes with varied basic compositions and eruptive styles; and the Tapias-Guacaica Monogenetic Volcanic Field, in the center of the country, which is comprised of at least seven volcanoes with felsic compositions and predominantly effusive eruptive styles. The knowledge generated has allowed us to determine that these fields have the potential for a new eruption, thus providing new data for assessing the volcanic hazard in the country, which currently focuses on polygenetic volcanoes. Additionally, the study of Andisol soils, a product of the alteration of volcanic rocks and volcaniclastic deposits, has been linked to the agricultural productivity of the regions. At the same time, it has been determined that there is a high geotourism potential around the volcanoes, associated with scientific, educational, and tourism values. This has enabled the identification of geological sites of interest, as well as the development of georoutes and geotourism interpretation plans for community use. The results of this project have facilitated the connection between science and society, providing accessible knowledge to local communities in both regions. The appropriation of this knowledge has enabled progress in communities' understanding and management of the territory, as well as their comprehension of volcanic hazards and exploration of their benefits.

Keywords: Monogenetic volcanoes, volcanic soils, geotourism, social appropriation of knowledge.

Implementation science for disaster risk reduction: a critical review

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There is a critical gap between what is known about effective disaster risk reduction strategies and what is provided and experienced by beneficiaries or end-users in real-life situations. Innovative countermeasures for disaster prevention are rarely implemented successfully. We cannot create resilient communities and cities due to the implementation gap, but damage and death tolls are increasing in both developed and developing countries. Due to this poor implementation mechanism, the social and economic costs of disasters are rising, while scientific and technological innovation offers us several new and potentially effective disaster prevention technologies. Therefore, the implementation of effective and innovative interventions in diverse settings and populations is a priority in DRR discussions. The gap between known effective countermeasures and the prevention delivered is mainly due to the paucity of evidence on implementation. Most information on implementation processes is based on anecdotes, case studies, or highly controlled experiments that have limited external validity and are unlikely to have practical implications. An actual science of implementation is only just emerging. Because of the pressing need to accelerate our understanding of successful implementation, concerted efforts are required to advance implementation science in DRR. This study seeks to advance implementation science in DRR by examining the emergence of implementation as a research topic, addressing key issues of language and conceptualization, presenting a schematic framework for the study of implementation processes, and identifying implications for research and training in this emerging field.

Digitalization of Participatory Mapping in Integrated Disaster Risk Management - Potential and Limitations of the Sketch Map Tool for Humanitarian Organizations

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In disaster risk management, participatory mapping bridges spatial data gaps in communities by integrating local risk knowledge. Despite the proliferation of tools facilitating participatory mapping, accessibility remains a challenge for communities and humanitarians unfamiliar with technologies, such as geographic information systems. The adoption of the Sketch Map Tool (SMT), a novel participatory mapping tool, has grown worldwide in the humanitarian community. However, its potential and limitations in supporting humanitarian operations, such as during transect walks, capacity assessments, and disaster risk reduction, lack formal data-driven analysis. This qualitative case study evaluated the technological advancement of the SMT by examining its application in community risk assessments and risk reduction planning by humanitarian organizations. Focusing on the first open version and its subsequent iteration (SMT 2.0), this study assessed strengths, shortcomings, and enhancements within the Enhanced Vulnerability and Capacity Assessment of the International Red Cross Red Crescent Movement. Findings revealed the SMT's potential for formalizing, visualizing, gathering, and discussing local knowledge, risk perceptions, and preferences during transect walks and group mapping, merging manual data collection with digital analysis and storage for improved community mapping and decision-making through digitalization. However, the tool's adoption and applicability in various scenarios faced limitations due to constraints in software functions and usability, which were partially addressed with the addition of new languages and user support materials, another base map option, and enhanced digitalization models. While SMT 2.0 aims to address previous constraints, additional growth opportunities have been identified that require further validation by future research to ensure its applicability in a variety of humanitarian tasks. Our results demonstrate essential requirements for the development of participatory mapping tools, emphasizing flexibility, adaptability, compatibility with other tools, two-way communication, and adoptability and usability for non-experts, thereby enabling the disaster risk community to advance in the field of integrated disaster risk identification and assessment.

Keywords: Disaster risk knowledge, Community-based disaster risk reduction, Participatory mapping, Technological innovation, International Red Cross Red Crescent Movement

Hybrid Monitoring System for Assessment of Thermal Effects on Concrete Bridge Girders

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The response of concrete bridges under the seasonal and daily temperature variations they undergo will become more critical because of climate change. This concern introduces the necessity to measure the temperatures of bridges to assess the adequacy of design guidelines for thermal actions, such as those established in the Colombian Bridge Design Code, and to estimate the thermal forces and deformations. This work discusses the development, implementation and partial results of a thermal monitoring system that combines a drone with integrated thermal camera and a meteorological weather station. The system was implemented on a full-scale, 1.2-m long, reinforced concrete slab-I-girder model. The girder consists of an AASHTO Type I and the slab is 0-15 m thick. The model was designed to represent an exterior girder of a bridge, and had many thermocouples embedded in a cross section to measure internal temperature. The thermal photos captured by the drone were processed to construct external temperature profiles on a face of the girder. This data was integrated to solar radiation, precipitation, wind direction and speed recorded with a meteorological weather station located meters away from the model. Due to accessibility constraints to the lab, the data was measured for 30 days from 6:30 to 4:00 pm every 30 minutes. The presentation will cover the comparison between external (drone-based) and internal (thermocouples-based) thermal profiles and their qualitative correlation to meteorological data. This step is critical before going into phase two of the development, in which artificial intelligence will be integrated to speed up prediction.

Keywords: Climate change, Bridge temperature, Temperature profile, Drone, Monitoring.

Technologies for community-based disaster risk management

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The implementation of technologies has a direct impact on disaster risk management, especially in vulnerable communities. Technological tools not only enable real-time monitoring of hazards but also empower local communities by facilitating their participation in the different stages of risk management. Platforms such as Kobo Toolbox and ALERCOM enable communities to collect and share information on imminent risks, thereby increasing their immediate response capacity and reducing the time required to activate responses. Furthermore, the use of drones and 3D modeling provides accurate data on affected areas, while the ONUSAT satellite offers key imagery for real-time monitoring of large areas, improving response capacity to respond to large-scale disasters. These technologies have been applied in projects such as the El Niño Preparedness and Anticipatory Action Program and the National Network of Forestry Brigades , as well as in the recovery of Providencia Island following Hurricane IOTA, where UNDP, in collaboration with government entities such as the Ministry of Environment and Sustainable Development (Minambiente) and the National Unit for Disaster Risk Management (UNGRD), used these technologies to coordinate the response and accelerate recovery. This study shows that, through the appropriate use of emerging technologies, it is possible to transform the way disaster risks are managed, offering not only immediate solutions to catastrophic events, but also planning tools to mitigate future risks and encourage community participation. In the long term, the integration of these tools, including satellite imagery and information management platforms, has the potential to improve community resilience, helping communities to be better prepared for natural disasters and contributing to a faster and more effective recovery.

Keywords: Technologies, Risk management, Vulnerable communities, Real-time monitoring, Kobo Toolbox, ALERCOM, Drones, ONUSAT, Satellite imagery, Recovery, UNDP, Community resilience.

Session 15.

Risk identification in rural and urban environments

Chair:

Sandra Mendoza
(UNGRD)

National Seismic Risk Model of Colombia

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The National Seismic Risk Model (MNRS) is an initiative of the Colombian Geological Survey, developed in collaboration with 14 Colombian universities affiliated with the Colombian Association of Engineering Faculties, with the guidance of two international experts, and the support of government entities and other public and private organizations. The MNRS is conceived as a public, open-data reference model that seeks to contribute to the knowledge and management of seismic risk in the country, at the national and regional levels. The current phase of the MNRS focuses on the residential sector, and for its development, 90 population centers were prioritized, covering more than 60% of the population, including capital cities. For these, building and population exposure models were developed at the census block level using public information and visual inspections of representative building samples. The replacement cost was approximated to the estimated construction cost from a national cost model, also developed for the MNRS. The MNRS vulnerability model was constructed by defining typologies and characterizing their construction using databases of structural and architectural attributes and the mechanical properties of building materials. This allowed for the definition of multiple structural archetypes to capture random uncertainty, their numerical modeling, and the derivation of fragility and seismic vulnerability functions. Seismic risk was assessed using a probabilistic and scenario-based approach, so that the MNRS results could be helpful for risk reduction and financial protection, disaster management preparedness, and reconstruction. Finally, examples of the results produced for each population center are presented, and their potential applications in DRM are discussed.

Keywords: Risk management, land use planning, seismic risk.

Use of Qualitative Methodologies for Risk Awareness in Road Infrastructure

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According to figures from the Ministry of Transportation, Colombia's national highway network totals 205,317 km, of which INVIAS is responsible for approximately 38,130 km, corresponding to 62% of the Primary Network and 19% of the Tertiary Network. In recent years, increased precipitation associated with rainfall patterns and climate variability has led to the materialization of multiple hazards, affecting the national road network in 26 of the country's 32 departments. For example, during the first five months of 2022, INVIAS responded to 570 road closures associated with rain, with 371 roads affected. The institute invested more than 2.6 billion pesos to address these emergencies. According to the institute, most events that cause damage to road infrastructure are associated with hazards from mass movements and flooding. Thus, in 2020, INVIAS signed Agreement Number 736 of 2020 with the University of Quindío and La Salle University. Within the framework of this, the University of Quindío generated qualitative methodologies to approach the knowledge of the risk in road infrastructure due to mass movements and floods, as a response to the need to create tools that facilitate decision-making at the institutional level, while allowing the generation of databases with georeferenced information using the capacities of the institutions. Subsequently, through Agreement Number 949 of 2021, the methodologies were applied through a pilot exercise with road administrators in their regions, as a result, the analysis of the physical risk was achieved in 1,171 km of road infrastructure with the tool for mass movements and 534 km for floods, in 12 departments.

Keywords: Risk, Road Infrastructure, Qualitative Methodology, Mass Movements, Floods.

Green Digital Transition: Integrating Carbon Neutrality for Sustainable Tourism Development

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Tourism is responsible for 8% of global greenhouse gas emissions and faces pressure to reduce its environmental footprint through innovation and sustainability. Achieving this transformation requires systemic changes in consumer behavior, tourism planning, and governance. The Digital Green Transition offers a strategic framework by integrating carbon neutrality measures, data-driven decision-making, and digital technologies to optimize environmental impact. Here, within the Gipuzkoa Provincial Council's Framework Program, we quantify the carbon footprint of tourism-related activities, analyze visitors' pro-environmental behaviors, and assess their willingness to pay (WTP) for sustainable tourism. We draw on two empirical studies: Hall (2022, https://doi.org/gn673d) and an ongoing assessment of pro-environmental tourist behavior in Donostia-San Sebastián. These analyses provided insights into mobility patterns, perceptions of sustainability, and the role of technology in fostering responsible tourism consumption. We found a need for digitalized tourism management systems that integrate real-time transportation data, behavioral analytics, and targeted incentives to promote low-carbon mobility options. Our results indicate: (i) 57% of respondents are willing to pay between €1 and €15 extra per night for eco-certified accommodations, while 16% reject price increases; (ii) moderate fee adjustments for museums, public transportation, and restaurants are widely accepted; (iii) 75% of respondents support environmentally responsible tourism, reflecting the growing demand for sustainable travel. Despite these positive trends, financial barriers pose significant challenges, requiring tourism planners to strike a balance between affordability and sustainability. Our findings underscore the importance of integrated governance strategies that leverage technology, policy, and consumer engagement to drive carbon-neutral tourism. We recommend adopting innovative mobility solutions, including real-time transportation data systems, eco-incentives, and digital signage tools to facilitate sustainable travel behaviors.

Keywords: Sustainable tourism, green digital transition, carbon footprint, smart mobility solutions, willingness to pay (WTP).

Evaluating a hospital system's response to disasters

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When assessing and managing the risk of essential buildings and systems, such as hospitals, it is necessary to consider not only direct damage but also the potential disruption of their functions during emergencies, as well as the impact on the provision of services to the population. In the event of a disaster, hospital systems must cope with a sudden increase in medical emergencies due to the number of people who may be affected. In this context, it is important to understand hospitals' capacity to manage the crisis and to evaluate possible damage reduction alternatives. This paper focuses on the application of various methodologies to assess the response of hospital systems to seismic events. In general, the analyses include the following aspects: (i) estimating the initial number of injured; (ii) the distribution of injured patients within a hospital network; (iii) the transportation of patients to hospitals; (iv) estimating the number of patients presenting at different intervals at each hospital; (v) assessing the number of patients being treated and those waiting; (vi) the definition of a timely response and operational criterion for each hospital and the hospital system. For illustrative purposes, estimates of damage to buildings and the number of affected people is made, considering a hypothetical seismic event. In turn, the system's supply conditions, and response capacity are evaluated. These results are helpful in the development of emergency plans, simulation and drill exercises, as well as for the benefit/cost analysis of seismic risk reduction in hospital infrastructure.

Keywords: Hospital security; Hospital systems response.

Monitoring of geophysical variables (seismic, electrical, magnetic and gas records) at the Andean and national campuses of the National University of Colombia (UNAL) through the UNAL Geophysical Network

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The development of the Geophysical Network of the National University of Colombia (RGUNAL) is described as a result of the integration of the inter-site work of the UNAL, which is reflected in the installation of multiparametric geophysical stations in all the campuses of the National University of Colombia (Bogotá, Medellín, Manizales, Palmira, La Paz, Amazonia, Orinoquia, Tumaco and Caribbean). The variables to be recorded are seismic, electrical, magnetic, and gas records: CO2, CH4, H2. These stations are part of the RGUNAL, which integrates the existing seismological stations and multiparametric stations installed in other regions, in collaboration with other institutions (UAN, UNAD, TIGO). This includes three multiparametric stations located in Antarctica, in partnership with the Argentine Antarctic Institute. This instrumental network transmits unique data in real time to a data reception and processing center located in the Department of Geosciences at UNAL in Bogotá, with the ability to generate digital mirrors. All information is available 24/7 to the general community and regional institutions as input for geological, geophysical, and engineering studies.

Keywords: Monitoring, geophysics, Colombia, Antarctica

Session 16.

Water resources and land-use planning

Chair:

Ana Milena Prada
(UNGRD)

Evaluating climate change vulnerability and risk management strategies for water security in coastal Colombian vulnerable communities

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Climate change has a significant impact on water security in coastal areas, particularly affecting communities located in Juan de Acosta, Tubará, and Puerto Colombia on the Colombian coast. These municipalities face heightened climate risks, including flooding, drought, and erosion, due to their coastal locations and tropical dry climate. The lack of substantial water sources compels residents to depend on wells and, occasionally, rainwater harvesting, emphasizing the urgent need for effective climate governance and robust adaptation and mitigation strategies. This need is further corroborated by the limited involvement of civil society and the inadequacy of public frameworks to integrate effective climate actions. This study adopted a multidimensional approach to analyze the impact of climate change on precipitation patterns and water security. We initially analyzed historical precipitation data from local meteorological stations to identify trends and deviations. Future climate projections were then modeled using IPCC scenarios to predict changes in precipitation through 2040, 2070, and 2100.

The methodology also involves the use of EPA's Storm Water Management Model (SWMM) to simulate hydrological impacts and the amount of water potentially available under various climate scenarios. This included modeling stormwater runoff and assessing storage capacities under potential future precipitation events. The simulations aimed to identify and propose tailored rainwater harvesting solutions to ensure sustainable access to water. Post-implementation effectiveness of these systems was also evaluated by comparing actual and future scenarios (before and after project execution), adjusted for observed climate variability. Results confirmed that rainwater harvesting significantly enhances water security, providing a stable supply of potable water during critical periods. This research presents a valuable model for similarly affected coastal communities, emphasizing the need for proactive infrastructure adaptation to address future water challenges.

Keywords: Water security, Climate change adaptation, Drought management, Sustainable water resources, Sustainable practices.

The Mocoa, Putumayo, river flood and its lessons learned for land use planning

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Considering risk conditions at the local level is a regulatory responsibility. Based on this responsibility, many municipalities across the country have incorporated content into their Land Use Plans as an essential requirement for advancing their land use planning processes. Mocoa was one of them. However, an extraordinary torrential flood impacted the lives, infrastructure, and livelihoods of a large part of the city. Disaster analysis immediately addressed the situation, considering the actions of various entities, organizations, and communities, who, using their resources and capabilities, sought to advance recovery from the situation. Likewise, the analysis of the causes took on great importance in establishing responsibility for what happened, rather than control and prevention options. The response to the disaster and the study of its origins provided several lessons regarding the effectiveness, efficiency, and importance of adequately incorporating risk into land use planning. This analysis aims to highlight some of the lessons learned from the disaster, while addressing the initial and subsequent conditions that continue to shape the dynamics of risk management. This seeks to identify the elements that make a disaster a permanent source of knowledge and learning for planners, government officials, and communities, who must guide land use processes, define the urban and rural environmental structure, and ensure the municipality's economic and social development. In this regard, several situations involving the regulation and enforcement of risk-related standards are presented, highlighting the perception and social construction of risk. This is one of the main elements that allowed for the identification of shortcomings in achieving comprehensive disaster risk management, where all stakeholders assume their appropriate roles in situations like the one that occurred in Mocoa.

Keywords: Torrential flood, lesson-learning.

Water security and resilient cities: comparing the cases of Brazil, Colombia, and Mexico

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Water security is emerging as one of the Sustainable Development Goals (SDGs) established by the United Nations in 2012. SDG 6 establishes the guarantee of a sufficient supply of water quality and quantity, to be achieved by 2030. According to future projections, the proportion of the global urban population is expected to increase from 46.6% in 2000 to 66.4% in 2050. This growth will increase water demand and stress. Problems related to water resources include pollution and degradation of surface and groundwater quality, as well as the occurrence of extreme events such as floods, droughts, and mass movements. The growth of vulnerable urban populations and increasing density are among the primary factors contributing to an increase in disaster risk, primarily due to greater exposure. Disaster resilience, in turn, refers to a city's capacity to understand, mitigate, and respond to risks. Preventive management and post-disaster recovery actions are also considered to return to conditions like those existing before the event that triggered the disaster. The article's challenge is to compare case studies conducted at different scales in three Latin American countries: a Water Security Plan developed for Caraguatatuba, São Paulo, Brazil; the Design of a Water Security Index for Strategically Important Watersheds in the Aburrá Valley, Antioquia, Colombia; and an analysis of Water Security Indices for Mexico with a focus on watersheds. The paper will analyze how the tools address the impact of climate change and extreme hydrometeorological events on water security. The expected results will include a comparison between the analyzed tools, identifying similarities and differences, and suggesting solutions to challenges based on other international experiences.

Keywords: Water security, Climate change, Risk, Resilience, Latin America

Recharge of lentic systems in paramo areas case study: origin of the recharge of the Laguna Negra system, located in the Oceta paramo, based on the development of a conceptual hydrogeological model

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The Laguna Negra lentic system is located in the department of Boyacá, within the jurisdiction of the municipalities of Mongua and Monguí. Due to the increase in sustainable tourism activities in the region, and the fact that the lentic system supplies the municipalities and the surrounding villages, it is essential to understand the hydrogeological dynamics of paramo systems and specifically the recharge phenomenon in glacial lagoons in paramo areas. This provides a prior understanding of the water processes involved, allowing for better planning and conservation of water resources. The lentic systems present in the paramos could be considered as future sources of water for populations with drinking water quality problems, such as the urban and rural areas of the municipalities of Monguí and Mongua, Boyacá. The academic research project developed corresponds to the implementation of a conceptual hydrogeological model in the area known as Laguna Negra, which is located within the Oceta paramo system. This model is developed to understand the recharge behavior of the Laguna Negra and its close relationship with the hydrological and hydrogeological dynamics of paramo areas. Due to the problems described above, it is important to develop and implement strategies for resource planning and preservation of these types of strategic ecosystems, which in turn will change tourists' socio-environmental perspectives on the functioning of the paramo and the processes that take place there. Ultimately, these academic and research processes should serve as technical tools for informed decision-making within environmental and governmental frameworks, as well as in the context of climate change scenarios, thereby contributing to their conservation and sustainable use.

Keywords: Water, Hydrogeological, Paramo, Lentic, Preservation.

Logic of care in inter-disaster phase: Managing a civilian disaster volunteer center at water-related disaster-prone area in Japan

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This presentation aims to leverage Annemarie Mol's theory on the "logic of choice" and "logic of care" in medical anthropology as an analogy to frame our understanding of disaster rehabilitation processes. It centers on a civilian disaster volunteer center, "O," which was launched in 2019 in Takeo City, Saga Prefecture, in the Kyushu region of Japan. In 2019 and 2021, Takeo City faced severe flooding and difficulties in disaster rehabilitation amidst the COVID-19 pandemic. This study addresses how disaster management paradigms can be enhanced by integrating the "logic of care" into community-driven efforts. The presenter demonstrates that fostering the community's autonomy and value judgment, based on the "logic of care," contributes to sustained disaster rehabilitation, in contrast to the "logic of choice" that emphasizes linear decision-making and places responsibility on individuals for the outcomes of their choices. The findings illustrate that rehabilitation that considers the emerging and relational context of the volunteer center from the bottom helps mend systems more deliberative than previously understood models based on predefined strategies. These insights underscore the importance of sustained and collective efforts among all stakeholders—including families, professionals, volunteers, governmental entities, and non-human actors such as infrastructure and documents—to build a resilient society equipped to handle sporadic disasters. Drawing on Mol's logic of care, this presentation advocates for a shared responsibility model that intertwines the resources of human/non-human actors to improve care and quality of life during inter-disaster phases. This perspective suggests a shift from merely creating resilience in response to each disaster to continuously caring for a resilient society.

Keywords: Logic of Choice/Care, Inter-disaster Phase, Civilian Disaster Volunteer Center, Responsibility.

Internal forced displacement due to environmental factors: a new legal paradigm in the Colombian state

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This analysis aims to deepen the academic debate on the phenomenon of forced internal displacement caused by environmental factors. This is necessary, given that Colombia, a nation with immense wealth in biodiversity, fauna, and flora, as well as various thermal zones, is also a territory not immune to the consequences of climate change. This issue constitutes a social, legal, and state challenge in terms of the institutional capacity for adaptation and coping with climate change, since "climate change scenarios for Colombia show that from 2011 to 2040, there would be an increase in average temperature of more than 2% homogeneously across almost the entire country. " Thus, about climate change, "the impacts will gradually appear, and Colombia will be significantly affected. IDEAM estimates that by 2050, 80% of the country's glacial area will have disappeared and 60% of the páramos area will be highly degraded. This will have diverse, global implications if we consider that the greatest biodiversity of páramos in the world is found in Colombia." These factors make this study and the proposed theories relevant, since climate change in Colombia constitutes a latent risk, against which measures must be adopted from the spectrum of state action, keeping in mind that the regions most affected by the increase in natural and climatic phenomena will be those that are most vulnerable and with the least range of adaptation to climate change. Thus, this proposal focuses on approaching the concept of forced internal displacement due to environmental or climatic factors as a new legal paradigm in the Colombian State - environmental or climatic displacement -, finding it equally necessary to address key aspects regarding possible actions to be taken by the State in the scenarios of prevention and attention to this type of cases based on respect for the right to prior consultation, the transversality of the differential approach (ethnic and gender) and under the premise of comprehensive reparation with a transformative vocation based on the jurisprudence of the Inter-American Court of Human Rights.

Keywords: Environmental and/or climate-related forced displacement; climate change; prevention and comprehensive reparation.

Session 17.

Differential approaches to DRM

Chair:
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Villa B, a scenario of socio-environmental impacts following the 2010 Sucre-Sucre floods

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Flooding is a global phenomenon, but equatorial countries, which enjoy the ecosystem riches of rivers, lakes, wetlands, and seas, tend to be disproportionately impacted by increased rainfall. The Colombian territory experienced an increase in rainfall in 2010–2011, a direct result of the so-called winter season. According to Sánchez (2014), the La Niña phenomenon was one of the most devastating natural disasters in the nation's history, causing significant social and economic losses. Flooding is a recurring event in the Caribbean region. The Mojana subregion comprises four regions: Antioquia, Bolívar, Córdoba, and Sucre. It is characterized by a complex water network of streams, wetlands, and the most important rivers: Magdalena, Cauca, and San Jorge. In this space, two phases are generated cyclically: the intense summer, with its direct effects of drought, and the winter, marked by increased rainfall and subsequent flooding. The central objective of the research was to determine the actions mobilized by the population of Villa B, in Sucre-Sucre, to confront the 2010 floods. In the previous approaches through non-participant observations and ethnographic observations, the following practices were found, undertaken by the community of Villa-B and, to a large extent, the municipal capital of Sucre: the creation of tambos (drums), these dry wooden structures, which allow circulation within the home and the protection of belongings in high places within the house, the creation of wooden canoes and balsas with recyclable materials for internal transport in the neighborhood and the municipal capital.

Keywords: Socio-environmental impacts, amphibious culture, resilient practices, floods.

Awareness on Women's Empowerment and the Role of Theatre: A Study in a village of West Bengal, India

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Facilitating the process of women's empowerment is crucial to enable women to enhance their self-worth and stand up for equality, helping them to speak out for others. The issue is closely related to human rights and a country's development, and raising awareness about women's empowerment and violence against women is essential for social development. The present study examines the efficacy of theatre as a medium for raising awareness among the masses on highly debated and crucial gender issues, including violence against women, and the empowerment of women, as well as the effectiveness of theatre as a means of communication. We conducted a field survey in Bishnuvati village, Birbhum, West Bengal, with 50 respondents to assess their level of awareness regarding Violence against Women (VAW). A play was also staged for them to understand the impact of theatre. The survey revealed that the majority of the respondents, both men and women, believed men possess more controlling power in the family. It was also revealed that decisions are often made jointly in the family. Regarding physical abuse as a form of violence, most respondents, mainly the women, responded in affirmation and identified it as severe form of violence. After the theatre performance, 2nd second-level survey was conducted with the same 50 respondents, and it was revealed that the theatre was the most preferred medium of generating awareness among the masses as compared to other media. Two case narratives out of twenty case studies are also presented in this paper for in-depth understanding. The justification of the study is that it attempts to establish that theater is a powerful and acceptable communication medium to raise awareness on violence against women particularly in rural areas and, thereby an effective tool to promote a gender-just society.

Keywords: Theatre; Women Empowerment, Awareness, Violence against Women (VAW)

The differential ethnic approach as a strategy to reduce disaster risk in Colombia

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Colombia is a multicultural country with a population of approximately 13% belonging to ethnic minorities, who are particularly vulnerable to disasters. In response to this situation, the ethnic differential approach has been implemented as a key strategy for reducing disaster risk. This approach aims to integrate ethnic perspectives into all risk management processes, thereby enhancing community knowledge and improving understanding of risk dynamics. Despite progress, the implementation of these initiatives faces significant challenges, particularly in adopting guidelines at the local level, which underscores the urgency of strengthening the integration of this approach within local institutions and communities. Furthermore, it is crucial to foster intercultural dialogue and the appreciation of scientific and ancestral knowledge, integrating these dimensions into all phases of the disaster risk management cycle. This chapter aims to analyze the implementation and challenges of the ethnic differential approach to disaster risk management in Colombia, highlighting its importance in mitigating the vulnerability of these communities to natural disasters. The effective incorporation of this approach not only contributes to local resilience but also promotes inclusive management adapted to the country's cultural realities.

Keywords : Disasters; risk management; Colombia; ethnicity; cultural diversity.

Memorializing disaster: community dynamics and memorial spaces The case of Storm Xynthia in La Faute sur Mer, France

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Lorem Storm Xynthia is a major meteorological depression that struck areas of the Atlantic Ocean and Europe before moving across the western part of France on February 27 and 28, 2010, causing substantial material damage and loss of life. The storm, high tidal coefficients, and high tide resulted in sudden and severe storm surges, causing dikes to fail in several locations, and severe flooding along the Atlantic coast. This event highlighted vulnerabilities in disaster preparedness and prompted questions regarding land use and coastal protection measures. La Faute-sur-Mer was one of the coastal towns worst impacted by storm Xynthia, with 29 victims. This research examines the intricate dynamics of disaster memorialization in La Faute-sur-Mer following the impact of Storm Xynthia. Part of the local community played a key role in campaigning for the memorialization of the disaster, including the establishment of a permanent memorial monument and public space to honor the victims' memories and commemorate the severity of the disaster. Based on fieldwork and interviews conducted throughout 2022 and 2023, this paper focuses on assessing the memorialization process as it has unfolded in La Faute-sur-Mer. Exploring the conditions and circumstances that shaped the community's response and memorializing activities, this study investigates the role and value of memorial spaces in community healing, memory traditions, and long-term recovery and resilience. It also addresses the tensions that emerged within the community during this time, focusing on the challenges of collective memory, narrative ownership, and remembrance practices. Ultimately, this study aims to contribute to a better understanding of the complexities involved in commemorating disasters and navigating tensions within communities going through memorialization processes by providing nuanced insights into the interactions between community dynamics, memorialization methods, and spatial representations of past disasters.

Keywords: Disaster memory, Memorialization, Disaster monuments, Risk communication, Community recovery.

Role of Civil Defence organization in community capacity building during pre- disaster phase: A Study of India

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There was a time when the occurrence of disaster was regarded as the act of God by the rulers and governments and people were left on the mercy of nature's fury. But with the advancement of technology and human consciousness, we figure out the vulnerabilities and adequate techniques to cope with these vulnerabilities and hence emerged the discipline of disaster management. The involvement of citizens in crisis management has always been part of disaster management activities and on the same lines the concept of Civil Defence emerged worldwide. Civil Defence is a voluntary force of trained citizens, who respond during any unforeseen situation in the locality. India enacted the Civil Defense Act, 1968 to provide basic training to its citizens regarding counter war measures. But in 2009, the responsibilities of the Civil Defence corps were increased, wthe hen government amended the Civil Defence Act 1968 and added disaster management duties. The objective of this paper is to understand the role of the Civil Defense organization in community capacity building during the pre-disaster phase in India. The study is based on the analysis of secondary data available atç national and state administration levels, and also the recommendations of various commissions and committees formulated by the Government of India from time to time have been analyzed and incorporated in the paper. The findings of the study revealed that the Civil Defence organization played a stellar role in community capacity building, and even in the Covid-19 pandemic, the volunteers trained by the Civil Defence organization helped the district administration by rendering para-medical and para-policing services. The schemes introduced by the Government of India, such as "Aapda Mitra" (Friends during disaster), are a testament to the importance of community capacity building during the pre-disaster phase, in which the government is investing a significant amount to make the community disaster-resilient.

Keywords: Disaster Management, Covid-19, Civil Defence, Disaster risk reduction, Volunteerism.

Disasters and their impact on violence against women: A correlational analysis for the Peruvian case 2014-2021

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This research analyzes two problems facing Peru: disasters and extreme hazards (landslides, low temperatures, floods, droughts, mudslides, avalanches, heavy rains, among others) that directly impact the most vulnerable populations, and violence against women (rape and femicide), primarily among adolescents and girls. Ordinary Least Squares (OLS) econometric analysis is applied to two variables: one proxy variable, consisting of the number of femicides recorded and the number of cases of sexual violence against women; and the other variable, emergencies caused by disasters, for the period 2014–2021. The correlation between these variables, taken from official Peruvian sources, was analyzed, verifying a positive trend between sexual violence against women and the number of disasters. That is, as the number of disasters increases, regardless of type, the number of rapes against women increases. Unfortunately, this relationship is equally positive concerning the rise in the number of femicides in Peru during the period analyzed. Regarding the research, we can highlight its relevance because it presents a distinct approach to the determinants of violence, addressing aspects beyond those traditionally studied, such as social, economic, and cultural factors. Furthermore, the work enriches the analysis of gender-based violence against women, given that it places greater emphasis on the occurrence of calamities, particularly those that occur suddenly. Unforeseen events, such as disasters, have direct effects on: (i) changes in the dynamics of family relationships, (ii) levels of overcrowding, (iii) the degree of exposure to domestic violence among the most vulnerable segments of the population, such as children and adolescents, among others. These characteristics are corroborated by the results achieved in this research.

Keywords: Disasters; Femicides; Women; Gaps; Gender.

Community Maps: A Participatory Tool in Disaster Risk Management

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Community participation in disaster risk management is widely discussed as a necessary element for achieving disaster governance, fulfilling the goals of the Sendai Framework in the countries of the region. In this regard, tools and methodologies that encompass social processes surrounding DRM are required. In response, Law 1523 of 2012 in Colombia proposes a participatory and culturally diverse principle, which incorporates stakeholders and diversity in organizational and participatory matters. Similarly, Article 18 of this same Law presents the members of the Territorial Councils for Disaster Risk Management, including social and community organizations. However, in practice, community participation is not representative, as reported in the monitoring and evaluation report on minimum municipal capacities in risk management, where in section 9, "promoting community and private sector participation," it is evident that the country's municipalities do not issue any reports on this aspect of risk management. In this framework, it is proposed to strengthen community participation through a tool that allows the identification and prioritization of relevant points, based on the perception and memory of risk, in the territories, which dialogues with the municipal planning instruments in DRM. This is how the community mapping methodology becomes the tool that collects the diagnosis and provides information on possible places that may be affected by a hazard, as well as the location of the communities, infrastructure, and the most vulnerable assets.

Keywords: Communities, Capacities, Risk Perception, Participation, Community Maps.

Session 18.

Financial Assurance and Protection for DRM

Chair:
Kakuya Matsushima
(Kyoto University)

A simple model of the excess-of-loss insurance contract for a government in a disaster-prone country

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It has been pointed out that governments need to be prepared for disaster risks under climate change by entering insurance contracts. However, in international disaster-finance markets, high additional premiums due to a catastrophe and transaction costs are required; for example, if the markup rate (i.e., loading factor) is two, the premium for the full-cover contract is twice the average annual loss directly caused by a disaster. Moreover, for countries that experience multiple disasters almost every year, the arrival of some disasters is not an uncertain event, but rather a nearly annual occurrence. In such an environment, it is not clear how sovereign insurance helps stabilize public finances, both in terms of the path of total spending on disaster policies and their volatility.

This study examines the impact of the excess-of-loss (XoL) insurance contract on a government in a disaster-prone country. The XoL insurance contract has been applied in the private sector to safeguard businesses against catastrophic or extraordinary financial losses arising from customer insolvency or default. This study examines whether the XoL scheme promotes fiscal sustainability by limiting insured events to those of low frequency and high impact. We formulate a simple model in the tradition of the Lundberg model, established in ruin theory, and incorporate the loss-level attachment point, beyond which the sovereign insurance begins to cover excess losses. The government needs to reduce both the expected level of the debt path and the probability that the debt will exceed a certain threshold (the threshold exceedance probability). These two objectives are tradeoffs, and depending on the parameter environment, the optimal loss-level attachment point exists as an interior point solution. We analyze the properties of the threshold exceedance probability function and the optimal attachment point through a numerical example.

Keywords: Excess loss insurance, Fiscal sustainability, Disaster-prone country.

An empirical analysis about risk financing measures and the post-disaster business recovery process

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To mitigate the impact of disasters, it is necessary to implement a range of measures, including the use of subsidies, the preparation of surplus funds in advance, and the purchase of disaster insurance. This paper aims to empirically demonstrate the impact of various risk financing policies on the recovery of business establishments in the case of recent flood disasters in Japan. Specifically, we empirically analyze the factors that function significantly on the recovery process of business establishments, using the results of a questionnaire survey and interview survey targeting the affected establishments. We examine the effects of risk financing measures such as insurance coverage, contingency expenses, and subsidies on the speed of recovery.

Keywords: risk financing, flood disaster, recovery process

Definition of seismic risk transfer strategies in Colombian municipalities

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In disaster situations, it is important to have diverse sources of financing that allow for the timely execution of recovery and reconstruction works. In Colombia, efforts have been made since 2004 to reduce fiscal vulnerability to disasters through access to external loans, loans with deferred disbursement options for catastrophes, and catastrophe bonds. These funds have been useful in addressing the emergencies caused by rains in 2012, as well as in addressing the COVID-19 pandemic. In general, the design of risk transfer instruments requires modeling of probable losses, as well as a financial model to assess the cost of implementing such instruments. Currently, the Colombian Geological Survey, in collaboration with the Association of Engineering Faculties and with the participation of various universities in the country, is developing a National Seismic Risk Model (MNRS), composed of rigorous inputs for probabilistic hazard assessment, quantification of exposed value, and characterization of the vulnerability of residential buildings. These inputs allow for probabilistic loss estimates. Based on the results of the disaster risk models, parameters for transfer instruments can be defined, such as interest rates, maturity periods, investor payment schedules, instrument amounts, among others. This paper adopts catastrophe bond valuation methodologies to propose risk transfer schemes in Colombian municipalities, using the results of seismic risk assessments conducted within the framework of the MNRS. These results are considered relevant because they provide reference values for both expected losses and the costs of financial instruments.

Keywords: seismic risk financing, risk transfer.

Managing Sovereign Climate Risk in Vulnerable Developing Countries Smart Support Guidance for Donors and Policy Makers

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Developing countries grapple with a critical dilemma: balancing the imperative of development with investing in measures to build resilience against climate risks. Current adaptation efforts are often insufficient due to limited resources and fragmented initiatives, leaving vulnerable countries increasingly exposed to escalating hazards. Madagascar serves as a poignant case study, vividly illustrating these challenges. Hence, there is a pressing need for close collaboration between national governments and international donors to strategically mobilize limited resources for maximal resilience benefits. The Smart Support Guidance provides an analytical framework to illustrate the benefits of various risk management strategies within a broader macroeconomic context. Integrating Climate Disaster Risk Reduction Measures (CDRM) and Climate Disaster Risk Insurance and Finance (CDRFI) solutions, this guidance facilitates the "optimization" of investments, the assessment of multi-metric impacts of policies, and the maintenance of a balance between risk reduction, development, and fiscal sustainability. Our Smart Support framework involves estimating risk profiles, assessing the government's ability to finance disaster damage, and evaluating the policy trade-offs of various adaptation strategies. The risk profile estimation uncovers the significant vulnerabilities of Madagascar to cyclones and surges. Identified in the financing ability analysis, we highlight a large gap between available resources and the need for recovery and reconstruction given the current risk profile. This underscores the necessity for substantial investments in CDRM and CDRFI. To better illustrate the broader development and resilience impacts of CDRM and CDRFI, we developed the macroeconomic model to demonstrate that investments in risk management can bolster GDP growth and stability. Subsidies on risk management measures, backed by international donors, mitigate fiscal vulnerabilities, and fortify resilience. In conclusion, tailored adaptation strategies, robust stakeholder engagement, and refined economic modelling are paramount. Collaboration between national governments and international donors is vital for constructing climate-resilient futures for vulnerable countries like Madagascar.

Keywords: Integrative risk management; Multi-risk analysis; Risk finance and insurance; Macroeconomic modelling.

Study on the interference mechanism among multi-hazard integrated risk, economy, and population based on multi-source data

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In today's world, frequent occurrences of natural disasters and disaster clusters exacerbate the overall disaster scenario, while the compounding effects of multi-hazard risks pose significant hazards to socio-economic and demographic development. In a multi-hazard environment, the development of integrated risk prevention strategies must consider the interdependent mechanisms of disasters, the economy, and population. This study, based on the spatial characteristics of the combined risk, wealth, and population distribution of four types of natural hazards, investigates the Interference mechanisms linking multi-hazard risks, economies, and populations in Sichuan Province, China, and analyzes the challenges of disaster impacts on socio-economic and population development. Using traditional statistical data, remote sensing, and other spatial information datasets related to multi-hazard risk assessment, this study employs a combination of hierarchical and spatial analyses to overlay integrated natural disaster risk, population, and GDP distributions. Besides, it introduces the concept of "Relative Poverty Exposure Bias (RPEB)" to assess the relative vulnerability of economically disadvantaged groups facing multi-hazard risks across different cities and regions of Sichuan Province. Findings reveal that the superposition of multi-hazard risks explains the spatial distribution of comprehensive high-risk areas in the province. At the provincial level, high-risk areas with multiple hazards exhibit a negative correlation with socio-economic status and population density, while displaying a tendency towards a positive correlation at the municipal scale. The RPEB further explains the intertwined relationship between socio-economic, demographic, and combined natural hazards, and that the vulnerability of economically disadvantaged groups to high-risk integrated hazards demonstrates a complex, non-linear relationship that does not uniformly correlate with regional economic conditions. This study highlights the mechanisms that link the superposition of multi-hazard risks with socio-economic and demographic factors, providing valuable insights for the development of integrated multi-hazard preparedness strategies tailored to diverse regions.

Keywords: Multi-hazard risk superposition, Economically disadvantaged groups, Spatial distribution, Interference mechanism.

SURA Regional Resilience Methodology

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Insurance companies play a vital role in the development of national economies and are essential to ensuring business continuity and protecting the assets of all policyholders in the face of catastrophic events, while also significantly contributing to the resilience of cities. Aware of the severe damage that catastrophic events can cause to the infrastructure and operations of insured clients, as well as the resulting economic and life losses, SURA has developed the Resilience Methodology. This methodology integrates internal business continuity management to ensure post-disaster operations, utilizing pre-designed protocols to quickly and adequately serve affected clients, thereby facilitating their prompt recovery and adaptation after the event. Internal business continuity planning is based on the development of models that represent probable or historical scenarios of natural events. The results of these models identify potential impacts on the insurance company's internal operations, as well as on its clients, technology, communications, and urban infrastructure, and have allowed for the development of a response plan to address these contingencies. This response plan encompasses a process that ranges from understanding and technical characterization of the event, to early quantification of probable losses, and estimation of the potential impact each client may face based on the intensity levels recorded or estimated at their location. This includes the application of a building diagnostic and rehabilitation design methodology by expert structural engineers. Finally, the application of the SURA Resilience Methodology to major natural events such as the Mexico City earthquake of September 19, 2017, and, more recently, Hurricane Otis in October 2023, is presented as a success story.

Keywords: Resilience, Disaster, Business Continuity, Recovery, Adaptation.

Estimating the economic impact of the Taal Volcano eruption through electricity consumption

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Estimating economic impacts is crucial for providing sufficient financial support to affected units. Specifically, information on the spatial and temporal distribution of impacts is critical for the proportionate and timely distribution of support. However, economic impact estimates often lack spatial dimensions, resulting in a mismatch between resource allocation and the temporal dimension, which can lead to delays. This paper used electricity consumption (EC) and nighttime light data to estimate and map the economic impacts of the Taal Volcano eruption in the Philippines on January 12, 2020. A CE model was generated from pre-eruption electricity consumption data and then used to predict a counterfactual CE from which the CE loss was calculated. CE loss was converted to GDP values using a regression model that estimates national quarterly GDP in CE. Economic impacts were then computed using three differentiating techniques that vary in reference values. Impacts were mapped by municipality to identify the most affected municipalities. The results estimated the total economic impacts as of January 30, 2020, at PHP 9.2 billion. The results indicate that most of the economic impact loss occurred during the first two weeks and stabilized by the third week. The most affected municipalities were Sta. Teresita, Talisay, Laurel, Agoncillo, San Nicolas, Taal, Lemery, and Balete. Overall, economic impact and long-term economic impact can be a useful alternative measure for estimating and mapping the economic impacts of volcanic eruptions.

Keywords: SNPP VIIRS DNB, Philippines, Regression, Remote Sensing, Disaster Loss and Damage.

Session 19.

Community Participation and NGOs

Chair:
Sandra Martínez
(UNGRD)

Land-use Planning Public Policy Management and Urban Agenda: resilience of cities and their territories in the context of climate change and socio-environmental vulnerabilities

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The research proposes to analyze and identify the challenges, strategies and actions to mitigate and adapt the urban territory to face climate change and the growing increase in socio-environmental vulnerabilities resulting from extreme weather events. Climate crises accentuate inequalities, given that the most vulnerable groups (children, women, elderly people, homosexuals, black people, mixed-race people, and people living in informal settlements) are more exposed to risks arising from extreme weather events. More people live in marginal areas lacking essential infrastructure and services, conditions that are even more aggravated by climate change, which requires the development of public policies, infrastructure, management, and territorial planning that include informal settlements adapted to climate change. From an interdisciplinary perspective, based on the theory of conflict tradition (Marx, Engels and Weber), the theory of risk society (Ulrich Beck), the right to the city (Lefebvre and Harvey), the use of space and territory (Milton Santos, Hall, Choay and Rodrigues), in decision-centered urban planning theory (Daviddoff and Reiner) and in public policy theories (Abruccio, Perreira, Keinart and Lubell), the aim is to provide a plural methodological approach, based on research bibliographic, documentary, field and case study, with the aim of establishing parameters and offering answers that can assist and improve public policy instruments for urban territorial planning – especially for informal settlements in the state of São Paulo – for a future adapted to climate change and serve as input for identifying areas of vulnerability and for developing a participatory risk management plan for local societies, promoting the inclusion and participation of vulnerable populations and enabling the strengthening of these actors in territorial management and planning.

Analysis of Individual Name-based Tsunami Evacuation Drill Data from both Qualitative and Quantitative Perspectives

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Effective evacuation during a disaster is a crucial factor in determining the survival of individuals and communities, and accumulating practical experience is essential for enabling appropriate evacuation behavior. Participation in disaster drills is critical in preparing for potential future disasters, and this has also been emphasized for tsunami disasters. On the other hand, however, there has been insufficient research conducted on participation in disaster drills. In terms of previous studies, most of them analyzed one-off drills, and there have been few ongoing studies. Even if the training is continuing, there has been no statistical analysis of the increase or decrease in the number of participants, such as those that only track the transition of participants. Furthermore, when it comes to research on the number of participants, there is a tendency to focus on quantitative analysis, while qualitative research is neglected. In this study, we therefore analyzed continuously collected, individual name-based data from both quantitative and qualitative perspectives. Utilizing individual name-based data, which has not been used extensively in the past, revealed that participation rates in training varied depending on residents' attributes, roles within the district, and geographical factors of residence, highlighting detailed issues that could not be revealed by simply repeating training sessions. In addition, the combination of interviews with community leaders and residents not only provided a new analytical perspective but also ensured the reliability of the interpretation of the quantitative analysis. Moreover, the participation rate in tsunami evacuation drills in this study could help clarify the evacuation risk at the time of the Special Early Warning Information (SEWI) announcement for the Nankai Trough earthquake, thereby aiding in determining which areas should be evacuated in advance at the time of the SEWI announcement.

Keywords: Tsunami, Nankai Trough earthquake, Special early warning information, Community disaster management plan.

Community Participation in Disaster Risk Reduction: Emic and Etic Perspectives

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There is increasing recognition of the importance of community participation in integrated disaster risk management. Although community participation has become a buzzword within Disaster Risk Reduction, there is no consensus regarding its definition, its process, its techniques, and its outcomes. Community participation has been defined, understood, and practiced in various ways by scholars and practitioners. Its implementation remains uncertain due to the lack of an agreed-upon framework. The problem becomes particularly acute in Asia, the world's most disaster-prone region. Community-based disaster risk management, or participatory DRR, has been defined, designed, and implemented in Asia by Western philosophical perspectives. In Asia, this etic perspective on community participation poses a significant challenge to generalizing any systematic approach and developing tools for implementing community-based disaster risk reduction in real-life settings. Practitioners in Asia often abandon community-based DRR while attempting to forcefully incorporate borrowed concepts, mechanisms, and tools of participation in their indigenous systems. This etic approach to DRR overlooks the locally available good practices and models of community-based DRR in Asia. The so-called theoretically successful participatory models and methods have no real-life impact on a community's disaster resilience. Therefore, it is imperative to understand the community involvement in disaster recovery in Asia from both an emic and etic perspective to establish a realistic, feasible strategy for the region that has the highest rate of disasters. In this paper, we present results based on an in-depth survey conducted in various parts of Asia.

Keywords: Community participation, Emic and Etic Perspectives, Asia, Disaster Risk .

Youth perspectives and practices: a proposal for cooperation in education on disaster risk management knowledge in Colombia

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Youth processes as bridges for social innovation provide guidelines for the social appropriation of knowledge. Through the understanding, identification, characterization, and monitoring of risk scenarios, the hazards and vulnerability of the territory and local communities to the indirect impacts of hydrometeorological phenomena in areas prone to flooding and/or torrential downpours are assessed and analyzed. Youth leadership is presented as a platform that opens possibilities for disaster risk governance through intergenerational dialogue. Territorial processes take shape in actions such as narrating the territory. The information generated from various forms of knowledge and communication connects awareness with multi-stakeholder expertise and dialogue. Youth actions in disaster risk management are based on educational and awareness-raising processes, with preparedness and risk communication being essential. These actions are, in turn, framed within decision-making processes, so active participation is linked to territorial planning, development plans, and municipal, departmental, and national plans. Based on the points above, this work examines the perspectives and practices of youth through the analysis of both qualitative and quantitative data. This chapter aims to contribute from a prospective perspective to education, awareness-raising, and innovation for impact in disaster risk management from a territorial governance perspective. It suggests a comprehensive investigation into the role of youth in disaster risk management in Colombia.

Keywords: Youth, Action, Governance, Perspectives, Practices, Phenomena.

Disaster risk management, a fundamental strategy in sustainability management

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Disaster Risk Management (DRM) is emerging as an essential strategy in Sustainability Management by merging risk mitigation with the promotion of sustainable practices. This integration reveals itself as a proactive approach to anticipating and responding to adverse events, thus safeguarding the long-term interests of organizations and communities. First, it contributes to the protection of natural, human, and economic assets and resources by avoiding or minimizing the adverse impacts of disasters. This is essential to ensuring operational continuity and the long-term viability of organizations. Furthermore, DRM fosters resilience, strengthening the adaptive and recovery capacity of communities and businesses in the face of extreme events. By integrating DRM into sustainability management, responsible and sustainable practices are promoted that reduce the vulnerability of populations and ecosystems. Furthermore, it contributes to achieving the Sustainable Development Goals (SDGs) of the 2030 Agenda, particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), by addressing challenges related to poverty reduction, environmental protection, and promoting more resilient societies. This convergence provides a robust framework for addressing emerging risks and enhancing the capacity of organizations and communities to overcome challenges. It also plays a crucial role in protecting assets and resources, promoting resilience, contributing to sustainability, achieving the SDGs, and enhancing planning and decision-making. These reasons underscore the importance of considering disaster risk as a central element in sustainability management, also highlighting climate change adaptation as a critical dimension for ensuring long-term viability and prosperity.

Keywords: Disaster Risk Management, Resilience, Sustainable Development Goals.

Characterization of the social dynamics related to the occurrence of forest fires and participatory contributions to their reduction in the department of Vichada, Colombia

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The Orinoquia region of Colombia has the largest area affected by forest fires, with a corresponding increase in the frequency of these events (Armenteras et al., 2009). The alteration of the fire regime in this region involves multiple social and environmental variables that need to be analyzed and understood to: i) promote the construction of strategies aimed at managing and understanding fire and forest fires; and ii) design comprehensive measures to reduce these types of events. Within the framework of the Project "Participatory design of strategies for forest fire reduction, biodiversity conservation and regional development in multifunctional landscapes of Vichada" executed by the National University of Colombia with resources from the General Royalties System, we have worked with various actors at different scales who are immersed in the dynamics of forest fires in the territory, involving around 1,360 people in the territory throughout more than 30 workshops, application of surveys and environmental education processes, addressing the different perceptions regarding fire, advancing in the strengthening and consolidation of community processes that promote the construction of the social fabric around fire governance and the comprehensive construction of strategic lines for its management in the territory. These initiatives not only contribute to understanding social and ecological dynamics but also promote awareness and social ownership of the territory, promoting fire prevention and biodiversity conservation. However, it is important to ensure continuity and sustainability of the processes, seeking to strengthen capacities and coordinate stakeholders, enabling them to influence risk management processes, territorial planning, and multi-scale conservation strategies.

Keywords: Science, Forest Fire, Fire, Community Participation

Knowledge management, prevention and risk reduction at the village level, using GIS tools and practical actions at the bioengineering level for mitigation

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Within the framework of national risk management, the greatest challenge has been prevention as a principle for risk reduction. The national territory covers a dynamic of different types of relief, thermal floors, morphological characteristics, anthropic activities, among many others, that make each place specific to be successful in the development of hazard zoning in a more local way, conditioned by the extent of municipal administrations and that go hand in hand with the resources to develop identification or knowledge work. Currently, risk management measures can be carried out at the level of villages or community action boards, providing step-by-step methodologies for them to develop their own hazard maps with free digital tools, analyze their vulnerability according to the magnitude of the hazards, classify the risk, and carry out simple bioengineering actions for prevention such as the recovery of vegetation cover, runoff management, slope stabilization, early warnings. Points requiring greater detail due to the complexity of natural events can be brought to the attention of municipal administrations for management and inclusion in territorial planning. These include Risk Awareness, Natural Events, Event History, Vulnerability, Risk Reduction.

Since the drafting and signing of Decree 1807 of 2014, I participated in the development of basic hazard studies in 26 municipalities in Boyacá and Cundinamarca, all with distinct terrain, population, and climate characteristics. These studies included the social component for the collection of historical information, the creation of social maps, the characterization of natural events, and georeferencing. These studies are essential for the development of hazard map models to calibrate the final results.

Digitizing community mapping with the Sketch Map Tool in the Colombian Red Cross' Vulnerability and Capacity Analysis (AVCA)

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The participatory principle of disaster risk management encourages the recognition, facilitation, and promotion of community organization and participation, which is essential for strengthening community resilience. Therefore, risk perception from the perspective of situational awareness fosters concerted decision-making and ownership of community risk management processes, based on what is happening around the people of a community, but specifically on what is important to them. One of the community tools that allows for gathering community perceptions is the Expanded Hazard, Vulnerability, and Capacity Analysis (EVA). However, two of its outputs are analog risk analyses and maps, which do not allow for adequate use and digitization of the information provided by the community. A solution to this difficulty is offered by an open-source and open-use tool called Sketch Map Tool (SMT), which, through four-phase implementation: Base map data analysis, base map preparation, community mapping, and automatic digitization of results facilitate the analysis and storage of community-provided data, primarily on hazard, exposure, and capabilities, in geographic information systems. This summary presents the experience of using the SMT in the implementation of the AVCA (Water and Sanitation Management System) in two communities in the municipalities of Soacha (Cundinamarca) and Tibú (Norte de Santander), respectively, for the analysis of flood hazard, exposed elements, community capabilities, and development aspects. These experiences demonstrate how traditional community-based work methodologies for risk perception assessments can be complemented with tools that facilitate the analysis and storage of digital data.

Keywords: Risk, Community, Perception, Map, Digitalization.

Session 20.

Adaptive capacity and vulnerability reduction to environmental and climate risks

Chair:

Joana Pérez (UNGRD)

Gauging and understanding environmental knowledge in ecosystem services conservation

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Ecosystem services are among the most critical services that sustain many livelihoods; these services regulate people's natural environment, support natural processes, and provide resources and cultural values. As such, over the years, solid relationships between people and nature were developed. Subsequently, people developed knowledge of their natural environment and established traditions to maintain and conserve ecosystem services. In this context, formal-state conservation strategies are either inappropriate or unenforced in rural communities. This study aims to understand the reason behind the decline in the conservation of traditional ecosystem services. The study is purely qualitative, collecting data through a systematic literature review approach. Relevant studies in the English language published between 2000 and 2022 in the African context were identified through Web of Science, EBSCO, and Google Scholar. The study applied deductive and inductive content analysis of the literature identified using NVivo software. The study started with the deductive approach to address the research question and incorporated inductive elements to capture findings. The study indicated that traditional knowledge practices for the conservation and management of ecosystem services across the municipality were totems, astronomy and climate predictions, rituals, rules, beliefs, taboos and myths, and traditional knowledge. Secondly, the awareness, value, and use of traditional knowledge have declined due to Western cultural influence. Furthermore, the study's findings revealed differences in awareness, value, and use of traditional knowledge, showing that younger people perceive traditional knowledge as archaic. The study indicated that the contributions of traditional knowledge to the conservation and management of ecosystem services across the municipality were diminished due to the decline in the use, value, and awareness of traditional knowledge.

Keywords: Ecological knowledge, ecosystem services, rural communities, Thulamela municipality.

Capacity Building for DRR in the Built Environment in Latin America and the Caribbean (BERLAC)

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Latin America and the Caribbean (LAC) stand as the second most disaster-prone region globally, with 1,534 disasters impacting 190 million people since 2000. Among these hazards, earthquakes have caused significant casualties and damage, exacerbated by the region's positioning within the seismic "Ring of Fire," which hosts over a quarter of the world's earthquakes of magnitude 8.0 or higher, primarily in South America. In response, UNESCO implemented the three-year project titled "Capacity Building for Disaster Risk Reduction in the Built Environment in Latin America and the Caribbean" (BERLAC) and financed by the Japanese Government. The project, structured into four components, aimed to strengthen the safety of the built environment in six earthquake-prone LAC countries. Throughout BERLAC's implementation, UNESCO developed technical guidelines for municipal staff to enhance systematic inspections during house construction, as well as guidelines for controlling the quality of materials used in the process. The second component targeted the safety of educational facilities, addressing diverse challenges through innovative solutions, including AI technology. The third component proposed retrofitting solutions utilizing both traditional and innovative approaches. Additionally, UNESCO developed risk-informed policy recommendations in the fourth component, focused on all stakeholders engaged in the construction process. These policies could contribute to more resilient, adaptable, and efficient governance. Allowing for proactive planning instead of reacting to disasters as they occur. Risk-informed policies are particularly relevant in a dynamic, complex, and uncertain world that faces various challenges.

Keywords: Built Environment, Building Codes, Resilience, Earthquake, Retrofitting.

Sustainability-oriented risk management: a path to improving the quality of life in small towns

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Within the framework of land use policy, some municipalities have revised the contents of their land use plans, seeking to gradually integrate risk management into land use planning under sustainable development models. This task has encountered functional, administrative, and financial difficulties, resulting in low available budgets, especially in small municipalities (categories 5 and 6); a lack of qualified personnel; and the high costs associated with risk awareness, making proper integration and management difficult, which is even more demanding in urban areas due to their density and high complexity. If the sustainability of cities implies adequate risk management, the first step is their transversal inclusion in their development, presenting practical instruments that indicate how to make it effective. This is because prospective and corrective interventions of risk management, integrated with structural themes for the sustainable functioning of small cities, constitute tools for creating safe, attractive, inclusive, and resilient environments (OCD 11). Thus, the management of areas under hazard or risk generally results in the recovery of occupied or degraded natural spaces. If this management is targeted correctly, it can generate multipurpose instruments that guide cities toward improving their environmental quality and overall sustainability through the implementation of nature-based solutions. These contribute, among other things, to reducing the exposure of residents and their assets, restoring ecosystem services from natural elements, reducing biodiversity loss and generating connectivity with rural ecosystems, increasing public space and tree cover, and ultimately advancing climate change adaptation through the reduction of heat islands, water retention and infiltration, and carbon capture, among others.

Keywords: hazard zoning, land use planning, sustainable urban management, SBN, quality of life.

Challenges of Coastal Adaptation: An Ecosystem-Based Approach in the Colombian Caribbean

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Coastal systems face increasing vulnerability due to the combined influence of extreme events, development and population growth, geomorphological changes, and sea level rise. Twenty-two-point three percent of the population is concentrated along the Colombian Caribbean coast, resulting in 9.86 million inhabitants, particularly exposed to coastal dynamics. This scenario has stimulated the search for climate change adaptation measures, where Nature-based Solutions (NBS) emerge as a promising option for risk reduction. NBS are based on the exploitation of natural ecosystem characteristics and technical solutions to reduce hydrodynamic energy in the coastal system. However, there is uncertainty regarding monitoring methodologies, benefits, and effectiveness at various spatiotemporal scales. The Coastal Erosion Monitoring and Ecosystem-based Adaptation Measures (SMEC-MAbE) System was developed in the departments of La Guajira, Magdalena, Córdoba, and Antioquia. The main contributions are based on a socio-environmental monitoring system composed of eight indices or indicators implemented that reflect the status of coastal ecosystems using traffic-light scale ratings. Additionally, 12 CAR officials and 148 community members received training. A total of 126 initiatives were mapped along the coastline. The results demonstrate the opportunity to combine efforts to monitor, visualize, analyze, and store MAbE measures in the coastal zone. The development of monitoring systems is a starting point for increasing knowledge about the evolution of coastal socio-ecosystems, reducing uncertainty regarding the function and effectiveness of NBS for coastal protection. The complexity of the system and the growing effort to develop alternatives for the protection of goods and services require scientific creativity and a science-based approach.

Keywords: Ecosystem-Based Adaptation Measures, Coastal Systems, Monitoring System, Nature-Based Solutions.

Ungovernable social housing, three decades of exclusion

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The Seismic Resistance Standards (NSR) in Colombia emerged 30 years ago, thanks to the collapse of hundreds of small homes, some built by the government. These standards, based on a private code for large buildings, initiate public governance of seismic activity and imply action on constructions following their adoption. However, the question of who builds the homes, what their techniques and expertise are, how they are made, in what timeframe, what the projections for their construction stages are, and who intervenes in the social production of housing all have their answers. Thus, in Bogotá, for decades, millions of square meters of unmanageable housing have been produced, classified in different ways depending on the political decisions that need to be made. This paper observes the practices of these experts and empirically demonstrates that the ontological production of seismic risk is tied to conditions of possibility and choice. These practices are as diverse as the realities they represent. The earthquake used to secure housing is not the same earthquake that is widely reported, nor the one used for the city's disaster management strategy. The same is true for vulnerability, which has a limited number of prescribed collapses according to different data sources developed for other purposes. Ultimately, it is demonstrated that, despite the evolution of regulations and the fact that seismic risks are contingent sociotechnical productions, socially produced housing is neither recognized nor included in public policies aimed at risk reduction. Therefore, from the perspective of care issues, the project aims to give voice to thousands of excluded Bogotá households, making visible what has been erased and considering alternatives that will make them viable in the future.

Keywords: Seismic risk, political ontology, practices, vulnerability, housing.

Assessment of the Ripple Effect of Supply-side Capacity Loss Caused by the Compound Hazards: Flood Disaster and COVID-19 Taking Enshi, Hubei Province as an Example

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The physical interactions between hazards often result in unintended and catastrophic consequences. The COVID-19 outbreak in 2020, combined with floods, had a significant dual impact on regional economies. It is urgent to develop targeted rescue policies that consider the various hazards associated with concurrent events. This study focuses on the flood that occurred in Enshi on July 17, 2020, during the COVID-19 epidemic. The overall supply-side production capacity loss rates (PCLRs) in the context of compound hazards, floods, and epidemics are estimated using a field survey. The urban travel intensity data is utilized to construct a time series model for evaluating the PCLRs caused by the single epidemic hazard. The PCLRs are then used as input in the proposed multi-regional mixed input-output (Mixed-MRIO) to quantitatively assess the indirect economic losses (IELs) and analyze the contribution of two hazards to the overall ripple effects. The results show: (1) Wuhan City has the largest IELs and the smallest loss rate; Jingmen and Jingzhou, two economically underdeveloped regions, have the largest loss rates due to their close industrial connections with Enshi. The most affected sectors are those related to livelihoods, manufacturing, and agriculture. (2) The IELs caused by floods are 2.6 times that of the epidemic. Sectors affected by floods are primarily concentrated in the secondary industry, while sectors affected by the epidemic are mainly concentrated in the tertiary industry. (3) The ripple effects caused by disasters is closely related to the regional economic foundation, and this feature is more prominent in the context of floods. The regional disparities in loss rates are more obvious in the context of floods, since government departments provide disaster assistance to disaster-affected enterprises and facilities based on their economic development levels.

Keywords: Flood-epidemic compound hazards; Supply-side production capacity losses rates; Ripple effect; Mixed Multi-Regional Input-Output Model.

Usefulness of Disease Surveillance Data in Enhanced Early Warning of the Cholera Outbreak in Southwest Cameroon, 2018

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This study determined how routine integrated disease surveillance and response (IDSR) data was used for preventative actions and the challenges faced by key health staff in IDSR-based decision-making. This was a mixed-methods study conducted from June 1st to September 30th 2021. District Health Information System 2 (DHIS2) data from January 2018 to December 2020 for the Southwest region of Cameroon were analyzed using simple linear regression on EPI Info 7.2 to determine the association between socio-political crisis and timeliness/completeness of data. Qualitative data generated through in-depth interviews with key informants were coded and analyzed using NVivo 12. During high conflict intensity (2018 and 2019), the average data timeliness and completeness were 16.3% and 67.2%, respectively. These rates increased to 40.7% and 80.2%, respectively, in 2020, when the conflict intensity had reduced. There was a statistically significant weak correlation between reduced conflict intensity and increased data timeliness ($R^2 = 0.17$, $p = 0.016$). Additionally, a weak correlation was observed between reduced conflict intensity and data completeness, although this relationship was not statistically significant ($R^2 = 0.01$, $p = 0.642$). During high conflict intensity, the Kumba and Buea health districts had the highest data timeliness (17.2% and 96.2%, respectively) and data completeness (78.8% and 40.4%, respectively). Components of IDSR that should be maintained include the electronic report aspect of the DHIS2 and the supportive supervision conducted during the outbreak. Routine IDSR data were not a reliable way of providing early warning of the 2018 cholera outbreak due to incomplete and late reports. Nonetheless, reduced conflict intensity correlated with increased timeliness and

completeness of data reporting. The IDSR was substantially challenged during the crisis, and erroneous data generated by the DHIS 2 significantly undermined the efforts and resources invested in controlling the outbreak.

Keywords: Cameroon; Cholera; Conflict; Early warning; Routine data.

SIATA: Two decades of innovation in early warnings for Medellín and the Aburrá Valley

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(The SIATA project is an instrument for risk management of Metropolitan Area of the Aburrá Valley – AMVA)

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There is an urgent need to establish effective Early Warning Systems (EWS). What began as a directed undergraduate project in the late 1990s evolved within a few years into the Medellín and Aburrá Valley EWS (SIATA). Ongoing interaction between the academic and public sectors has enabled the ongoing strengthening of the initiative. To date, the target population for the information and knowledge generated by SIATA reaches 4 million inhabitants. This strategy supports the Urban Environmental Authority's Risk Management System, contributing to effective decision-making. SIATA follows national and international risk management guidelines and is structured into four work packages: a hazard and risk observatory, the data route, a plan for the social appropriation of knowledge, and project management and sustainability. Community EWSs are established in collaboration with regional stakeholders, and educational strategies are implemented accordingly. The project has been strengthened by increasing the number of stations in the hydrometeorological network and through greater use of satellite and remote sensing information, as well as by strengthening monitoring efforts for surface currents, seismic activity, and landslides. In addition, the image processing capacity of surveillance cameras has been improved. SIATA shares information with risk management agencies using effective mechanisms and issues alerts through social media and phone chains, among other channels. This experience allows for the development of adaptive capacity, preventive action, and mitigation and risk reduction actions necessary to address normal natural climate variability, extreme weather events, episodes of deteriorating air quality conditions, and climate change.

Keywords: Early Warning System, Risk, Management, Prevention, Adaptation.

THIRD DAY

AUGUST 30, 2024

Session 21.

Amazonia, indigenous and local communities

Chair:
Evelin Langebeck
(UNGRD)

Community Maps: A Participatory Tool in Disaster Risk Management

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Community participation in disaster risk management is widely recognized as a necessary element for effective disaster governance. Considering that Law 1523 of 2012 proposes a participatory and culturally diverse principle, which incorporates stakeholders and diversity in organizational and participatory processes, we present here the strengthening of citizen participation for disaster risk management through the community mapping methodology within the framework of the Risk Awareness Subdirectorate's actions. Community maps are cartographic representations constructed collectively and invoke social perception, risk memory, and social and cultural representations. These maps can interact with the Municipal Risk Management Plan or Municipal Emergency Response Strategies, providing information on potential locations that may be affected by a hazard, as well as the location of the most vulnerable communities, infrastructure, and assets, validating and updating geospatial data. The main steps for constructing a community map as a group are outlined, with an emphasis on community capacities and resources. The generation and use of community information strengthens the capacities of territorial actors by providing tools for community work in disasters and other areas.

Keywords: Community participation, community maps, capacity building.

Indigenous cultural practices for forest fire risk reduction

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Fire has historically been a key element in the lives and subsistence of Amazonian communities. For more than 11,000 years, burning has been part of the cultural heritage, used to improve the fertility of poor, acidic soils. There are different types of fire: controlled, prescribed, cultural, and uncontrolled, the latter associated with forest fires. In recent decades, mega-fires have emerged that, despite the deployment of human and technical resources, remain uncontrollable, affecting both large natural and urban areas. In the Amazon, the highest incidence of forest fires occurs in the agricultural frontier, where deforestation interacts with climate change, increasing temperatures, and the frequency of these events. The "zero fire" policies implemented in various countries have proven to be costly and ineffective, based on the erroneous premise that all fire is harmful. Successful cases of integrated fire management that balance ecosystem conservation with the traditional practices of local communities are presented here. Evidence indicates that Indigenous lands offer greater environmental protection compared to areas of strict conservation or intensive agricultural use. Key experiences in Canaima National Park (Venezuela), the Chiquitano Dry Forest (Bolivia), and the PREV-FOGO Specialized Center are analyzed, along with recent initiatives, such as those of Amazonia+, in strengthening RAMIF (Amazonian Integrated Fire Management Network) and developing the cultural component in integrated fire management plans. We recommend that reducing fire risk in the Amazon requires a paradigm shift in national and regional policies, adopting strategies based on scientific and traditional knowledge for more effective and sustainable fire management.

Keywords: fire, forest fires, integrated fire management, Amazon.

Disaster risk reduction strategy with a differential ethnic approach for the Awá and Pasto indigenous peoples in the Department of Nariño, Colombia

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This research provides elements for constructing a disaster risk reduction strategy with a differential ethnic approach for the Pasto and Awá indigenous peoples of the Nariño department. Considering that this territory possesses great diversity in both natural and cultural aspects, it is necessary to identify aspects of their culture that may conflict with the institutional discourse of risk management. This requires understanding the imaginaries and perceptions of indigenous communities in a country where public risk management policy is primarily guided by a generic and positivist approach, which at first glance could be considered antagonistic. However, for adequate risk management, common ground and coordination must be found. To this end, we aim to broaden the concept of governance in risk management and conceptually understand that each development model generates its own unique risk model. Methodologically, we employ qualitative methods that enable us to understand the specific characteristics of the communities and engage with stakeholders who have not had a voice. A comparative analysis identifies cultural elements that influence the construction of imaginaries and perceptions, which are then articulated in relation to the phases of risk management. The result is a series of actions that can contribute to adequate disaster risk management and involve the social and cultural aspects of the indigenous communities of the Awá and Pasto peoples, based on the pillars of governance, participation, and coordination, which are articulated with the objectives of an ideal proposal for adequate risk management.

Keywords: Risk reduction, Strategy, Governance, Community risk management, Ethnic.

Collaborative research project "Tropical Forests: Global Implications and Urgent Actions" - FORESTS 2024

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The Belmont Forum Collaborative Research Action (CRA) "Tropical Forests: Global Implications and Urgent Actions" (FORESTS 2024), in partnership with the G20, aims to coordinate actions and projects with a transdisciplinary approach to develop innovative solutions to the challenges facing tropical forest regions, the Amazon being the largest and most populous. Recognizing differences in governance, cultural diversity, and territorial configuration, this CRA encompasses tropical forests worldwide that face similar challenges. This call for proposals acknowledges the increasing threats to these ecosystems and their inhabitants, including climate change, deforestation, unregulated agribusiness, land conversion, illegal activities, pollution, and environmental and climate injustices. In global tropical forest regions, such as the Amazon, Central America, Asia, and Africa, the well-being and survival of Indigenous Peoples and local communities depend on the local ecosystem, which is under pressure. The challenges facing tropical forest regions vary depending on governance, local ecology, cultural diversity, and territorial configuration. The call for proposals focuses on 1) Reducing deforestation and promoting sustainable development and local economies; 2) Ecosystem function, connectivity, and climate change science; and 3) Environmental justice and governance. Proposals submitted to this call for proposals must address elements of at least two of the listed areas. Details of the call for proposals and the application process are available through the bfgo.org application portal.

Keywords: Financing, tropical forest, Amazon, indigenous peoples, local communities

Biodiversity, People and Territories

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In Brazil, climate models project an increase in the intensity and frequency of extreme events. To anticipate and establish early warning systems, it is essential to understand these phenomena through the analysis of historical data and real-time monitoring. This study examines the management of Indigenous lands and sustainability in the northern Amazon (Roraima) and the Pantanal (Mato Grosso do Sul), aiming to ensure traditional management is adapted to climate change, particularly in fire management and flood response. The strategy seeks to strengthen resilience to extreme events, improve governance, and promote sustainable development through equitable benefit sharing. To this end, priority has been given to training Indigenous leaders in technical skills that strengthen their self-determination. Indigenous monitoring rooms have been established for real-time monitoring and management of hazards such as forest fires. These rooms operate in a network with associations, brigades, and entities responsible for emergency and disaster management. Fires detected, whether by satellite systems or high-resolution cameras, are reported to local brigades for immediate control. This system, managed directly by Indigenous communities, represents a reliable and innovative model for real-time fire monitoring, strengthening the protection of Indigenous lands in Brazil.

Keywords: Forest fires, integrated fire management, indigenous communities, monitoring.

Amazonia in Flames: Community Governance and International Strategies

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[Transcript] Lack of landscape management and climate change have increased the frequency and intensity of forest fires in the Amazon. A positive feedback loop has emerged, in which fires emit CO_2, alter vegetation structure, and increase the likelihood of new fires. Hotspots of deforestation coincide with areas of most significant agricultural activity and are located outside of protected areas and Indigenous territories. Forest fires in the Amazon basin respond to different drivers depending on the region. In Brazil, they are linked to the expansion of crops such as soybeans, while in Colombia, they are related to land grabbing. The current perception of fire has led to the implementation of restrictive policies and disjointed management plans, which have exacerbated socio-environmental conflicts. However, not all fires are harmful. The Amazon is not a homogeneous ecosystem; it ranges from moorlands and large cities to savannas where fire is key to ecological maintenance. Therefore, its definition should not be simplistic or reduced to the notion of fire. Fire is an essential element for food security and a vital tool for territorial management in Indigenous and peasant communities. Fire occurs when a fire spreads out of control, requiring containment measures. It is essential to adopt a comprehensive approach that considers the ecological role of fire, cultural diversity, and socio-environmental relations. Risk management is a social process that must include communities and promote policies such as community-based fire management brigades. The Amazon Network for Integrated Fire Management was established in response to the major fires of 2019 as an international call to action. The international calls from 1997 to 2023 are summarized.

Keywords: forest fires, integrated fire management, policies, governance

Session 22.

Preparing for a Multi-Hazard Response

Chair:
Laura Salgado
(UNGRD)

What prevents people from early evacuation? In case of Licungo River basin, Mozambique

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This study explores the factor that prevent local people in Mozambique from early evacuation based on the questionnaire survey of the evacuation behavior of 300 respondents who are suffered by 2022 Cyclone Ana and succeeding flood from the Licungo River. The survey was conducted in October 2023 by the authors, targeting the local people whose house are in inundation area. The participants are mostly farmers and 59% have no formal education. Among 300 respondents, we identified that 87 (29%) evacuated after the water overtopped the levee, while the other 213 (71%) evacuated before. The cross-sectional analysis revealed the following facts:1) The evacuation timing does not necessarily depend on the education and literacy level of the residents. 2) The better financial situation of the household induced the early evacuation. 3)The form of farmland ownership affected the evacuation timing considerably, in a sense that the renter (individual ownership with lease or certificate) has less incentive for early evacuation than landowners (individual ownership under customary law). This implies that due to the lack of formal legal system, renters might have inclined to stay in their cultivated land because otherwise they may lose their livelihood. 4) The level of social capital in general might have negatively affected the evacuation timing. The early evacuators can be characterized as the people who belong to a smaller number of organizations, do not trust government nor the local committer for disaster management (CLGRRD), and who believe in self-help principle. These findings are contrary to the existing literature that emphasize social capital to encourage early evacuation.

Keywords: Community-based early warning system (CBEWS), Evacuation, Disaster information.

Theoretical Classification for Business Continuity Strategy: Consideration from Japanese Companies

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Japan is one of the most natural hazard-prone countries with the most corporate assets in the world. It currently has various policy initiatives in promoting business continuity management (BCM) for Japanese companies. For instance, the Cabinet Office, Government of Japan, has published the "Business Continuity Guidelines" for implementing BCM and creating BC plans (BCPs). In addition, the Small and Medium Enterprise Agency has an assistance system for small and medium-sized enterprises (SMEs) to promote their business continuity efforts. SMEs that create certified disaster prevention plans can receive tax incentives, financial support, and additional subsidies. Under such circumstances, Japanese companies that produce their BCPs have progressively increased over time. However, there is more emphasis on developing BCPs than creating business continuity strategies, and particularly SMEs have not made significant progress toward enhancing their strategy to a disaster. There is a lack of a structured framework for business continuity strategies that is useful for informed business decisions. Furthermore, many companies lack knowledge of the options for business continuity strategies and take half measures. This study aims to develop a theoretical framework for business continuity strategies. It reviews the options for business continuity strategies available for Japanese companies on the ground. It then theoretically organizes these options from perspectives such as adaptability and inherence. The results will be used to develop a web-based tool that can recommend effective options for business continuity strategies to companies.

Keywords: Theoretical framework, Business continuity strategies, BCM, BCP, Japanese companies

Knowing the risks in my territory allows me to safeguard lives; Oi, oi, the tsunami may come

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The Max Seidel National High School is in the district of Tumaco, Nariño, Colombia. Because it is built on Morro Island, it is exposed and susceptible to various coastal marine phenomena, including tsunamis. Since 2005, when the school emergency plan was reorganized, it has been strengthened over the years with the implementation of new pedagogical strategies that facilitate community participation in preparedness actions against tsunami risks. Thus, with the project "Knowing the risks in my territory allows me to safeguard lives; I heard, I heard; the tsunami may come," and with the support of the Licenal Risk Prevention Seedbed, playful processes are carried out to raise awareness in the community about the recommendations to keep in mind when a seismic movement (tidal wave) occurs, which can generate a tsunami. On this occasion, the recommendations to follow in a tsunami event are carried out through dramatization: I heard, I heard; The tsunami may come; prepared by Fabiola Salazar Torres, professor of the Marine Sciences Department; The dramatization appropriates the application of Paulo Freire's critical pedagogy to strengthen transformative optimism in tsunami risk prevention in Tumaco, Colombia. Research conducted by Carlos Andrés Ríos-Uribe, Ph.D., Research Professor at the University of Antioquia's Faculty of Education, combines cultural aspects of the territory to engage children, young adults, and older adults in this risk preparation and prevention initiative. The native dances depicted in the dramatization and the message song, which incorporate rhythms from the Colombian Pacific, enable us to learn about the culture and prepare for potential risks to this population, such as tsunamis.

Keywords: Tsunami, Risk, Prevention, Seedbed, Safeguard.

From local to national; from emergency response to effective rehabilitation

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In Colombia, in the department of Cundinamarca, in the municipality of Chía, located 25 kilometers north of the city of Bogotá, a 5.1 magnitude earthquake struck on the morning of March 28, 2020. The epicenter was La Mesa de los Santos, in the department of Santander. Social media reported no damage to human life or infrastructure. However, in the municipality of Chía, ground shaking was observed, affecting the pedestrian bridge at La Sabana University, causing ruptures in the main water supply pipeline to Chía. The emergency occurred eight times in succession until 2022, due to multiple causes, in the same area within a 150 linear meter margin, generating a municipal emergency. A public calamity was declared to resolve the impasses caused by the incident. This situation occurred eight times in the same area in front of the Centro Chía shopping center. The first seven were for different reasons, and the eighth was caused by the company's construction of the parallel network, which involved local, departmental, and national authorities.

Keywords: Breakage, Water, Resilience, Innovation, Recurrent.

The recurrence of the “ends of the world” for marginalized groups in climate disaster and recovery contexts: perspectives on gentrification and displacements

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In disaster and recovery situations, disruptions to the physical and social dimensions trigger redevelopment formulas that may not protect the tenure security, livelihoods, housing affordability, socioeconomic diversity, and the very existence of low-income (and often long-time) residents. In this context, there is a gap in disaster studies: they generally stop the investigation when safer and more resilient places are created. It can be said that current analyses still lack nuance regarding the social and temporal complexity of detrimental post-disaster consequences, such as gentrification—a system of class-based eviction—and displacement pressure. This research aims to provide insights into how recovery processes, which often drive gentrification, operate in the context of climate disasters. In this sense, fieldwork in Brazilian informal settlements, which are heavily affected by the country’s most significant climate disasters, was conducted with the support of the Movement of People Affected by Dams. Through counter-maps and timelines, produced from the combination of a macro (community and surroundings) and micro (oral histories) scales, the research shows that post-disaster recovery is often instrumentalized, intentionally or not, by public authorities as opportunities to “rid” land of its original inhabitants, using the discourses of “disaster risk” and “redevelopment”. The findings demonstrate that post-disaster reconstruction outcomes are associated with segregation, gentrification, vulnerability, and neighborhood decline. Contradictorily, it is the opposite of what the notion of “building it back better” seeks. As the indigenous philosopher Ailton Krenak writes, historically, marginalized groups have already experienced the “end of the world” a long time ago. The case studies show that the recurrence of disasters and subsequent redevelopment is often the “end of the world” (sometimes all over again) for many communities and individuals. The findings can help improve DRR and policy-making processes by incorporating the disruptive potential of disasters on land issues into these procedures.

Keywords: Gentrification, Climate disaster, social exclusion, Forced displacement, Post-disaster recovery.

Economic impacts of complex disasters affecting the twin ports of Los Angeles and Long Beach

Adam Rose, Noah Miller, Zhenhua Chen, Fred Roberts, Andrew Tucci, Latha Vijayagopal

Economic disruptions at seaports are becoming more frequent due to direct reasons such as climate change, which can manifest itself in the short term through more intense hurricanes and stronger storm surges, and through long-term sea level rise. Another is the possibility of terrorism in the form of chemical, biological, radiological, or nuclear (CBRN) agents inserted into shipping containers, which can cause widespread contamination of cargo and surrounding facilities, as well as death and injury to port personnel. Another reason is the continuing history of labor unrest, which sporadically results in port closures or slowdowns. In addition to disruptions directly on-site, off-site events can have disastrous consequences. For example, wildfires can cause both planned and unplanned power outages. Another category of indirect sources is sociopolitical events, such as recent tensions in the Middle East, which have led to major vessel rerouting, increasing congestion at some ports and thereby significantly increasing transportation costs, making serious maritime accidents more likely. Seaports are critical infrastructure for economic activity, both as part of the marine (maritime) system and, more broadly, as part of national and international trade systems through their role as nodes in complex transportation networks. Therefore, disruptions to their operation will have ripple effects on regional, national, and international economies. We simulate the regional and national economic impacts of three overlapping and cascading disruptions for the twin ports of Los Angeles and Long Beach, California, the busiest container port complex in the United States: 1) a labor strike, 2) a loss of electrical power due to wildfires, and 3) a terrorist incident affecting shipping containers. The analysis will be conducted using the Economic Consequence Analysis (ECA) framework (Rose 2015; Rose et al. 2017), a comprehensive, multi-step analytical and empirical process developed at the Center for Risk and Threat Economic Analysis at the University of Southern California. The macroeconomic modeling approach is the application of a multi-regional computable general equilibrium (CGE) model known as TERM (Horridge et al. 2017), which can estimate the economy-wide impacts of individual and complex disruptions operating through supply chains. This model has been successfully applied in previous analyses of economic disruptions in general (e.g., Wittwer, 2022) and in the maritime transport system (see, e.g., Wei et al., 2020, 2022; Chen et al., 2024). This paper advances the literature in several ways. This is the first study to examine a complex disruption at a seaport consisting of three overlapping and cascading events. It decomposes the results according to causal factors and derives a reduced-form regression equation that can be used to perform rapid estimates and to test the sensitivity of the results to underlying assumptions and the relative influence of the factors driving the impacts.

Keywords: complex disasters, seaports, complex events.

Session 23.

Effective resource management and logistics coordination

Chair:
Claudia Rodríguez
(IDIGER)

Model building for developing effective countermeasures against supply chain risks on the global economy: A Case of the Japanese Automotive Industry

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In recent years, significant disruptions have been observed at global maritime transport hotspots, posing a major risk to global trade and the economy. Amid the COVID-19 pandemic, starting in the latter half of 2020, a so-called supply chain crisis emerged due to a rapid increase in transportation demand and insufficient cargo handling capacity at the world's major ports. Additionally, the Suez Canal blockade occurred in March 2021, and since the summer of 2023, a historic drought has drastically reduced the number of ships passing through the Panama Canal. Similarly, from December 2023, many shipping companies have been forced to detour from the Red Sea and Gulf of Aden to the Cape of Good Hope to avoid Houthi attacks on merchant vessels. These disruptions at maritime hotspots have led to stagnation in global trade and the economy, resulting in significant increases in transportation costs and time. This study aims to model the supply chain of Japanese automakers' North American production and develop a method to assess the effectiveness of countermeasures against transport disruptions. In automobile production, a shortage of auto parts directly leads to a halt in production lines. A discrete event model has been developed to simulate the supply of auto parts from Japan and other Asian countries via ocean containers and air transportation, enabling the calculation of automobile production outputs under various conditions, including the implementation of countermeasures. The objective of this study is to develop a model-building technique for assessing the resiliency of the supply chain, thereby enhancing the disaster response capability of global trade and the economy.

Keywords: Trade, Logistics, Container, Hotspot, Detour Route.

The truths of applying emergency and contingency plans, the enigmas of budgetary value" emergency due to water shortage in the city of Yopal"

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Yopal, the capital of the Casanare Department, faced a severe water crisis due to a geological fault (a rotational landslide) that destroyed the 400 l/s water treatment plant in 2011, resulting in a lack of water and causing concern and hardship for the city's residents. Currently, challenges continue to be overcome in order to mitigate the contingency fully. The EAAAY (Water and Sanitation Authority) had an emergency and contingency plan that had never been implemented; the magnitude of the cost was unknown. The contingency triggered community protests, planning failures due to haste, significant investments in treatment systems and distribution systems, riots due to community discontent over the lack of potable water service, and the presence of rotavirus and enterovirus. Faced with this situation, local, departmental, and national authorities implemented a response plan with short-, medium-, and long-term measures to address the emergency. Investments have been made in infrastructure for collection, deep wells, treatment plants, water storage, and distribution via tanker trucks. Investments have also been made in the rehabilitation of low-production wells for loading and maintenance of provisional treatment systems (plants in the Vega sector). Additionally, awareness campaigns have been promoted to emphasize the efficient use and conservation of water, as well as its importance. In Yopal, stationary storage tanks, public drinking fountains, routes, and micro-routing for distribution via tanker trucks were implemented for the first time. Water quality analysis was intensively increased, and a special group called the CAC (Contingency Assistance Center) was established. In conclusion, the drinking water shortage emergency in Yopal from 2011 to 2022 was a major contingency that significantly impacted the community. Measures were taken to address this crisis, but it also became clear that long-term policies and actions were needed to ensure an adequate and sustainable water supply in the city.

Keywords: Emergency and contingency plan, treatment plant, Contingency Response Center.

Modeling Food Supply Dynamics in Disaster Refugee Camps: A System Dynamics Approach

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Forced displacement is a profoundly impactful consequence of both natural and technological disasters, compelling thousands of individuals to abandon their settlements and seek refuge in managed encampments. Depending on the magnitude of the disaster and the speed of the national governments' response capabilities, the permanence of the affected population in encampments can last months or years. Thus, providing the necessary food supplies to the affected population becomes a challenge. In this research, a System dynamics-based simulation model is proposed to assess the overall impact on the affected population by a disaster and the subsequent aid intended for a temporary refugee camp. We explore 60 scenarios based on the demographic characteristics of small municipalities in Colombia, evaluating the total number of days during which refugees experience food shortages, average food inventory levels, and the time it takes for the population to recover. Our findings reveal that when humanitarian coordinators struggle to meet increasing food demands, average food inventory levels significantly rise due to accumulated food orders. Additionally, scenarios with prompt repair efforts demonstrate that stored food within the refugee center can be sustained even after all refugees have returned to their original municipalities, emphasizing the need for accurate forecasts to prevent food overstock.

Keywords: Refugee center, Simulation, System dynamics, Humanitarian logistics, Disaster aftermath.

Coordination of business emergency plans with Mutual Aid Committees, an effective alternative for risk management governance in micro-territories.

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The coordination of emergency plans for companies and institutions with the entities of the Emergency Systems (Local, Regional, or National) is a palpable necessity, which also demonstrates that if each company or entity attempts to respond alone to the demands of comprehensive emergency and disaster risk management, the results will never be as expected. This is where partnerships with neighboring communities—whether companies, institutions, or residents—become a vital strategy for disaster risk management. However, this partnership cannot be sporadic and improvised; to be truly effective, it must be carried out with the necessary formality. In this sense, Mutual Aid Committees (MACs) provide an alternative that enables the establishment of governance criteria for risk management within the micro-territories where they operate. Furthermore, for the entities that comprise Disaster Risk Management Systems, it is more efficient to channel their efforts and scarce resources through coordinated actions with the Disaster Risk Management Systems (CAMs) than to do so in a dispersed manner with each of the companies or entities in those territories. This presentation aims to highlight the most relevant aspects of these coordination actions, where the participation of companies in Mutual Aid Committees serves as a strategy to optimize resources and enhance results in disaster risk management.

Keywords: Mutual Aid, Emergency Plans, Companies.

Implementation of Interface Forest Fire Prevention and Response Strategies on Cerro Quitasol de Bello, Antioquia

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Over the past 12 years, wildfires and human intervention resulting from new human settlements have become the main causes of deforestation and impacts on the tree cover in the peri-urban areas of Cerro Quitasol, in the municipality of Bello, Antioquia (Aburra & Herran Varon, 2019). Consequently, a new risk scenario for fourth-generation wildfires or interface fires has emerged for the Bello population. This study aims to assess the risk of interface fires in Cerro Quitasol using a spatial multicriteria analysis method based on quantitative data and expert judgment collected through a participatory approach. This initiative aims to implement fire prevention and response strategies within the study area. A detailed analysis of vulnerability criteria allowed for the establishment of an interface buffer where built-up areas and vegetation intersect. The above, under a multi-criteria model of hazard and vulnerability, enabled the establishment of the risk level for the zone classified in the interface buffer. Self-built areas lacking public services or with rudimentary construction methods are at greater risk of being affected by a forest fire. Multi-criteria risk analysis, community outreach, risk perception, and community preparedness for these conflagrations were key inputs, gathered through inter-institutional social mapping and training exercises. In conclusion, the timely implementation of territorial control strategies (both preventive and reactive) will be the most effective mechanism for preventing interface forest fires in Colombian cities, a risk scenario for which response authorities and communities are poorly prepared.

Keywords: Interface Fires, Self-Constructed Zones, Risk Scenarios, Multi-Criteria Analysis, Participatory Approach.

Session 24.

Early Warning Systems

Chair:
Bárbara Tapia
(WMO)

EWS as an instrument for disaster risk management

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The Hydroclimatological Network of the Department of Risaralda, operated by the Technological University of Pereira since 2005, collaborated with various public and private institutions such as the Government of Risaralda, Aguas y Aguas de Pereira, CARDER, the Pereira Energy Company, and the municipalities of Pereira and Dosquebradas, among others, to establish a local environmental monitoring network. This network collects, processes, analyzes, and disseminates hydroclimatological data through a website and a mobile application. In 2018, work began on developing an Early Warning System (EWS) in the Department of Risaralda to prevent and mitigate the impacts of natural events such as floods and landslides. This initiative was carried out within the framework of the General Royalties System, highlighting the technical, institutional, and community needs that supported it. The department's vulnerability to extreme events, such as the 2010-2011 La Niña phenomenon, underscored the urgency of implementing the EWS, which entailed expanding instrumentation coverage and strengthening both institutional and community capacity. For this purpose, 21 institutional workshops were held, concluding with the General Royalties System's approval of the project "STRENGTHENING THE RISARALDA EARLY WARNING SYSTEM (EWS) RELATED TO CLIMATE VARIABILITY AND CHANGE." The project increased instrumentation coverage strengthened institutions and communities, and established action protocols. The project's development provided insight into other early warning systems in the country, identifying opportunities for improvement. Furthermore, the EWS for flooding was successfully integrated as a basis for other warning systems, and the hydroclimatological network was expanded to 103 instrumented points and 28 alarm points in seven municipalities. This presentation highlights the technical, administrative, and financial challenges, as well as the importance of municipal, relief agency, and community participation.

Participatory monitoring to strengthen the community early warning system for floods and flash floods in mountainous regions. Case study of the Manizales ravine, Manizales

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Incorporating citizen science into community-based early warning systems can improve the effectiveness of flood warnings and the resilience of vulnerable communities (Buytaert et al., 2014; Njue et al., 2019; Wolff, 2021, 2022). By empowering vulnerable populations to contribute real-time data through participatory monitoring, these systems close gaps in traditional monitoring infrastructure, providing crucial insights into localized flood dynamics and enabling more timely and targeted response efforts. Studies have shown that integrating citizen science not only improves data collection and analysis but also fosters community ownership and adaptive capacity in the face of natural hazards (Buytaert et al., 2014; Paul & Buytaert, 2018; Shirk & Bonney, 2015). Community-based early warning systems (CESS) often face challenges related to limited equipment, resources, infrastructure, and institutional support. In this study, we present the co-design, implementation, and results of a participatory environmental monitoring and citizen science project, involving vulnerable communities and the local school in response to flooding and flash floods in the Manizales ravine, where a CESS exists. The project is currently underway and is working on the areas of risk awareness for local natural hazards, construction of community level and rainfall stations, design and incorporation of low-cost level and rainfall sensors at strategic locations, and finally, the community water sensor program. The integration of citizen science projects into flash flood early warning systems generates broad benefits, such as information redundancy, increased awareness and preparedness, and strengthened relationships between scientists, authorities, and the community, fostering collaborative approaches to disaster risk reduction.

Keywords: Community environmental monitoring, Community early warning systems, Resilient communities, Low-cost sensors, Citizen science.

Early warning system of the Risaralda department, technical/ technological component

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Due to its geographic location and geological and topographic characteristics, the Department of Risaralda is vulnerable to various types of events related to high rainfall, including torrential floods, landslides, and flooding, which create high-risk conditions. The Risaralda Department Hydroclimatological Network, operated by the Technological University of Pereira since 2005, was established in collaboration with various public and private institutions and entities. These include the Risaralda Governor's Office, Aguas y Aguas de Pereira, CARDER, the Pereira Energy Company, as well as the municipalities of Pereira and Dosquebradas, among others. These entities have contributed to the implementation of the network in the department, resulting in a local environmental monitoring network that collects, processes, analyzes, and disseminates hydroclimatological data freely over the internet. In 2018, to strengthen the monitoring system and transform it into an Early Warning System, a project was formulated within the framework of the General Royalties System, for the creation of said system, called "Strengthening of the Early Warning System (SAT) of Risaralda related to variability and climate change", as a result of the strengthening of technological and monitoring instrumentation, 67 stations were installed in the department, distributed in; 29 hydrometeorological stations, three meteorological stations, 28 alarms and seven warning stations, in the municipalities of Pereira, Dosquebradas, Santa Rosa, La Virginia, Mistrató, La Celia and Pueblo Rico, to improve the availability of primary information to mitigate the effects of natural events that put the population at risk, associated with floods and torrential floods. Additionally, other components are considered necessary to provide the required comprehensiveness, such as more direct involvement of institutions and the community as key players in the implementation of a SAT.

Keywords: SAT, Risk, Instrumentation.

Tsunami Risk Forecasting, Assessment, and Mitigation on the Colombian Pacific Coast: Contribution to Risk Management

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The northern Andes, particularly the seismic belt located off the southern Pacific coast of Colombia and Ecuador north, is characterized by intense seismological activity (Gutsher et al., 1999; Collot et al., 2004; Sagiya and Mora-Páez, 2019). During the 20th century, the area was affected by four major earthquakes of magnitude Mw > 7.7 in 1906, 1942, 1958, and 1979. The largest occurred on January 31, 1906 (Mw > 8.4) (Yoshimoto et al., 2017). All of these earthquakes generated tsunamis that caused significant damage and loss of life throughout the Pacific coastal region of Colombia and Ecuador. In particular, the 1979 event affected several areas of the Tumaco region. In the department of Nariño, there were approximately 452 deaths and 1,011 injuries. In terms of structural damage, approximately 3,080 homes were destroyed and another 2,100 were damaged (Ramírez and Gobernador, 1980). Thus, tsunami hazard assessment, based on the study of the phenomenon's behavior and analysis of flooding impacts and damage in the coastal zone, has been a necessity for communities along the Colombian Pacific coast, laying the foundation for the development of mitigation and risk management measures. This paper reviews studies conducted on tsunamis along the Colombian Pacific coast, examining advances in hazard forecasting, assessment, and mitigation, as well as their contributions to risk management in the country. It presents flood assessment using deterministic methods, studies, and designs of evacuation infrastructure, as well as nature-based mitigation alternatives. It also presents the development of real-time tsunami flood forecasting and assessment tools for early warning in Pacific communities.

Keywords: Tsunami, Colombian Pacific Coast, Risk management, Real-time simulation, nature-based solutions.

Early Warning System to Prevent Floods and Landslides – Peru Project

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The Automated Local Evaluation in Real Time (ALERT2) system is a radio protocol developed and used as an open standard by the National Weather Service (NWS) for early warning environmental monitoring networks to ensure robust interoperability between independent hardware and software platforms, using remote sensors to transmit environmental data via radio to base stations for analysis and processing. An Early Warning System (EWS) will be deployed in various watersheds in Peru to protect the population, authorities, and local entities from flooding and landslides. This system will provide real-time information to enable effective responses and safeguard lives and property. The system will comprise radars, hydrological networks, meteorological networks, centralized processing centers, a siren network, ground movement monitoring networks, a risk awareness platform, and monitoring and analysis modules for regional and national emergency operation centers (REOCs). The expected benefits following the system's implementation are early detection and rapid response to floods and landslides, protection of lives and property, improved resilience and response capacity of local communities, and the integration and interoperability of systems at the national level.

Keywords: Alert2, Early warning system, Floods, Landslide, Radar, Sirens.

Tsunami Crossing Borders: Lessons Learned from the Hunga Tonga - Hunga Ha'apai Tsunami of January 2022

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The Hunga Tonga-Hunga volcano erupted on January 15, 2022, in the Pacific Ocean off the island of Tonga, generating a tsunami that caused local damage and activated tsunami warning systems in the American Pacific and Japan. This section summarizes the performance of tsunami early warning systems during the event in Peru, Colombia, and Costa Rica. Five topics are discussed: 1) The effectiveness of tsunami risk monitoring and warning dissemination during the volcanic and tsunami event. 2) Obstacles to local and international telecommunications during the event, and the type of instrumentation used for emergency analysis. How can communication technology and protocols improve future responses? 3) How prepared communities mitigated tsunami damage locally and internationally, and strategies to improve the global community's tsunami preparedness. 4) Conclusions obtained from the implementation of the Tsunami Ready program in coastal communities around the world and the benefits during the Tonga event. 5) Obstacles to strengthening global tsunami risk management and how nations can collaborate with the PTWC to find practical solutions. The paper concludes by reporting on the PTWC's actions in Colombia.

Keywords: Tsunami, Early Warning System, Community Resilience.

SPECIAL SESSIONS

Introduction to the Scorecard Tool: Addendum for Multi-Hazard Early Warning Systems at the Local Level

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About the session: The session addressed the relevance of localizing the Sendai Framework, focusing on Multi-Hazard Early Warning Systems (MHEWS), and explored the efforts and tools of the Making Cities Resilient 2030 (MCR 2030) initiative. This was followed by an activity to implement the MHEWS Scorecard tool as part of a global pilot. Participants were organized into city-based working groups, allowing for a targeted and contextualized approach. This initiative is closely related to the Early Warning Systems for All (EW4All) initiative, which seeks to achieve global, multi-hazard coverage by 2027.

Objectives: 1) Strengthen the relevance of Multi-Hazard Early Warning Systems at the local level. 2) Increase visibility and interest in the Scorecard Tool: Annex for Multi-Hazard Early Warning Systems.

Rationale: The proposed session aligns directly with the theme and objective of IDRIM 2024, "Disaster-Resilient Communities for Life." It highlights the efforts of the Making Cities Resilient 2030 (MCR 2030) initiative to strengthen local resilience. It also introduces the Scorecard Tool as a global pilot, providing participants with the opportunity to pioneer its understanding and application. This will not only promote a theoretical session but also provide rapid training in the use of these tools. Additionally, by addressing the Early Warning Systems for All (EW4All) initiative, the session emphasized the importance of preparing communities to face a range of challenges.

Keywords: Early warning systems, scorecard, cities, resilience.

Diverse and Inclusive Voices, a Resilient Future: Participation of Women, People with Reduced Mobility, the LGBT Community, and an Ethnic Approach in Disaster Risk Management and Climate Change

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About the session: The importance of youth, women, the LGBT community, and ethnic groups participating in disaster risk management (DRM) and climate change adaptation in Colombia was addressed. Through a discussion, the invited experts shared experiences, strategies, and best practices for integrating an inclusive approach into the planning and implementation of risk management policies.

Objectives: 1) Promote inclusion. To encourage the participation of people with reduced mobility, women, the LGBT community, and ethnic groups in disaster risk and climate change management. To share knowledge and experiences. 2) To present case studies, best practices, and experiences that have proven effective within the context of the Differential and Gender Approach to Disaster Risk Management, to develop strategies and tools for inclusive risk management and climate change adaptation that strengthen the resilience of all communities.

Rationale: This session recognized that effective resilience can only be achieved through the inclusion of all voices and perspectives in disaster risk management. Women, people with reduced mobility, the LGBTIQ+ community, and ethnic groups often face additional barriers and specific vulnerabilities that increase their risk in disaster situations. By providing a space to discuss and address these issues, this session contributes to the creation of more equitable and effective practices. The Sendai Framework for Disaster Risk Reduction 2015-2030 emphasizes the importance of adopting an inclusive and gender-sensitive approach to risk reduction. It further emphasizes the need to empower communities and strengthen their resilience through the participation of all sectors of society. Furthermore, the focus on sharing knowledge and best practices fosters international collaboration and mutual learning,

which is crucial for addressing the global challenges of climate change and natural disasters. Ultimately, this session sought to empower communities and ensure that their needs and capacities are integrated into all phases of risk management, from prevention to recovery, thereby promoting truly inclusive and sustainable resilience.

Keywords: Diversity, equity, inclusion, inclusive approach.

Unraveling Risk Dynamics with Impact Chains: A practical session on participatory risk analysis

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About the session: While it is widely recognized that risks result from the dynamic interaction of three fundamental elements (hazards, exposure, and vulnerability), risk analysis or assessment methodologies are often characterized by a siloed approach that hinders understanding of risk dynamics and, consequently, limits the effectiveness of adaptation options. In this session, we will introduce and guide participants through the implementation of Impact Chains, an analytical tool that unravels the interactions between multiple risk components, describes key vulnerability drivers, and simplifies the various causal relationships that determine specific risk pathways. In addition to offering a new approach to risk analysis, the Impact Chains methodology promotes a comprehensive understanding of risk dynamics shared by multiple actors. This methodology has a strong participatory component, allowing for a picture of the specific risks in a given context, while also enabling local stakeholders and experts to reflect on and identify specific contextual vulnerabilities. Participants in this session will gain a deep understanding of the theoretical framework underlying the methodology, as well as the opportunity to apply it in a group exercise. This hands-on experience will provide them with practical skills to enhance their risk analysis and adaptation strategies.

Objectives: i) to explain the concepts of the impact chain methodology, ii) to experience its implementation. The session aims to expand participants' knowledge of risk analysis methodologies and provide them with the opportunity to apply the knowledge acquired during a participatory activity. Through this interactive activity, we also aim to provide a collaborative space that stimulates mutual learning and knowledge exchange among participants. We also hope to generate networking with regional and international experts working in risk analysis.

Rationale: In an increasingly globalized world, societal challenges interact with changing climatic conditions, generating constantly evolving risks for societies. Risk science progressively recognizes the complexities and multifaceted challenges inherent in risk analysis. However, traditional risk analysis methodologies often fail to offer a comprehensive analysis, frequently focusing on individual risk elements. Here, a methodology is developed that addresses the limitations of conventional disaster assessment and risk analysis frameworks. Our approach

provides a systematic and comprehensive representation of risk components, grounded in contextual knowledge and an understanding of risk dynamics, developed in collaboration with local stakeholders and experts. The session aligns with Priority 1 of the Sendai Framework by providing a methodology that better captures the interactions between risk components, reflecting the dynamic and complex nature of risk. With a participatory approach, this session allows participants to gain experience in implementing the methodology. This interactive format distinguishes our session from other breakout sessions planned at the conference, encouraging discussion among participants and strengthening their practical skills.

Keywords: Impact chains, risk analysis, methodologies.

Resilient Colombia: Preparation and anticipatory action against the ENOS phenomenon, implementation of the National Network of Forest Brigades and the ALERCOM System

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About the session: The National Network of Community Forest Brigades project allows diverse institutional and community actors to share their experiences, lessons learned, and challenges faced. This network comprises 80 brigades and 1,120 firefighters, distributed across five regions of the country, in rural areas. During the sessions, the participants discussed how the Colombia Resilient project implements the Sendai Framework, focusing on several key aspects such as: 1) understanding disaster risk by increasing risk perception in communities and identifying and assessing risks; 2) strengthening disaster risk governance, fostering community participation and reducing institutional vulnerability, with an inclusive approach that considers ethnic and gender aspects, in addition to international cooperation; 3) reducing risk for resilience, utilizing technology and information within the firefighter network and establishing early warning systems (EWS); and 4) preparing for multi-hazard responses, ensuring that communities are ready to face diverse challenges.

Objectives: To demonstrate the successful implementation of a solution with an innovative DRR component in the country's territory to address risk scenarios due to the materialization of hazards during the presence of the ENOS phenomenon.
Rationale: The proposed session aligns with the conference themes by implementing a national network of forestry brigades operating in areas with high complexity and risk of wildfires. Community Forestry Brigades are critical to increasing the country's resilience to fire-related disasters, enabling rapid and effective responses through training and equipment for prevention and self-protection. These brigades focus on prevention and mitigation activities, and through a social ownership strategy, brigade members transfer knowledge to communities, improving their skills and fostering social cohesion in risk management. The National Network comprises 80 brigades and 1,120 participants across 23 departments, contributing to climate change adaptation and playing a crucial role in combating this phenomenon. The session was distinguished by its high level of articulation and integration between the government, local authorities, and the community.

Keywords: National Network of Forestry Brigades, Response Preparedness, Community Resilience.

Implementation Science Continued: Progress Update and Forward-Looking Suggestions

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About the session: Since 2022, coordinators Prof. Okada and Prof. Goble have led two Special Sessions at the IDRiM Annual Conferences (in 2022 in Romania and 2023 in India), focusing on implementation gaps to foster implementation science. A concept paper, discussed at IDRiM 2022, led to the publication of a perspective paper (Okada et al., 2023). Following IDRiM 2023, an IDRiM Working Group on Implementation Science was established, led by Prof. Okada. The Working Group engaged implementation scientists through online meetings, where six presented cases related to various implementation challenges. These discussions prompted case comparisons and inspired an integrative approach to implementation studies. The proposed special session sought to foster research interest, facilitate the exchange of ideas, and encourage collaboration in implementation science.

Objectives: 1) To continue the special sessions on implementation science at previous IDRiM annual conferences to foster and stimulate interest in implementation-focused research and exchange; 2) To update the progress of the IDRiM Working Group on Implementation Science; and 3) To propose a set of suggestions, including the development of a platform (e.g., a website) for case collection and suggestions for the development of an Implementation Gap Catalogue—a common 'case database'—to promote implementation-focused scholarship.

Rationale: The proposed special session aligns with the IDRiM 2024 conference theme, "Disaster-Resilient Communities for Life." While there has been tremendous progress in understanding and knowledge about disaster resilience and disaster-resilient communities, effective implementation remains a common challenge at every stage of integrated disaster risk management: prevention, mitigation, emergency response, recovery, and redevelopment—all essential for the development of disaster-resilient communities. Therefore, IDRiM 2024 has explicitly called for "integration to bridge the gap between science and implementation, to increase the usability and use of knowledge for disaster risk reduction and management, and to advance research and implementation solutions." The proposed special session directly responds to this call.

Keywords: Implementation science, disaster resilience, integrated disaster risk management.

The benefits and challenges of transnational research and collaboration: case studies from the field

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About the session: "National culture" refers to the shared attitudes, values, and beliefs that define a country's citizens. National culture influences how communities understand, prepare for, respond to, and recover from disasters. Risk perception, preparedness practices, response protocols, and recovery priorities can all be shaped by national culture. For example, different cultural norms and political orientations emerged as key factors hindering the international harmonization of mobile public warning practices between Japan and the United States. While many disaster risk researchers work within their own national cultures, many also collaborate across borders. Transnational researchers often consider linguistic differences, cultural norms, and other factors that those working solely within their own national contexts might overlook. Cultural sensitivity, understanding, and trust can play a crucial role in the success or failure of transnational research projects. Understanding the dynamics of transnational research and collaboration is essential for developing effective global disaster risk management. The session featured seven presentations covering various case studies.

Objectives: To engage reflexively with the following questions: 1) Disaster risk management research evokes work at the local level within a national culture or political system. What are the risks and rewards of conducting similar research transnationally?; 2) When conducting transnational disaster risk management research, how can we engage respectfully and effectively with communities very different from our own?; 3) How do we persuade international actors to participate in research when the reward for their time and attention is uncertain, distant, or potentially minuscule?; 4) What opportunities do machine translation and generative AI offer to disaster risk management researchers and communities working transnationally?; 5) How should researchers working transnationally configure social scientific "expertise" and "local knowledge" in the service of broader shared goals?

Rationale: Cultural attitudes, values, and beliefs exhibit both stability and change. Researchers conducting transnational projects are in a unique position to observe how cultural norms foster strong local networks that facilitate mobilization during emergencies. These networks not only enhance immediate responses but also support recovery efforts (including preparation for the next disaster), which are critical for long-term resilience. It is important not to solidify culture or reduce it to national stereotypes. However, a community is more likely to adopt policies and practices that align with its cultural expectations. How can disaster risk management scholars and practitioners address these complex issues? The presenters' field case studies are likely to challenge some assumptions about national culture while confirming others. Ultimately, however, integrating more transnational research into disaster risk management could help build resilient communities that are better equipped to handle disasters.

Keywords: Transnational research, international harmonization, cultural norms.

From Natech risk management to risk governance to build territorial resilience

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About the session: Natech accidents result from the impact of natural hazards on industrial facilities, with the subsequent release of hazardous materials. In recent years, increased attention has been paid to Natech hazards and risks. This includes considering them in the context of critical infrastructure resilience, such as renewable energy, and climate change. Furthermore, efforts are being made to address Natech risk governance issues. The session featured six presentations by international experts in the field.

Objectives: The purpose of this session is to raise awareness about Natech risk and present a summary of the latest research directions based on the findings of the 8th Natech Symposium held on July 1-2, 2024, as well as current international initiatives for Natech risk governance from around the world.

Rationale: The proposed session aligns with the IDRIM 2024 theme, "Disaster-Resilient Communities for Life," as it addresses one of the conference's thematic areas.

Keywords: Natech risk management, Risk governance, territorial resilience.

The economic impact of disasters in a rapidly changing business environment

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About the session: With global inflation, changes in the work environment, supply chain disruptions, and disasters, the impact on businesses and economies is increasingly diverse. This session focused on methods for analyzing the economic impact of disasters and presented case studies of small and medium-sized businesses facing various external shocks, including labor shortages, CO2 emissions constraints, supply chain disruptions, and disasters.

Objectives: The session was organized by specialists in disaster economic impact analysis from Japan and the United States and aimed to exchange the state of the art in this area among panelists and audiences interested in disaster losses, compensation, and the cost-benefit of countermeasures.

Rationale: The session was related to the conference topics "4.b Post-Disaster Loss and Damage Estimation" and "3.d Financial Assurance and Protection," but focused specifically on the impacts and roles of the surrounding business environment and methodologies for quantitative loss and resilience analysis. The speakers are members of the joint research project between the Japan Science and Technology Agency and the U.S. National Science Foundation, and the presentation of our joint research and shared goal will be beneficial for all attendees interested in this area.

Keywords: Economic impact of disasters, Supply chain disruptions, Business resilience.

Am I at risk if an earthquake were to occur?

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About the session: The session was designed for the public and aimed to create a space for dialogue, where attendees could ask questions about earthquakes, seismic risk components, risk management, and other relevant topics. During the session, attendees were asked to share their concerns, doubts, myths, and other issues related to earthquakes. These concerns served as the basis for the session (as is the case with the community awareness workshop) and were addressed with the help of a video developed for the seminar that presented basic concepts of seismic hazards and risk, and with the interventions of the Chairs. Additionally, the Chairs explained (i) an activity to identify the characteristics of attendees' homes and understand their capacity to withstand seismic forces, and (ii) how to respond effectively during a seismic event.

Objectives: The objective of this session was to build the capacity of attendees to apply the workshop methodology in their respective territories, aiming to address the topic of seismic risk with communities clearly and transparently. The workshop includes online resources (video and workshop guide) that can be adapted to the needs of different audiences. It is expected that attendees will identify alternative methods of disseminating knowledge about seismic risk, enabling the information to reach diverse audiences.

Justification: To address the challenge of ensuring that seismic risk assessment models and results are relevant to society, a seismic risk awareness workshop was created through interdisciplinary and inter-institutional collaboration. This workshop aims to foster a process of change in attendees so that, through critical reflection, they enhance their resilience to earthquakes and acquire tools to contribute to seismic risk management. Recognizing that risk management is everyone's responsibility, the session seeks to share tools with attendees that facilitate the social appropriation of knowledge and enable citizens to respond as effectively as possible in the event of an earthquake, aligning with the IDRiM 2024 theme "Disaster-Resilient Communities for Life." The methodology proposed in the session, which includes active participation from attendees, creates a dynamic learning experience designed to inspire some participants to replicate the workshop in their communities. This innovative approach differs from other sessions planned for IDRiM 2024 and is considered a valuable contribution to the event.

Keywords: Seismic risk, risk perception, knowledge transmission.

Community with Science - How to build a better relationship between society and science for disaster risk reduction

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About the session: The session focused on discussing ways to strengthen the relationship between society and science, promoting science- and evidence-based disaster risk reduction. The disasters addressed included earthquakes and tsunamis, as well as climate-related disasters and Natech-related disasters. Researchers and practitioners will present their methodologies for connecting scientific knowledge with communities in various locations, including Japan, the United States, Mexico, and Colombia.

Objectives: The objective of the session was to share academic and practical experiences on how to bridge science and community, and to foster discussion on how to deepen implementation science.

Rationale: Distrust of science has been observed worldwide. Therefore, it is necessary to change the traditional way of constructing science and the risk communication model. Thus, the session aimed to offer a new perspective that would strengthen the relationship between science and society. This idea is part of IDRiM 2024's concept of achieving resilient communities for life.

Keywords: Scientific knowledge, community, disaster risk reduction.

Senior Management for Risk Management

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About the session: The importance of strengthening the resilience of health systems in the Americas was highlighted through the session "Emergencies and Health." Knowledge, successful experiences, and lessons learned in prevention, risk reduction, preparedness, surveillance, response, and early recovery from hazards to human health were shared. In addition, the need to manage risks and promote disaster reduction through a culture of prevention and sustainable development was emphasized to improve the response capacity of health systems. The PAHO Health Emergencies Department provided expert support to member countries in addressing emergencies and disasters of natural, biological, chemical, radiological, or human origin. The session included participation from PAHO/WHO staff and representatives from the Ministries of Health of several countries in the region, who exchanged ideas and strategies to strengthen regional capacity to respond to health crises. This collaboration was crucial in advancing toward safer and more sustainable health systems throughout the region.

Objectives: 1) To understand disaster risk from a managerial perspective in the health sector. 2) To strengthen disaster risk governance for effective management in health systems. 3) To invest in disaster risk reduction for the resilience of health services from a development perspective. 4) To improve disaster preparedness for effective response and "building back better" in terms of sustainable recovery, rehabilitation, and reconstruction in the health sector.

Rationale: The urgency and complexity of the challenges facing disaster risk management in health were highlighted, emphasizing the relevance of the Sendai Framework 2015-2030 and its call for joint action among governments, international organizations, NGOs, and the private sector. Within this framework, the PAHO/WHO "Resilient Hospital" initiative was analyzed as a key strategy to ensure the operational availability of health services in the face of disasters. Implementation experiences in different countries were shared, highlighting their impact on reducing vulnerabilities. The COVID-19 pandemic underscored the need to enhance emergency preparedness and response, emphasizing the role of the WHO in global coordination and strengthening the health emergency preparedness and response architec-

ture (HEPR). In Colombia, the incorporation of resilient hospitals into the National Development Plan 2022-2026 and its coordination with the Ten-Year Public Health Plan 2022-2031 were discussed, reaffirming the commitment to resilient and equitable health services. The role of human talent was also emphasized, aligned with Strategic Axis 6 of the Ten-Year Plan. The session addressed the challenges of historically marginalized groups—women, people with reduced mobility, the LGBTIQ+ community, and ethnic groups—emphasizing inclusive and equitable strategies. PAHO promoted the exchange of experiences among countries, strengthening international cooperation and mutual learning. In conclusion, the need to integrate community voices into all phases of risk management, promoting inclusive and sustainable resilience, was reaffirmed.

Keywords: resilience, health, health response, prevention.

Digitizing paper-based participatory risk mapping with the Sketch Map tool

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About the session: The session used the Sketch Map Tool, an open-source technology designed to bridge the gap between traditional hand-drawn mapping methods and the growing demand for data analysis and storage. Participants learned about two components of this tool: analog data collection using hand-drawn maps and a web application that enables automatic digitization, data quality analysis in OpenStreetMap (OSM), and satellite imagery integration. Through demonstrations and a hands-on group exercise, participants gained firsthand experience using the ketch Map Tool, exploring its applications in integrated disaster risk management.

Objectives: 1) To become familiar with the Sketch Map Tool and its applications in disaster risk management through participatory approaches. 2) To develop knowledge and skills to use the Sketch Map Tool in their professional work, promoting community participation and informed decision-making in disaster risk management. 3) To explore its use in mapping risk perceptions and applying participatory approaches in disaster forensic investigations. 4) To apply the tool in identifying individual and group preferences for community-based disaster risk assessments and risk reduction strategies. 5) To integrate the Sketch Map Tool into ecosystem-based adaptation approaches, strengthening community resilience to environmental hazards.

Rationale: Disaster risk assessment and strategy planning require data on hazards, vulnerabilities, and capacities, which are often lacking in remote and vulnerable communities. This lack of local spatial information limits their ability to strengthen resilience. However, communities possess valuable local knowledge about risk, which is essential for understanding it. Forensic disaster investigations (FORIN) require greater social participation to analyze how dynamic factors transform root causes into conditions of insecurity. Participatory mapping, a key component of Participatory Action Research approaches in Disaster Risk Reduction, facilitates the collection and utilization of local spatial data for collective action. Paper-based methods, such as freehand or scale maps, which are low-cost and accessible, are helpful for

communities with low digital literacy and allow for better understanding of maps. However, digitizing this content is laborious and prone to errors, which can limit its use for external advocacy or quantitative analysis. The Sketch Map Tool enabled the benefits of paper maps to be leveraged within participatory mapping, providing time efficiency and ensuring the sustainable use of information through digitization. Unlike other scheduled thematic sessions, this session featured an exploratory learning experience on the potential applications of the Sketch Map Tool in integrated disaster risk management, utilizing participatory mapping technologies.

Keywords: Disaster risk, participatory mapping, resilience, digitalization, local knowledge.

IDRiM Young Scientists Forum (YSF)

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About the session: This session marked the launch of the Young Science Forum (YSF), a dynamic initiative designed to empower young researchers within the IDRiM society. The forum aimed to create a supportive space where emerging scientists could discuss and address the challenges they face, fostering greater collaboration and innovation through a transnational approach. The session was open to all members of the society, with a particular focus on engaging younger researchers. During the session, several key questions were addressed: How can young researchers be better supported? What unique challenges do they face in different regions of the world? By answering these questions, the aim was to identify common obstacles and explore solutions sensitive to diverse geographical and cultural contexts. The objective was to facilitate a dialogue leading to concrete strategies to support young researchers. It also sought to strengthen collaborative efforts at the international level, thus reinforcing the global research community. The session included interactive discussions, allowing participants to share their experiences and knowledge.

Objectives: The objective of the session was to listen to and learn from the experiences of young researchers within the IDRiM Society. By addressing their concerns and questions, we sought to gather valuable information that would contribute to the development of an article for the IDRiM Journal. This article will not only document the challenges and solutions discussed. Still, it will also serve as a fundamental roadmap for the development and growth of the IDRiM YSF, fostering a supportive and collaborative environment for future researchers within the IDRiM Society.

Rationale: The session addressed the importance of understanding and highlighting the experiences of young researchers within the IDRiM society to strengthen their professional development and foster a collaborative environment. Through open dialogue, the specific challenges they face in different regions of the world were explored, identifying both barriers and opportunities for their academic and professional growth. The session also provided va-

luable input for preparing an article for the IDRiM journal, which will document the concerns and proposals discussed. This article will serve as a basis for consolidating the IDRiM YSF, an initiative that aims to support young researchers and promote transnational cooperation within the scientific community. Finally, the need to establish concrete strategies to facilitate the active participation of young researchers in the IDRiM society was emphasized, ensuring their integration into global knowledge networks and their contribution to the advancement of research in disaster risk reduction.

Keywords: Young researchers, transnational collaboration, professional development, disaster risk reduction.

DesignSafe.CI: Cyberinfrastructure to advance cooperation in natural hazard research

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About the session: The session covered the use of DesignSafe-CI, a cyberinfrastructure platform developed by the NHERI (Natural Hazards Engineering Research Infrastructure) program of the NSF in the U.S. This platform provides access to advanced tools for research, analysis, and visualization of data related to disasters such as earthquakes, hurricanes, tornadoes, and floods. The session presents how researchers can use DesignSafe to integrate their data, model extreme scenarios, and collaboratively share results.

Objectives: To introduce the DesignSafe platform as a fundamental tool for engineering and hazard science research. To demonstrate its usefulness across the entire data lifecycle, from collection to preservation and publication. To present real-life use cases where computational models and structural simulations were applied to extreme events. To promote collaboration among researchers by facilitating open access to data and results.

Rationale: The increasing frequency and intensity of disasters demand integrated tools to improve the resilience of infrastructure and communities. DesignSafe emerges as a response to this need, enabling researchers to develop reproducible science, assess structural vulnerabilities, and propose safer design solutions. Cyberinfrastructure addresses the need for platforms that integrate data storage, analysis, and visualization in a manner that is both accessible and scalable for the scientific community.

Keywords: Cyberinfrastructure, DesignSafe-CI, NHERI, disaster simulation, open data, computational modeling.

Information Systems for Disaster Risk Management: Experiences from Antioquia and Medellín

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About the session: This session addressed the role of information systems in disaster risk management (DRM), in compliance with Law 1523 of 2012, which requires their creation at the territorial level and their interoperability with the National Disaster Risk Management System (NDRMS). The Sendai Framework, which promotes the use of information and communication technologies to improve data collection, analysis, and dissemination, was also considered. The need for a robust technological tool to manage DRM information was highlighted, and the concept of an information system was defined within the context of smart cities, emphasizing the importance of community participation and the role of artificial intelligence. Five interconnected components were presented: baseline information, scientific information, disaster management information, territorial planning, and monitoring, providing a comprehensive view of DRM. The session demonstrated how accessible technologies, such as basic viewers, enable the identification of risk scenarios and improved management. The case of Antioquia and the DAGRAN system, which has achieved progress in territorial characterization, emergency response, and knowledge dissemination, was presented. Finally, the potential of artificial intelligence and emerging technologies to strengthen regional DRR was highlighted.

Objectives: 1) To compile and analyze attendees' perceptions of information systems for DRM to establish a common basis for understanding. 2) To share concepts associated with information systems for DRM, emphasizing the achievements obtained from their conception and implementation in the Department of Antioquia and the District of Medellín. 4) To foster a deep understanding of the topic addressed through a participatory approach that establishes key concepts and identifies opportunities for advancement.

Rationale: The session addressed the implementation of information systems for disaster.

risk management (DRM), supported by Law 1523 of 2012 in Colombia and the Sendai Framework 2015-2030. Both instruments promote the use of information technologies, spatial data, and GIS to improve the analysis, dissemination, and access to real-time information. Despite their legal recognition for more than a decade, the adoption of these systems in Colombia remains limited. At the same time, the concept of smart cities has gained traction globally, demonstrating how the intensive use of data and innovative technologies can optimize planning, monitoring, and response to hazards. According to Munawar et al. (2022), these approaches enhance the effectiveness of DRM plans by enabling the continuous processing of large volumes of data. The session highlighted the importance of strengthening institutional and community culture regarding the value of robust information systems, promoting their adoption to facilitate effective information management and informed decision-making. He also presented the case of Antioquia as an example of practical implementation, demonstrating concrete benefits in communication, analysis, and territorial response.

Keywords: Information systems, Disaster risk management, Smart cities, Innovative technologies, Interoperability.

What is community-based resilient housing?

Adriana Duque Pardo[1] & Manuela Pinilla Rodríguez[2]

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[2] Build Change, Latin America Program Director.

About the session: Build Change led a series of activities to strengthen participants' capacities to assess and improve housing vulnerable to disasters and climate change. First, a global context on housing vulnerability was established through participatory questions, highlighting the need to address existing self-built housing. Subsequently, a discussion was held on the specific Colombian scenario, analyzing the relationship between housing vulnerability and the potential impact on the country's GDP in the event of large-scale natural events. Following this initial immersion, an interactive exercise was held in which attendees shared their experiences and gained insight into the technical, social, and financial aspects of resilient housing. These perceptions were compared with data collected by Build Change from its collaborations with communities in Colombia. In addition, the eight key factors that contribute to housing resilience were presented, followed by a practical case study. In this exercise, participants identified the vulnerabilities of a real home and proposed solutions to enhance its resilience. Finally, Build Change presented the tools available to address this issue and promote the construction of more resilient communities and homes, closing the session with a practical approach and tangible solutions.

Objectives: To provide attendees with practical tools and knowledge to address the problem of inadequate housing in Colombia, thus promoting the construction of safer communities and homes that are more prepared for natural disasters.

Justification: This session allowed for an analysis of Colombia's scenario regarding the risks of natural disasters, particularly in vulnerable communities and homes. According to DANE figures from 2021, over the last three years, nearly 3,977,000 Colombian households have lived in a qualitative deficit, meaning they lacked adequate structures, living spaces, and access to public services. Furthermore, it is estimated that more than 65% of buildings in Colombia lack adequate structural systems to withstand earthquakes. For example, in Bogotá, according to IDIGER data, the percentage rises to 70%. Meanwhile, in Medellín, it is 61%, and in Cali, it is 70%, according to Global Earthquake Modeling (GEM). This implies that more than six million homes in Colombia are vulnerable. Considering that more than 80% of the population lives in areas of medium or high seismic hazard, the need to promote resilient communities and homes is evident. This initiative not only seeks to improve the living conditions of millions of people but also to reduce the risk of human and economic losses in

the face of natural disasters. Early and systematic intervention in housing construction and improvements can mitigate this risk and promote the well-being of Colombian communities.

Keywords: Vulnerable housing, Seismic risk, Community resilience, Housing shortage, Risk reduction.

Collaborative mapping and multi-sector networks: promoting inclusive local disaster risk management

Juan Arellano Valdivia
Humanitarian OpenStreetMap Team.

About the session: This session is a practical introduction to using OpenStreetMap (OSM), a collaborative platform for creating open-source maps. It demonstrates how to access the site, view geospatial information, and make edits to the map. It emphasizes its potential for communities, researchers, and organizations that need up-to-date, freely accessible geographic data.

Objectives: To familiarize participants with the OpenStreetMap interface and basic functionalities. To demonstrate how to contribute to collaborative mapping. To illustrate the use of tools such as iD Editor to modify maps. To promote the use of OSM as a data source for analysis in risk management, territorial planning, and other areas. To foster an active community of users and mappers.

Justification: In contexts where access to spatial data is limited or expensive, OpenStreetMap represents a democratic and collaborative alternative for collecting and accessing geographic information. It plays a crucial role in developing countries, emergency response activities, urban planning, environmental projects, and disaster risk management. Furthermore, it strengthens local capacities and fosters community empowerment by producing community-based knowledge.

Keywords: Collaborative mapping, geospatial data, iD Editor.

Featured Activities

The conference featured four types of activities that allowed participants to explore and share knowledge dynamically and collaboratively on the conference topics.

Illustration 1. Photograph taken during the conference opening ceremony at the Cartagena Convention Center. Credit: UNGRD 2024.

Keynote Speeches: Eight plenary sessions were held, featuring international experts in risk management, resilience, and climate change. These speeches provided a comprehensive overview of the issues and solutions through presentations that included cutting-edge research and innovative policies implemented in different regions of the world.

Illustration 2. Photographs of keynote talks and panel discussions given by world experts. Credit: UNGRD 2024

Parallel Sessions: In addition to the keynote speeches, four panels and 24 thematic sessions were held. These sessions, totaling 141 talks, included 110 in-person sessions, 31 virtual sessions, and 17 special sessions. The sessions were thematically focused segments to share research or innovative ideas on a topic of interest, presenting academic research, case studies, intervention strategies, and practical examples of disaster risk management worldwide. The parallel sessions facilitated an exchange of ideas among attendees and promoted the discussion of effective solutions to common challenges.

Illustration 3. Photographs of exhibitors and attendees at the many talks given by researchers, professionals, and students held in the four auditoriums of the Cartagena Convention Center. Credit: UNGRD 2024.

Booths: The conference featured 32 dynamic, interactive, and academic trade exhibits from various stakeholders in the SNGRD, including universities, research centers, DRR sector companies, and response agencies, among others.

Illustration 4. Photographs of the SNGRD stakeholders' booths. These spaces provided an opportunity for two-way interaction between visitors and exhibitors. Credit: UNGRD 2024.

Young Scientist Sessions: An important component of the conference was the recognition of young scientists leading innovative research in DRM. The three best presentations were awarded in person, online, and poster formats, as part of an effort to encourage creativity and engagement among the next generation of professionals. This approach highlights the importance of involving future generations in building resilient communities, giving them a space to present their proposals and encouraging their active participation in addressing global challenges.

Illustration 5. Photographs of the spaces provided to young managers and young scientists. Credit: UNGRD 2024.

The winners are described below:

In-person-YSS		
1	Sebastián F. Alvarado Amézquita	4.85
2	Samuel D. Pinto Argel	4.75
3	Johan A. García	4.55
Online-YSS		
1	Haris Rahadianto	4.29
2	Pritam Ghosh	4.16
3	Ryo Tsuchida	4.08
Poster-YSS		
1	Akihiro Suzuki	4.38
2	Nicolas Espitia	4.06
3	Daniel D. Burgos	4.00

First Meeting of Departmental DRM Coordinators: The participation of Departmental DRM Coordinators was encouraged to strengthen their capacities and knowledge on the topics discussed during the conference. The First Meeting of Departmental Coordinators was also held, an event led by the Deputy Directorate General.

Field Trip: The field trip took place at the Colombian Navy's facilities, specifically at the maritime simulator located in Cartagena. This simulator is designed for the management and response to hydrocarbon spill emergencies in the maritime environment, allowing for training and capacity assessment in highly realistic scenarios.

Two visits were conducted at different times: the first with departmental disaster risk management coordinators, who had the opportunity to learn about the simulator's technical capabilities and participate in practical exercises focused on oil spill containment and mitigation. The second visit was conducted with foreign guests, who emphasized the importance of having tools of this type to strengthen international preparedness and coordination for environmental emergencies.

These activities enabled participants to interact with the simulator's technologies, evaluate operational procedures, and share experiences related to risk management in maritime contexts.

Networking: Lunches and a social dinner were organized to facilitate the exchange of ideas and experiences with professors and experts from Kyoto University, as well as UNGRD executives.

Photo Archive: The UNGRD Communications Office provided a photo gallery of the conference for attendees. It can be accessed through the following link: https://drive.google.com/open?id=1-Vz0INJnccqqnxck3iBZ3_FEowoO_unh&usp=drive_fs

Access to the event's reports: Each of the event's sessions featured a professional who recorded the most relevant discussions in a report card (in Spanish). To access them, please visit the following link: https://docs.google.com/document/d/1JMSnqF_9h3NawV8H4nzRANwxHGoEI5gNRWo_WMP83Q8/edit?usp=sharing

CITIZEN PARTICIPATION

Diario El Gabinete de la Palabra

Climate Justice

From your perspective

how would you define climate justice, and what is its importance in policymaking for disaster risk management?

What strategies do you consider most effective for reducing inequality in communities vulnerable to climate change?

OPINIÓN

"Climate justice is about understanding and managing differentiated impacts from an equity perspective."

"We need a planet where leaders make decisions based on environmental knowledge and sustainable development models".

"Strategies to reduce inequality:

-A development model agreed upon by all countries; consider Bill Gates' idea. (reduction of annual greenhouse gas emissions).

-Technically study climate change (understand its causes, impacts, and dynamics), invest in solutions, and avoid simply getting rid of problems."

"Equitable access to adaptation and resilience building."

"We must be aware of the climate and what we are experiencing."

"Citizen participation and oversight to improve resilience and relationships with society."

"Ensure that responsibility for climate-related factors is equitably distributed. Furthermore, those most vulnerable to the risks associated with climate change must receive greater resources to reduce their vulnerability."

"Incorporate their knowledge into management processes: Develop management plans in consultation with communities and invest in promotion and prevention with local experts."

"First of all, we must raise awareness; I believe this is the first step."

"Reducing inequalities by recognizing the ancestral and historical knowledge of communities."

"Establish a fair and relevant order concerning communities."

"It's time to take action to control human risk creation."

"Promote greater education and local development in communities."

"Commitment and responsibility to oneself and the planet are fundamental."

"Payment for environmental services and compliance with the Escazú Agreement. (Guaranteeingthe full and effective implementation in Latin America and the Caribbean of the rights to: acces to environmental information, public participation in environmental decision-making processes, and acces to justice in environmentalmatters)."

"When human beings understand and love the planet, change will occur."

Diario El Gabinete de la Palabra

Climate Change & Emerging Risks

In your opinion

What do you think are the most worrying emerging risks related to climate change?

In your opinion, how can institutions improve their capacity to face these new challenges?

OPINIÓN

"Institutions must seek synergies that allow them to combine knowledge with action to build knowledge and experience. This has been proven and applied by the community and for the community."

"The organization of the SNGRD from the administrative base must have standard instruments built from global experience."

"It's not new, but climate change has indeed made its effects more devastating."

"Coastal erosion has existed for a long time due to the abuse of our coastal areas. It's important to educate people about its protection."

"The threat from maritime phenomena associated with climate change is increasing."

"Coastal erosion has always existed, but the neglect of our governments has exacerbated it."

"New sources of potential vectors that could cause pandemics."

"Assessing climate risk scenarios is crucial for effective environmental planning."

"To improve response capacity, more conscious risk prevention policies are needed."

"Climate change greatly affects children and older adults."

"Implementation of climate change adaptation measures."

"Increase in the frequency of forest fires."

"Improving your work techniques and tools.

–Water shortage.
Generating policies to protect water.

Adapting community practices to change.

Improve capacity by investing in risk awareness.

Institutions can improve their risk management capabilities by including risk management in their development plans.

Lack of NSR-10 standard.

–Vector-borne diseases.
Community-based early warnings based on climate information.

The El Niño and La Niña phenomena, and what can be done to mitigate this problem somewhat.

The shortage of food and drinking water for poor communities."

"The risks with the greatest impact are landslides and floods."

"The most worrying risks: territorial governance, water potability, and climate change."

#ColombiaWithoutWater #ClimateChange

Institutions can improve by strengthening and appropriating the importance of climate.

The large number of human settlements in unsuitable areas due to irregular settlements, without studies or quality materials.

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Exploring Coastal Hazards

What's your opinion?

Is coastal erosion a new phenomenon due to climate change, or has it existed before? What do you think?

How do you think climate change is affecting the frequency and severity of coastal hazards, and in what ways?

OPINIÓN

"It's not new; it happens more and more frequently every day."

"Erosion is not a new phenomenon, as it is also influenced by natural factors such as wind and coastal drift."

"What is the government's commitment to large industries to ensure true justice?"

"Drought, forest fires, economic instability."

"One of the most worrying emerging risks is drought, as many communities are left without drinking water."

"Rising sea levels in coastal areas."

"Equitable public policy strategies throughout Colombia regarding land use for livestock and other sectors, which benefit only a few at the detriment of humanity."

- *Limited financial resources*
- *Uncontrolled urban development.*
- *Climate change, torrential floods, droughts, winters, and high tides.*

"Flooding and landslides."

"Raise awareness in communities and monitor companies that dump waste."

"Floods, landslides, and collapses."

"Erosion is the fault of humans."

"Coastal erosion is not a new phenomenon; however, it has become more noticeable as many communities live in coastal areas, losing their homes and, in many cases, their lives."

"Loss of mangroves and soil salinization due to rising sea levels."

"That there are regulations and legislation for compliance."

"Settlements on water sources."

–Recognition of risk zones through mapping by entities.

"Forest fires, droughts, tides."

"Floods, earthquakes, and fires."

"Climate justice as a determinant of development plans."

"Coastal erosion has existed since ancient times; it's nothing new, but climate change has increased its intensity due to rising sea levels caused by melting glaciers."

"I think it has existed since before, but today it has increased due to poor human management."

"Deforestation in mangrove areas."

"Climate change exacerbates this situation, as melting ice and rising sea levels, along with wave and tidal phenomena, cause erosion to remove at higher rates year after year."

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Geohazard Modeling & Forecasting

From your perspective

What would be the applicability of geohazard models and forecasts in the territory?

What do you propose to strengthen the population's understanding of geohazard models, enabling decision-making to resolve associated problems?

OPINIÓN

"I propose strengthening climatological instrumentation in each of the municipalities."

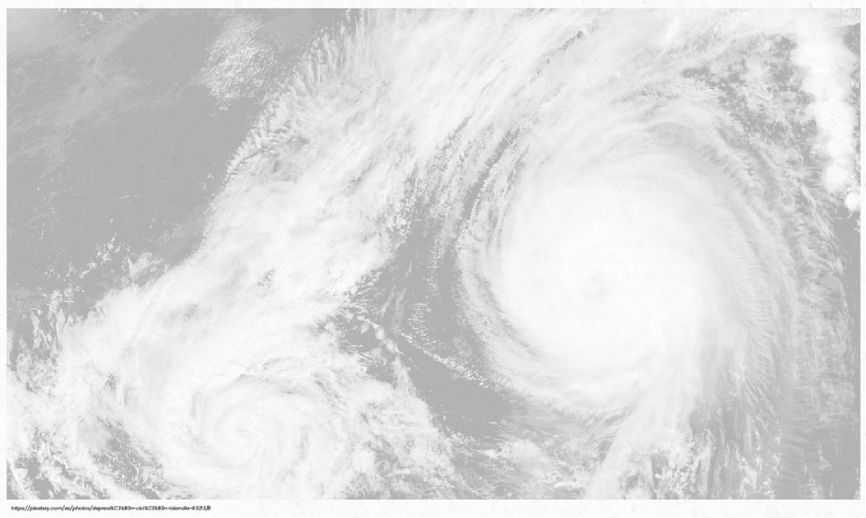
"That departmental and local governance implement community plans that encourage community participation."

"These plans would serve as a basis for community decision-making in areas exposed to geological phenomena."

"Use open data portals that allow everyone to create thematic maps of existing risks."

"Promote awareness of geohazards through instructive and communicative pedagogy that encourages community participation and engagement."

"Promote the social appropriation of knowledge with communities located in risk zones, to generate collective awareness."



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Risk Identification, Risk Assessment, & Evaluation of Systemic and Complex Risks

In your opinion

What approaches do you consider most effective for risk assessment in complex scenarios?

What do you suggest for addressing the challenges surrounding risk identification between the technical and community levels, enabling decision-making?

OPINIÓN

"Appropriation of knowledge about geological threats."

"The need to coordinate risk assessments with planning institutions and communities."

"Take an environmental approach, integrating social mapping to engage the community."

"To address community challenges, it is suggested to implement a weekly activity focused on the most urgent and practical problem to be solved."

"Apply the circle of words (dialogue) as a method."

"Holistic approach and nature-based solutions."

"Conduct dialogues and support with interdisciplinary groups for decision-making."

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Rural and Urban

Environments, Land Use Planning Around Water

From your perspective

How do you see the relationship between water resource management and land use planning?

In your experience, how do risks vary between rural and urban environments?

What strategies do you consider most effective in terms of citizen participation for understanding and managing water use in areas with rapid urban growth?

OPINIÓN

"More innovation in education."

"Promote a culture of self-care and prevention to progress."

"Value the land, love the planet, care for the ecosystem, and the animals."

"Identify and identify ourselves with the territory."

"Achieve the development of ancestral and technical knowledge."

"Coastal dynamics have always existed, but their effects have accelerated and increased due to climate change."

"Consider the phenomenon by prioritizing the protection of coastal areas."

"In general terms, for planning, the dissemination of knowledge to society is essential."

"It's not new; it's part of the Earth's natural cycle. However, it has increased in frequency and severity due to climate change, caused by drastic temperature changes and the impact of human displacement to areas with these types of problems."

"It makes it possible to explore what is imposed in risk-related activities and to promote values."

"The threat has always existed, as we have contributed to erosion for a long time."

"The threat is growing; the ocean is and will continue to recover its space."

"Erosion has always existed, as it is a phenomenon that can be both natural and dynamic."

"Coastal erosion has existed since ancient times, but is now more noticeable due to construction."

"It has a significant impact, generating variability in frequency and affecting areas inhabited by humans."

"Coastal erosion has increased due to climate change; stronger tides and more powerful storm events are increasing erosion."

"The application of measures is subject to the territory and its dynamics, questioning and defining acceptable risk."

"In land use planning to avoid risks, planning corrective interventions is crucial."

"Erosion has increased due to rising sea levels."

"It allows us to investigate what is imposed on risk activity and promote values."

Foto de Pixabay: https://www.pexels.com/es-es/foto/close-up-de-salpicaduras-de-agua-247910/

Diario El Gabinete de la Palabra

Communication and Education in Disaster Risk Management *(DRM)*

In your experience

What messages do you propose to address disaster risk management communication creatively?

how can disaster risk management education strengthen community knowledge?

OPINIÓN

"Integrating academia into disaster risk management (DRM) for knowledge transformation."

"In-person and virtual training to reach communities."

"Understanding communities and working based on their needs."

"Colloquial messages with terms specific to each region."

"Strengthen training or virtual reality that includes practical theory".

"Peparation of illustrative booklets."

"Acquiring knowledge from an early age, along with ancestral wisdom, prepares a community to respond to risk and empower the territory."

"The priority issue is to implement effective actions to halt deforestation, prevent the expansion of the agricultural frontier, and prevent land use changes."

"Nature-based solutions, reforestation, and hydrological studies are necessary to make information useful and accessible."

"To know the knowledge of the population in their territories."

"Broadly speaking, strengthen education to prevent any risks and emergencies that communities face."

"Be careful with the waste we throw away, and take care of the environment."

"Risk management is for everyone and by everyone."

"Expand the COMBITAS (Neighborhood Emergency Committees) project, which is a training ground for children in our city to become active participants in risk management."

"We are the San Bartolomé de la Florida educational institution, and 18 years ago, we incorporated risk management into the school curriculum."

"Achieve more direct communication with communities and participate more in these spaces."

"Get started! Reaching communities isn't easy; it seems like a job without immediate results. You have to start with a good attitude and be aligned with the system."

"Risk management education should be articulated through the policy of the Ministry of National Education (MEN) and implemented at the preschool, primary, secondary, and higher education levels."

"Carry out creative campaigns to capture the attention of both adults and children and instill the importance of protecting the environment to prevent disasters."

Departamentos de Caldas y Tolima 2012 Nevado del Ruiz

Diario El Gabinete de la Palabra

"Use popular sayings or current songs."

"Without a doubt, knowledge is the starting point for risk management. Creating spaces for knowledge, information, and community ownership will allow them to react efficiently and become aware of their environment and the importance of joint prevention against any type of risk."

"Strengthening information systems and strategies for dissemination and assertive communication."

"For communities, language based on the experiences of their environment provides information that impacts their historical memory."

"Transforming habits from the first generations."

"Prevention is better than cure": By doing real dynamics, the effects can be reduced."

"Knowledge of risk management through teaching methodologies, either virtual or digital, such as word searches with concepts and diagrams."

"Messages without technical jargon that we can all understand, with examples of what happens in everyday life."

"It is important to include risk management education as a subject in private and municipal schools."

"When there is respect and responsibility for your square meter and the space of others."

"When there is respect and responsibility for your square meter and the space of others."

"When will Colombian education give environmental education the importance it deserves?"

"Education in communities helps safeguard lives."

Working extensively with children on risk management and its importance to our organizations.

It would be excellent if the education ministries participated in these events.

Education and awareness will always lead us to save lives and find answers and solutions.

Risk Perception, Human Behavior, and Culture

How you see it

how does culture influence risk perception and human behavior in risky situations?

What factors do you think are key to understanding risk perception in the territory's communities?

OPINIÓN

"In some cases, the impact is positive and in others negative, as their beliefs affect their environment; for example, crops may be damaged by burning."

"Key factors: knowledge of the subject and awareness of the risk."

"Culture is fundamental to risk perception.."

"Risk perception is based on knowledge, and culture can affect or favor this perception."

"This means that if humans do not identify and recognize their environment, they will never be able to change their perspective or their risk preparedness."

"When a person has not experienced an event or emergency, they are not prepared for it and will not want to, as it will seem unlikely to happen."

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"The priority is prevention and risk management, which implies creating an appropriate culture."

"The participation of young people in their early stages of learning about risk management must be assertive."

"The central and municipal governments must facilitate processes and assist communities in this ownership so that there is effective co-responsibility in disaster risk management (DRM)."

"Doing work conscientiously and ethically improves processes and the efficient use of resources."

"In risk management, the first step is to inform."

"Effective communication must be tailored to the environment and specific; it is essential to understand and respect the culture and ways of life."

"Culture is a major source of vulnerability."

"The lack of adequate environmental education."

"Until when will environmental education remain the Cinderella of the Colombian educational curriculum?"

"Awareness contributes to risk specificity and understanding of the territory."

"Culture influences risk perception because people view social problems based on what they've been taught at home, and it's difficult to adopt new perspectives."

"The greatest risk is the neglect of environmental education at the educational level."

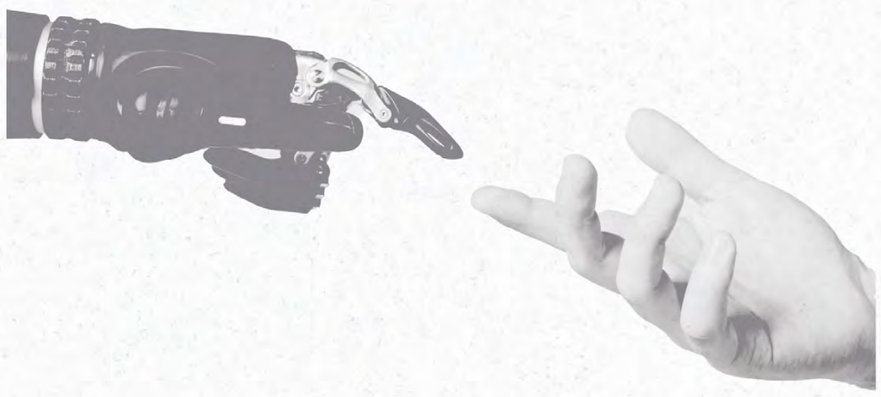

Foto de cottonbro studio https://www.pexels.com/es-es/foto/persona-con-mantenimiento-de-mano-negro-y-plateado-6153343/

Artificial Intelligence, Science, Technology and Innovation

In your opinion

How do you see the role of artificial intelligence in disaster risk management?

OPINIÓN

Based on your experience, do you know of any initiatives in science, technology, and innovation that contribute to knowledge in disaster risk management?

"AI plays a very important role in disaster risk management (DRM) because it can help us create measurement tools that help minimize the effects of disasters."

"Based on knowledge, policies could be included that investigate AI as a risk analysis tool.."

"Surveys should be conducted with people, using different social media platforms, to help vulnerable people."

"AI is a tool that must be available for use."

"Technologies are essential for the teaching and learning process in risk management topics."

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"AI provides and facilitates useful and necessary information to inform the design of disaster risk management (DRM) plans and tools. Its effective use can contribute to better management."

"Science, technology, and innovation must be embraced in all phases of risk management."

"Use of technology and robotics in seismic risk management due to the Galeras volcano."

"AI is advancing and should be leveraged in DRR to study threats and vulnerabilities, especially in Land Use Planning (LUP)."

"There is an app in Japan called " Nigetore " that allows you to mark routes and ways to react to tsunamis.."

"AI could reform and validate models, protocols, and other risk management mechanisms with an appropriate learning process."

"More investment is needed in AI for disaster prevention around the world.."

"It is a precise alternative to effectively manage the condition."

Foto de Thirdingineering de Pexels: https://www.pexels.com/es-es/foto/brazo-protesico-sobre-fondo-azul-3912025/

Financial Assurance and Protection for Disaster Risk Management *(DRM)*

In your opinion

What do you think people's perceptions are regarding financial insurance and protection?

How do you think insurance could be better adapted to the needs of vulnerable communities?

OPINIÓN

"At the sectoral level, the perception of insurance is oriented toward assets; however, the issue of people is not clear. It is recommended to implement awareness-raising strategies for the various stakeholders involved at various levels of exposure."

"Create entrepreneurship programs and teach people to protect themselves."

"For efficient financial protection, it is important to clearly differentiate funds from financing mechanisms to avoid confusion."

"The perception that insurance is too expensive or unimportant can be addressed by reaching out to communities to educate them about costs and by partnering with institutions to raise awareness."

"Take communities into account when formulating Territorial Planning Plans (POT) in the territories."

"People believe that having insurance is expensive and consider it unlikely that they will personally experience an event."

Foto de Muhamad hamdi: https://www.pexels.com/es-es/foto/calculo-de-impuestos-16202206/

Diario El Gabinete de la Palabra

Adaptive Capacity and Reduction of Vulnerability to Environmental and Climate Risks.

How you see it

How would you explain adaptive capacity in the face of risk in a simple way, and what actions would you recommend to the people who read this newspaper?

OPINIÓN

"To adapt is to prepare for what the territory offers us."

"Communities organized in the territory through Community Action Boards (JAC) play an important role in adaptive capacity."

"Adaptation of settlements in risk zones and resettlement to safe locations."

"Adaptation is knowledge, preparation, and coexistence with the environment."

"Prepare leaders in everything related to risk."

"Know the territory and establish response capabilities.."

"Plan development according to available capabilities."

"It is overcoming adversity with the resources available at the time."

"Adaptive capacity and vulnerability reduction are ways in which individuals and communities respond to living under stilt buildings."

Indigenous and Local Communities

How you see it

From your perspective, how does the traditional knowledge of indigenous and local communities contribute to disaster risk management?

What approaches do you think are most effective for engaging ethnic communities in the design of instruments and tools for understanding risk?

OPINIÓN

"Communities, as active agents in their territories, are essential for community maps to be truly useful and support risk management and event reduction, tailored to the needs of the affected community.

"As essential actors in risk management, those who inhabit a territory not only know their physical environment, but also deeply understand it. Community collaboration and inclusion reflect a more comprehensive and participatory development."

"The lack of inclusion and the low appreciation of their knowledge."

"My advice is to always be prepared for any eventuality that may occur around us."

"Listening to these communities offers a great insight; they are ancient communities that have survived through the centuries and are better versed in the dynamics of these phenomena."

"They contribute significantly through their worldview, knowledge and ancestral wisdom."

"Integrating and coordinating with community life plans, among others."

"Thanks to their worldview and the exchange of knowledge, since, rather than "teaching" them, they contribute their own experience of the environment."

Diario El Gabinete de la Palabra

Preparing for a Response

From your experience

What are the main challenges in preparing for complex emergencies?

What approaches do you consider most effective in strengthening the preparedness of families and communities for the response?

OPINIÓN

"Challenges: Finding mechanisms so that participation has a real impact and is not limited to workshops or accountability."

"Overcome the denial of risk and assume responsibility for it."

"It is necessary to build a community to achieve participation in DRR, working with individuals and raising awareness among the population."

"Community participation, community management plans, and resilience."

"Challenges: Risk perception and community vision regarding threats and risks."

"Challenges: Insufficient knowledge, lack of organization, unity, and institutional corruption."

*"Challenges: They receive information positively, reliably monitor community projects, and provide confidence to the sector to be leaders with the authorities.**"*

*"Challenges: Being in the territory and listening to the community without rushing**"*

"Promoting prevention in the classroom."

"Take into account the communities of La Mojana to find a solution to the problem."

"Uniform training across entities to achieve identical concepts: "speaking the same language" with all responding entities."

"Implement participatory community tools associated with access to tax incentives."

"Limited response capacity in unknown scenarios."

"Strengthen communities to coordinate with response agencies."

"What are the mitigation and response measures for the Galeras and Nevado del Ruiz volcanoes?"

"Challenges: Having a mechanism to measure response capacity based on risk scenarios and avoiding inertial preparation."

"Lack of knowledge of the territory and the response capacity (technical and operational)."

.

"One challenge is including animals in risk management and understanding their close relationship with communities."

"For me, one of the most important approaches is the education that should be provided to children from early childhood, so that they embrace the subject and teach it to their families."

"Maintain communication and coordination with the sectoral entities of the DUMGRD."

Diario El Gabinete de la Palabra

Community Participation

From your experience

What specific challenges does community participation in disaster risk management face?

How do you think disaster risk management tools can be better adapted to local contexts with a differentiated approach?

OPINIÓN

"From an ancestral, territorial, and knowledge perspective, we must transcend the response to reduction, understanding that reduction involves processes that require time, but that are catalysts for adaptive capacity and development."

"Re-signify the position and role of human beings in nature, building awareness that we are part of it and not its owners."

"Articulate knowledge such as sacred areas, paths, nomads and settlements according to the time of year (rain, sun, etc.).."

"From the accumulated pre-knowledge and the multiple strategies to care for the planet."

"Traditional knowledge provides feedback for fire management.."

"Consider the SINÚ culture (Colombian indigenous people) and the relationship they had with water.."

"Ancestral knowledge is key to feedback."

"In caring for the environment, since this knowledge has been developed with respect due to their beliefs."

"Ancestral knowledge contributes positively, being an invaluable treasure that cannot be forgotten; this knowledge helps protect nature.."

"Indigenous communities contribute knowledge in risk management, as they pass on knowledge of their land to each generation."

"The ancestral and empirical knowledge of communities can be very useful, as they know their territory very well."

"This knowledge allows us to understand the terrain and the ancestral measures that have been used empirically."

"From the ancestral, territorial and knowledge perspective."

"The scenarios of the armed conflict."

"Importance: In the daily life of communities, emergency management is only observed once it occurs (the "afterward")."

"I believe there is a lack of opportunities for participation and recognition of the territory to generate a culture of disaster risk prevention and management (DRM)."

"A focus on protection, gender, and inclusion is vital to involving everyone in these community processes."

"Economic resources, knowledge of the territory, on-site experience, credibility in institutions, and unmet basic needs (UBN)."

"Community meetings and visits to affected areas with community support."

"The lack of community participation in decision-making has prevented further understanding of community and social participation work."

"Challenges: The commitment of communities to understand the importance of this social process."

"Challenges: Define care models in accordance with the communities' lifestyles and adapt the instruments to the local context."

Diario El Gabinete de la Palabra

Effective Resource Management and Logistics Coordination

From your perspective

From your perspective, what are the keys to effective resource management during a crisis?

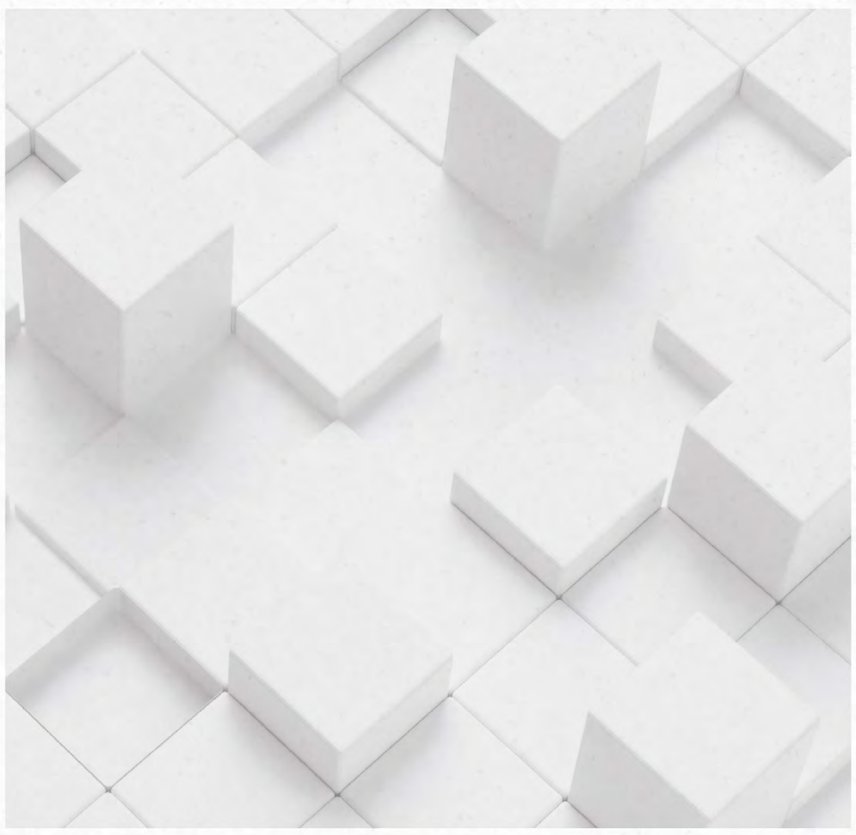
How can logistical coordination between different actors and levels of government be improved in emergency and disaster situations?

OPINIÓN

"There must be an adequate and up-to-date characterization of the population, since emergency resources must reach those affected, not outsiders."

"To manage a crisis, it's necessary to know the risk scenario in advance. ."

"Risk awareness prepares me to handle the disaster effectively.."



How you see it

What would you suggest to promote participation and thus strengthen people's awareness of the risks in their environment?

How do you suggest increasing population participation in disaster risk management?

OPINIÓN

"UNGRD must design an instrument for the response preparedness subprocess that complements the National Emergency Response Strategy (ENRE) and includes a targeted community component."

Foto de Logan Fixed Bank Initiative: https://www.pexels.com/es-es/foto/gente-mujer-ninos-comunidad-8042451/

Results and impact of the event

The conference served as a key platform to:

- Promote the exchange of knowledge and best practices in the region.
- Emphasize the importance of international collaboration in addressing global challenges, including climate change and increasing disasters.
- Strengthen bonds between governments, academia, civil society, and multilateral organizations around integrated disaster risk management.

In addition, participating countries made joint commitments to prioritize resilience and adopt inclusive approaches in their disaster risk reduction strategies.

Conclusions

This was the first time the IDRiM conference had been held in Latin America, consolidating Cartagena and Colombia as a hub for international dialogue on disaster risk management. The diverse participation and high-caliber presentations underscored the importance of a systemic and inclusive approach to addressing the complex and emerging risks facing our society.

The results and proposals discussed at the conference will strengthen regional and global capacities in risk reduction. Furthermore, the Young Scientists session reaffirmed IDRiM's commitment to developing and enhancing young professionals in the field.

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