Modeling of the socioeconomic consequences of an earthquake at the urban scale and responsibilities

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Abstract

In moderate-to-low seismic hazard regions, the estimation of the socio-economic consequences of an earthquake at an urban scale is a costly, difficult but essential task, since the necessary resources become insufficient for seismic evaluation. However, public authorities have the duty to take into account this risk and mitigate it according to their resources. Thus, the positioning of the acceptable level of responsibility in the implementation of the earthquake regulations and the induced economic cost is a key issue. The responsibility of the public persons but also that of insurers in their approach to prevent is at the forefront when natural disasters happen. The modification of the seismic regulation has a direct impact on the level of responsibility. In this study, the impact of prevention's policies implemented is translated in terms of decision variables thanks to the qualitative analysis of the interviews conducted with elected representatives, insurers, technicians, lawyers and first-aid workers. Consequently the decision variables selected are damages to structures, the number of deaths, injuries, homeless people to be managed, the repairing's costs for damaged buildings or their destruction / reconstruction, the impact on economic activity (business interruption) and responsibility. Thus, in this study, by analyzing the existing global earthquake data bases as well as the literature, a loss database listing all the world earthquakes between 1906 and 2018 with a magnitude greater than 4.5 has been updated and prepared showing the social losses (dead, wounded...) and economic losses (direct and indirect costs, number of buildings destroyed or damaged...), in relation with the ground motion footprint provided by USGS Shake-Map. In this talk, we first analyzed the relevancy of information contained in the databases, related to earthquakes and induced losses and we propose an analysis of the database, in terms of loss prediction and consequences.

Keywords

Socioeconomic loss database, loss modelling, earthquake, government and liability.

MEETING FORMAT*

*Select an option (X).

	Regular Poster Presentation
	Young Scientist Poster Presentation

	Regular Oral Presentation
X	Young Scientist Oral Presentation
	Symposia
	Roundtable

AREAS*

Natural hazards

X	Seismic
	Flooding
	Subsidence
	Hurricanes
	Landslides
	Volcanic eruption
	Wildfire

Technological and manmade hazards

	Chemical and petrochemical industry
	Nuclear industry
	New and emergent technologies
	Transportation
	Natech
	Critical infrastructures
	Cyber attacks
	Terrorism

Complex hazard interactions and systemic risks

	Climate change and its impact
	Natech
	Epidemics / pandemics
	Critical infrastructures

TOPICS*

*Select an option (X)

Learning from experience

	Organizations, territories and experience feedback
	Expertise and knowledge management
	Weak signals
	Early warning systems

Social and human sciences for risk and disaster management

	Human, organizational and societal factors
	Risk perception, communication and governance
	Systemic approaches
	Risk and safety culture
	Resilience, vulnerability and sustainability: concepts and applications
	History and learning from major accidents and disasters
	Territorial and geographical approaches to major accidents and disasters
	Social and behavioral aspects

Cross-disciplinary challenges for integrated disaster risk management

	Compound/cascading disasters (simultaneous and/or co-located) and Mega-disasters
X	Connecting observed data and disaster risk management decision-making
	Practical applications of Integrated Disaster Risk Management
	Development and disasters
	Build Back Better (than Before)
	Disaster-driven innovation and transformation
	STGs and disaster governance

Complex systems

	Complexity Modeling
	System of Systems / Distributed Systems
	Critical Infrastructures
	Probabilistic Networks

Economics and Insurance

X	Disaster impacts and economic loss estimation
	Cost-benefit approaches
	Insurance and reinsurance

Decision, risk and uncertainty

	Decision aiding and decision analysis.
	Disaster risk communication
	Ethics.
	Gender
	Responsibility
	Governance, citizen participation and deliberation
	Community engagement and communication
	Scientific evidence-based decision-making, modelling and analytics
	Policy analysis
	Uncertainty and ambiguity
	Multi-criteria decision aid and analysis
	Operational research

Artificial intelligence, big data and text data mining

	Disaster informatics, big data, etc.
	Deep learning
	Neural networks
	Experts systems
	Text data mining

Engineering Models

	Numerical modelling & functional numerical modeling Formal models / formal proofs
	Model-based approach
	Safe and resilient design and management.

Legislation, standardization and implementation

	Certification and standardization.
	Regulation and legislation.
	Legal issues (scientific expertise, liability, etc.).
	Precautionary principle and risk control and mitigation.

SIGNIFICANCE TO THE FIELD*

*Select an option (X)

	Demonstrates current theory or practice
	Employs established methods to a new question
	Presents new data
X	Presents new analysis
	Presents a new model
	Groundbreaking
	Assesses developments in the field, in one or more countries
	Other (Please specify)

EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
X	Applied
	Theoretical and Applied
	Review
	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)

Practice of Disaster Education in Mexico

"Cultural Tuning" Based on Comparative Study of Public Educational Curriculum Between Japan and Mexico

Takuya Iwahori 1[1], Genta Nakano[2], Katsuya Yamori[2]
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Abstract

The purpose of this research is to compare curriculum of public education between Japan and Mexico with specific focus on knowledge of seismology. The authors at first review the public compulsory educational curriculum in each country, and secondly, carried out practice of disaster education in a university in Mexico City and analyzed the questioner survey of the class. As the result, the authors found that "plate tectonics" is the key to compare the system of the knowledge constructed in the course of public education in each country.

Keywords

…

MEETING FORMAT*

*Select an option (X).

	Regular Poster Presentation
	Young Scientist Poster Presentation
	Regular Oral Presentation
X	Young Scientist Oral Presentation
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	Terrorism

Complex hazard interactions and systemic risks

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*Select an option (X)

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	Expertise and knowledge management
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	Early warning systems

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SIGNIFICANCE TO THE FIELD*

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EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
	Applied
X	Theoretical and Applied
	Review
	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)

IDRIM 2019 paper proposal

This paper proposal is intended for challenge 2 (How to foster individual, organizational and territorial abilities to manage and govern known and emerging risks and resiliencies, AREA 2 (Technological and manmade hazards), Topic 9 (Legislation, standardization and implementation).

Risk management and mandatory regulation: the lessons of SEVESO directives

Claire Auplat – Myriam Merad – Mohammad Habibpourfatideh

Abstract

The paper aims to bring a new brick of knowledge on the dynamics of risk management and corporate governance by looking at the influence of mandatory regulation on risk management.

Our research question is: To what extent does mandatory regulation have an impact on risk mitigation in product manufacturing?

To answer this question, we look at the SEVESO REGULATORY FRAMEWORK, and its impact on the number of accidents in the EU perimeter. The name of the regulation comes from the industrial accident that took place in a chemical manufacturing plant in the Italian town of Seveso in1976 and prompted the adoption of EU-wide standardized legislation on the prevention and control of such accidents. The first Seveso-Directive (Directive 82/501/EEC) was later amended in view of the lessons learned from accidents such as Bhopal, Toulouse or Enschede resulting into Seveso-II (Directive 96/82/EC). In 2012 Seveso-III (Directive 2012/18/EU) was adopted considering, amongst others, the changes in the Union legislation on the classification of chemicals and increased rights for citizens to access information and justice. The Directive applies to more than 12 000 industrial establishments in the European Union where dangerous substances are used or stored in large quantities. We use the eMars database to study the relationship between the mandatory SEVESO regulation and the characteristics of the industrial accidents taking place on SEVESO sites. eMARS contains reports of chemical accidents and near misses provided to the Major Accident Hazards Bureau (MAHB) of the European Commission's Joint Research Centre (JRC) from EU, EEA, OECD, and UNECE countries (under the TEIA Convention). Reporting an event into eMARS is compulsory for EU Member States when a Seveso establishment is involved, and the event meets the criteria of a "major" accident" as defined by Annex VI of the Seveso III Directive (201218/EU). For the 12 000 registered SEVESO sites, the eMars database contains a total of 961 declarations, corresponding to 462 fatalities and 1395 injuries over forty years.

In our paper, the analysis of the risk management variables accounts for the lags between the occurrence of events and their SEVESO declaration, as well as the overlaps of SEVESO 1, 2 and 3.

The paper may bring a significant contribution to the understanding of the role of mandatory regulation on risk management, and therefore to the field of integrated disaster risk management.

Impact Analysis of Designating Disaster Risk Zones on Land Prices of Tourist Regions

A study across four regions in Japan

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[2] SIT Research Laboratories, Shibaura Institute of Technology
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Abstract

The Great East Japan Earthquake and the large scale disasters in the years following it, have affected many tourist regions Japan. Thus recently, disaster preparedness has been of concern not only to tourism-oriented facilities that welcome tourists, but also to those who visit the region as tourists. In order to incentivize long-term disaster mitigation for regions vulnerable to tsunamis and landslides, the national government has enacted policies that permit the voluntary designation of special risk zones in these areas which can entail land-use- and building restrictions and/or special regulations.

Different levels of risk zone classification (yellow, orange, red in order of strictness of the measures implied on the area) can be designated depending on the likely risk of the area in question. However, to date there are only limited number of areas that have been designated as high risk zone (i.e. red) due to fear of it impacting land and property values near where such risk zones may be designated. This concern is especially high in regions where nature-based tourism (coastal and mountainous) is the primary industry of the region as people fear that the inflow of tourists may also decrease if the risk is publicized as part of the designation process.

As such, this work sets out to investigate whether such concerns are valid. We use the hedonic regression approach to consider the whether any impact from risk zone designations have been observed on land prices in the past. We find that while an area’s value may be affected by the *presence* of risk, it is not necessarily impacted by the *designation* of the risk zones. This implies that designating risk zones is likely to provide more benefits (in terms of better disaster preparedness in the long run) than any expected losses the residents might presume.

Keywords

Hedonic regression, risk zone designation, tsunami, landslide, tourism

MEETING FORMAT*

*Select an option (X).

	Regular Poster Presentation
X	Young Scientist Poster Presentation
	Regular Oral Presentation
	Young Scientist Oral Presentation
	Symposia
	Roundtable

AREAS*

Natural hazards

	Seismic
	Flooding
	Subsidence
X	Hurricanes
X	Landslides
	Volcanic eruption
	Wildfire

Technological and manmade hazards

	Chemical and petrochemical industry
	Nuclear industry
	New and emergent technologies
	Transportation
	Natech
	Critical infrastructures
	Cyber attacks
	Terrorism

Complex hazard interactions and systemic risks

	Climate change and its impact
	Natech
	Epidemics / pandemics
	Critical infrastructures

TOPICS*

*Select an option (X)

Learning from experience

	Organizations, territories and experience feedback
	Expertise and knowledge management
	Weak signals
	Early warning systems

Social and human sciences for risk and disaster management

	Human, organizational and societal factors
	Risk perception, communication and governance
	Systemic approaches
	Risk and safety culture
	Resilience, vulnerability and sustainability: concepts and applications
	History and learning from major accidents and disasters
	Territorial and geographical approaches to major accidents and disasters
	Social and behavioral aspects

Cross-disciplinary challenges for integrated disaster risk management

	Compound/cascading disasters (simultaneous and/or co-located) and Mega-disasters
X	Connecting observed data and disaster risk management decision-making
	Practical applications of Integrated Disaster Risk Management
	Development and disasters
	Build Back Better (than Before)
	Disaster-driven innovation and transformation
	STGs and disaster governance

Complex systems

	Complexity Modeling
	System of Systems / Distributed Systems
	Critical Infrastructures
	Probabilistic Networks

Economics and Insurance

	Disaster impacts and economic loss estimation
	Cost-benefit approaches
	Insurance and reinsurance

Decision, risk and uncertainty

	Decision aiding and decision analysis.
	Disaster risk communication
	Ethics.
	Gender
	Responsibility
	Governance, citizen participation and deliberation
	Community engagement and communication
	Scientific evidence-based decision-making, modelling and analytics
	Policy analysis
	Uncertainty and ambiguity
	Multi-criteria decision aid and analysis
	Operational research

Artificial intelligence, big data and text data mining

	Disaster informatics, big data, etc.
	Deep learning
	Neural networks
	Experts systems
	Text data mining

Engineering Models

	Numerical modelling & functional numerical modeling Formal models / formal proofs
	Model-based approach
	Safe and resilient design and management.

Legislation, standardization and implementation

	Certification and standardization.
	Regulation and legislation.
	Legal issues (scientific expertise, liability, etc.).
X	Precautionary principle and risk control and mitigation.

SIGNIFICANCE TO THE FIELD*

*Select an option (X)

	Demonstrates current theory or practice
X	Employs established methods to a new question
	Presents new data
X	Presents new analysis
	Presents a new model
	Groundbreaking
	Assesses developments in the field, in one or more countries
	Other (Please specify)

EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
X	Applied
	Theoretical and Applied
	Review
	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)

Legal challenges for the effective public participation in flood risk management plans

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Abstract

Since the beginning of the 21st century the floods are affecting Europe regularly and a number of extreme weather events will continue to growth in the future. The impact of flooding on human life and health, environment, economy, finally the cultural objects cannot be overestimated. Therefore, the issue of flood protection, prevention and flood risk management is raised both on international and national levels. The good example is the Directive 2007/60/EC of the European Parliament and the Council of 23 October 2007 on the assessment and management of flood risks. It is the first international document providing binding legal norms related to flood risk management. It requires the European Union Member States, among others, to prepare the flood risk management plans. The national authorities shall encourage active involvement of the interested parties in the whole process of the preparation and later review of those plans. The participation of the interested parties facilitates policy implementation and improves the quality of measures that are or have to be undertaken. However, the process of involvement is not always effective. One of the reasons of the lack of effectiveness is a weak legislative basis for the implementation of the public involvement. For instance, the law does not require the authorities to consider the conclusions of public consultations or there are no clear deadlines for announcing the documents, that are the subject of these consultations, moreover, the selection of the interested parties could be arbitrary and not including local communities or local businesses etc.

The given study presents the European legal requirements for the public participation in flood risk management and their implementation in Lithuanian and Polish legal systems. The study will contribute to a broader understanding both of the requirements related to public participation in flood risk management as well as the obstacles in their implementation in national legal systems. The results of the study will contribute to mutual learning and future comparative analysis. Moreover, the conclusions of the study could serve for the development of the more effective legal measures for the public involvement in flood risk management.

The study will contribute to the area of Natural Hazards, namely: legal issues of flood risk management.

Keywords

…

MEETING FORMAT*

*Select an option (X).

	Regular Poster Presentation
	Young Scientist Poster Presentation
X	Regular Oral Presentation
X	Young Scientist Oral Presentation
	Symposia
	Roundtable

AREAS*

Natural hazards

	Seismic
x	Flooding
	Subsidence
	Hurricanes
	Landslides
	Volcanic eruption
	Wildfire

Technological and manmade hazards

	Chemical and petrochemical industry
	Nuclear industry
	New and emergent technologies
	Transportation
	Natech
	Critical infrastructures
	Cyber attacks
	Terrorism

Complex hazard interactions and systemic risks

	Climate change and its impact
	Natech
	Epidemics / pandemics
	Critical infrastructures

TOPICS*

*Select an option (X)

Learning from experience

	Organizations, territories and experience feedback
	Expertise and knowledge management
	Weak signals
	Early warning systems

Social and human sciences for risk and disaster management

	Human, organizational and societal factors
	Risk perception, communication and governance
	Systemic approaches
	Risk and safety culture
	Resilience, vulnerability and sustainability: concepts and applications
	History and learning from major accidents and disasters
	Territorial and geographical approaches to major accidents and disasters
	Social and behavioral aspects

Cross-disciplinary challenges for integrated disaster risk management		Compound/cascading disasters (simultaneous and/or co-located) and Mega-disasters
		Connecting observed data and disaster risk management decision-making
		Practical applications of Integrated Disaster Risk Management
		Development and disasters
		Build Back Better (than Before)
		Disaster-driven innovation and transformation
		STGs and disaster governance

Complex systems		Complexity Modeling
		System of Systems / Distributed Systems
		Critical Infrastructures
		Probabilistic Networks

Economics and Insurance		Disaster impacts and economic loss estimation
		Cost-benefit approaches
		Insurance and reinsurance

Decision, risk and uncertainty		Decision aiding and decision analysis.
		Disaster risk communication
		Ethics.
		Gender
		Responsibility
		Governance, citizen participation and deliberation
		Community engagement and communication
		Scientific evidence-based decision-making, modelling and analytics
		Policy analysis
		Uncertainty and ambiguity
		Multi-criteria decision aid and analysis
		Operational research

Artificial intelligence, big data and text data mining		Disaster informatics, big data, etc.
		Deep learning
		Neural networks
		Experts systems
		Text data mining

Engineering Models

	Numerical modelling & functional numerical modeling Formal models / formal proofs
	Model-based approach
	Safe and resilient design and management.

Legislation, standardization and implementation

	Certification and standardization.
x	Regulation and legislation.
x	Legal issues (scientific expertise, liability, etc.).
	Precautionary principle and risk control and mitigation.

SIGNIFICANCE TO THE FIELD*

*Select an option (X)

x	Demonstrates current theory or practice
	Employs established methods to a new question
	Presents new data
x	Presents new analysis
	Presents a new model
	Groundbreaking
x	Assesses developments in the field, in one or more countries
	Other (Please specify)

EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
	Applied
	Theoretical and Applied
x	Review
x	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)

Conceptualising the Communicative Behaviour of Citizens towards Natech Risk Information Disclosure in Japan

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Abstract

The contribution of effective risk communication towards active community involvement in disaster risk management has been explicitly emphasised by academics and practitioners. Fostering transparency and dissemination of risk information seems to create favourable conditions for participatory risk management, since it encourages trust-building and community engagement. Moreover, disseminating such information empowers all involved stakeholders to make comprehensive and risk-informed decisions. In this vein, assessing the community's actual demand for such information is an important first step in comprehending their willingness to meaningfully engage in risk management processes. This discussion gains specific importance in consideration of large-scale complex disasters, for instance technological accidents triggered by natural hazards (i.e. Natech); sharing critical information related to the associated chemical risks goes a long way in enhancing the local community's disaster preparedness.

This research ventures to understand citizens' communicative behaviour towards Natech risk information disclosure in the Japanese context through the prism of the Situational Theory of Problem Solving (STOPS) (Kim & Grunig, 2011). According to STOPS, an individual's perception of the problematic situation concerning the lack of Natech risk information (Problem Recognition), their perceived connection with it (Involvement Recognition) and the perceived obstacles which limit their ability to take action (Constraint Recognition), consist of the key factors of their Situational Motivation in Problem Solving. Along with any potential subjective knowledge, experiences and expectations (Referent Criteria), Situational Motivation determines the individual's engagement in Communicative Action as a means to seek out and exchange information to resolve this issue. In turn, this communicative behaviour is categorised in three types of actions: Information Acquisition, Information Selection and Information Transmission. Additionally, elements that define organisation-public relationship quality, namely Trust and Control Mutuality, in combination with an assortment of sociocultural factors were examined in this study in an attempt to better comprehend citizens' situational motivation to resolve the chemical risk information deficiency issue.

This study deals with a risk communication issue associated with complex and technological hazards, in particular chemical and Natech risk information disclosure. In order to analyse this emerging topic, a novel framework is presented through employing established methods from the Public Relations field. The research contributions in this regard are both theoretical and applied; the study introduces a new perspective concerning risk communication and community engagement in disaster risk management processes, while the survey findings highlight citizens’ perceptions towards Natech risk information disclosure in Japan and the influence of key sociocultural factors on their communicative behaviour.

Keywords

Risk communication, Natech risk information, Situational Theory of Problem Solving (STOPS)

MEETING FORMAT*

*Select an option (X).

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X	Young Scientist Poster Presentation
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	Gender
	Responsibility
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X	Presents new analysis
	Presents a new model
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EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
	Applied
X	Theoretical and Applied
	Review
X	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)

Decision-making in ERM (enterprise risk managment) and risk analysis methods

Risk management is the set of procedures and mechanisms for identifying, evaluating, prioritizing and explaining, mitigating risks (Magne & Vasseur, 2006). These approaches are used to prioritize risks and make decision according to strategic objectives but also according to preferences of decision-makers.

Decision-making has become more a mathematical science (Figuera et al., 2005), with the emergence of more efficient methods and softwares, rather than operational research methods thanks to the technological revolution.

We are interested in risk analysis methods and decision-making process, to understand the impact of risk analysis results on decision maker ?

The Manager makes always taking into account methods and processes mobilized in the ante-decision phase. The decision maker is a human actor who is influenced by a range of indicators such as : previous experience, education, emotions, personal preferences, public pressure, advices of experts and analysts, or probabilistic and risk analysis results without projecting them to reality.

The qualitative research methodology based on grounded theory (Strauss & Glaser, 1967) has been implemented. This method allows us to develop new knowledge, based on expertise data collected from academic or professional experts in risk management, particularly in the decision-making phase.

A software of textual analyzes (Iramuteq) to treat the interviews of the experts and to find correlations between concepts, has been used to analyze them and to explain the obtained results.

As results, our study enables to :

- Identify of the 5 clusters of concepts mobilized during decision-making ;
- Importance order according to their importance in the decision-making phase.

The analysis of graphical results highlights the trends and can explain the interest of the professional and personal factors in the decision making.

Every decision making in enterprise risk management (ERM) is based on analysis of risks, hypothesis, quality and relevance of data and expertise. Methods of risk analysis and decision-making remain tools to support decisions and, their results are influenced by the availability and scarcity of data. Natural Language Processing can help in modeling and simplification of expertise data.

References :

1. Glaser, B., & Strauss, A. (1965). Awareness of Dying. Chicago : Aldine.

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Optimal parameter estimation in a landslide motion model using the adjoint method

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Abstract

This work proposes an optimal approach for parameter estimation in a landslide motion, based on the so-called adjoint method. The system is described by an extended sliding-consolidation model made of an ordinary differential equation and 1D hyperbolic partial differential equation representing landslide motion and pore pressure evolution respectively. The main feature of this model is pore pressure feedback which regulates landslide motion, and leads to coupling between both differential equations. Parameters to be estimated include the mechanical strength and dilatancy angle of the material. The objective functional for the optimal estimation is composed of: i) a cost function defined as the least square error between measurements and related simulated values, and ii) a product of Lagrange variables and system dynamics. A variational approach is applied in order to get the gradients with respect to parameters to be estimated and adjoint model. The cost functional is optimized by means of steepest descent method to estimate parameters. Finally, the presented optimal estimation method is validated on a simulated synthetic test case and a preliminary application on real field data from the literature is demonstrated.

Keywords

Landslide motion, Dynamical model, Parameter estimation, Variational approach, Adjoint method.

MEETING FORMAT*

*Select an option (X).

	Regular Poster Presentation
	Young Scientist Poster Presentation
	Regular Oral Presentation
X	Young Scientist Oral Presentation
	Symposia
	Roundtable

AREAS*

Natural hazards

	Seismic
	Flooding
	Subsidence
	Hurricanes
X	Landslides
	Volcanic eruption
	Wildfire

Technological and manmade hazards

	Chemical and petrochemical industry
	Nuclear industry
	New and emergent technologies
	Transportation
	Natech
	Critical infrastructures
	Cyber attacks
	Terrorism

Complex hazard interactions and systemic risks

	Climate change and its impact
	Natech
	Epidemics / pandemics
	Critical infrastructures

TOPICS*

*Select an option (X)

Learning from experience

	Organizations, territories and experience feedback
	Expertise and knowledge management
	Weak signals
	Early warning systems

Social and human sciences for risk and disaster management		Human, organizational and societal factors
		Risk perception, communication and governance
		Systemic approaches
		Risk and safety culture
		Resilience, vulnerability and sustainability: concepts and applications
		History and learning from major accidents and disasters
		Territorial and geographical approaches to major accidents and disasters
		Social and behavioral aspects
Cross-disciplinary challenges for integrated disaster risk management		Compound/cascading disasters (simultaneous and/or co-located) and Mega-disasters
	X	Connecting observed data and disaster risk management decision-making
		Practical applications of Integrated Disaster Risk Management
		Development and disasters
		Build Back Better (than Before)
		Disaster-driven innovation and transformation
		STGs and disaster governance
Complex systems	X	Complexity Modeling
		System of Systems / Distributed Systems
		Critical Infrastructures
		Probabilistic Networks
Economics and Insurance		Disaster impacts and economic loss estimation
		Cost-benefit approaches
		Insurance and reinsurance
Decision, risk and uncertainty		Decision aiding and decision analysis.
		Disaster risk communication
		Ethics.
		Gender
		Responsibility
		Governance, citizen participation and deliberation
		Community engagement and communication
		Scientific evidence-based decision-making, modelling and analytics
		Policy analysis
		Uncertainty and ambiguity

		Multi-criteria decision aid and analysis
		Operational research

Artificial intelligence, big data and text data mining		Disaster informatics, big data, etc.
		Deep learning
		Neural networks
		Experts systems
		Text data mining

Engineering Models		Numerical modelling & functional numerical modeling Formal models / formal proofs
	X	Model-based approach
		Safe and resilient design and management.

Legislation, standardization and implementation		Certification and standardization.
		Regulation and legislation.
		Legal issues (scientific expertise, liability, etc.).
		Precautionary principle and risk control and mitigation.

SIGNIFICANCE TO THE FIELD*

*Select an option (X)

X	Demonstrates current theory or practice
X	Employs established methods to a new question
	Presents new data
X	Presents new analysis
	Presents a new model
	Groundbreaking
	Assesses developments in the field, in one or more countries
	Other (Please specify)

EXPECTED CONTRIBUTIONS*

*Select an option (X)

	Theoretical
	Applied
X	Theoretical and Applied
	Review
	Perspective
	Other (Please specify, e.g. success/failure practices, lessons learned, and other implementation evidence)