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Editorial: Integrated disaster risk management: From earth sciences to policy making

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Editorial on the Research Topic
Integrated disaster risk management: From earth sciences to policy making

Integrated disaster risk management (IDRM) is a complex and fundamental process for disaster risk reduction. Its achievement implies global compound challenges whose response must be implemented locally, but also formulated and pursued on sub-national, national and regional scales. In principle, it is oriented towards preventing new disaster risk, reducing existing disaster risk, managing residual risk and permanently controlling disaster risk drivers (Kirsch-Wood et al., 2022). Thus, IDRM is deeply intertwined with urgent milestones such as the sustainable development goals, the adaptation to climate change, the new urban agenda, the financing of sustainable development, and the humanitarian agenda.

The use of science-evidence policy making is a fundamental and necessary ingredient for the attainment of these critical targets. However, the consequences of the global disaster triggered by COVID-19 unveiled that what was “normal” is the source of vulnerability and exposure (Alcántara-Ayala et al., 2021). Therefore, it remains to be seen whether the existing evidence-policy gap generates sufficient concerns about the need to put transformative thinking into action, and any further policy measures are developed accordingly.

The responsibility of science, particularly of Earth sciences, for the betterment of society has long been recognized (National Research Council, 1993), but recent efforts seek to promote the role of geodynamic understanding for disaster risk reduction and sustainability (Ismail-Zadeh, 2018), priority setting and informed decision-making (Satake et al., 2018). The contributions included in this special Research Topic of articles provide insights on deriving Earth Sciences knowledge to disaster risk reduction, and by and large to policy making.

Bwambale and Kervyn were concerned with integrating indigenous knowledge and science to understand and address disaster risk. Analysing floods in the Rwenzori, western Uganda, where there are discrepancies between research, policy, and action, they recognised the convergence of overlaps in the theorising of the process, the acceptance of the diversity of ontological values and self-criticism among policymakers.

Using the lens of the tourism-disaster-conflict nexus, Neef examined the impacts of the tourism sector on post-disaster response and recovery in Vanuatu, especially as this relates to land relations and rural livelihoods. The findings showed the need to implement disaster risk governance strategies in the tourism sector that address power differences and inequalities, which are often at the core of vulnerabilities and compromised resilience.

In evaluating children's understanding of earthquakes and tsunamis in risk areas of Chile, Cabello indicated the importance of science educators in offering learning opportunities that connect hazards as both social and scientific problems with aspects of understanding their causes and impact.

León et al. used a mixed-method approach combining field-collected data and computerised evacuation and tsunami models to analyse the performance of evacuation drills for four K-12 schools in the cities of Valparaíso and Viña del Mar, Chile. Their results showed that following national evacuation strategies could result in significant loss of life in these schools if rapid evacuation onset times cannot be enacted.

Addressing the direct and indirect effects of earthquakes on Bucharest's road networks, Toma-Danila et al. developed a framework that provides means for real-time integration and time-dependent analysis. This enabled the identification of travel times in emergency situations, the need for seismic lifeline retrofits, traffic management, and increased capacities for critical hospitals or new facilities in specific areas.

By undertaking a retrospective view of the 30 years of continuous operations of the Seismic Early Warning System of Mexico, Suárez recognised the difficulties of alerting earthquakes at close distances. He also highlighted future challenges in terms of exploring better ways to use and communicate warnings, including automatic processes to shut down hazardous facilities.

Dramis et al. focused on the development of object-oriented maps as a tool for landslide risk assessment in highly urbanized areas, whose interoperability in data management allows the analysis of the interaction between landslides and vulnerable assets, such as infrastructure.

An agent-based model to integrate dynamic human behaviours into disaster risk management measures and evaluated its effectiveness in reducing human losses was developed by Wu et al. The model was calibrated to simulate the debris-flow event at Longchi town, China. The results suggested that Early Warning Systems were an effective tool in community-based DRM, while their credibility was essential for their effectiveness.

Ning et al. documented that the delivery of large volumes of sediment by debris flows in a short period of time to rivers frequently initiates a perilous chain reaction in mountain valleys. As this often occurs in Southwest China's Sichuan province, they also provided insights into the role of implementing structural engineering measures in preventing further cascading process in this region.

Payo et al. developed a custom database, FORINSEA1.0, for two study areas in the Southeast Asia region to address the need for the systematic preservation of information required to conduct disaster forensic investigations. The latter aims at recognising and addressing the root causes and drivers of disaster risk and disasters (Oliver-Smith et al., 2016).

Based on Markov chain theory, Mignan et al. presented the prototype of an online platform for the pre-assessment phase of "super-catastrophes" focused on the elaboration of a transition matrix of event interactions from which domino effects crossing natural, technological, and socio-economic systems can be modelled and ranked.

Considering current trends in strategies to characterise, assess and manage risk in historic urban areas, Ferreira and Ramírez Eudave offered a perspective for future lines of research, from empirical calibration models to advanced techniques based on artificial intelligence.

From an epistemic perspective, Raška questioned transdisciplinary education, research, and practices for disaster risk reduction and conveyed the message that fostering understanding and justification of diverse epistemic perspectives would, in turn, allow students and professionals develop axioms that can improve the effectiveness of IDRM.

Based on the notions of apparatus and paradigm associated with vulnerability and resilience introduced by Foucault and Kuhn, respectively, Lièvre et al. envisioned the incorporation of an Apparatus-Paradigm articulation. Their findings indicated that although management practices in Arequipa, Peru appear to be focused on the vulnerability paradigm since the 1990s, after 2015 some operations have emerged as resilient but still fall within the vulnerability paradigm.

In order to enable decision makers to undertake retrofitting projects and improve urban risk planning in the city of Arequipa in Peru, Thouret et al. used and compared several numerical codes to model the potential impacts of tephra fallout and frequent mass flows from El Misti volcano on a vulnerable building stock. The proposed methodology for assessing impacts and losses due to mass flows is useful to develop emergency plans. This, in turn, helps raise awareness among local inhabitants and helps stakeholders formulate adequate disaster management policies in Latin American cities exhibiting similar disaster-prone conditions.

Solheim et al. offered an account of the goals and activities of Klima 2050, a Norwegian centre for research-based innovation, focused on developing innovative solutions for climate change adaptation of buildings and infrastructure. They provided insights

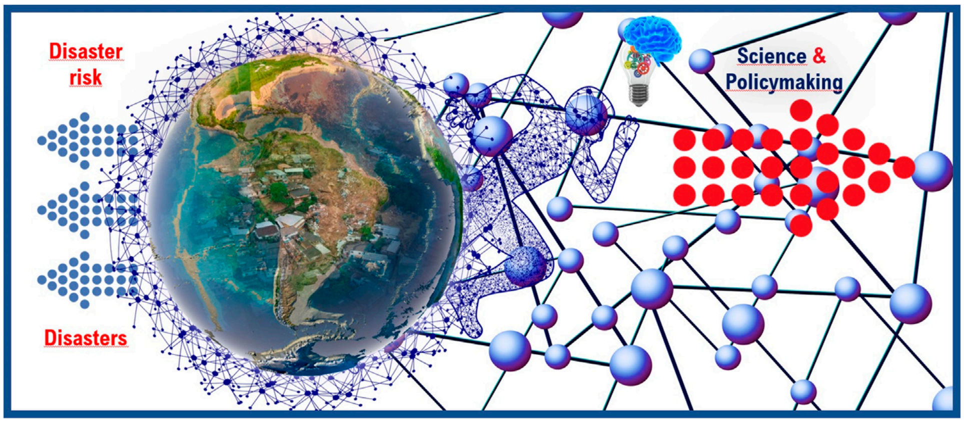

FIGURE 1
A basic interaction scheme between disaster risk and disasters and the need to promote science-based policy-making.

from pilot projects aimed at managing landslide risk, which were carried out based on intersectoral and interdisciplinary collaboration.

The geosciences are beginning to reflect more clearly their interest in the policy making arena. Nonetheless, moving from Earth sciences to policy making is an extremely sensitive endeavour in which knowledge is unbalanced with strategic goals and trade-offs. Holistic, inter and transdisciplinary perspectives are required to understand the interactions and interdependencies among hazards, vulnerability, and exposure to manage the complex dimensions and the political and diplomatic avenues of disaster risk reduction.

Certainly, disaster risk management requires not only the comprehension of the social dimensions and physical dynamics of the planet. It calls for a global understanding and action that advances integrated transdisciplinary science and anticipates the vitalness of a bonding interface between science and policy making, in which co-production of knowledge is the core nature of this key issue (Figure 1).

Global understanding implies global thinking and local action, thus bridging the gap in awareness between local initiatives and strategies and global effects, in which socio-cultural background is highly relevant (Werlen et al., 2016). Likewise, it also necessitates a way of recognising that international policies and models of development, biased in favour of particular sectors of society, influence political frameworks, institutions, policies and the daily course of consequences on laypersons at local scale. This blending of multidirectional and multiscale processes actually mirrors the systemic nature of disaster risk.

The social construction of systemic risk recognises that economic globalization has resulted in a greater complexity, interdependence, non-linearity, feedback loops, and uncertainty of the system (Maskrey et al., 2021). Obviously, this has a considerable impact on IDRM. It therefore becomes paramount and urgent to encouraging a new paradigm for the governance of systemic risk at local and national levels to re-evaluate the trade-off between privatising gains and socialising risks in favour of sustainability and resilience (Maskrey et al., 2022).

Consequently, and in the context of global environmental change, it is very likely that for the foreseeable future, most efforts of applied Earth sciences will need to be directed at answering and addressing issues of governance of the Earth system.

Author contributions

All authors listed have contributed equally and made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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