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Editorial: Dynamic earthquake hazard and risk communication

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Editorial on the Research Topic

Dynamic earthquake hazard and risk communication

Over the last few decades, communication about seismic hazard and risk has drastically changed and improved, thanks in part to technological innovations and scientific advances. These have made it possible not only to improve our knowledge of earthquakes and calculate the probability of these events, which cannot be predicted with any accuracy, but also to make this information available to a large number of people through communication technologies. To this end, various communication products have been developed that together contribute to a dynamic communication framework providing relevant, available information throughout the disaster management cycle. Such products include, among others, long-term forecasts, short-term forecasts, earthquake early warning, rapid earthquake information, and rapid impact assessments. In addition to assessing the products' technical value, it is important to involve societal stakeholders in their design to ensure a successful translation from science to practice and to develop effective communication products (Dallo et al., 2024).

The four papers of the Research Topic *Dynamic earthquake hazard and risk communication* collectively stress the importance of innovative educational approaches, multidisciplinary research, and the application of scientific knowledge to improve societies' resilience toward earthquakes.

The societal impact of earthquake early warning systems

Earthquake early warning (EEW) systems represent a significant advancement in disaster preparedness, offering the potential to save lives and reduce injuries by providing crucial seconds to take protective actions before seismic waves arrive. However, the effectiveness of these systems extends beyond the technology itself; it is deeply intertwined with the societal response to the alerts (McBride et al., 2022). The true value of an EEW system is realized only when the public understands the warnings and acts swiftly and appropriately. Public education, trust in the system, and clear communication strategies are essential components that determine whether these warnings translate into effective action. Thus, addressing the human and social factors associated with EEW is as critical as the technical development of the systems, ensuring that they fulfill their life-saving potential in real-world scenarios; see Study I in Table 1.

TABLE 1 Short description of the four studies and their link to the four overarching themes.

Studies	Description and link to four overarching themes
Study I	The study by Vinnell et al. examines public knowledge, perceptions, and behavioral responses to the Android Earthquake Alert System (AEA) introduced in Aotearoa New Zealand in 2021, where no national earthquake early warning (EEW) system currently exists. The research highlights that while most participants found the alerts useful, there is a significant gap in public knowledge about EEW systems and appropriate protective actions, such as “Drop, cover, and hold.” Surveys conducted after two widely received alerts revealed that few people took protective measures despite receiving the warnings. These findings emphasize the need for better education and communication strategies to ensure that the public can effectively respond to earthquake alerts, ultimately improving safety and reducing potential injuries during seismic events.
Study II	The study by Fallou et al. investigates the impact of misinformation about earthquakes on social media, particularly on Twitter, and explores strategies to counteract it through automated pre-bunking and debunking efforts. Focusing on earthquake predictions, the study highlights the dynamic and predictable nature of false information in this context. By analyzing the engagement with automated and manual tweets during the seismic events in Turkey (February 2023) and Morocco (September 2023), the study found that while automated tweets are effective, manual intervention significantly increases public interaction and trust. The research emphasizes the need for a comprehensive strategy that combines automated tools with manual engagement and considers cultural differences in communication to combat the spread of misinformation effectively. The findings underline the importance of a multi-faceted approach, involving both technological solutions and human oversight, to enhance the reliability of seismic information and public safety during earthquakes.
Study III	The study by Becker et al. examines earthquake preparedness among residents of Canterbury, Aotearoa New Zealand, over a period spanning before, during, and 10 years after the Canterbury Earthquake Sequence (CES). By analyzing surveys conducted in 2009, 2013, and 2021, the research explores how perceptions, beliefs, and preparedness actions evolved as a result of the CES. Key findings indicate that people’s experiences with the earthquakes significantly influenced their preparedness behaviors and attitudes. For example, while the CES increased the belief that preparedness is beneficial for daily life, it also led to skepticism about the effectiveness of such measures in preventing property damage. The study underscores the importance of providing dynamic, experience-based preparedness information that evolves over time to meet changing needs and perceptions. This approach can enhance the effectiveness of earthquake risk communication and support the development of better-informed preparedness strategies.
Study IV	This paper by Gargiulo et al. delves into the innovative approach of using escape rooms as a didactic tool to educate young people about seismic risk. By blending education with the interactive and engaging format of serious games, the study aims to enhance seismic awareness and preparedness among high school students. The escape room experience includes solving technical issues related to seismological data analysis, thereby immersing students in practical, real-world applications of seismic knowledge. The COVID-19 pandemic necessitated a shift to virtual platforms, which surprisingly proved to be effective, demonstrating the adaptability and potential of such interactive learning methods.

Combating earthquake misinformation on social media

In the age of instant communication, social media platforms have become critical channels for disseminating information

during emergencies, including earthquakes. However, the rapid spread of misinformation on these platforms can undermine public safety, leading to confusion, panic, and inappropriate responses, and can counter or contradict official advice from trusted sources. Earthquake misinformation, such as false predictions or exaggerated reports, can exacerbate the challenges faced by emergency managers and communities during seismic events. Therefore, it is crucial to actively combat the spread of false information on social media by leveraging both technological tools and human intervention ([Fallou et al., 2022](#)). Ensuring the accuracy and reliability of information shared online is vital for maintaining public trust and enhancing the effectiveness of earthquake preparedness and response efforts; see Study II in [Table 1](#).

Understanding perceptions and beliefs in earthquake preparedness

Effective earthquake preparedness is not only a matter of having the right tools and information but also deeply influenced by people’s perceptions and beliefs ([Bray et al., 2023](#)). How individuals perceive the risks associated with earthquakes and their beliefs about the effectiveness of preparedness measures can significantly shape their actions before, during, and after a seismic event. Understanding these psychological and social factors is crucial for developing strategies that encourage proactive preparedness and appropriate responses during an earthquake. By addressing the underlying perceptions and beliefs that drive behavior, emergency management efforts can be better tailored to meet the needs of communities, ultimately reducing the impact of earthquakes and enhancing public safety; see Study III in [Table 1](#).

Educational innovation and risk communication

The use of escape rooms as an educational tool represents a novel approach to improving risk communication and disaster preparedness. By engaging younger generations through interactive and immersive experiences, such approaches can significantly enhance public awareness and readiness for natural disasters. This is particularly crucial in regions prone to seismic activity, where educating the population, especially the youth, can lead to a more resilient society ([Sumy et al., 2022](#)); see Study IV in [Table 1](#).

Conclusion

All in all, while seismic communication products have evolved considerably in recent years, this Research Topic demonstrates once again the importance of social science research in supporting advances in seismology. Understanding how this information is received, in terms of beliefs, cultural habits and perceptions of risk, is essential for effective risk reduction. There remain many gaps in knowledge and areas requiring future research investment, particularly in understanding the value of participatory co-design of risk communication

initiatives, and evaluating the effectiveness of emerging tools and approaches, in order to learn lessons to reduce future earthquake risk.

Author contributions

ID: Writing – original draft, Writing – review & editing. CO: Writing – original draft, Writing – review & editing. LF: Writing – original draft, Writing – review & editing.

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