frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 16 March 2023
DOI 10.3389/feart.2023.1182252

OPEN ACCESS

EDITED AND REVIEWED BY
Valerio Acocella,
Roma Tre University, Italy

*CORRESPONDENCE
Supriyati Andreastuti,
s7andreastuti@gmail.com

SPECIALTY SECTION
This article was submitted to Volcanology, a section of the journal Frontiers in Earth Science

RECEIVED 08 March 2023
ACCEPTED 10 March 2023
PUBLISHED 16 March 2023

CITATION
Andreastuti S, Wright H, Fontijn K and Miller V (2023), Editorial: Volcanic forecasting, crisis management, and risk communication.
Front. Earth Sci. 11:1182252.
doi: 10.3389/feart.2023.1182252

Editorial: Volcanic forecasting, crisis management, and risk communication

Supriyati Andreastuti[1]*, Heather Wright[2], Karen Fontijn[3] and Victoria Miller[4]

[1]Center for Volcanology and Geological Hazard Mitigation, Bandung, Indonesia, [2]United State Geological Survey, United States Department of the Interior Reston, Reston, VA, United States, [3]Department of Geosciences Environment and Society, Université Libre de Bruxelles, Brussels, Belgium, [4]GNS Science, Lower Hutt, New Zealand

KEYWORDS

volcanic eruption, crisis management, risk communication, eruption forecasting, hazard and risk

Editorial on the Research Topic
Volcanic forecasting, crisis management, and risk communication

Volcanic eruptions intermittently punctuate periods of repose at volcanic centers and fields. Forecasting the timing, style, distribution, and magnitude of these eruptions is difficult, because eruptive activity varies over time, commonly in an irregular way. Furthermore, the impacts of eruptions can include loss of lives, property damage, and social and economic disturbance, where every eruption produces different impacts. Mitigation of volcanic risk is therefore complex, requiring community action that is aided by preparedness actions of emergency managers, stakeholders, community leaders, and individuals, and by timely delivery and reception of hazard information during a crisis.

This Research Topic addresses efforts to understand complexities in these relations dealing with volcanic unrest, eruptions, and eruption impacts. Research Topic range from eruption forecasting (Wild et al.; Christophersen et al.; Bernard et al.) and volcanic hazard assessment (Mead et al.) to risk communication and action (Martinez-Villegas et al.; Todesco et al.; Graham et al.; Bernard et al.) prior to and during volcanic crises. The studies use various methodologies and approaches, touching on various parts of the integrated, multi-partner systems that exist to improve risk mitigation.

Christophersen et al. implement a Bayesian network (BN) approach to eruption forecasting, using artificial intelligence to model unrest at Ruapehu volcano. The BN model incoporates expert understanding (through expert elicitation) of the volcanic system, of the eruptive history of the volcano, and of extensive volcano monitoring data. The BN is used to support decision-making and to provide probabilistic forecasts of volcanic eruptions at Mt Ruapehu, New Zealand on a daily basis. Authors address the need of stakeholders to balance the risk and the possibility of false alarms, due to the connection to actions and procedures.

Wild et al. also use Bayesian methods, applying a Bayesian event tree approach to eruption forecasting at the Auckland Volcanic Field (AVF). They use the BET_EF model, incorporating results from an expert opinion workshop, and modifying model priors, input parameters, and monitoring thresholds for distributed volcanism in the AVF. The modified model may be useful to help support crisis decision-making in future unrest.

Mead et al. present a new location-based volcanic hazard analysis at Mt. Taranaki, New Zealand derived from existing Bayesian event trees. This approach uses a conditional probability chain to assess probability of multiple volcanic hazards at specific infrastructure locations within the national park. This structured location-based approach allows for different hazard assessment methodologies to be applied in different locations, based on the type of infrastructure and/or the hazard.

Bernard et al. studied eruptions from Sangay volcano, Ecuador in 2020 and the effectiveness of eruption warnings and ash dispersal forecasts. The authors ran ash dispersal simulations before, during, and after the eruption and then compared results with field estimates of deposit dispersal and eruption size. Discrepancies between simulations and observed dispersal can be refined using new data about ash aggregation and eruption source parameters for this eruption. The authors also used short reports, volcano observatory notices for aviation, social media posts, and reports of ash fallout simulations during the 20 September 2020 eruption to understand forecast efficacy and forecast communication pathways. Authors suggest that forecast models were widely seen and used by populations with internet access, successfully triggering early risk mitigation actions, but did not reach all communities.

Martinez-Villegas et al. describe an example of the effect of good communication and trust built between scientists, local government, and communities at Taal volcano, and the role of first-person experience and interpretation of its implications for risk mitigation decision-making during the 2020 Taal eruption in the Philippines. Authors compare two different communities' responses to the volcanic activity. They found that self-evacuation occurred more readily in the location where residents had direct observations of volcanic change and had the context to interpret it. Residents who did not have personal experience with the same changes in volcanic behavior did not immediately self-evacuate, but instead waiting and using social cues (seeing others evacuate) as a prompt for action.

Graham et al. also emphasize the importance of risk communication both during unrest and during quiescent times. The benefit of communication during quiescent periods is to raise awareness and reduce potential risk and to build sustainable community engagement. They also stress the importance of safeguarding the scientists from political influence by limiting their role to providing only strictly scientific information to decision makers resulted in more apparent the role of both physical and social science in providing information to decision makers. This research focuses on developing communication engagement between scientists and communities with the involvement of social science.

Finally, Todesco et al. highlight communication to the public through social media in Italy. They suggest that each individual volcano with its characteristics and geographical location has a specific social and cultural contex that needs to be considered individually. Specific needs of local communities should be obtained using different approaches. They suggest that sharing experiences and lessons learned through social media can build the ability to improve volcanological knowledge and foster engagement with the community. The Istituto Nazionale di Geofisica e Vulcanologia (INGV) has been implementing communication through internet and social media since 2018. The authors also emphasize the important of visualization, media friendly content and glossaries to explain the technical terms used in communication. And as with many papers in this Research Topic, building trust during non–eruptive periods were highlighted.

This Research Topic includes contributions about eruption forecasting, volcanic hazard assessment, and communication both before and during eruptive events. Contributions highlight the importance of preparation, planning, cooperation and formation of trusting relationships so that communities can better understand the hazards and take action when appropriate.

Author contributions

SA wrote the first version of the manuscript, with contributions from HW, KF, and VM.

Conflict of interest

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.

Publisher's note