Hazard perception

A limited number of earthquakes and volcanoes, primarily located in global north countries, dominate the collective research output on these geohazards. Efforts to improve monitoring at both local and global levels can address this disparity and reduce the associated risk.

Nature Geoscience has published nearly 300 papers on earthquakes and volcanoes since its launch in 2008, representing just a small fraction of the published research related to these geohazards. While much of our understanding comes from direct observations of recent and ongoing events, data from decades-old events are still generating publications. Some earthquakes and volcanic eruptions, especially in global north countries, generate many more publications than others for a host of reasons unrelated to the scientific potential of these events, including funding, access and coverage, as well as editorial and community bias. Recent and continuing efforts to expand monitoring of these geohazards can address this geographic deficit.

To better understand the imbalance of geohazard research outputs, we used the Web of Science database to count the number of publications over the past 20 years generated by a selection of 10 major earthquakes and active volcanic systems (Fig. 1). Conscious that our choice of events and systems may bias the findings, we nevertheless see that a few events dominate publications, in particular the 2008 Wenchuan and 2011 Tohoku-oki earthquakes.

Volcanoes seem to generate fewer overall publications than earthquakes but some individual systems, such as Kilueaua, Mount St Helens and Stromboli, had relatively high numbers of publications. There is no apparent relationship between the number of publications and earthquake magnitude or recent volcanic explosivity; instead the most-published-on events occurred in countries with some of the highest investments in instrument coverage and research, like the United States, China, and Japan. For example, Tohoku research has benefited from Japan's high-quality, dense seismic network, while Kileaua and Mount St Helens have dedicated volcano observatories.

In contrast, over 50% of active volcanoes in Latin America go unmonitored[1] and related publications are relatively sparse despite the risks. Similarly, the 2010 Maule megathrust earthquake in Chile was close in magnitude to the Sumatra and Tohoku events, but occurred before recent expansions in the country's seismic station coverage. The less-studied events aren't necessarily less valuable in terms of the scientific insights they can provide; more data and research could uncover important triggers and hazards.

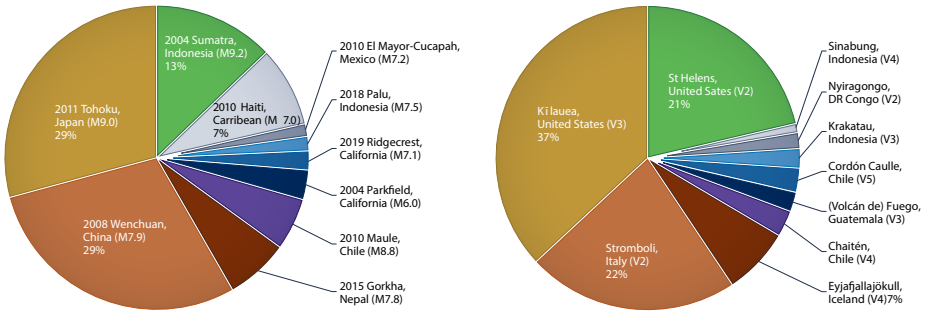

Fig. 1 | Selected earthquake and volcano publications for the past 20 years. Pie charts showing the distribution of research articles between 2001–2021 for 10 earthquakes (**a**) and volcanoes (**b**). The selected examples represent destructive and well-known earthquakes and volcanic eruptions from around the world and have all been active in the past 20 years. A total of 7,641 earthquake and 4,450 volcano articles are represented. M, earthquake magnitude; V, Volcanic explosivity of the largest eruption at the volcano in the past 20 years.

Globally-distributed Earth observation systems have the potential to help tackle this geographic disparity by providing data in more isolated or unobserved areas. For example, the International Monitoring System has provided extensive infrasound, seismic and other data on the recent Tonga eruption[2]. Galetto and colleagues, in this issue, demonstrate how the improvements over the past few decades in satellite monitoring of associated ground deformation could be used for eruption forecasting, along with remote thermal and sulphur dioxide measurements.

There are also emerging, low-cost technologies that could assist with local monitoring efforts. The proliferation of high-quality photography equipment, smartphones, and drones has made monitoring volcanoes more accessible[3], creating possibilities for new citizen–science and crowdsourcing initiatives. Smartphone sensors have also been used as part of early warning systems for earthquakes[4]. Cooperation between national and international partners is especially important, as demonstrated by the recent efforts by Latin American countries to increase the number of volcanoes being monitored by sharing resources, data and expertise[1].

Ongoing research into earthquakes and volcanic eruptions continues to provide insights into the processes underlying and risks stemming from these events. Continued expansion of monitoring and collaborative networks to regions underrepresented in the scientific literature, especially in the global south, is crucial for forecasting and risk mitigation efforts. ❐

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