

# Volcanologists are uniquely positioned to inform disaster risk reduction, particularly Multi-Hazard Early Warning Systems

Molly Urquhart<sup>1</sup>, Carina Fearnley<sup>1</sup>, and Sarah Dryhurst<sup>2</sup>

<sup>1</sup> University College London Department of Science and Technology Studies,

<sup>2</sup> University College London Department of Risk and Disaster Reduction, London



## 1. Context

Current disaster risk reduction approaches are often siloed by hazard type, discipline, or agency, leading to inconsistent guidance, coordination gaps, and greater impacts after events. Robust Multi-Hazard Early Warning Systems can address this by helping to detect and respond to multiple hazards occurring alone, simultaneously, or sequentially. They are vital to reducing mortality, improving preparedness, and guiding resource allocation.

This priority is reflected in the UN Secretary-General's announcement of the \$3.1 billion Early Warnings for All initiative, launched in 2022. This initiative calls for strengthening global risk knowledge, forecasting, warning communication, and preparedness. The initiative's overall aim is to have every person in the world covered by an early warning system by 2027.

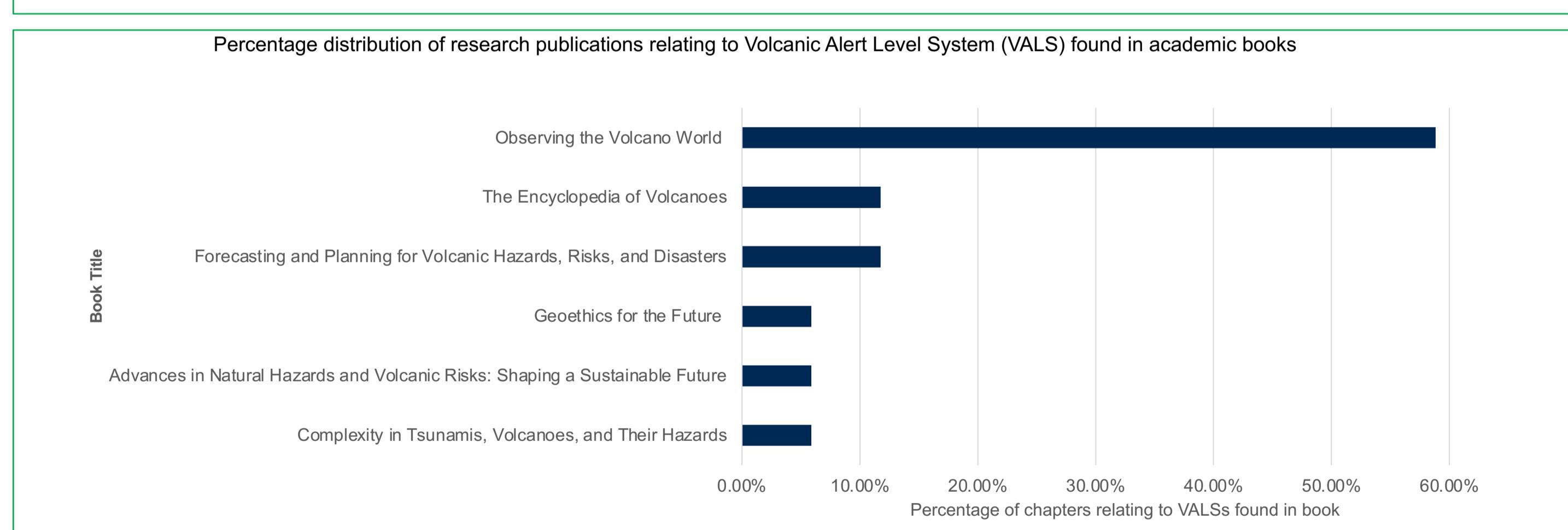
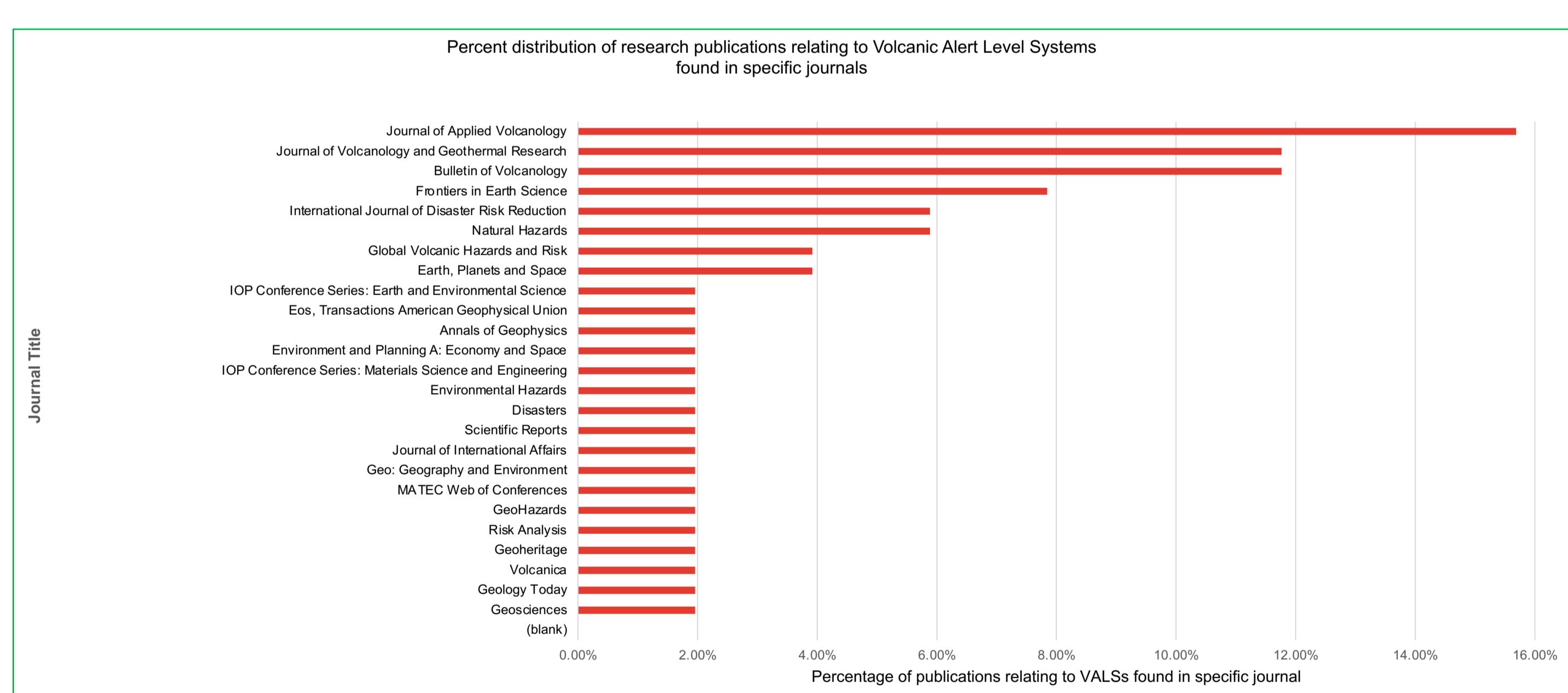
This push for integrated, people-centred warning systems is where volcanologists' experience could make a huge contribution. And yet, there is limited inclusion of volcanic hazards in this initiative.

## 2. Research question

How can we translate volcanologist expertise into broader Multi-Hazard Early Warning System frameworks?

### 3. Aim

- Use Volcanic Alert Level Systems as a case study, exploring how this system can act as a good practice model for strengthening broader Multi-Hazard Early Warning Systems.
- Explore how volcanic hazard knowledge can be better integrated into initiatives like the UN's Early Warnings for All framework.



## 6. Significance

With the intensification of anthropogenic activity and climate change, we're seeing more hazards increasingly compounding, cascading, or triggering one another, leading to multi-hazard events.

The expertise of Volcanologists in balancing scientific uncertainty, warning and alert level dissemination, and community engagement provides a strong foundation for designing more inclusive, socially informed multi-hazard early warning systems for other hazard domains.

## 4. Volcanic Alert Level Systems

VALSs are a multi-hazard early warning and communication tool used between scientists and civil authorities to signal the current level of volcanic activity and the potential for eruption.

VALSs act as a "bridge" between complex scientific data and practical, actionable decisions. They help give the public, emergency managers, and other stakeholders a 'heads up' about what might happen, based on criteria for activity, hazards, or risk.

Every country tailors its VALSs to its own social, cultural, and political contexts. VALSs can act as a template for more inclusive Multi-Hazard Early Warning Systems.

### Volcano Alert Levels Used by USGS Volcano Observatories

Alert Levels are intended to inform people on the ground about a volcano's status and are issued in conjunction with the Aviation Color Code. Notifications are issued for both increasing and decreasing volcanic activity and are accompanied by text with details (as known) about the nature of the unrest or eruption and about potential or current hazards and likely outcomes.

Term	Description
<b>NORMAL</b>	Volcano is in typical background, noneruptive state or, after a change from a higher level, volcanic activity has ceased and volcano has returned to noneruptive background state.
<b>ADVISORY</b>	Volcano is exhibiting signs of elevated unrest above known background level or, after a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
<b>WATCH</b>	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, OR eruption is underway but poses limited hazards.
<b>WARNING</b>	Hazardous eruption is imminent, underway, or suspected.

\*Examples of VAL systems used in the United States

## 5. VALS Literature — Where Are We Publishing?

Most publications (n=68) appear in volcanology journals, with very limited crossover into broader disaster risk reduction outlets.

This suggests that even we, as volcanologists, are siloed, mostly sharing knowledge within our field.

## 7. Key Takeaway

Volcanology's experience can help shape better multi-hazard early warning systems

The volcanological community should engage proactively with initiatives like the UN Early Warnings For All

Volcanologists should build bridges with the wider disaster risk reduction community and publish beyond volcanology in DRR journals to share our lessons learned.

