

Workshop Report:

Developing the future vision for seamless multi-hazard warnings for volcanic eruptions

IAVCEI 2023 Post-conference workshop - 5 February 2023, Rotorua, New Zealand

Authors:

Andrew Tupper¹, Graham Leonard²

1. Natural Hazards Consulting, Australia; andrewtupper@naturalhazardsconsulting.com
2. Te Pū Ao GNS Science, New Zealand; g.leonard@gns.cri.nz

Full list of contributors: see Appendix 1

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Disclaimer: This workshop report has not been through a peer review process

IAVCEI Workshop Report

“Developing the future vision for seamless multi-hazard warnings for volcanic eruptions”

Rotorua, New Zealand, 5 February 2023



Figure 1 - workshop room

Introduction

Much work has been done to build arrangements between volcanology and meteorology to handle the aviation risks from volcanic ash, but recently there has been increasing international discussion around other volcanic hazards to the public, particularly where a multi-disciplinary approach is required. These hazards include tsunamis, ashfall, rainfall-induced dome collapses, lahars, pumice, glacial floods, and gas. They threaten a range of sectors including marine users, land transport users, agriculture, and residential communities. Approaching these hazards in an integrated fashion with the hydrometeorological community will help provide consistent and coherent warnings, create a focus on the capacity development required, and ultimately build a safer world consistent with the Sendai Framework and the recent UN call to provide universal coverage for early warning systems¹.

This half-day workshop followed the Scientific Assembly of the International Association of Volcanology and Chemistry of the Earth’s Interior, a major gathering of volcanologists held for the first time in nearly six years in early 2023, in Rotorua, New Zealand. The workshop also followed the World Meteorological Organization (WMO)-led 8th International Workshop on Volcanic Ash, and was thus able to take advantage of the presence of experienced meteorologists and volcanologists who were ‘in the mood’ to discuss interdisciplinary matters. With only half a day available, the workshop was more along the lines of an exploratory discussion, but still attracted enthusiastic participation and deep insights from the attendees.

Summary of discussions

The workshop consisted of some short presentations, some panel discussions, and then group discussions and a ‘post-it’ note exercise to articulate the key themes identified by the group.

The workshop was opened by co-convenors Andrew Tupper and Graham Leonard. In Andrew’s introductory remarks, he discussed some of the global arrangements around managing the risk from active volcanism, including past efforts to encourage multi-disciplinary cooperation through the aviation context, and the current global efforts to improve multi-hazard early warning systems.

¹ See ‘Early Warnings for All’, <https://public.wmo.int/en/earlywarningsforall>, and related documents.

Graham highlighted the significant risks that volcanoes pose, including from both relatively common smaller eruptions, and the rarer catastrophic-scale eruptions that can potentially create severe global consequences.

Johan Stander of WMO gave some brief remarks to help contextualise multi-hazard early warning systems from the point of view of the WMO Secretariat, and to encourage engagement from the volcanological community. Gill Jolly presented some reflections about the needs of users of volcanological services, based mainly on her experiences working with decision makers in emergency management. David Wilson spoke from the marine services perspective, describing the issues that are being examined at intergovernmental level, and how the user and messaging requirements for volcanic hazards could be developed.

Gill joined an illustrious group of volcanologists for the first panel discussion, during which Ima Itikarai gave clear insights around his experiences as head of the Rabaul Volcano Observatory. He particularly noted that observatory sustainability (for example, through aviation cost recovery) is a very important challenge, particularly when 24/7 operations are required, but that automation of seismic alerting has proven to be useful even for the difficult Manam volcano. Ma. Antonia (Mariton) Bornas presented a comprehensive overview of the operation of PHIVOLCS and some of the challenges involved. During her presentation, she also noted that severe weather is also a challenge for volcanologists due to equipment damage (in addition to multi-disciplinary hazards such as tsunamis and vog), and identified some immediate issues for consideration (use of weather observation systems such as radar for volcanic plume monitoring, and financial commitment by government). Chris Newhall gave his well-considered perspectives around the long-term effort to build volcanic monitoring sustainability, including past initiatives to progress the conversation at the UN level. During the discussion, the consistent application of best practice alert level strategies attracted much attention, as did the Volcano Observatories Best Practice workshop process².



Figure 2 - 1st panel discussion. Left to right: Mariton Bornas, Chris Newhall, Gill Jolly, Ima Itikarai, Graham Leonard

In the second panel discussion, Ian Lisk and James Lunny joined David Wilson. Ian expanded on the global Early Warnings For All initiative, WMO's role, and future opportunities. The initiative is an important UN push for global geographic coverage of early warning systems. Although WMO (who

² Eg Lowenstern, J.B., Wallace, K., Barsotti, S. *et al.* Guidelines for volcano-observatory operations during crises: recommendations from the 2019 volcano observatory best practices meeting. *J Appl. Volcanol.* **11**, 3 (2022). <https://doi.org/10.1186/s13617-021-00112-9>

have a hydrometeorological focus) and UNDRR are leading the effort with a focus on climate risks, there is an important question of how geohazard warnings will be enhanced. James Lunny gave the meeting a rest from Powerpoint presentations with a live demonstration of the web resources available to Pacific Islands through the WMO Severe Weather Forecasting Programme, which uses a distributed model that allows insights and modelling from wealthier countries to be used as part of the local decision-making.

During these presentations and discussions, the group had been invited to write their thoughts on post-it notes and arrange them under two key questions:

- 1) What do we want to achieve with future multi-hazard volcanic warnings, particularly in relation to integration with other warnings, and
- 2) How can the future vision be pursued?

The workshop split into two groups, each swapping between the themes to organise and discuss the ideas put forward. The 'raw' results are shown below.



Figure 3 - group contributions around the theme of the future vision

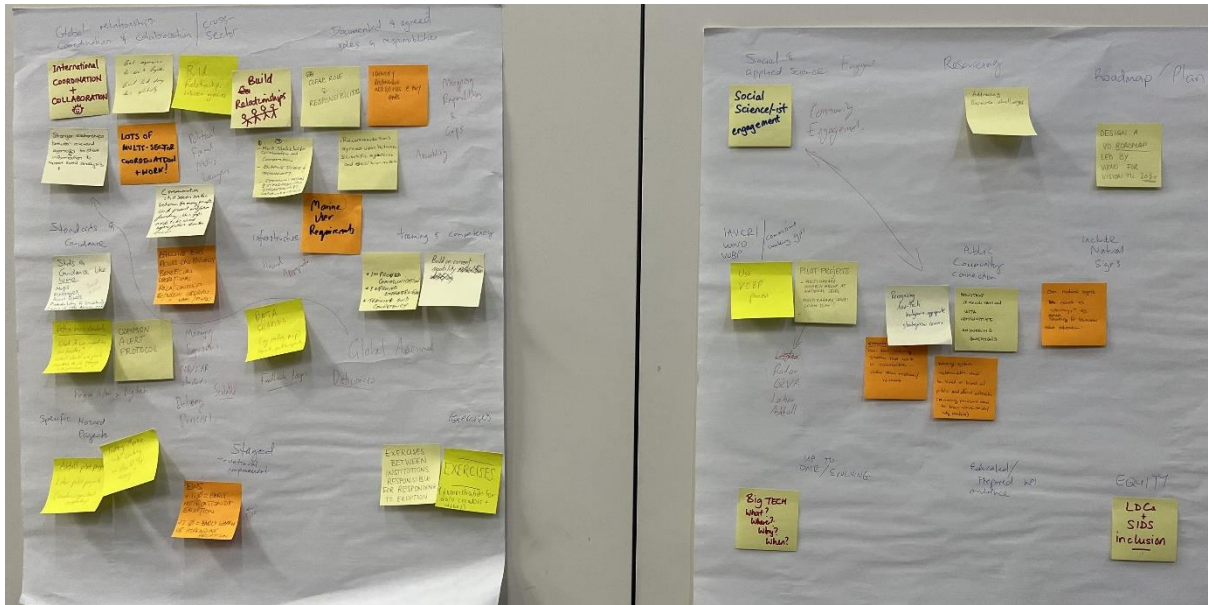


Figure 4 - group contributions around the theme of how to achieve the future vision

Following the workshop, these contributions have been summarised into a suggested future vision and suggested themes and activities for achieving that vision, as shown in Appendix 2.

During the discussions, the group showed great enthusiasm for continuing to explore these themes, including in the context of the UN Early Warnings for All initiative, during future relevant IAVCEI events, and future Volcano Observatory Best Practice workshops.

Recommendations:

- 1) That the workshop outcomes as shown in Appendix 2 be made available to relevant organisations involved in Early Warnings for All, with particular relevance to discussions around geohazards
- 2) That future workshops and discussions on this topic be held as convenient, noting the depth of practical expertise in operational volcanic early warnings available through IAVCEI

Andrew Tupper & Graeme Leonard

Co-convenors

Contact: andrewtupper@naturalhazardsconsulting.com

Appendix 1 – Attendees

Paula	Acethorp	Civil Aviation Authority of New Zealand, NZ
Sara	Barsotti	Icelandic Meteorological Office, Iceland
Frances	Beckett	UK Meteorological Office
Dov	Bensimon	Environment Canada (Montreal VAAC)
Ma. Antonia	Bornas	Philippine Institute of Volcanology and Seismology
Rory	Clarkson	Rolls-Royce Civil Aerospace
Alice	Crawford	NOAA Air Resources Laboratory, USA
Gabriela	Delgado	El Servicio Nacional de Geología y Minería, Chile
Natalia	Deligne	USGS (Hawaiian Volcano Observatory), USA
Jarrad	Denman	VAAC Darwin, Bureau of Meteorology, Australia
Samantha	Engwell	British Geological Survey, UK
Nico	Fournier	Te Pū Ao GNS Science, NZ
Sebastian	Garcia	Sebastian Garcia Servicio Geológico Minero, Argentina
Ima	Itikarai	Rabaul Volcano Observatory, Papua New Guinea
Gill	Jolly	Te Pū Ao GNS Science, NZ
Jamie	Kibler	NOAA (Washington VAAC), USA
Graham	Leonard	Te Pū Ao GNS Science, NZ
Ian	Lisk	UK Meteorological Office / WMO
James	Lunny	MetService NZ
Anton	Muscat	UK Meteorological Office
Christopher	Newhall	Mirisbiris Garden and Nature Center, Philippines
Solomon	Sammy	Solomon Islands Meteorological Services
David	Schneider	USGS (Alaska Volcano Observatory), USA
Johan	Stander	WMO
Paul	Taylor	Australian Volcanological Investigations
Thomas	Toba	Geological Survey Division, Solomon Islands
Andrew	Tupper	Natural Hazards Consulting, Australia
David	Wilson	Maritime NZ

Appendix 2 – Summarised future vision and ‘roadmap’.

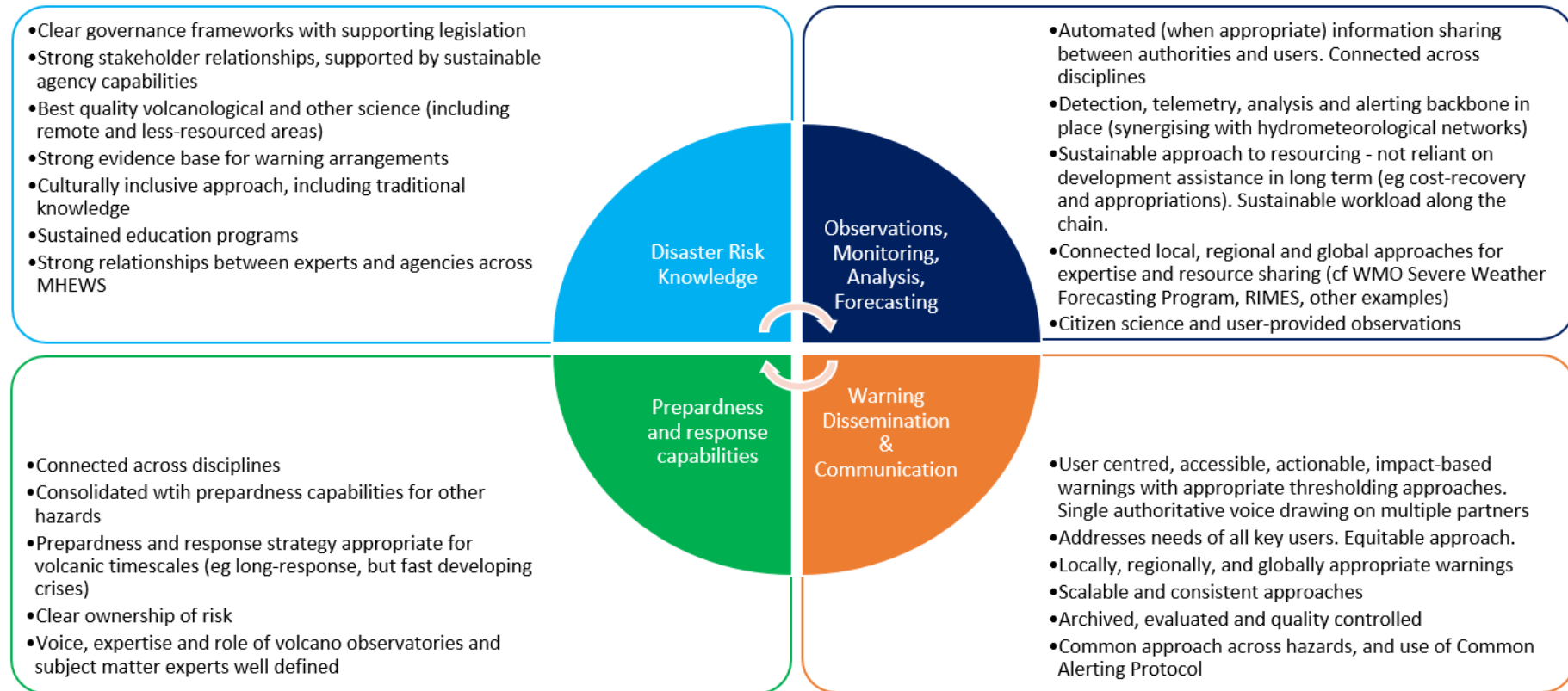


Figure 5 - summary of key themes of the future vision for volcanic multi-hazard warnings, organised into an early warnings systems framework form.

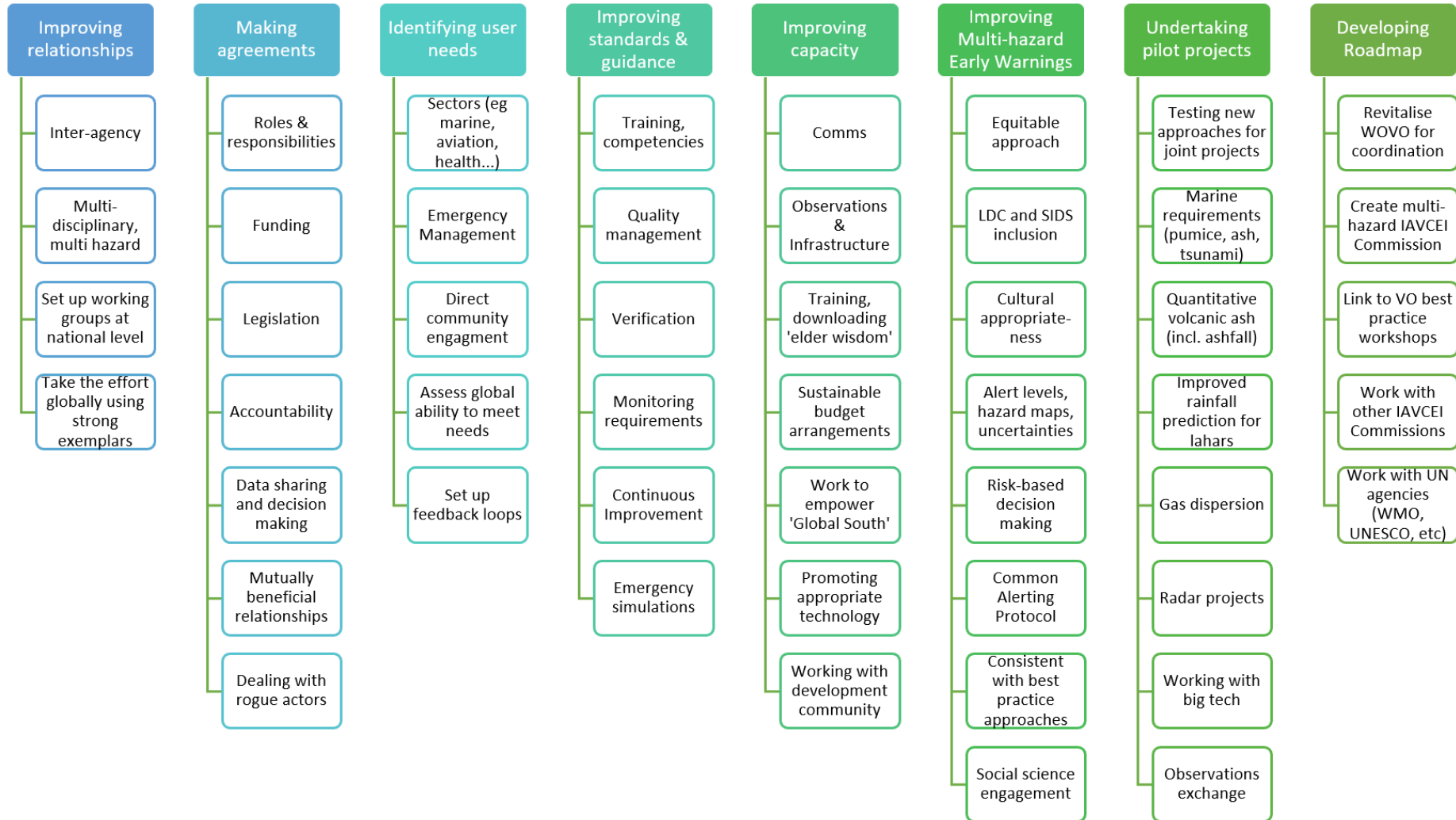


Figure 6 - key ideas from the discussion of 'how do we get there?', organised into suggested themes and activities.