The integrated role of research and monitoring in the assessment of volcanic hazards and risk in New Zealand

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GNS SCIENCE
TE PŪ AO

Science advice context

- **GeoNet project: aim to build and operate systems to monitor volcanoes (and other geohazards) and provide timely information to NZ; collect research quality data. Funded largely by EQC.**

- **Natural Hazards Research Platform: multi-party research platform to increase NZ resilience to natural hazards via high quality collaborative research. Funded largely by MBIE.**

- <u>**For volcanoes, research and monitoring go hand in hand**</u>

Science advice context – existing co-ordination

- **Regional advisory groups e.g. Central Plateau Volcanic Advisory Group**

- **New Zealand Volcanic Science Advisory Panel:**
  - developing subgroups for health, lifelines, agriculture

Aim: co-ordinated information and advice to people that need it

- **Need for science during planning, response and recovery**

Co-ordinated, comprehensive volcano science

Planning: all sectors

Science Response

All sector response

Recovery

Unrest or eruption

GeoNet

SAG or Expert Panel

Wider Expert Community

Improved:

Science capability

Risk Reduction

CD/EM planning, response and recovery

Resilience

Community Development

Underpinning Research

Post Event Research

Coordinated Event Research

Diagram courtesy Richard Smith, EQC with modifications

GNS Science

An example of how this works in practice: The response to the recent Tongariro eruptions

- **Monitoring and research:**

  – **Long term under-pinning**

  – **Immediate pre-event**

  – **Immediate post-event**

  – **Mid term post-event**

  – **Long term under-pinning**

Te Maari, ca. 1900

Long term underpinning

- **Monitoring baselines:**
  - **GeoNet networks: seismic, GNSS**
  - **GeoNet annual campaign geochemistry**

- **Research (many):**
  - **Geological mapping**
  - **Petrology and eruptive styles**
  - **Geophysics across Tongariro**
  - **Impacts studies**

Immediate pre-event

- **First earthquakes: 11-13 July – "hybrids"**

- **Main swarm: 18-22 July**

➢ **GeoNet meeting on 20 July: Increased volcanic alert level to 1 (signs of unrest)**

VAL change
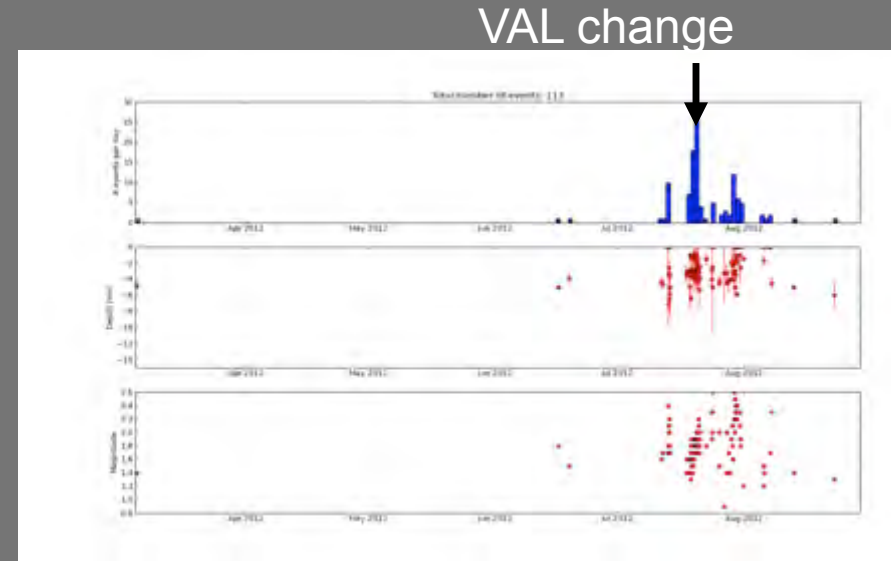
Triggers:
  Calls to CDEM, VAAC, DOC
  Start of engagement with community
  Calls to CPVAG science group
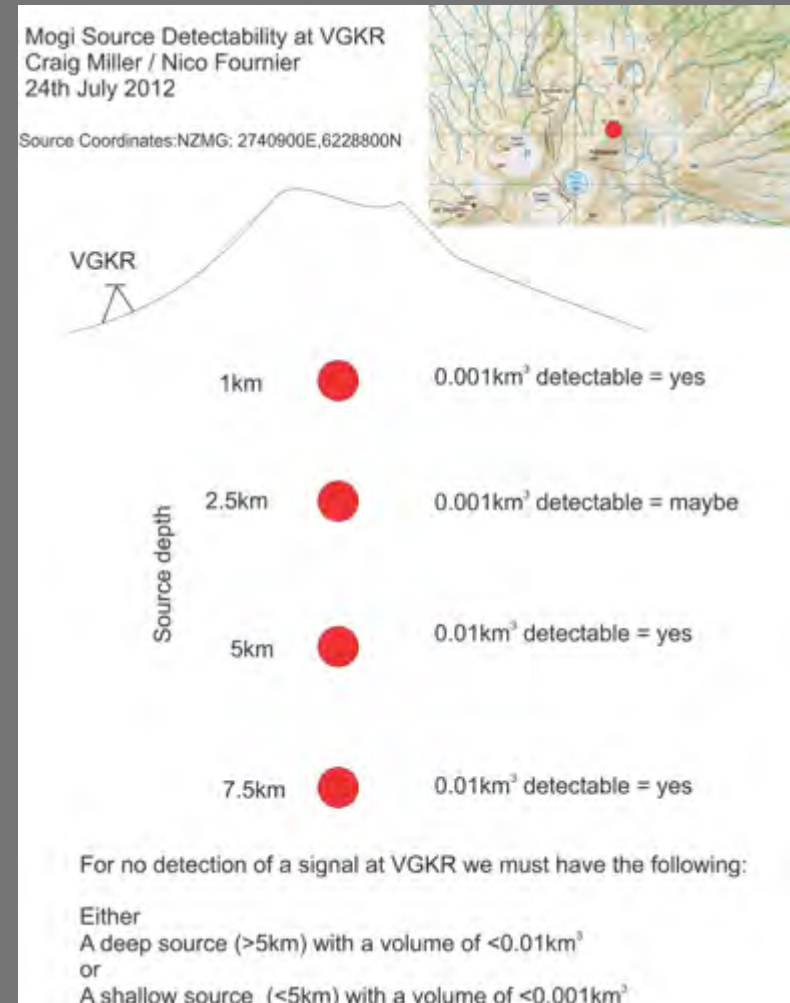 ➢ **What needs to be done to understand future scenarios?**

GeoNet response

- **Field plans**

  - **Additional seismic and GNSS stations installed**

 - **Additional fumarole sampling undertaken**

Developing models and scenarios

- **Understanding historic activity (GNS, Massey, Waikato)**

- **Geodetic models (GNS)**

- **Flow models (Massey)**

- **Involve other science groups**

Mogi Source Detectability at VGKR
Craig Miller / Nico Fournier
24th July 2012

Source Coordinates:NZMG: 2740900E,6228800N

VGKR

Source depth

1km — 0.001km^3 detectable = yes

2.5km — 0.001km^3 detectable = maybe

5km — 0.01km^3 detectable = yes

7.5km — 0.01km^3 detectable = yes

For no detection of a signal at VGKR we must have the following:

Either
A deep source (>5km) with a volume of <0.01km^3
or
A shallow source (<5km) with a volume of <0.001km^3

Developing models and scenarios

- **Understanding historic activity (GNS, Massey, Waikato)**

- **Geodetic models (GNS)**

- **Flow models (Massey)**

- **Involve other science groups**

Massey University
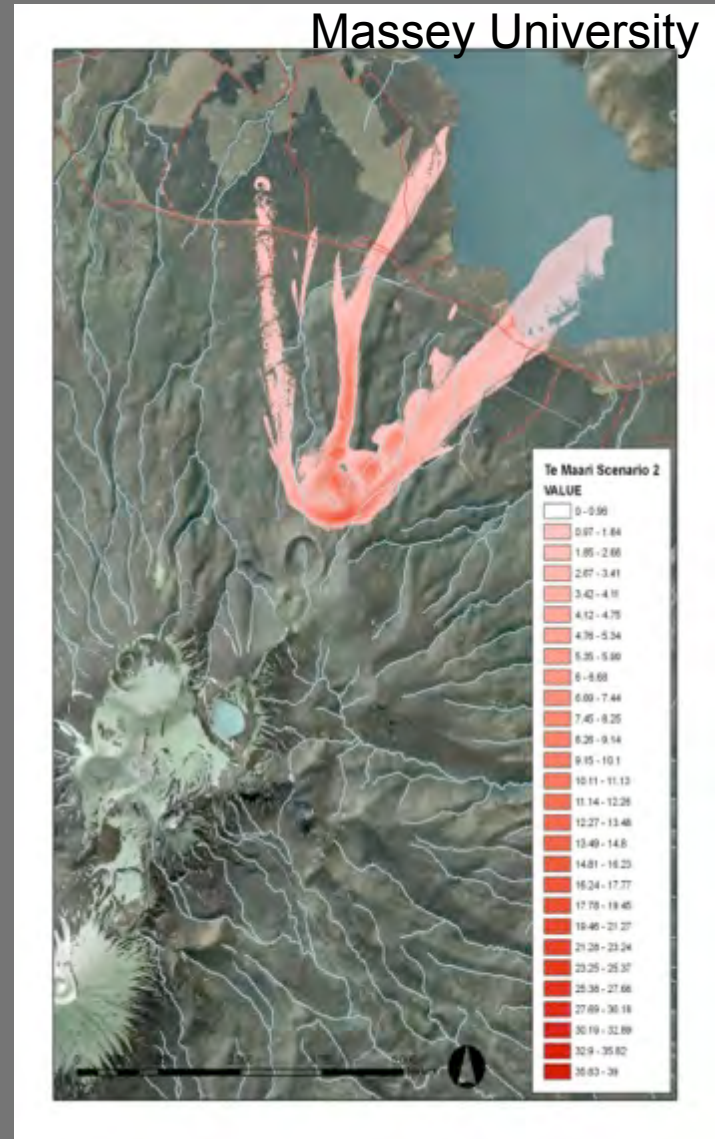
Eruptions

- **6 August:**
  - **Middle of the night**
  - **Impacts tramping tracks and huts**
  - **Minor ashfall**
- **21 November:**
  - **Middle of the day**
 - **Youtube around the globe in minutes**
  - **Impacts very limited**

Immediate post event

- **Multiple meetings to discuss activity**
  - **Discuss monitoring data – feed into risk assessments**
  - **Co-ordinated science**
    - **e.g., ash analysis, seismic deployments, satellite observations, debris flow potential**
    - **Hazard modelling and mapping**
- **Sharing of information on wiki**
- ➢ **Consistent messages for different sectors**

Mid term post event

6 August 2012 eruption-Seismo-acoustic data

- **Monitoring:**
  - **Continuing**
  - **Augmented networks**
  - **Discussions on additional techniques**
- **Research:**
  - **Understanding eruptions: geophysics, physical volcanology, geochemistry, petrology, modelling…**
  - **Immediate feedback to recovery eg into risk assessments and designing future monitoring**
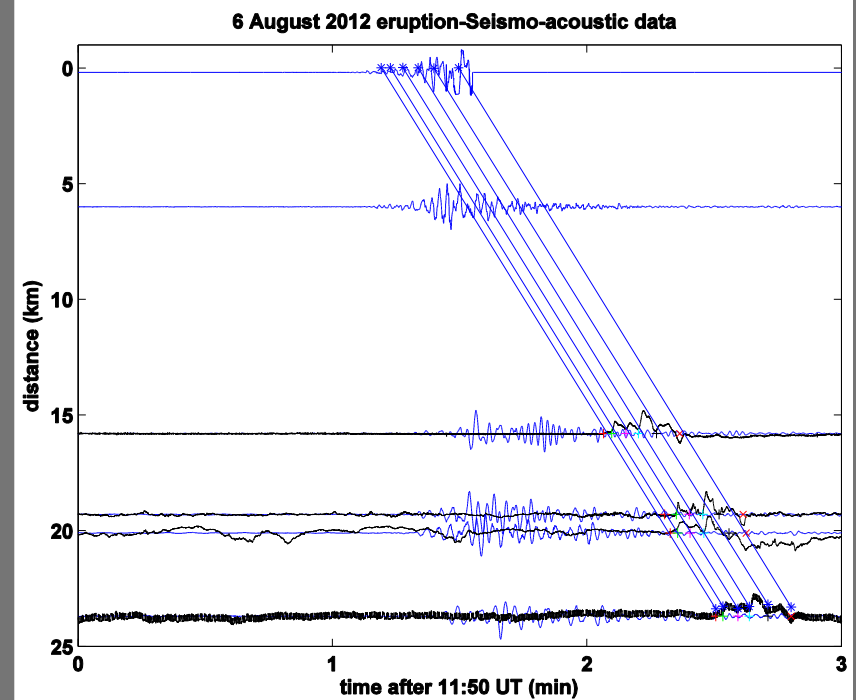
Long term underpinning

- **Monitoring:**
  - **Better networks eg additional infrasound**
  - **Additional geochemistry eg FTIR**
- **Research:**
  - **Better understanding geology of Tongariro and controls on volcanism eg hydrothermal system, structure, past history**
  - **Understanding eruption dynamics**
  - **Longitudinal social science studies of response**
  - **Impacts studies**

Integrated volcano research and monitoring in New Zealand

- **Monitoring through GeoNet**
- **Multi-institute co-ordinated research under umbrella of Natural Hazards Research Platform**
  - **Short, medium and long term**
  - ➤ **Provision of co-ordinated advice to all sectors for improved readiness, risk reduction, response and recovery**