VISG NEWSLETTER

VOLCANIC IMPACT STUDY GROUP

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VISG CO-ORDINATOR'S NOTE

by Natalia Deligne

The end of the calendar year is a good time to reflect on this year's achievements. New Zealand's volcanoes continue to be quiet, providing us with the time to better prepare for the next eruption.

The **VISG team has had a busy year**. We have completed an ALG co-funded study on the impacts of volcanic ash on diesal-power generators (see March 2017 newsletter). We are making progress towards revising and updating the VISG volcanic ash impacts poster series. We published two papers (one more on its way) that gathered a lot of media attention looking at the consequences of a hypothetical Auckland eruption on Auckland's infrastructure service provision. We've also published papers on ballistic impacts to buildings, clean-up models following an Auckland eruption, impacts of volcanic ash on road skid resistance, surface road markings, and visibility, and the link between hazard severity and impact on infrastructure. We've presented at international conferences, learned from eruption experiences overseas, and used experimental facilities overseas to better understand how buried infrastructure might be impacted by lava flows. We've welcomed new students onto the team (and farewelled some as well).

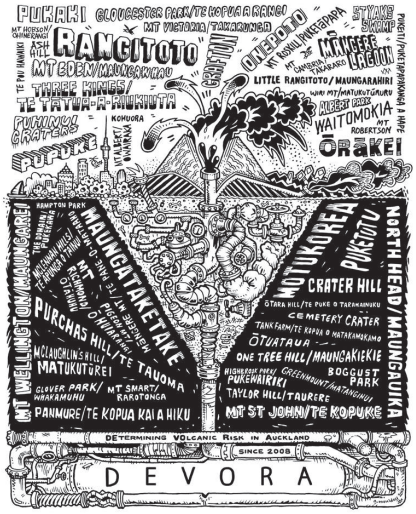
This quarter's ***Research Spotlight*** is by Zoë Juniper on her Masters project exploring the potential consequences of Taranaki unrest and eruption on the nation's petroleum production sector. Zoë is in the final stretch of her one-year Masters, and has already completed an impressive amount of work on this subject.

Have a lovely and safe summer.

NEWS

A successful **10th Annual DEVORA Research Forum** was held on 7 November at the University of Auckland, with about 70 attendees and 19 research presentations (available on DEVORA website presentation page). Gavin Mouldely designed a **commemorative tea towel** for this important anniversary. The forum keeps everyone up to date on current Auckland Volcanic Field research and results, and allows stakeholders and lifelines to directly communicate their needs to scientists.

VISG researcher **Natalia Deligne** gave an invited presentation on 5 September at a symposium at the University of Bristol, UK, celebrating the research and achievements of Professor Willy Aspinall, one of the world's leaders in volcanic risk assessment. Natalia spoke about advances in characterising New Zealand's volcanic hazard and risk.



Commemorative teatowel by Gavin Moudely

University of Canterbury student **Zoë Juniper** organised and facilitated a successful expert elicitation **workshop** concerning **volcanic risk for the petroleum production and exploration** sector on 27 October in Taranaki. The 27 attendees came from the petroleum industry, council and civil defence, related regulators and scientific community.

On 1 October at the **Auckland Heritage Festival,** volcano and earthquake scientists ran demonstrations and experiments for the public. The event was sponsored by The University of Auckland, Auckland Council and The Earthquake Commission. Participating outreach groups included DEVORA, QuakeCoRE, the Auckland University Geoscience Association.

The first **DEVORA Fact Sheet** was released, entitled, ***City of Volcanoes: The Auckland Volcanic Field / Ngā Tapuwae ō Mataaho – An Introduction to Auckland's volcanoes.*** The DEVORA Fact Sheet series will summarise and synthesis AVF research, with each fact sheet focused on a different topic.

GNS Science publicly launched the **GeoTrips** website (www.geotrips.org.nz). Each GeoTrip provides directions to **rock outcrops, geological displays or landforms** to visit and explore, and provides images and useful background information. At the time of writing, there 58 GeoTrips in the Auckland area and 106 nationally concerning volcanoes; this number will increase with time.

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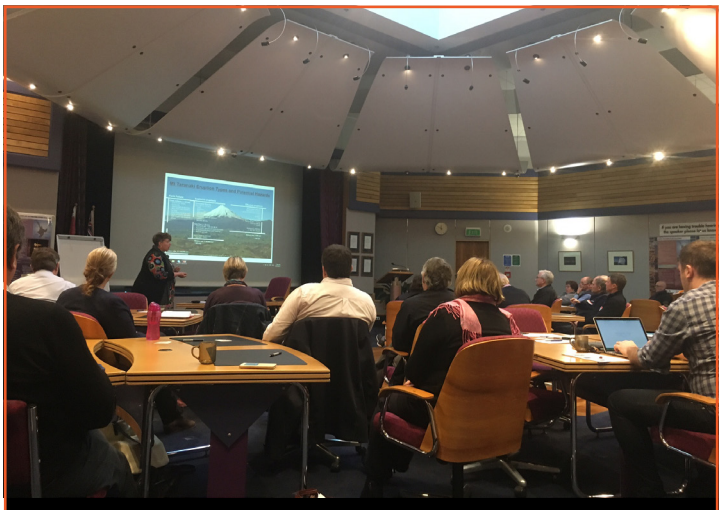
RESEARCH SPOTLIGHT

Potential Mt Taranaki impacts to the petroleum sector

by Zoë Juniper, University of Canterbury

Mt. Taranaki viewed from one of Taranaki's critical petroleum infrastructure sites (photo credit: Zoë Juniper)



Expert elicitation workshop (photo credit: Tom Wilson)

As you enjoy a beer this summer while cooking on your gas BBQ, take a moment to ponder: what will happen to New Zealand's gas supply the next time Mt. Taranaki goes into volcanic unrest, or worst, unrest followed by an eruption? All of New Zealand's petroleum production sector is in the Taranaki region… a region named after a volcano with an up to 80% chance of erupting within the next 50 years.

Recent disruption to the fuel supply pipeline from Marsden point reinforced how vulnerable our small country is to infrastructure service disruption. How vulnerable are we to natural gas disruption? All natural gas that we use at home as cooking gas, heating fuel or BBQ gas comes from one region in New Zealand: Taranaki. As there are only about 4-6 days gas supply 'stored' in the transmission and distribution pipelines, the petroleum industry will need to continue to produce natural gas without interruption, even when faced with an emergency or disaster situation.

For my Masters, I am working with the petroleum sector to understand how various volcanic hazards are likely to impact the sector, enabling companies to then consider risk reduction and readiness actions, and pre-event response and recovery planning. I bring to my Masters over 18 years working in the petroleum industry, both as a seismic data analyst in the UK and New Zealand, and as a regulator, where among other activities, I led a project at NZP&M on 4Rs planning for the sector, which opened new doors for me in emergency management and disaster risk. This project inspired me to return to full-time study in early 2016. In late 2016 over a few beers, a project developed that made use of my unique background: looking at the impacts of a Mt. Taranaki eruption to the petroleum sector, with a focus on the gas supply. I am now coming towards the end of my one-year Masters, and already my preliminary findings may represent a significant knowledge improvement for one of New Zealand's critical lifeline services.

My aim is to produce a high-level preliminary impact assessment and to develop a robust methodology that can be repeated as improved data, hazard modelling or more detailed site-specific studies become available. My methodology draws heavily using geospatial information system (GIS) tools to both build an asset inventory of petroleum infrastructure assets and map volcanic hazards. This, coupled with an extensive literature review and consultation with industry experts, will allow me to fill a knowledge gap of a major risk to the New Zealand critical lifeline sector. My work develops a platform from which further research can help the sector develop a greater resilience for the benefit of all New Zealanders.

I have secured an unprecedented level of engagement from the petroleum sector, expedited by existing relationships. In the last few months, several companies have taken the lead with one-to-one discussions and hosting site visits. This has provided me a better understanding of the sector's assets and vulnerabilities. In October, I ran a highly successful expert elicitation workshop, hosted by the Taranaki CDEM, to group asset types together, develop damage matrices, and consider interdependencies. I am now compiling workshops findings and writing up my thesis – I have a March 2018 deadline.

The last few years has been an inspiring journey of personal growth. It is fulfilling to be able to draw on my varied experiences to identify a critical gap in energy security for New Zealand. I am personally very proud to have successfully facilitated a collaborative industry workshop that generated thorough and at times surprising discussions and highlighted a sector desire for improvement and greater knowledge of volcanic hazards. The result is that every new conversation, discussion, and action taken grows our resilience to future volcanic eruptions.

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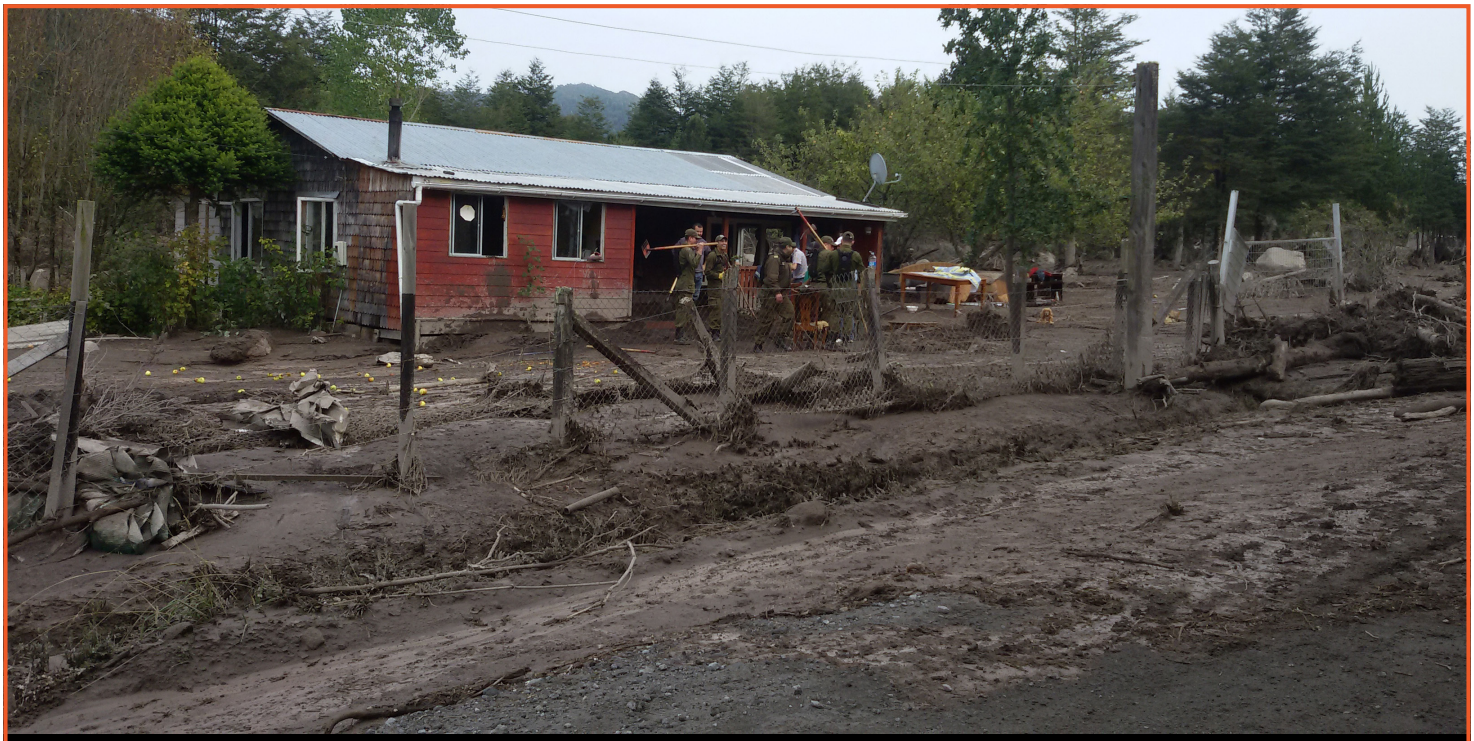
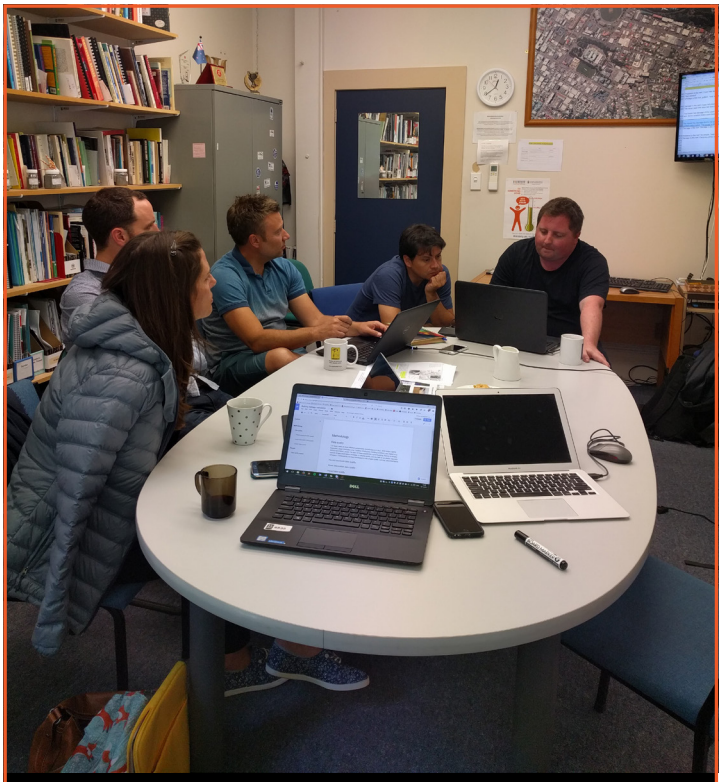
RESEARCH HIGHLIGHTS



A house affected by lahar inundation from the Rio Blanco Sur following the Calbuco eruption, Chile. Photo credit: Victor Gonzalez



Researchers discussing the Calbuco building damage dataset at the Joint Centre for Disaster Research, Massey University. Photo credit: Natalia Deligne

On 8-9 November VISG researchers from the University of Canterbury and GNS Science were joined by Susanna Jenkins and George Williams from Nanyang Technological University (Singapore) and Rodrigo Calderon from SERNAGEOMIN (Chile) to work on analysing a dataset that characterises the **damage to housing from lahar and tephra** fall due to the 2015 eruption of Calbuco Volcano, Chile. The housing stock in this region of Chile is similar to New Zealand: it is timber-framed with a relatively high exposure to snow hazards, making it a particularly useful comparison for New Zealand. Analysis continues and a manuscript is planned for completion in 2018.

University of Auckland PhD student **Sophia Tsang** visited Syracuse University (USA) to conduct molten rock experiments to measure the **thermal profile in soil underneath lava flows**. These experiments will help constrain what impacts may occur to buried infrastructure in the event of a lava flow.

Grant Wilson (formerly University of Canterbury) and **Daniel Blake** (University of Canterbury) each published a paper in the Journal of Applied Volcanology entitled, respectively, ***Framework for developing volcanic fragility and vulnerability functions for critical infrastructure*** and ***Improving volcanic ash fragility functions through laboratory studies: example of surface transportation networks.*** These papers represent important advances in understanding the relationship between volcanic hazards and their impacts.

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GLOBAL ERUPTION ROUNDUP

by Sophia Tsang and Brad Scott

As per usual volcanic activity is occurring around the world. There only appears to be one that has produced significant ash (Kirishimayama, Japan) where there is infrastructure. There has also been an eruption at Ambae in Vanuatu and Brad Scott and Nico Fournier from GNS Science spent some time helping the Vanuatu Geohazards team with the response.

Ambae (Aoba), Vanuatu

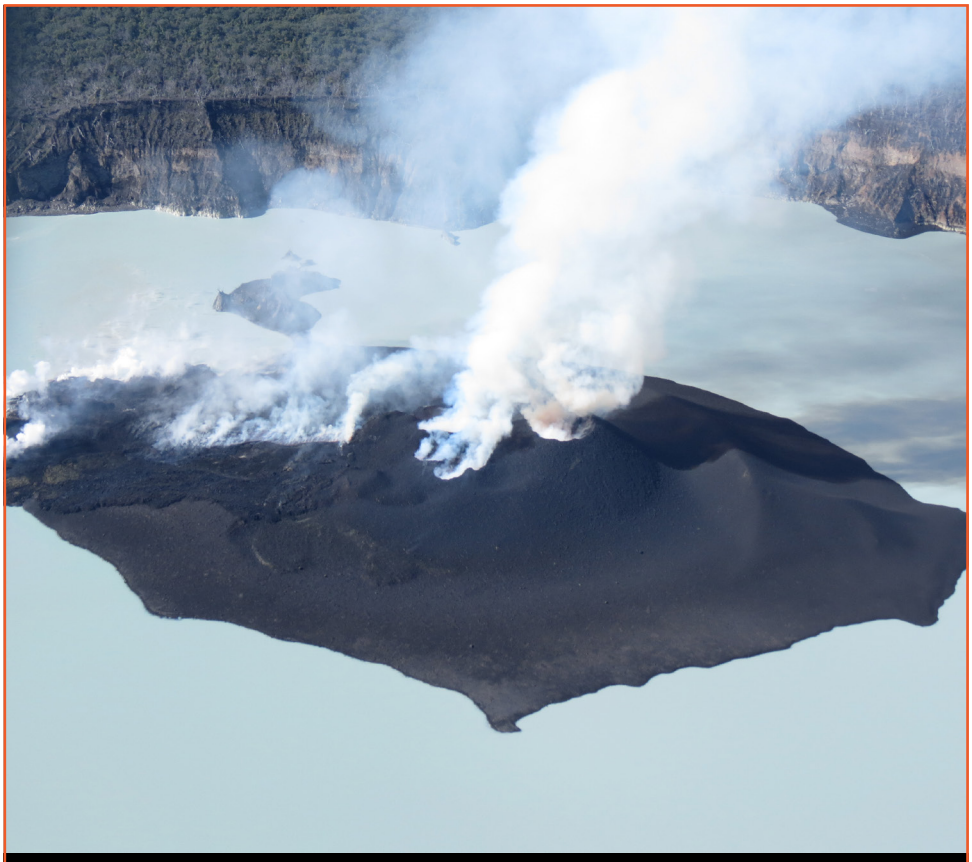
In the beginning of September, the volcano alert level at Aoba was raised in response to a minor eruption phase, which led to an exclusion zone being put in place. Additionally, people were asked to stay out of areas downwind of the active crater (there are trade winds here). The eruption is focused in Lake Voui and is building a volcanic cone in the lake. On two occasions in September eruptions produced minor ashfalls. Initially the eruption built a tuff cone, then lava flows started and a lava fan was built. The eruption style then changed and more explosive eruptions started. Minor ashfalls have occurred and have had some impacts on village water supplies and gardens. The eruption is ongoing.

Agung, Indonesia

Also in September, an increase in the number of earthquakes around Agung prompted the local geological survey, Pusat Vulkanologi dan Mitigasi Bencana Geologi, to raise Agung's alert level to 2 (note: Indonesia uses a different alert level system than New Zealand). A continuation of seismic and gas activity led to an exclusion zone. As activity increased, the exclusion zones also increased until over 146 thousand people and 10 thousand livestock had been evacuated. Agung's unrest appears to have begun decreasing towards the end of October although the exclusion zones still remain.

Kirishimayama, Japan

A small tephra eruption occurred at Kirishimayama in the middle of October. At least four towns reported tephra landing in addition to pilots reporting a tephra plume at least 3.4 km high. Despite the week-long eruption and elevated volcanic alert level (note: Japan uses a different alert level system than New Zealand), there seem to be few impacts.



Aerial view of the small volcanic cone growing in Lake Voui, Ambae Island, Vanuatu (1 Oct 2017; photo credit: Brad Scott, GNS Science).

UPCOMING EVENTS

The **VISG seminar has been postponed** to the beginning of 2018. Details will be circulated when they are available.

CONTACT

Dr. Natalia Irma Deligne
Volcanic Hazard and Risk Modeller
GNS Science - Te Pu Ao
PO Box 30368
Lower Hutt 5040
New Zealand

Email: **N.Deligne@gns.cri.nz**
Tel: **+64 4 570 4129**
Fax: **+64 4 570 4600**

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