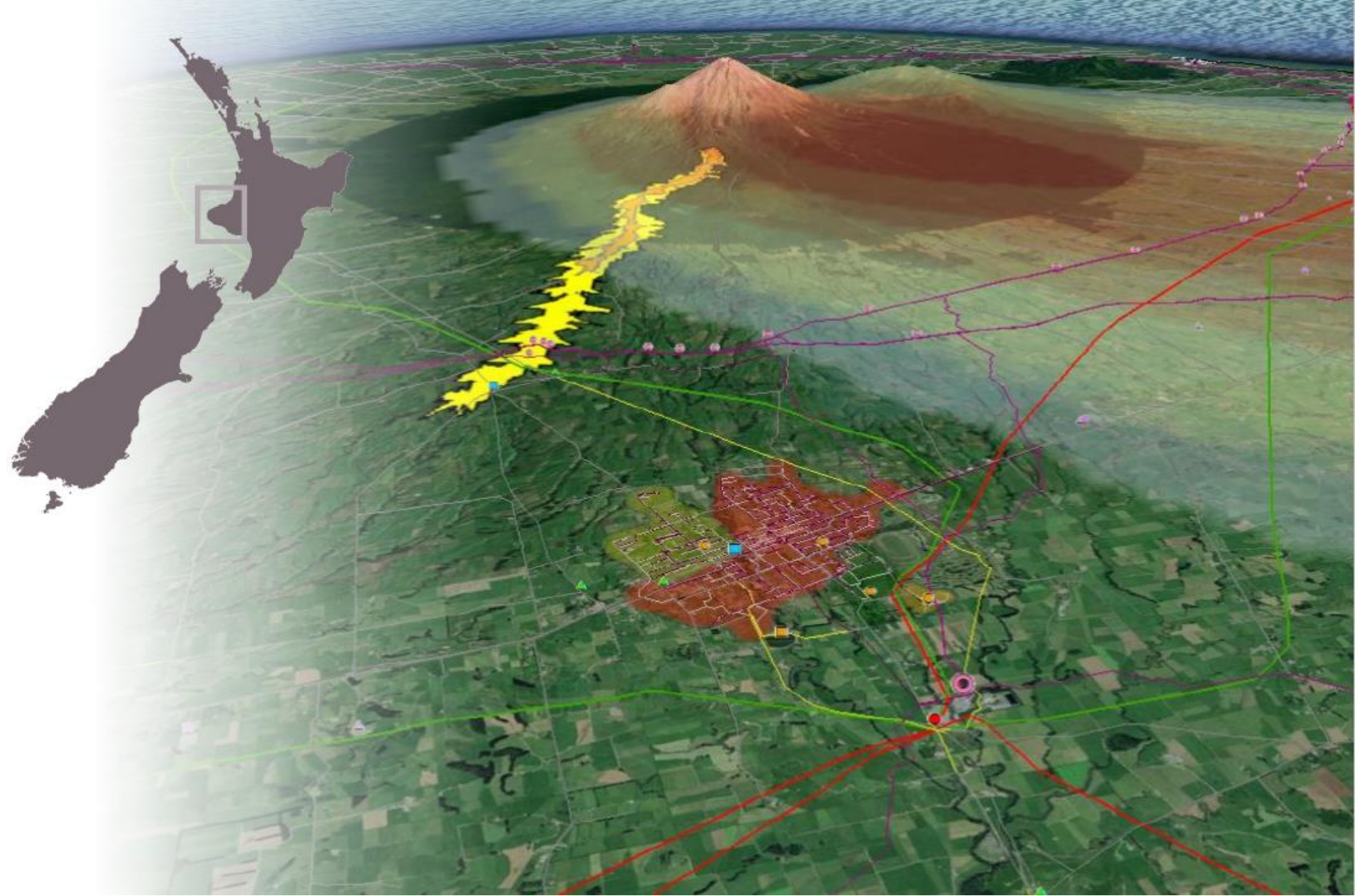


VOLCANO RISK MODELLING FOR DISTRIBUTED INFRASTRUCTURE SECTORS



ALANA WEBER

Infrastructure Research Day
22nd Nov 2022

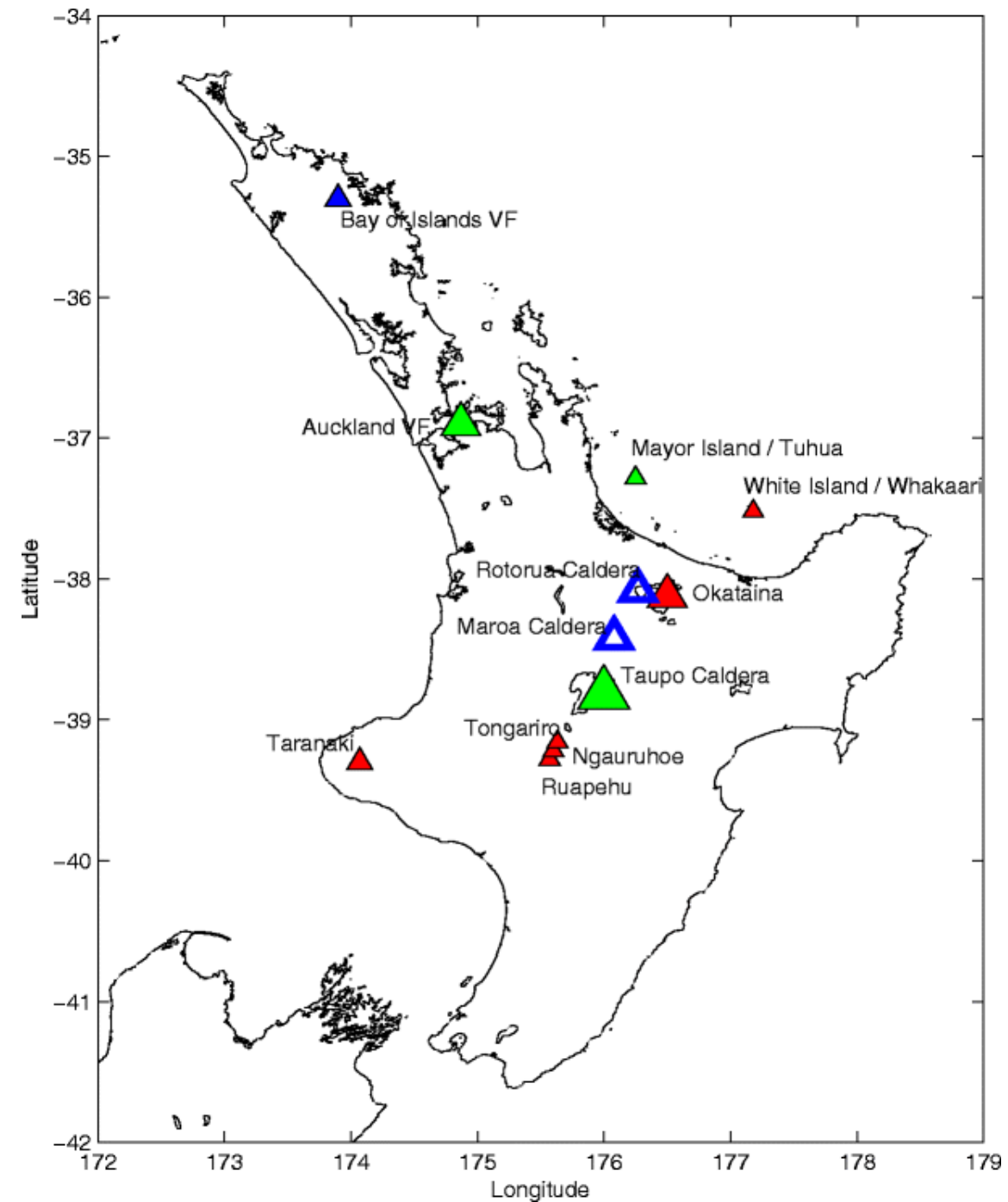
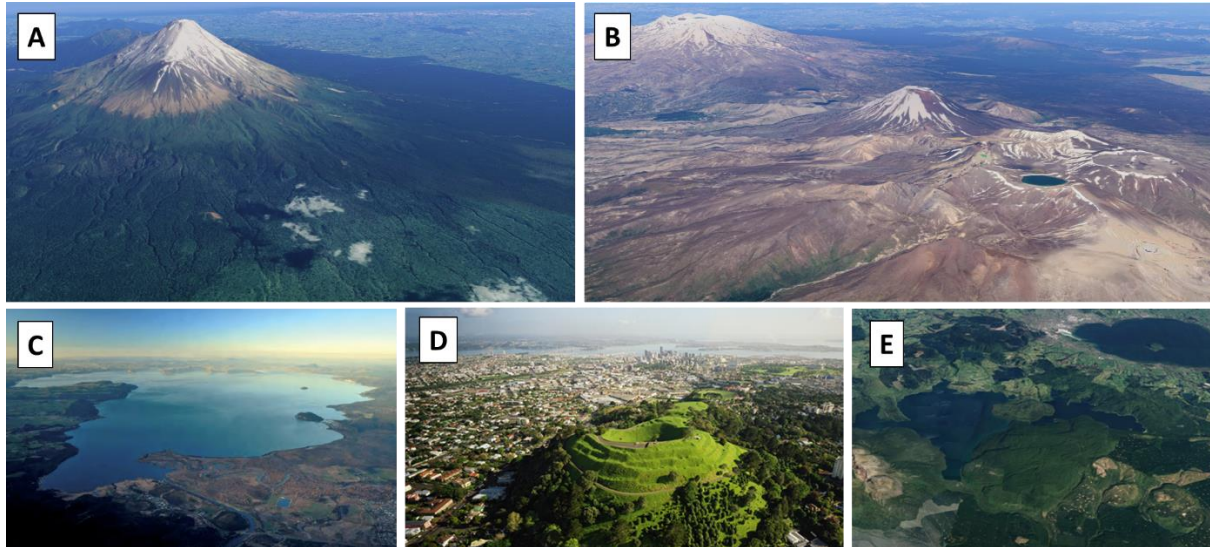


He Mounga Puia, Pūea Ru, Pūea Korero
volcanicfutures.co.nz



VOLCANIC LANDSCAPE

- NZ volcanoes – 3 main types:
 - Cones
 - Fields
 - Caldera
- All capable of different eruption sizes, style, durations and hazards

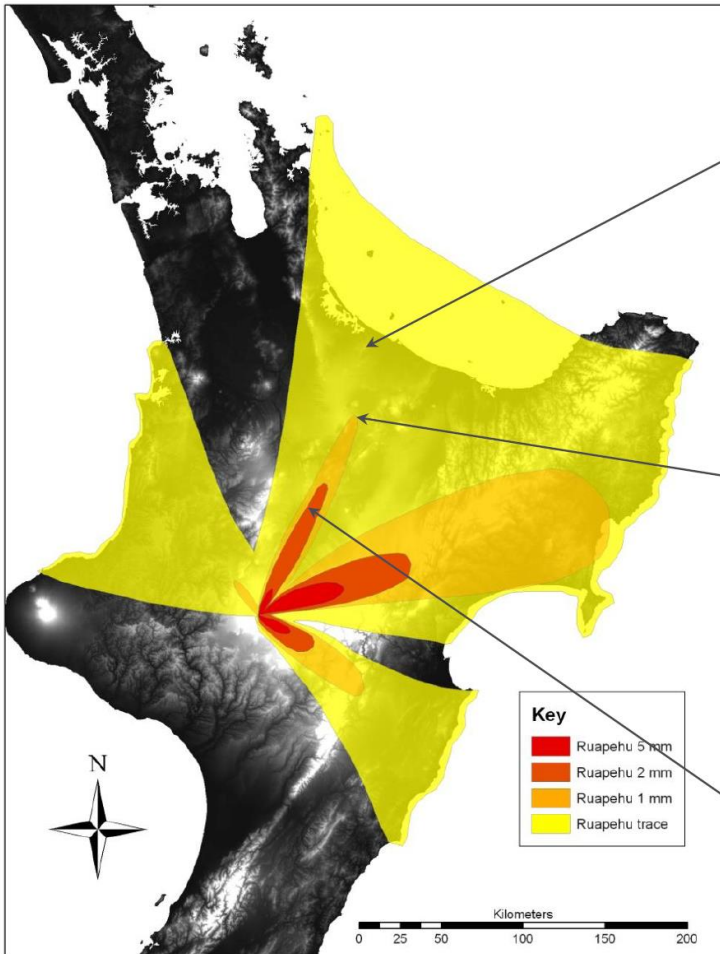


RECENT LIVED EXPERIENCE

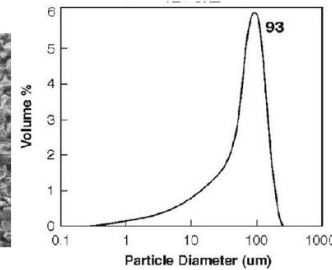
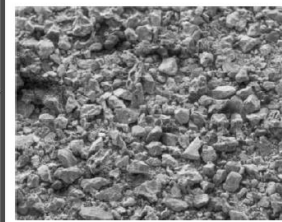
- Ruapehu
- Whakaari
- Te Maari

+ A wealth of knowledge and data from overseas experiences

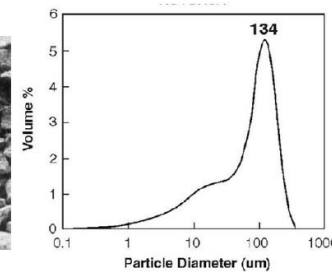
Copyright of Michael Schade



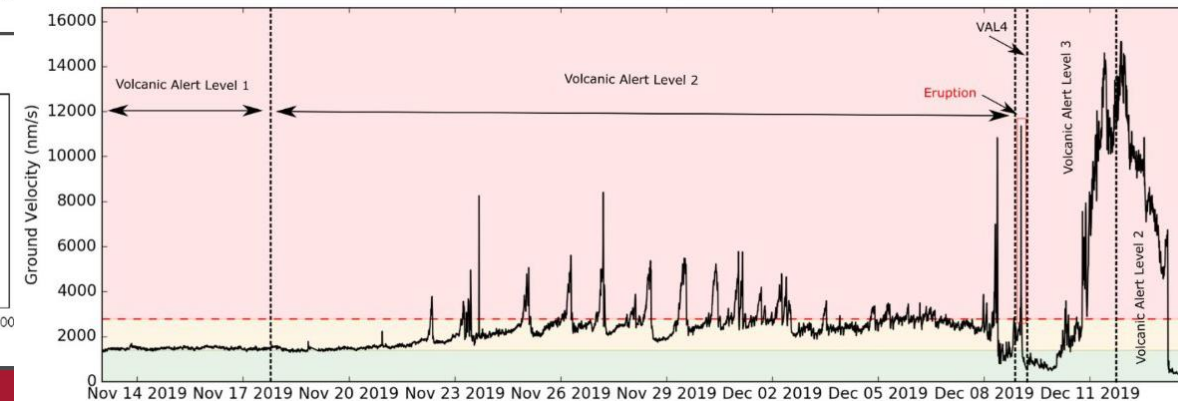
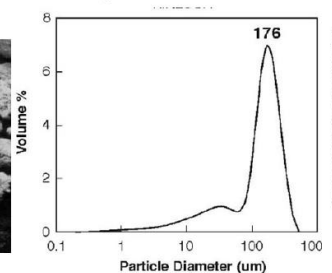
Te Puke: 179 km from Ruapehu



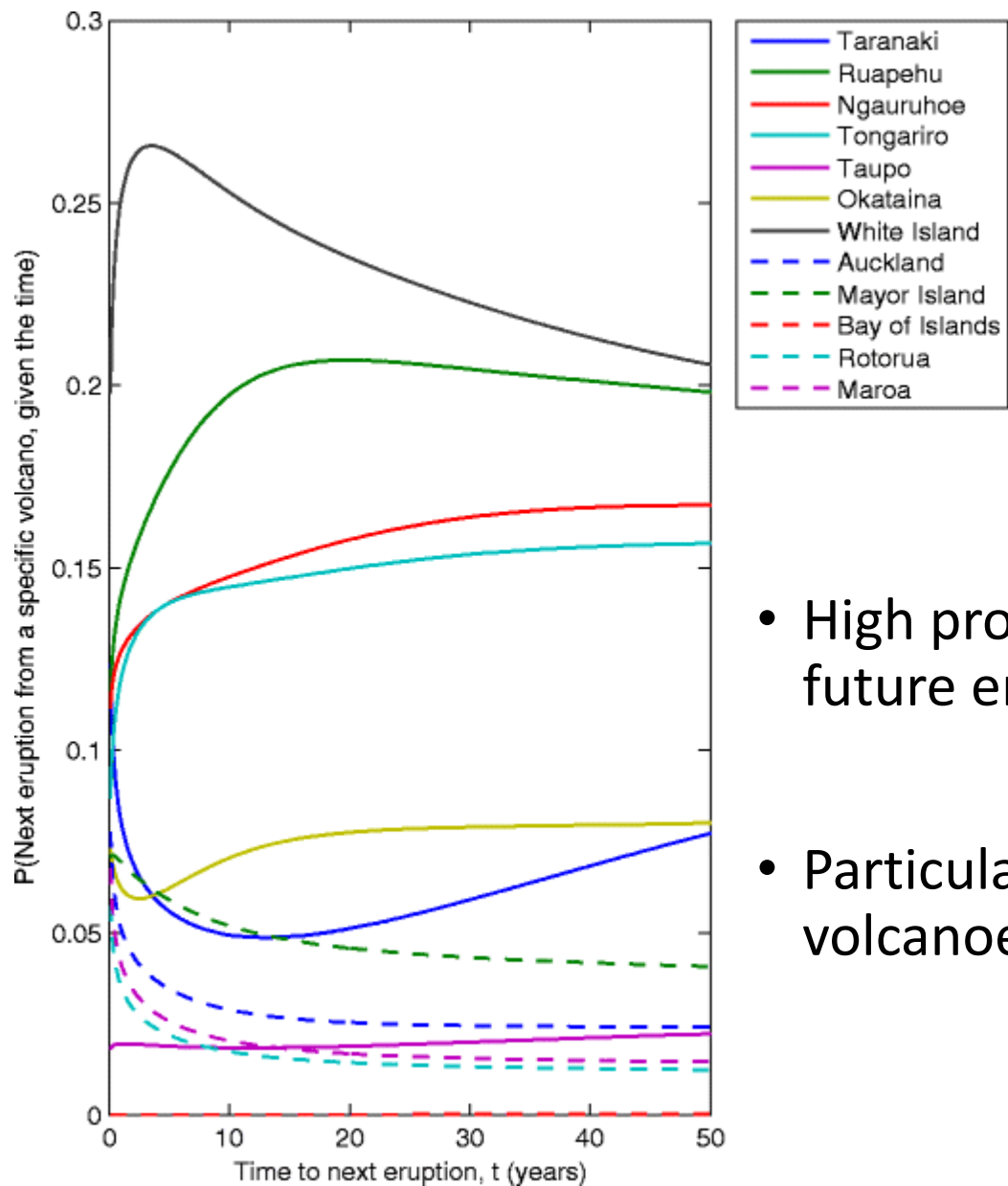
Rotorua: 140 km from Ruapehu



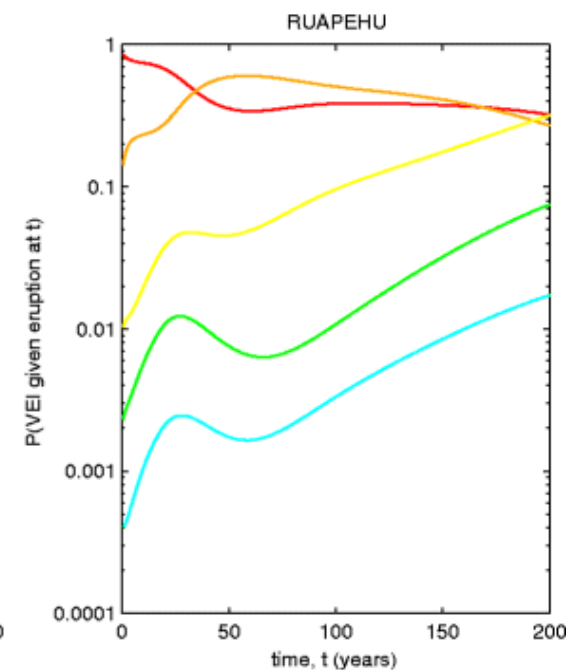
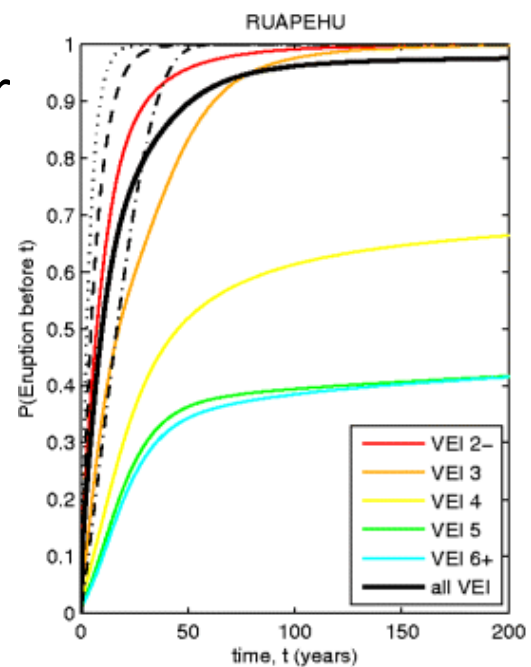
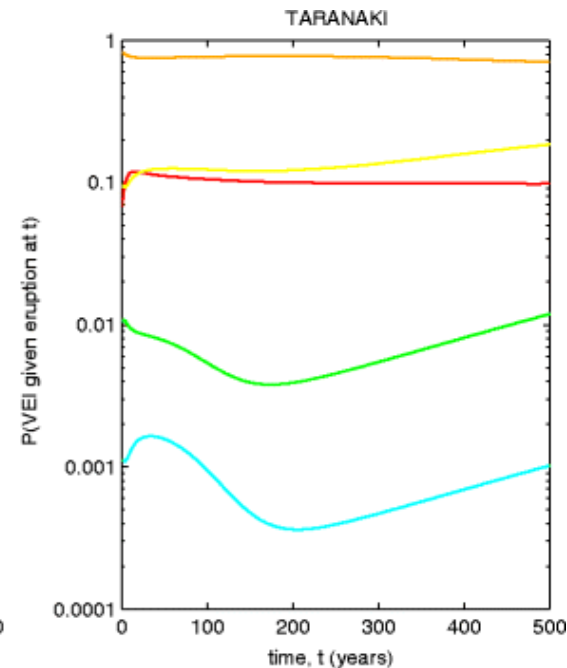
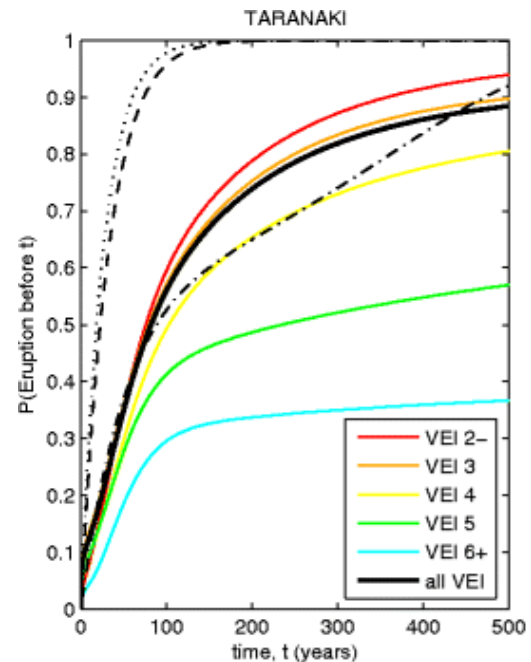
Kinloch: 75 km from Ruapehu



PROBABILITY OF ERUPTIONS



- High probabilities for future eruptions
- Particularly at cone volcanoes



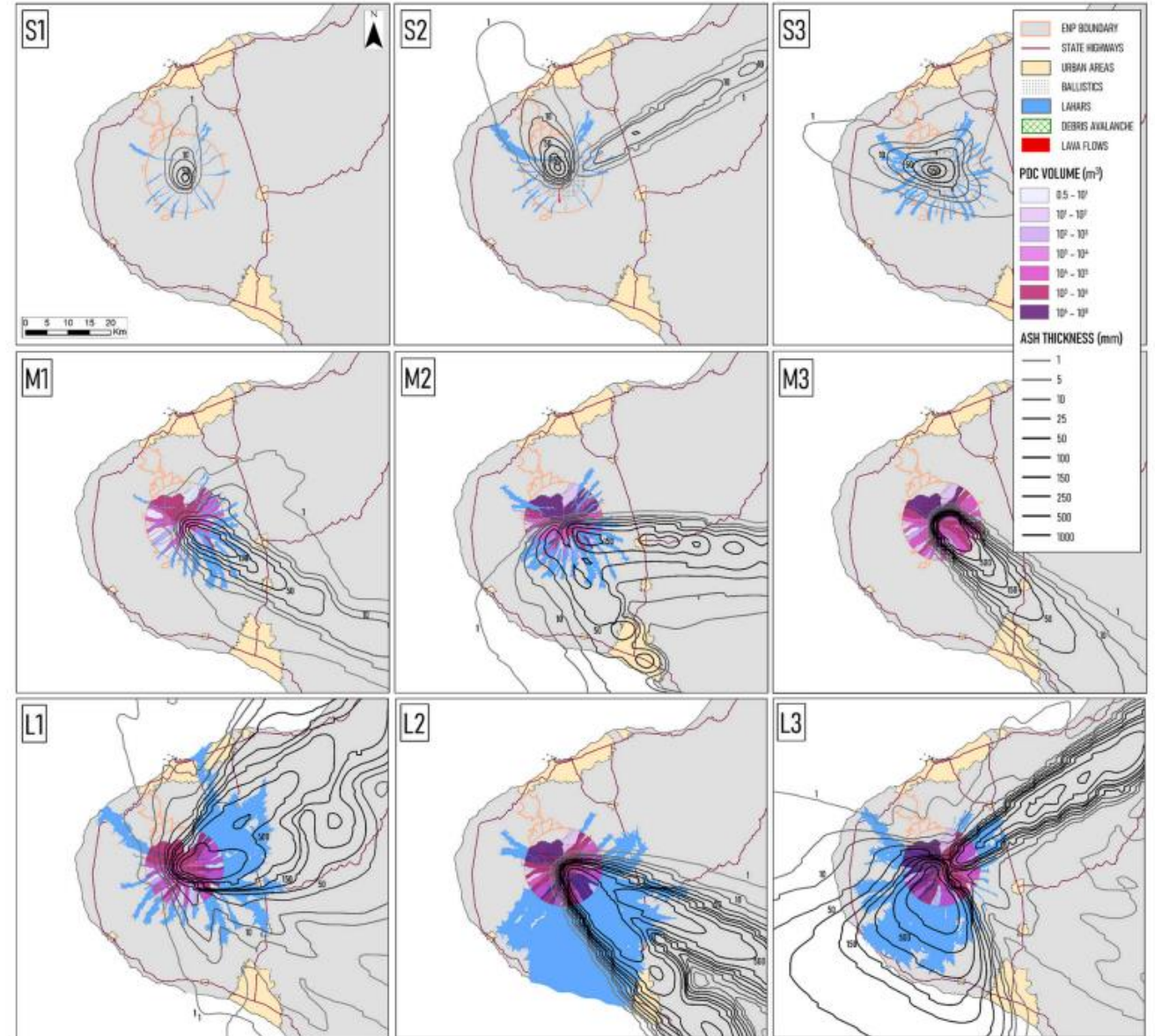
RECENT ADVANCES

- Over the last 5 years, NZ has been moving away from the traditional single-hazard, single-phase approach for volcanic hazard and impact assessment
- And addressing the end-user requirement for impact-led decision-support tools
- And recently, some strides have been made in volcanic probabilistic hazard and risk assessment



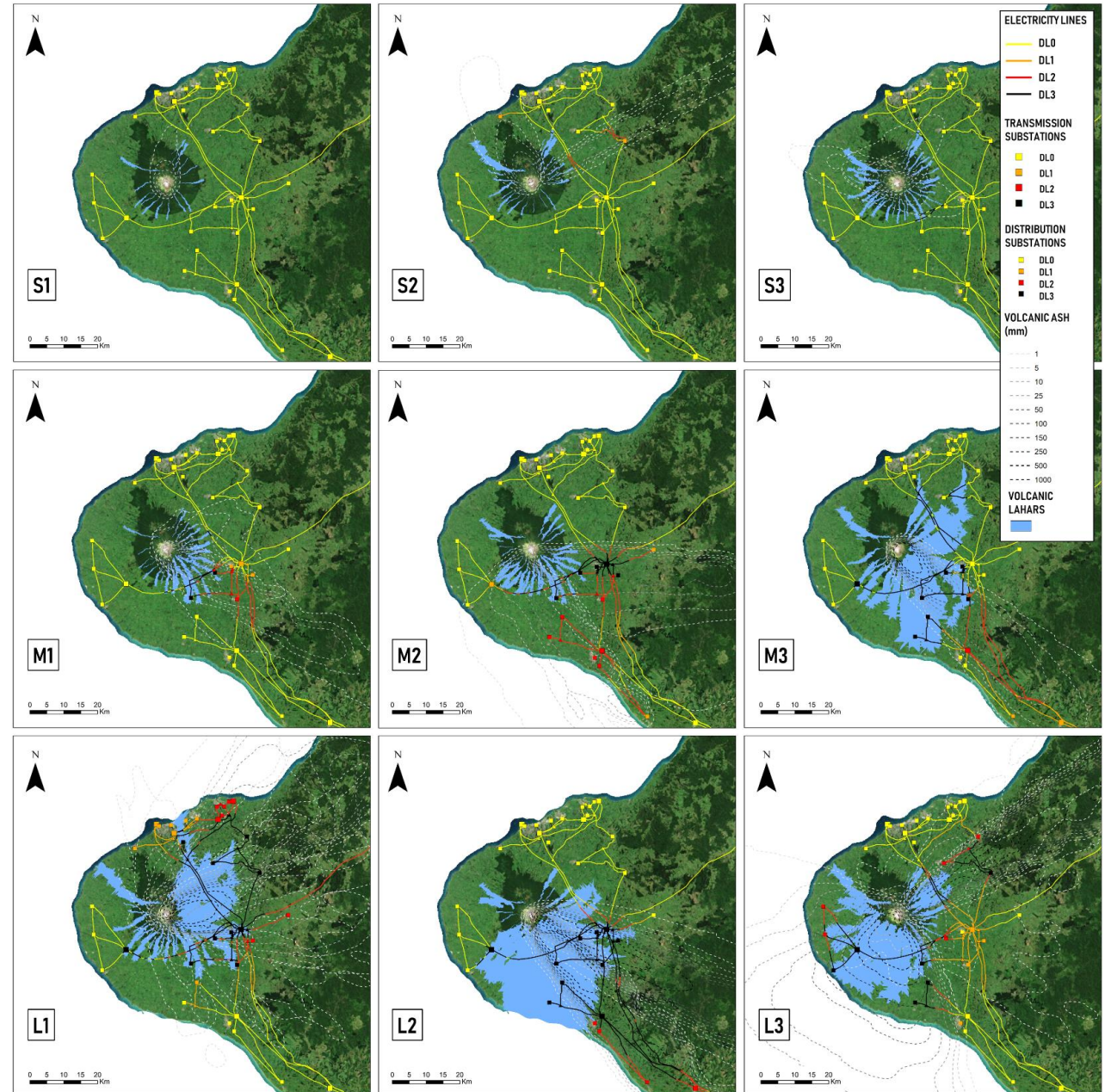
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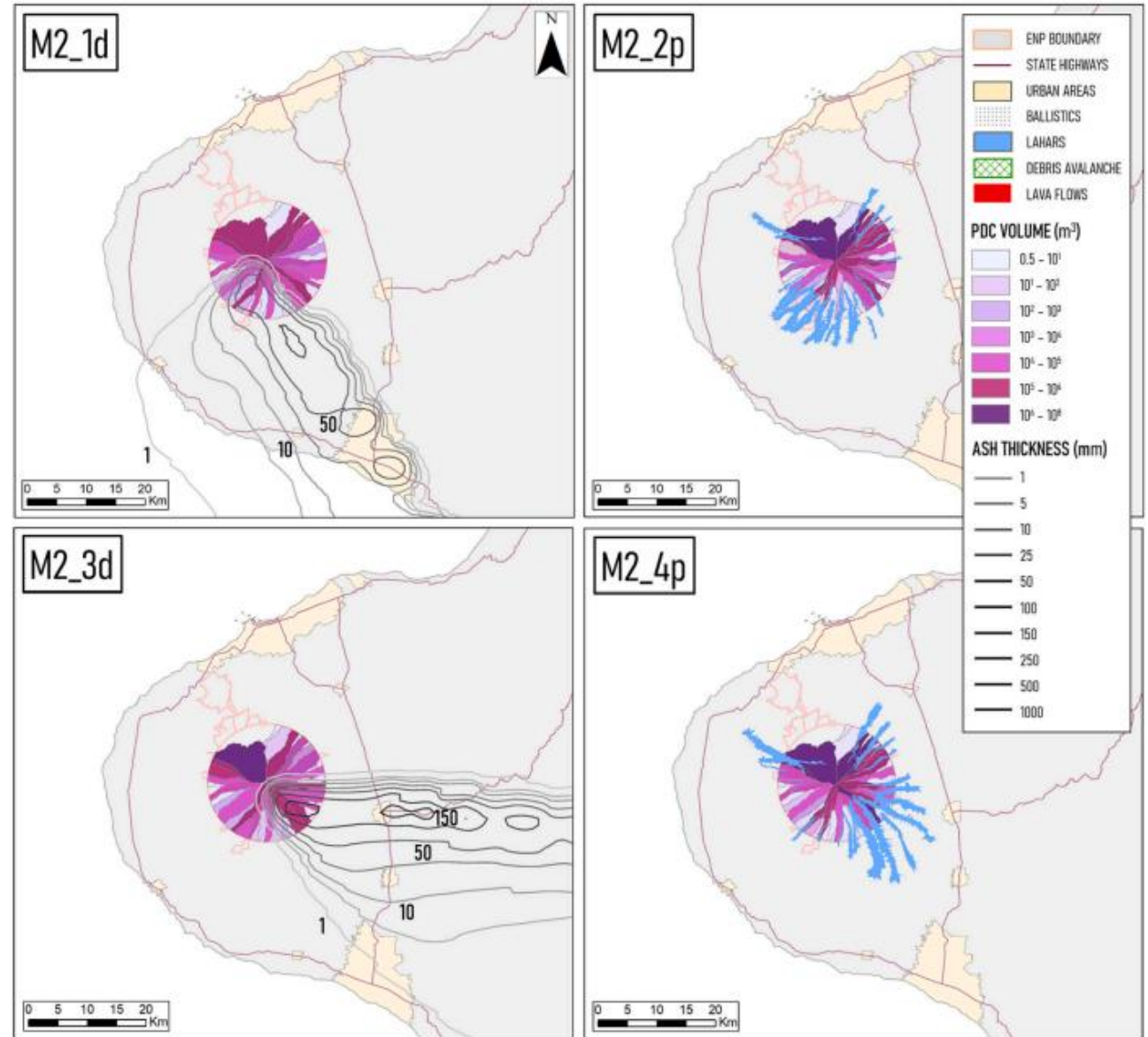
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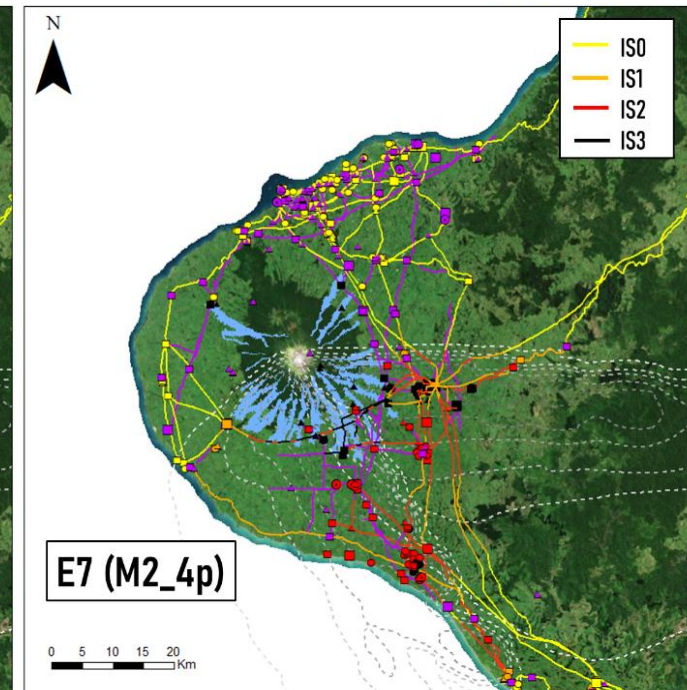
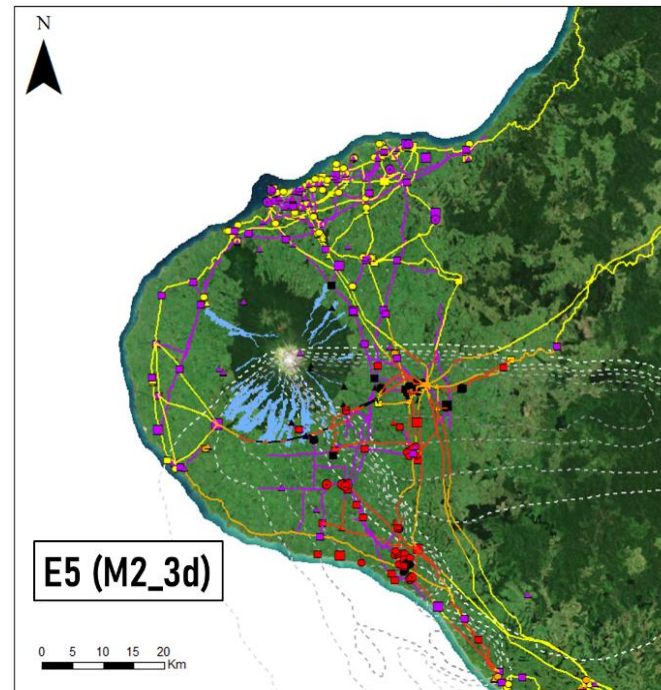
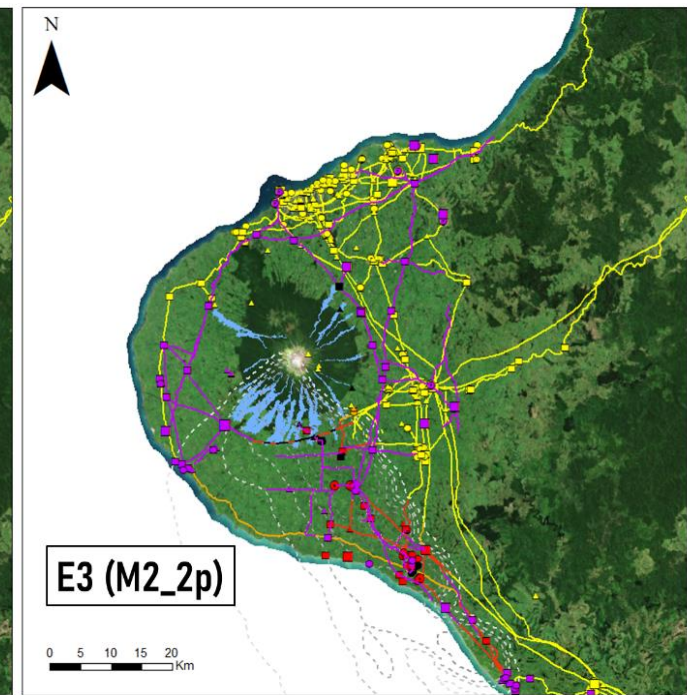
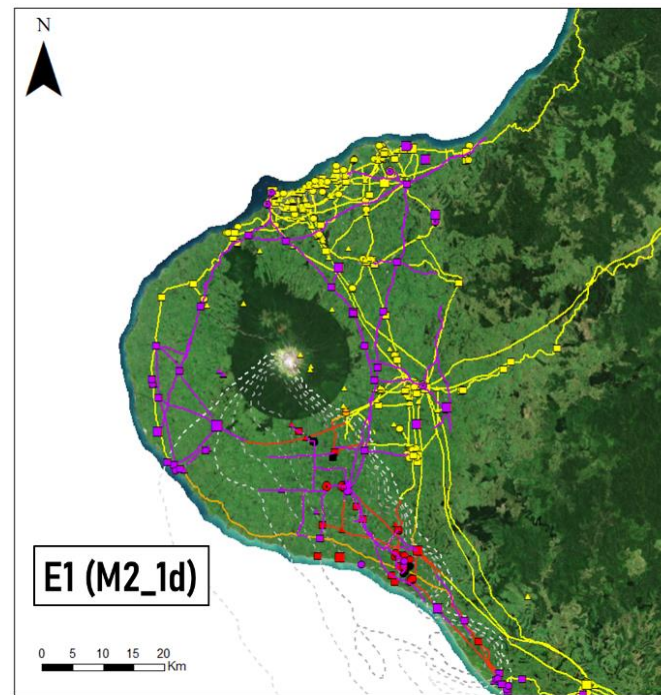
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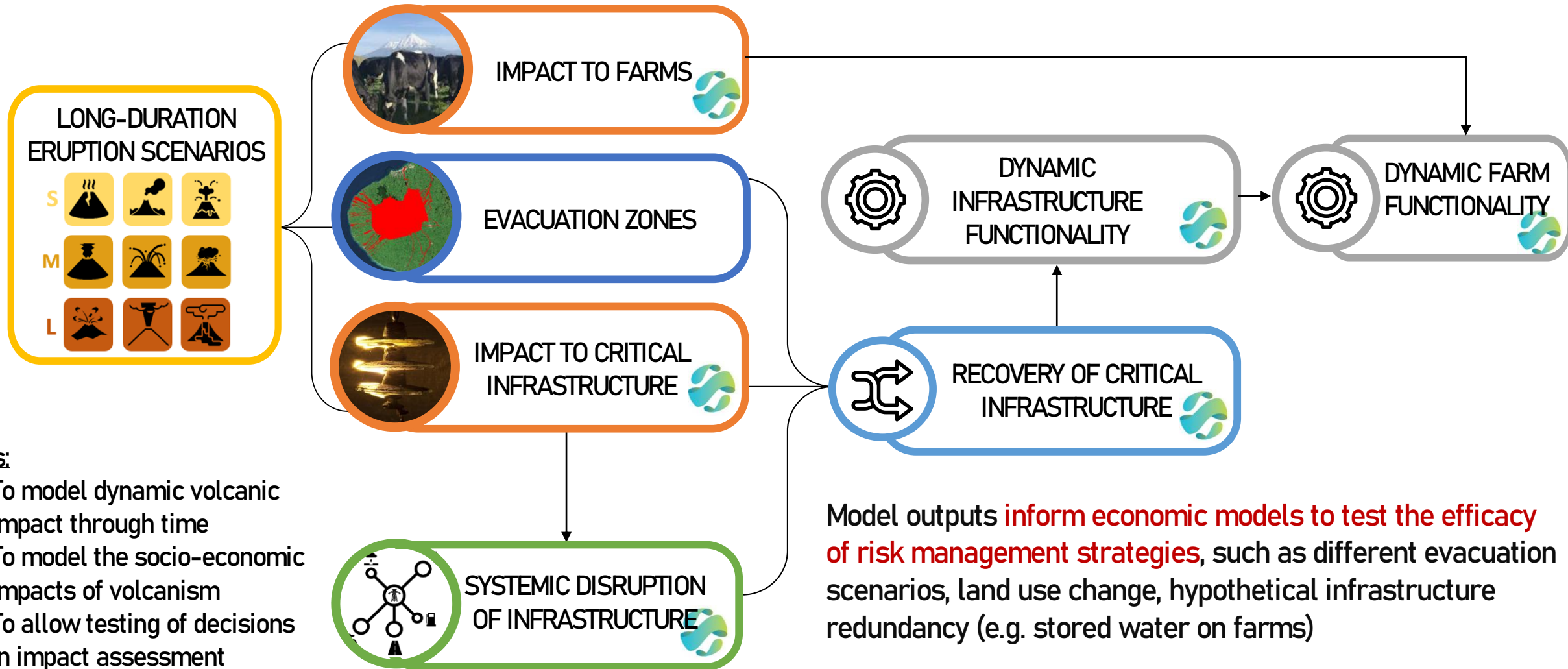
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Volcanic Risk Modelling

Dynamic modelling of impact and risk management strategies

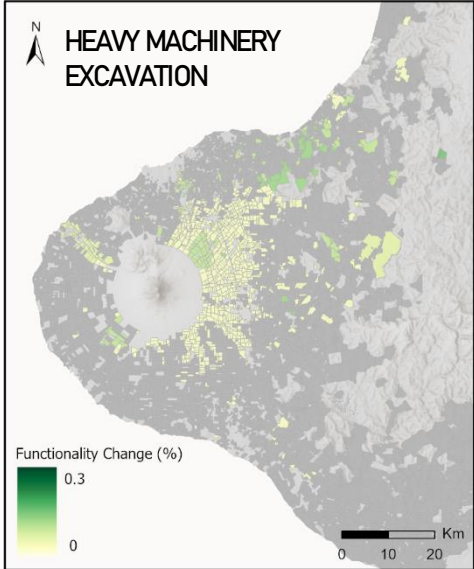
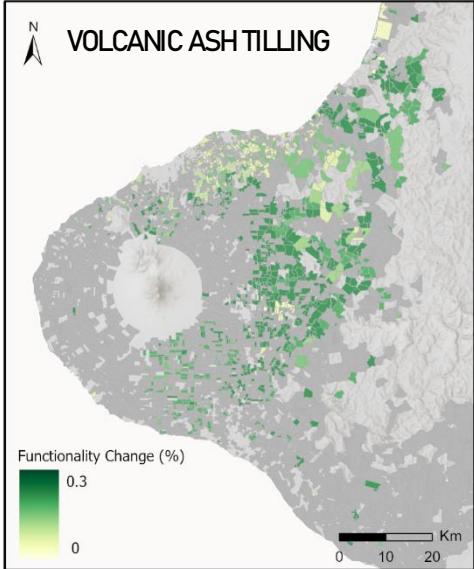
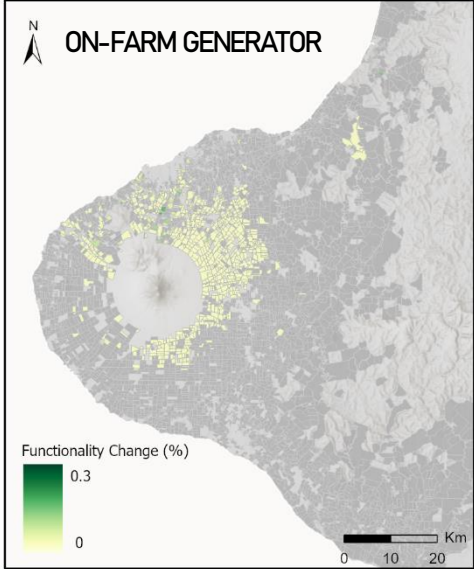
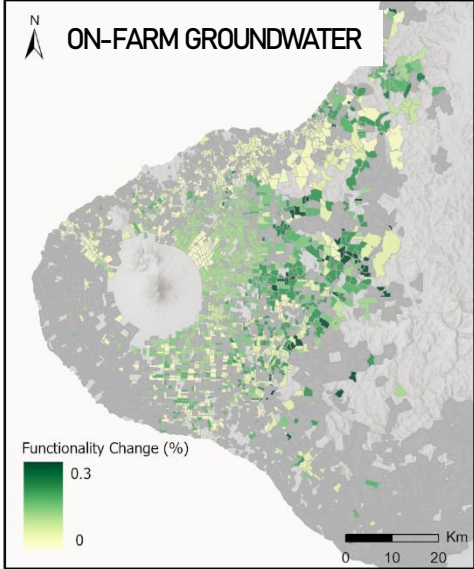


Aims:

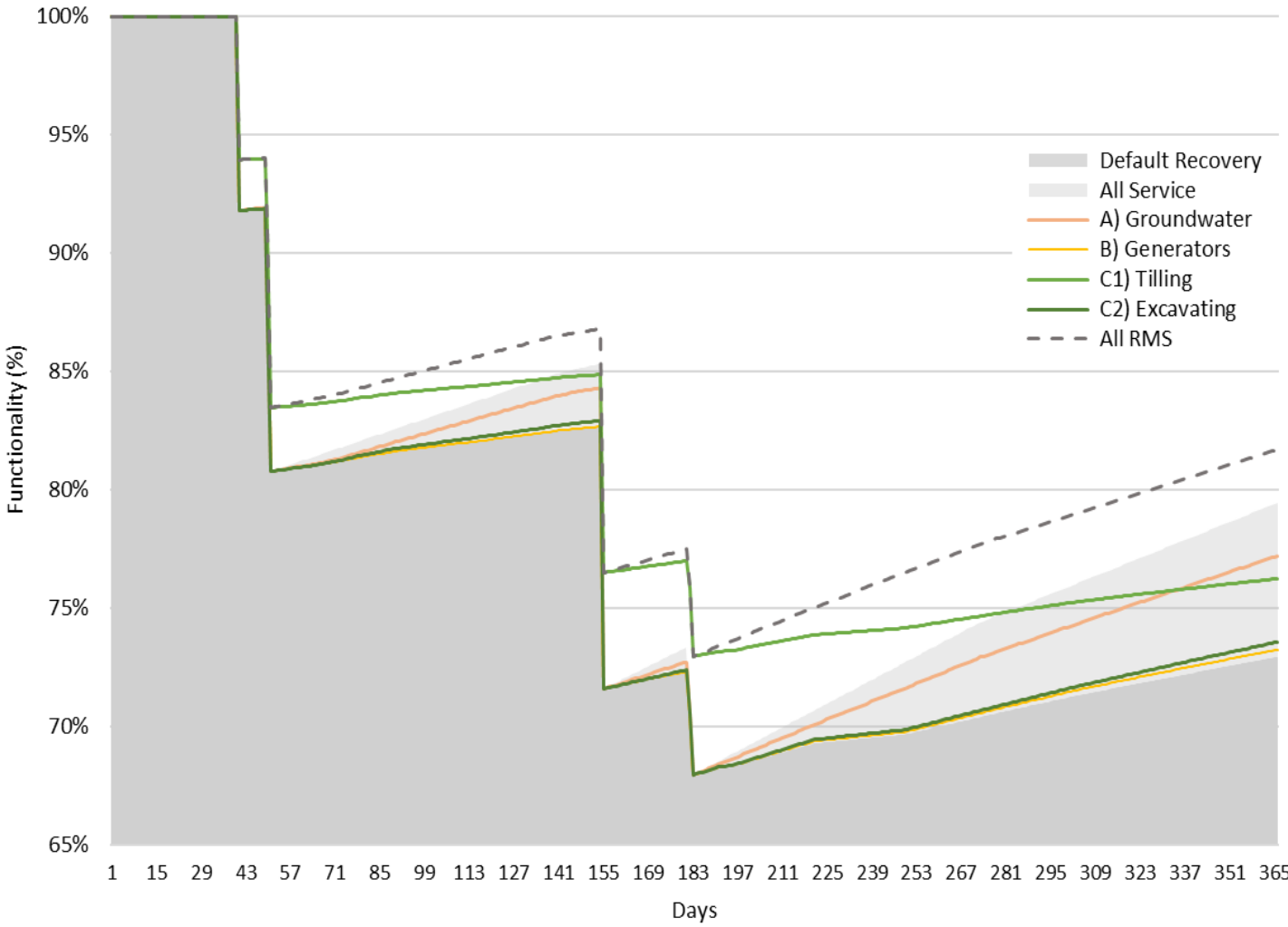
- To model dynamic volcanic impact through time
- To model the socio-economic impacts of volcanism
- To allow testing of decisions in impact assessment

Model outputs **inform economic models to test the efficacy of risk management strategies**, such as different evacuation scenarios, land use change, hypothetical infrastructure redundancy (e.g. stored water on farms)

Building a Holistic Picture of Farm Impact and Recovery During and After Eruptions

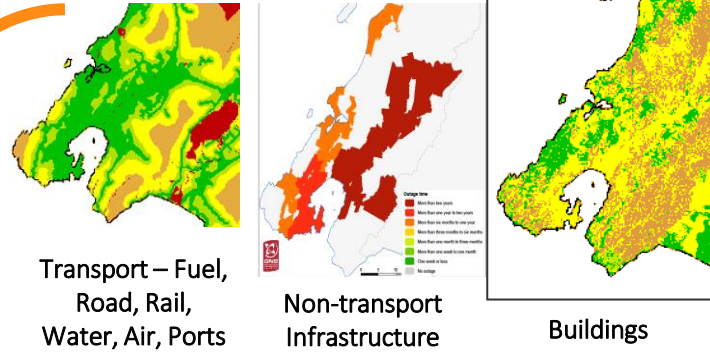


Testing Risk Management Strategies



MERIT Overview

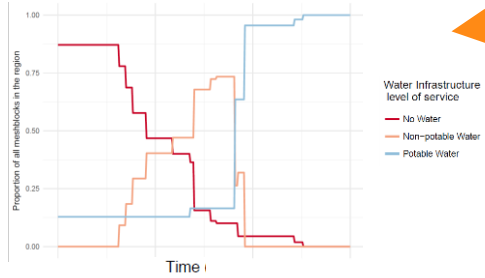
Direct Impact Maps (including interdependencies)



Event Occurs - Building and Infrastructure Damage



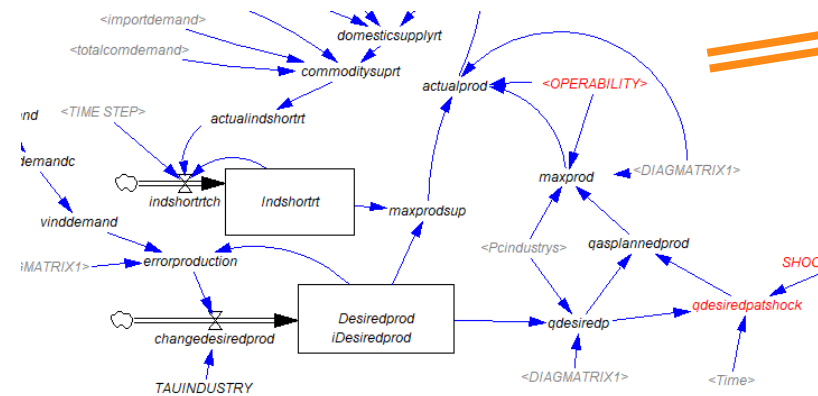
Infrastructure Recovery through time



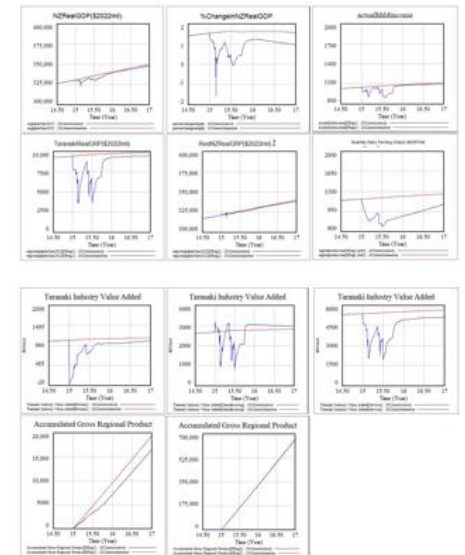
Direct Tourism impacts



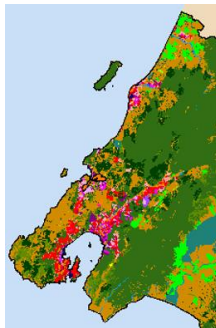
Flow on Wider Economic Impacts using the Dynamic Economic Model



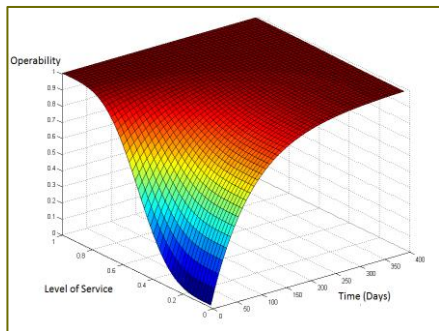
Results through time for Region, NZ – GRP, Income etc by industry



People & Business Relocation

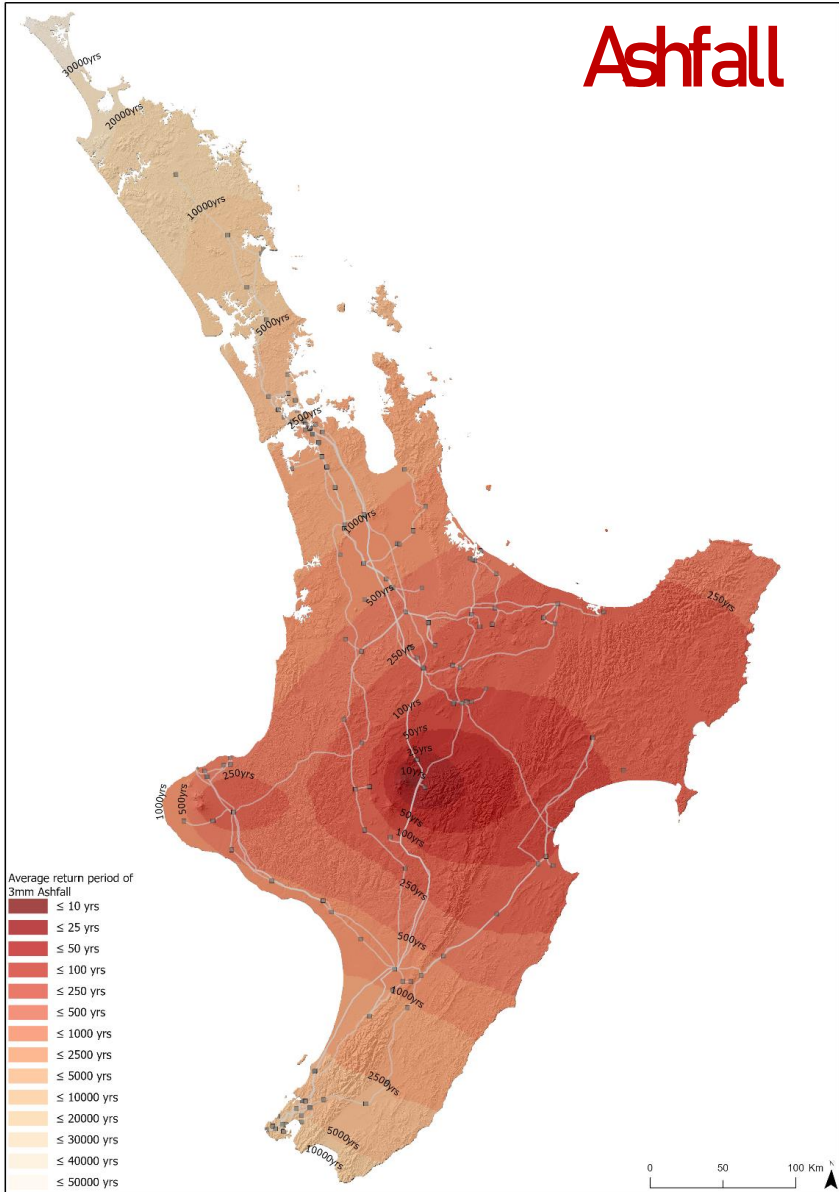


Business Operation

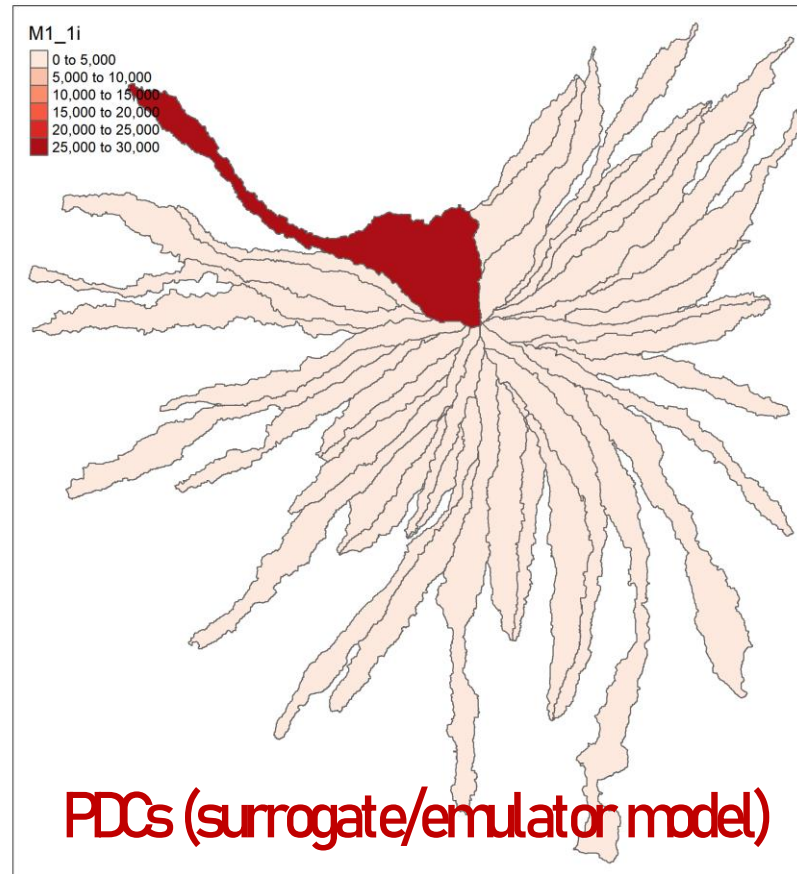


Moving towards probabilistic modelling (where appropriate)

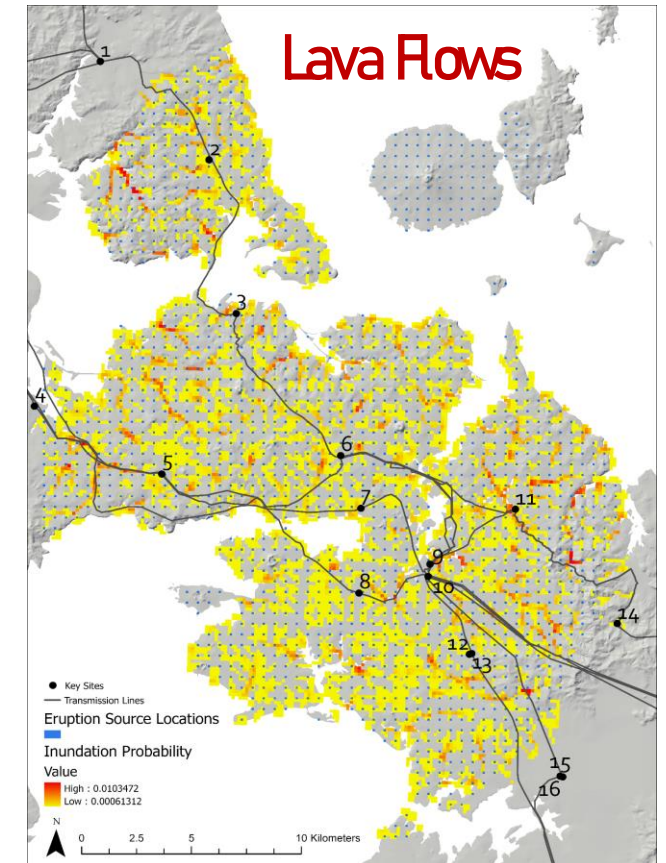
Ashfall



Lahars??

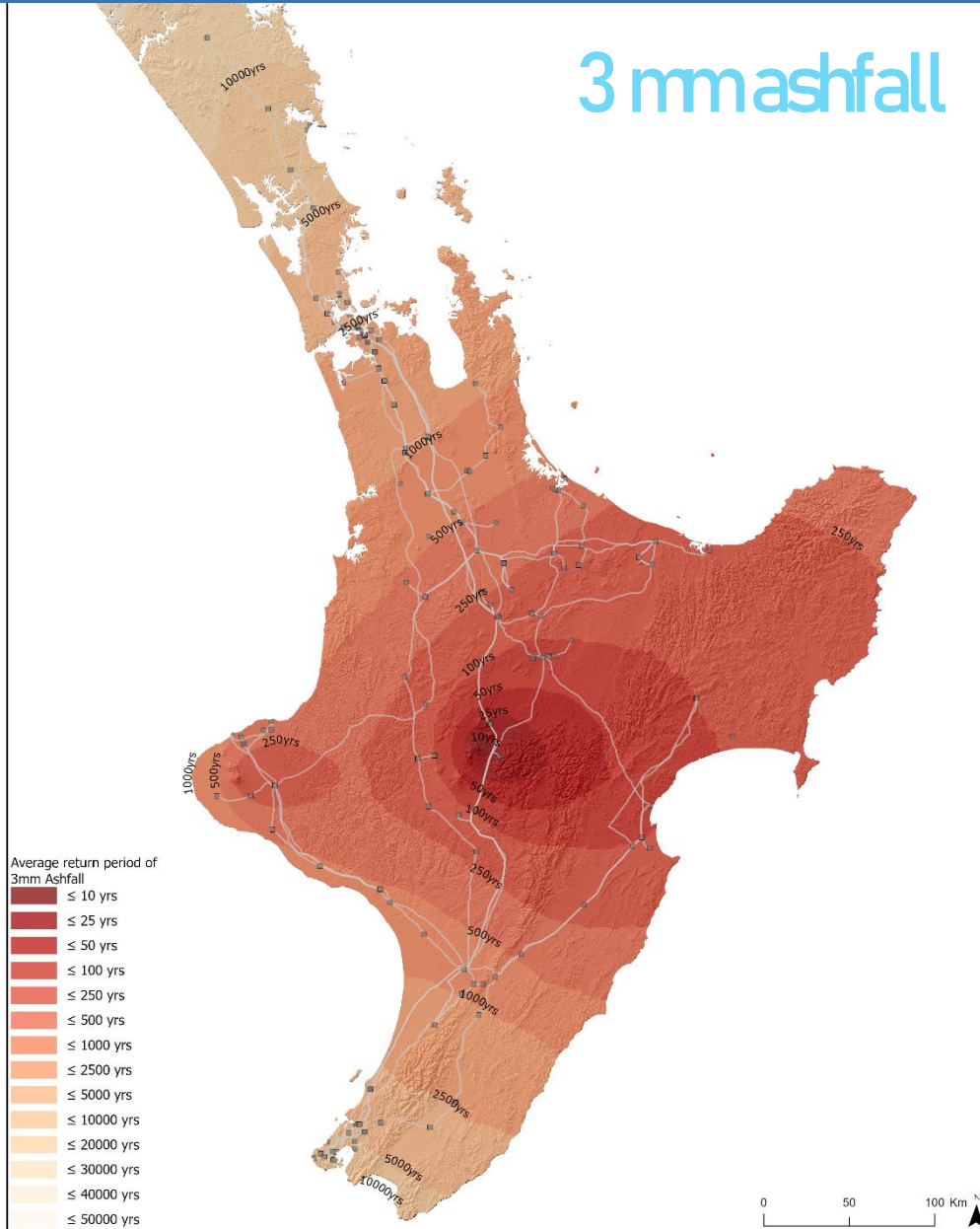


Lava Flows

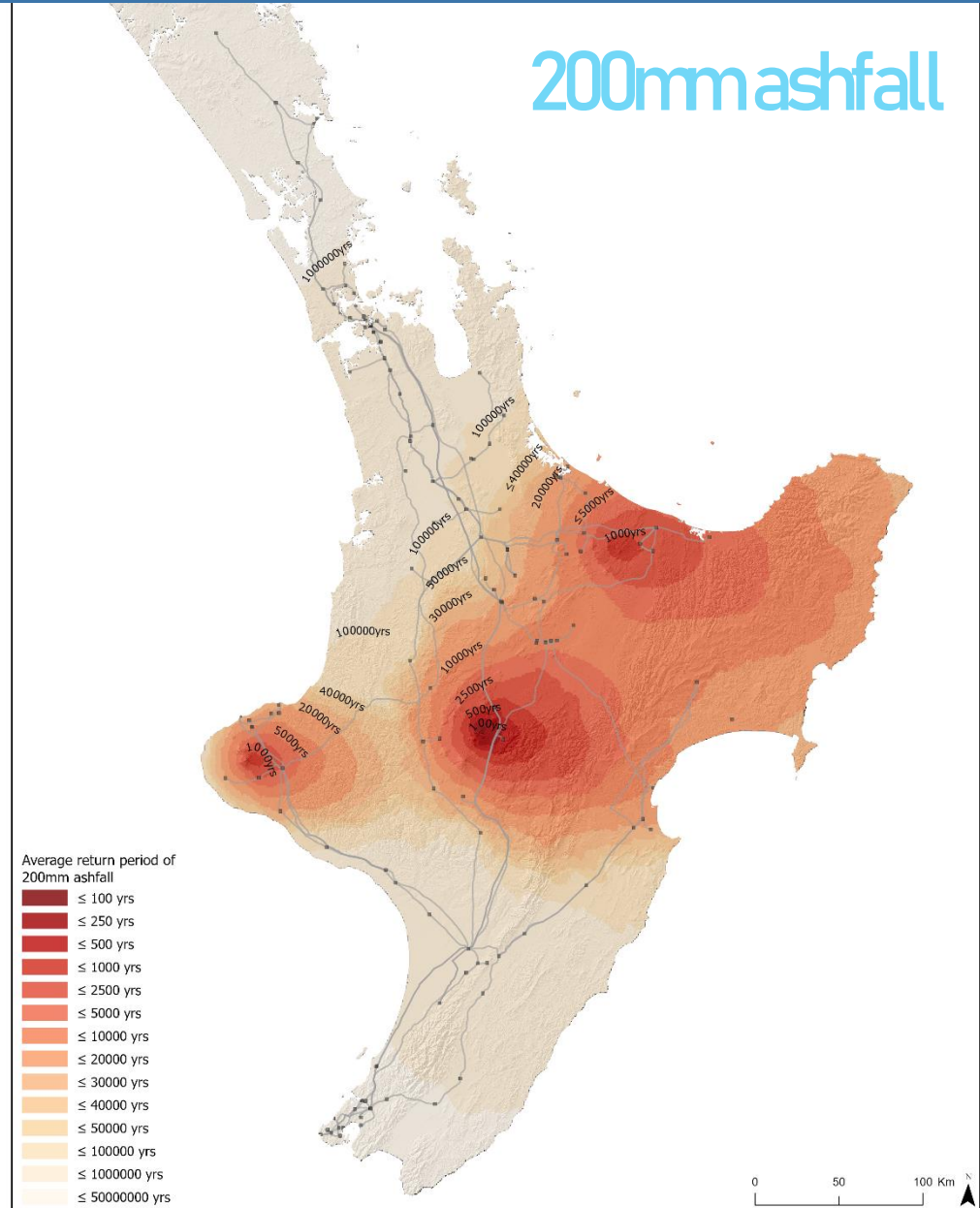


HAZARD: Probabilistic Ashfall Hazard (all volcano sources)

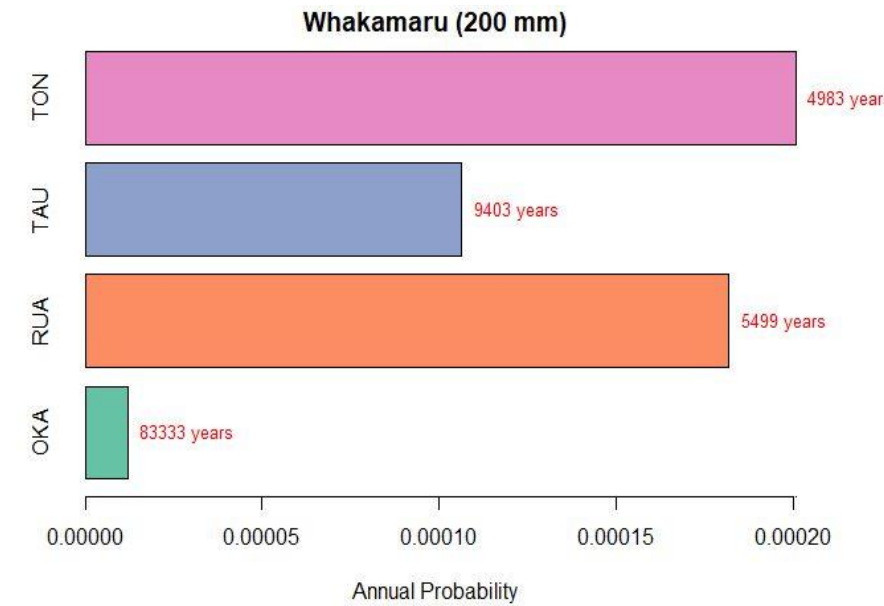
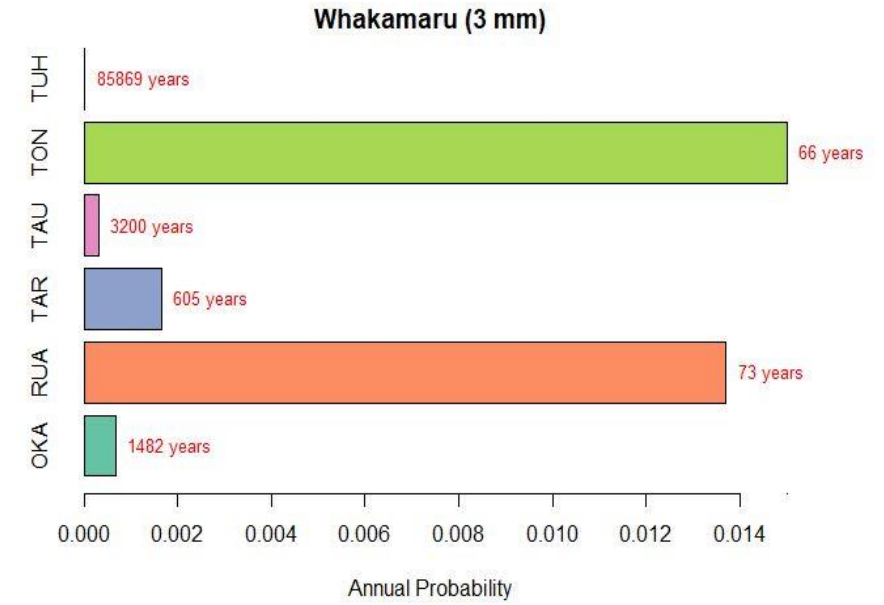
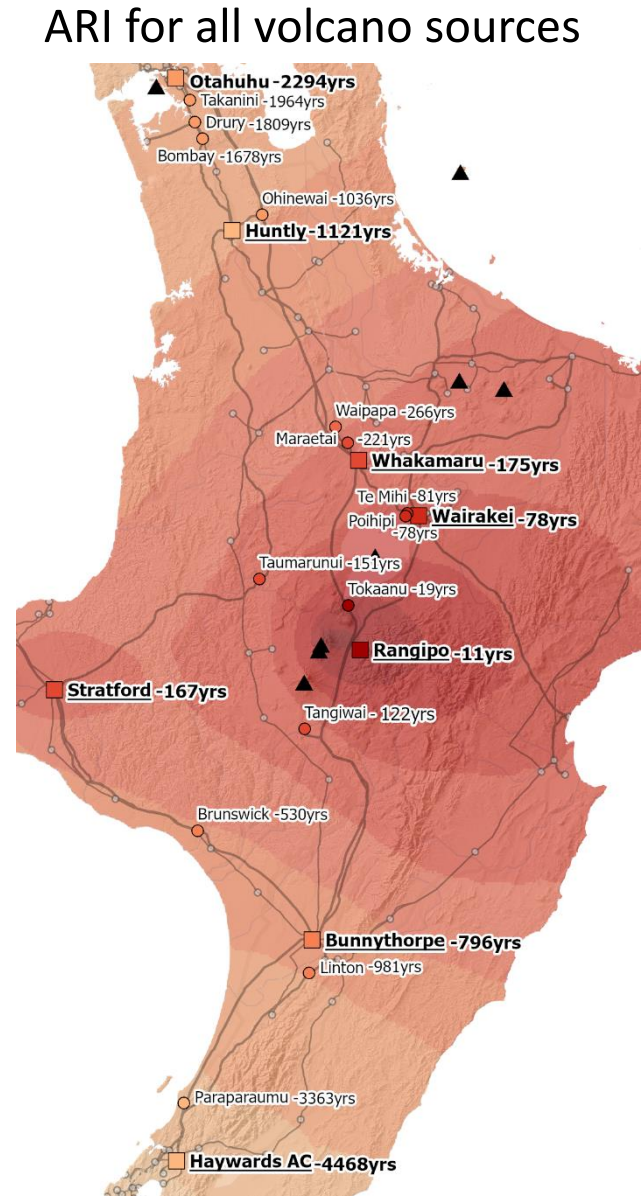
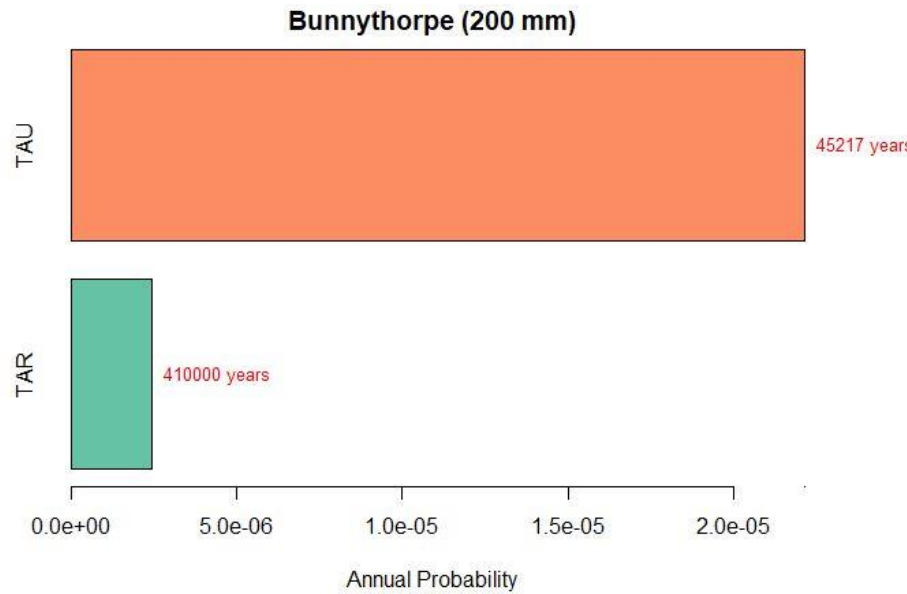
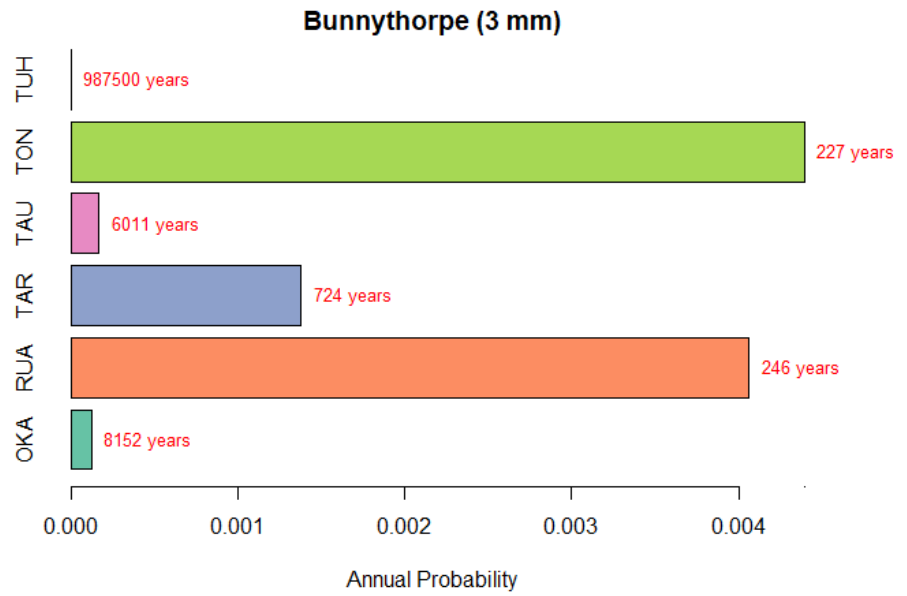
3 mm ashfall



200mm ashfall

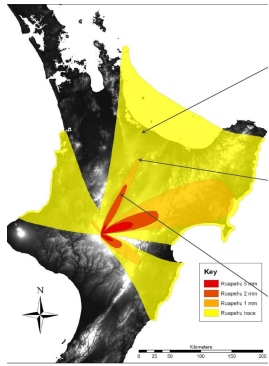


Probability of hazard threshold at key stations, by volcano

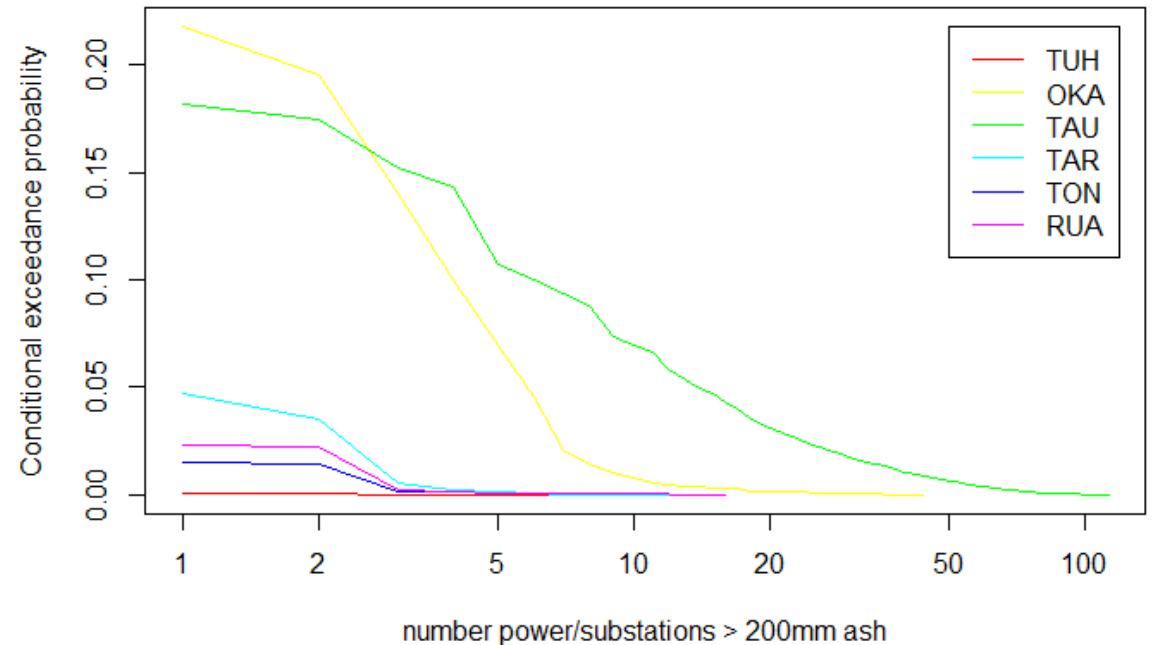
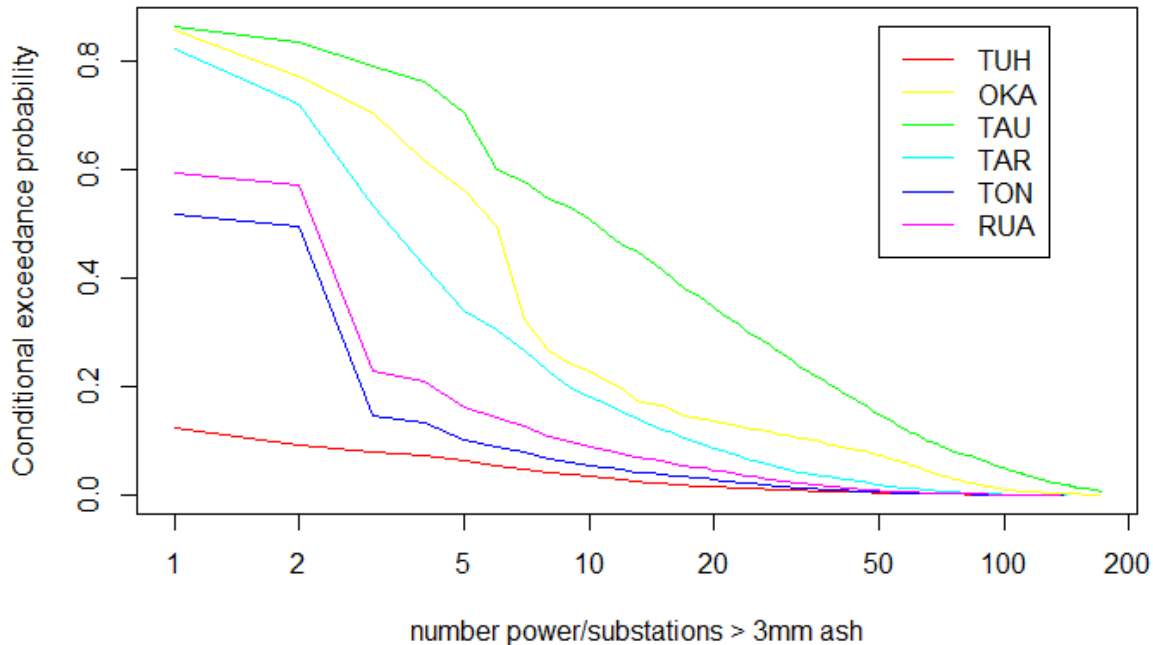


HAZARD EXPOSURE

If volcano erupts, this is the probability of 'n' stations exposed to 'x' hazard threshold (ashfall) being exceeded



#remember, this model is made up of 10,000's of ashfall models, varying eruption size/styles & wind conditions



Catalysing a national volcanic hazard and risk model for Aotearoa New Zealand

Josh Hayes, James Williams, Graham Leonard, Thomas Wilson, Rebecca Fitzgerald, Christina Magill, Mark Bebbington, Stuart Mead, Jan Lindsay, Alana Weir, Rodrigo Calderon

DEVORA
EQC and Auckland Council
\$4.7 million
2008 - 2023



RNC-MRM
Including RNC-Rural, RNC-Weather and RNC-Infrastructure
MBIE National Science Challenge
\$5.5 million
2019 - 2024



Beneath the Waves
MBIE Endeavour
\$13.3 million
2021 - 2026



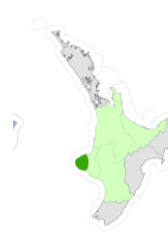
Transitioning Taranaki to a Volcanic Future
MBIE Endeavour
\$13.6 million
2019 - 2024



RNC-Volcano
MBIE National Science Challenge
\$4 million
2019 - 2024



RNC-Rural
MBIE National Science Challenge
\$2.5 million
2019 - 2024



GNS Science
MBIE Strategic Science Investment Fund
\$2 million/yr

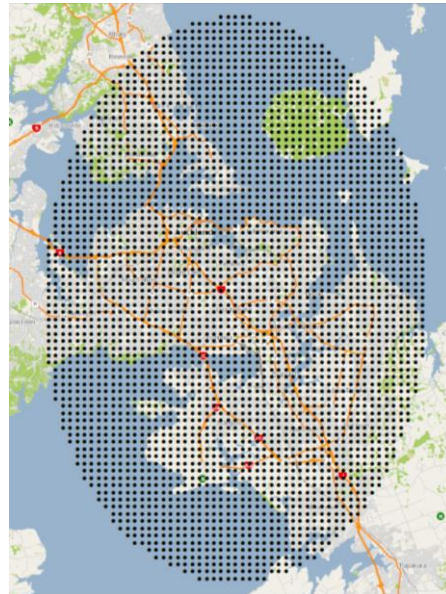


ECLIPSE
MBIE Endeavour
\$8.2 million
2017 - 2022



Probabilistic loss for AVF

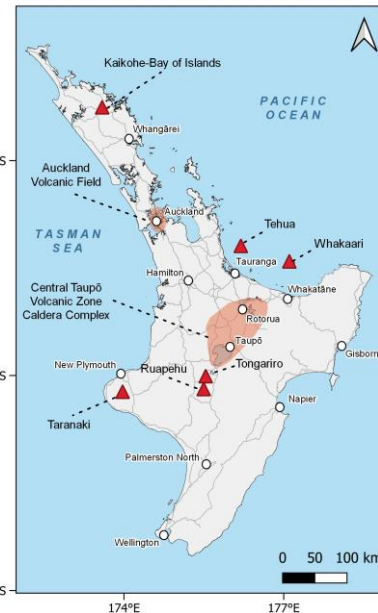
- Develop a **framework and methodology** for **probabilistic** assessment of AVF hazard and impact to the **built** environment.
- Produce probabilistic **impact and loss outputs** for the AVF, **relevant** for EQC and other key stakeholders.



Led by James Williams (UC)

Scoping and designing a national framework

- Scope** the application of **probabilistic loss** to **Taranaki, Tongariro National Park, and Central Taupo Volcanic Zone**, and provide **recommendations** for next steps.
- Develop a NZ volcanic Hazard and Risk Model **framework** across **DEVORA, ECLIPSE, SSIF, RNC2, TTVF, and BTW**.
- Support **consistent inclusion** of hazard models from each programme to **RiskScape**.
- Trial loss and impact** calculations for at least one scenario at Taranaki, TNP, and a caldera to **demonstrate and test consistency** of the NZVHRM framework.

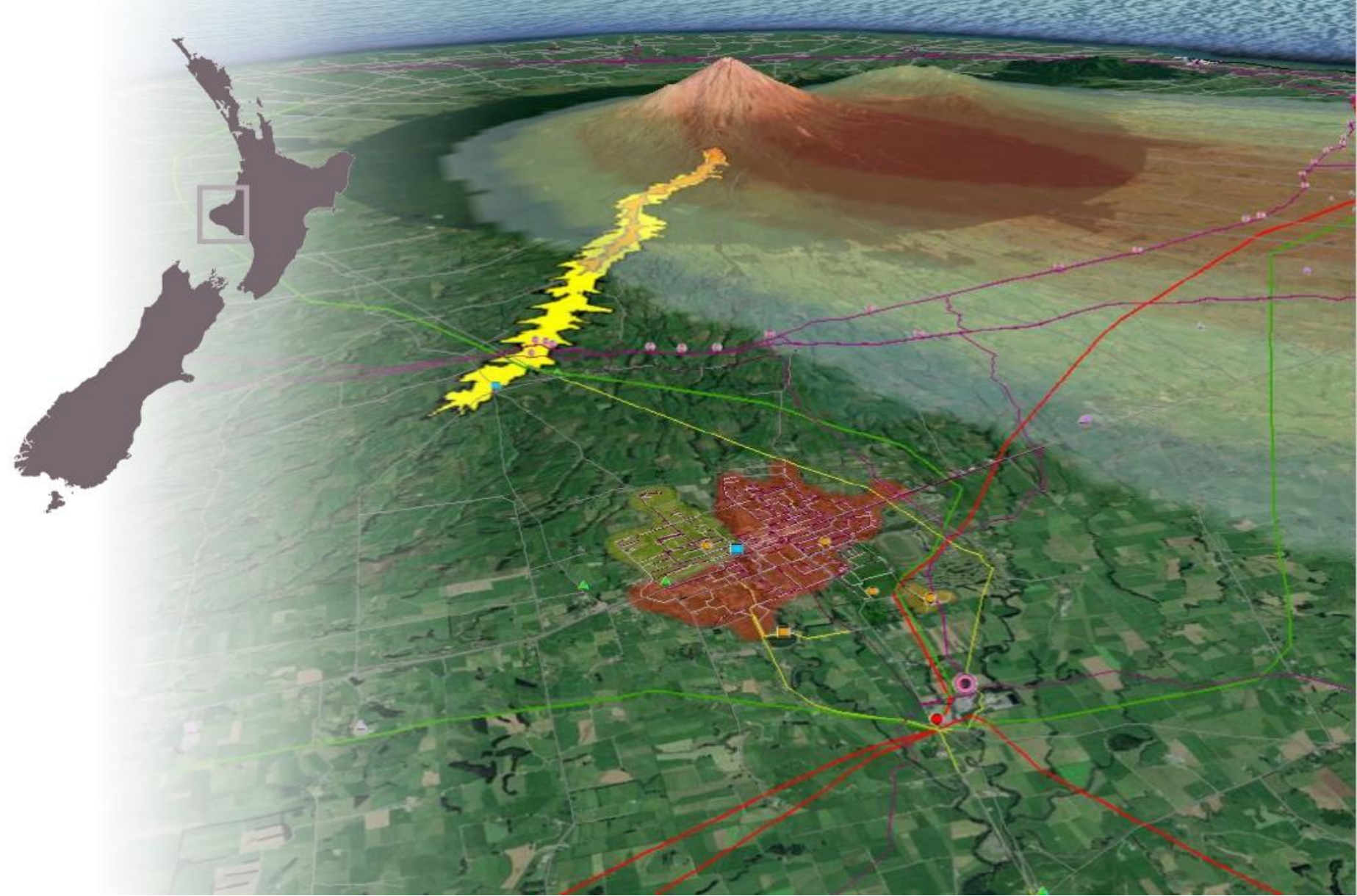


Led by Josh Hayes (GNS)

Knowledge gaps and opportunities

- National Volcanic Hazard and Risk Model – early stages, national focus
 - Ruapehu eruption and impact scenario suite development
- Upcoming..
 - Update of H&S in volcanic environments report
 - Volcanic ashfall impact poster for telecommunications
- Key research gaps:
 - Understanding volcanic evacuation management (and implications for infrastructure managers; MSc scoping project underway)
 - Infrastructure recovery modelling for volcanic multi-hazards (project underway)
 - Volcanic waste clean-up (MSc scoping project underway)
 - Probabilistic lahar modelling
 - Risk management strategies for infrastructure sectors

VOLCANO RISK MODELLING FOR DISTRIBUTED INFRASTRUCTURE SECTORS



Thanks!



He Mounga Puia, Pūea Ru, Pūea Kōrero
volcanicfutures.co.nz

