



CLEAN-UP AND RESTORATION OF URBAN ENVIRONMENTS AFTER VOLCANIC ERUPTIONS

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OVERVIEW

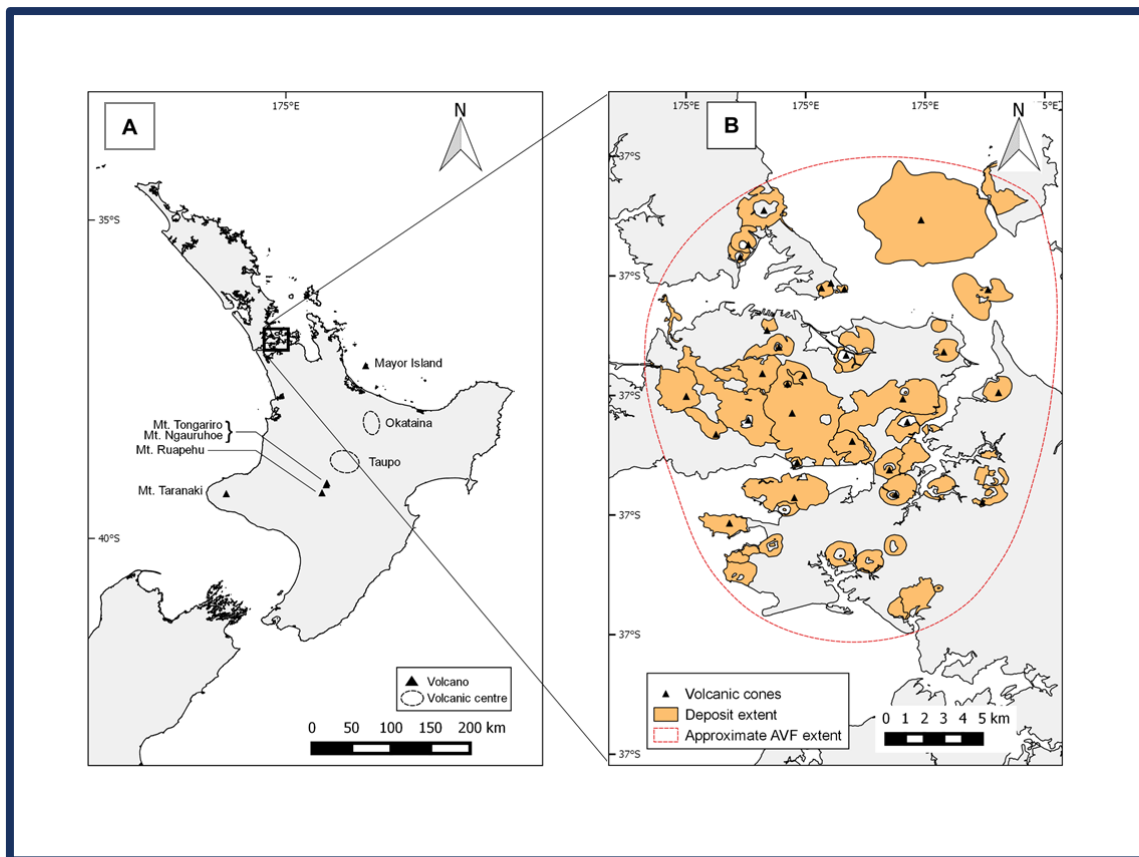


- Background on Auckland volcanic hazards
- Cleaning up after eruptions
- Assessing spatial and temporal volcanic **hazards and impacts** in Auckland
- Developing decision support framework for **disaster waste** management
- Determining **optimised** disaster waste disposal sites

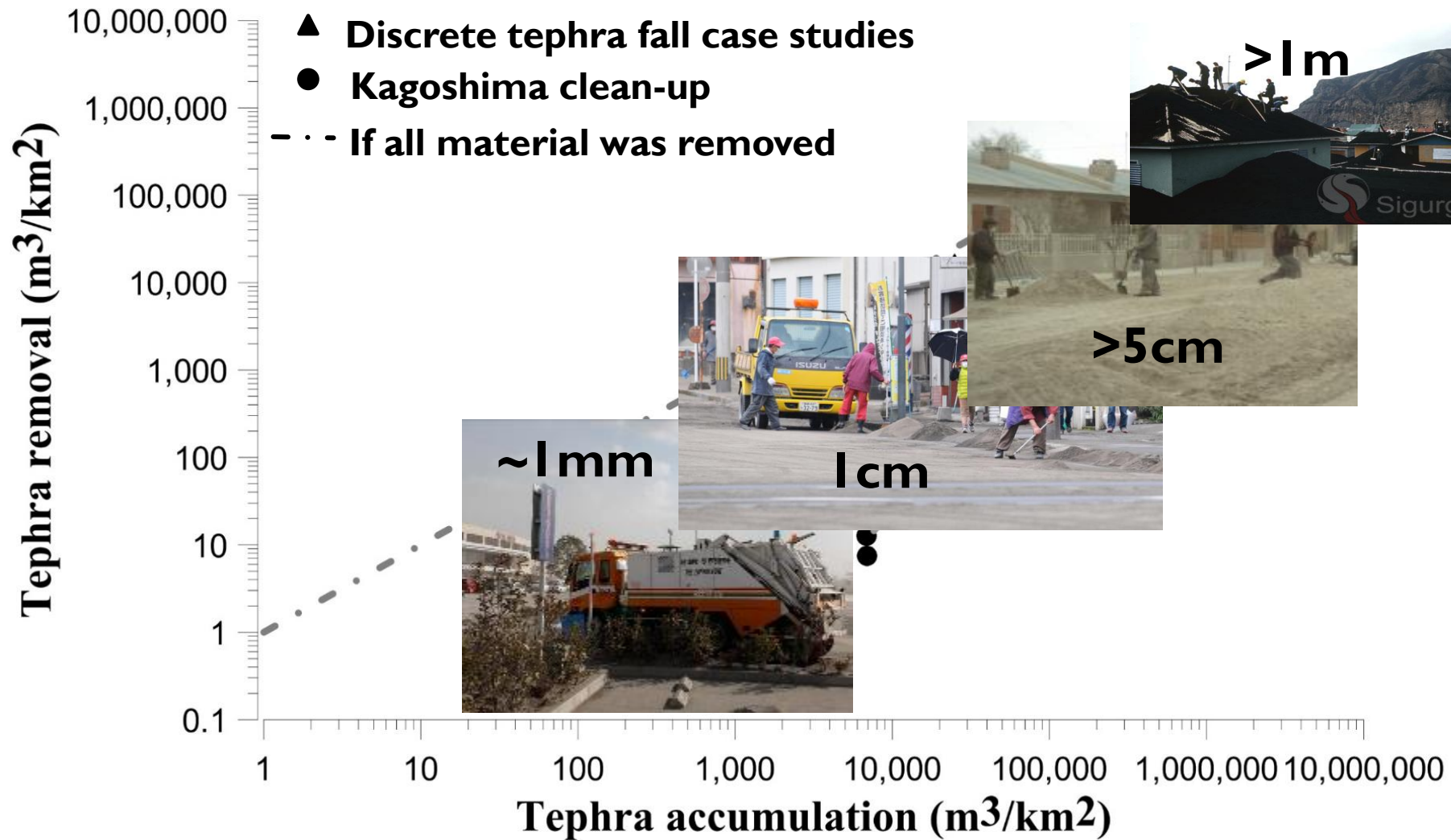


Photo: Victor Gonzalez & Jose Villifana

AUCKLAND VOLCANIC HAZARDS



- Ash hazard from North Island volcanoes
- Auckland Volcanic Field (AVF)
 - Activity from scattered vents
 - Rangitoto largest and most recent (~600 years ago)
 - Will erupt again, but uncertain where new vent will form
 - Location (water availability) is a strong control for eruption style (and possible hazards)
 - DRY eruption: Mildly explosive, lava flows, ash fall, ballistics, scoria cone
 - WET eruption: Shock wave, base surges, ash plume, ballistics

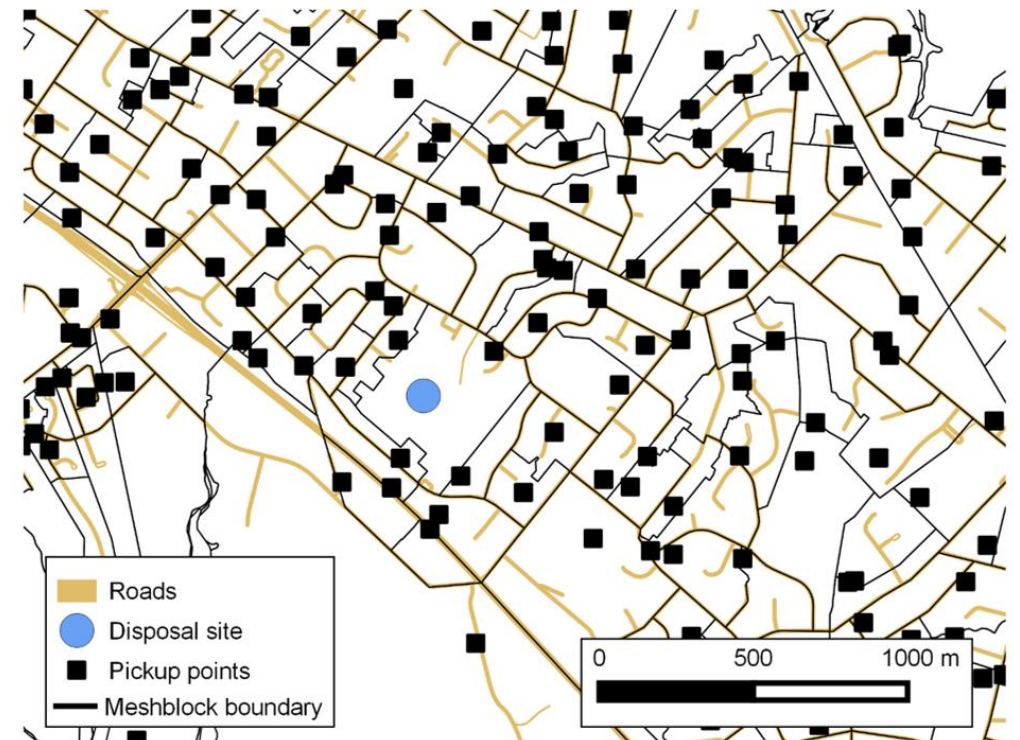


Full details: Hayes JL, Wilson TM, Magill C (2015) Tephra fall clean-up in urban environments. Journal of Volcanology and Geothermal Research, 304:359–377.

CLEANING UP VOLCANIC ASH



- Modelling for Auckland
 - Distal eruptions (e.g. Ruapehu, Taupo, Taranaki)
 - 40,000 – 2,000,000 m³ ash to dispose
 - Cost \$500,000 - 2,000,000
 - Local eruptions (within the Auckland Volcanic Field)
 - Couple of million to tens of millions of cubic metres to dispose
 - Cost tens of millions to hundreds of millions
 - But....does not consider some disaster waste complexities





ELDFELL ERUPTION ON HEIMAEY, ICELAND (1973)

- Best historical analogy for a 'dry' eruption in Auckland
- Huge clean-up required ~ 1.5 million m³ of ash removed
- Lava flow removal and management



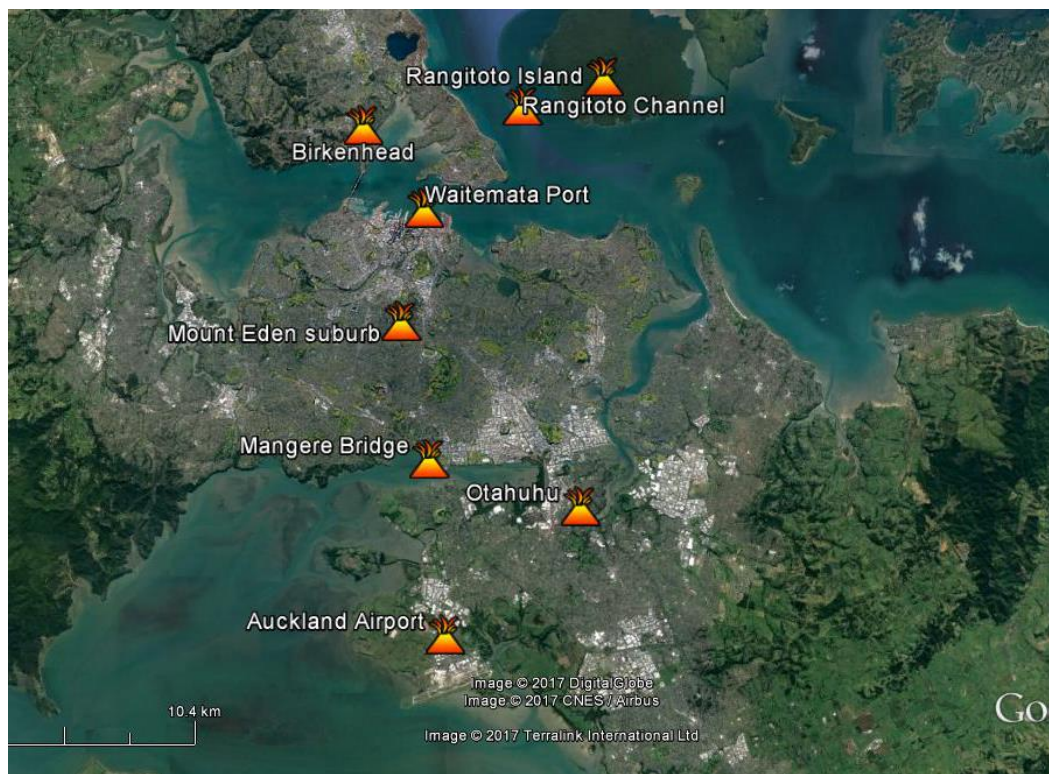
MANGERE BRIDGE – WET AND DRY ERUPTION

Sector	Outage time
Evacuation	7 weeks
Clean-up	>6 months
Electricity	>1 year
Fuel	4 months
Roads	>7 weeks
Rail	>7 weeks
Aviation	3 months
Port	Mostly negligible
Water supply	Wide scale restrictions for >1 year
Wastewater	>2 years of raw sewage discharge
Stormwater	Reduced capacity in some areas
Telecommunications	< 2 weeks

Full details:

- Deligne et al. (2017) Investigating the consequences of urban volcanism using a scenario approach I: Development and application of a hypothetical eruption in the Auckland Volcanic Field, New Zealand. *Journal of Volcanology and Geothermal Research*, 336:192–208.
- Blake et al. (2017) Investigating the consequences of urban volcanism using a scenario approach II: Insights into transportation network damage and functionality, *Journal of Volcanology and Geothermal Research*, 340:92-116
- Stewart et al. (in prep) Investigating the consequences of urban volcanism using a scenario approach III: Contrasting implications for water supply and wastewater networks

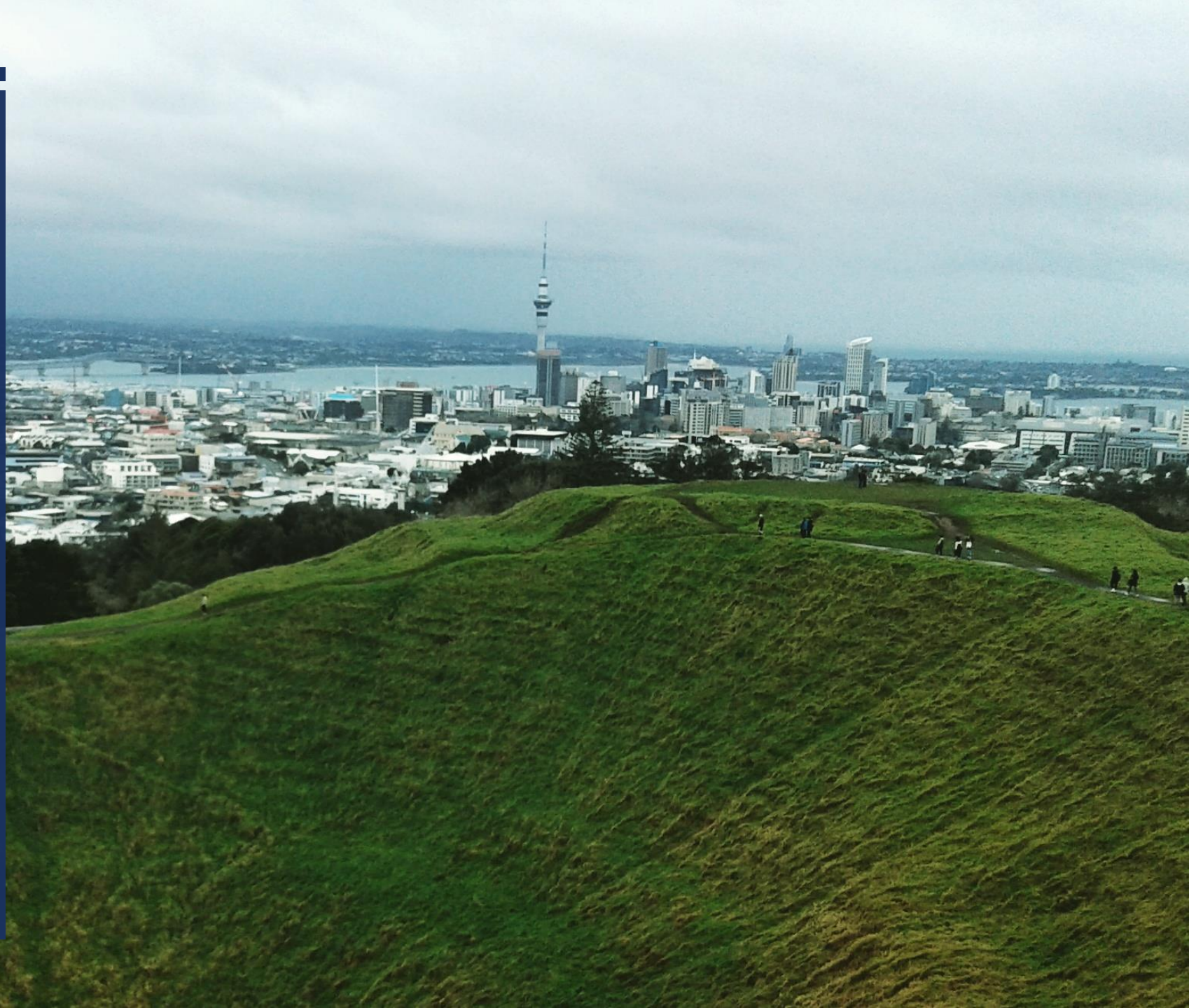
AUCKLAND VOLCANIC FIELD SCENARIOS

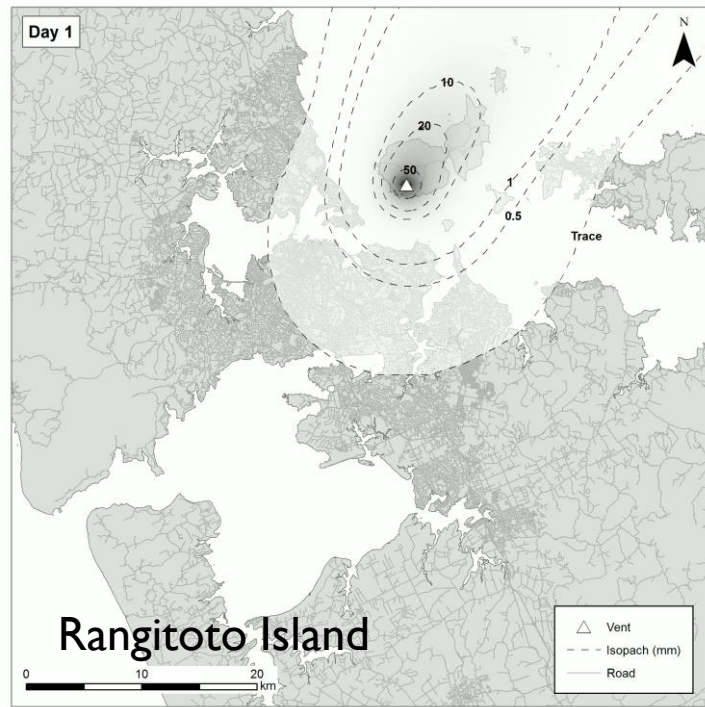
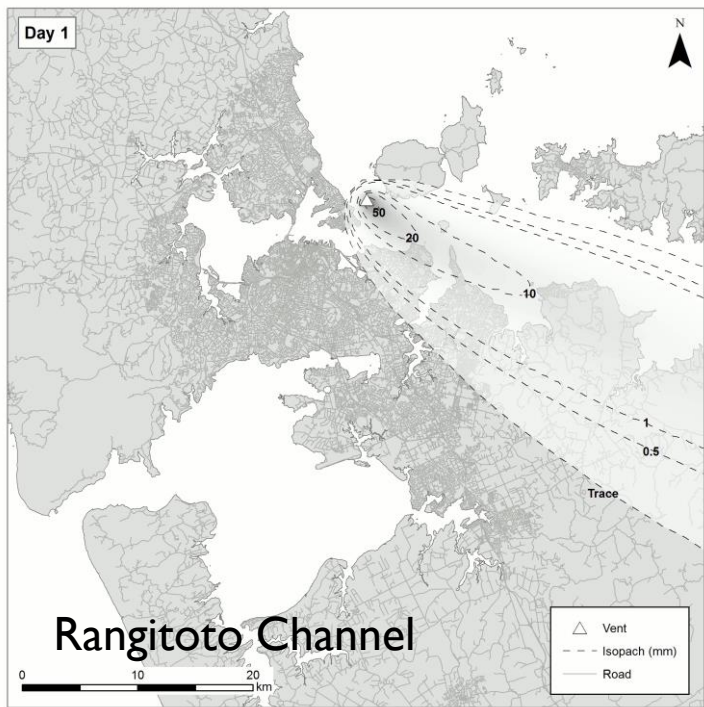
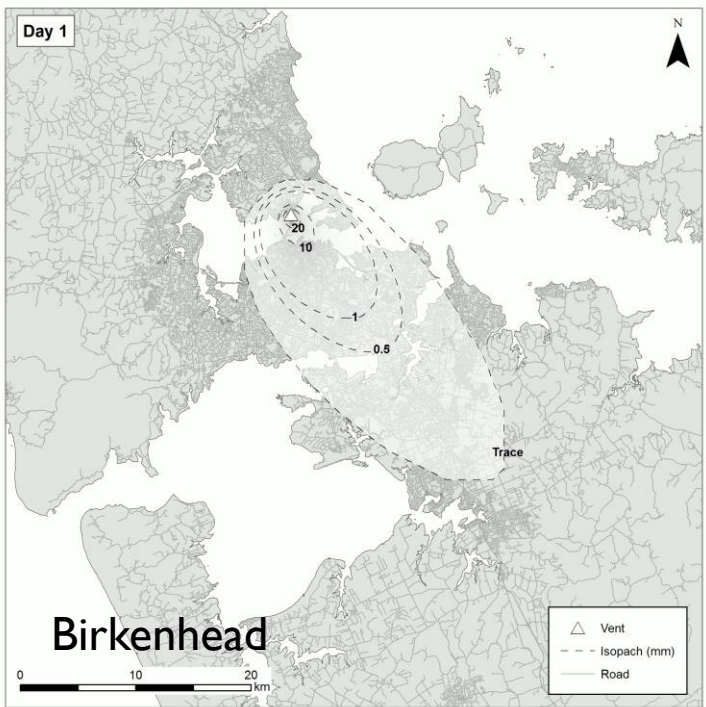
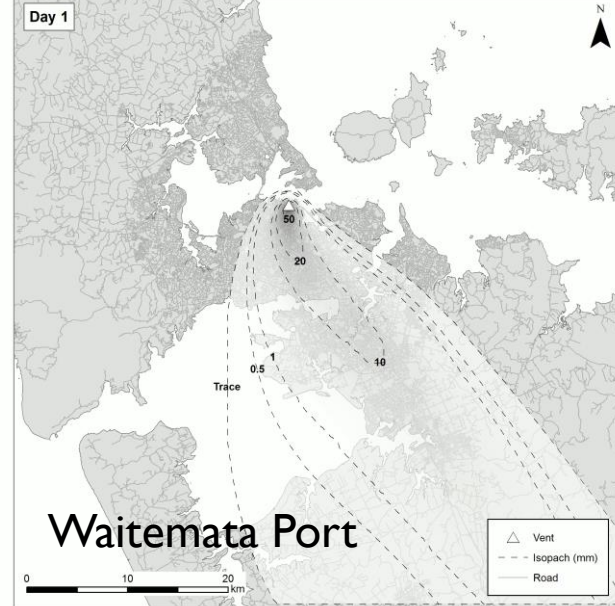
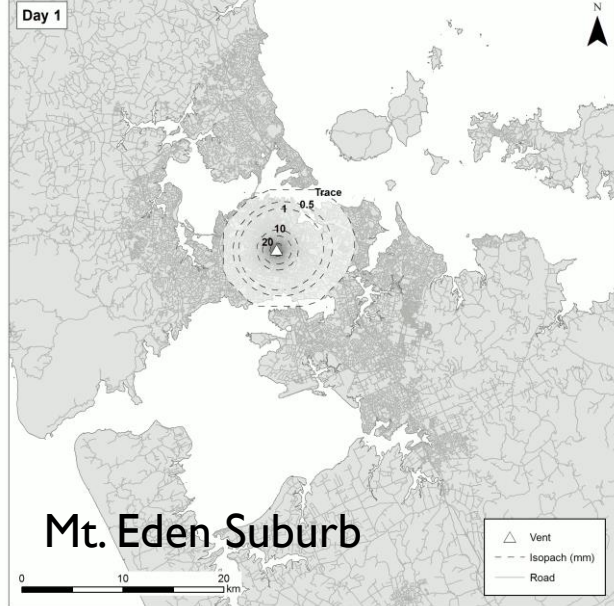
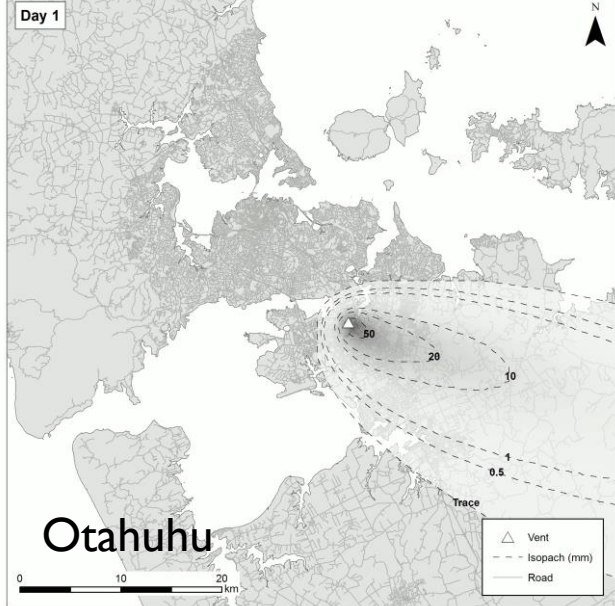


- **Aim:** Develop a seven new credible scenarios that demonstrate a range of eruption phenomena and impacts
- Requirements
 - Response and recovery **driven**
 - Different vent locations
 - Describe spatial distribution of impacts through time
 - Precursory earthquakes
 - Eruption hazards
 - Impacts during eruption
 - Response actions (e.g. evacuation, clean-up)
- Consider where scenarios can plausibly occur throughout the AVF

CHALLENGES ASSESSING VOLCANIC RISK IN AUCKLAND

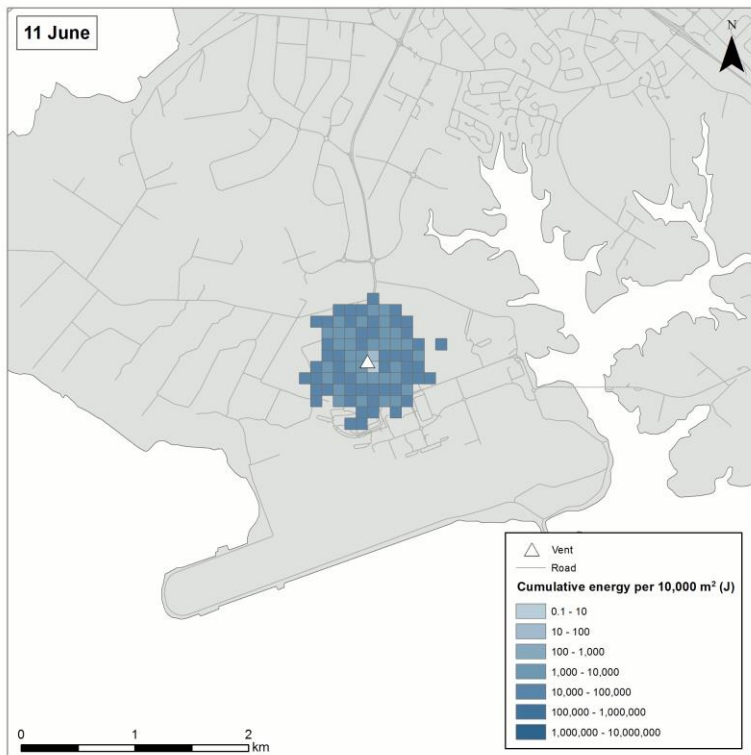
- Must rely on geological information...No historical records of AVF eruptions
- Urban development complicates geological data collection – few eruptions studied in the necessary detail
- Plenty of ambiguity and uncertainty in the geologic record
- Limited global historical observations of monogenetic volcanism
- Some hazardous phenomena produce more than one hazard metric (heat and force)
- Limited models available for small monogenetic volcanic hazard assessment
- Limited guidance available for modelling multi-hazards in volcanology





BALLISTICS – AIRPORT SCENARIO

- Ballistic modelling by UC PhD Candidate Rebecca Fitzgerald (Rebecca.fitzgerald@pg.canterbury.ac.nz)
- Example building ~1 km from vent



DISASTER WASTE INDICATORS

- Review and develop indicators for disaster waste management
- Use indicators to build a picture of post-disaster waste management in Auckland using scenarios
 - Non-exhaustive list of examples
 - Waste handling requirements (e.g. hazardous waste)
 - Volume of material
 - Waste composition & mixing
 - Volunteer management
 - Critical infrastructure requirements
 - Safety risks



DISPOSAL SITES

- Expert and stakeholder elicitation process to determine appropriate factors for consideration
- Considerable what factors would be important for each of the different scenarios developed



Photos: Victor Gonzalez & Jose Villafana

SUMMARY



- Auckland is complex volcanic risk environment
- Developing a suite of credible eruption scenarios to consider variability
- Assess level of service and infrastructure outages to develop disaster context
- Use disaster waste indicators to consider waste management challenges in Auckland