Natural hazards research in New Zealand: context and contribution to IRDR

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GNS SCIENCE
TE PŪ AO

Natural Hazards Research Platform

- Combining the best of NZ's research into natural hazards under a single umbrella
- Funded directly from government vote science, but with additional support from the Earthquake Commission (EQC), institution funds etc
- Strong focus on delivery of results to end users

- Includes earthquakes, tsunami, volcanoes, landslides and weather-related perils
- Platform Manager = Kelvin Berryman

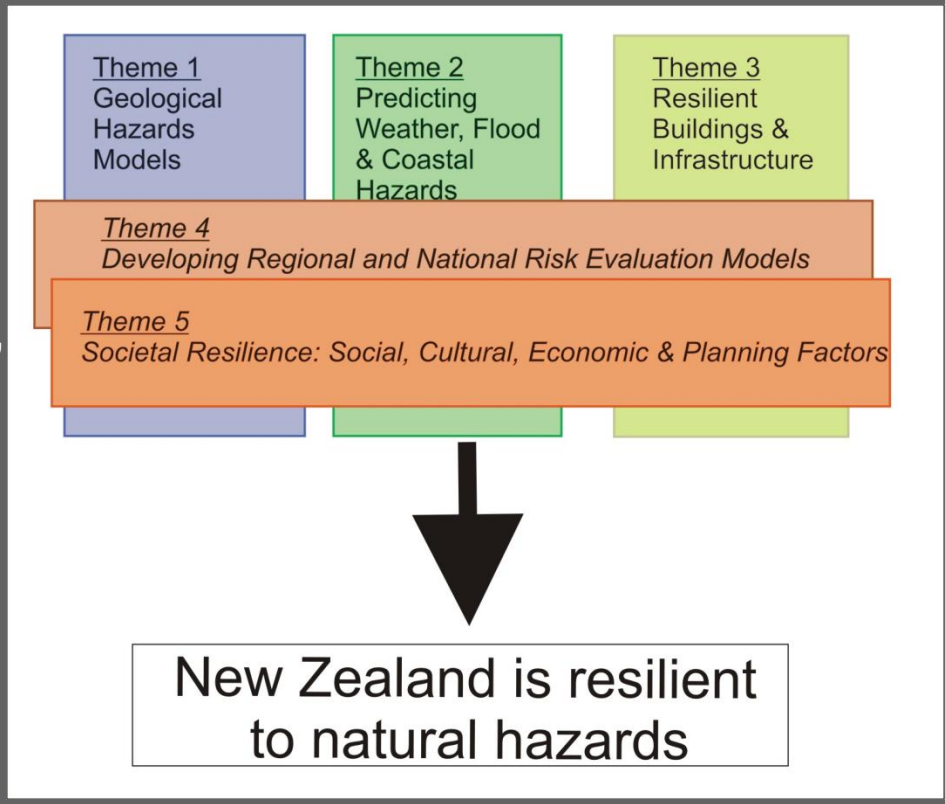
The Natural Hazards Research Platform

- A devolved approach where CRIs, universities and private companies, construct, execute and deliver research and applied tools in the national interest

- In Nov 2009 government signed a 10 year, $14M pa, contract with GNS Science and NIWA for the platform research

- GNS Science is the host institution for the platform

- Funding (pa) :	$ M
GNS Science	6.63
NIWA	3.18
University of Auckland	0.60
University of Canterbury	0.82
Massey University	0.70
Opus International	0.42
contestable	1.38



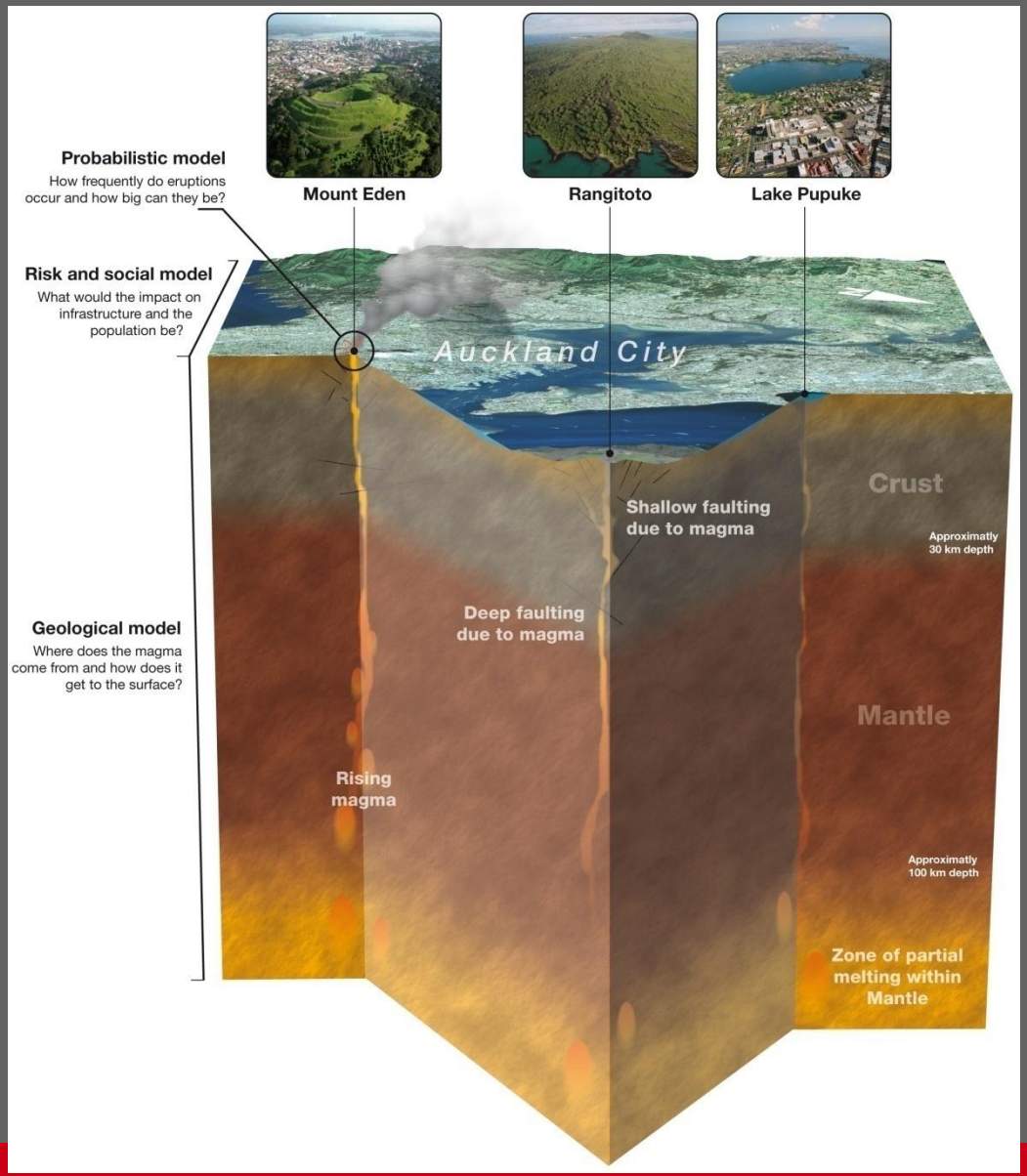
An additional $3m pa has been provided to learn lessons from the Canterbury eqs

Social science research themes

1. Policy and planning for disaster reduction and recovery
2. Community resilience to disasters
3. Effective warnings and emergency management

   – Improved understanding of what factors lead to increased community resilience and sustainable communities

DEVORA – Determining Volcanic Risk in Auckland



- Co-led by University of Auckland and GNS Science
- Currently in year 4 of 7
- Funded by EQC
- Includes research from VUW, Massey, Canterbury and others

Three main themes:

- ❖ Geological Model
- ❖ Probabilistic Hazard Model
- ❖ Risk and Social model

DEVORA

Theme 1: Geological Model

Objectives

1. Synthesis of existing data
2. New analyses of volcanic rocks
3. New studies on the tectonic control of eruptions
4. Investigations into the plumbing systems of the volcanoes

Where is the magma coming from?
Why does it leave its source?
What controls the path of magma in the crust?
Where will the magma reach the surface?
What is the crust made of?
Why is the most recent eruption the largest?
How fast will magma travel to the surface?
When will we detect the ascending magma?

Theme 2: Probabilistic Hazard Model

Objectives

1. Synthesis of existing eruption dates
2. Evaluation of probabilistic hazard methodology
3. New analyses to determine eruption ages
4. Investigation of thin ash deposits from existing drill cores
5. Correlation of ash fall deposits with their source volcanoes
6. Drilling new cores to fill gaps in eruption data
7. Comparative study of eruptions at other volcanic fields

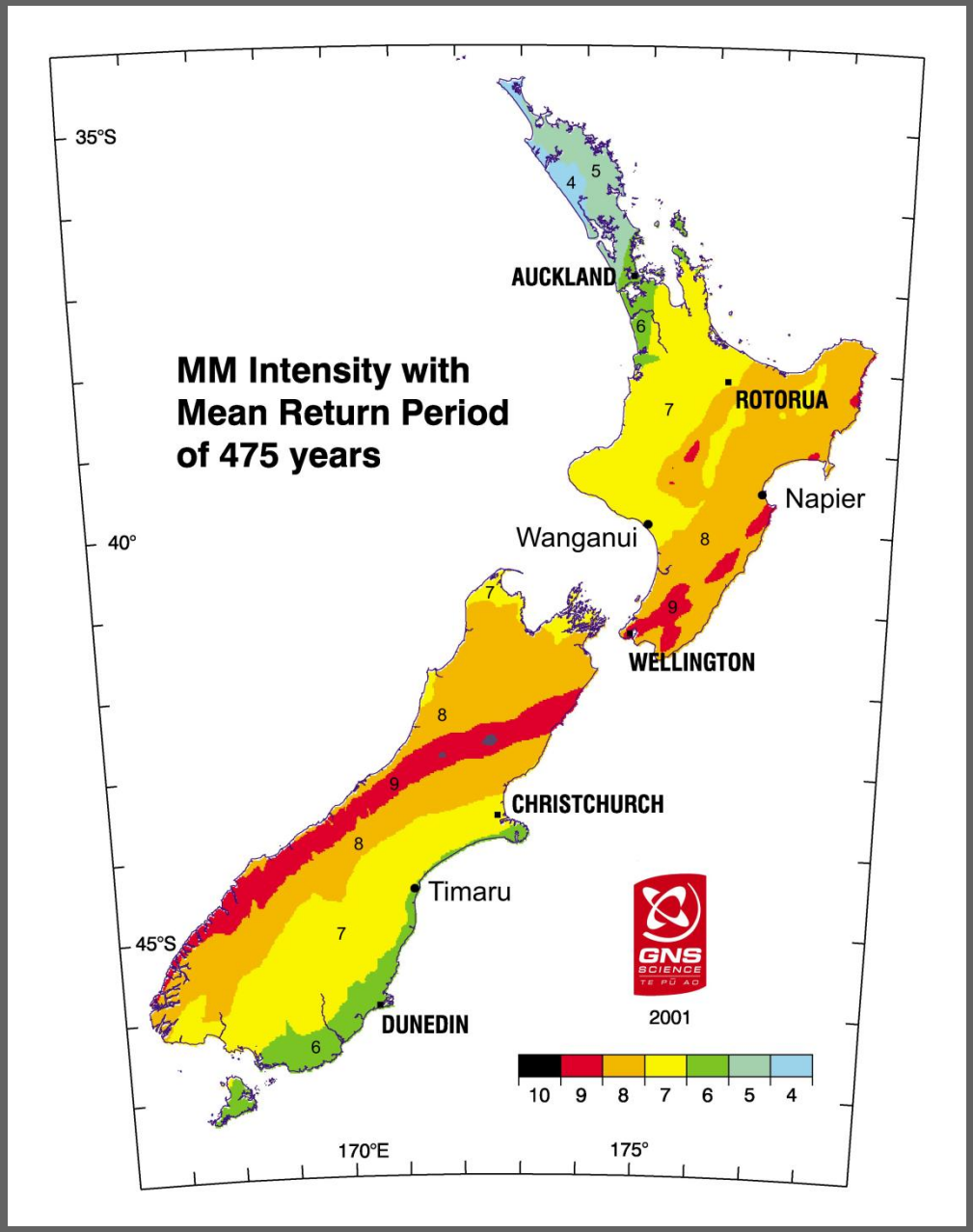
What is the distribution in time of past eruptions?
What is the likelihood and size of future eruptions?
What are likely styles, sizes and hazards?
Where are we in the lifespan of the Field?
How do we usefully calculate probabilistic volcanic hazard for Auckland?
What is the probabilistic volcanic hazard?
How intensive should the monitoring be to provide adequate warning of an AVF eruption?

Theme 3: Risk and Social Model

Objectives

1. Synthesis of existing volcanic risk and social data
2. Fragility of Auckland infrastructure, buildings & population
3. Development of exposure database and model
4. Determining indirect and intangible impacts
5. Development of statistical risk assessment methods
6. Development of tools for improved societal response

Who and what are exposed to volcanic hazards in Auckland?
How will each hazard affect people and infrastructure?
How will people and organisations cope?
What are the flow-on effects nation-wide?
How can we calculate risk to people and infrastructure?
What are the risks to people and infrastructure?
How can these risks be reduced?
How can people and organisations prepare to respond effectively to warnings?


MM Intensity with
Mean Return Period
of 475 years
35°S
40°
45°S
170°E
175°
AUCKLAND
ROTORUA
Napier
Wanganui
WELLINGTON
CHRISTCHURCH
Timaru
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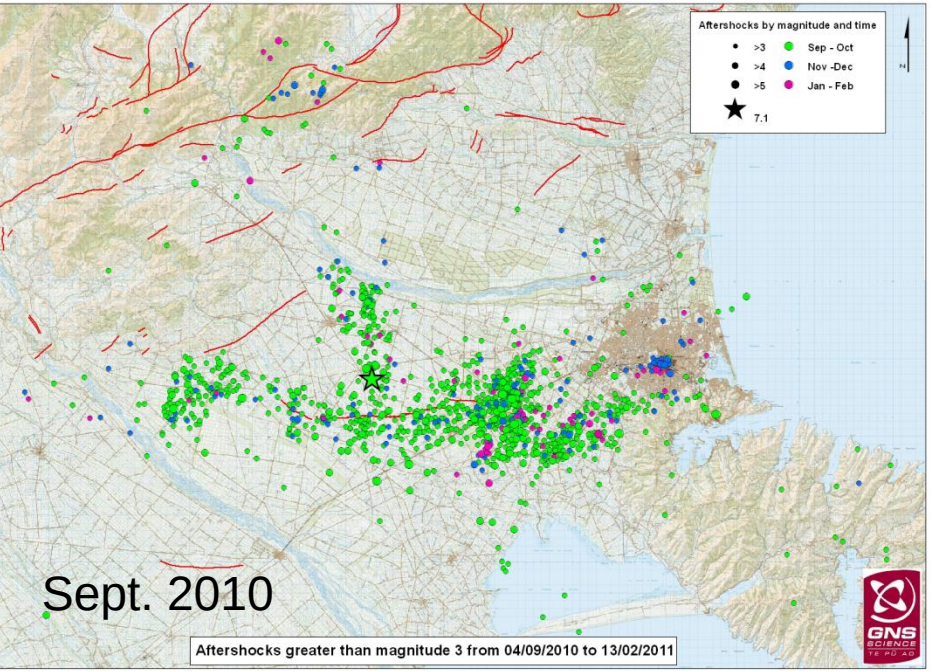
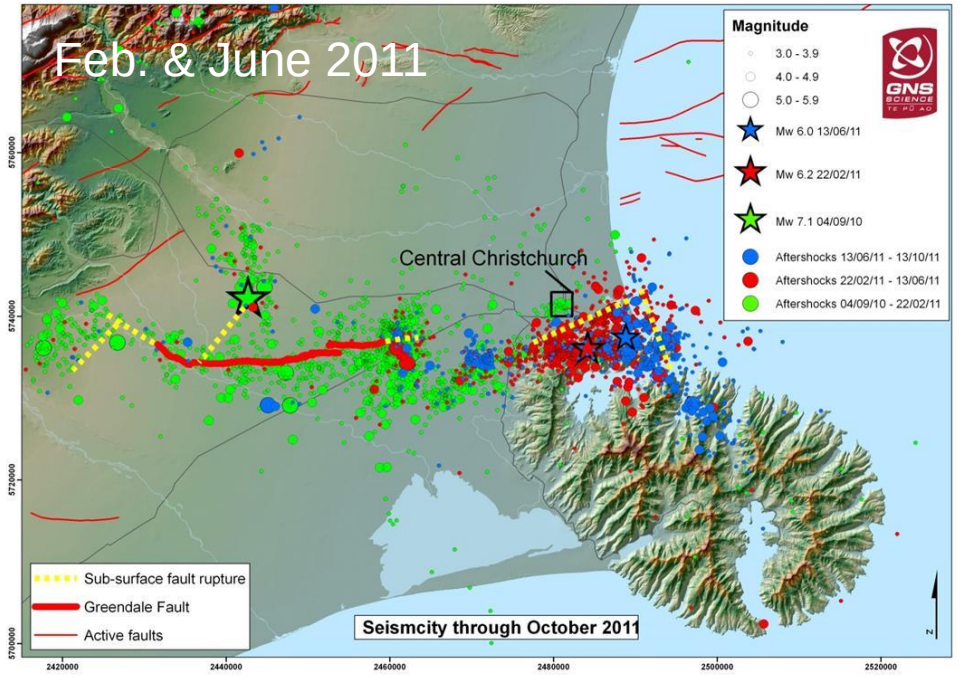
Earthquake comparison



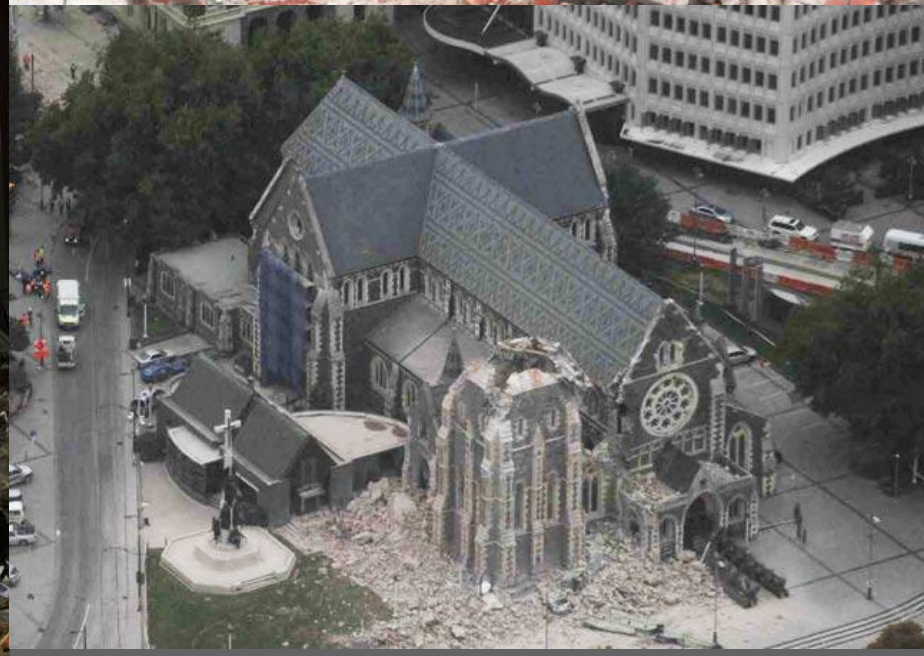
- M7.1 earthquake, 30 km west of city
- Saturday 4th September at 4:36 am
- 0 fatalities, only 2 serious injuries
- Damage to older brick and URM
- Residential damage due to liquefaction and lateral spreading
- Cost: Estimate of $4-5 billion (direct)
- Psychological and business impacts on community despite no loss of life

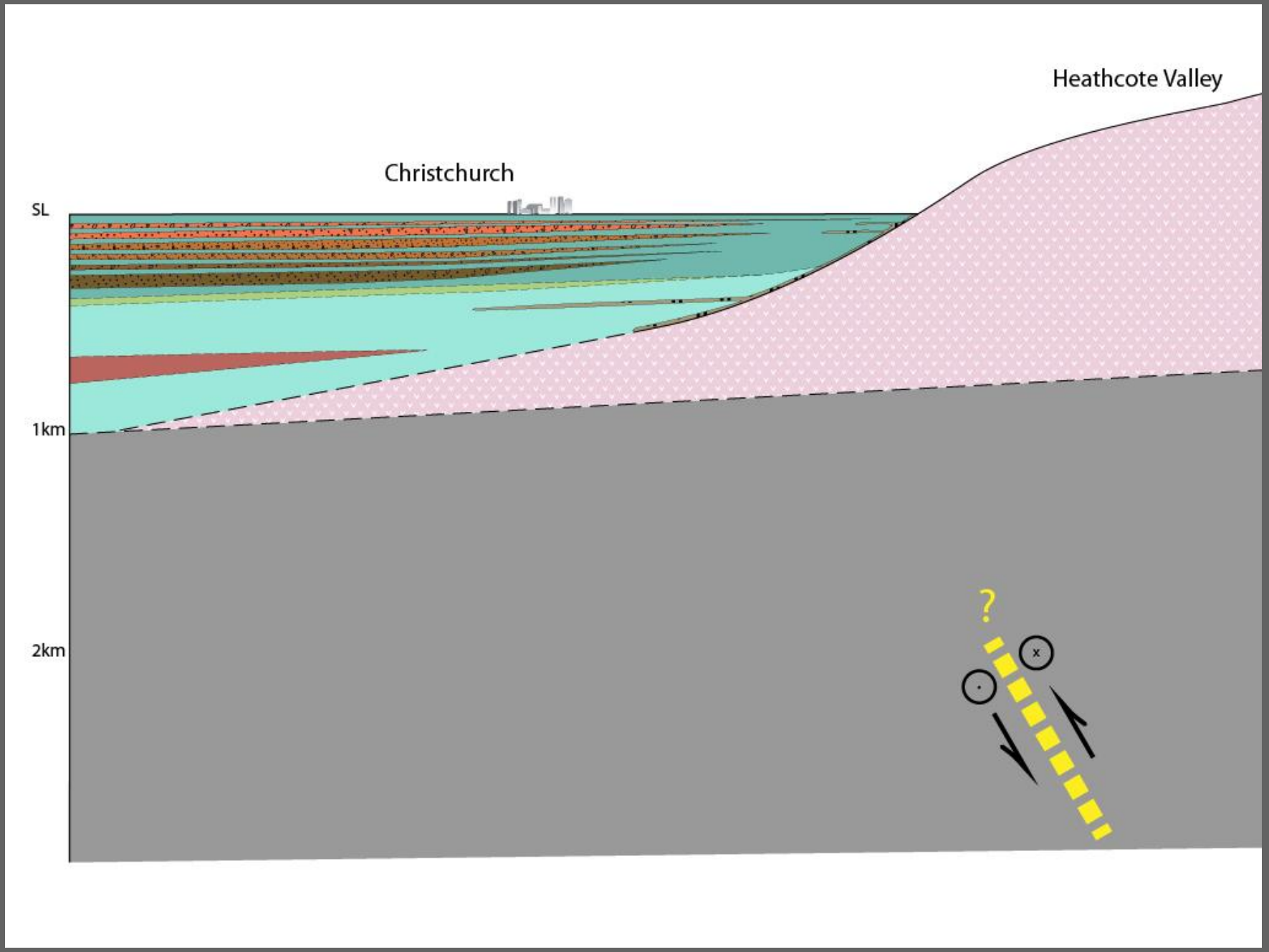


- M6.2 & M6.0 within 5 km of the city
- Both occurred in the afternoon
- 182 fatalities, scores of serious injuries
- Damage & deaths in the CBD in older brick, URM and a few commercial buildings built prior to modern code
- Modern code buildings generally performed very well under extreme loads
- Widespread residential damage resulting from liquefaction and shaking (> 1 g PGA)
- Cost: Estimate of $ 20+ billion
- Most significant socio-economic event in NZ since 60 years – 8-10% GDP

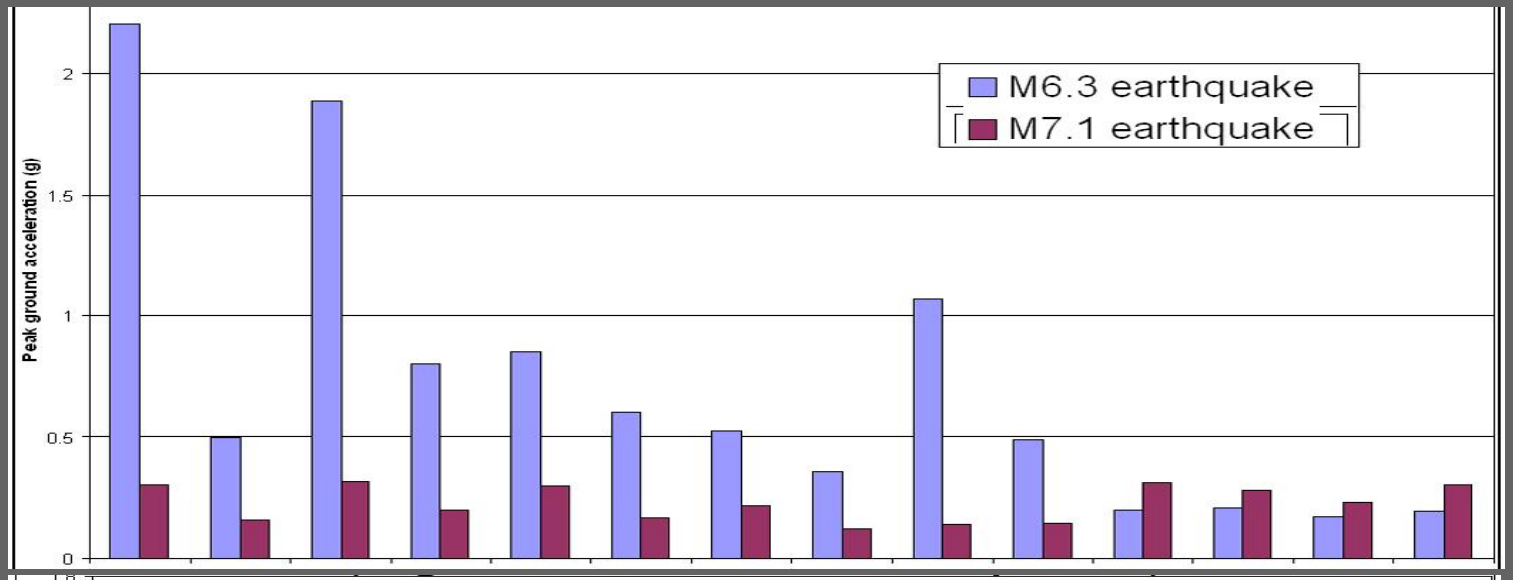
The earthquakes & their impacts: 4 Sept 2010

The earthquakes & their impacts: 22 Feb 2011

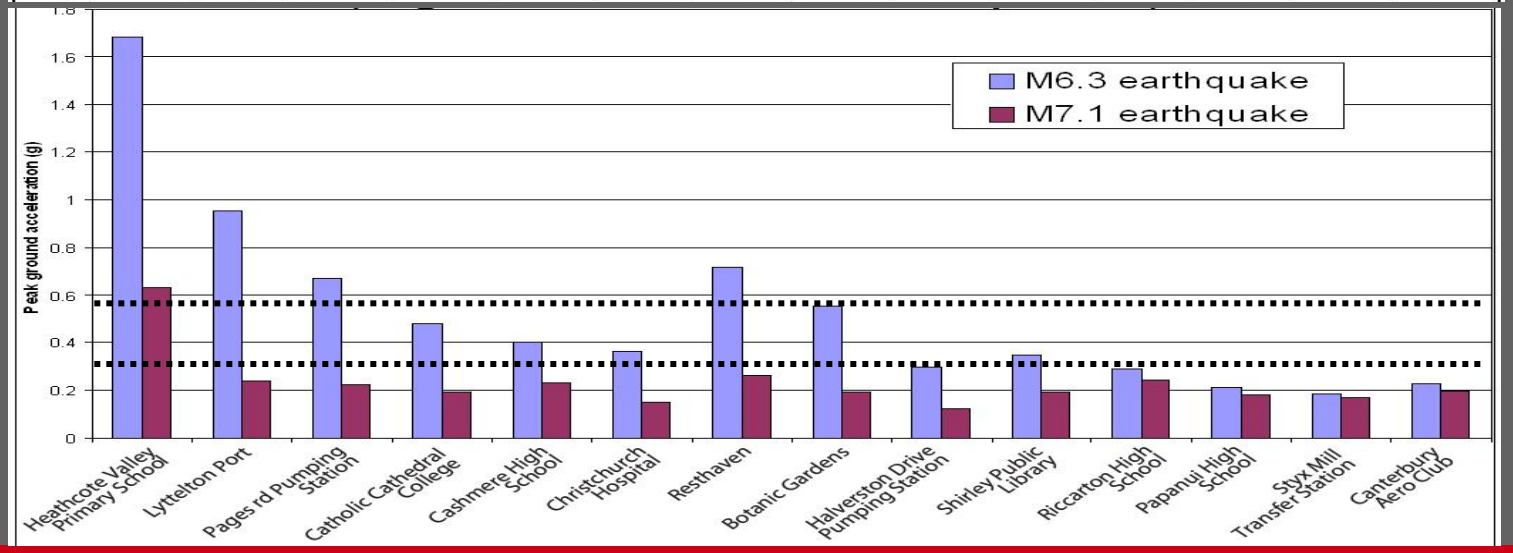



Heathcote Valley
Christchurch
SL
1km
2km
?

Comparison of Vertical and Horizontal Ground Shaking



Vertical



Horizontal

2500 yr code 0.54g

500 yr code 0.30g

CTV Building

Lateral spreading in Fitzgerald Ave near Avonside Drive. There was no spreading here after the Darfield EQ

Liquefaction