

# Development and analysis of the New Zealand Strong Motion Database

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Contributors of site data

# Funding sources

GNS Core funding

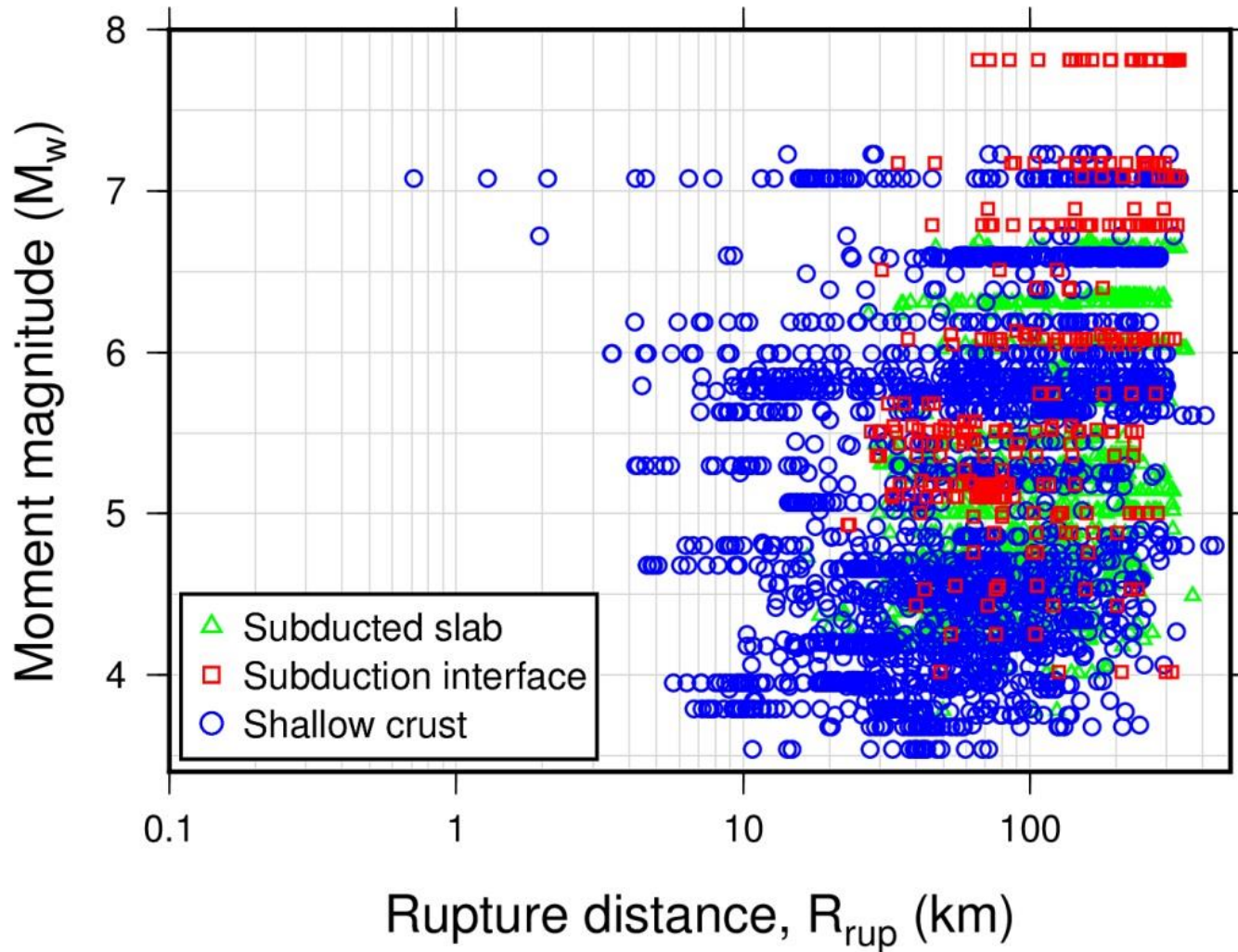
NHRP project “Rethinking PSHA”

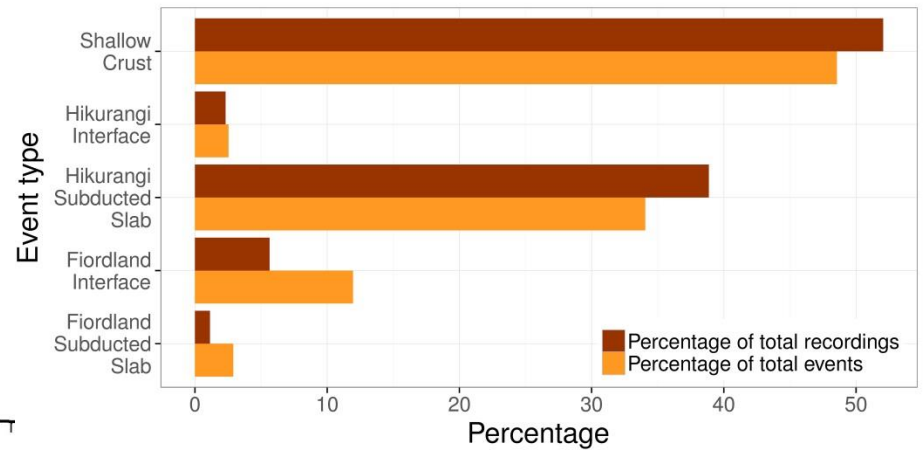
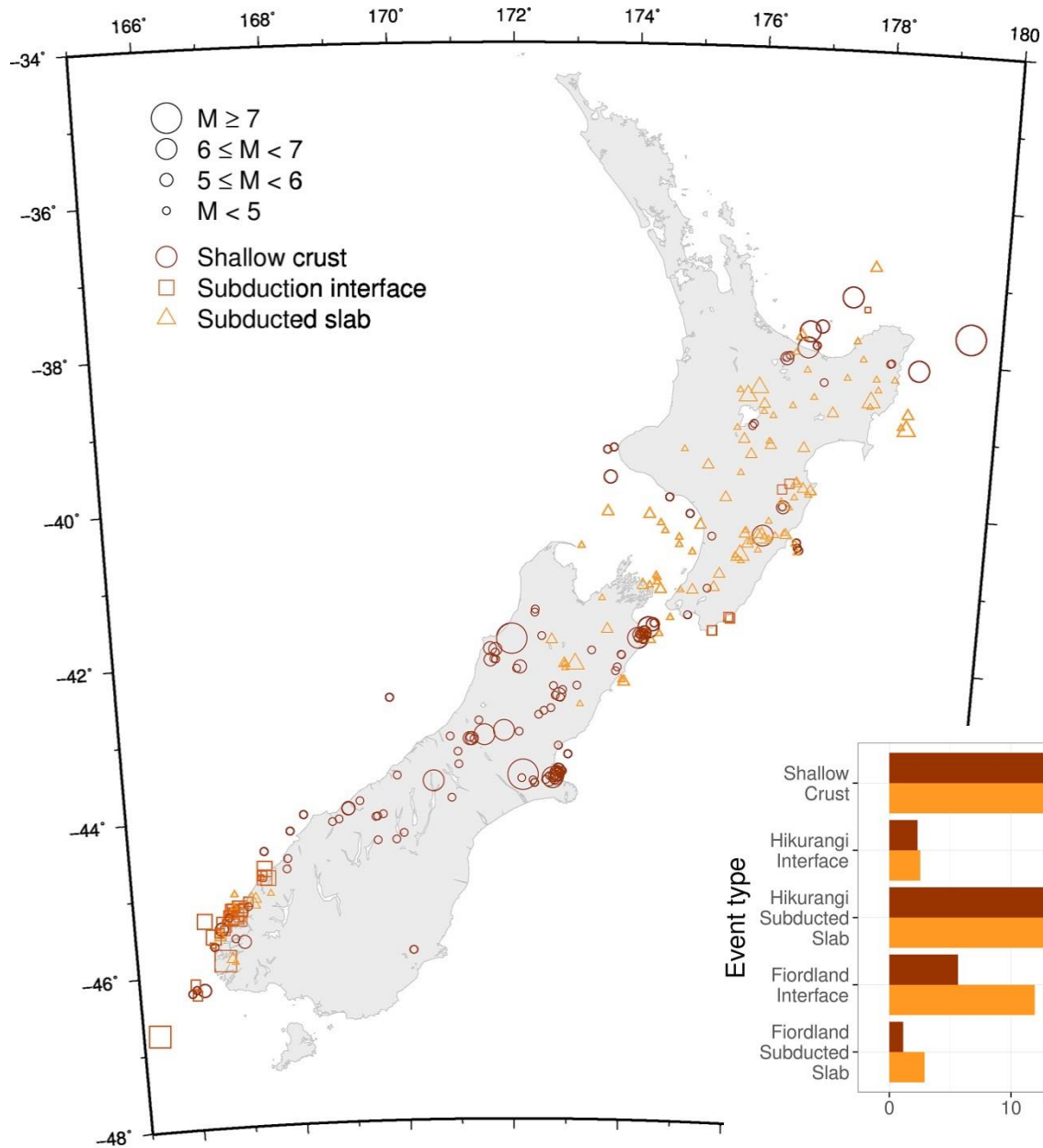


# Objectives

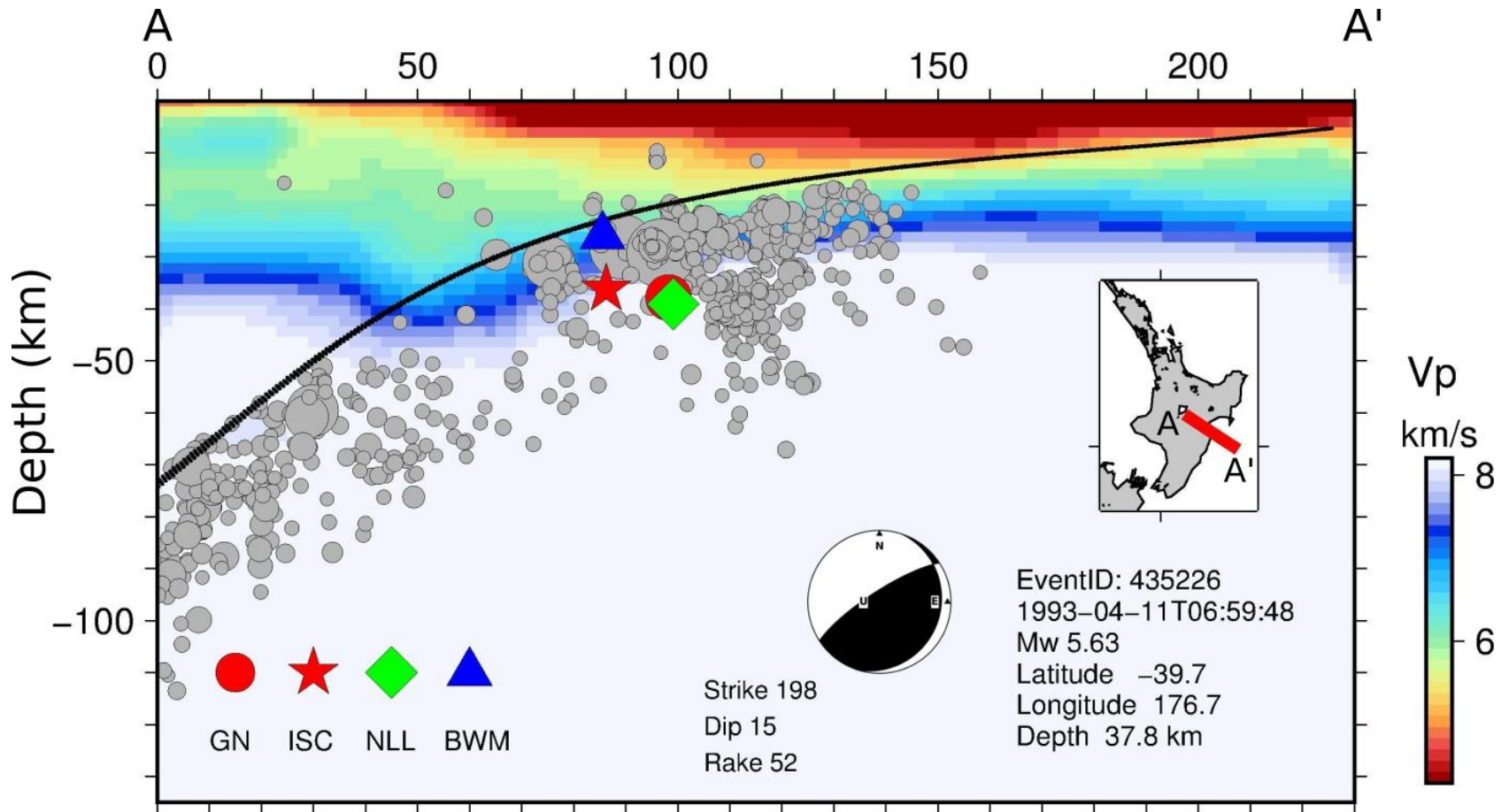
- High quality
- Robust, reproducible research.
- A starting point

276 events, 4148 recordings



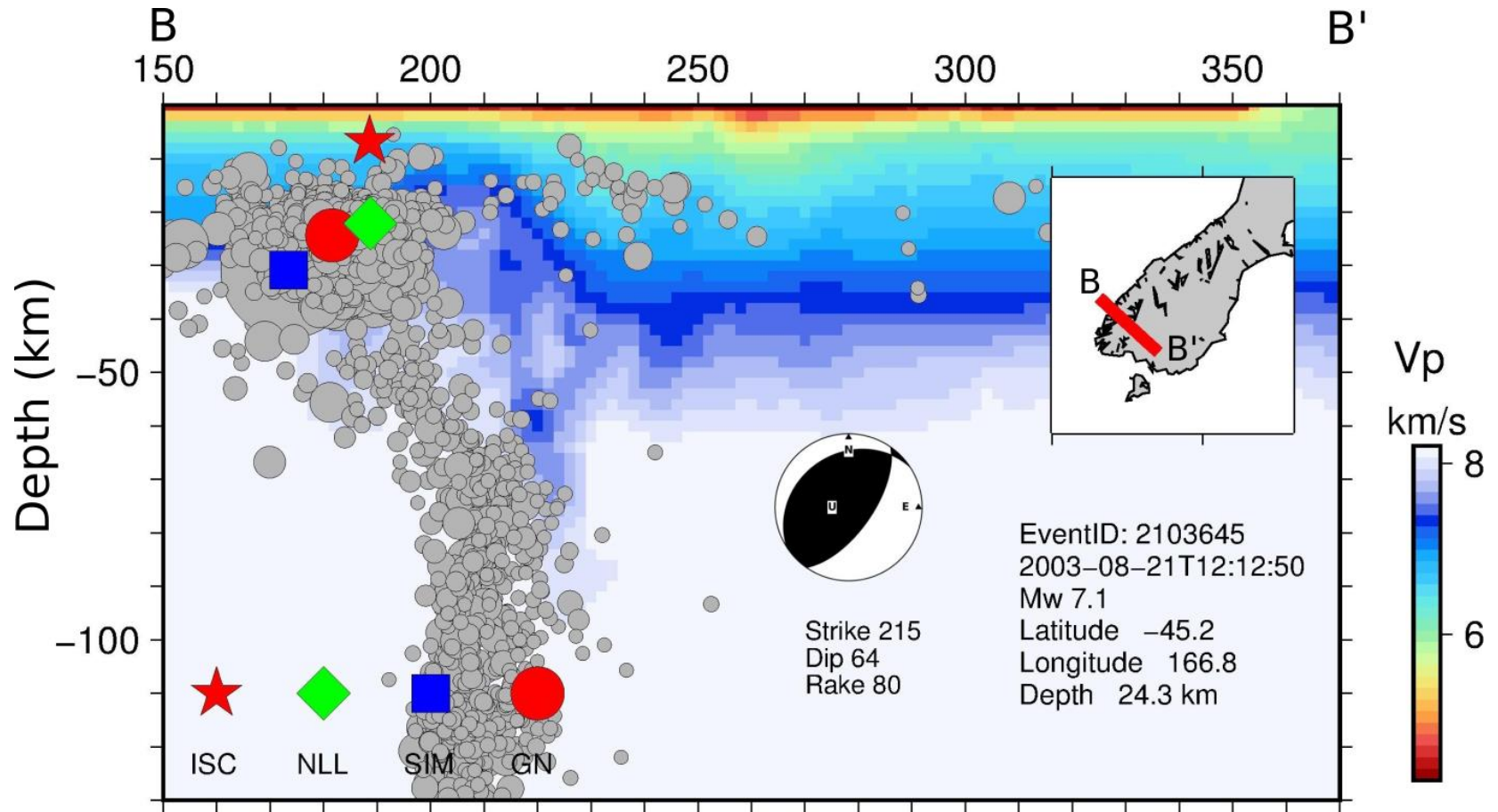


# Relocations - Hikurangi



Relocated seismicity (grey points) courtesy of Martin Reyners

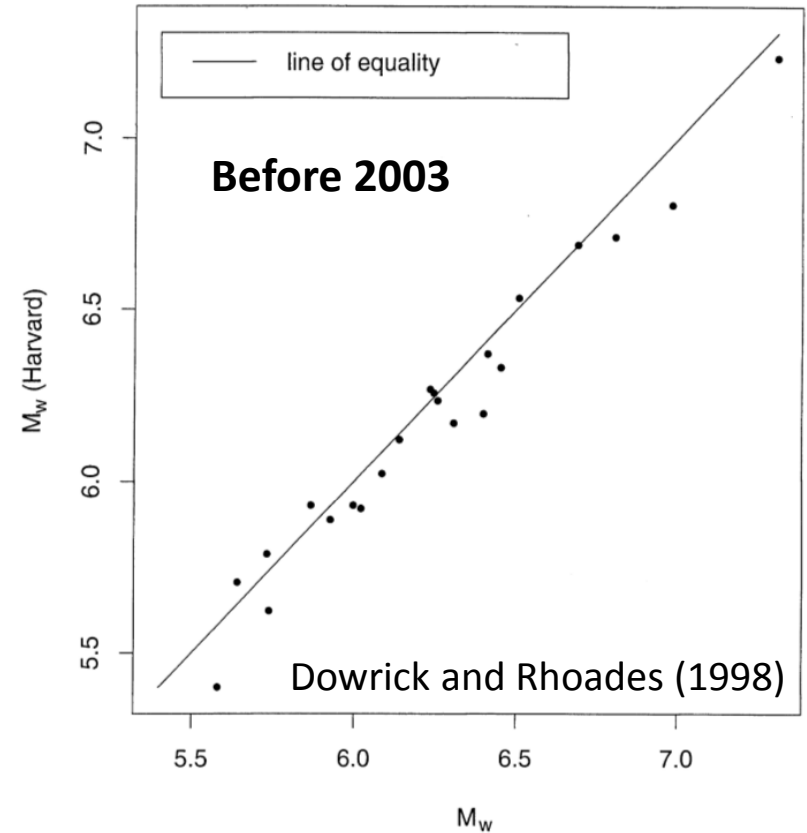
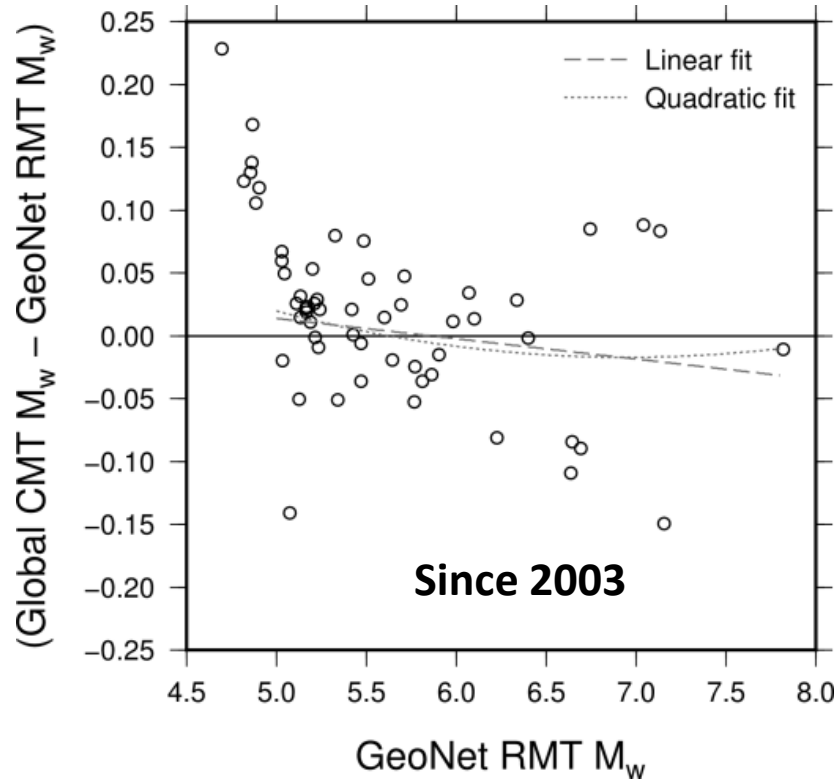
# Relocations - Fiordland



Relocated seismicity (grey points) courtesy of Martin Reyners



# Magnitude uncertainty

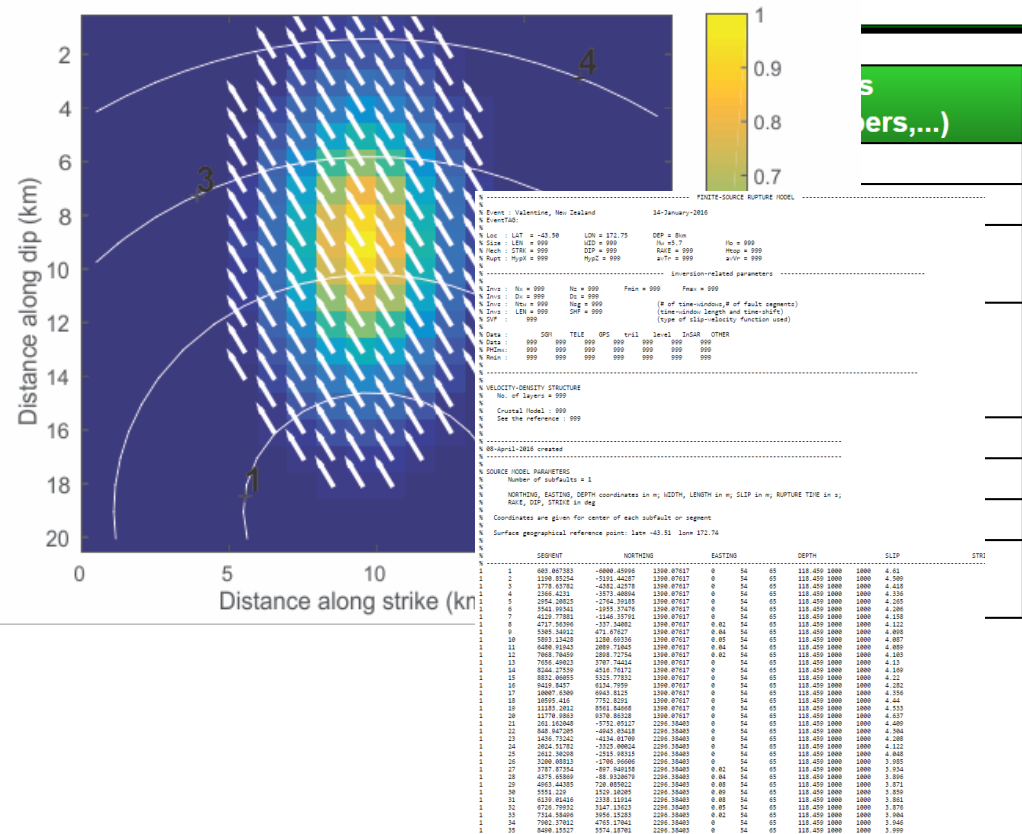


Different catalogues have different magnitudes

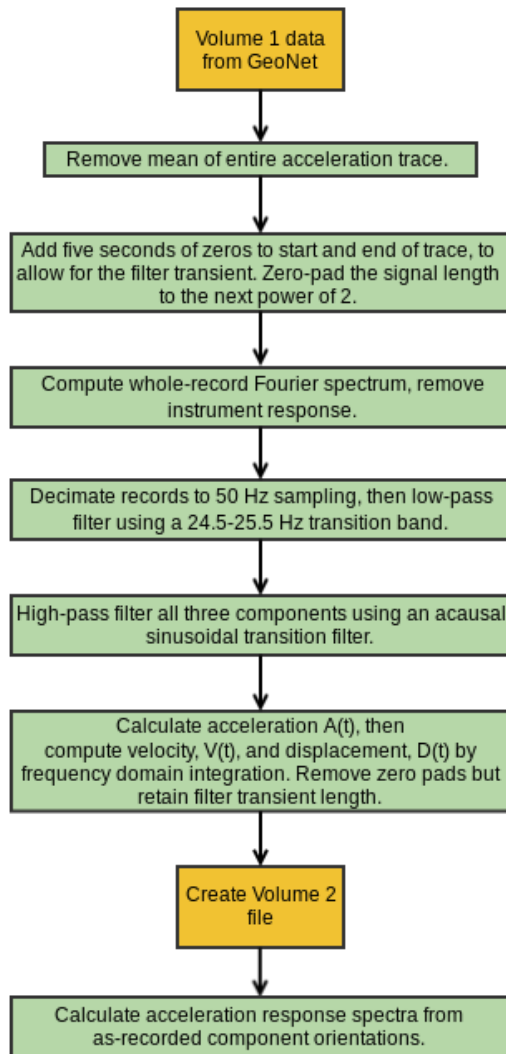


# Earthquakes in New Zealand

Year	Month	Day	Event
2016	February	14	<a href="#">Christchurch</a>
2014	January	20	<a href="#">Eketahuna</a>
2013	August	16	<a href="#">Lake Grassmere</a>
	July	21	<a href="#">Cook Strait</a>
2011	December	22	<a href="#">Christchurch</a>
	June	13	<a href="#">Christchurch</a>
	February	23	<a href="#">Christchurch</a>
2010	September	04	<a href="#">Darfield</a>
2009	July	15	<a href="#">Dusky Sound</a>
2007	December	20	<a href="#">Gisborne</a>
2003	October	15	<a href="#">George Sound</a>
	August	21	<a href="#">Fiordland</a>

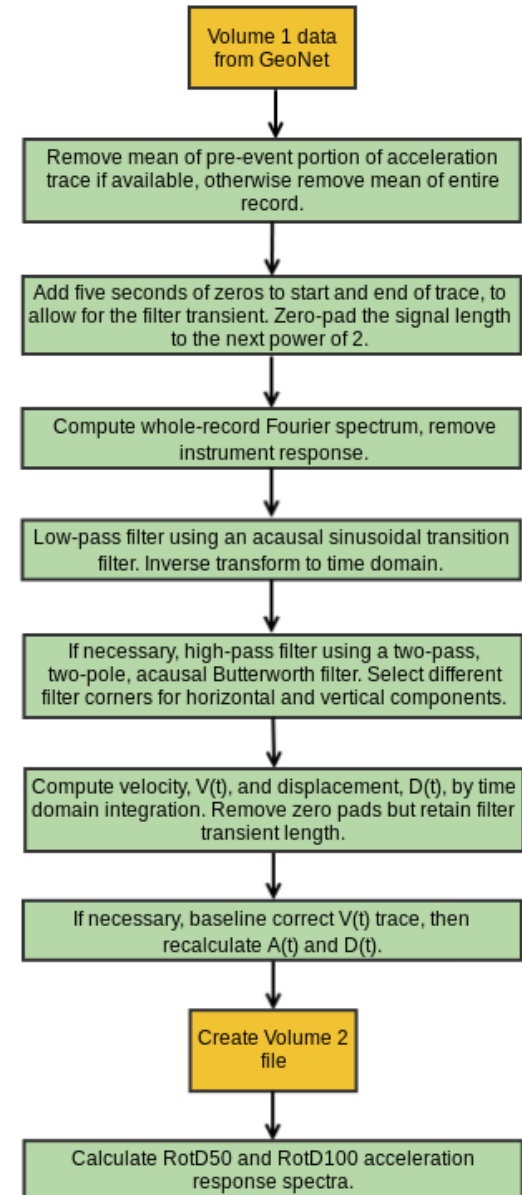


## STANDARD GEONET PROCEDURE

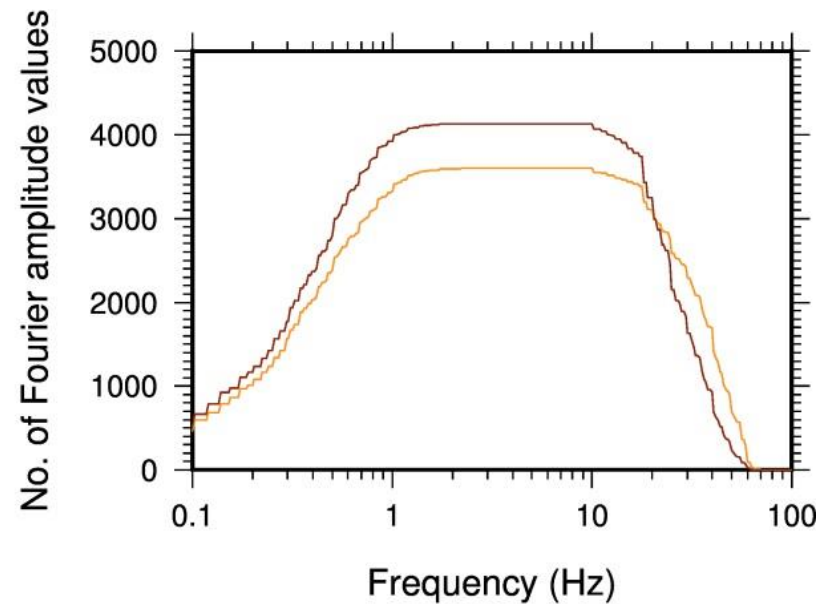
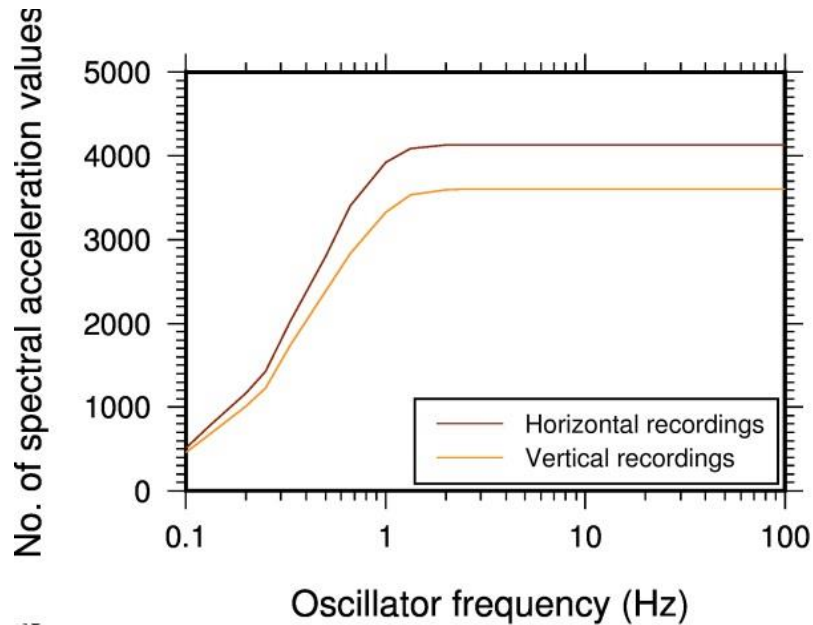


**Hodder (1983)**

## UPDATED PROCEDURE



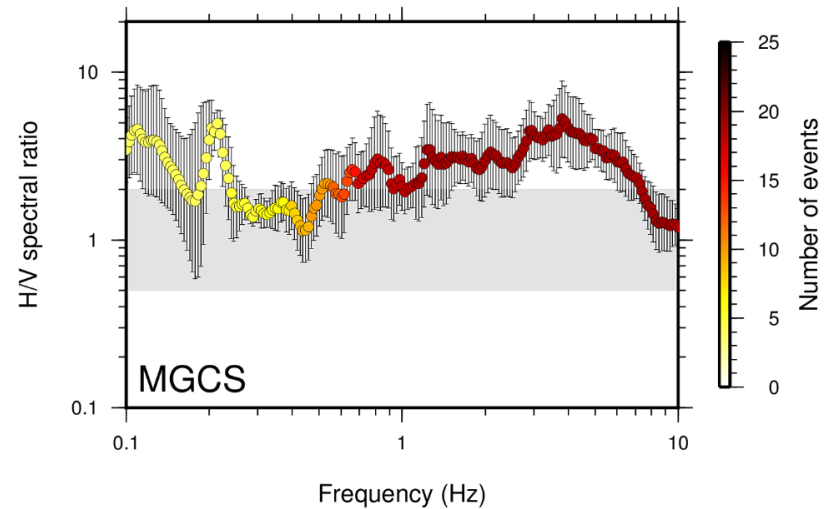
# Passband of data



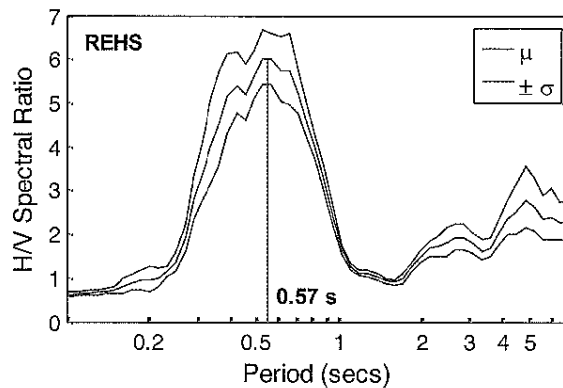
# Site database (on behalf of Anna Kaiser)

Sources of data:

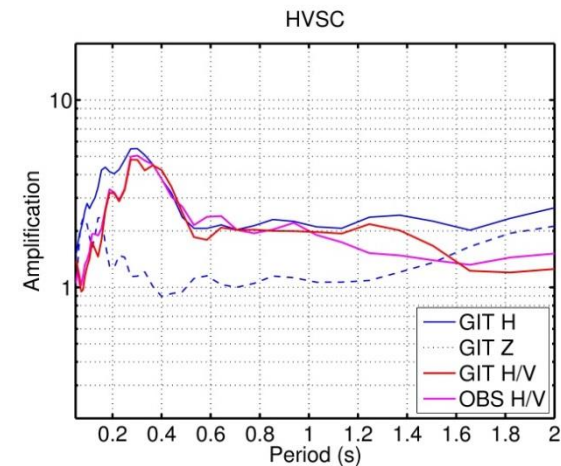
Spectral ratio plots



Van Houtte (unpublished)



Wotherspoon et al. (2015)



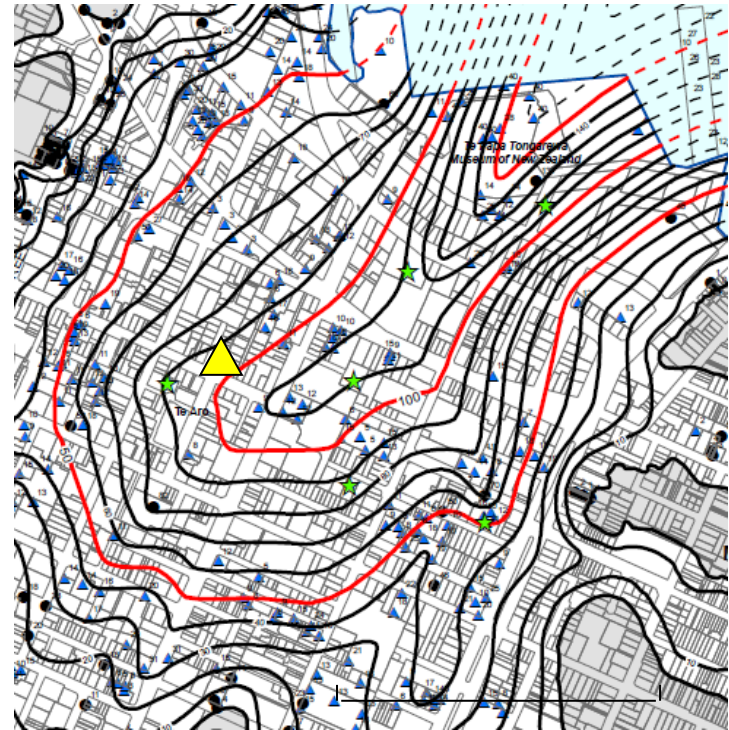
Kaiser et al. (2013)

# Site database (on behalf of Anna Kaiser)

## Sources of data:

Spectral ratio plots

Borehole logs and spatial  
interpolation



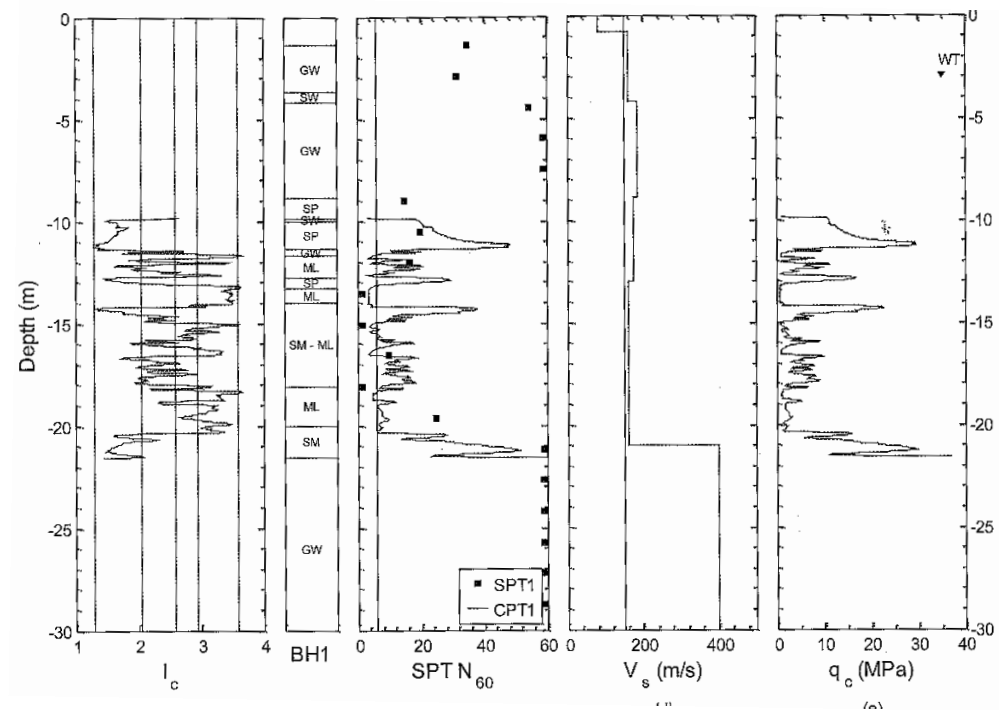
Semmens et al. 2010

# Site database (on behalf of Anna Kaiser)

## Sources of data:

Spectral ratio plots  
Borehole logs and spatial  
interpolation

MASW investigations



Wotherspoon et al. (2015)



# Site database (on behalf of Anna Kaiser)

## Sources of data:

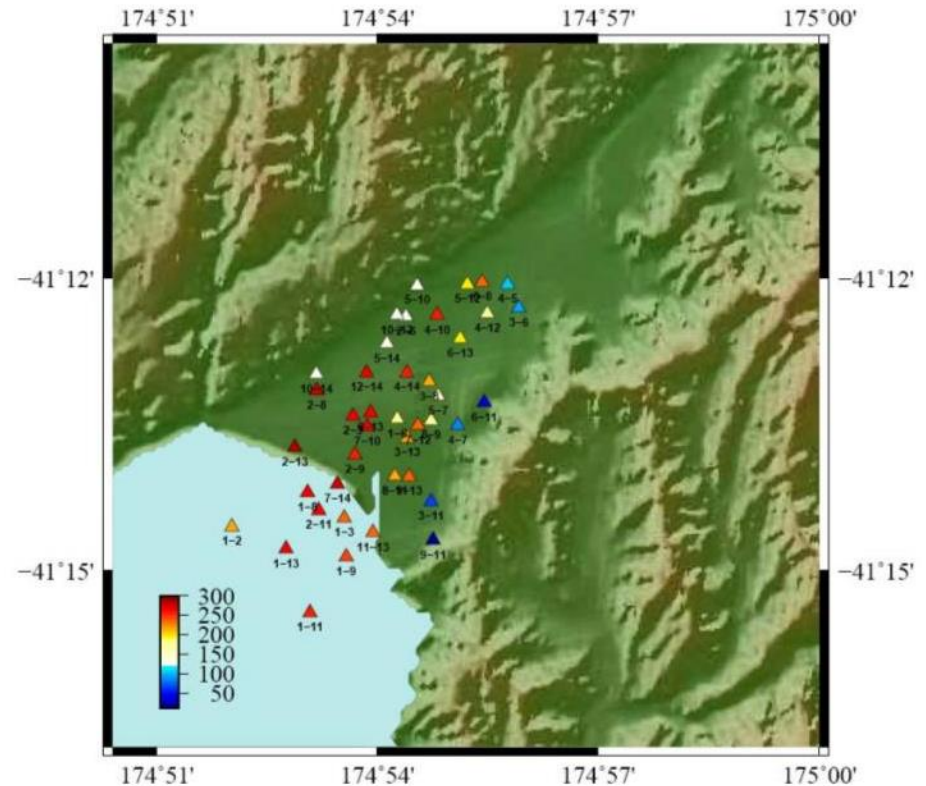
Spectral ratio plots

Borehole logs and spatial  
interpolation

MASW investigations

3D velocity models

- Wellington and Hutt Valley (Fry et al., 2010)
- Canterbury (Lee, Bradley et al)





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Old GNS reports (Bill Stephenson and others)

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**Vs30 map (Perrin et al., 2015)**

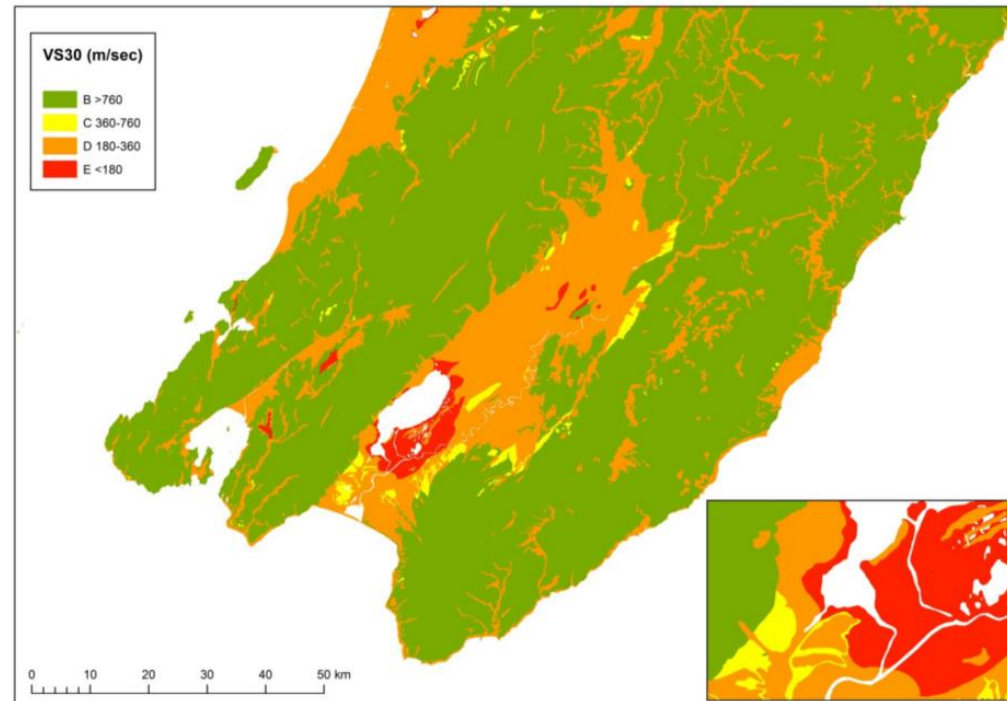
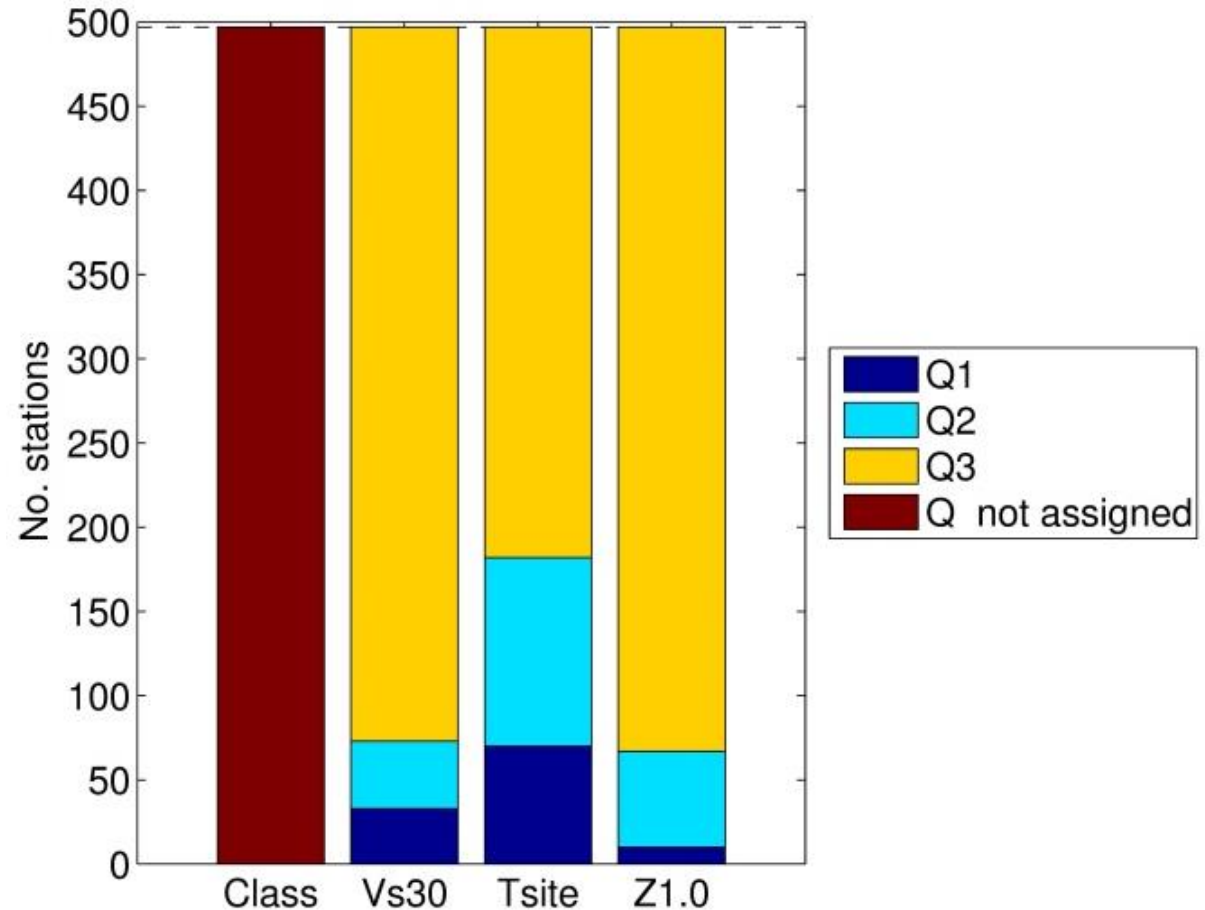


Figure 4. Portion of New Zealand  $V_{s30}$  Map.

# Site database (on behalf of Anna Kaiser)

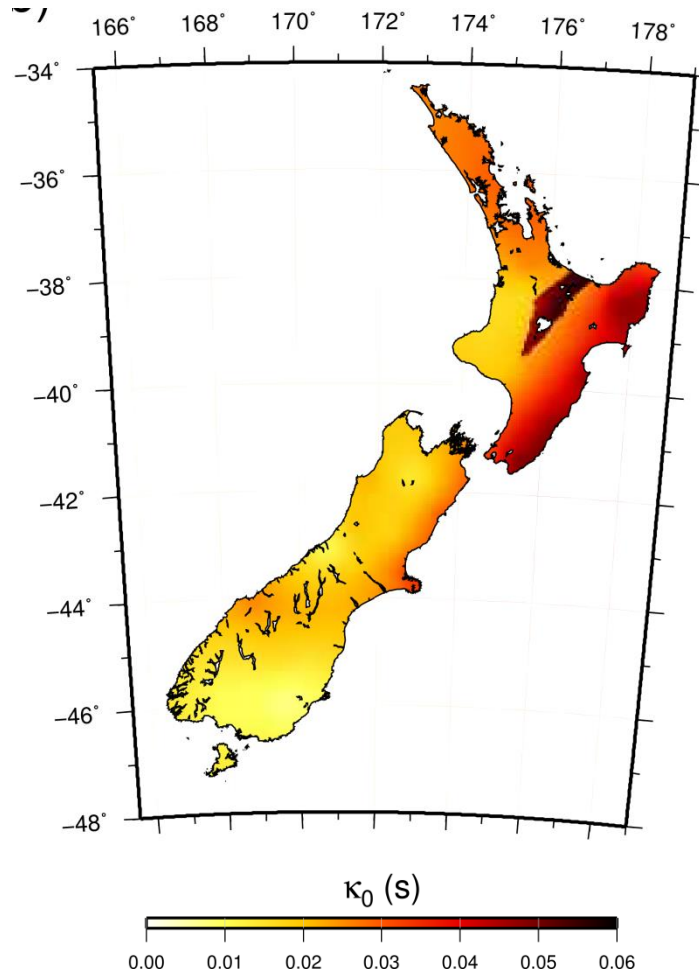
Reconciled the data as well as possible, but still not much is known



# Site attenuation ( $\kappa_0$ ) values

Available for every rock site  
in the database.

Will likely be distributed  
separately.



# Public availability

Currently under review for BNZSEE (three separate articles).

Once they are accepted, I will put everything on the GeoNet website.

# Public availability

Flatfiles for RotD50, RotD100 and vertical response spectra for 22 periods, PGA, PGV at 12 different damping levels.

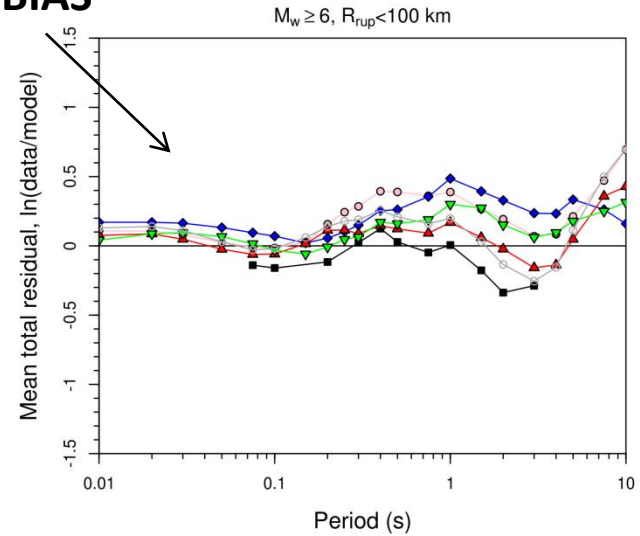
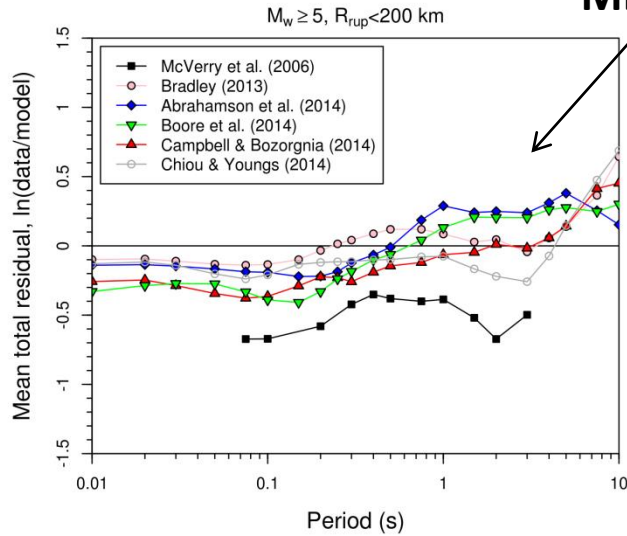
Whole-record Fourier amplitude spectra also available

For people wanting something different, the processed time-series will be available.

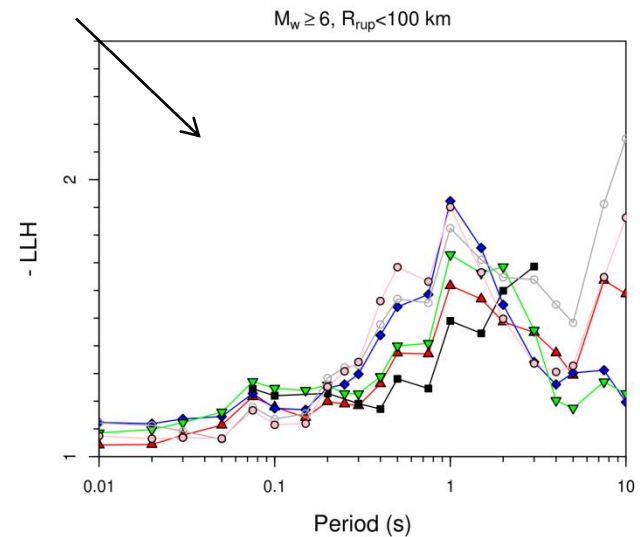
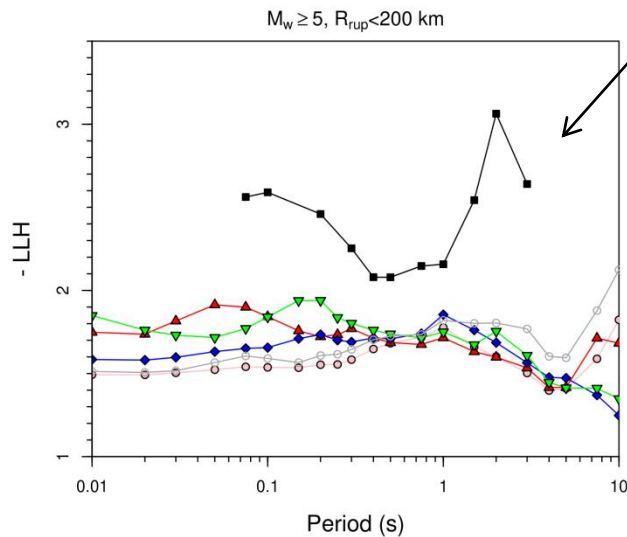
# Performance of ground motion models



## MEAN BIAS

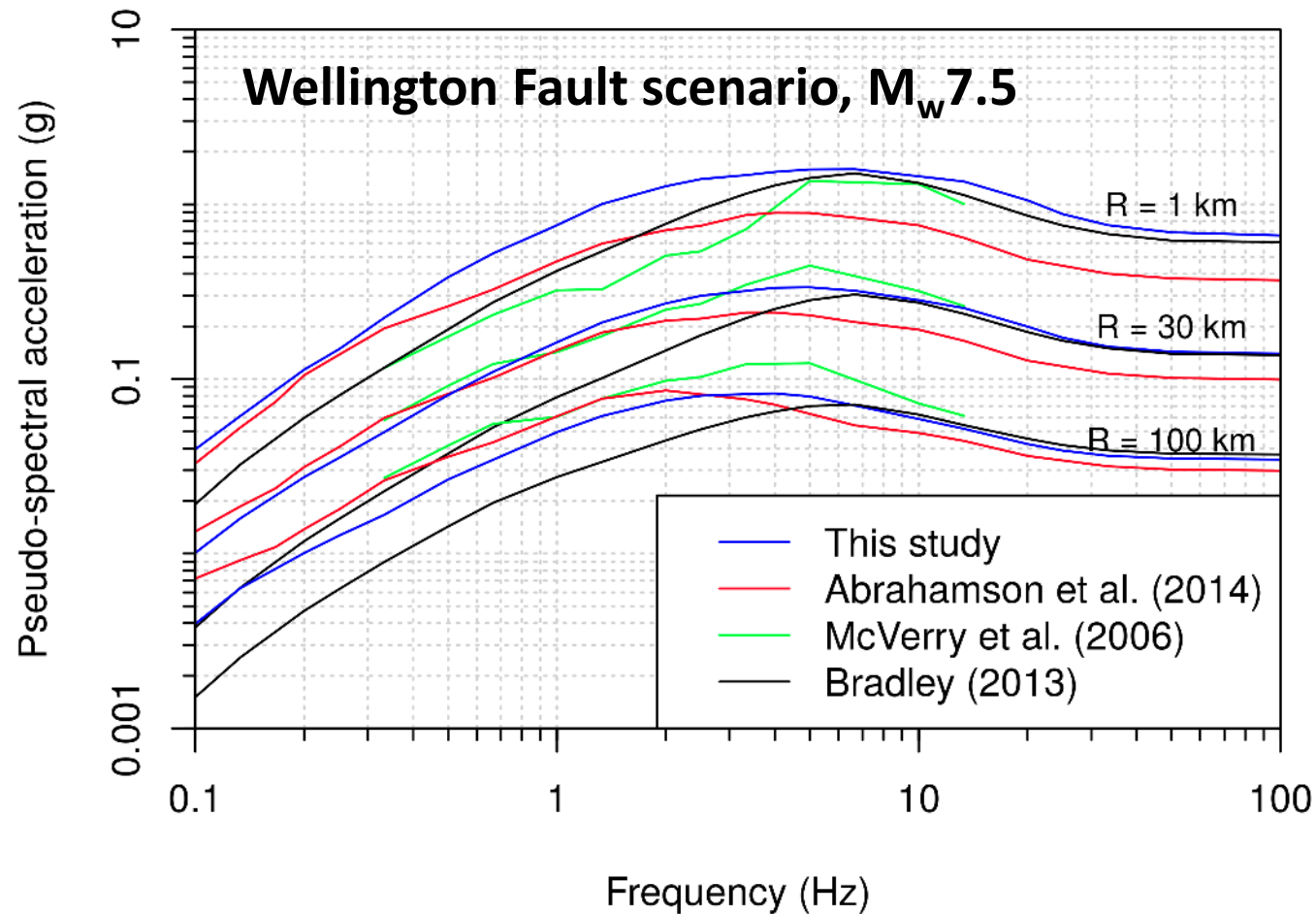


## KL DIVERGENCE



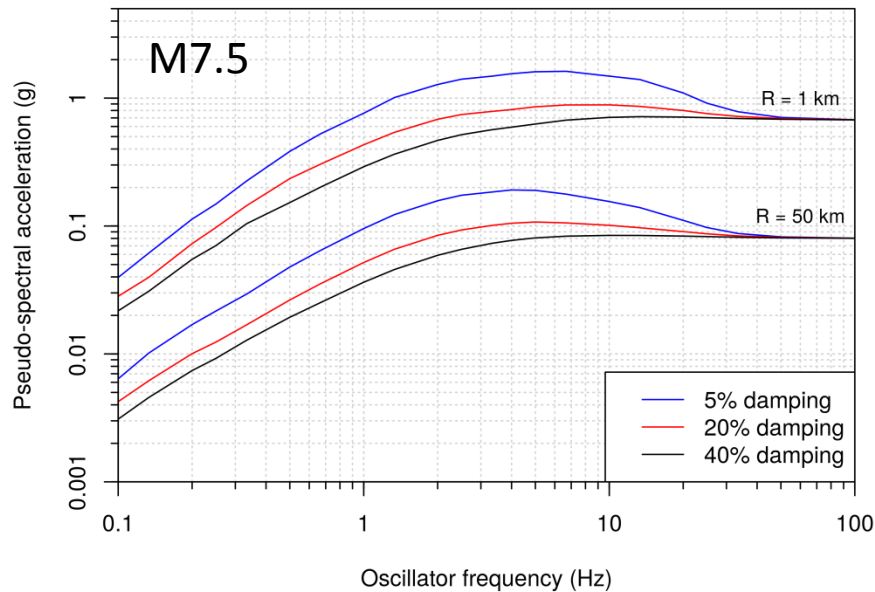
- BNZSEE paper on model comparisons under review
- Makes some tentative recommendations for a ground motion characterisation logic tree for PSHA.
- Work currently underway to derive a full epistemic variance model for New Zealand PSHA.

# A new New Zealand model

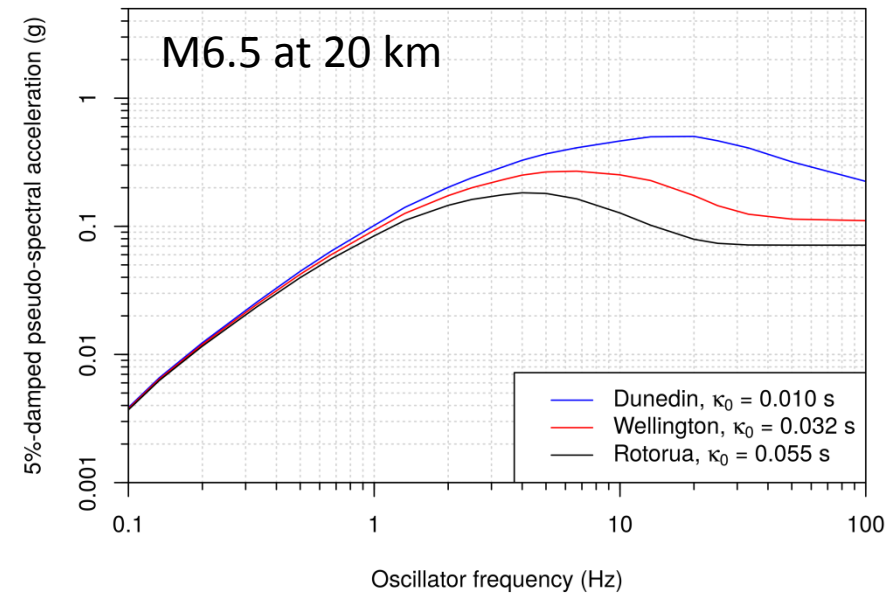


# A couple of unique things

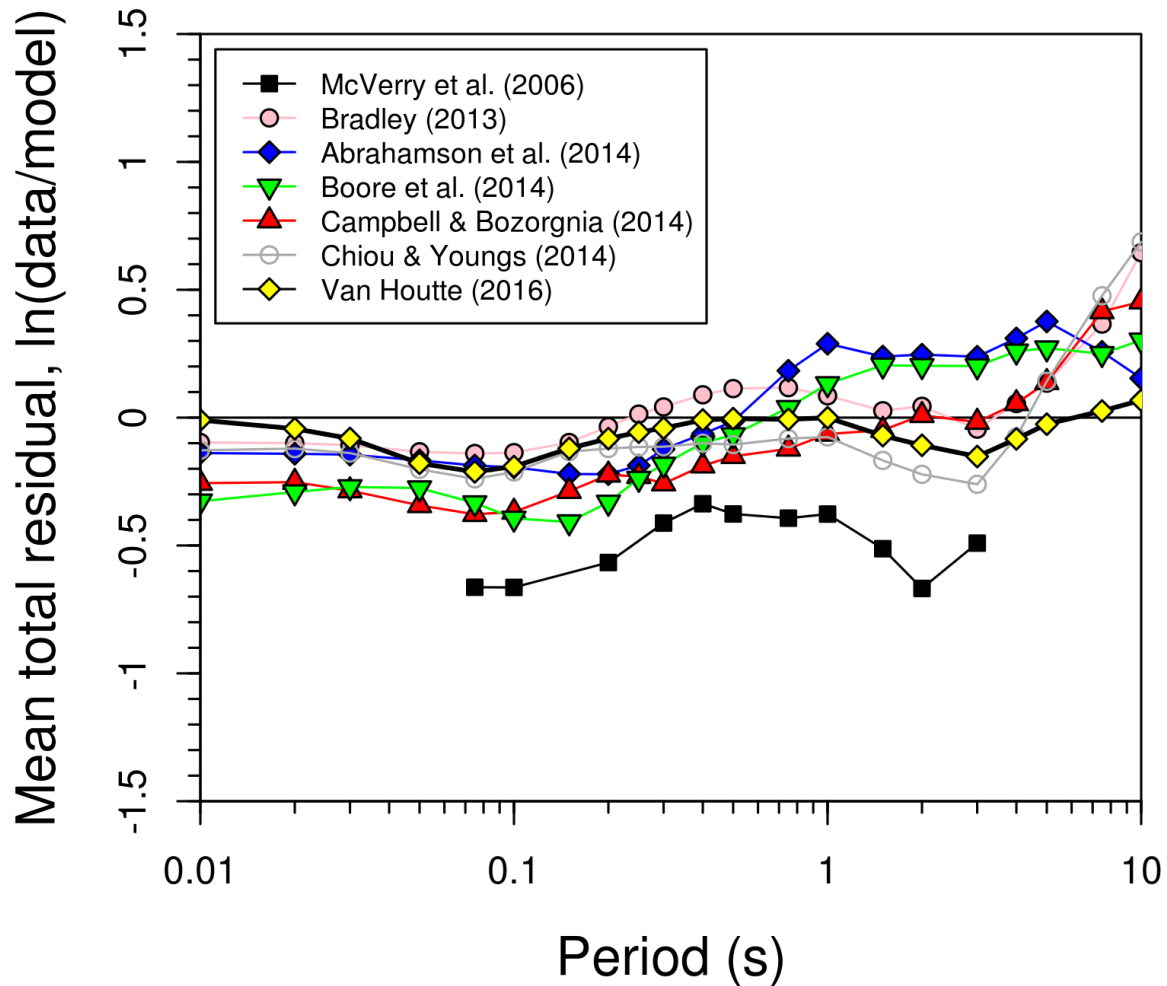
## Different values of oscillator damping



## Incorporates $\kappa_0$ as a predictor



# The new model



Thanks