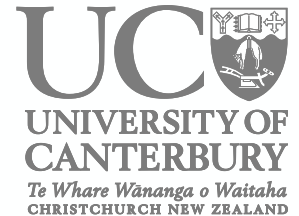QuakeCore Flagship 1 Meeting

Progress update and initial versions of the 2021 New Zealand ground motion database

Jesse Hutchinson, PhD

UC
UNIVERSITY OF
CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Outline

- Objective

  - To establish a consistent, expandable database for ease of use containing earthquake source and ground motion intensity measures.

- Discussion

  - Tables and data.

  - Figures.

  - Near-term additions.
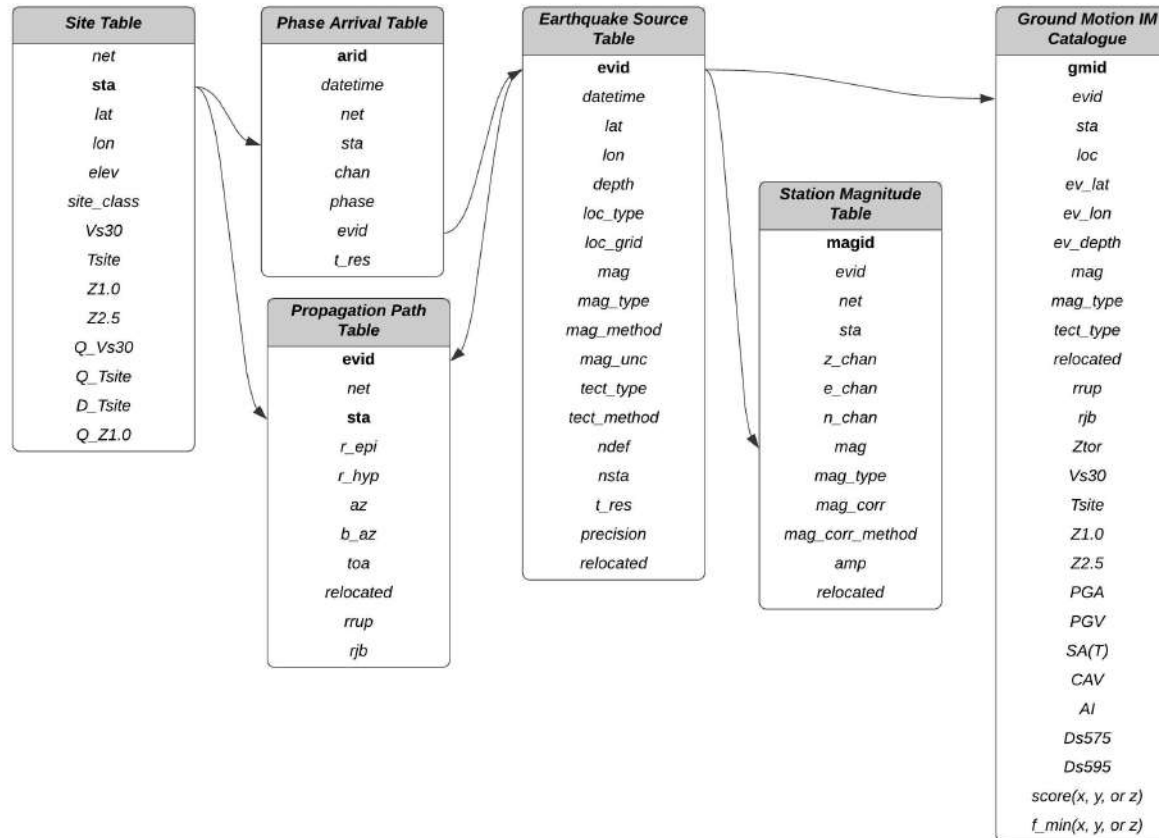
  - Long-term goals.

Tables and Data

- The ESGMIM (earthquake source and ground motion intensity measure) catalogue is divided into several tables.

  - Earthquake Source Table

  - Phase Arrival Table

  - Station Magnitude Table

  - Propagation Path Table

  - Site Table

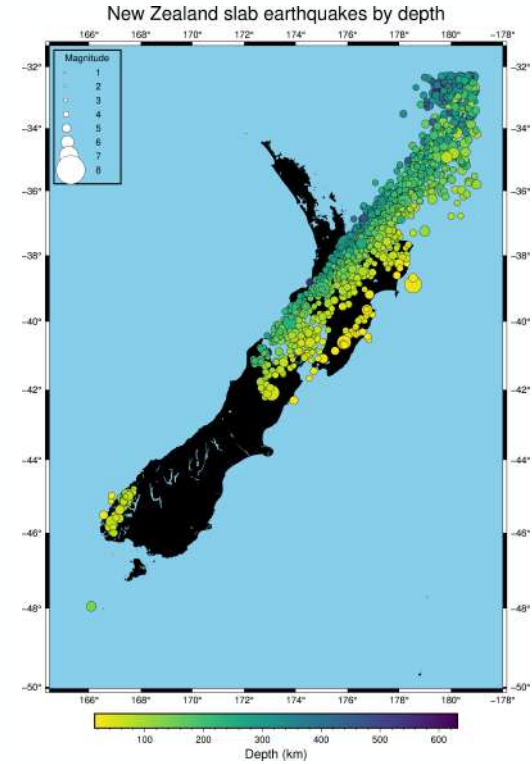 - Ground Motion Intensity Measure Tables (000, 090, and vertical)

Tables and Data

Site Table
- net
- **sta**
- lat
- lon
- elev
- site_class
- Vs30
- Tsite
- Z1.0
- Z2.5
- Q_Vs30
- Q_Tsite
- D_Tsite
- Q_Z1.0

Phase Arrival Table
- **arid**
- datetime
- net
- sta
- chan
- phase
- evid
- t_res

Propagation Path Table
- **evid**
- net
- **sta**
- r_epi
- r_hyp
- az
- b_az
- toa
- relocated
- rrup
- rjb

Earthquake Source Table
- **evid**
- datetime
- lat
- lon
- depth
- loc_type
- loc_grid
- mag
- mag_type
- mag_method
- mag_unc
- tect_type
- tect_method
- ndef
- nsta
- t_res
- precision
- relocated

Station Magnitude Table
- **magid**
- evid
- net
- sta
- z_chan
- e_chan
- n_chan
- mag
- mag_type
- mag_corr
- mag_corr_method
- amp
- relocated

Ground Motion IM Catalogue
- **gmid**
- evid
- sta
- loc
- ev_lat
- ev_lon
- ev_depth
- mag
- mag_type
- tect_type
- relocated
- rrup
- rjb
- Ztor
- Vs30
- Tsite
- Z1.0
- Z2.5
- PGA
- PGV
- SA(T)
- CAV
- AI
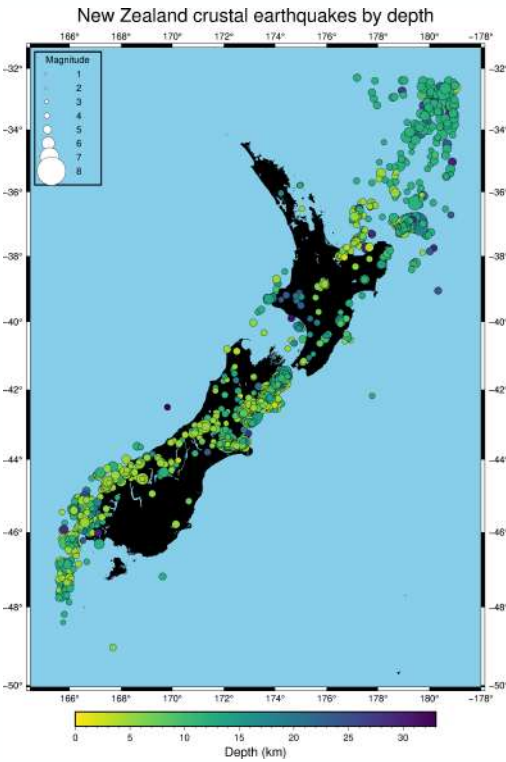- Ds575
- Ds595
- score(x, y, or z)
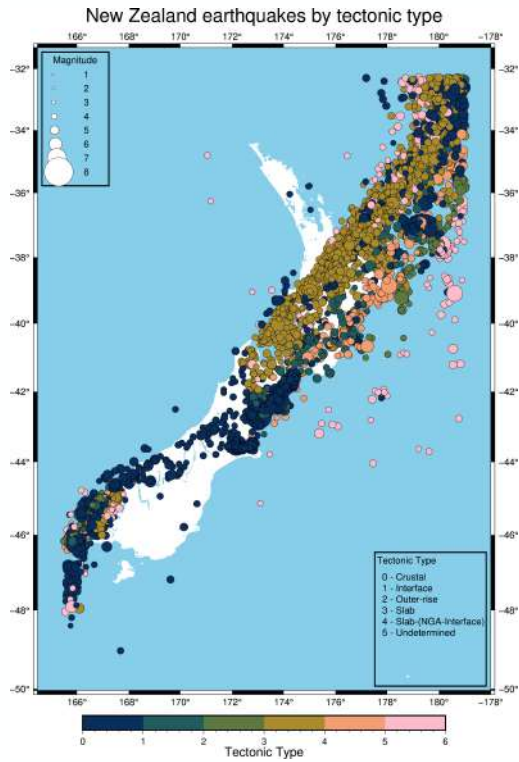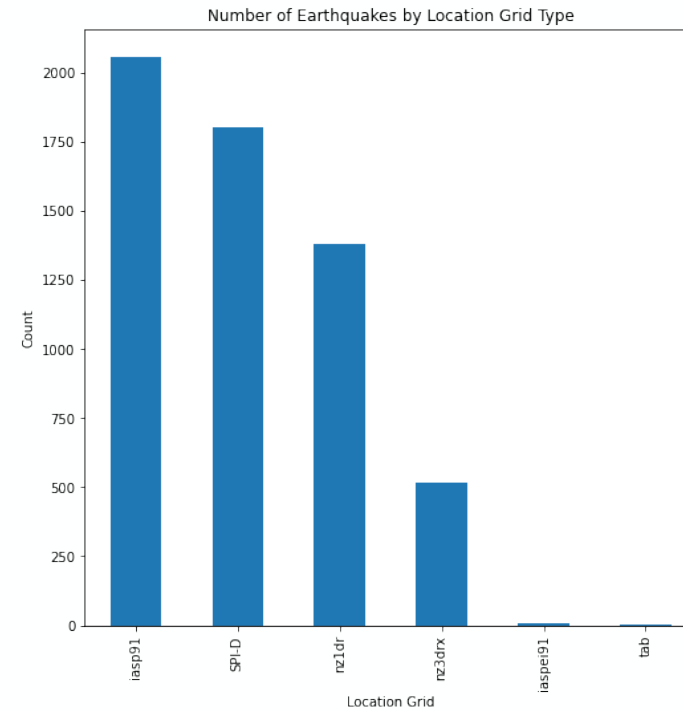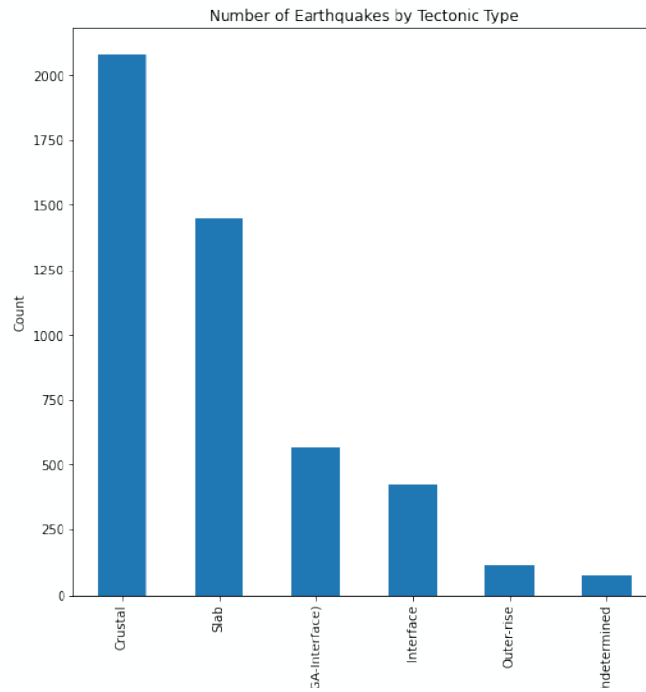- f_min(x, y, or z)

Tables and Data

- All tables and data provided in the ESGMIM catalogue are subset from the complete GeoNet database based on the available ground motion intensity measures. Aside from the GMIM tables, versions of these tables encompassing the entire database from 2000-2020 are available.
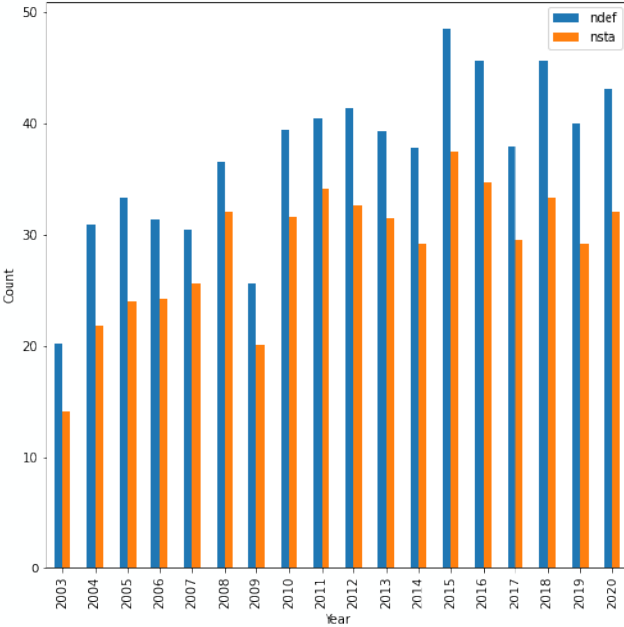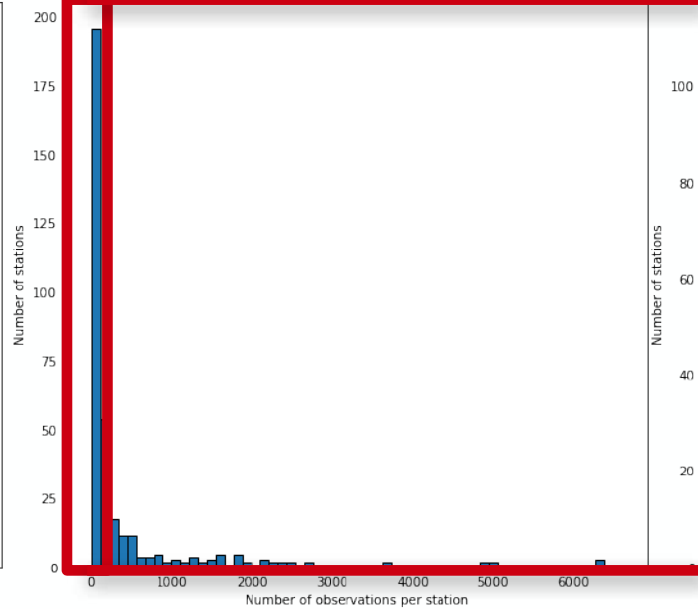
Figures

Figures

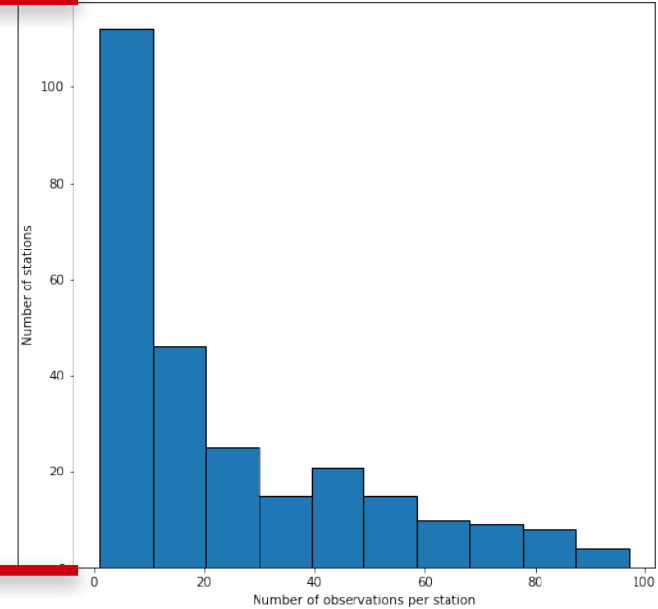# Figures

Figures

Rrup distance from event to station vs magnitude
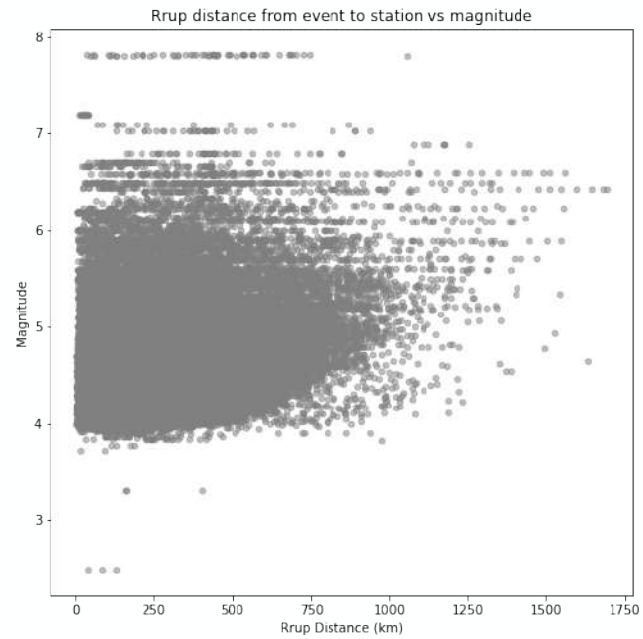
Near-term Additions

- Expand database to include all of 2020, as well as 2000-2002.

- Ground Motion IM Tables

  - SA(T) currently covers periods of 0.02, 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.75, 1.0, 2.0, 3.0, 4.0, 5.0, 7.5, and 10.0.

    - This will be revised to at least include periods of 0.01, 0.015, 0.02, 0.03, 0.04, 0.05, 0.07, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5, 2., 3., 4., 5., 7., 10, as suggested by Gail Atkinson.

  - Current tables provided are for 000, 090, and vertical. The next major version will include rotD50 and rotD100 tables.

  - Tables are now flatfiles that contain event, site, and propagation data.

  - The next major version will include M 3.5+ data. This is currently in the pre-processing phase.

Near-term Additions

- Earthquake Source Table and Station Magnitudes

  - Local magnitudes (ML) were corrected to be more on par with moment magnitudes (MW) using the NZ20 (Rhoades et al., 2020) formula.

  - It was found, however that amplitude measurements were not always consistent or properly converted to mm. I am currently reprocessing data, which requires downloading waveforms and calculating amplitudes from the Wood-Anderson response.

Near-term Additions

- New Table: Source Mechanisms

  - The first iteration will include data from RMT and CMT solutions.

  - Future iterations will include focal mechanisms. This require hunting through literature sources and/or calculating focal mechanism solutions.

Long-term goals

- Earthquake Source Table

  - Relocation of earthquakes using the MAXI method (Font et al. 2014).

  - Expanding the earthquake catalogue with the EQTransformer deep-learning model.

- Phase Arrival Table

  - Calculation of takeoff angles (can be determined from a 3-D velocity model with Pykonal (White et al, 2020)).

  - Determine first-motions for P-phases.

- Source Mechanism Table

  - Calculate focal mechanisms from takeoff angles, first motions, and S/P ratios using HASH (Hardebeck and Shearer, 2002).