GROUND MOTION CLASSIFICATION AND REDUCTION OF THE MAGNITUDE OF COMPLETENESS OF RMT SOLUTIONS FOR THE NEW ZEALAND EARTHQUAKE DATABASE, 2003-2020

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OUTLINE

Ground Motion Classification

- Objective
- Procedure
- Progress

RMT solutions with Grond

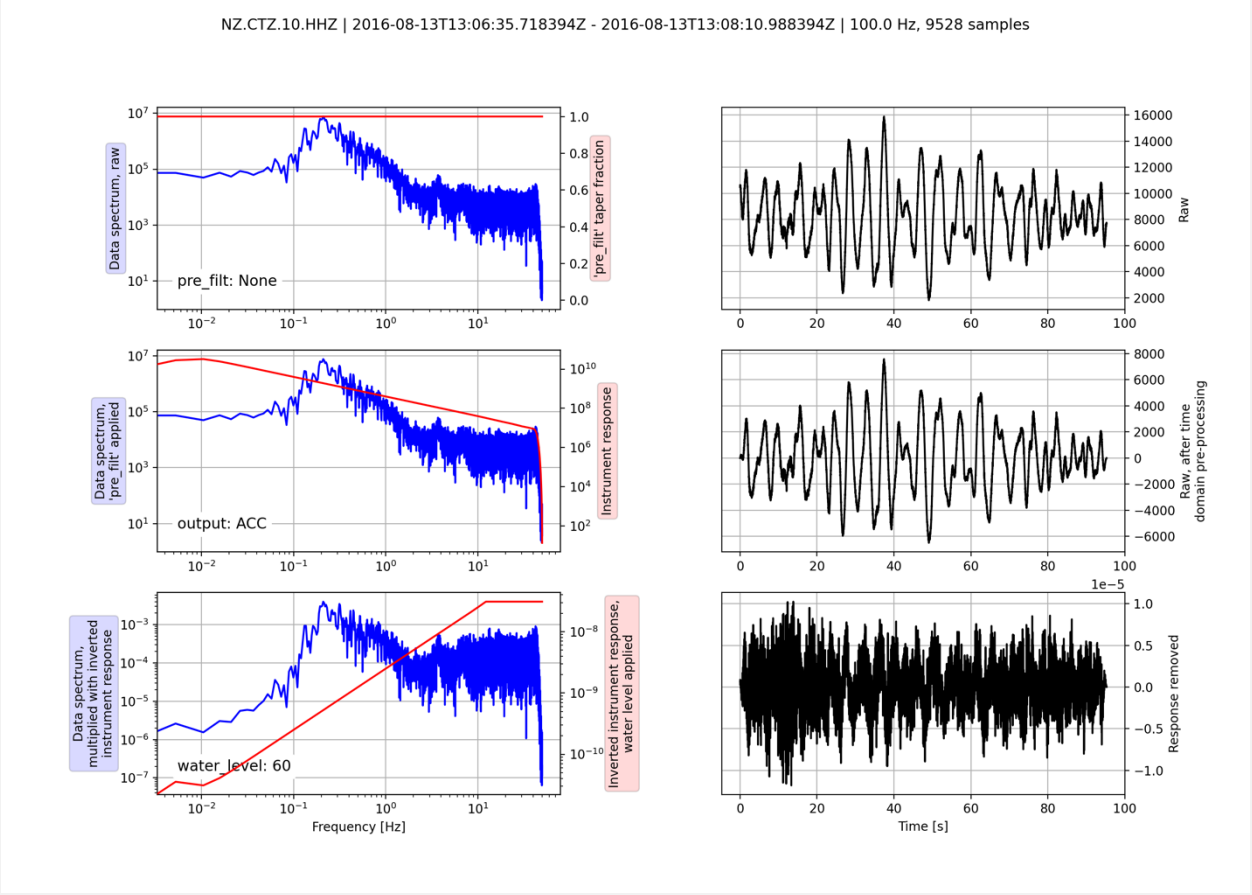
- Objective
- What is Grond?
- Procedure
- Progress

GROUND MOTION CLASSIFICATION

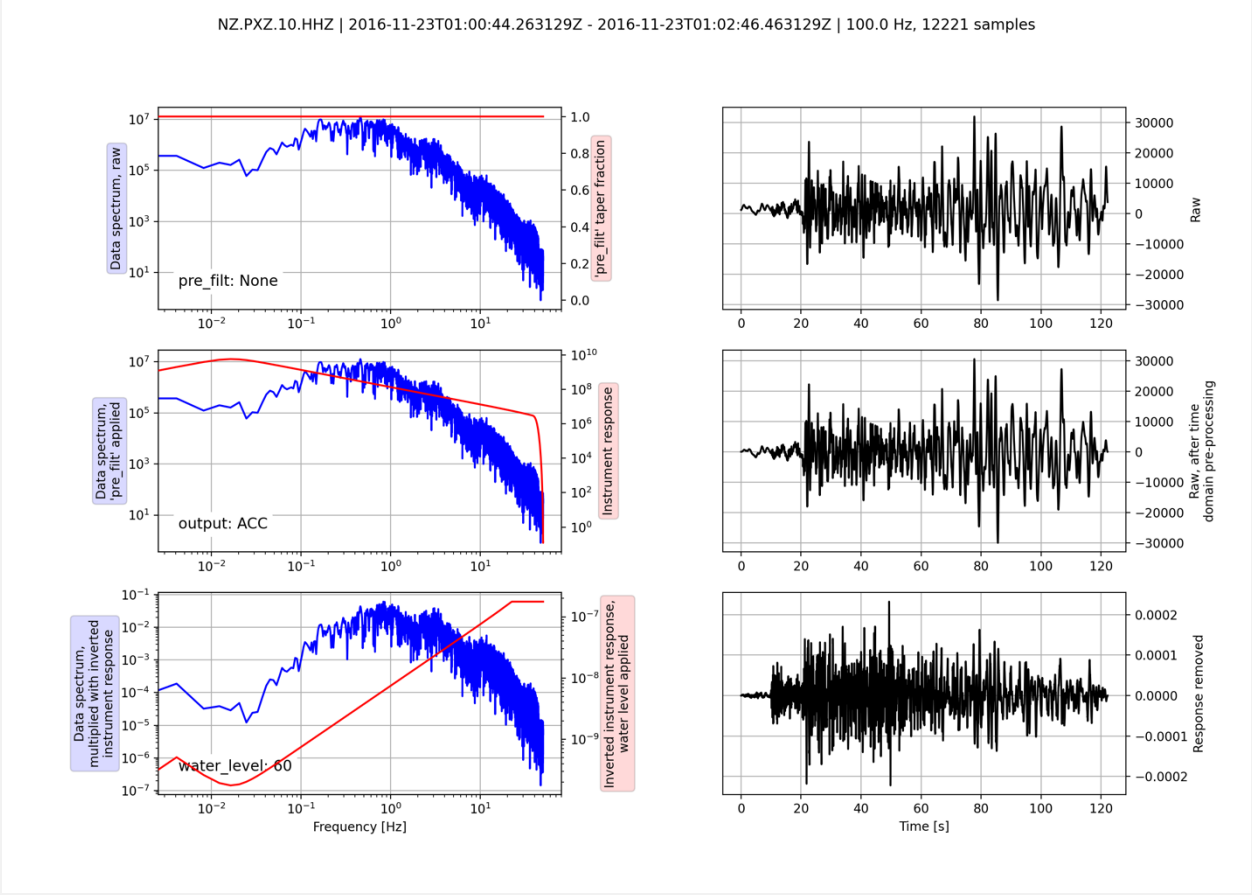
- Objective
  - Classify whether ground motions for events from the entire New Zealand GeoNet database are high quality.
  - High quality ground motions can be used to ascertain site response characteristics.
  - Site response informs the input for hazard prediction models.
  - Low quality ground motions indicate less than ideal conditions; site characteristics, azimuthal/depth distribution of certain events, instrument problems.
  - Provides minimum and maximum frequencies for bandpass filtering.

GROUND MOTION CLASSIFICATION

- Procedure
  - Acquire data from the GeoNet FDSN webserver:
    - Performed with the Obspy module for Python
    - Miniseed waveform data for short-period, broadband, and strong-motion seismometers.
    - StationXML data for the station inventory
      - Also include SNZO from IRIS
  - Process miniseed data:
    - Performed on yearly basis.
    - Instrument sensitivity is removed and data is converted to accelerograms and detrended.
    - Waveform parameters, such as peak noise, PGA, and the SNR at various frequencies are recorded.
  - Evaluate waveform parameters:
    - Evaluates feature records using the TensorFlow neural network.



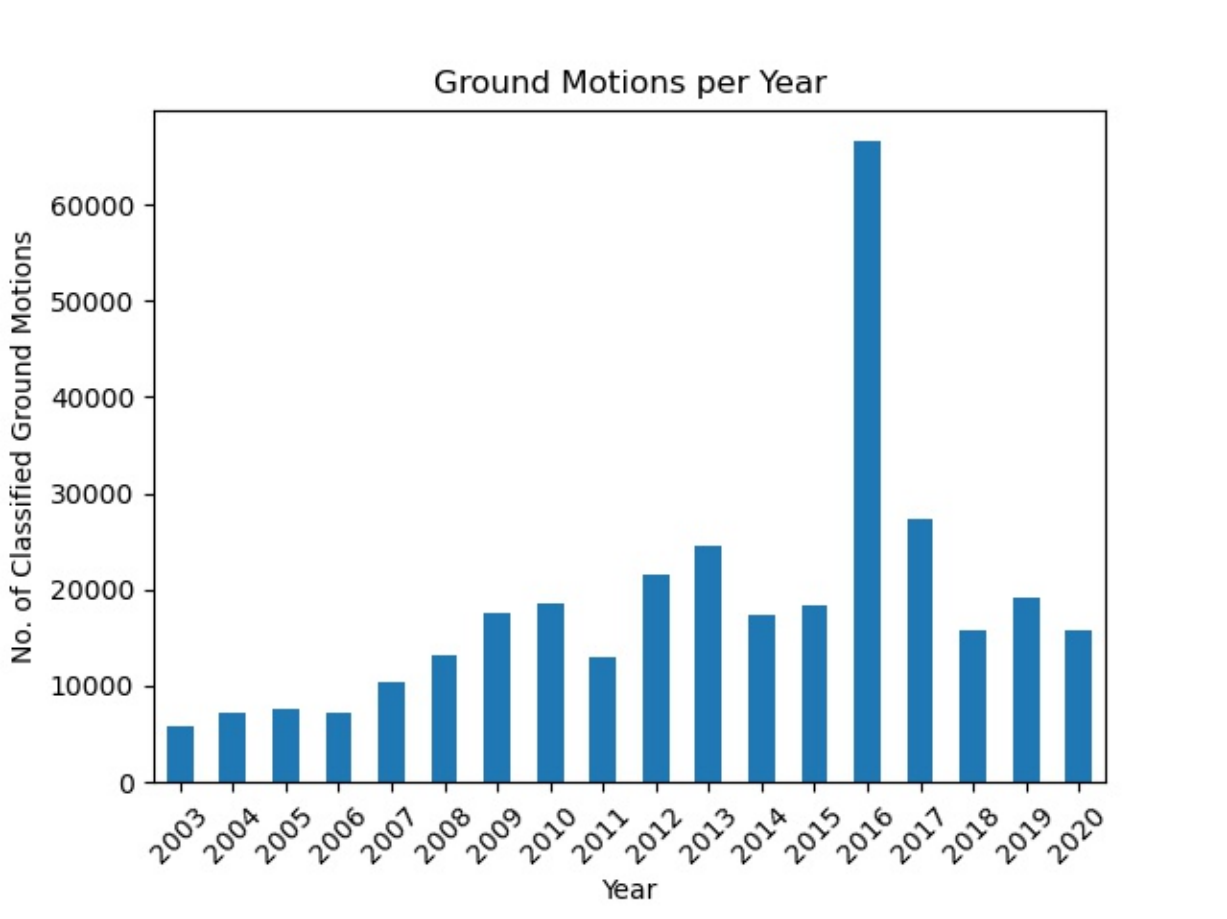
A very low-quality GM record.

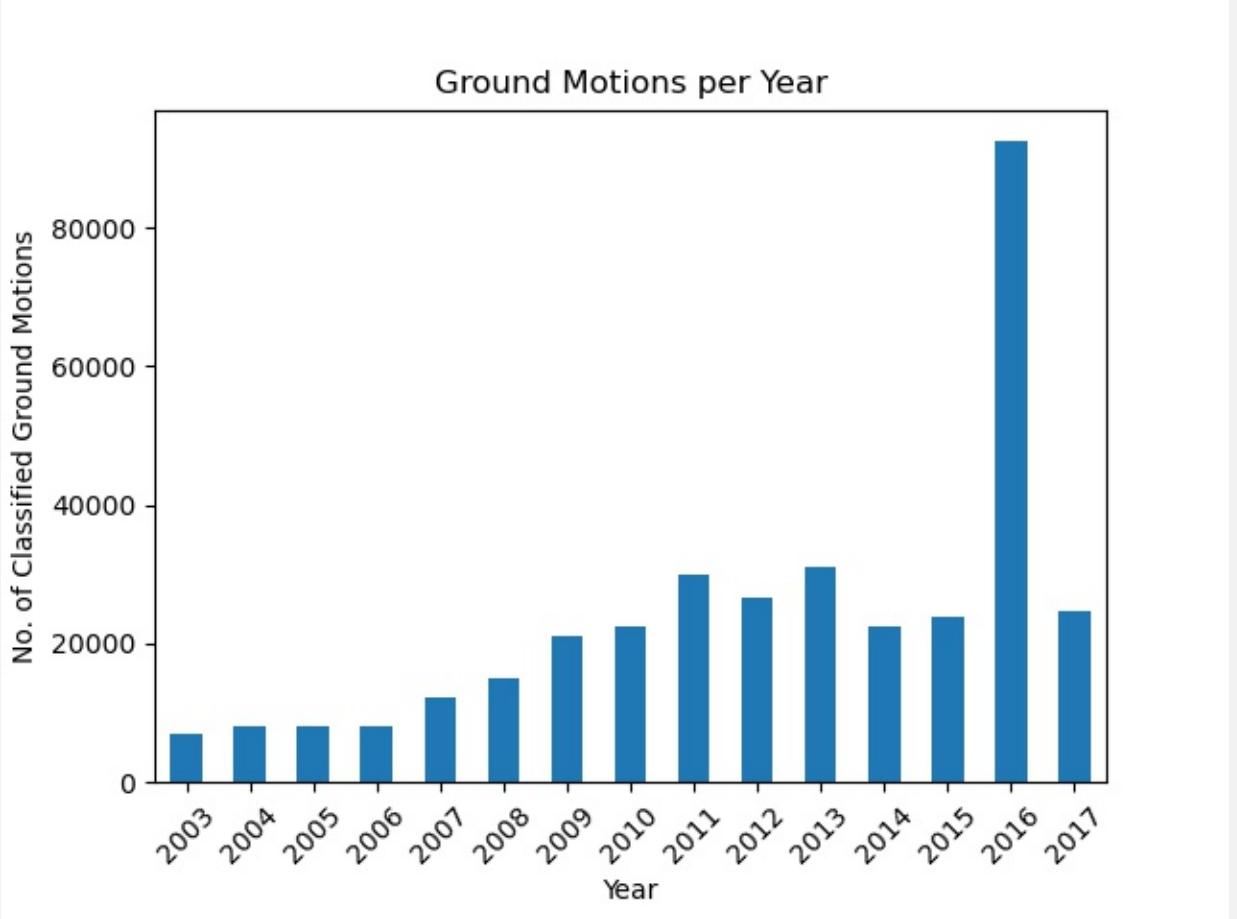


A higher quality GM record.

GROUND MOTION CLASSIFICATION

- Progress
  - Originally tested with V1A data. Implementation of miniseed support has greatly reduced processing times.
  - All events for M >= 4 have been processed from 2003-2017.
  - The input model for the final phase will be retrained with the new dataset.
  - We must still process ground motions for lower magnitude events and for events through 2020.





- 2011 Total Classified GMs : 13,002 vs 22,504
- 2016 Total Classified GMs: 66,571 vs 92,426
- Processing for 2017 is still in progress.

RMT SOLUTIONS WITH GROND

- Objective
  - To expand the national catalogue of regional moment tensor solutions.
  - Moment tensor solutions contain accurate estimations of magnitude, which can be used to further calibrate local magnitude to moment magnitude scales.
  - RMTs illuminate rupture types for faults, directly informing our hazard models.

RMT SOLUTIONS WITH GROND

- What is Grond?
  - https://pyrocko.org/grond/docs/current/
  - Grond is a probabilistic forward modelling approach to computing earthquake source characteristics.
  - Grond uses Green's function data (synthetic waveforms) to find the best-fit models to waveforms for events over a number of user-defined inversions.
  - The final results can be output into an HTML style report database.
  - Grond can also accept GNSS and InSAR observations as input.

RMT SOLUTIONS

- Procedure
  - Retrieve 1-hour miniseed waveforms from the GeoNet FDSN webservice for broadband seismometers.
  - The time-window for these data are centered around the origin times for events defined by the user (currently events with M >= 4.
  - Run Grond for selected events.
  - Generate reports.
  - Review reports for potential problems and/or events with poor inversions.

RMT SOLUTIONS

- Progress
  - Currently testing with data from 2011.
  - Inversions for a single event can take up to 100 minutes, but can be processed in parallel.
  - Further configuration could reduce processing times (fewer iterations, L1 vs L2 normalization, fewer stations considered for input)