# QuakeCoRE GMSV
# 2019 RfP – AECOM Research Plans

Jeff Bayless, Paul Somerville, Andreas Skarlatoudis

Paul.Somerville@aecom.com

Jeff.Bayless@aecom.com

Andreas.Skarlatoudis@aecom.com

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# Research alignments:

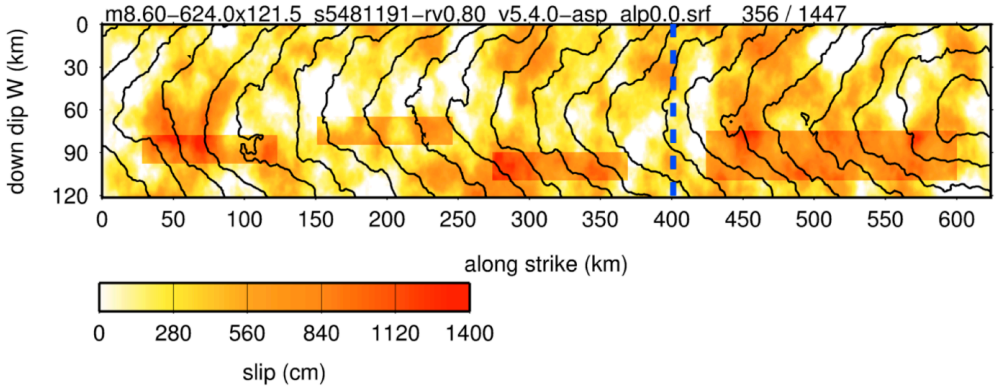
- FP1.1: Simulation methods
- FP1.5: Uncertainties and PSHA

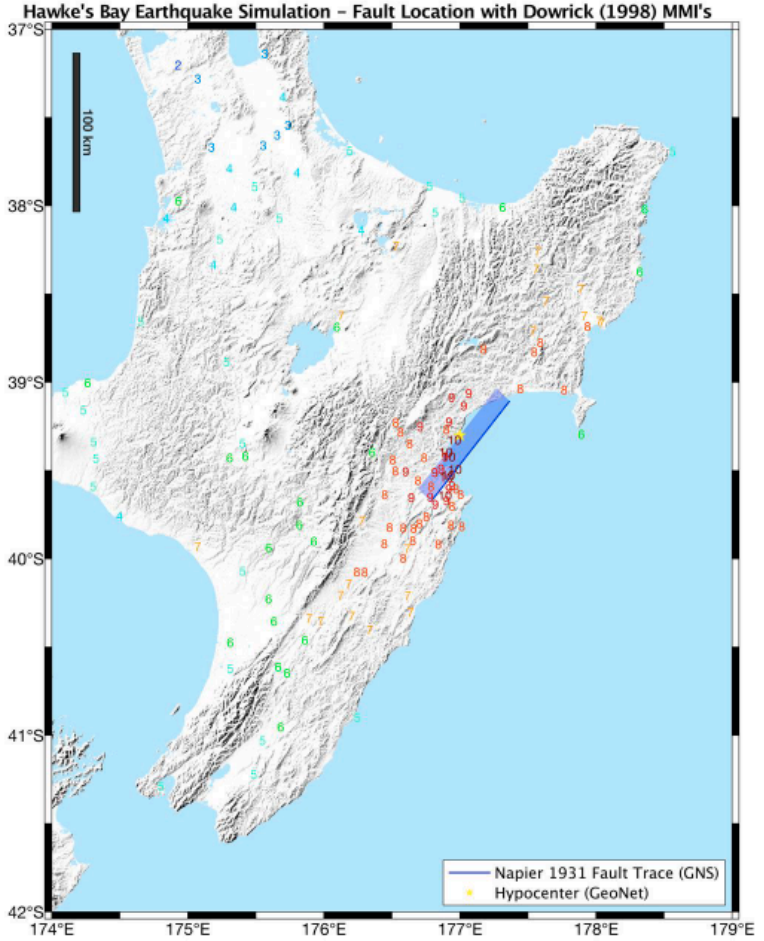
- Project 4a: Validation of simulations for NZ-wide historical events
- Project 4b: Simulation of Hikurangi Subduction zone earthquakes

# Summary of AECOM-QC work

- Previous work
  - Validation of the 1931 Hawke's Bay and 2009 Dusky Sound eqk GMs (2016)
  - Rupture modeling of the Hikurangi megathrust using GP-IM asperity/stochastic hybrid source method (2017)

Hikurangi slip



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# Summary of AECOM-QC work, cont.

- Ongoing work (2018)
  - Using the 2017 source model, preliminary validation of 1D sims against GMPEs and comparison with code spectra for Wellington
    - Sensitivity analyses to slip distribution, asperity number, hypocenter, etc

- Proposed Future Research (2019)
  - Validation of the GP-IM asperity/stochastic hybrid source method against megathrust eqk data

# (2019) Validation against data - Background

The results of our previous work show that more code validation is required for megathrust simulations using GP.

The Pitarka et al. (2018, in prep) source method combines the Irikura and Miyake (2011) asperity-based kinematic rupture generator with the Graves and Pitarka (2015) rupture generation methods for stochastic spatial variability and background slip.

– the rules for the definition of size/strength of asperities for megathrust events need to be worked out

Up to now, the model input parameters have been only calibrated for crustal earthquakes. The source model should be validated with recordings from interface events, in addition to validation against GMPEs.

The 2011 Tohoku earthquake is a prime candidate event for validation.

# (2019) Validation against data – Approach for the Tohoku Earthquake

- Use the GP-IM source generator, considering the Irikura recipe and source inversions (Kurahashi and Irikura, 2013)
  - Tohoku simulation validations are ongoing in Japan (Hiroe Miyake, pers. comm.).
  - The Irikura recipe involves specifying sizes of asperities and stress drop on the asperities; the GP-IM algorithm follows the Irikura approach but is modified to parameterize the source asperities in terms of slip and slip velocity in accordance with the GP simulation method. We will focus on understanding the differences between the two methods.
  - We are in close contact with Rob Graves and Arben Pitarka (of GP-IM) and Hiroe Miyake (of Irikura-Miyake)

- Use 1D Green's functions and strong-motion stations from Skarlatoudis et al. (2015)

- Use the SCEC-GP wave propagation method (low and high frequencies)
  - The HF will be parameterized following Kkallas et al (2018) which calibrated the stochastic method to subduction eqks in the southern Aegean Sea

# (2019) Validation against data – Outcomes

– This, along with the 2018 project results, will better inform us how the GP-IM source model performs for a megathrust event. We will identify frequency ranges which need further calibration.

– We will assess the sensitivity of the GMs to the “strength” of the source model asperities relative to background slip in order to calibrate the source model, compare the two methods for defining asperities (slip-based vs stress drop based), and provide guidance on their application.

– A journal paper on the topic