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NZ Centre for Earthquake Resilience

Guidance on the Utilisation of GM Simulations in Engineering Practice

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Document Overview

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- Guidelines for the utilization of ground motion simulations in site-specific applications
- Framework to which current and future research/development of simulated GMs can be referenced
- Similarly it's a reference for assessing applicability for practical use
- Engagement with researchers and practitioners at all levels
  - Workshop July 2016 w/ 19 participants from NZ universities, CRIs, consultants, international researchers
- Long-term goal for simulated GMs to be adopted/referenced in future iterations of the NZ Standards
  - If the development and early adoption has been carried out with consistent context then Code recommendations or normalization should be easier to achieve

Anticipated Application

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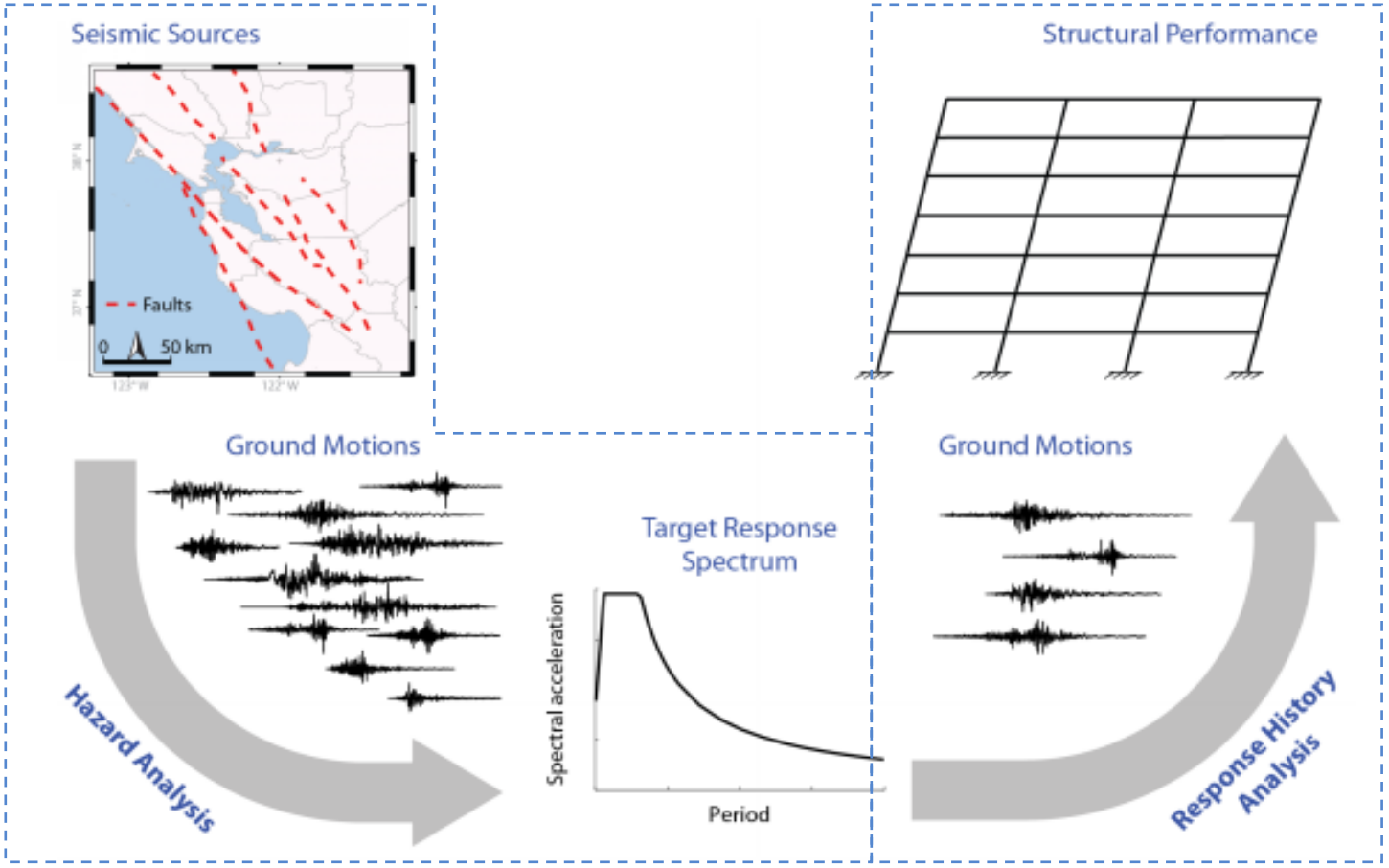

Key Components

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- Verification
  - Assessment of the solution of the computational model
  - Accuracy
  - Suitability
  - Typically via comparison with analytical solutions or different computational codes
- Validation
  - Assessment of simulation accuracy measured using experimental observations
  - Physics rather than a numerical problem
- Utilisation
  - Aspects that need to be communicated to assist end-users

Key Components

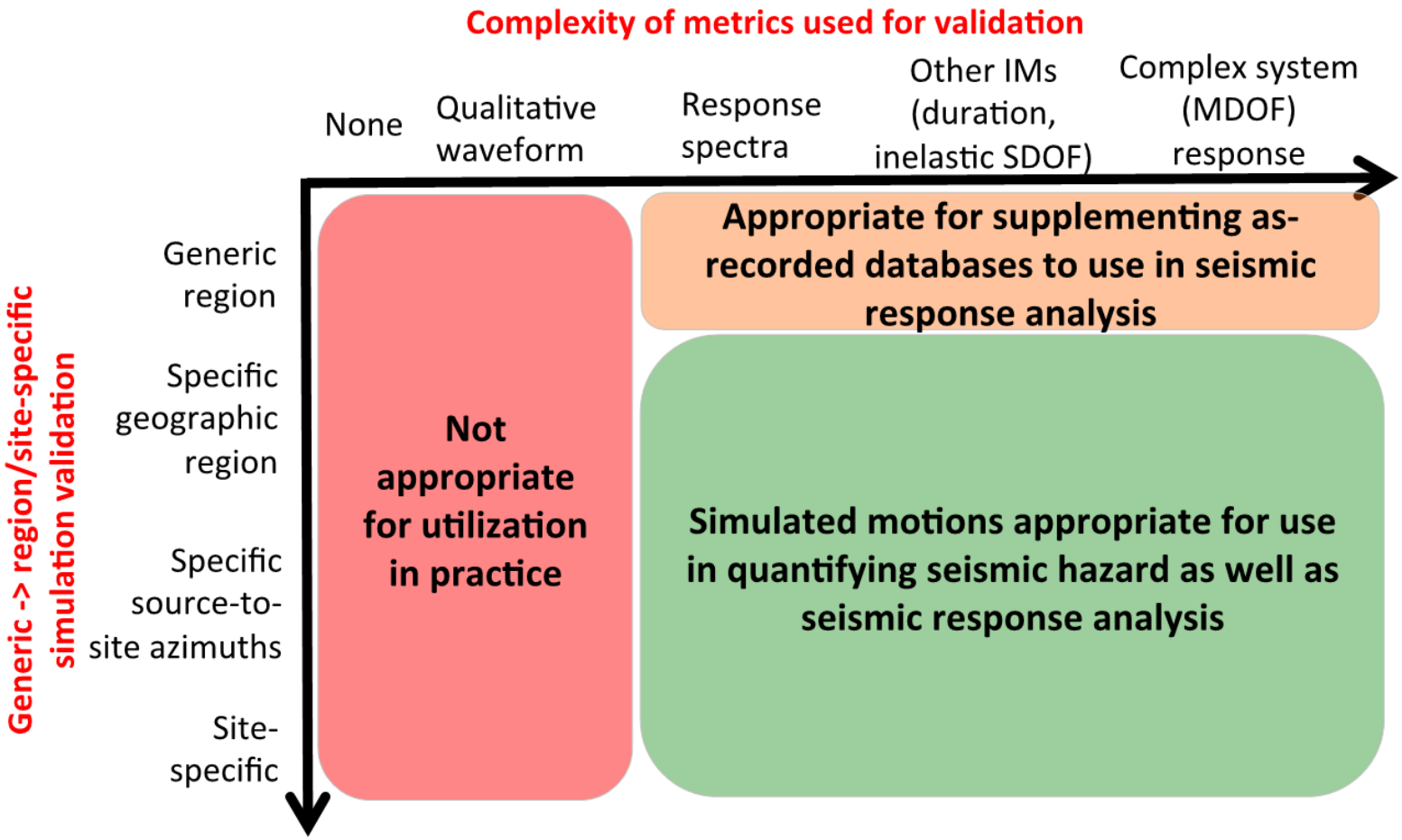
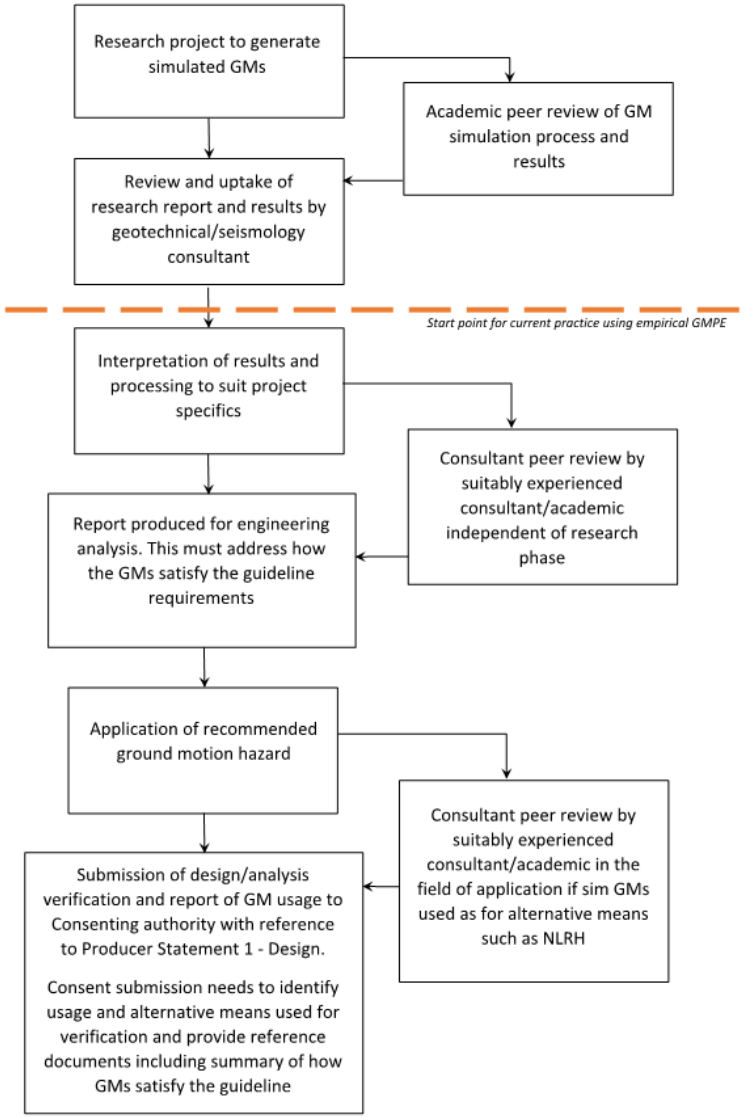


Figure 2: Validation matrix for GM simulations and illustration of appropriateness for utilization in the context of Figure 1

How to bring this into practice?

- New direction in research to provide results for use in practice
- Use of guidance by consulting geotech/seismologist
- Use of recommended hazard/GM by structural engineer



Example Applications

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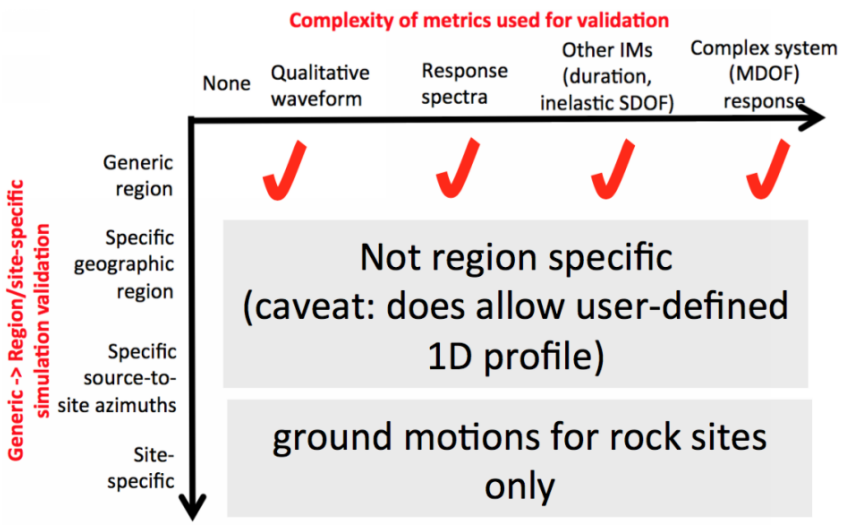
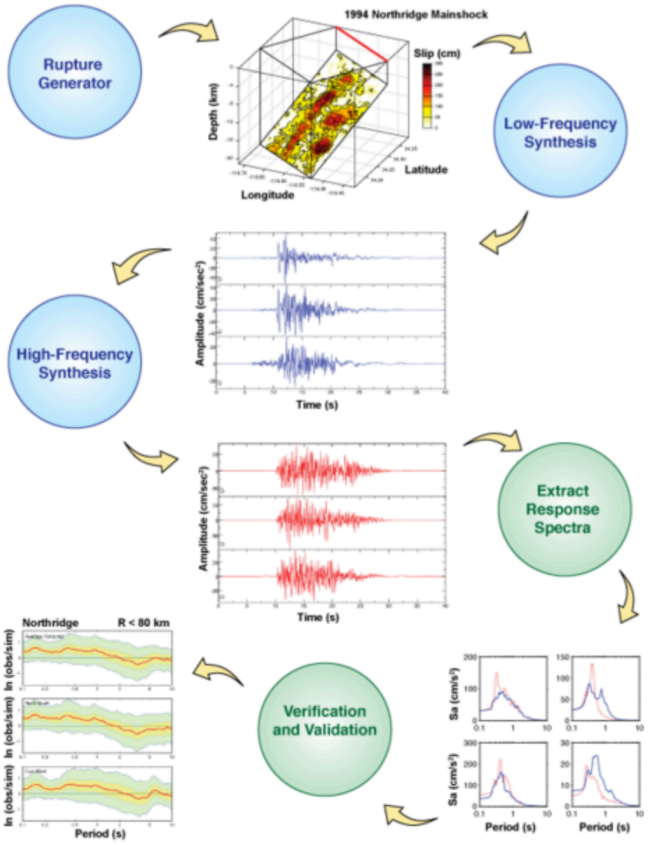
Example 1: SCEC BBP





Appropriate for use in seismic response analyses when scaled to a target spectrum

Example Applications

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Example 2:Alpine fault (site specific)

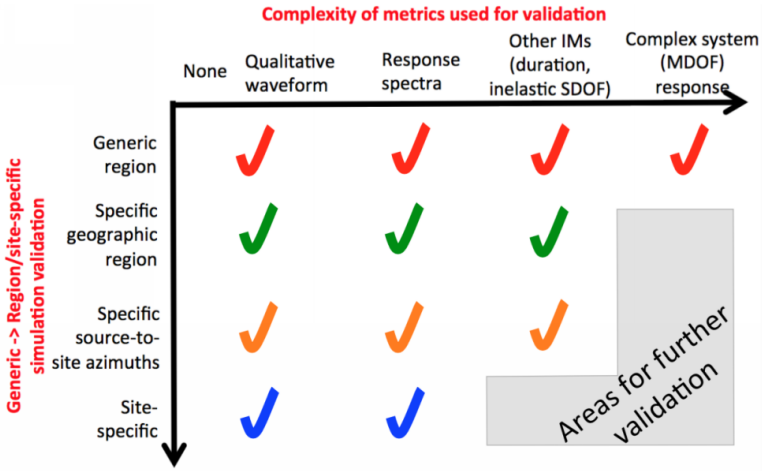

Figure 5: Validation matrix for GM simulations of Alpine Fault EQs on the Canterbury region

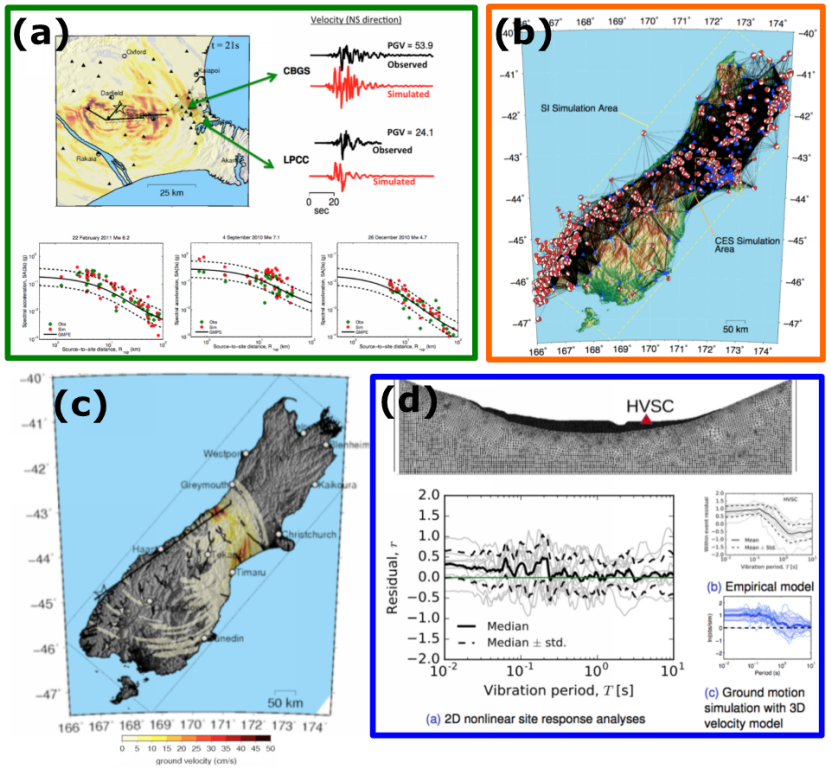

Figure 4: Illustration of validation examples (a,b,d) for Alpine Fault simulations (c)

Additions to come…

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- Benchmarking with empirical models
  - What is the ‘pass’ criteria for each part of the matrix
- Definition of “pass” varies from case-to-case
  - Perspective of practical application - can consider a pass as performing better than empirical models
- Incorporation of simulation modelling uncertainty into the guidance
  - Guidance will explicitly comment on average and uncertainty in simulation predictions

…and finally…first up-take