QuakeCoRE
NZ Centre for Earthquake Resilience

Development of a QuakeCoRE database for access to Ground Motion simulation outputs at specific locations

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High Performance Computing @ QuakeCoRE

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NeSI
New Zealand eScience Infrastructure

Fitzroy : IBM POWER6 Cluster of 3392 CPU cores

QuakeCoRE's Ground Motion simulation workflow is one of benchmark tests for upgrade in 2017

QuakeCoRE Ground Motion Simulation Workflow

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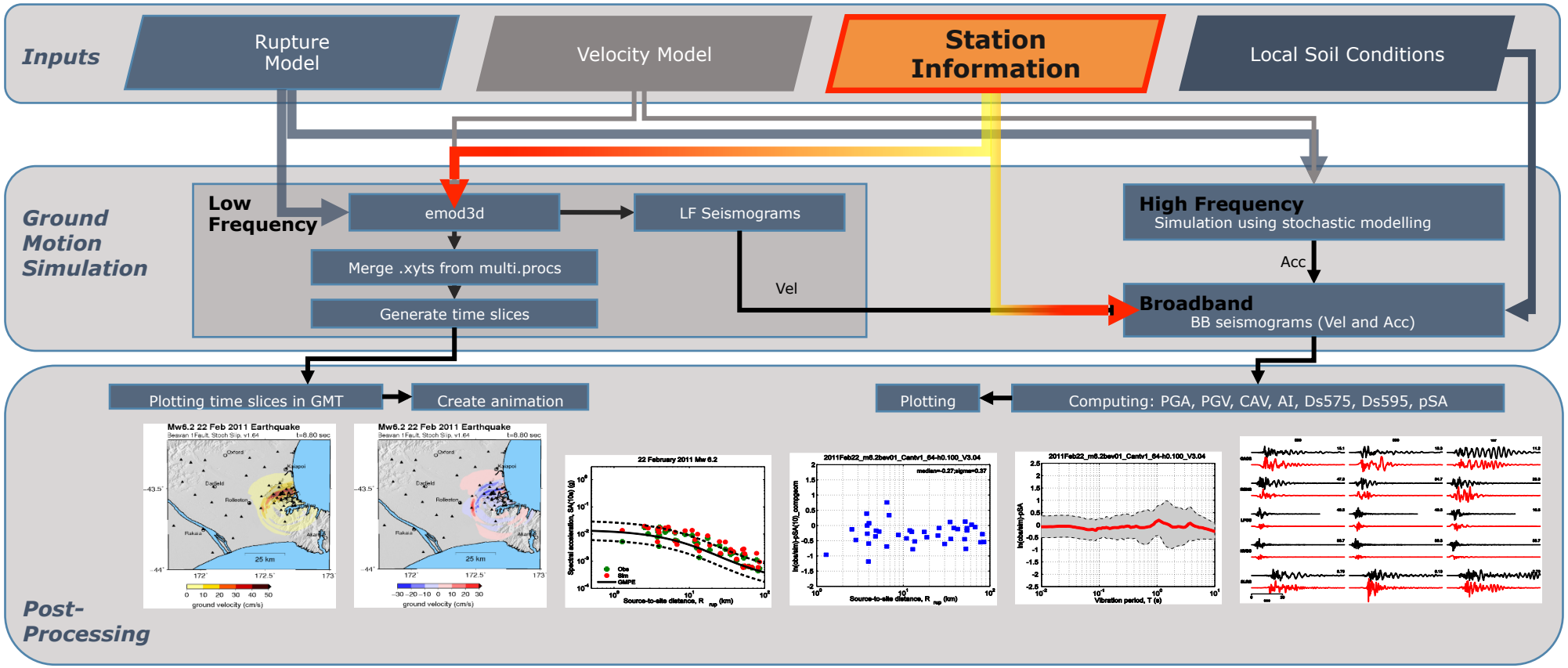
Based on Graves & Pitarka (2010, 2015)

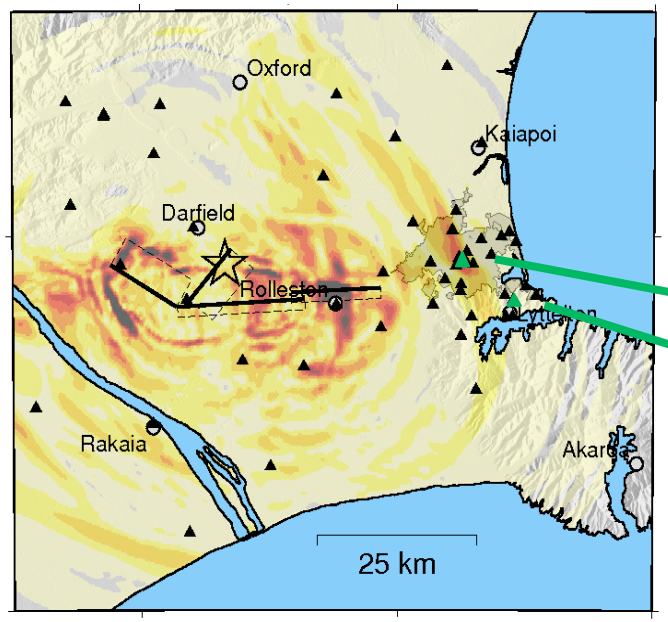
More details on poster #250



GM Simulation for historical earthquake scenarios

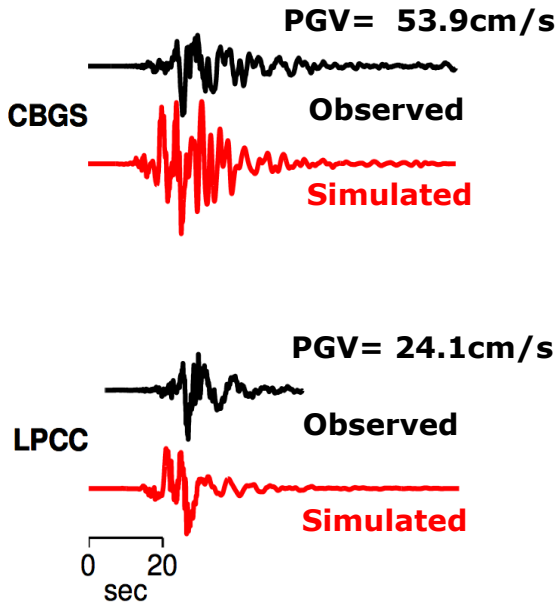
- Simulation computes seismogram for existing stations only
  - Less computation and storage
  - Empirical data is available for validation

N simulations for N rupture models (non-uniform weights based on misfit of each simulation with observed motions)



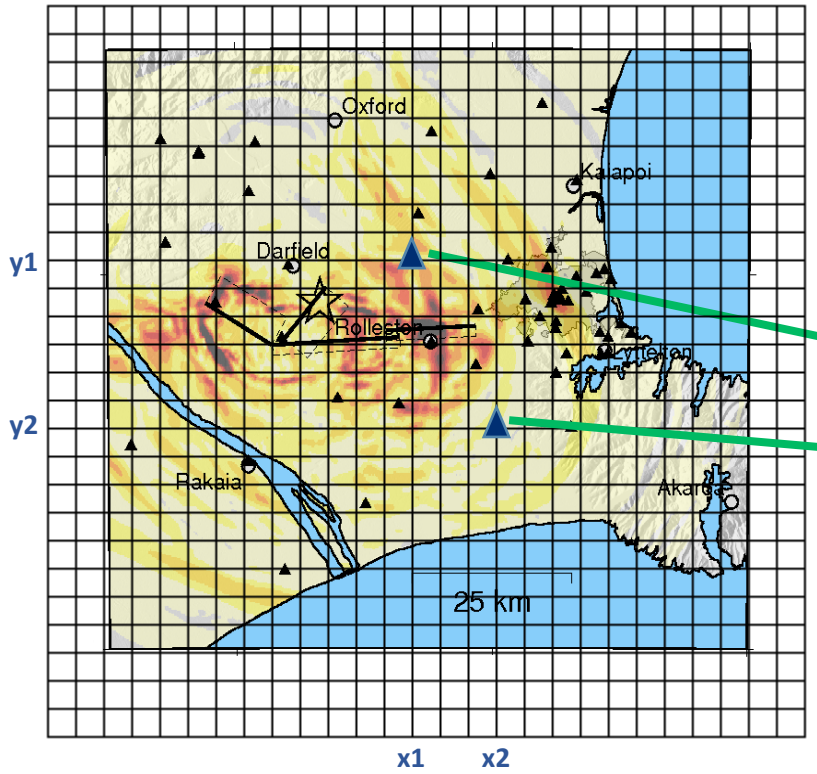
StationInfo

Name	Longitude	Latitude
....		
CBGS	172.6199	-43.5293
....		
LPCC	172.7248	-43.6078
....		



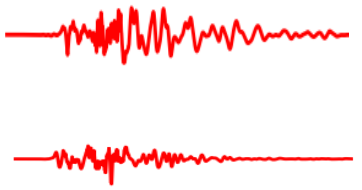
GM Simulation for 'future' earthquake scenarios

- Compute seismograms for every grid point (ie. virtual stations)
  - More computation
  - More storage
    - Canterbury (100m, 20,000Ts): 50Gb
    - South Island (400m, 50,000Ts): 2.5Tb
    - South Island (100m, 50,000Ts): 40Tb



StationInfo

Name	Longitude	Latitude
....		
x1y1	172.2	-43.49
....		
x2y2	172.31	-43.69
....		

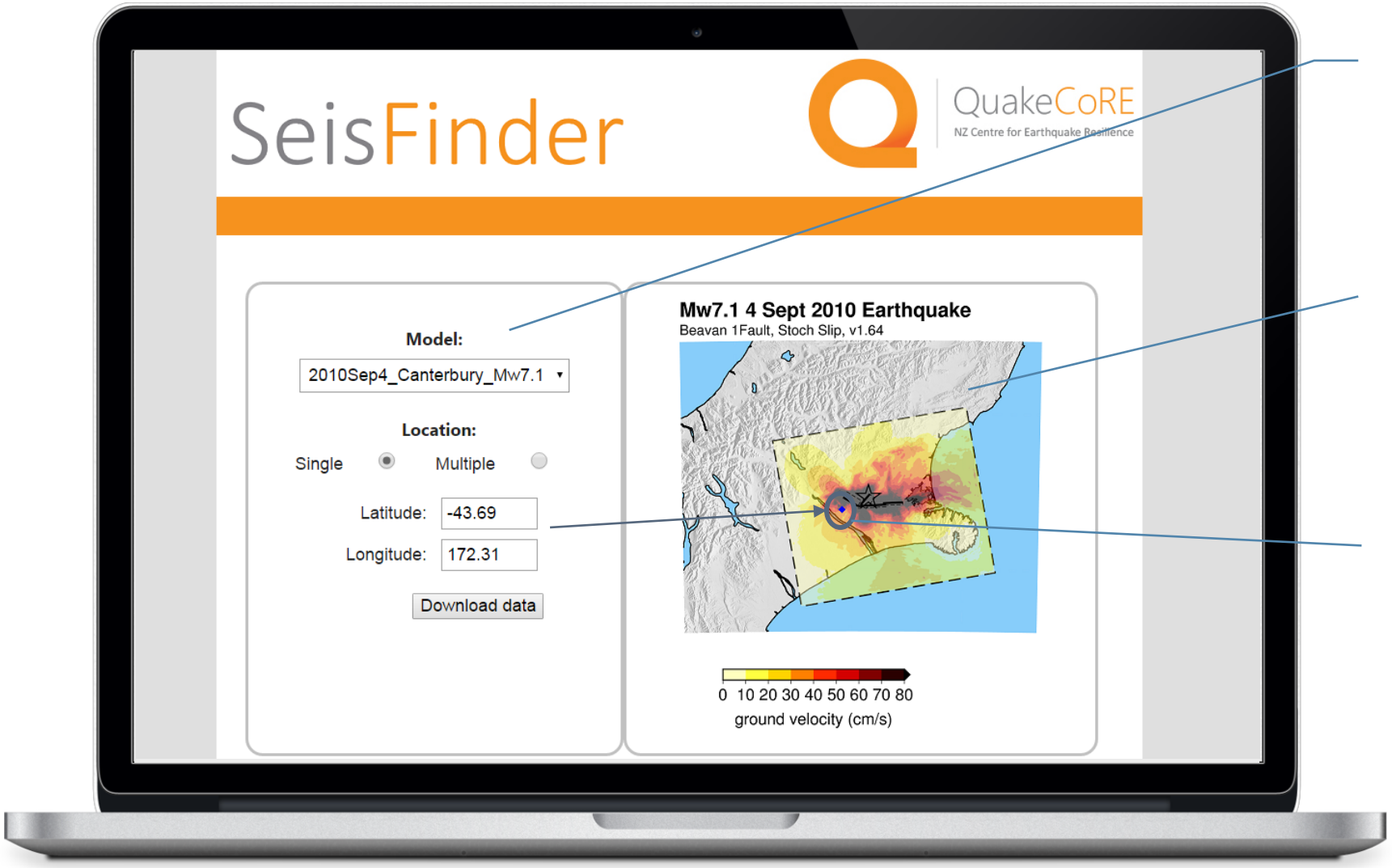


N simulations for N rupture models (equally likely with weight 1/N)

Currently considering variable spatial grid to contain data storage size

QuakeCoRE SeisFinder

Prototype application



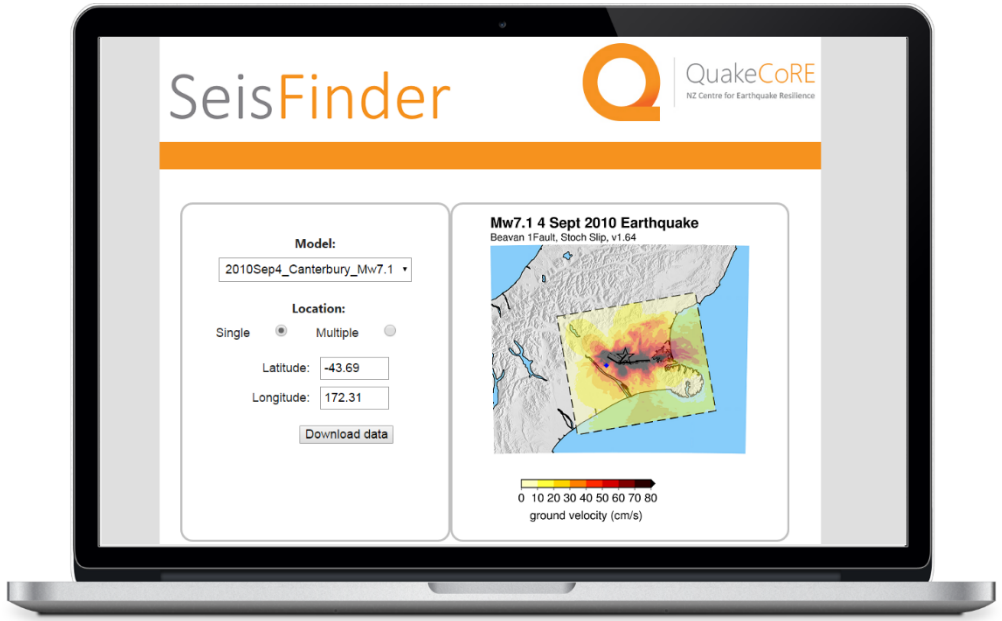
1. Specific historic/future simulation result

2. Domain of the selected model &
Maximum ground shaking illustrated to user

3. Depiction of selected location(s) on region shown for user

Points 2 and 3 to enable users (who are not familar with the simulations) to have confidence in what they are actually downloading

QuakeCoRE SeisFinder

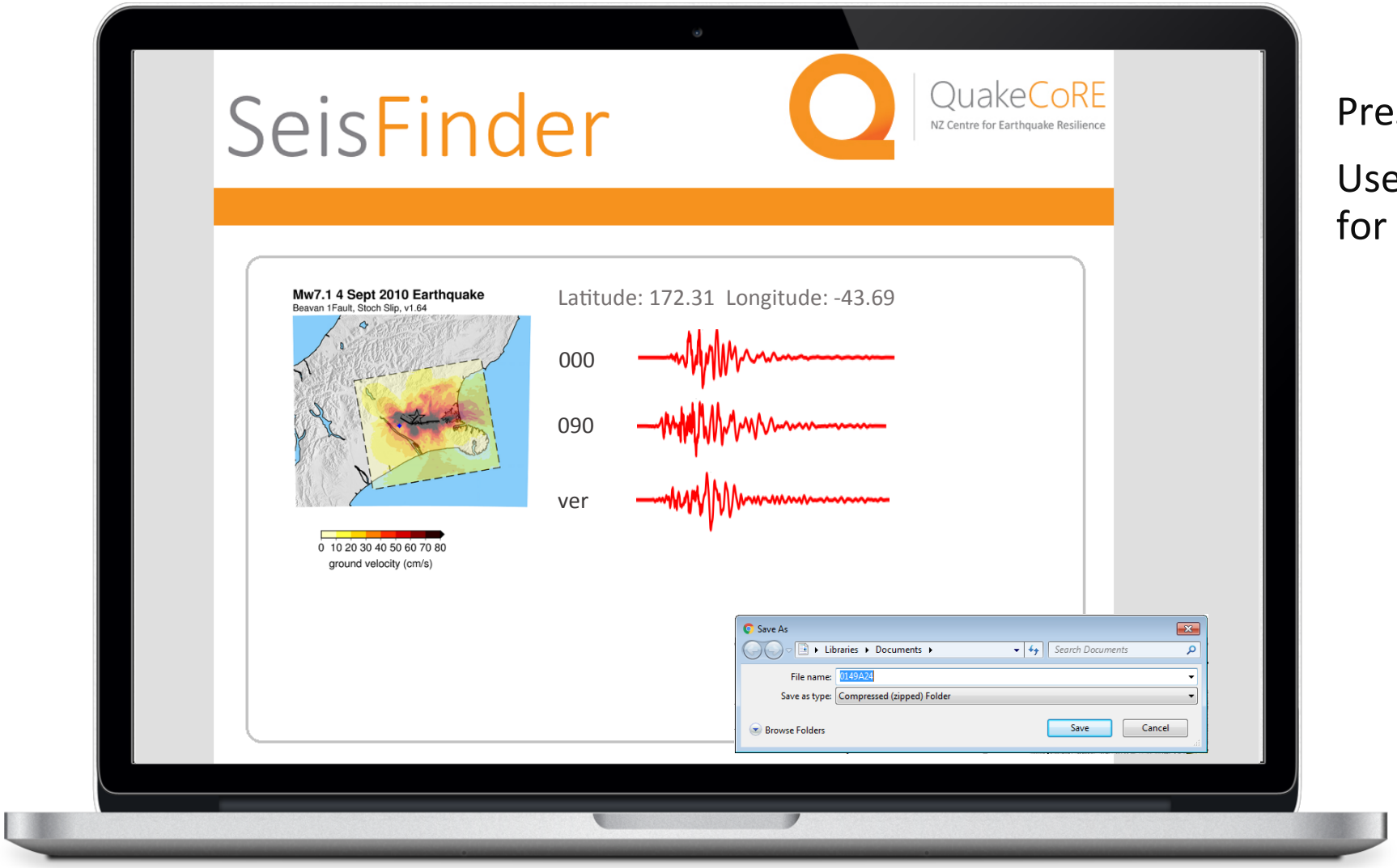


Latitude/longitude -> (X,Y)

Seismogram for the given (X,Y)

Database
(HDF5)

QuakeCoRE SeisFinder Result



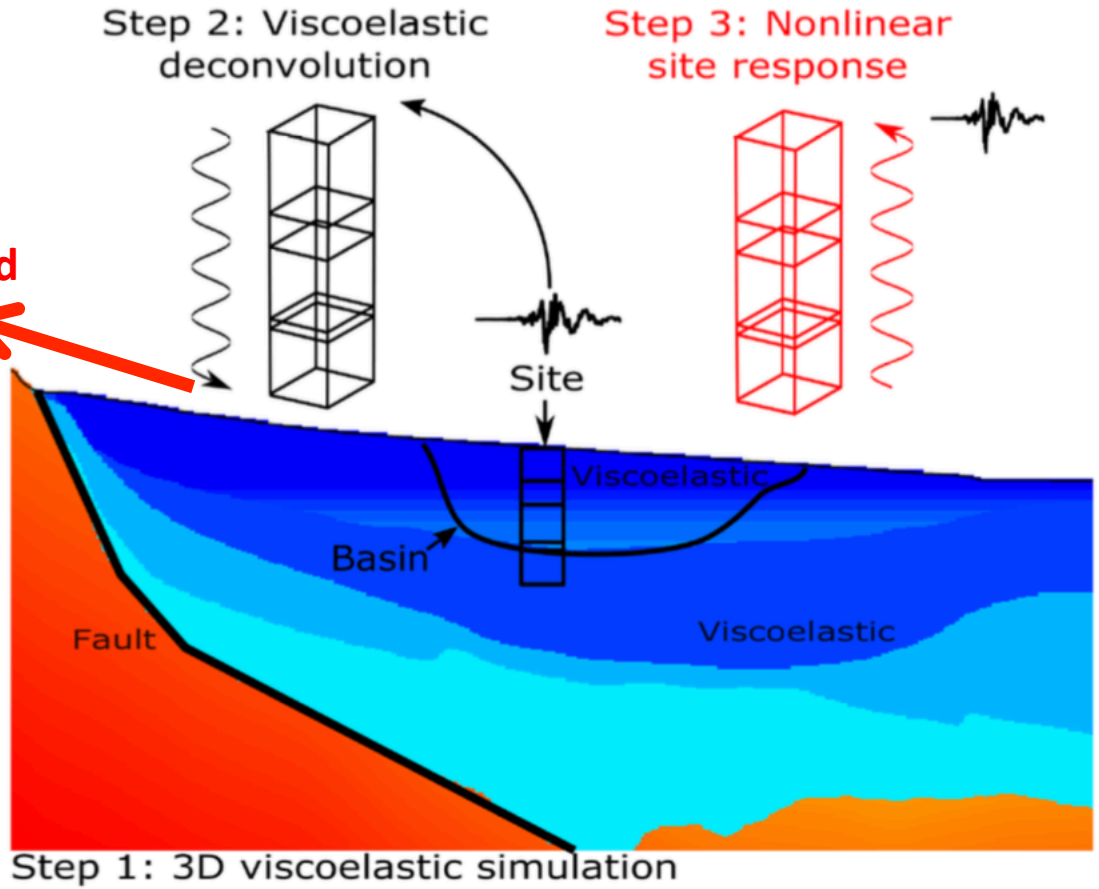
Presents result for each location

User can download seismogram files for advanced analysis

Query GM with/without amplification and deconvolution

- GM simulation result = Ground surface level: Empirical site amplification (V_{s30}) already applied
- Option to query de-amplified and de-convolved result : Useful for geo-technical site response analysis, soil structure interaction modelling etc.

Deamplified and deconvoluted ground motion



Future plans

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- More ground motion simulation scenarios and models
- Database porting: HDF5 -> SQL for quicker query response and massive parallel queries
- Web interface interacting with Google Map (i.e. specify street address in place of Lat/Lon)
- Finalise implementation for queries with/without local soil conditions (V_{s30} amplification)
- Smaller grid-spacing for higher-resolution query (need to adopt spatially-variable grid-spacing to keep data storage within capacity)

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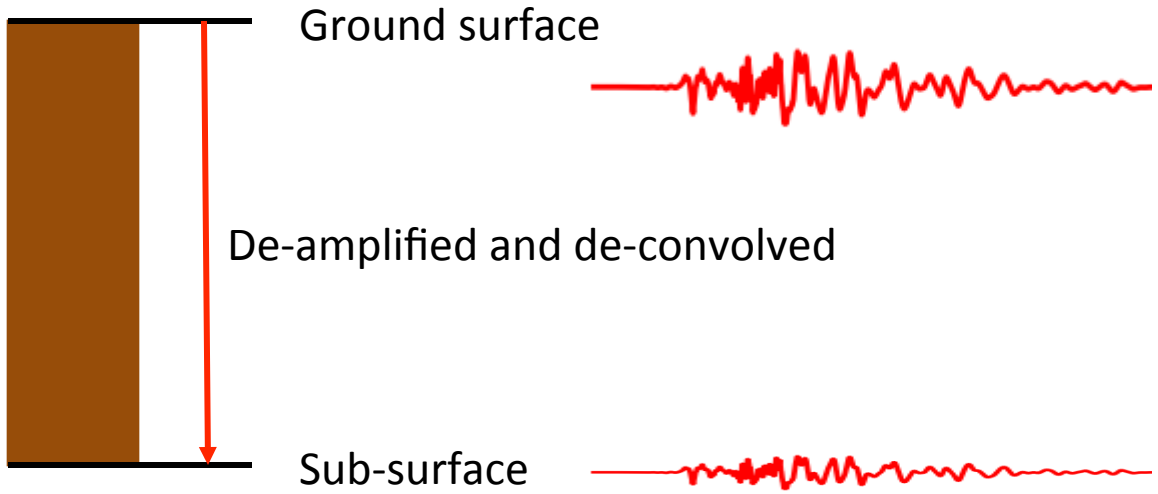
Thank you!

www.quakecore.nz

UC University of Canterbury
The University of Auckland New Zealand
Resilient Organisations
GNS Science
Massey University
Te Whare Wānanga o te Upoko o te Ika a Māui Victoria University of Wellington
The University of Waikato Te Whare Wānanga o Waikato
BRANZ


Ground surface
De-amplified and de-convolved
Sub-surface