

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

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QuakeCoRE

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High Performance Computing @ QuakeCoRE



Fitzroy : IBM POWER6 Cluster of 3392 CPU cores

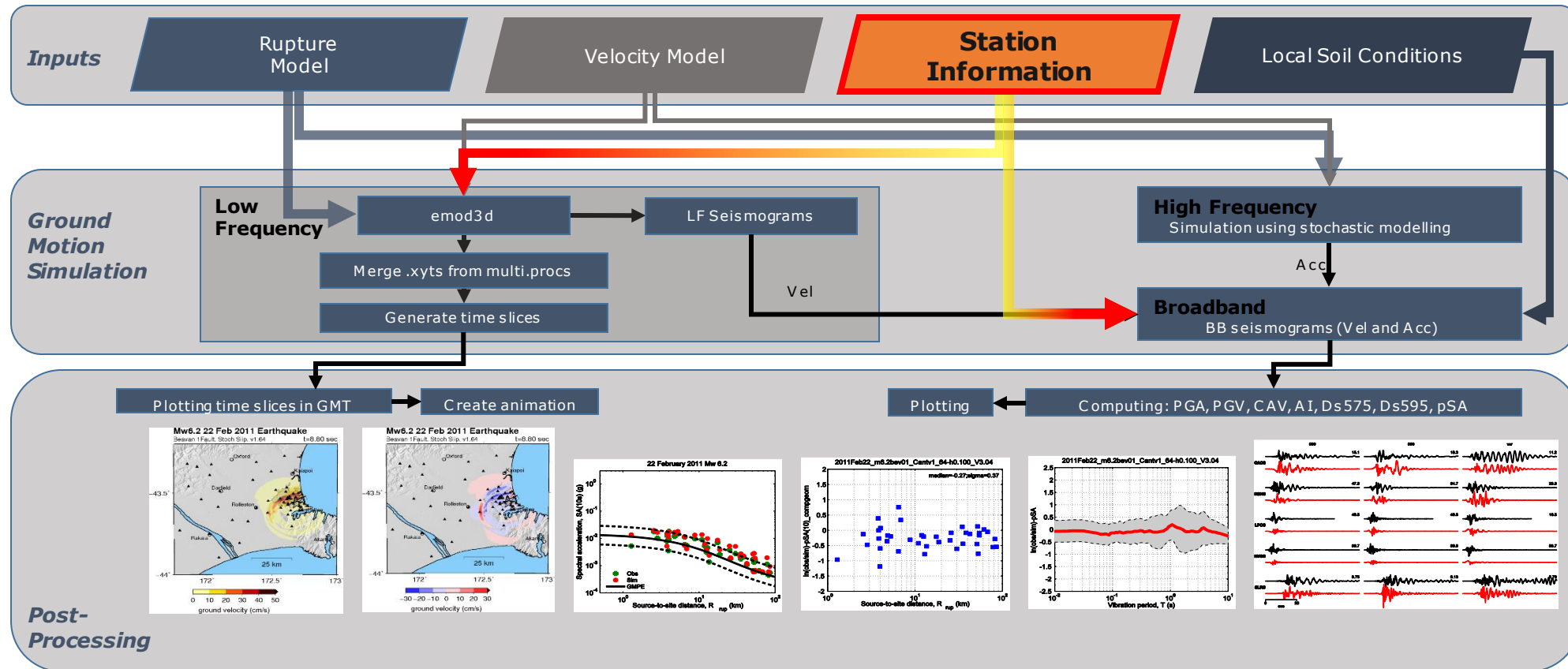
QuakeCoRE's Ground Motion simulation workflow is one of benchmark tests for upgrade in 2017



QuakeCoRE Ground Motion Simulation Workflow

Based on Graves & Pitarka (2010, 2015)

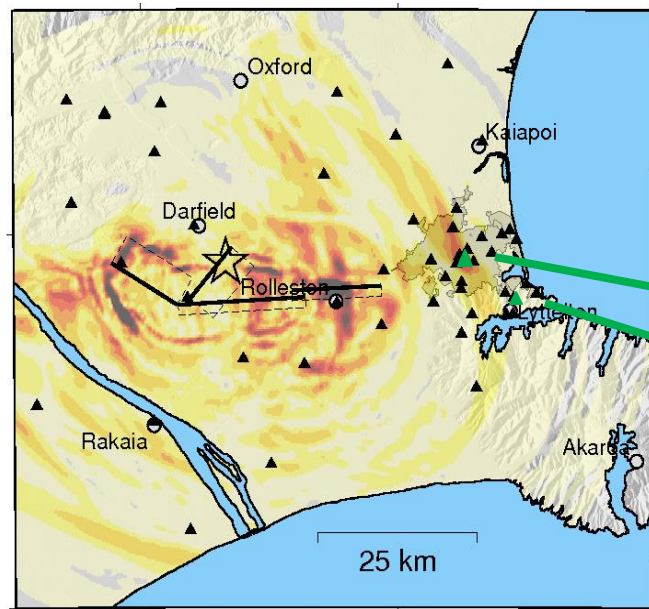
More details on poster #350



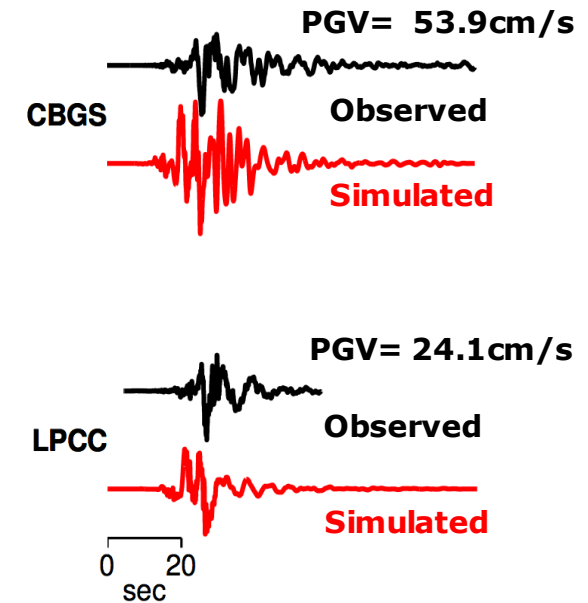
GM Simulation for historical earthquake scenarios

- 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 |
| | | |

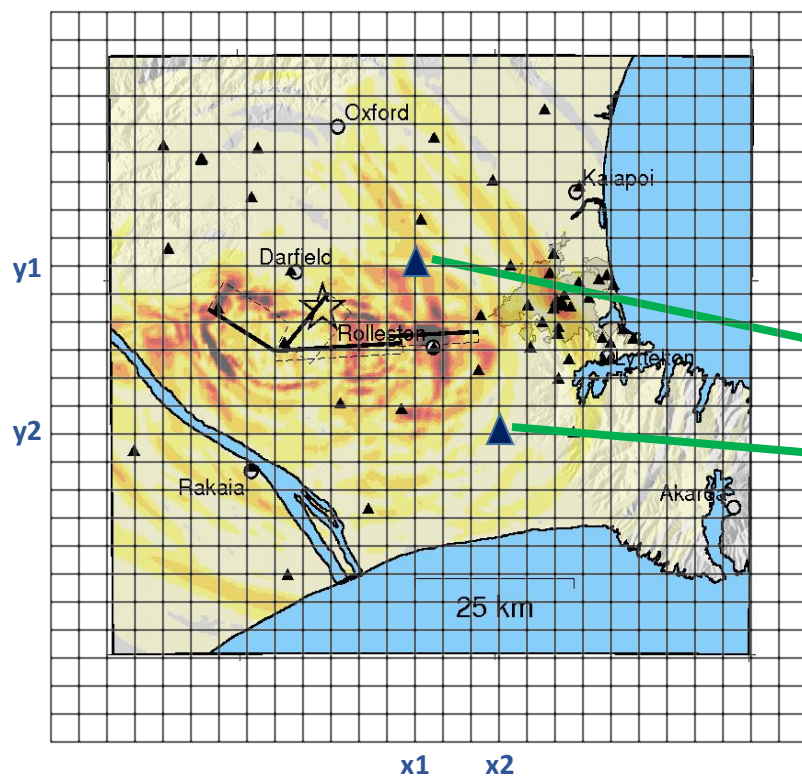


GM Simulation for 'future' earthquake scenarios

- 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

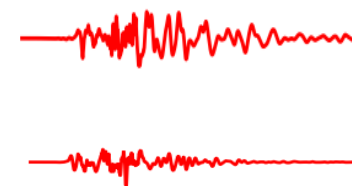
**N simulations for N rupture models
(equally likely with weight 1/N)**

**Currently considering variable spatial grid
to contain data storage size**



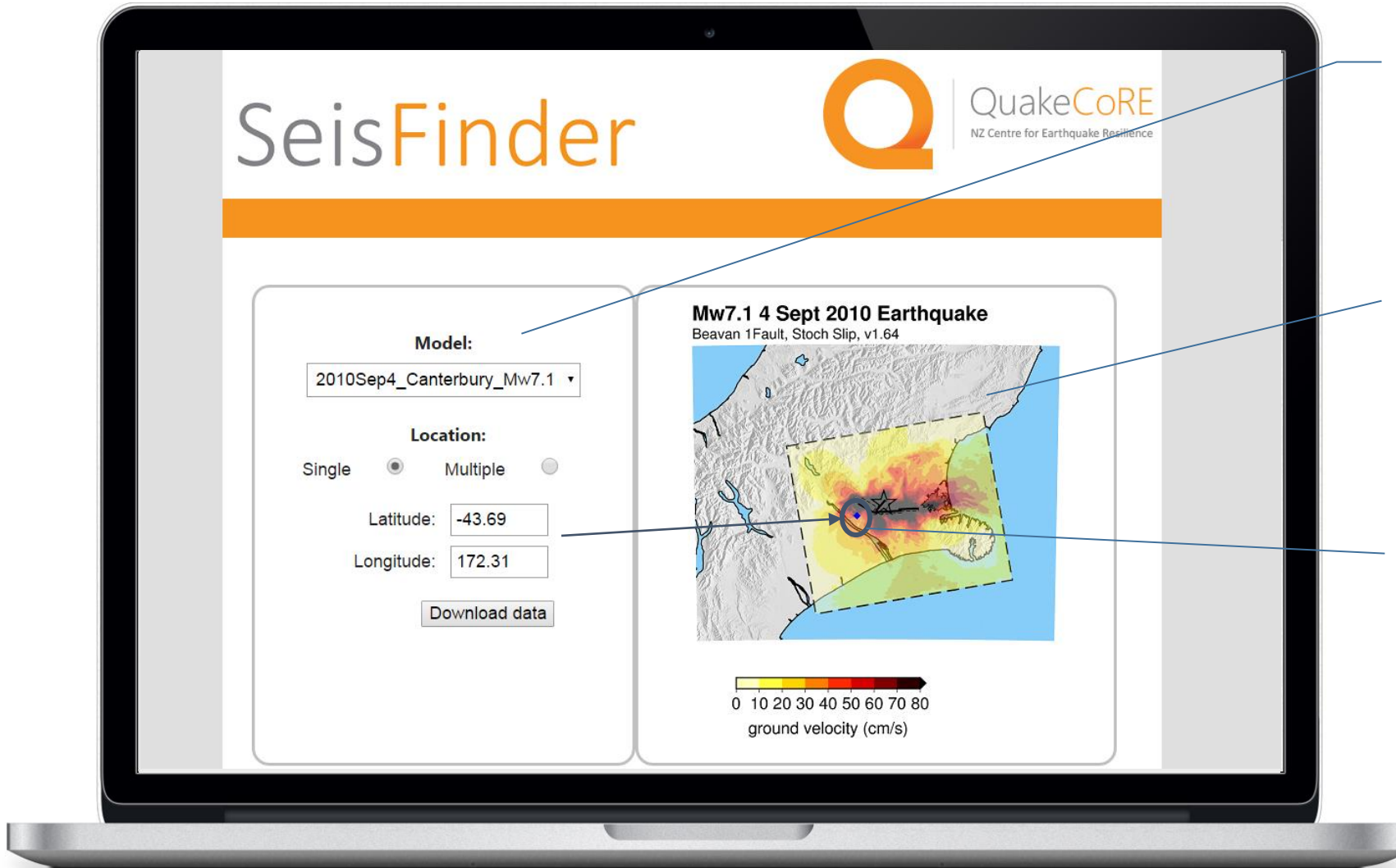
StationInfo

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



QuakeCoRE SeisFinder

Prototype application



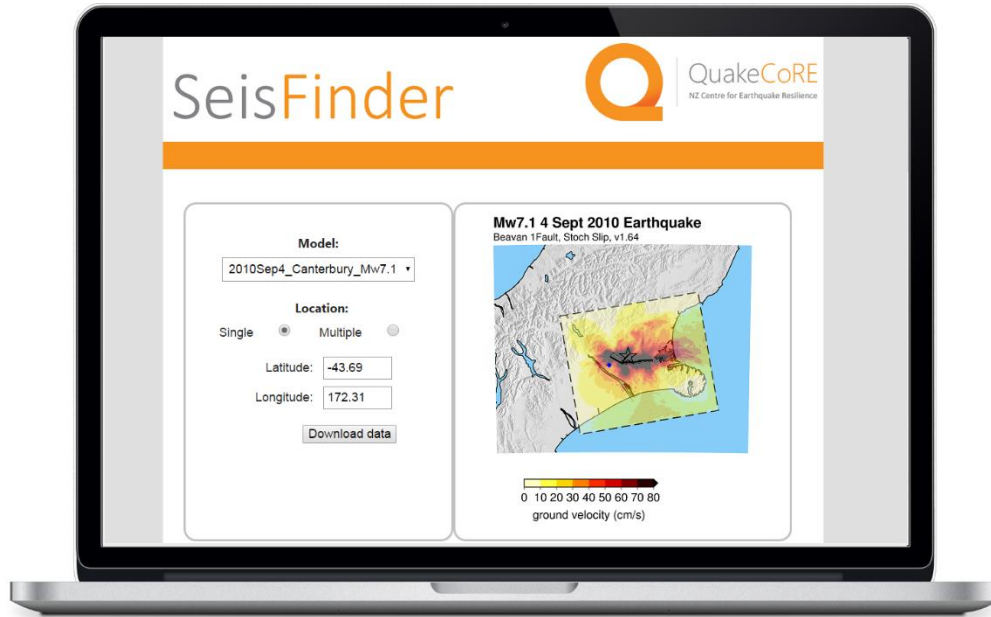
1. Specific historic/future simulation result

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 familiar with the simulations) to have confidence in what they are actually downloading

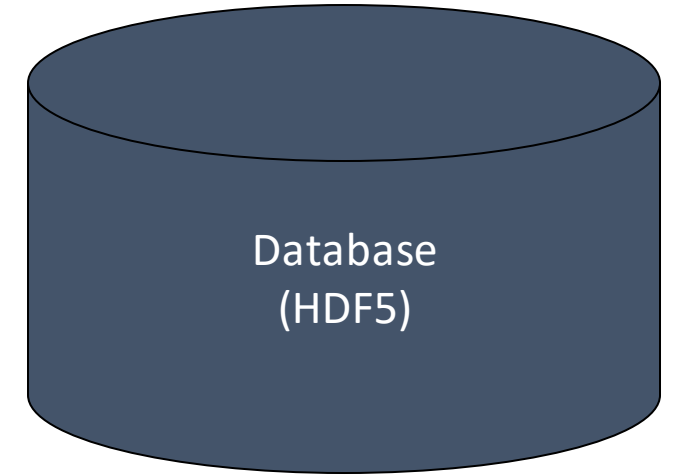
QuakeCoRE SeisFinder



Simulation model id,
Latitude/longitude -> (X,Y)



Seismogram for the given (X,Y)

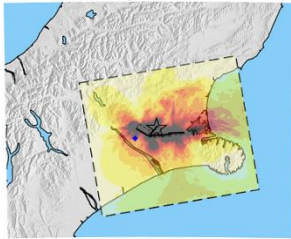


QuakeCoRE SeisFinder Result

SeisFinder

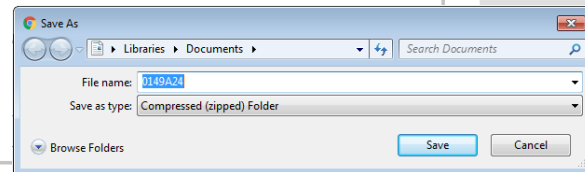
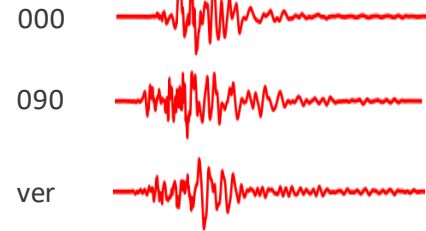


Mw7.1 4 Sept 2010 Earthquake
Beavan 1 Fault, Stoch Slip, v1.64



0 10 20 30 40 50 60 70 80
ground velocity (cm/s)

Latitude: 172.31 Longitude: -43.69

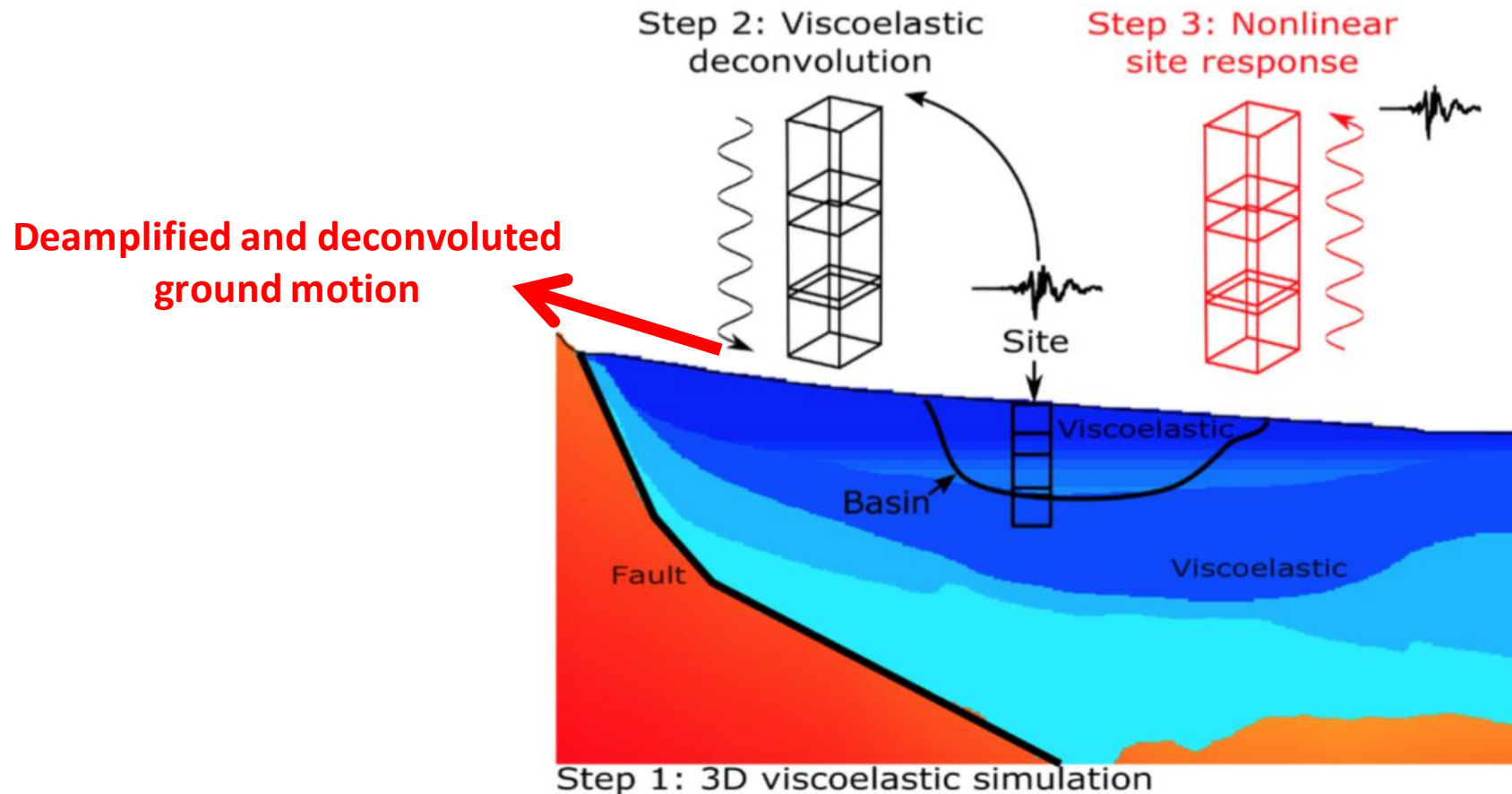


Presents result for each location

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-convoluted result : Useful for geo-technical site response analysis, soil structure interaction modelling etc.



Future plans

- 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)
- Finalize 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)

Thank you!

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