Ground motion simulations for Dunedin: recent progress

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FP1 GMSV call

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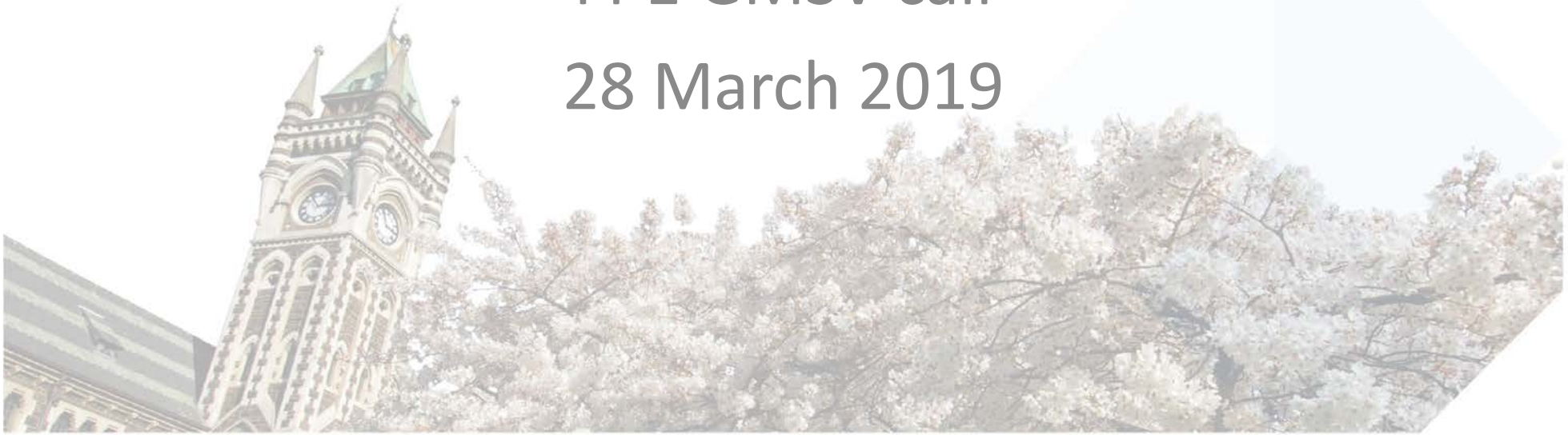
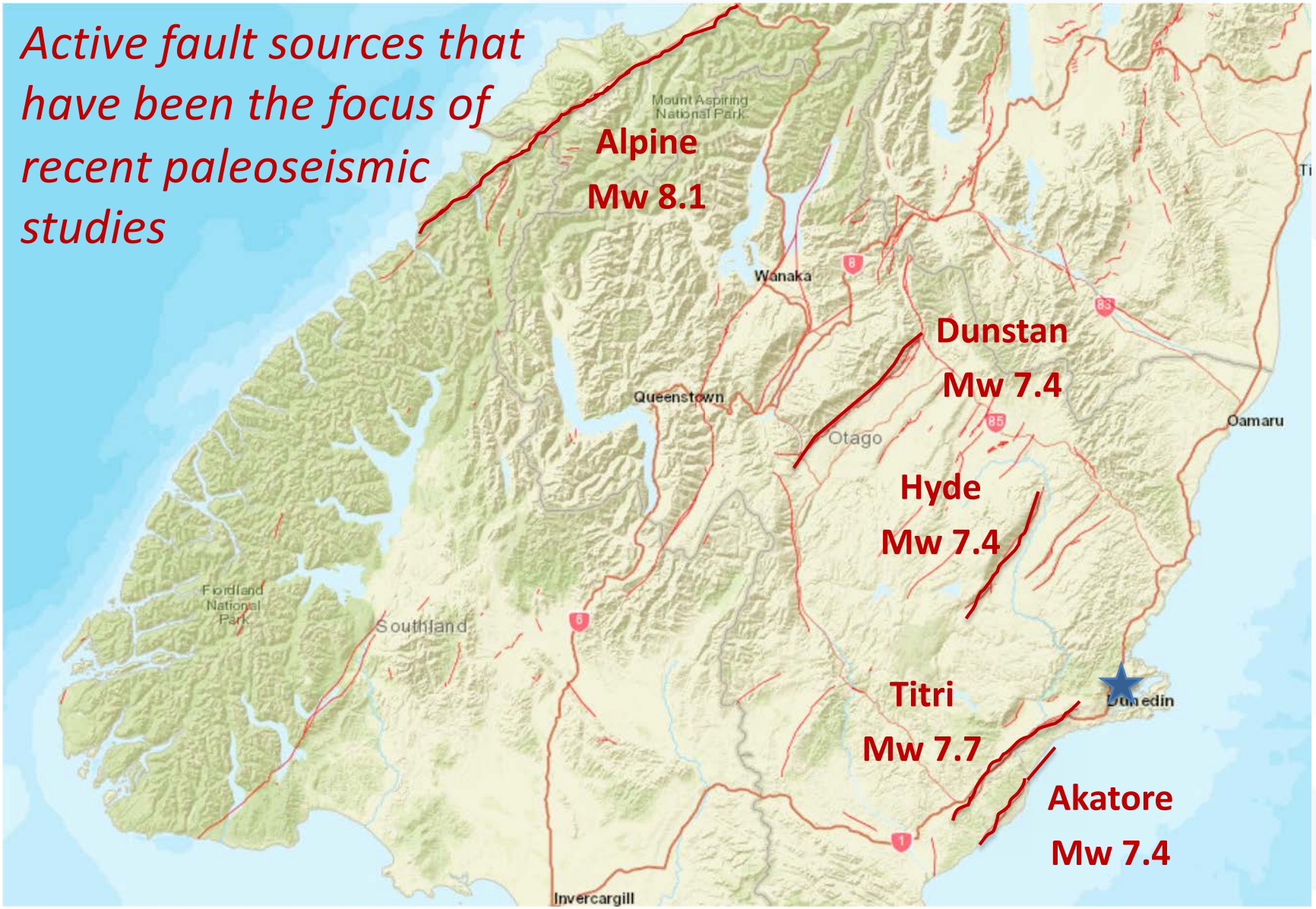


Introduction

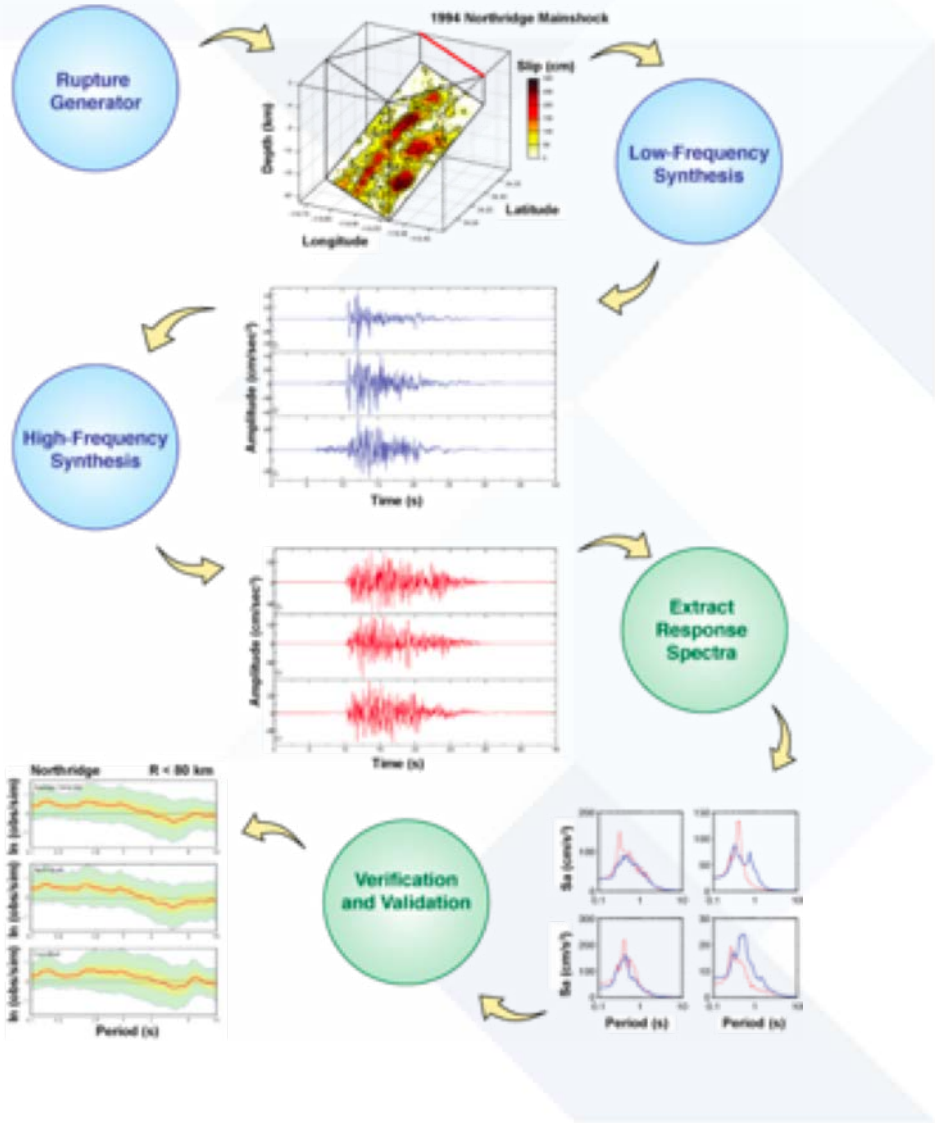
- Ground motion simulations for Dunedin from local and regional active fault sources
- No large local or regional earthquakes have impacted Dunedin in historical time (1840-present)
- Old built environment: need to understand the potential impacts of local and regional large earthquakes

Considered sources



Simulations – SCEC BBP

- 1D
- User defined scenarios
- Graves-Pitarka method
- Mojave velocity profile

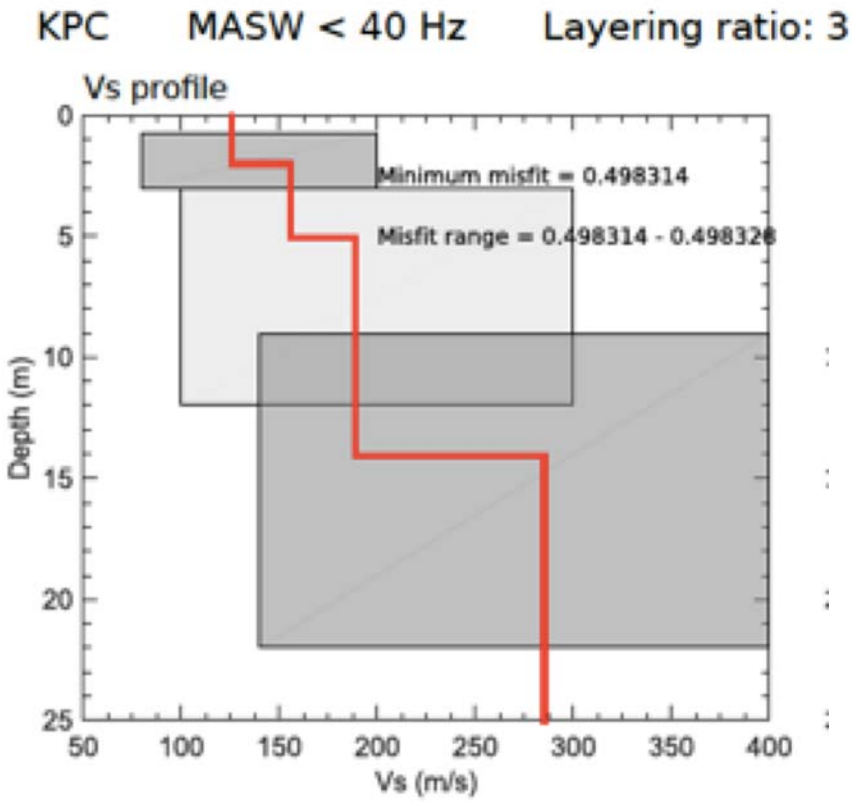


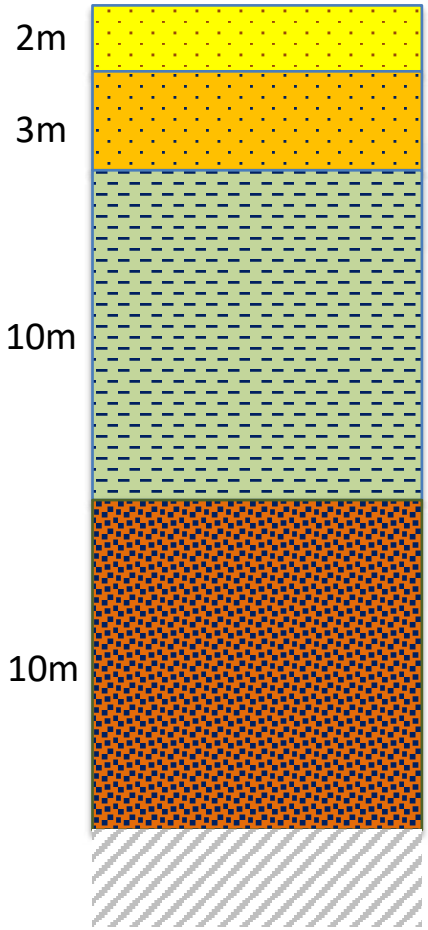
Non linear 1D site effects analysis

- Run in OpenSees – nonlinear finite element method
- Vertical, Vs propagation for a single horizontal component of GM
- Using *Pressure-dependent multi yield* model
- No liquefaction effects included at this stage
- Comparison of results with one-dimensional analysis tools (empirical, based on GMPEs).

Near surface 1D profile

- Kettle Park Centre site – located in South Dunedin





Soft soils (to 25 m): Sandy sediments
Vs = 120 m/s, rho = 1.43 Mg/m³

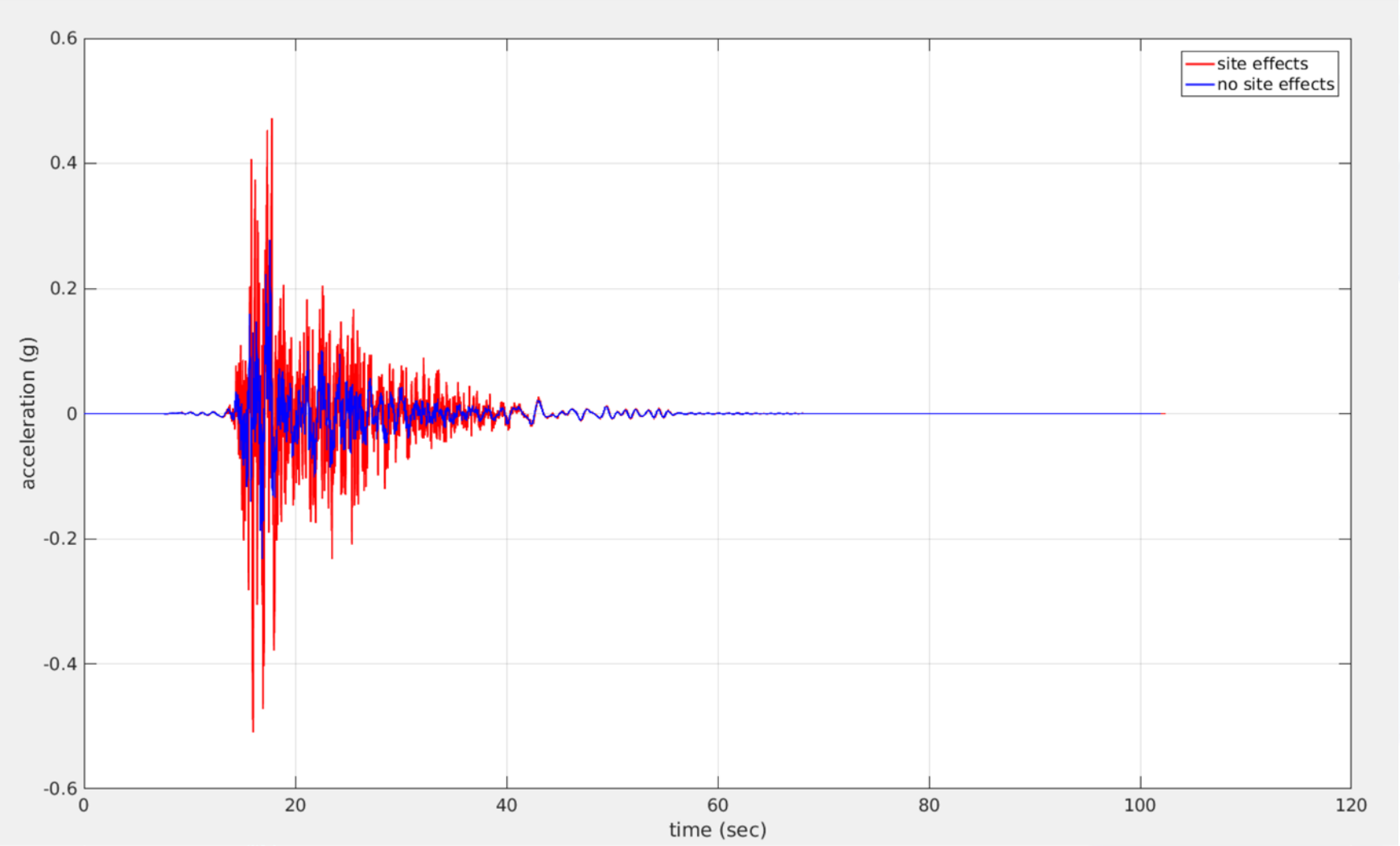
Vs = 150 m/s, rho = 1.8 Mg/m³

Vs = 180 m/s, rho = 2.0 Mg/m³

Vs = 280 m/s, rho = 2.20 Mg/m³

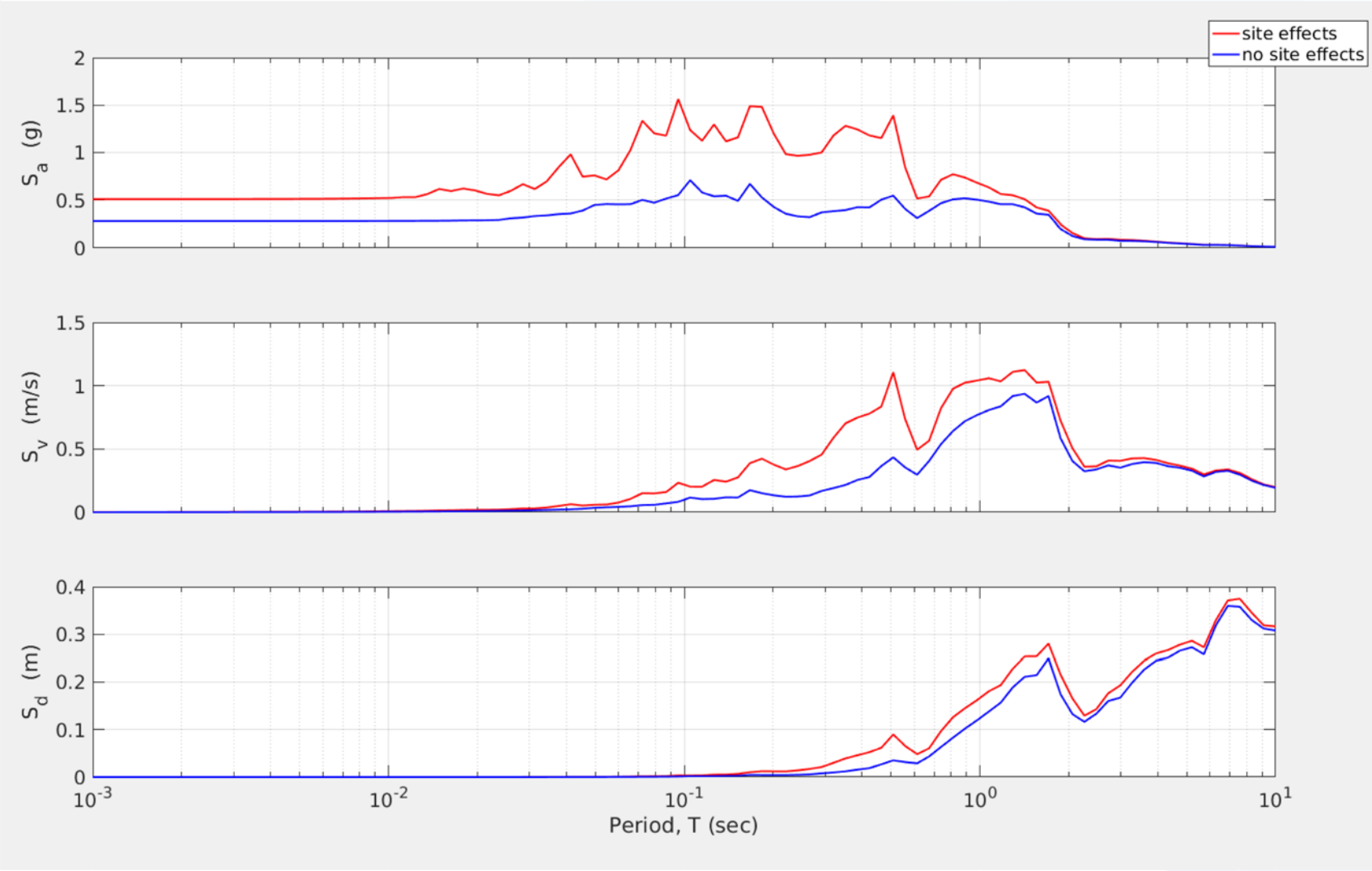
Rock halfspace: Caverhsam sandstone
Vs = 600 m/s, rho = 2.4 Mg/m³

Akatore Fault – Acceleration time history response



- Hypocentre in the middle of the fault
- Mw = 7.4
- NS component

Akatore Fault – response spectra



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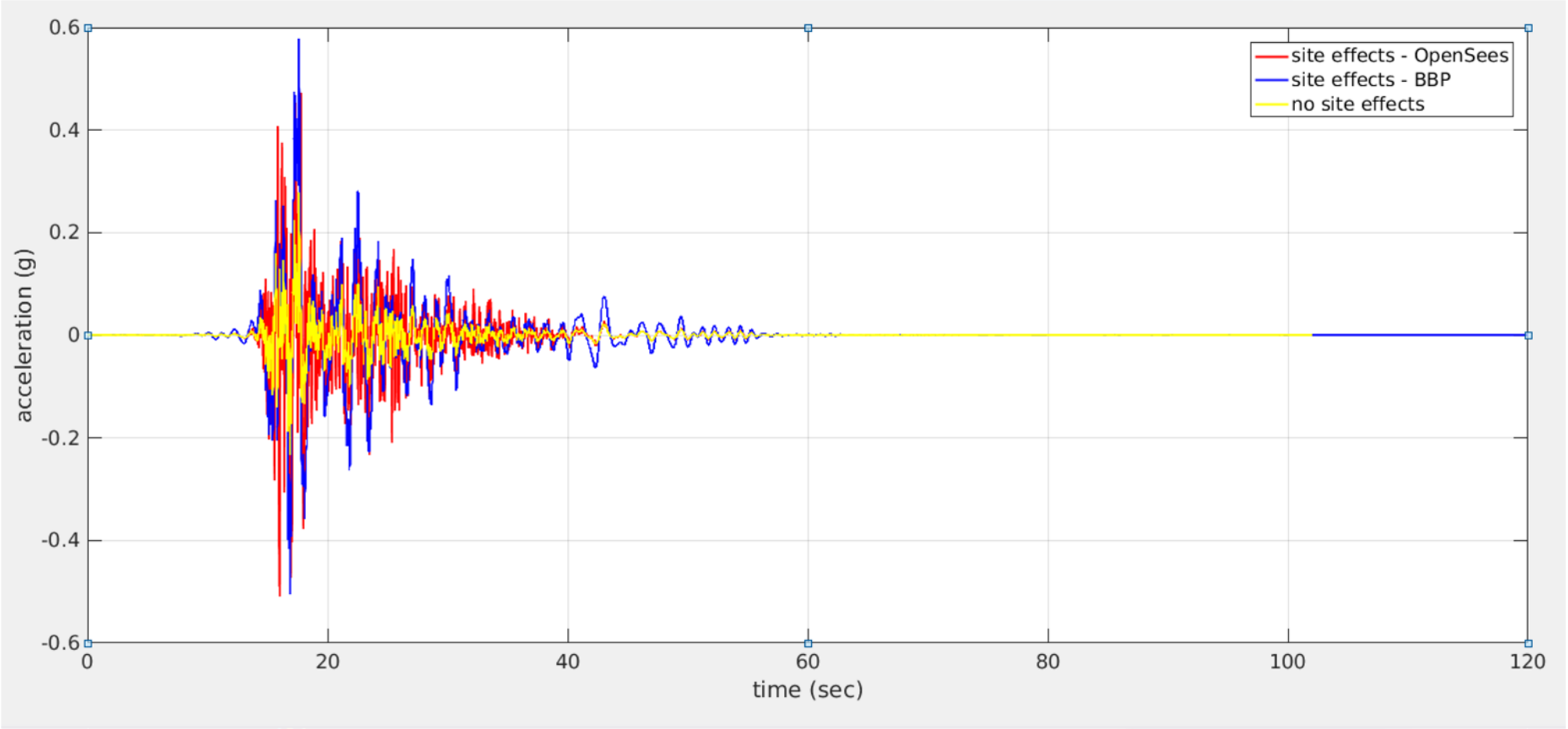
Akatore Fault – BBP – OpenSees results comparison



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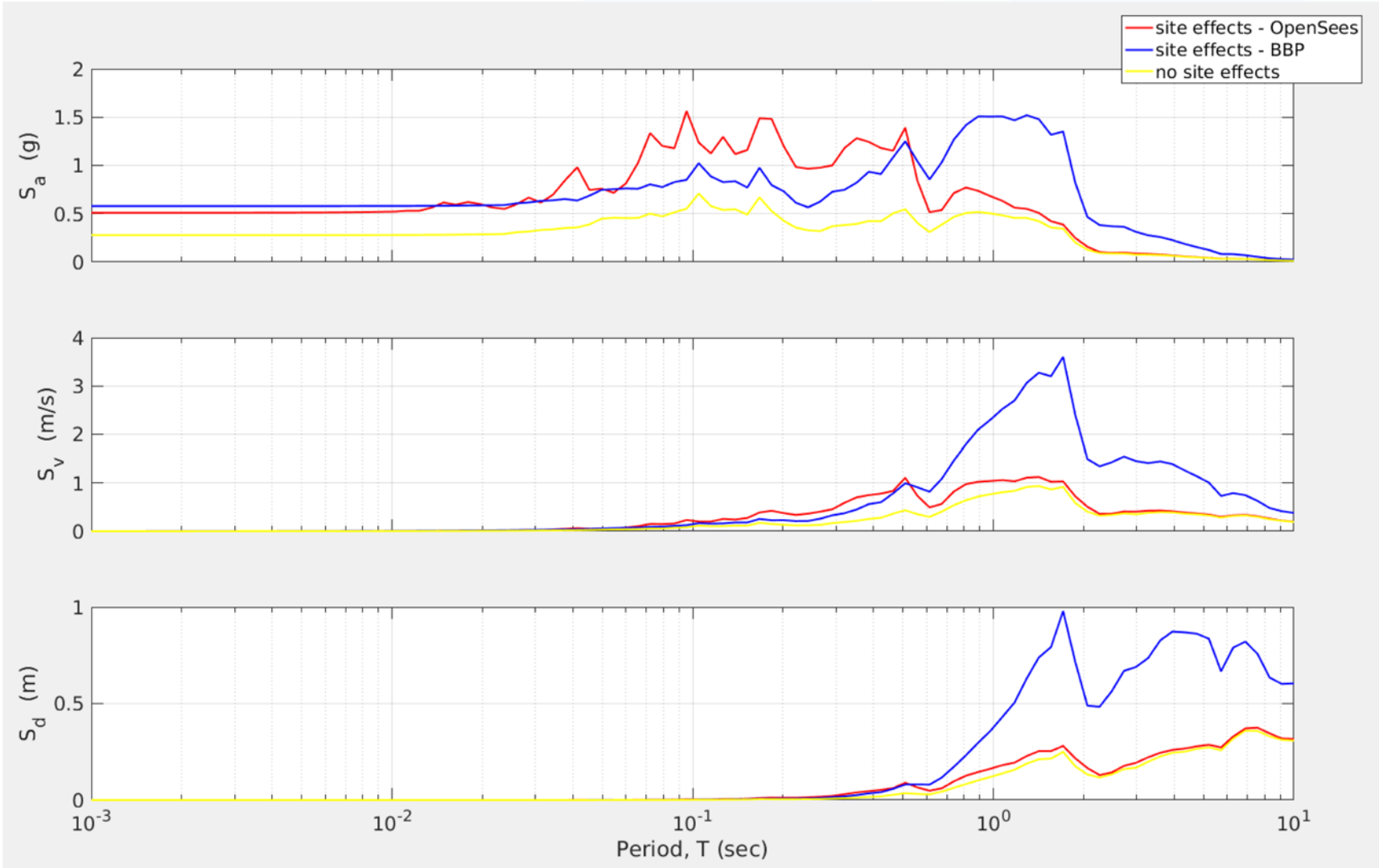

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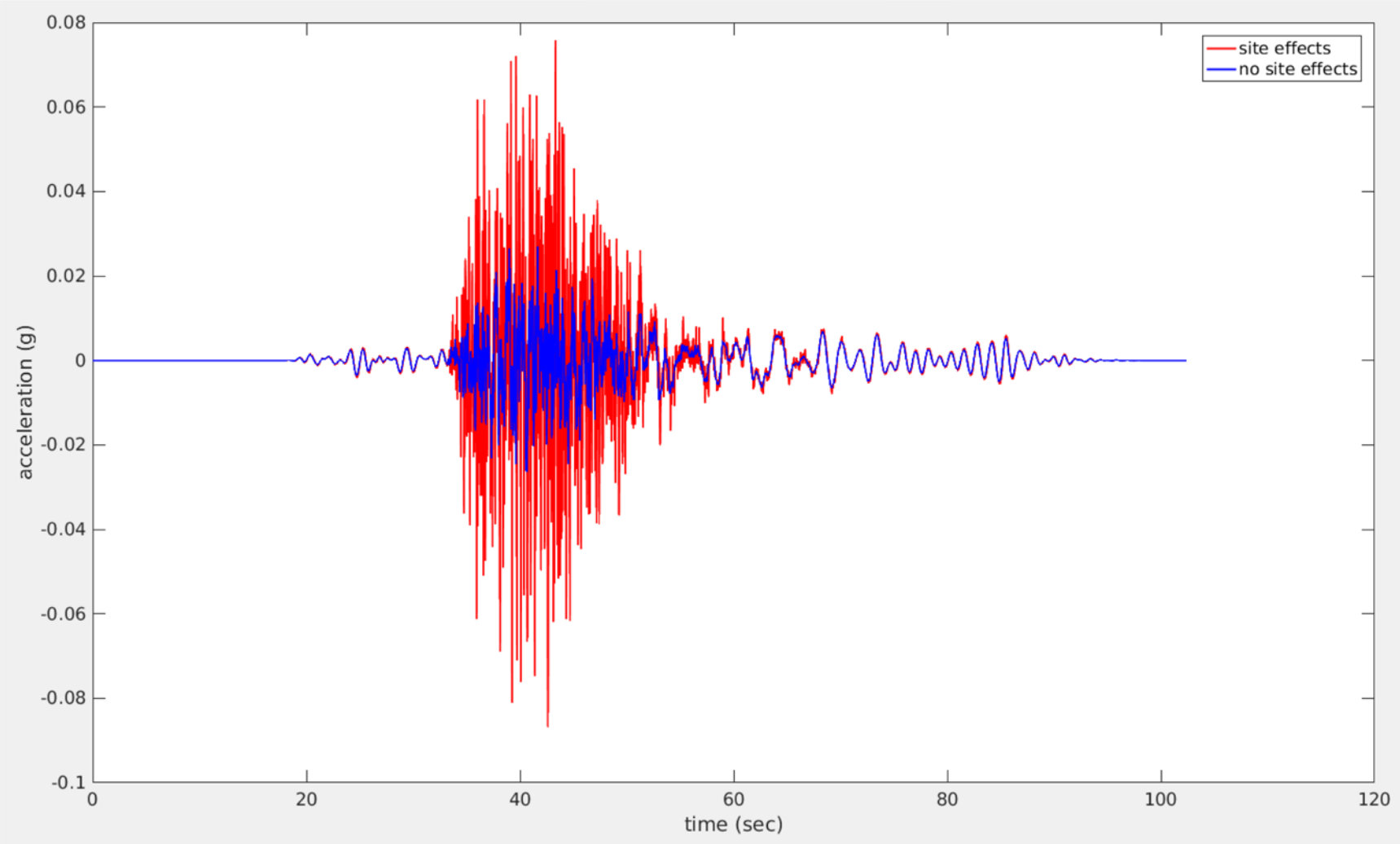
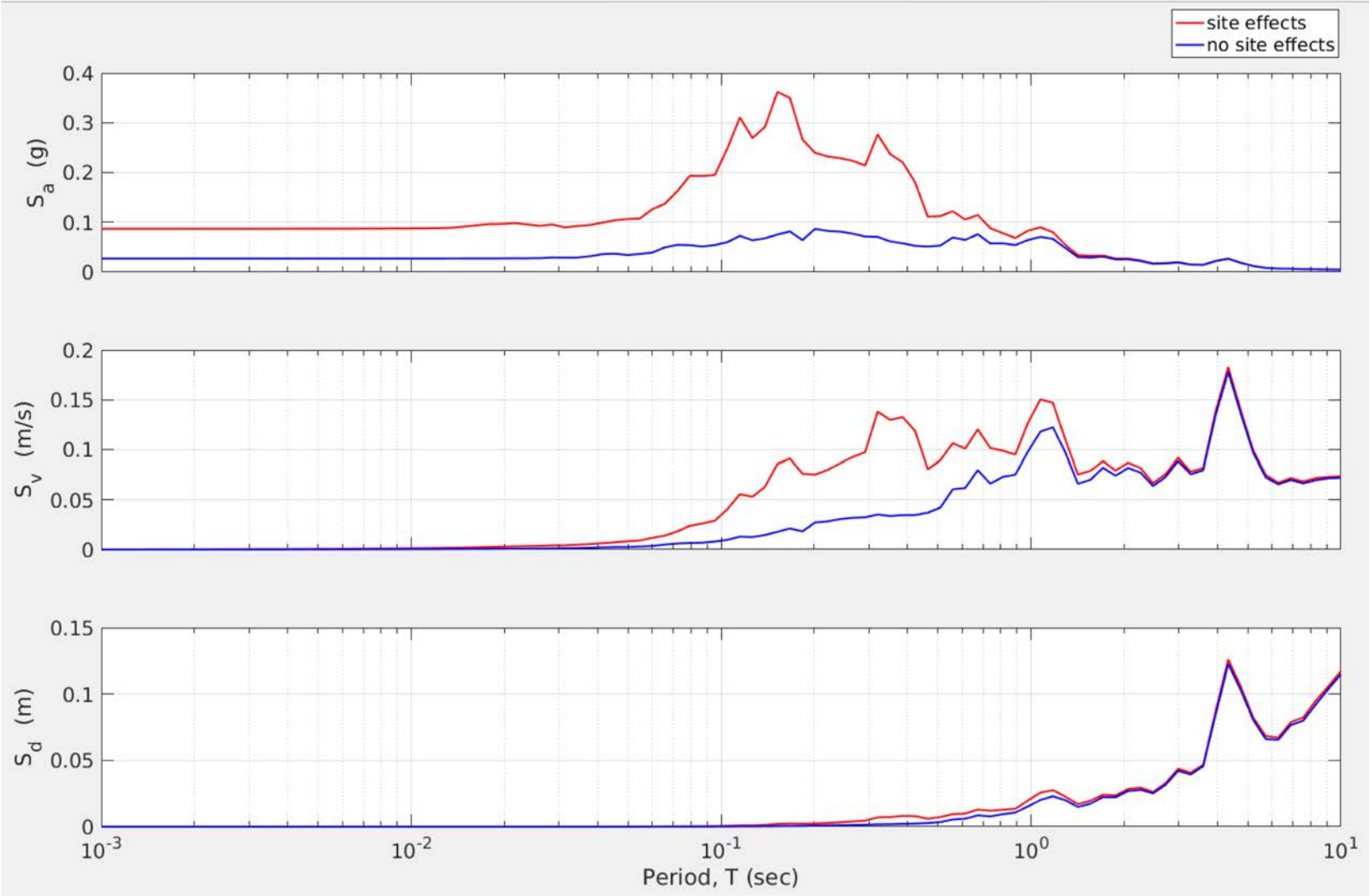
Dunstan Fault – Acceleration time history response



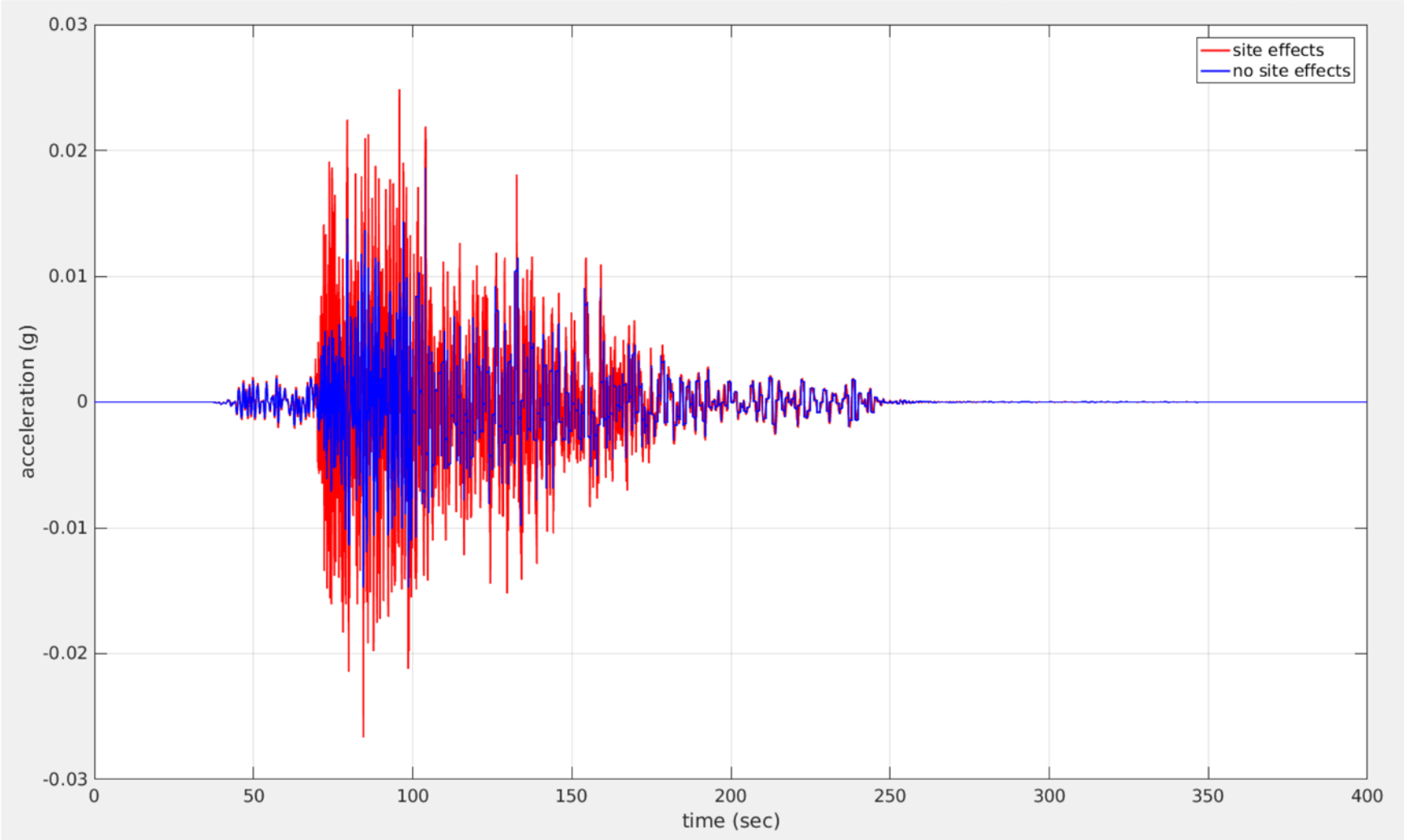
- Hypocentre in the middle of the fault
- Mw = 7.4
- NS component

Dunstan Fault – response spectra



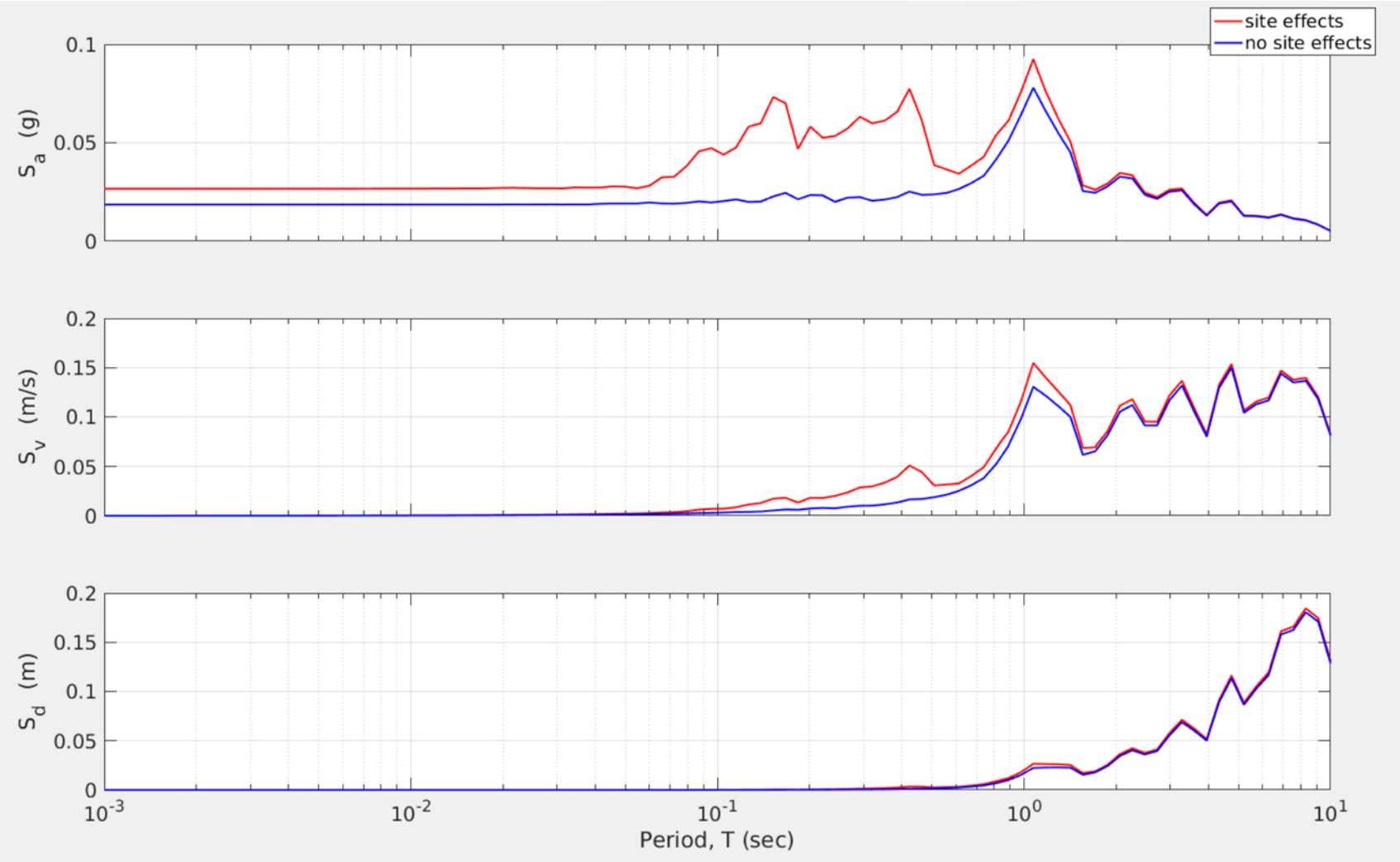
- Hypocentre in the middle of the fault
- Mw = 7.4
- NS component

Alpine Fault – Acceleration time history response



- Hypocentre in the middle of the fault
- Mw = 8.1
- NS component

Alpine Fault – response spectra



- Hypocentre in the middle of the fault
- Mw = 8.1
- NS component

Next steps and Future challenges

- Finalise modelling approaches. Run analysis for multiple sites (soil profiles).

- Further develop 3D shear wave velocity model, and apply to the simulations.