

# Broadband ground motion simulations for the Canterbury earthquakes with nonlinear effective-stress modelling of surficial soils

Annual report, 2016 SCEC Project #16012

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## Abstract

This SCEC funding provided travel support for the PI to attend the 2016 SCEC annual meeting to present on-going work related to broadband ground motion simulations of the 2010-2011 Canterbury earthquakes. This project is a multi-institutional effort with researchers from New Zealand and the USA (Rob Graves, USGS, and Brady Cox, UTexas, Austin), and has benefited greatly from interaction with SCEC researchers.

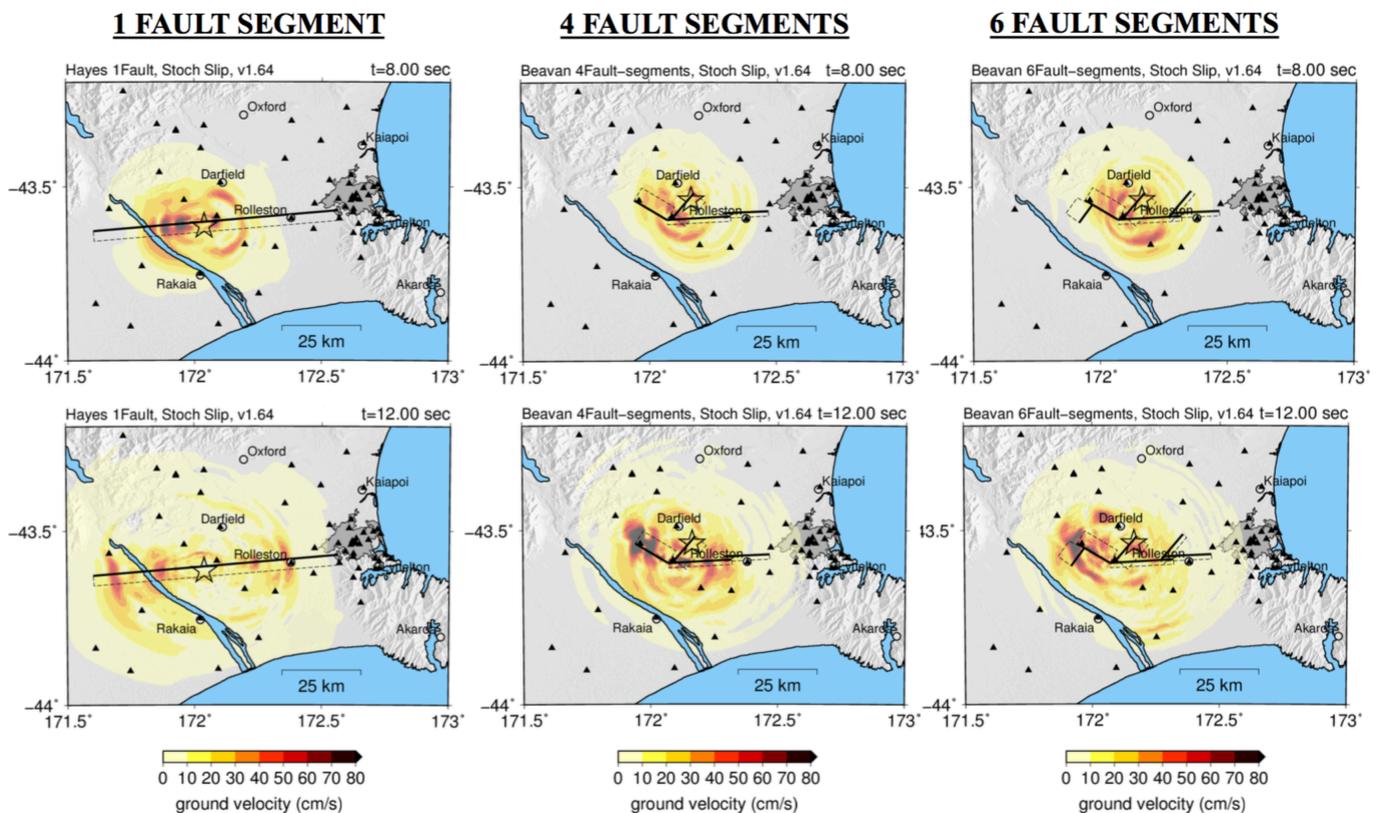
## SCEC Annual Science Highlights

- Ground Motion Prediction (GMP)
- Ground Motion Simulation Validation (GMSV)

## Technical Report

To date this project has led to the development of a new 3D seismic velocity model of Canterbury, New Zealand; as well as hybrid broadband simulation of the 10 most significant events in the sequence. In 2016 we also extended to examining ground motion simulation of Porters Pass earthquakes (and validation of smaller magnitude events), consideration of multi-fault rupture for the 4 September 2010 Darfield earthquake, and South Island-wide simulations of potential Mw~8 earthquakes on the Alpine Fault. Finally, the PI was a co-lead of an ‘international workshop on ground motion simulation validation’ held in conjunction with the SCEC AM

## Exemplary Figure



**Figure 1:** Velocity snapshots taken at t=8s and t=12s after rupture initiation of Darfield event for three different representations of multi-segment rupture modelling.

## Science Objectives

(6e) Collaborate with the engineering community in validation of ground motion simulations.

## Interlectual merits and broader impacts

The developed 3D velocity model makes use of numerous high quality datasets, and is the first such model developed for the region, and in fact NZ. The hybrid broadband simulations are consistent with those state-of-the-art analyses for other locations, and addresses the GMSV and EERI SCEC objectives.

## Publications

*SCEC Annual Meeting*. 10-14 September 2016. Palm Springs, CA (posters).

1. Lee RL, Bradley BA, Jeong S. Ground motion simulation validation using small-to-moderate magnitude events in the Canterbury, New Zealand region.
2. Bae SE, Polak V, Clare R, Bradley BA, Razafindrakoto HNT. QuakeCoRE ground motion simulation computational workflow.
3. Razafindrakoto HNT, Bradley BA, Graves RW. Effect of realistic fault geometry on simulated ground motions in the 2010 Darfield earthquake, New Zealand.
4. Jeong S, Bradley BA. Heathcote Valley site response simulation during the 2010-2011 Canterbury earthquakes.
5. Nazer MA, Razafindrakoto HNT, Bradley BA. Hybrid broadband ground motion simulation of Porters Pass fault earthquakes.
6. Bradley BA, Pettinga JD, Baker JW. Guidance on the utilization of ground motion simulations in engineering practice.