



Visualisation of 2010 Christchurch Boxing Day aftershock

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2010-2011 Canterbury Earthquake



2010-09-04 m 7.1

2011-02-22 m.6.3

- 185 killed
- 50~ 100 yrs for full recovery
- Estimated cost: \$40b

11,000 aftershocks (>m 2.0)
by 2012-06-06

Ground Motion Simulation - Overview

Assoc. Prof. Brendon Bradley (UC)

3D seismic wave propagation simulations (Parallel code by Rob Graves (USGS))

Uses 4th order spatial and 2nd order temporal finite differences to solve the elastodynamic wave equation

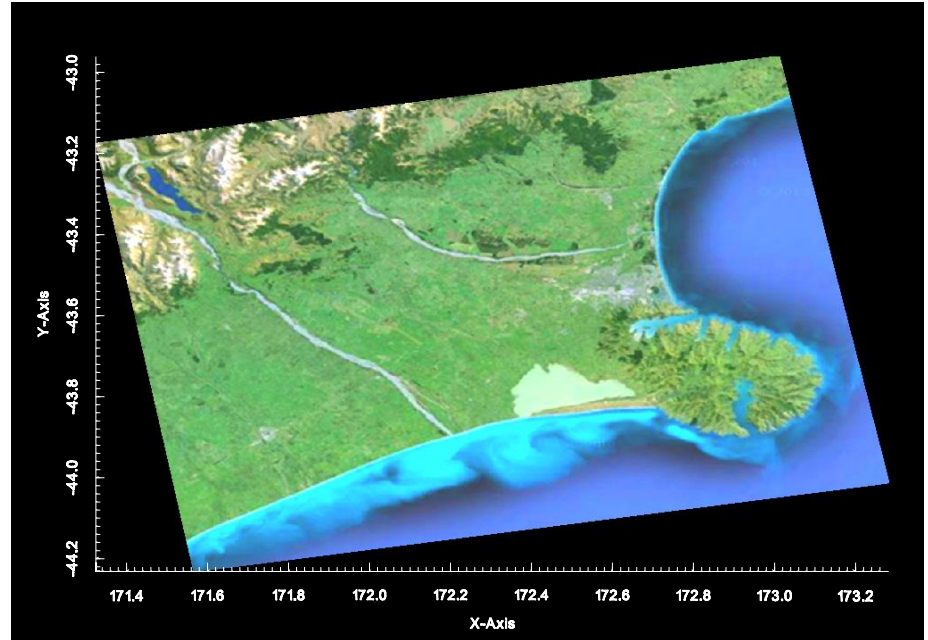
Simulations: 4 hours @ 2048 cores on BlueGene/P



Ground Motion Simulation - 26 Dec 2010



Ground Motion Simulation - Domain



Ground Motion Simulation - Output

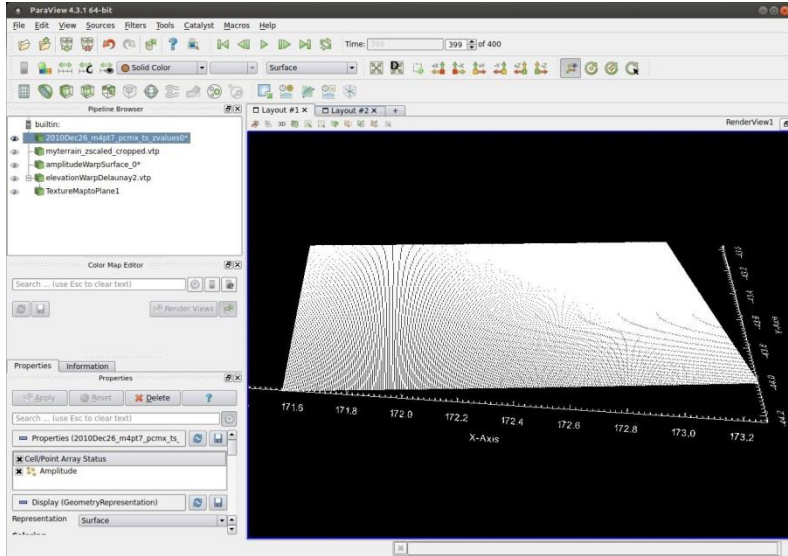
	Point ID	Amplitude	Points		
0	0	0.00174115	171.323	-43.1742	0
1	1	0.00242043	171.329	-43.1735	0
2	2	0.00318736	171.335	-43.1728	0
3	3	0.00359	171.341	-43.172	0
4	4	0.0037696	171.347	-43.1713	0
5	5	0.00378886	171.353	-43.1706	0
6	6	0.00367444	171.359	-43.1698	0
7	7	0.00337141	171.365	-43.1691	0
8	8	0.0028559	171.371	-43.1684	0
9	9	0.00215803	171.377	-43.1676	0
10	10	0.00155958	171.383	-43.1669	0
11	11	0.00137226	171.389	-43.1662	0
12	12	0.00170431	171.395	-43.1655	0
13	13	0.00219822	171.402	-43.1647	0
14	14	0.00256071	171.408	-43.164	0
15	15	0.00292813	171.414	-43.1633	0
16	16	0.00328771	171.42	-43.1625	0

Particle velocity (cm/s) at 67,200 points

400 time stamps (0.1 sec) = 40secs

Visualisation can help to better understand earthquakes.

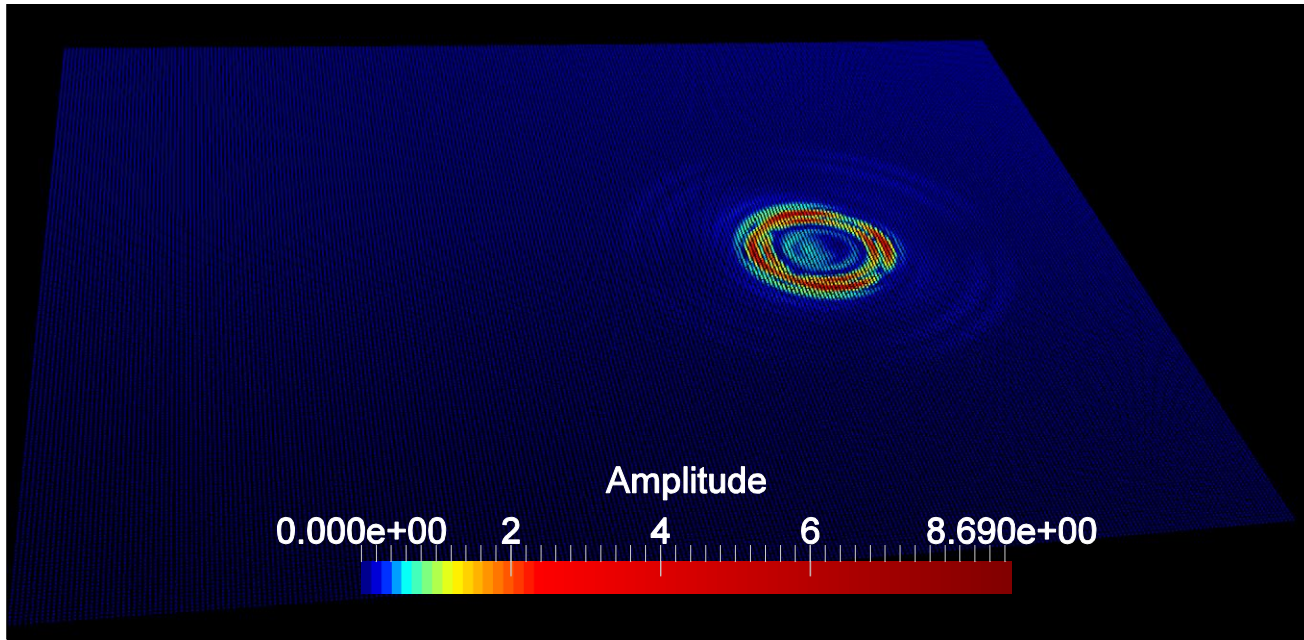
Visualisation - Overview



Viz Cluster (NeSI, BlueFern)

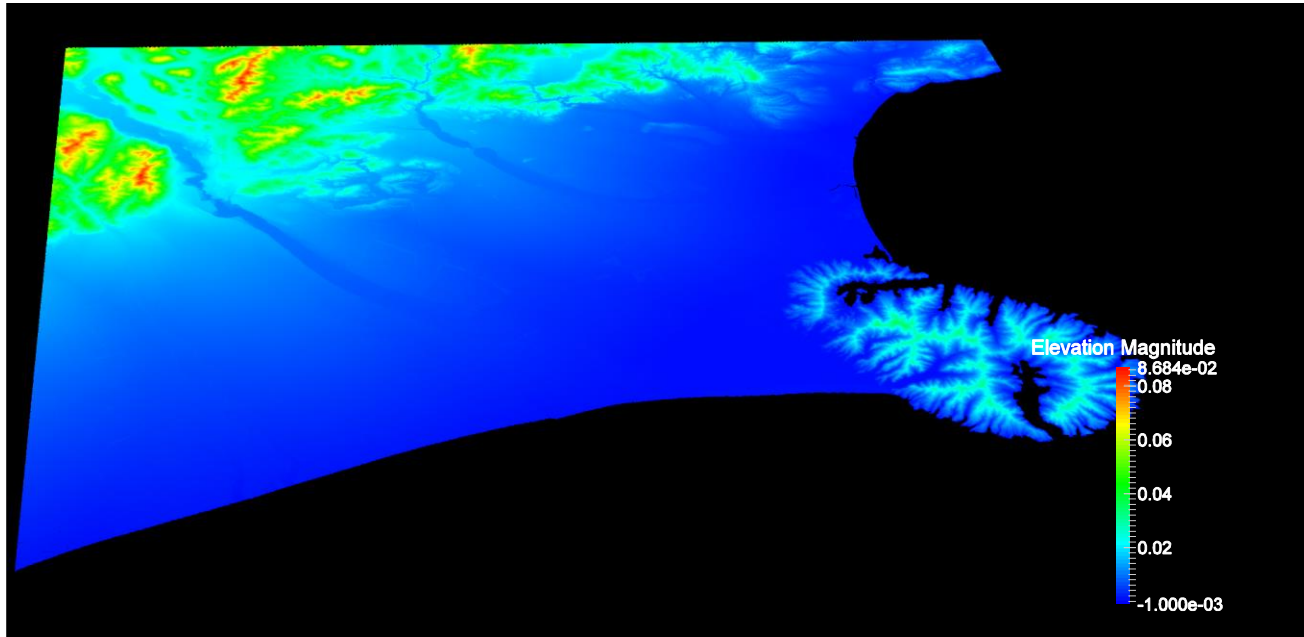
Paraview + VTK

Visualisation I. Data imported to Paraview



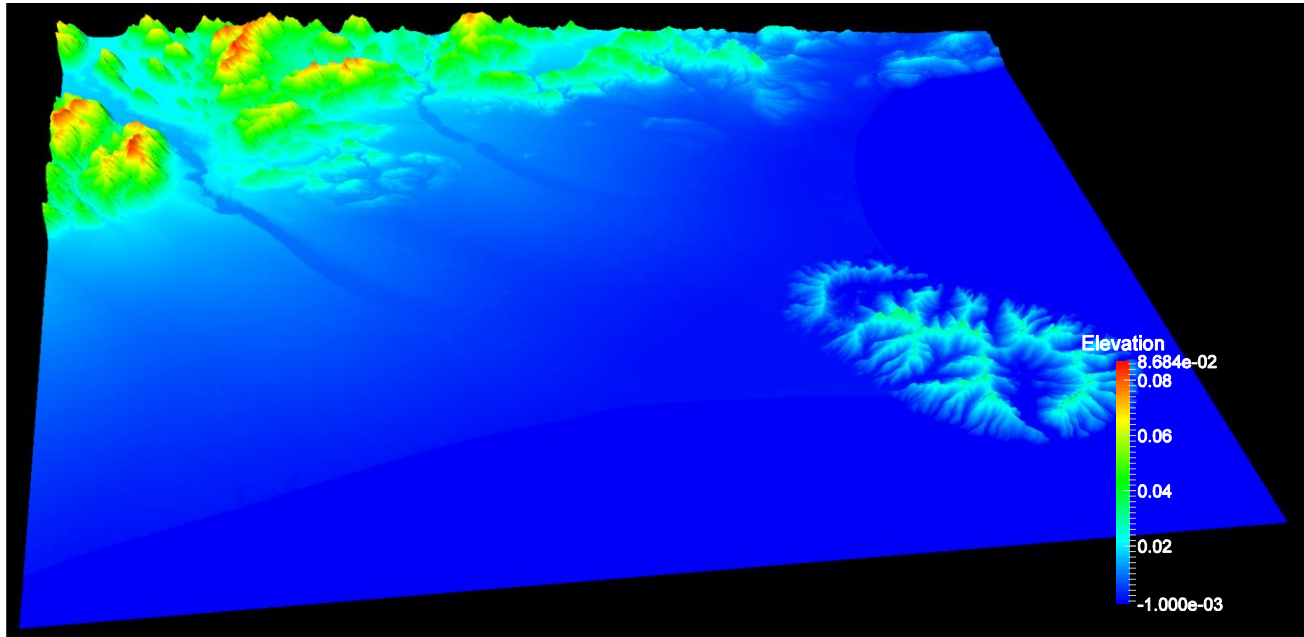
Amplitude is presented on 2D plane

Visualisation II. GeoTIFF data into Paraview



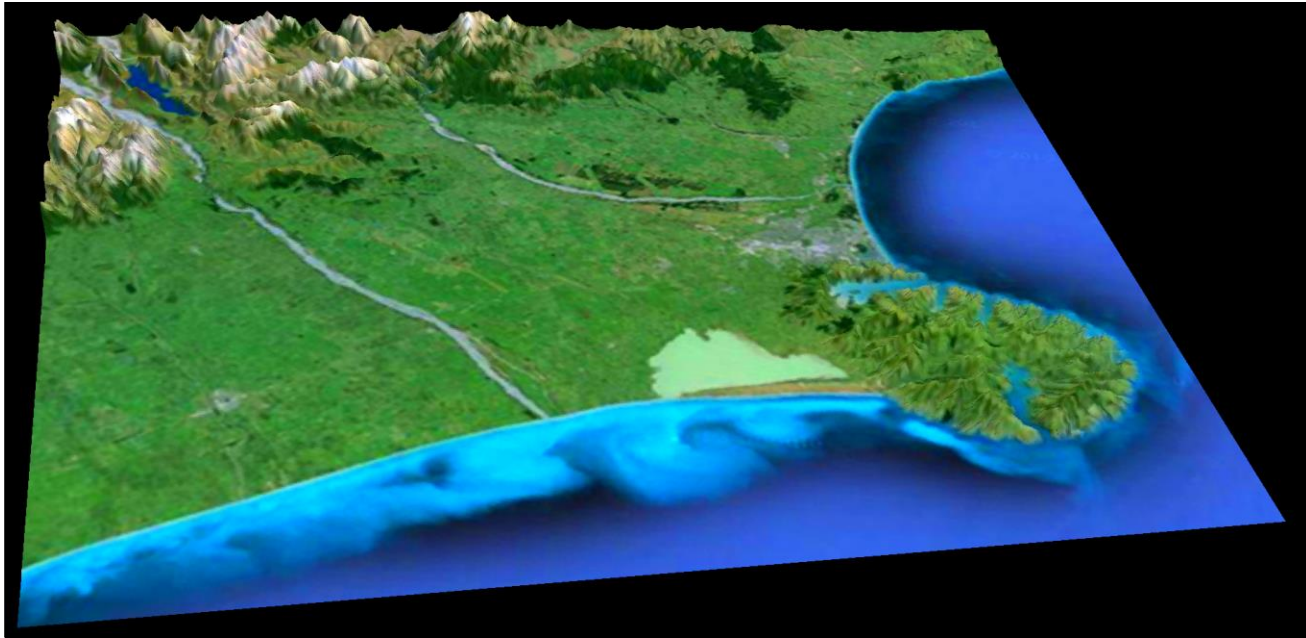
Cropped to fit the domain and converted to VTP format

Visualisation III. Terrain surface interpolation



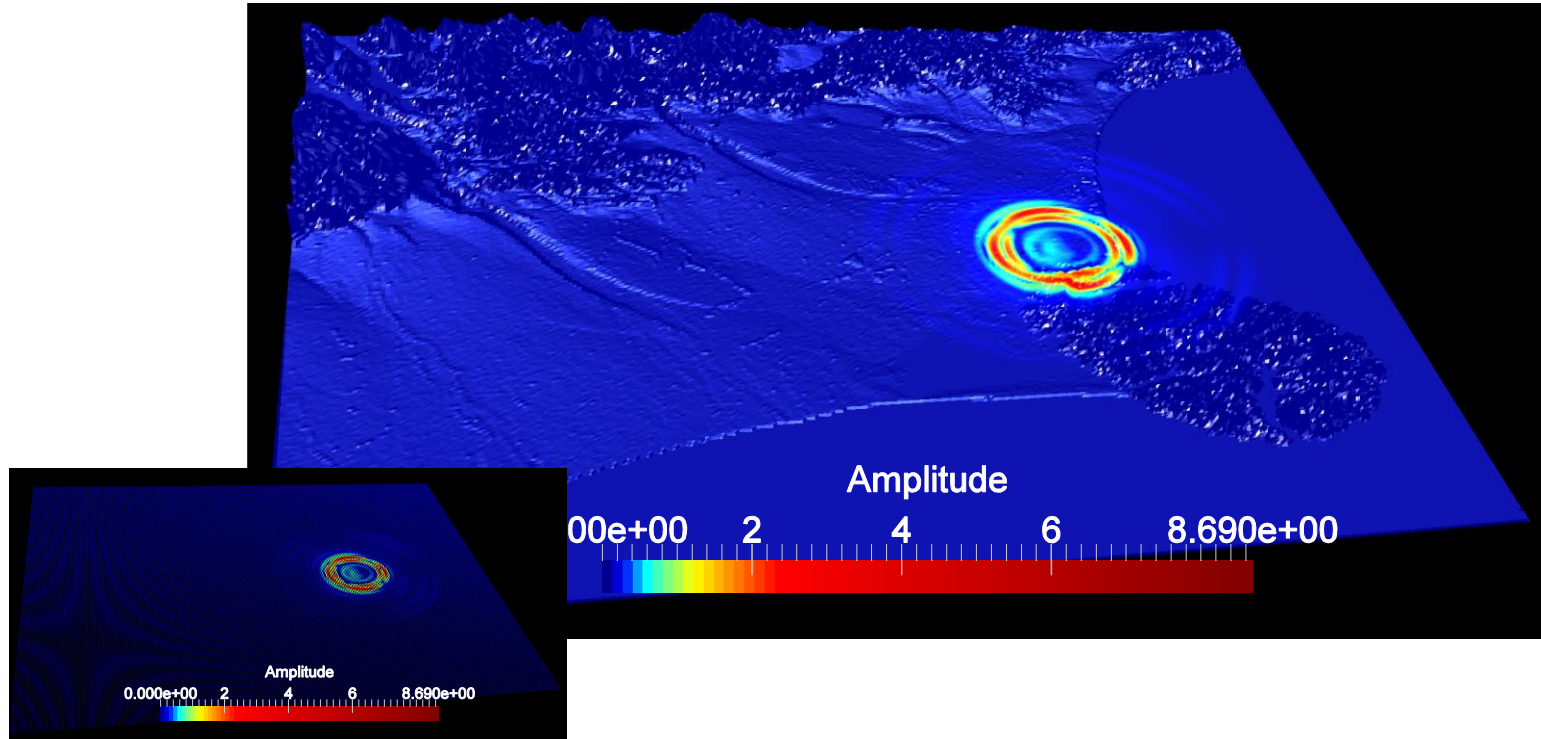
Using 2D Delaunay interpolation

Visualisation IV. Terrain texture mapping

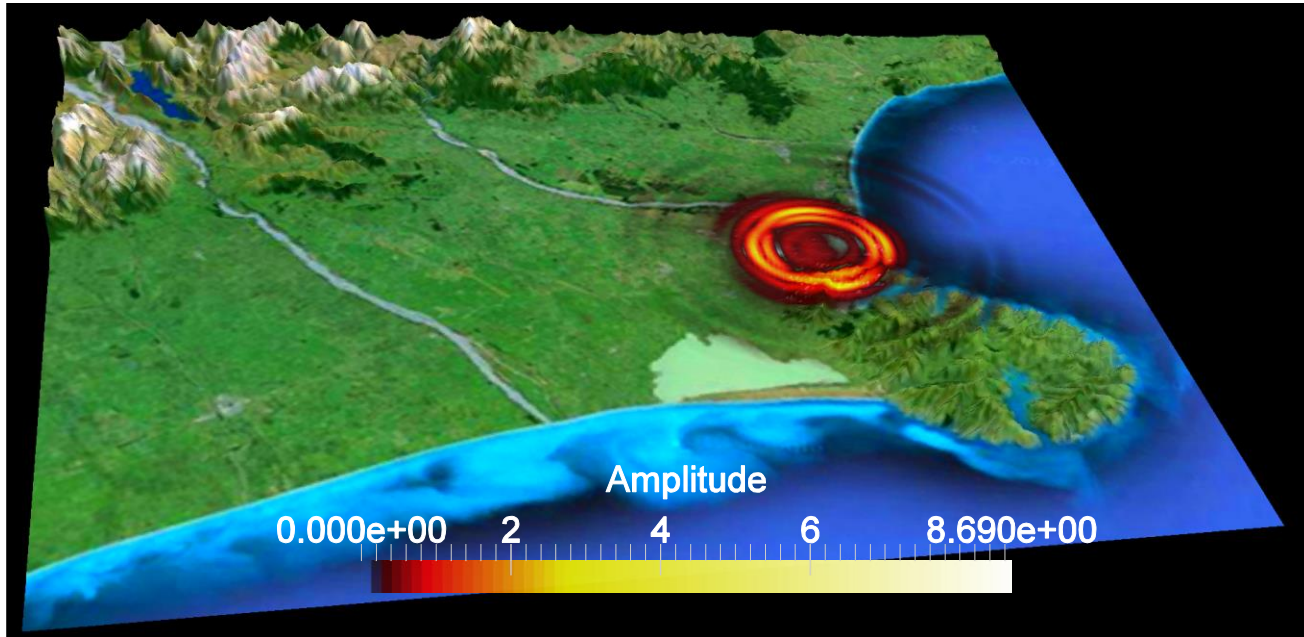


Satellite image obtained from Google Earth (screen captured) and “Photoshop”ped

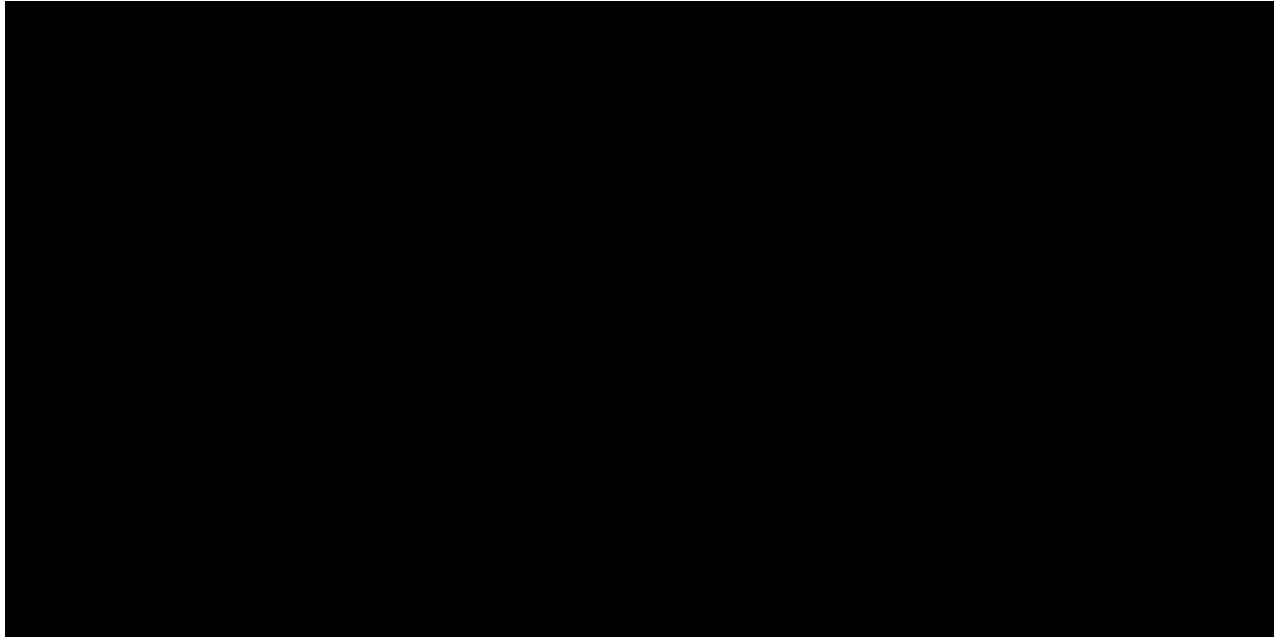
Visualisation V. Warping plane of Ground motion



Visualisation VI. Show terrain + ground motion



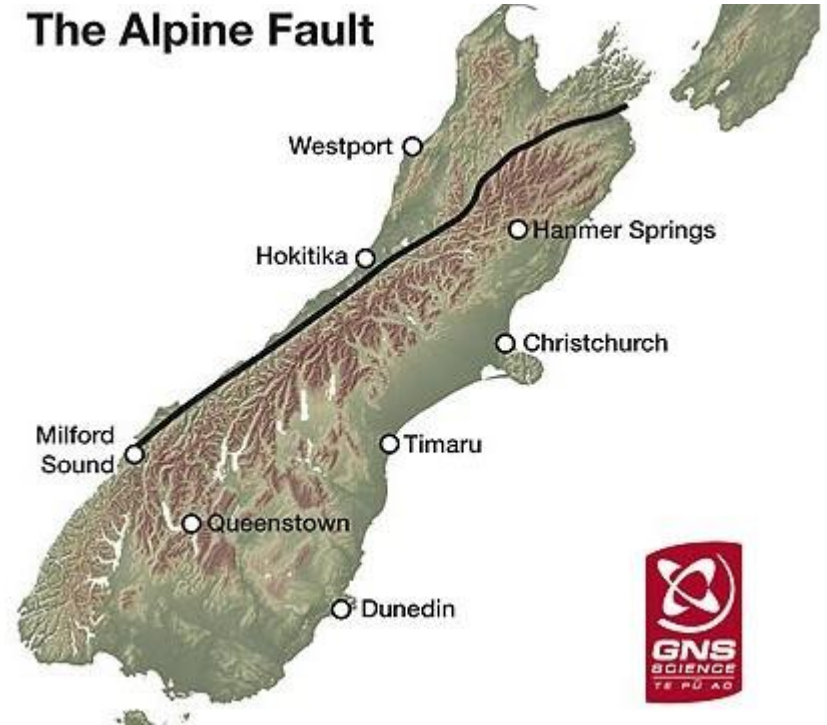
Final. Video



Future work

Simulations of Alpine Fault scenario
(in progress)

The Alpine Fault



Future work

Terrain texture with high resolution

Easy NZ satellite image retrieval on
coordinates input

