Kaikoura Earthquake – Selected Geological Impacts and Slip Modelling

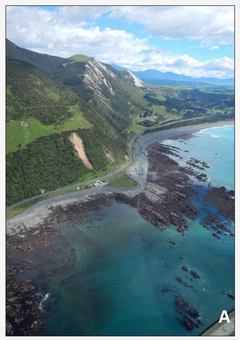
Papatea Fault - Clarence River Coastal Plain

Photo credit: Julian Thomson

Photo credit: Will Ries

- The reverse left-lateral Papatea fault ruptured along two splays at the coast
- Up to 6 m vertical coseismic offset inland from coast
- Near the coast, at least 5 m left-lateral slip and 3 m vertical offset
- Fault zone extends offshore to South

Papatea Fault - South Strand



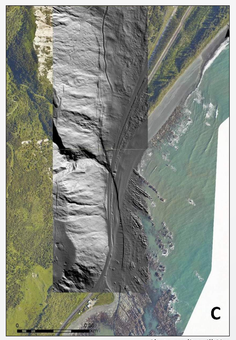


Photo credit: Will Ries

A) Aerial oblique looking north along the ground rupture trace of the Papatea Fault west strand
B) Vertical aerial photograph of the west strand of the Papatea Fault ground rupture
C) Recently acquired LiDAR DEM ground surface map detailing the complexity of the ground surface rupture

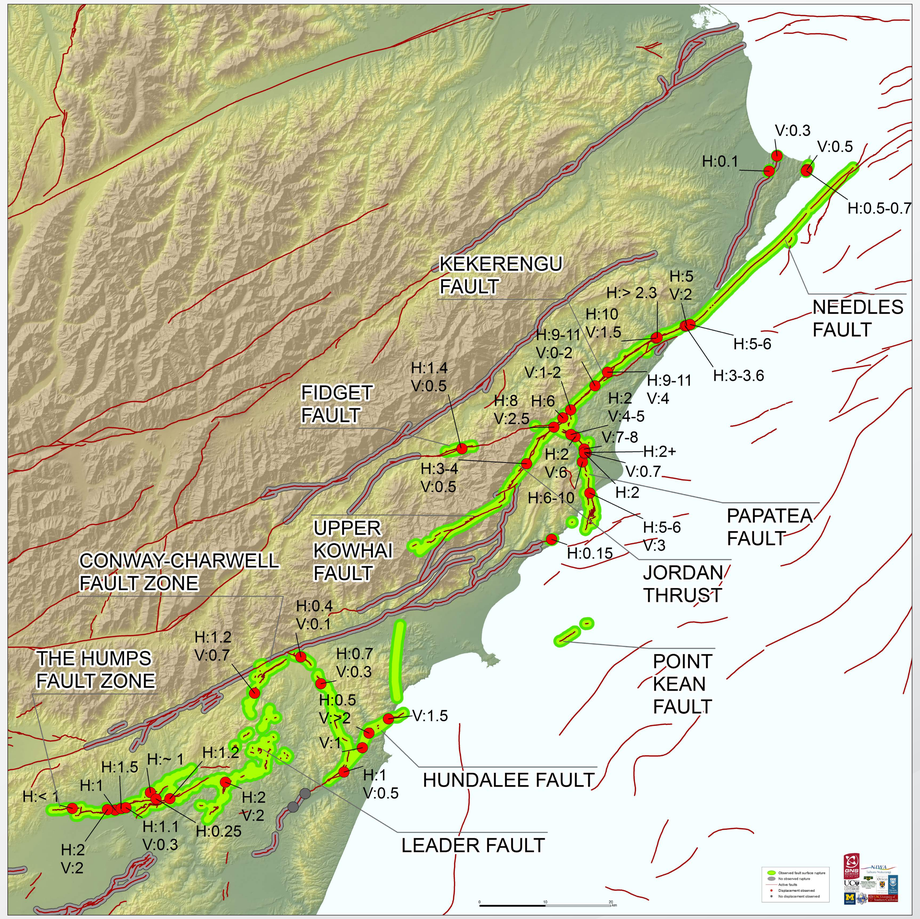
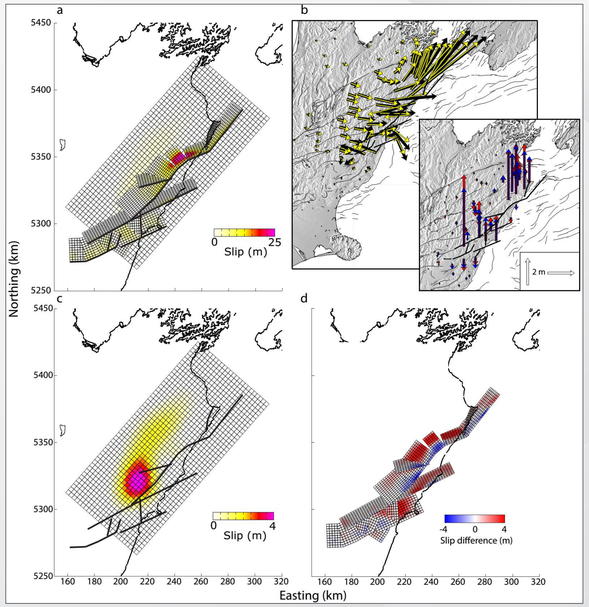
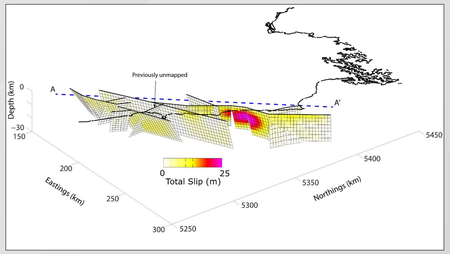


Figure Source: GNS Science

Fault slip Modelling Including a Subduction Interface Source



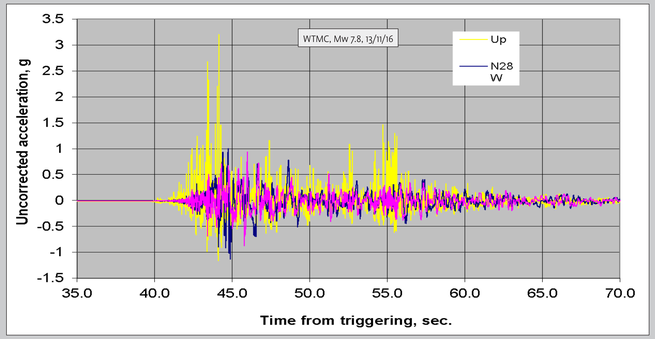
a) Best fitting fault slip models for the Kaikoura Earthquake with the inclusion of a subduction interface rupture source.
b) Observed and modelled surface displacements at continuous and campaign GPS stations based on the interface model.
c) Slip distribution for only the subduction interface, black lines show the location of the corresponding crustal faults.
d) Difference in slip on the crustal faults, when including the subduction interface, as an earthquake source. Blue colours show areas where more slip is predicted by the interface model and red areas where more slip is predicted by the crustal only model.



Best fitting slip model based on geodetic and coastal uplift data. Heavy black lines denote the top edge of the various faults that ruptured.

Figure source: Hamling et al., accepted - Science

Accelerogram record of the Kaikoura Earthquake (M_w7.8) Mainshock - Te Mara Farm Station, Waiau



Berrill J. B., "The Canterbury Accelerograph Network and other Follies", Proc New Zealand Workshop on Geotechnical Earthquake Engineering, University of Canterbury, Christchurch, New Zealand, 20-21 Nov 2006

CANTERBURY SEISMIC INSTRUMENTS

- This recording is from CUSP instrument located closest to the Kaikoura Earthquake epicentre, at Te Mara Farm station. WTMC, 4 km N of the township of Waiau and 8.3km NNE of the epicentre.
- The accelerograph at WTMC belongs to GeoNet and is a CUSP-3A, manufactured by Canterbury Seismic Instruments (CSI), the Christchurch based manufacturers of the CUSP instruments.

Coastal Uplift

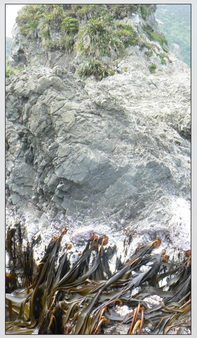


Photo credit: Pilar Villamor

Photo credit: Kate Clark

Photo credit: Jarg Pettinga

- Geological observations and GPS measurement have documented a complex pattern of coastal uplift.
- Abrupt uplift changes are mapped across onshore faults that have ruptured. There is also a contribution to uplift from offshore faults that ruptured (e.g. Needles and Hundalee faults).
- Modelling of the uplift pattern is best related to crustal faults with a small (~10%) contribution from plate interface rupture.