PRELIMINARY ANALYSIS OF SEISMIC ANISOTROPY CHANGES ASSOCIATED THE KAIKOURA EARTHQUAKES IN NEW ZEALAND

[1] Kenny Graham, [1] Martha K Savage & [2] Richard Arnold

[1] Institute of Geophysics, SGEES, VUW, NZ [2]School of Mathematics and Statistics, VUW, NZ.
Email address of presenting author: Kenny.Grahan@vuw.ac.nz

MARSDEN FUND
TE PŪTEA RANGAHAU A MARSDEN

INTRODUCTION

The M7.8 14 November 2016 Kaikōura Earthquake, South Island New Zealand, occurred in a complex tectonic regime in the eastern Marlborough fault system.

It is the largest and most complex earthquake recorded on land in New Zealand since the digital seismological age.

A remarkable number (more than 20) shallow crustal fault segments ruptured, including vertical motions of more than 10 m and horizontal displacements over 11 m (Hamling et al., 2017).

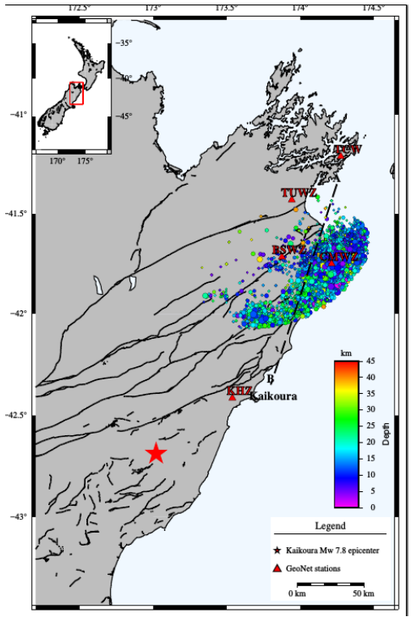
It ruptured the surface over a distance of 150 km. The main shock was followed by more than 20,000 local and regional aftershocks clustered with three unique spatial patterns.

The Kaikōura earthquakes provide a unique dataset to test the use of shear wave splitting for measuring variations in stress because clusters of closely-spaced earthquakes occurred both before and after a main shock.

OBJECTIVES

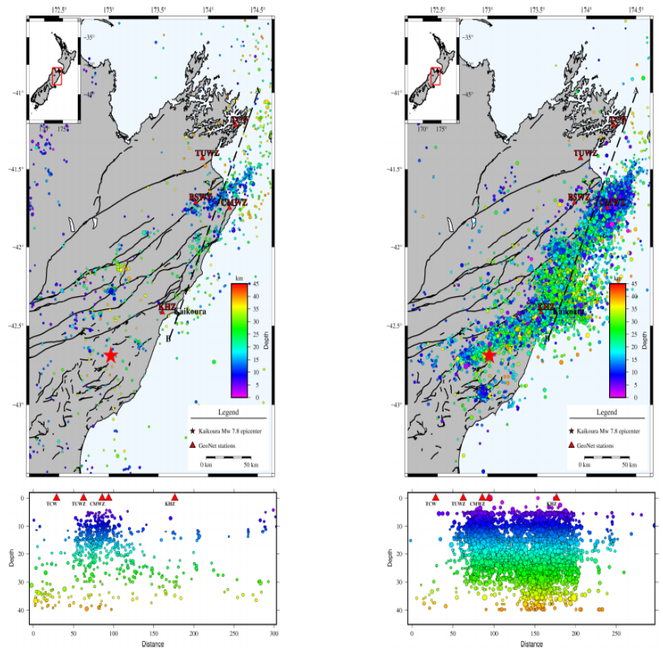
The study aims to measure any appreciable changes in Shear wave splitting measurements before and after the Kaikōura earthquake

METHOD



We determine shear wave splitting measurements, during the period of 2015 to August 2017, for over 5,000 crustal earthquakes which were located close to each other and near the previous Seddon earthquake sequence.

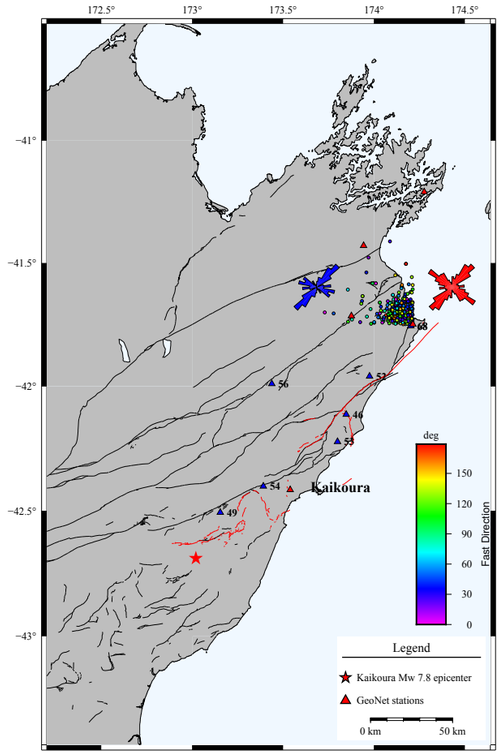
We used the automatic, objective splitting analysis code MFAST and an automatic S-phase picker to speed the processing and to minimize observer bias.



a. Before Kaikoura event *b. After Kaikoura event*

Figure 3: ***Map showing station and before (a) and after (b) events of Kaikoura earthquake:*** *Local and regional earthquakes recorded by Geonet. Red star shows the Mw 7.8 epicenter and Geonet stations for analysis are shown in red triangles. Events are scaled according to its magnitude, and colour coded according to its depth. A cross-section from A to B shows the depth distrubution events. The inset shows the location of the study area*

PRELIMINARY RESULTS

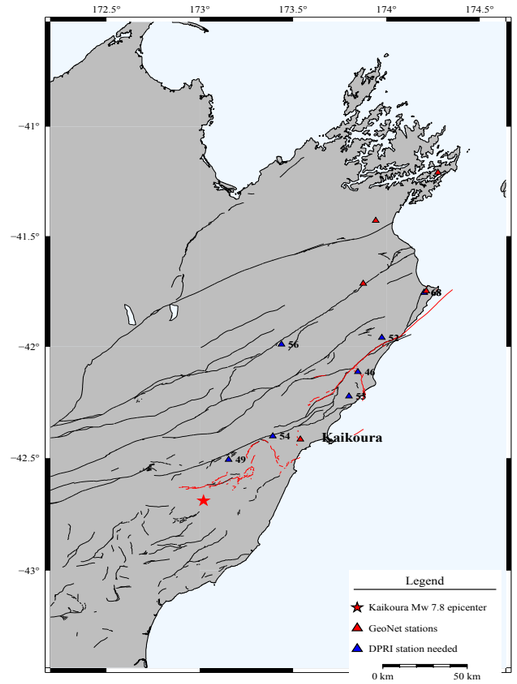


COMMENT

We made preliminary shear wave splitting measurement for two GeoNet stations around the Cape Campbell (CMWZ) and Seddon region (BSWZ) which released the most energy during the earthquake. The mean fast orientation at both stations for events before the Kaikōura earthquake are parallel to NE-SW tectonic structures of the area. Station BSWZ showed similar NE-SW orientation after the earthquake. For station CMWZ, there is bimodal fast orientation after the earthquake, with a NE –SW mode and a NW-SE mode, which could be an indication of stress changes. These changes may be related to crack opening and closing and to the fluids contained in the cracks.

FUTURE WORK

Further analysis is planned for stations around the Marlborough region, particularly areas where most of the surface ruptures occurred.



REFERENCES

Hamling, IJ, Hreinsdóttir, S, Clark, K et al. (26 more authors) (2017) Complex multi-fault rupture during the 2016 Mw 7.8 Kaikōura earthquake, New Zealand. Science, 356 (6334). eaam7194. ISSN 0036-8075

Kaiser, A. et al. Seismol. Res. Lett. http:/dx.doi.org/10.1785/0220170018 (2017).

Litchfield, N.J.,et al., 2017, 4th November 2016 M7.8 Kaikōura earthquake. Summary surface fault traces and preliminary displacement measurements. http://dx.doi.org/10.21420/G21422RC21427C.

K.J. Clark, et al., Strong, Highly variable coastal deformation in the 2016 MW7.8 Kaikōura earthquake reflects rupture complexity along a transpressional plate boundary, In Earth and Planetary Science Letters, Volume 474, 2017, Pages 334-344, ISSN 0012-821X, https://doi.org/10.1016/j.epsl.2017.06.048.