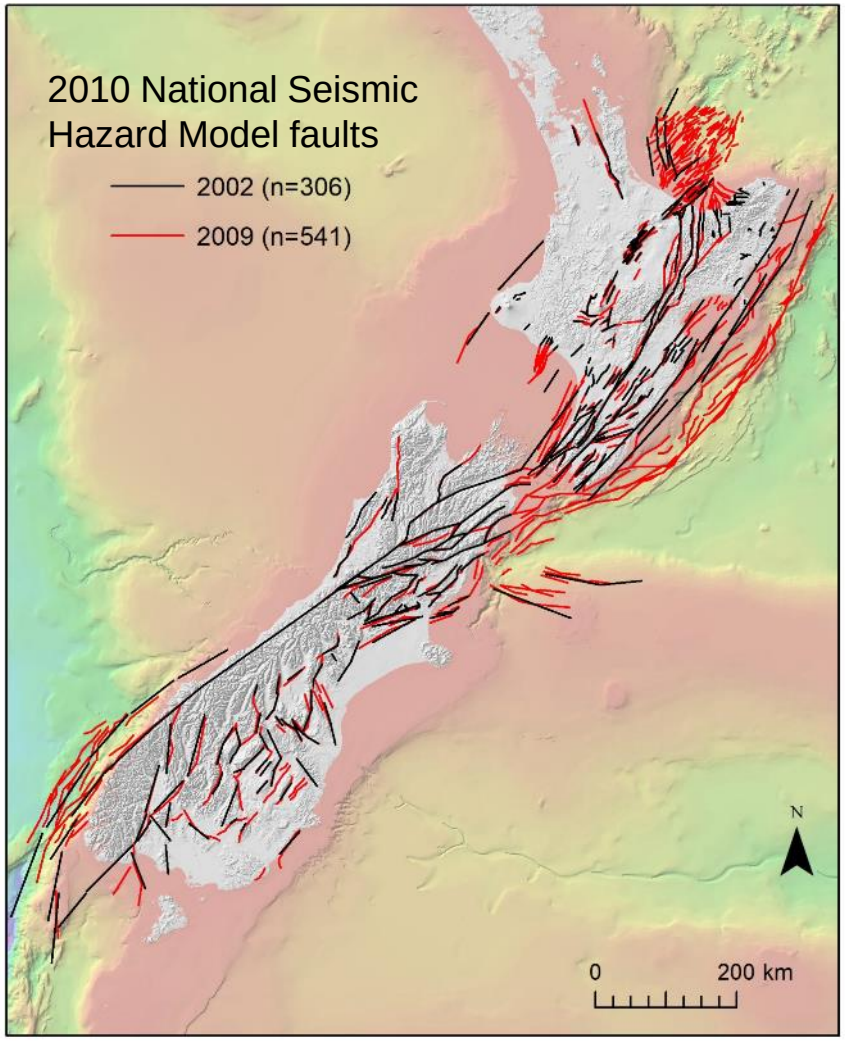
Earthquake Hazards:
10 years of learning from earthquakes

Nicola Litchfield *on behalf of many others…*
NHRP & RNC Forum, Te Papa Tongarewa
30 May 2019

Where we were in 2009



- **2010 NSHM update nearly complete, Active Fault Model**

https://www.gns.cri.nz/Home/Our-Science/Natural-Hazards-and-Risks/Earthquakes/Earthquake-Forecast-and-Hazard-Modelling/2010-National-Seismic-Hazard-Model

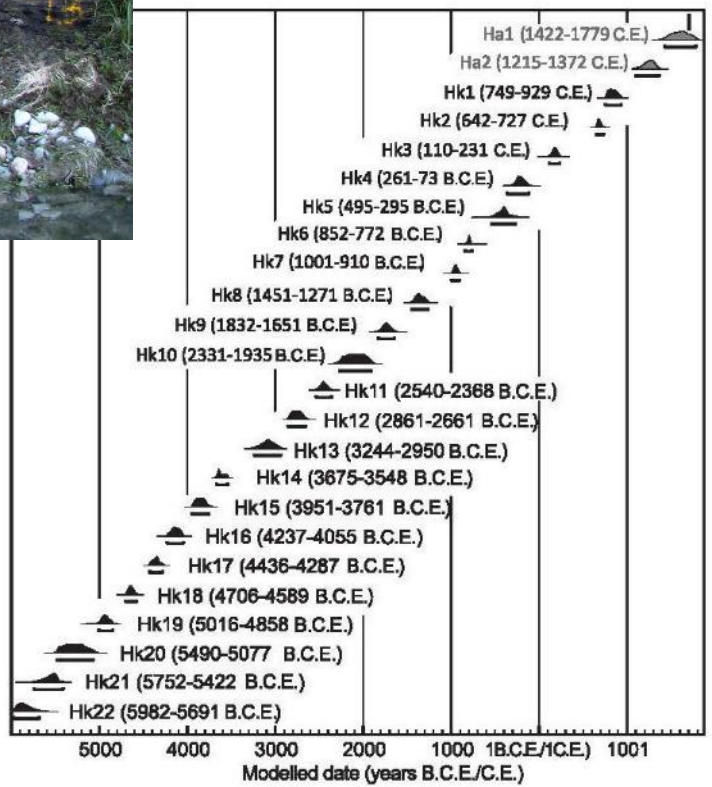
https://www.tandfonline.com/doi/suppl/10.1080/00288306.2013.854256?scroll=top

Where we were in 2009

Clark et al. (2011)

- 2010 NSHM update nearly complete, Active Fault Model
- 2009 M7.8 Dusky Sound Earthquake showed minimal coastal deformation and tsunami

Where we were in 2009



- 2010 NSHM update nearly complete, Active Fault Model
- 2009 M7.8 Dusky Sound Earthquake showed minimal coastal deformation and tsunami
- Alpine Fault long (24) paleoearthquake record project underway

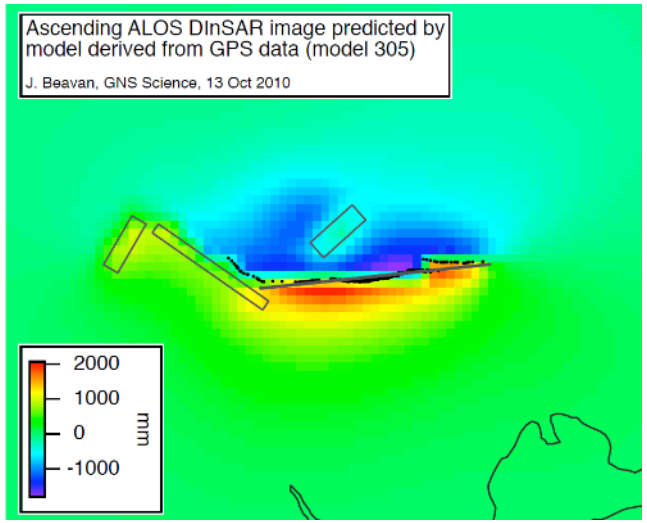
Berryman et al. (2012)
Clark et al. (2013)
Biasi et al. (2015)
Cochran et al. (2017)

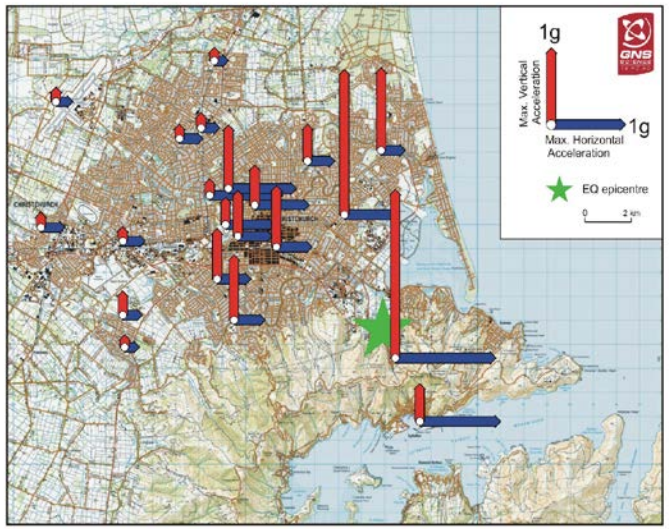
Where we were in 2009

Langridge et al. (2014)

- 2010 NSHM update nearly complete, Active Fault Model
- 2009 M7.8 Dusky Sound Earthquake showed minimal coastal deformation and tsunami
- Alpine Fault long (24) paleoearthquake record project underway
- No Lidar data – first Lidar (Alpine Fault) collected 2010

2010-2011 Christchurch Earthquakes

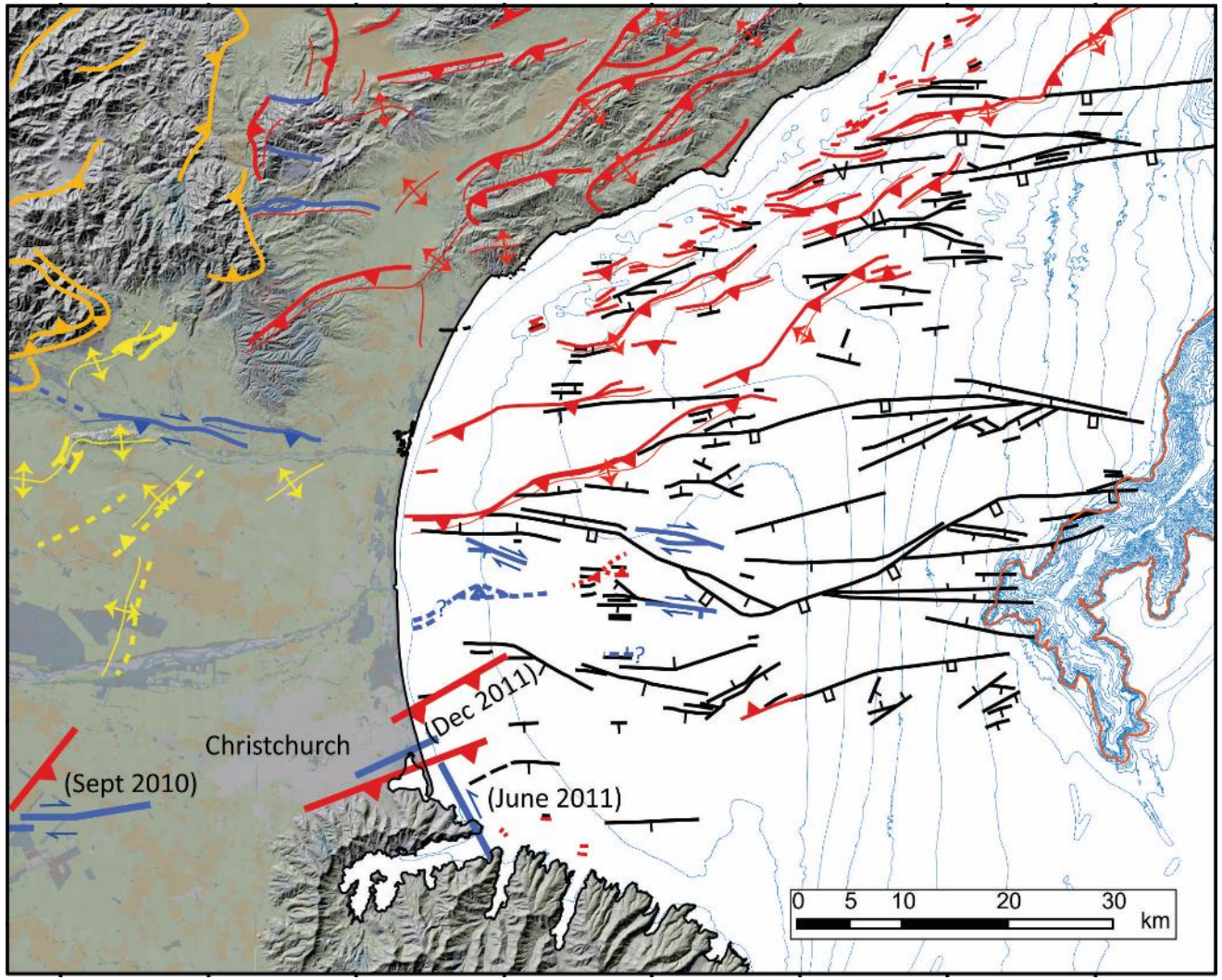




- Complex rupture including blind faults
- Prolonged aftershock sequence / triggering
- Locally very high ground motions due to local site effects
- Secondary impacts – liquefaction, landslides, subsidence

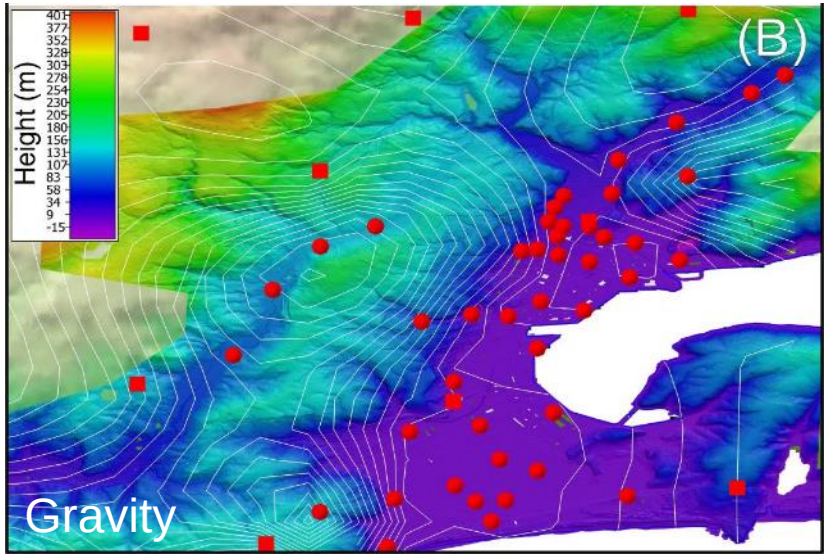
Lessons learned from Christchurch projects

Offshore Canterbury active faults



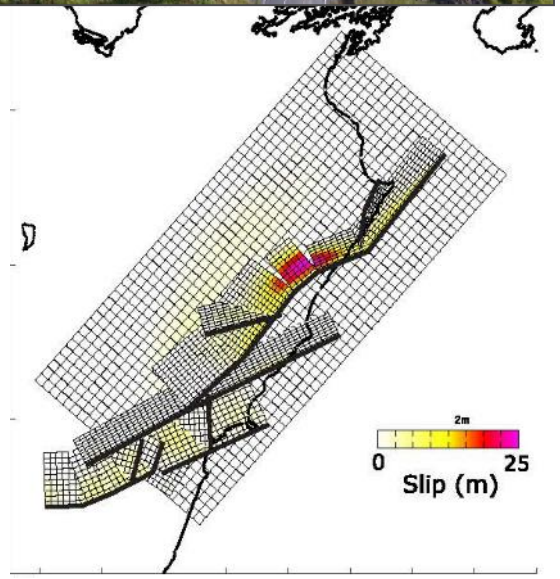
Barnes et al. (2016)

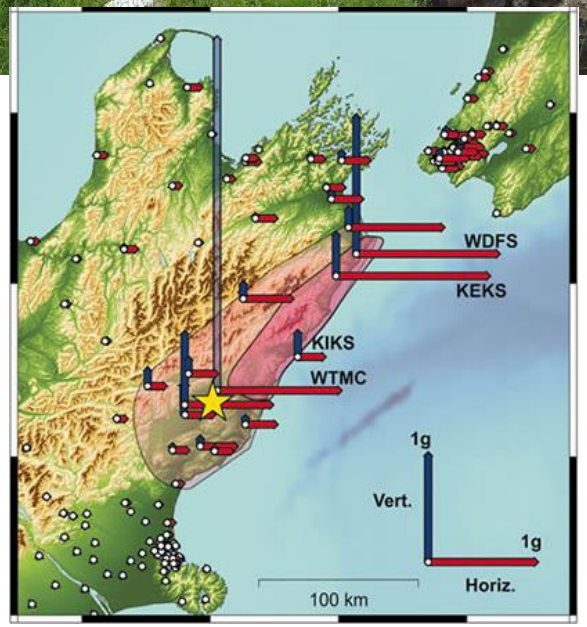
Hidden Faults Under Cities (Dunedin pilot study)



Villamor et al. (2018)

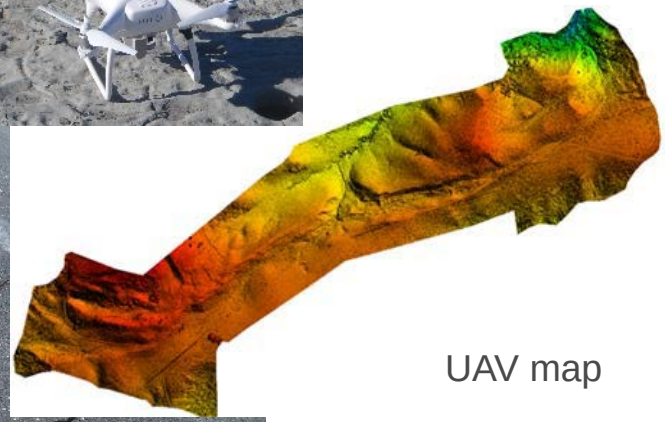
2016 Kaikōura Earthquake



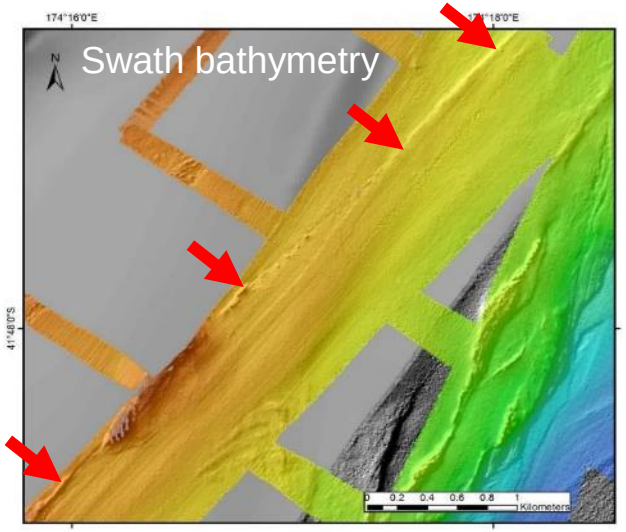


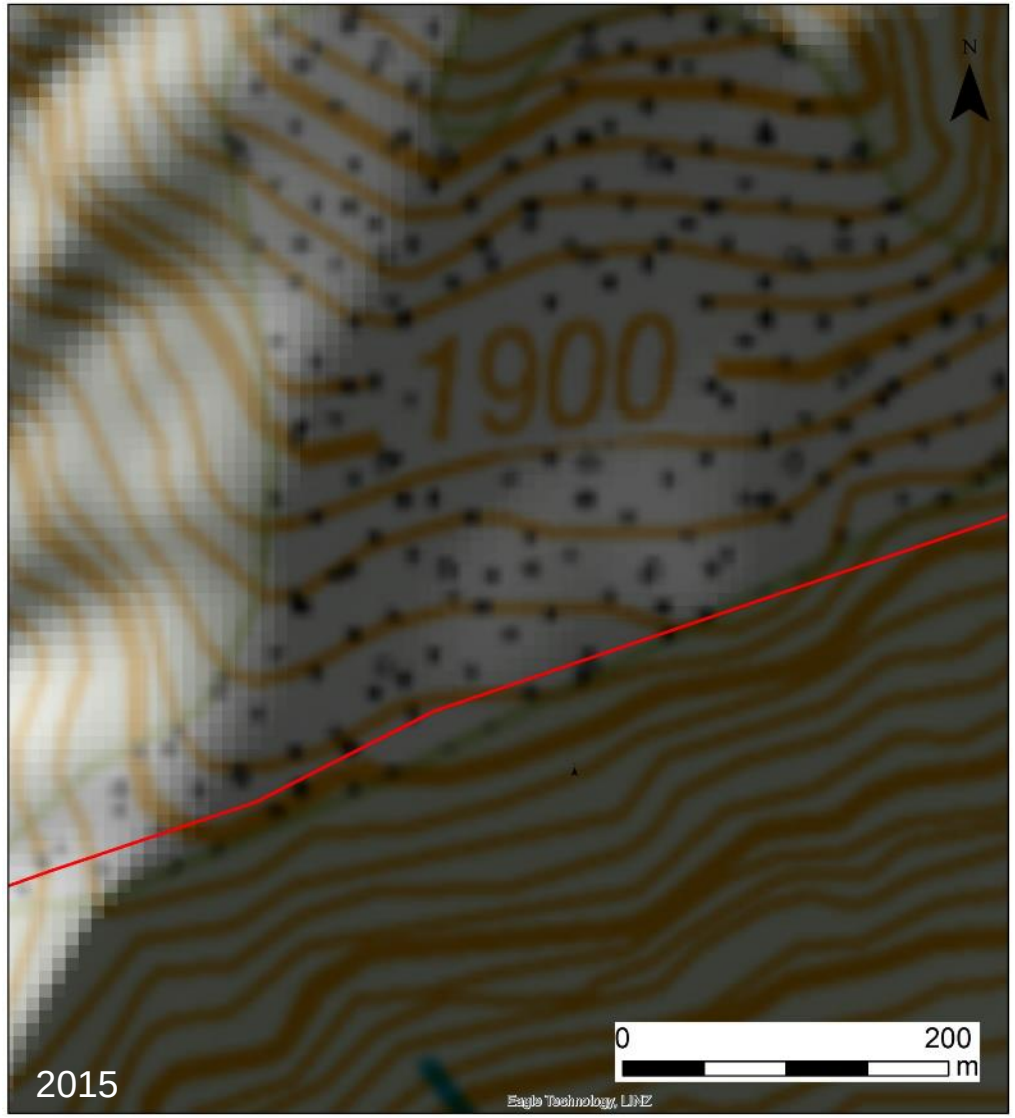
- Even more complex rupture – bypassed the Hope Fault
- Onshore earthquake triggered a tsunami and coastal deformation
- Some Hikurangi Subduction Interface rupture and triggered Slow Slip Events
- Secondary impacts – landslides and landslide-dammed lakes

Kaikōura Earthquake - perishable and high resolution data



UAV map





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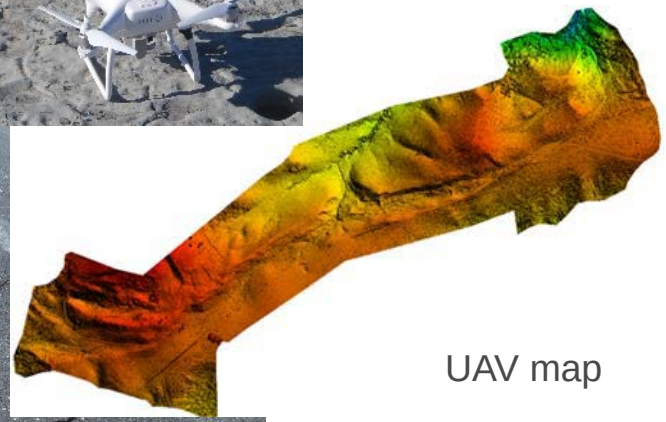

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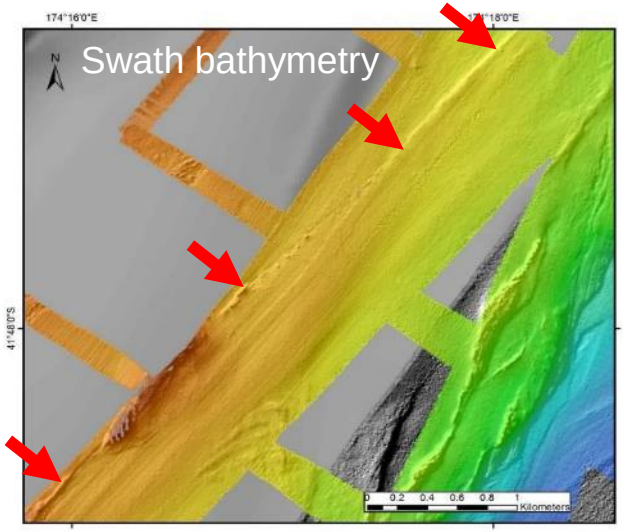

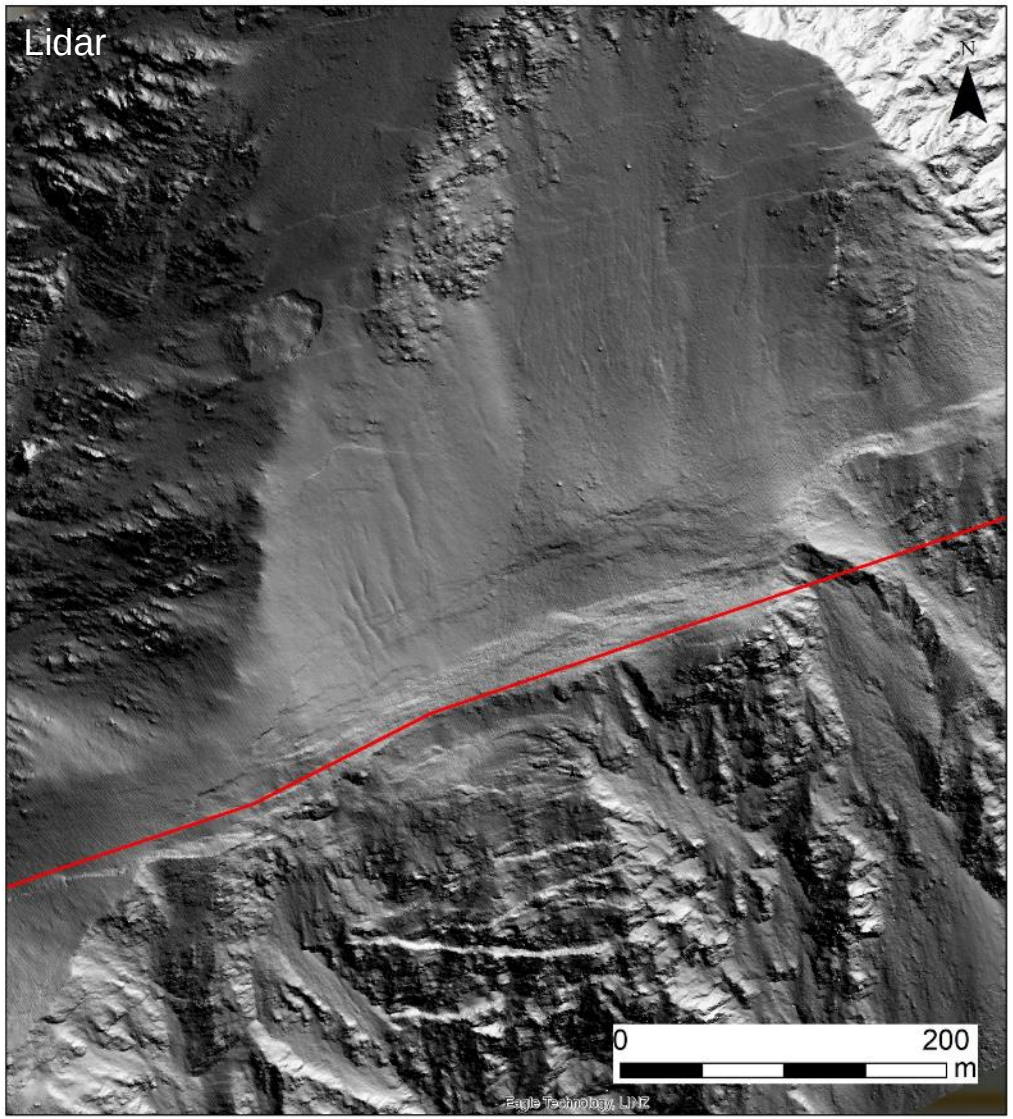

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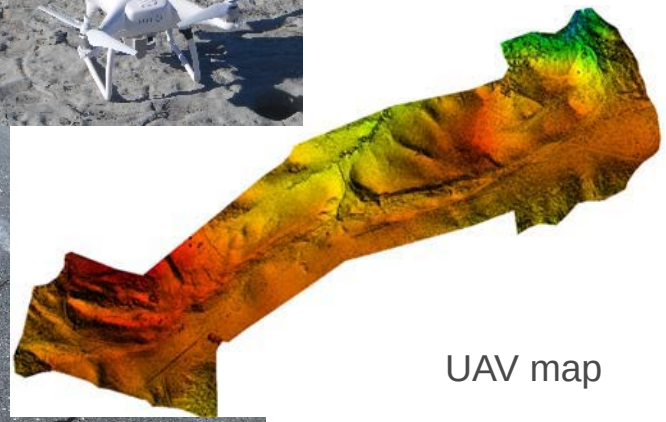

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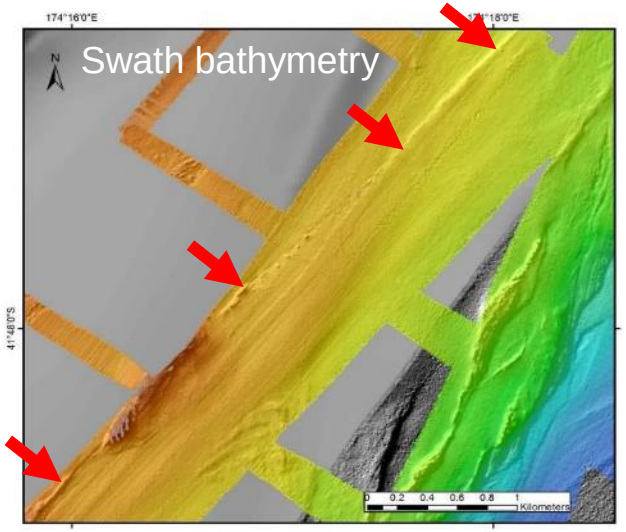
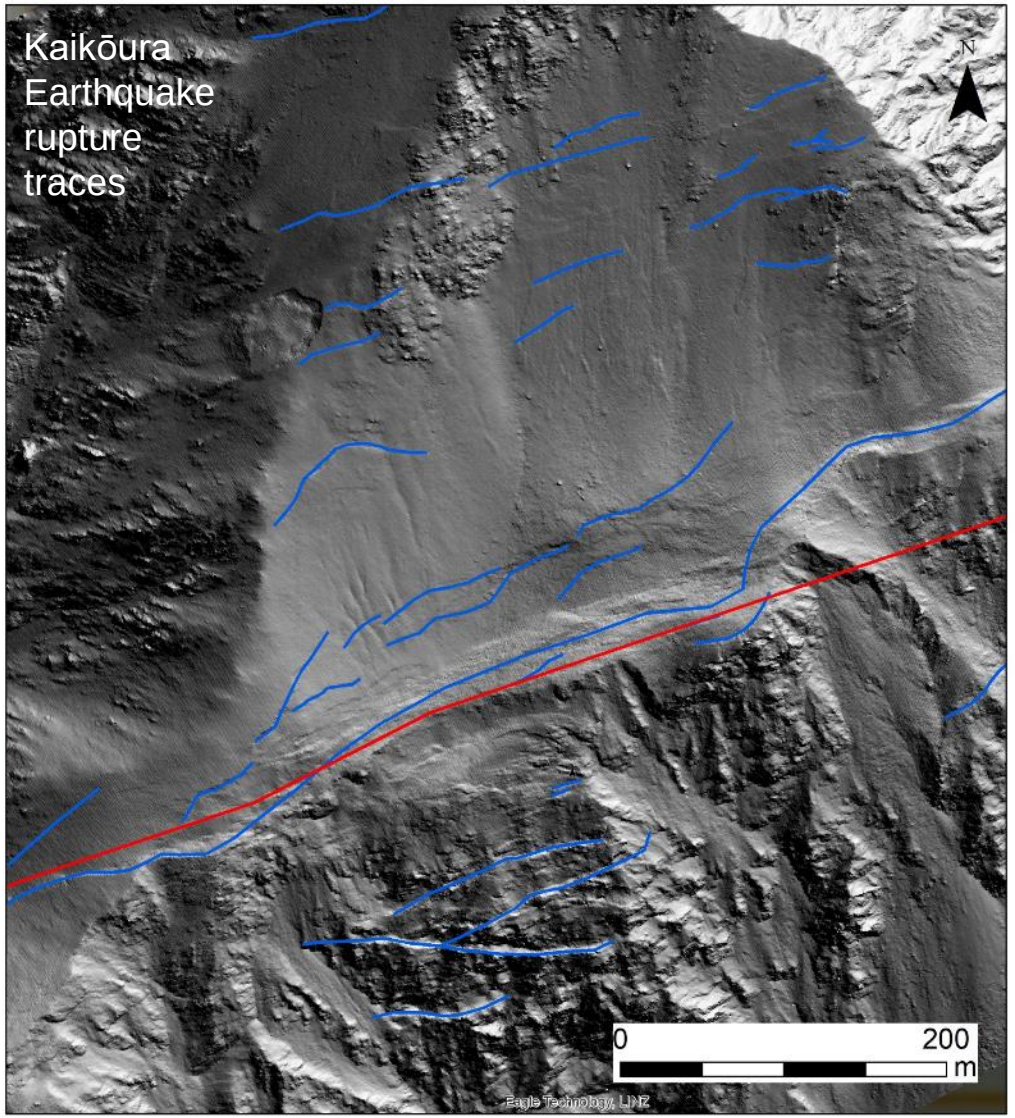
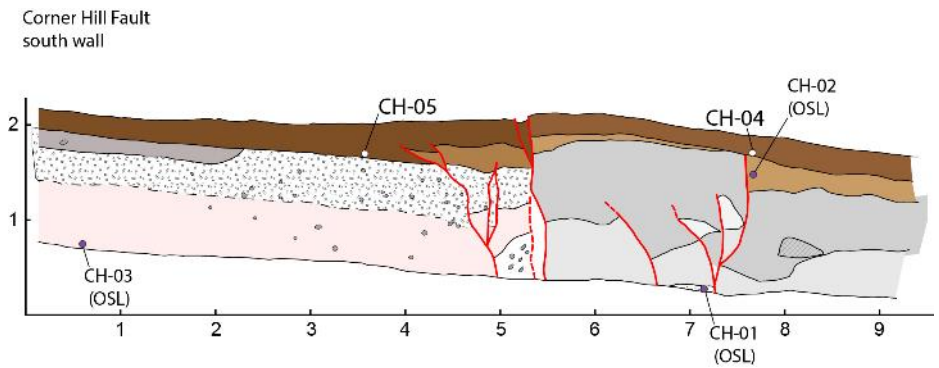
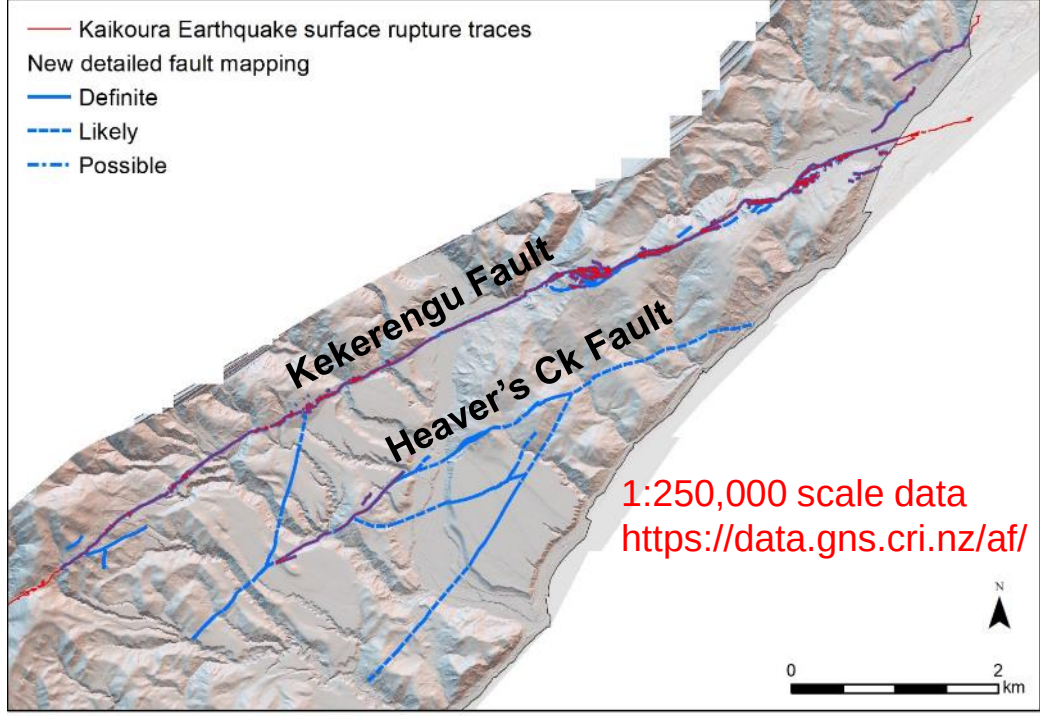


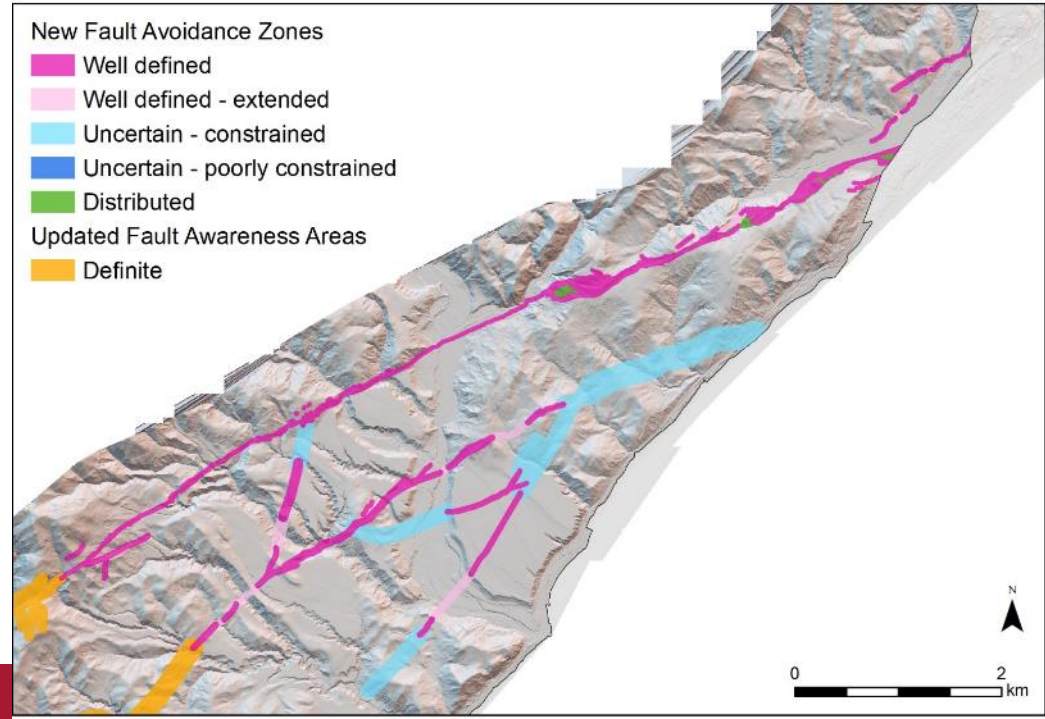


Post-Kaikōura Earthquake projects

Pre-historic earthquakes on Kaikōura's earthquake faults







Langridge et al. (in prep.)

Litchfield et al. (2019; DRAFT)

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