IT'S OUR FAULT
NŌ MĀTOU TE HAPA

It's Our Fault Subduction Earthquake Task
2023 Wellington Earthquake Resilience Collaboratory

Andy Howell on behalf of Kate Clark and the project team

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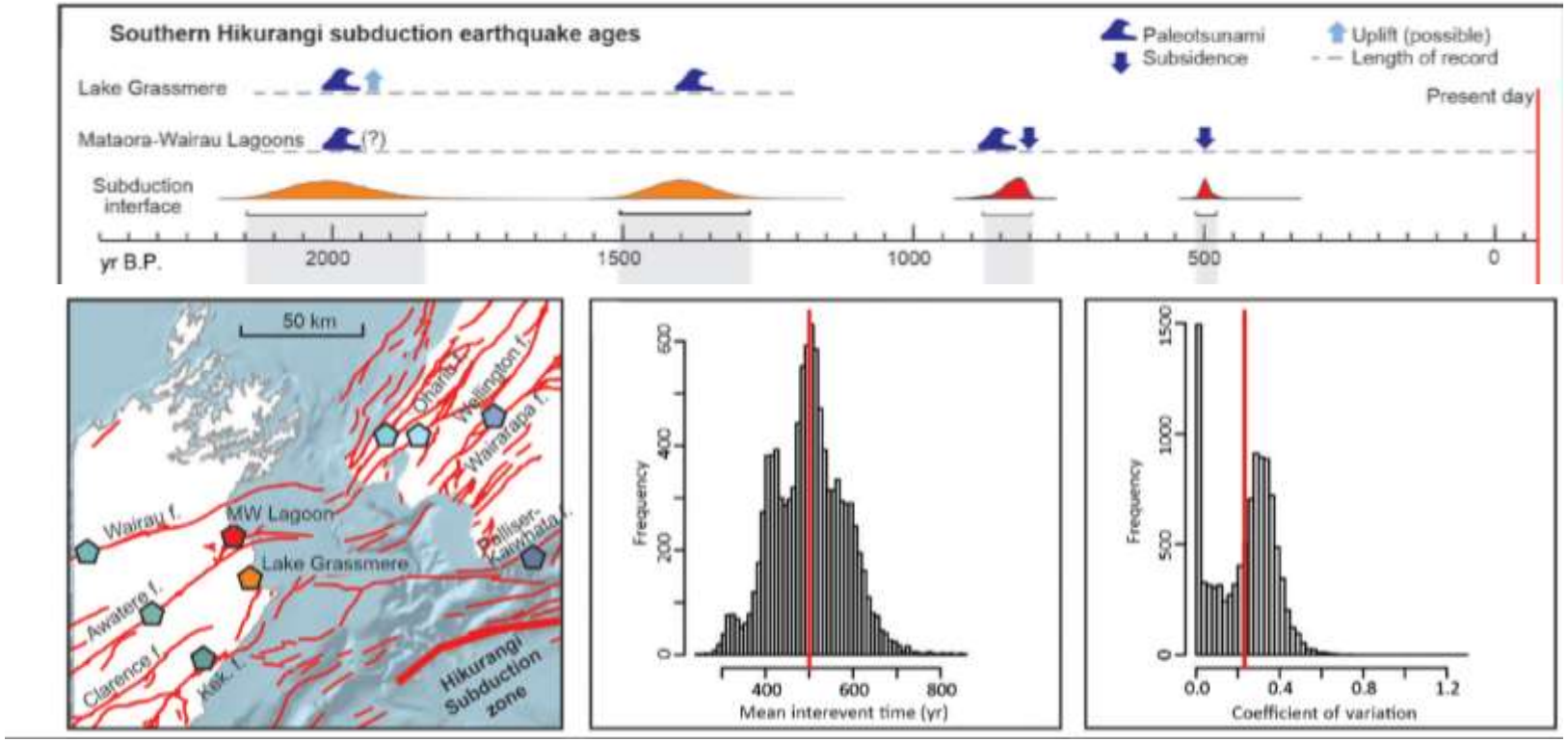
Outline

1. Coring of Mataora-Wairau Lagoon, NE South Island (led by Kate Clark).
2. Modelling of ground motions from combined subduction-crustal ruptures.
3. Next FY: Probabilistic coseismic coastal deformation model.

Mataora-Wairau Lagoon

Mataora-Wairau Lagoon

Why core at Mataora-Wairau Lagoon?

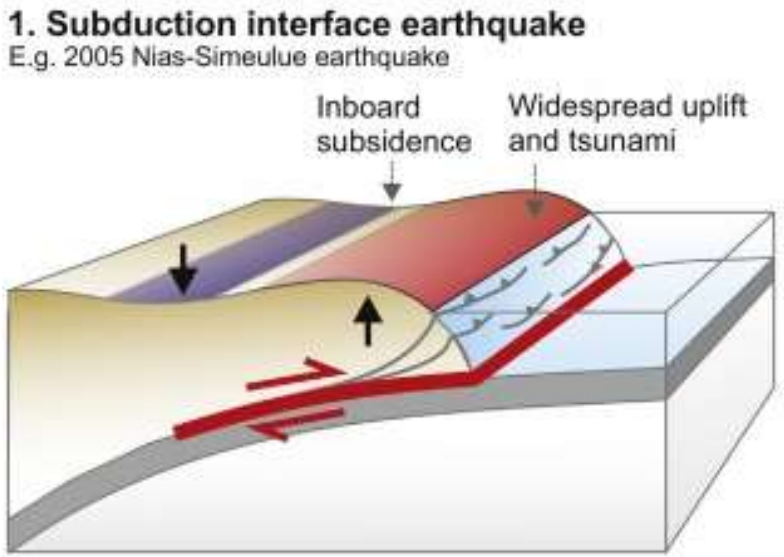


"We calculate a recurrence interval of 500 yr (335–655 yr, 95% confidence interval) and a coefficient of variation of 0.27 (0.0–0.47, 95% confidence interval). The probability of a **large subduction earthquake on the southern Hikurangi subduction zone is 26%** within the next 50 yr."

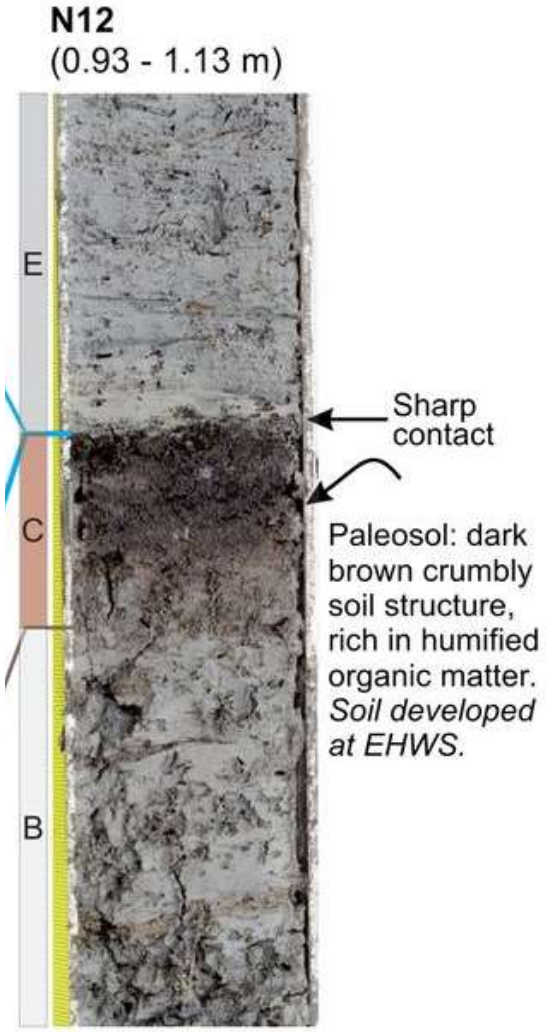
Pizer et al., 2021

What are we looking for?

https://serc.carleton.edu/download/images/57766/trees_dropped_surf_zone.jpg



Clark et al., 2019



Clark et al., 2015

Acquiring cores

Core results

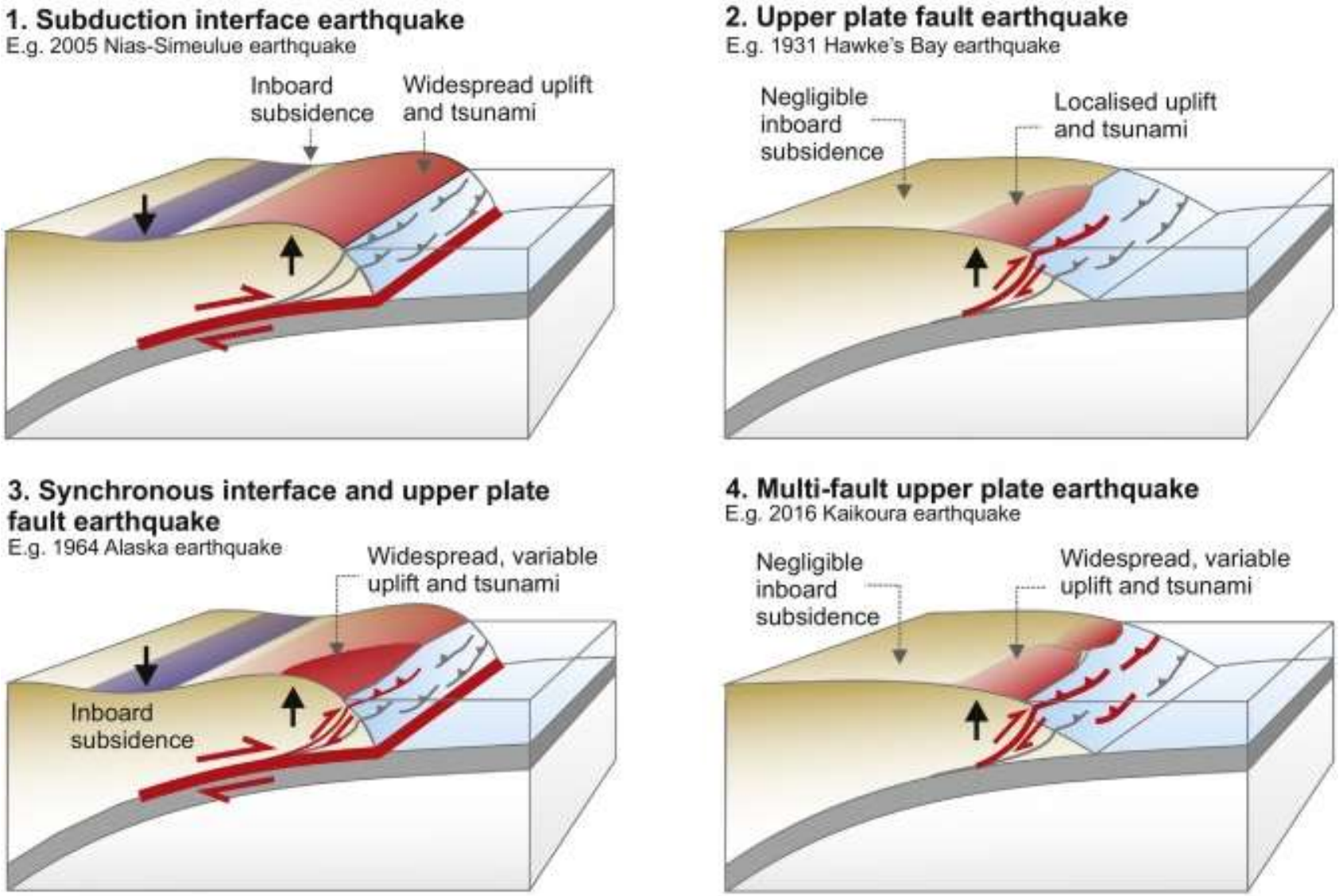
Preliminary results and implications

- **Tighter age constraints on the ~800 years BP earthquake.**
- **Two older possible events not previously well constrained at Mataora-Wairau Lagoon:**
  - ~1500-1700 and ~2000 years BP.
  - Possible correlation with paleotsunami deposits from Lake Grassmere?
- **Plan to update conditional probability and recurrence interval.**
- **Potential to combine with dislocation modelling to constrain location and magnitude of past earthquakes.**

Ground motions from combined subduction-crustal ruptures

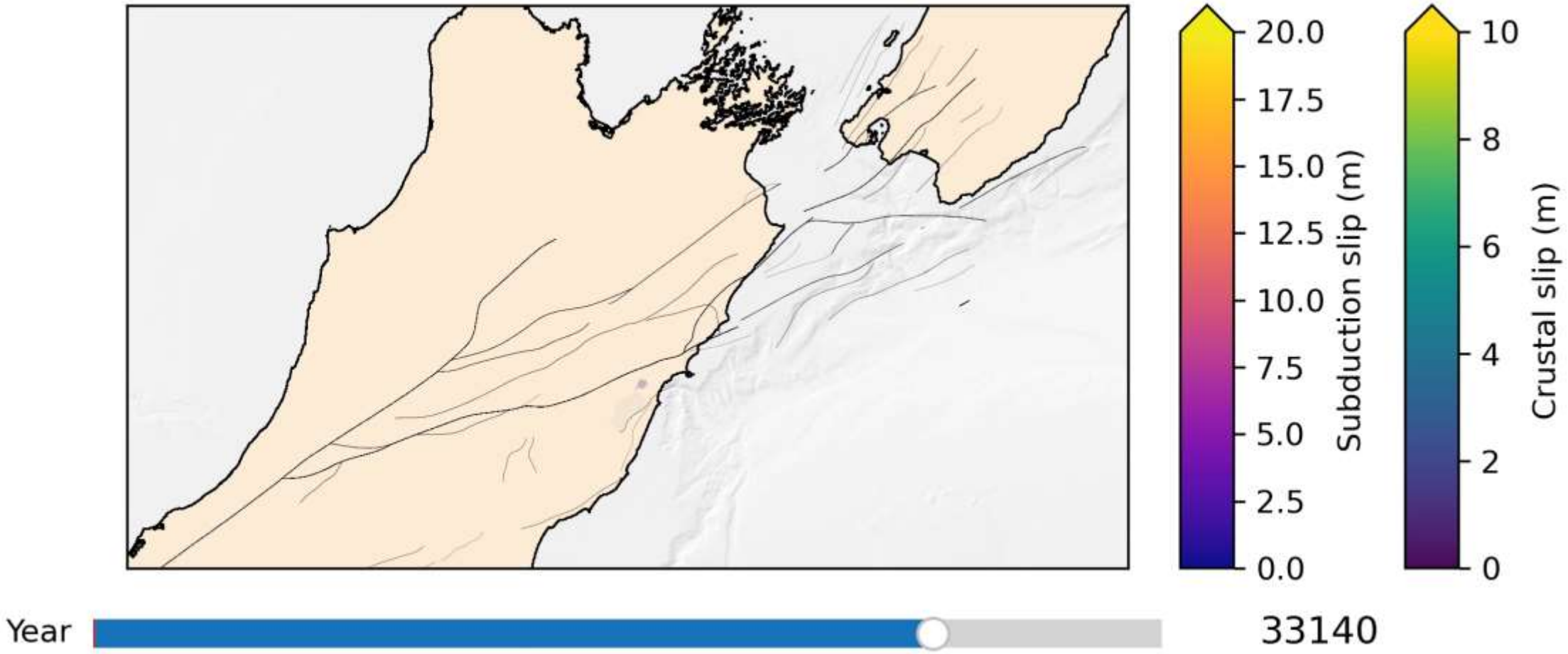
- Not currently considered in NSHM.
- Considering combined ruptures has potential to affect modelled seismic hazard (and risk) for Wellington.
- Work co-funded by Resilience to Nature's Challenges earthquake and Tsunami Theme (led by Bill Fry and Andy Nicol).

What is a subduction-crustal rupture?



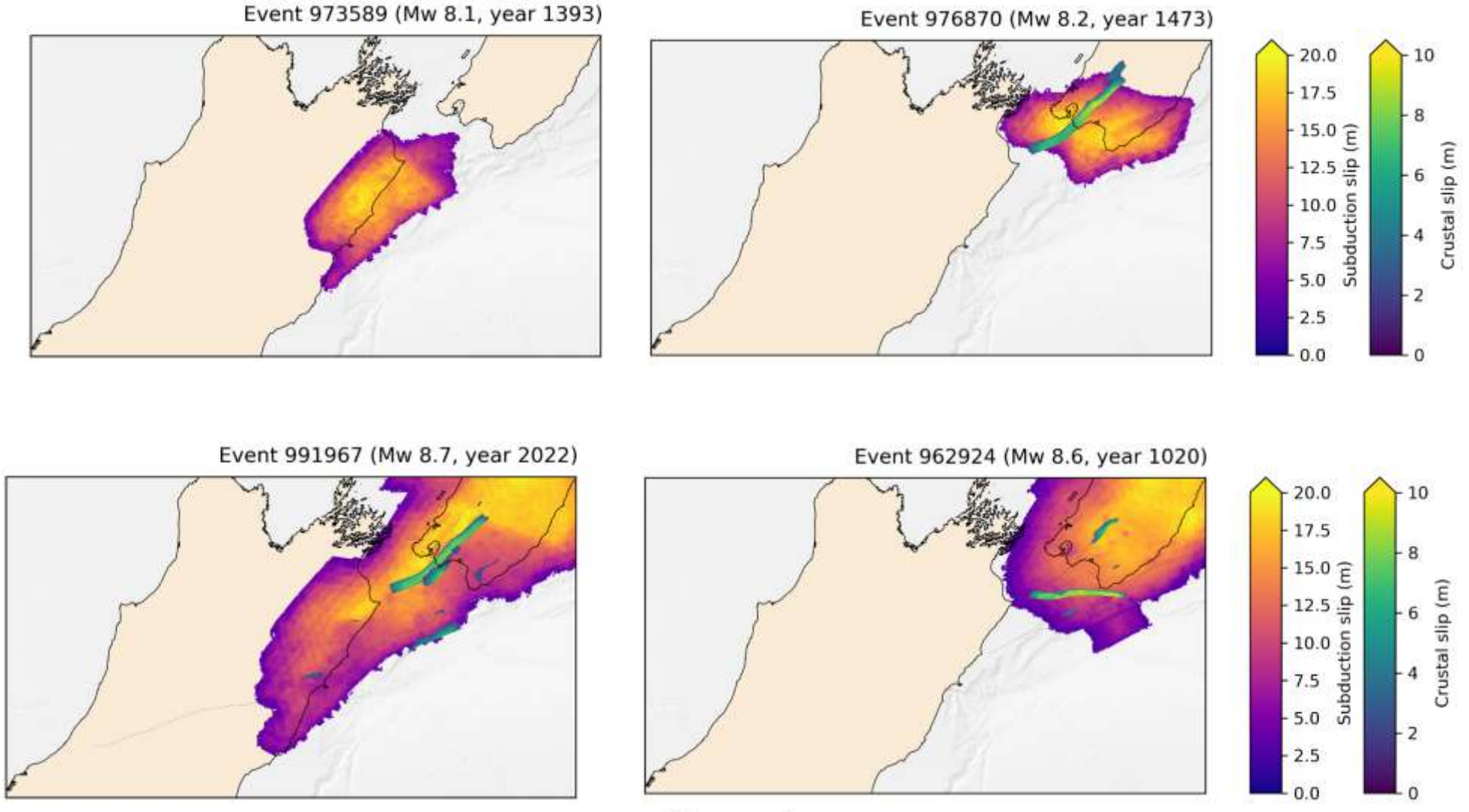
Clark et al., 2019

Combined subduction-crustal ruptures in physics-based models

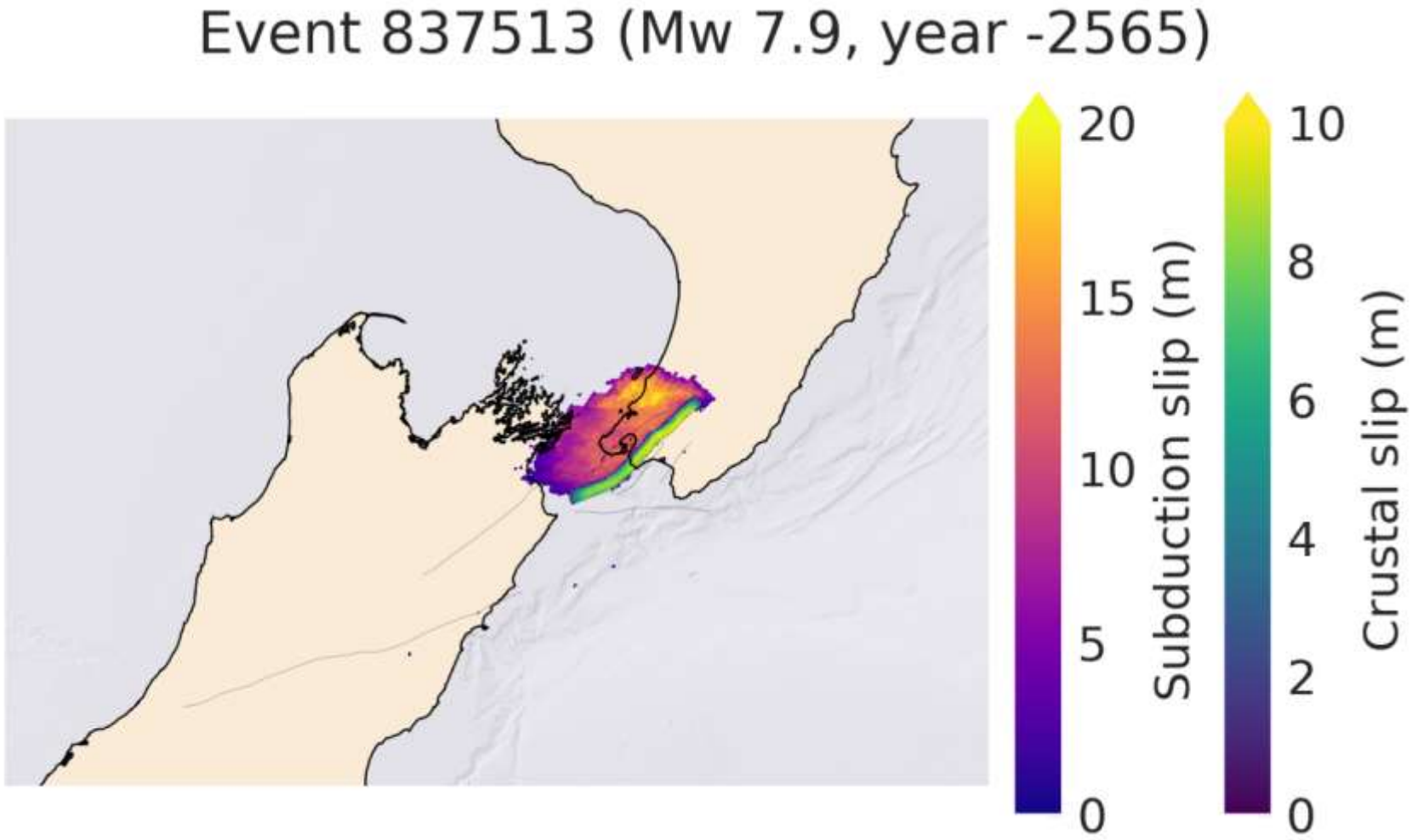


Camilla Penney, UC

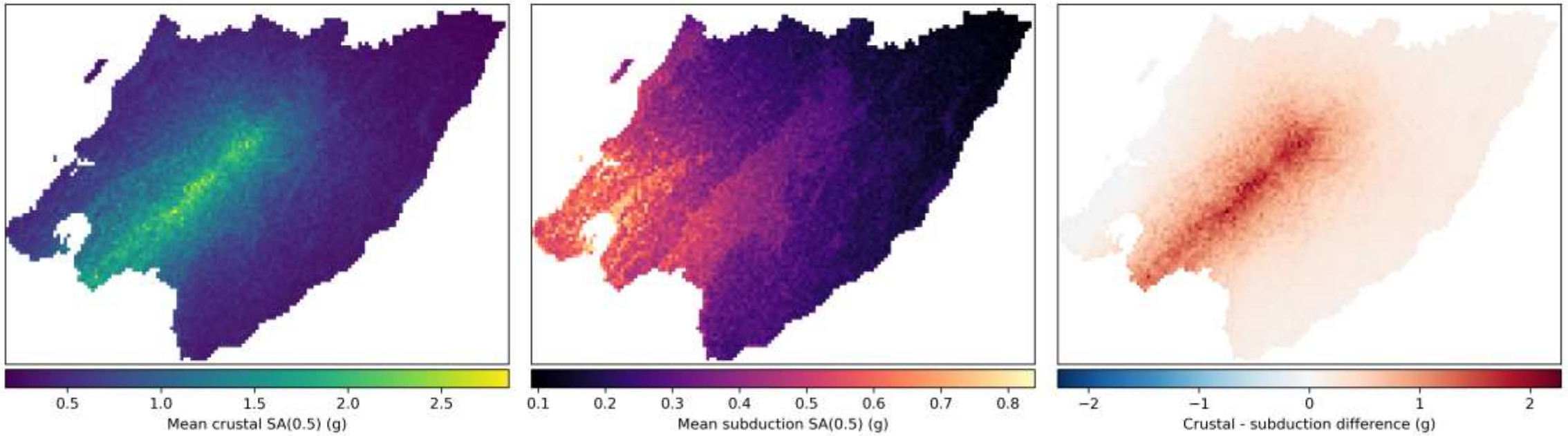
Combined subduction-crustal ruptures in physics-based models



Example: Mw 7.9 rupture of the subduction interface and Wairarapa Fault



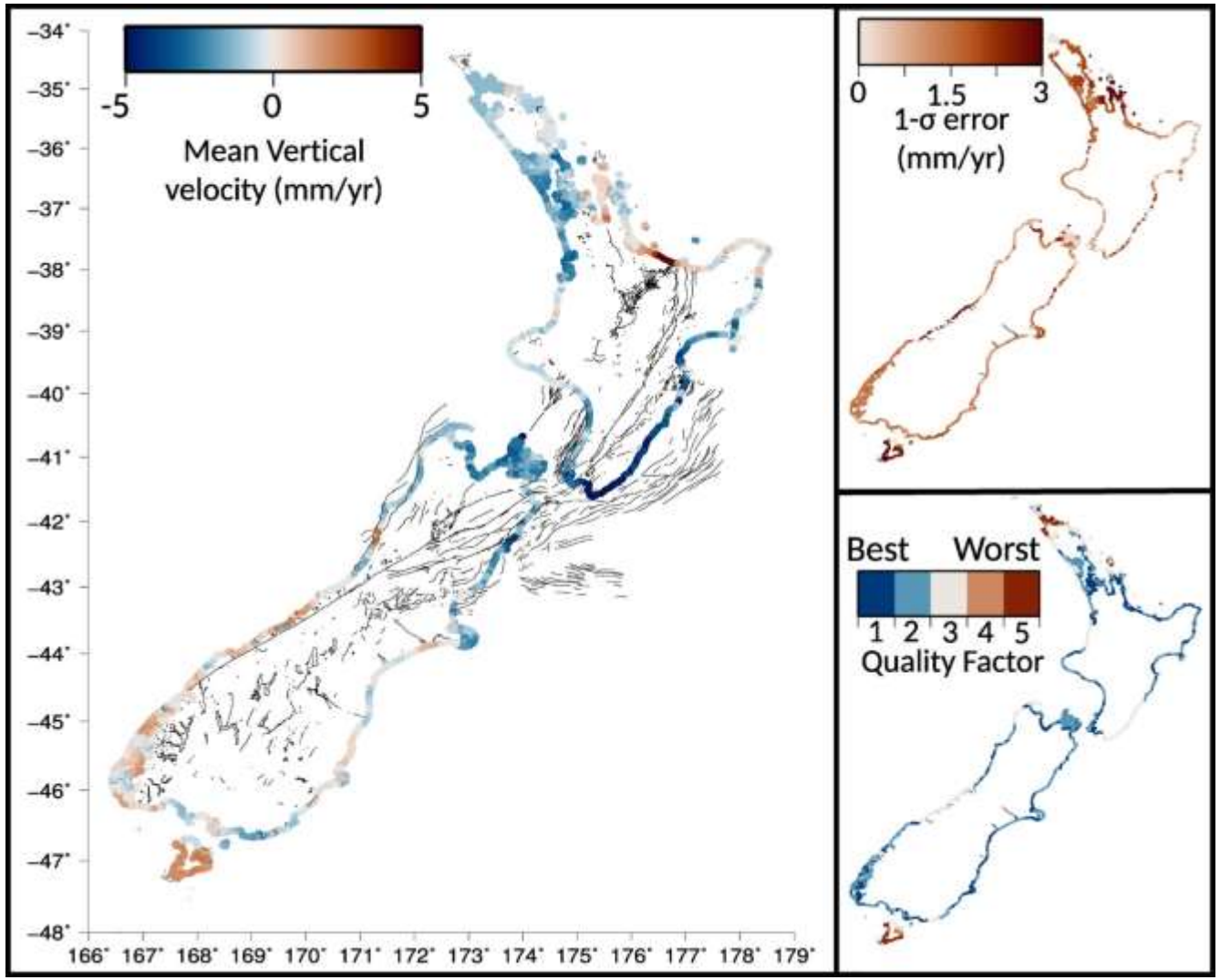
Modelled ground motions



Preliminary results and future work

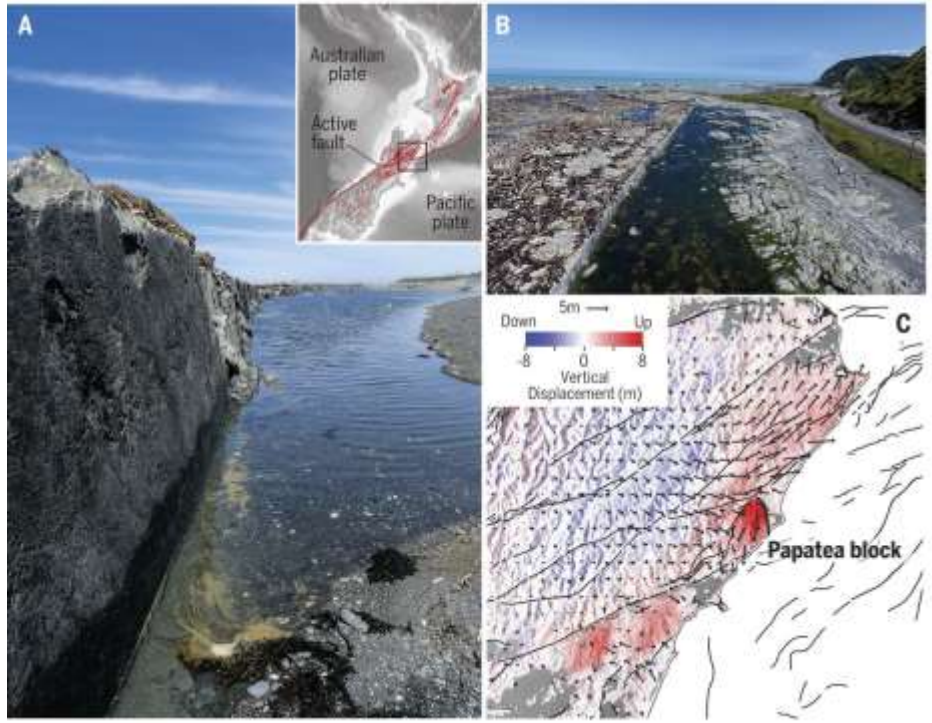
- Physics-based multi-cycle earthquake simulators offer a way to understand possible future combined subduction-crustal ruptures.
- Ground motions modelled using Ground Motion Prediction Equations (GMPEs) suggest that the crustal component of combined ruptures may dominate shaking.
- Plans to test GMPE approach through comparison with more realistic physics-based ground motion simulations.

Probabilistic coseismic coastal deformation model



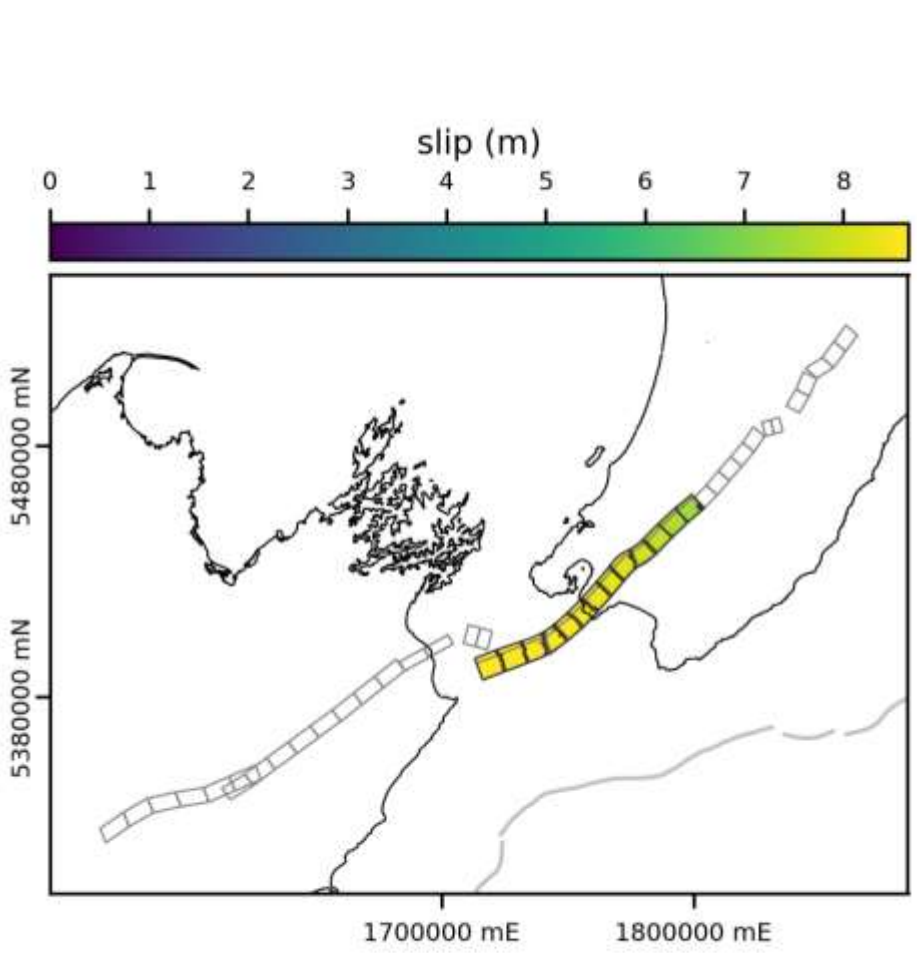
Hamling et al., 2022

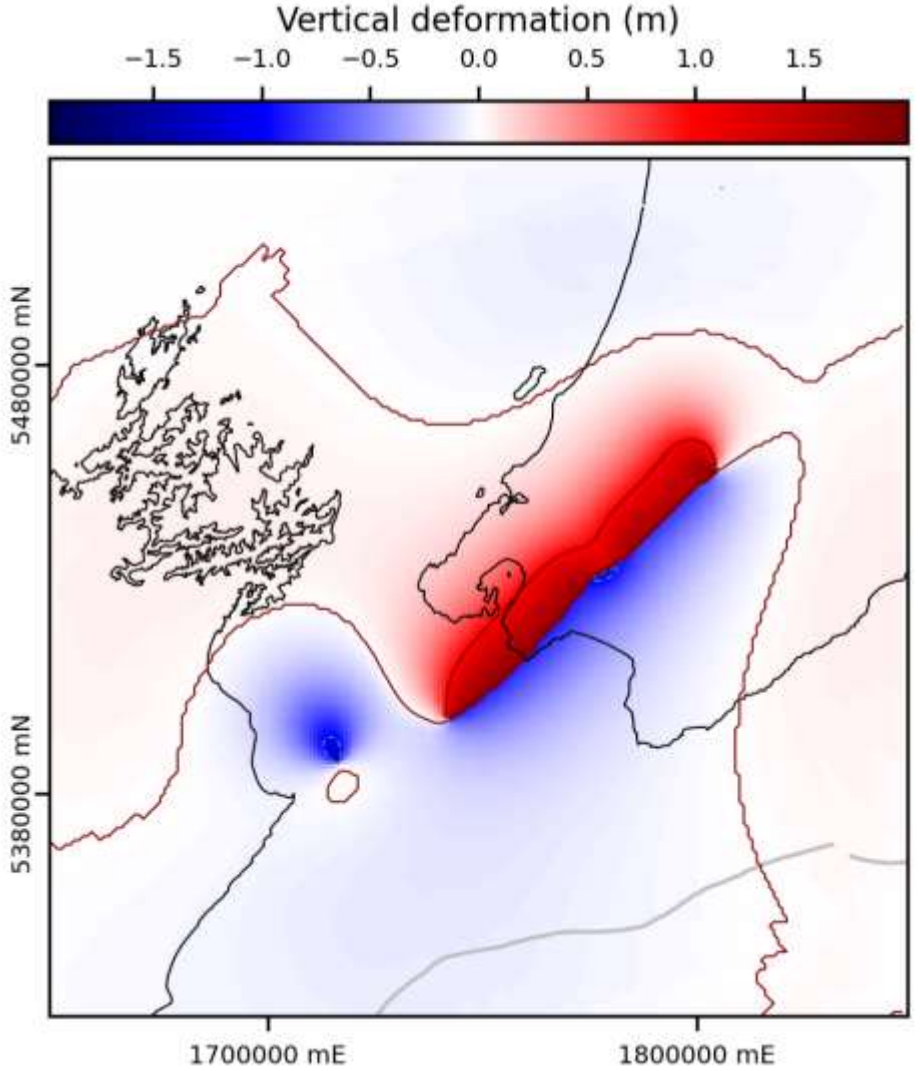
What if an earthquake moves the coast up or down?



Hamling et al., 2017

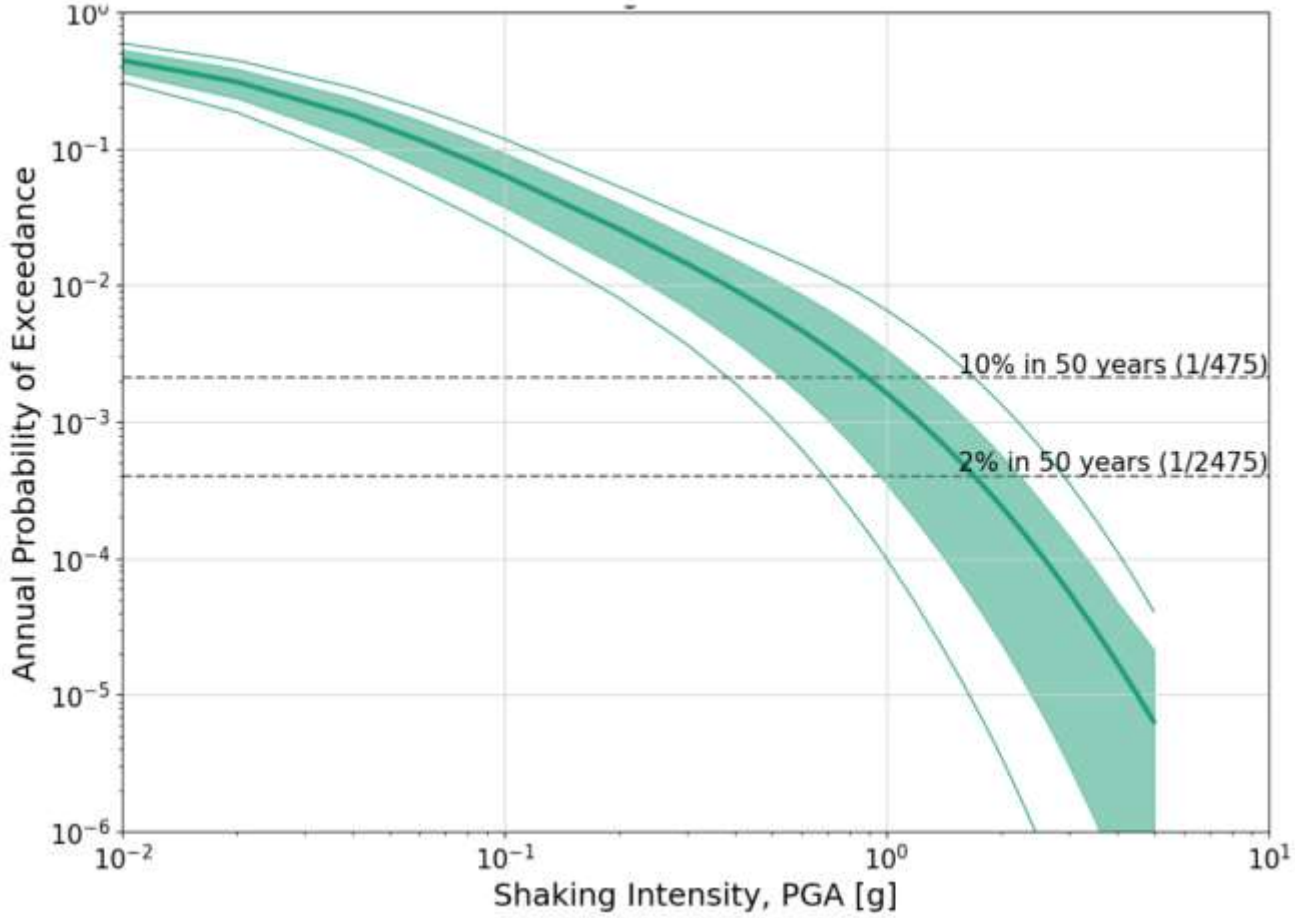
Rupture scenarios from the NSHM





Jaime Delano, UC PhD

How to communicate results?



Gerstenberger et al., 2022

Pātai?

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