Plans and progress for “Validation of Ground Motion Simulations using Fragile Geologic Features”

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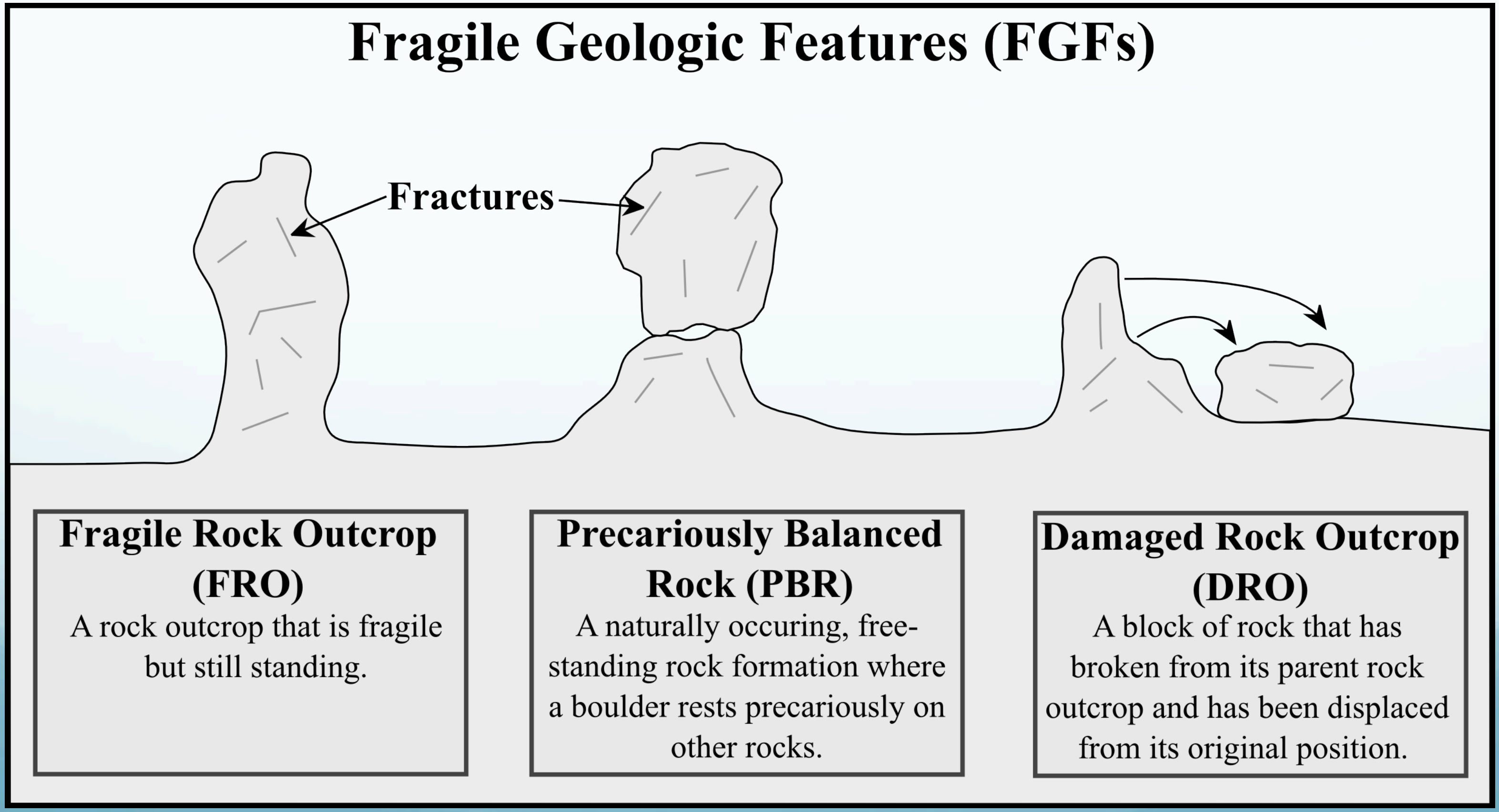
26 May monthly web conference – Ground Motion Simulation and Validation (GMSV)

To refresh your minds…

- Goal: Develop ground-motion simulations for the Dunstan Fault in central Otago.
- Validate simulations with Fragile Geologic Features (FGFs)
- Today's talk will provide an update on the whereabouts of the QuakeCoRE & University of Otago GMSV project.



Agenda

1. SCECs ground-motion simulation platform is up and running on Otago University's network.
2. Trip to Wellington to visit Chris Van Houtte (GNS)
3. Current complication impeding research
4. Research plan

SCECs Broadband Platform (BBP)

- The BBP is a software than runs ground-motion simulations for user-defined and scenario EQs.
- Issues around the installation of SCECs BBP have been eradicated.
- Many thanks to Fabio Silva (SCEC) for helping to get the BBP up and running at Otago.
- This is great news at Mark Stirling hopes to get more students familiar with the BBP in the future.
- A new version of the SCEC BBP is due for release soon, it is unsure what/if new features are included.
    - Depending on the update, this may be installed at Otago

Wellington trip

- Visited Chris Van Houtte at GNS Science for a few days
- With Mark Stirling, we discussed a game plan for my one-year Masters.
- The problem we discovered was the stochastic generation of slip distribution during simulations.
- The slip needs to approximate average conditions, which has been estimated by analysing the Dunstan Mountain Range elevations and distribution of PBRs.
- Elevations are higher to the N, lower to the S, and more PBRs are present in the S, indicating slip is concentrated to the north.

Dunstan Fault Slip Distribution?

Map displays elevations for a 2x2 km grid across the Range

- Elevations across the Mountain Range can be a proxy for slip distribution.
- Circled areas indicate high elevations = **large slip.**
- PBRs abundant = **little slip.**

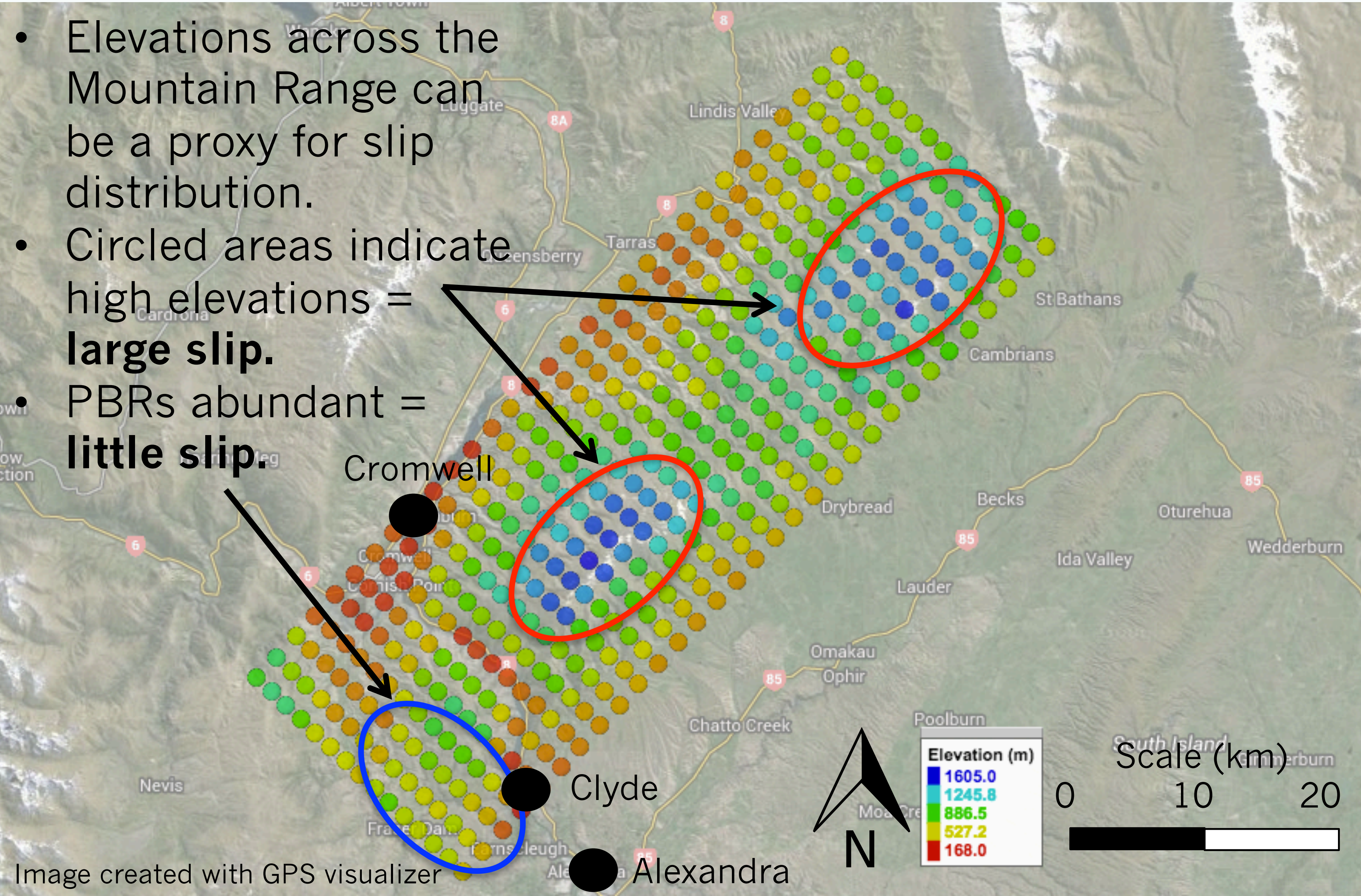
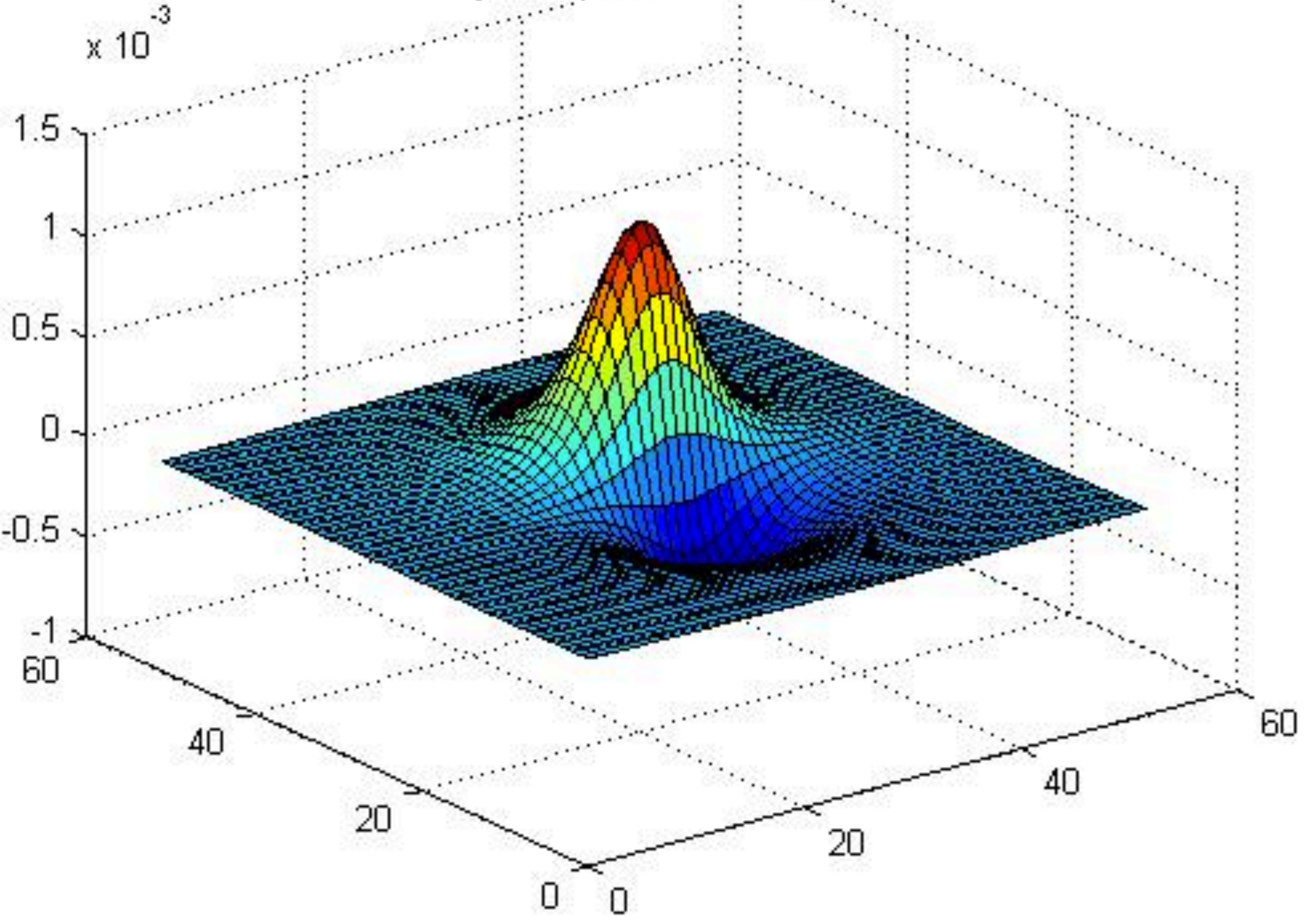


Image created with GPS visualizer

Okada solution

- In 1985, Yoshimitsu Okada developed theoretical formulations to describe the surface deformation of a shear fault in a half-space restricted to the near-ground surface.
- In 2009 François Beauducel published a script on mathworks file exchange incorporating Okada's work.
- Using data from the BBP, the Okada code allows for slection of 'average' slip distributions from a set of 1000.
- However, modification to the code is required so that it will run correctly.

Output from Okada code

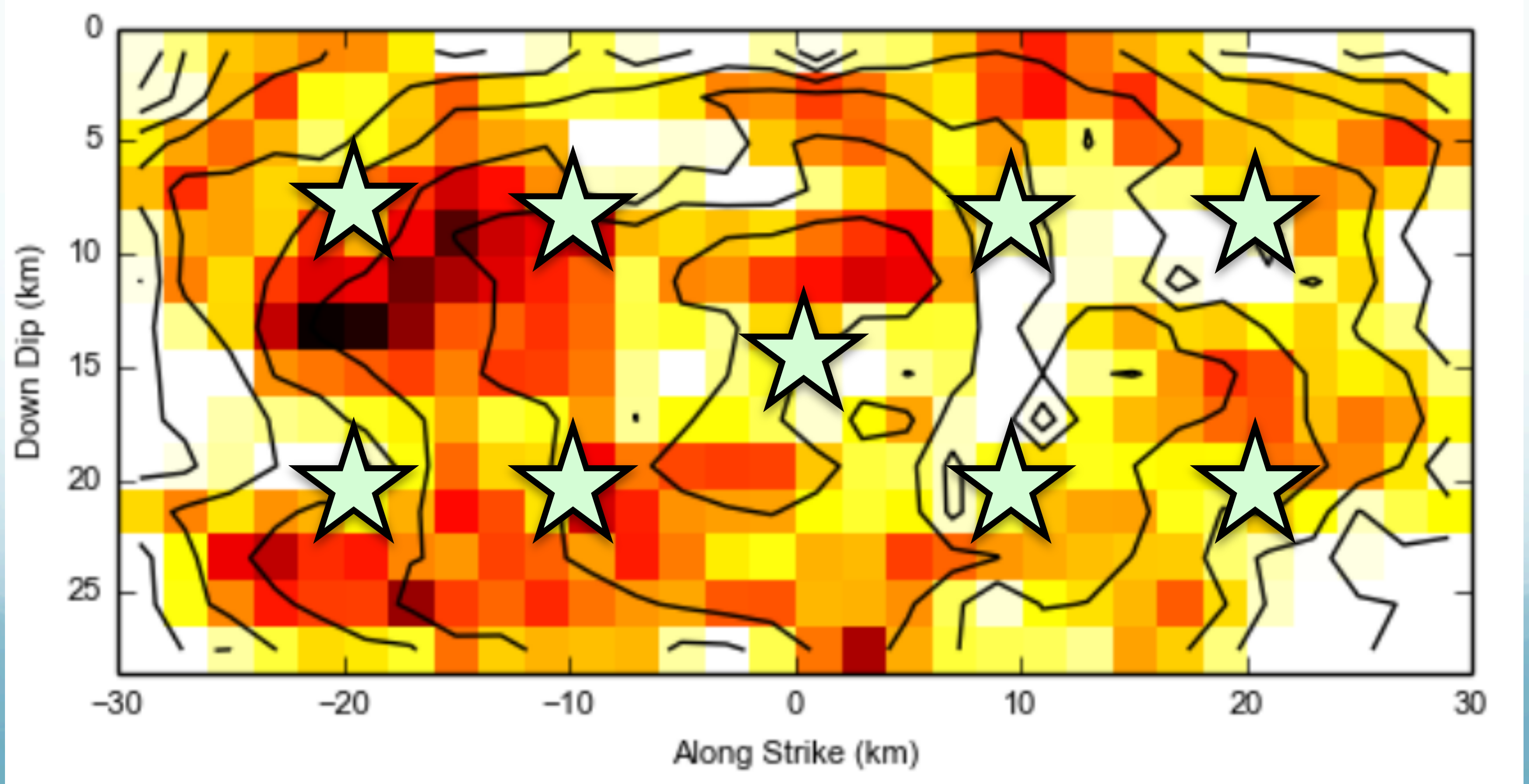


Research Plan

1. Get Okada code working to select slip distribution.
    - Almost there
    - Once completed, I will have a subset of slip distributions that could be considered ‘appropriate’ for a real Dunstan Fault rupture
2. Generate hypocenter locations from subset of slip distributions.
3. Combine data to gather average ground-motions.
4. Compare data to PBR fragilities.

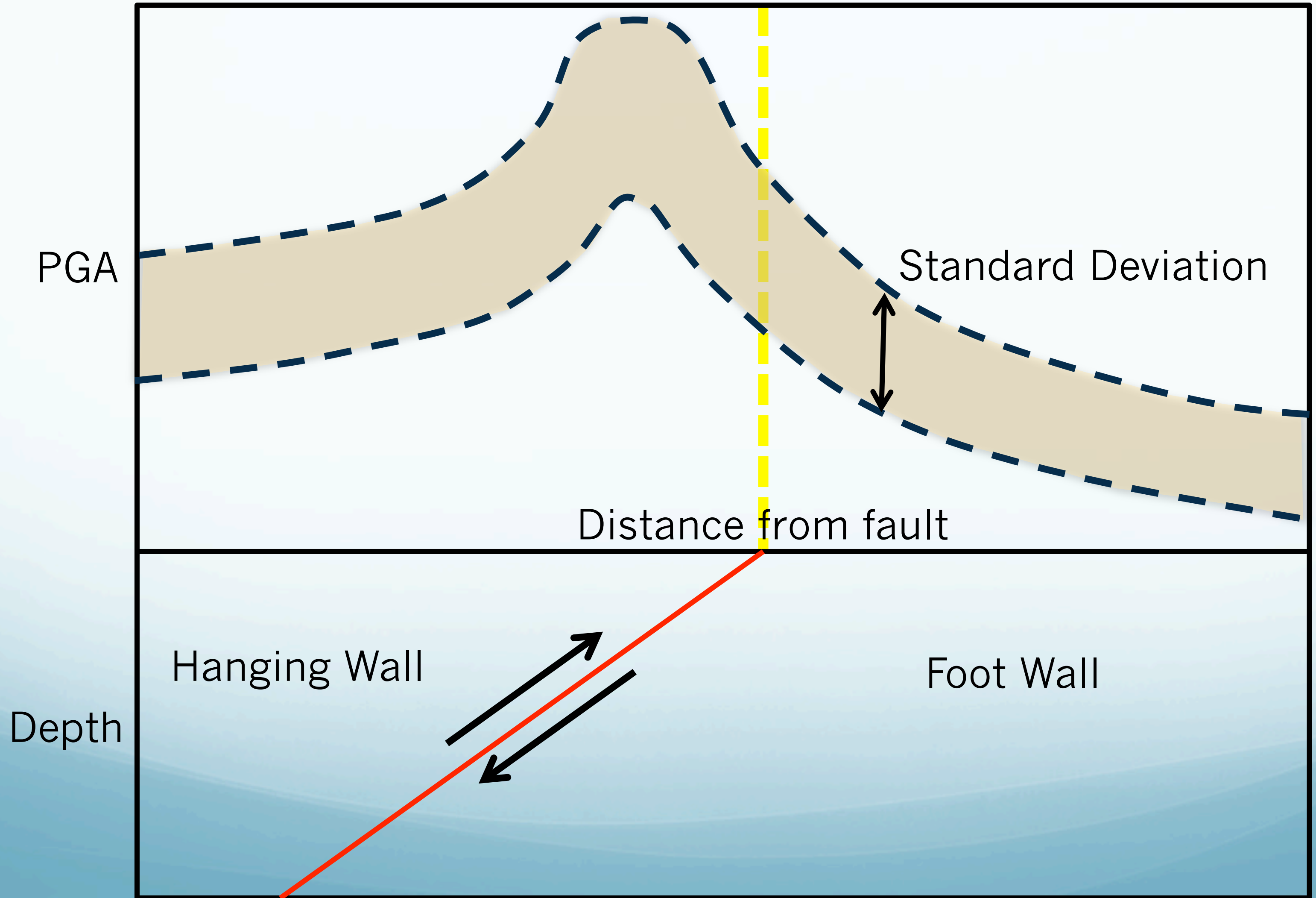
Hypocenter Location

- The hypocenter location will generate a wide spectrum of ground motions at a specific site dependent on where nucleation begins.
- No constraints are provided for hypocenter location, therefore nine locations will be generated across the fault plane.



Combine Data

- Combining the data will allow for average ground-motions to be calculated (e.g. Hanging Wall effects - Below).



Comparison with PBR data

- Gather the appropriate subset of slip distributions and run the nine hypocenters through each distribution.
- Run a synthetic station at the average location of the PBRs (they are all located within 1000 m of each other).
- Combine ground-motions from each simulation to gather a spectrum of PGAs.
- Compare the spectrum of PGAs to the fragilities of the PBRs.
- In theory, PGAs should be lower than the fragilities of the PBRs – otherwise they wouldn't be present.
- The majority of PBRs have experienced four to six, near-field EQs (Van Dissen et al., 2007), indicating PBRs will validate ground-motions for these EQs, and to some point, EQs post dating them.

Questions?