



Urban Earthquake Early Warning

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RESILIENCE
TO NATURE'S
CHALLENGES

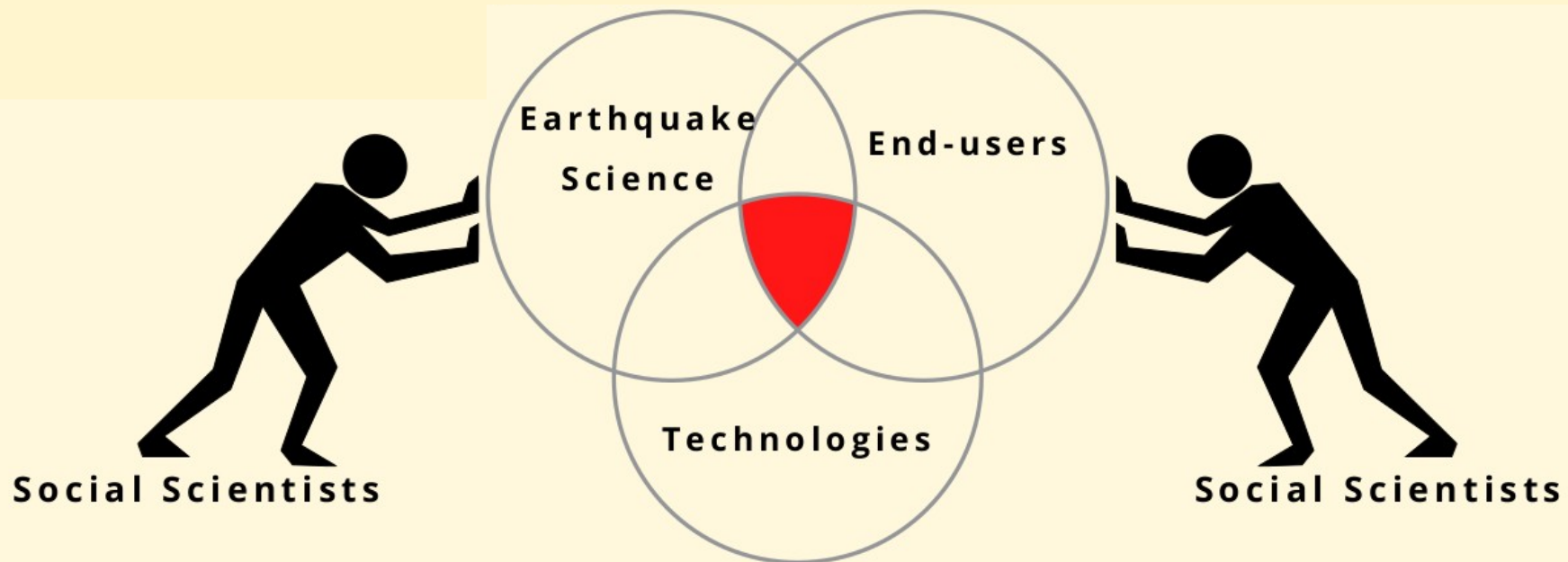
Kia manawaroa
– Ngā Ākina o
Te Ao Tūroa

National
Science
Challenges

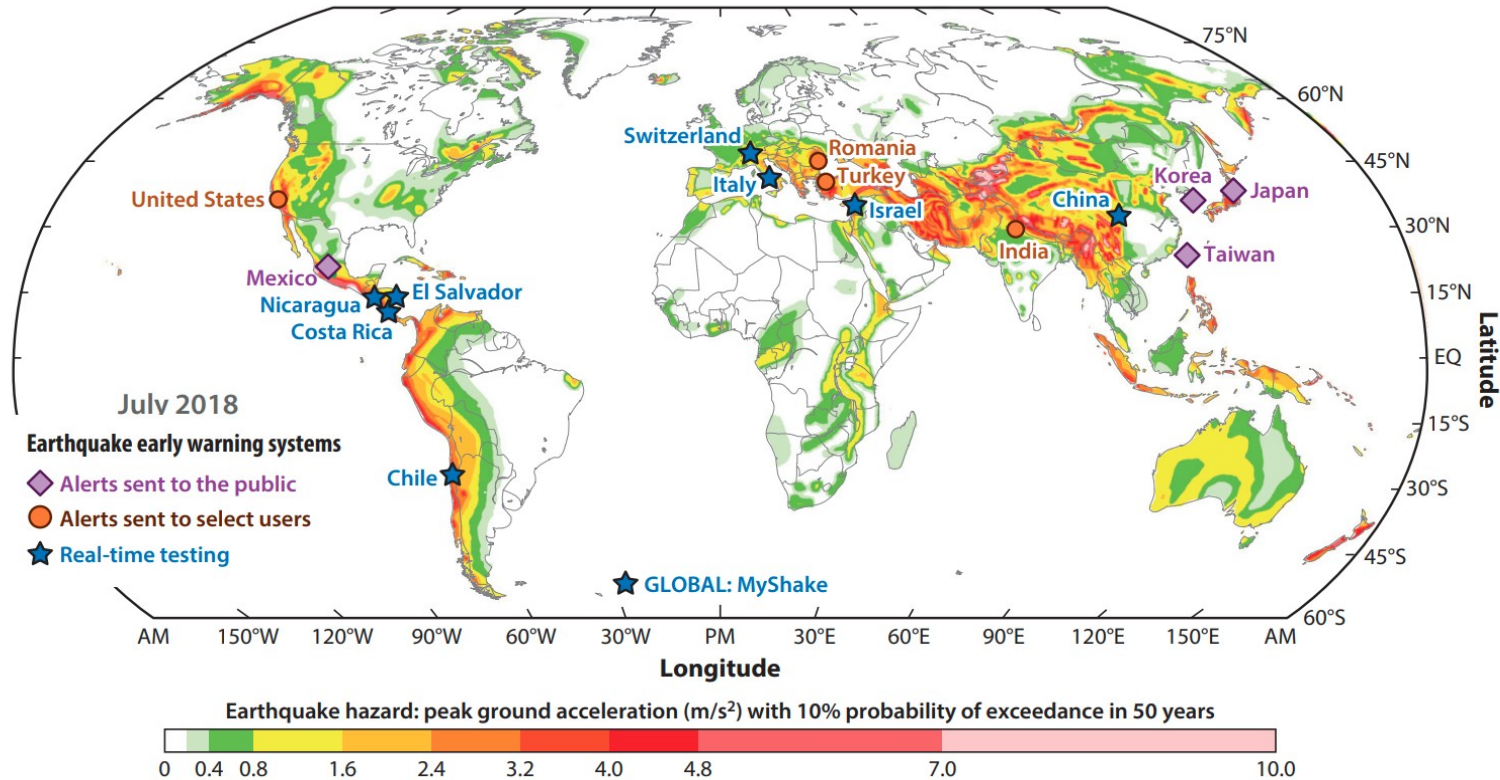
No EEW for NZ

What's an Earthquake Early Warning (EEW) System?

After an earthquake,
EEW provides **seconds of warning before incoming ground shaking**
to reduce damage, injuries and deaths



No EEW for NZ



(Allen & Melgar., 2019)

No EEW for NZ

However appetite and expectation from the New Zealand public (Becker et al., 2020)

RESILIENCE
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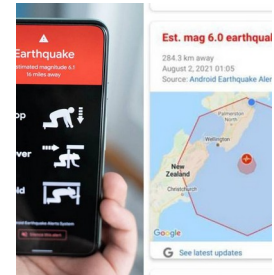
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National
SCIENCE
Challenges



QuakeCoRE
NZ Centre for Earthquake Resilience
Te Hiranga Rū

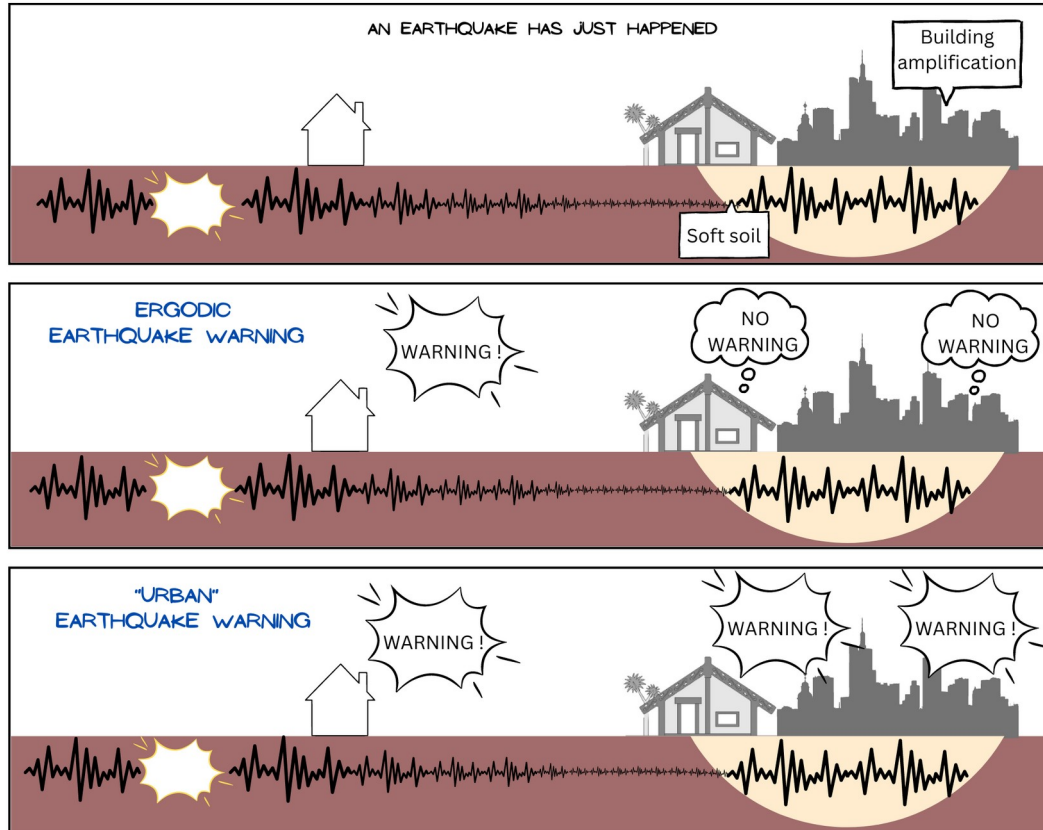
Google earthquake Alert



JENLOGIX
INDUSTRIAL TECHNOLOGY PARTNER

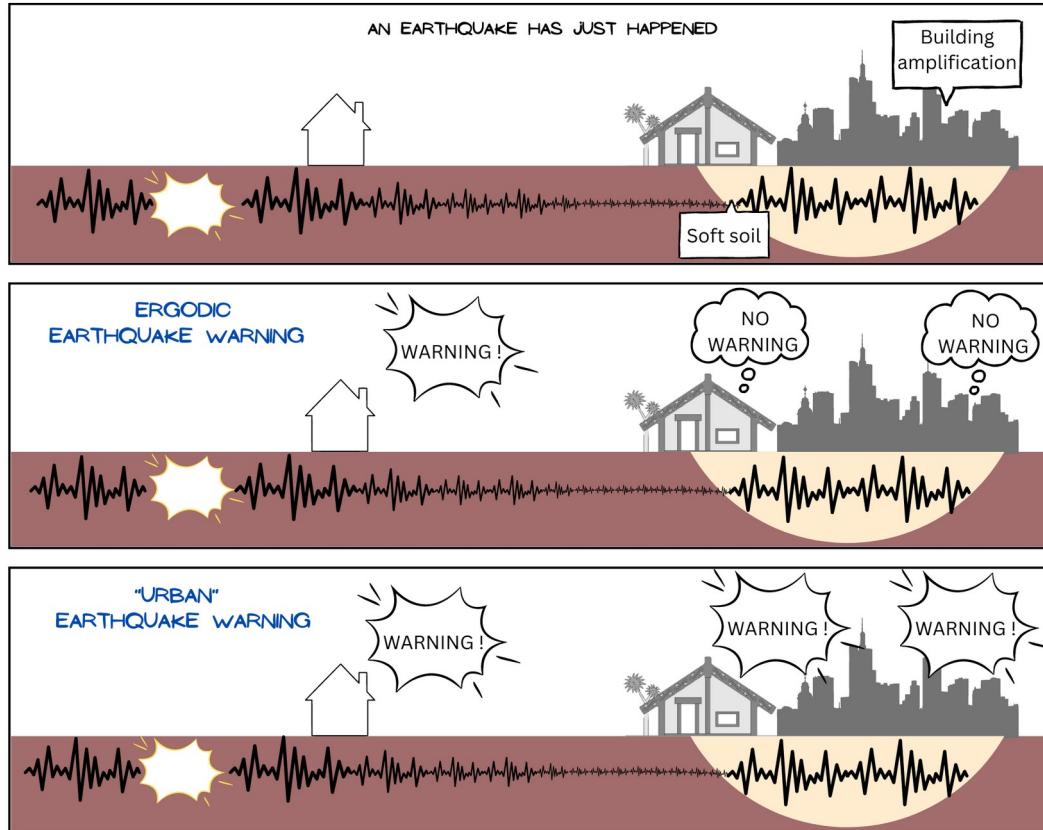
No EEW for NZ

Current ergodic EEWs fail to consider complexities generated by the urban environment



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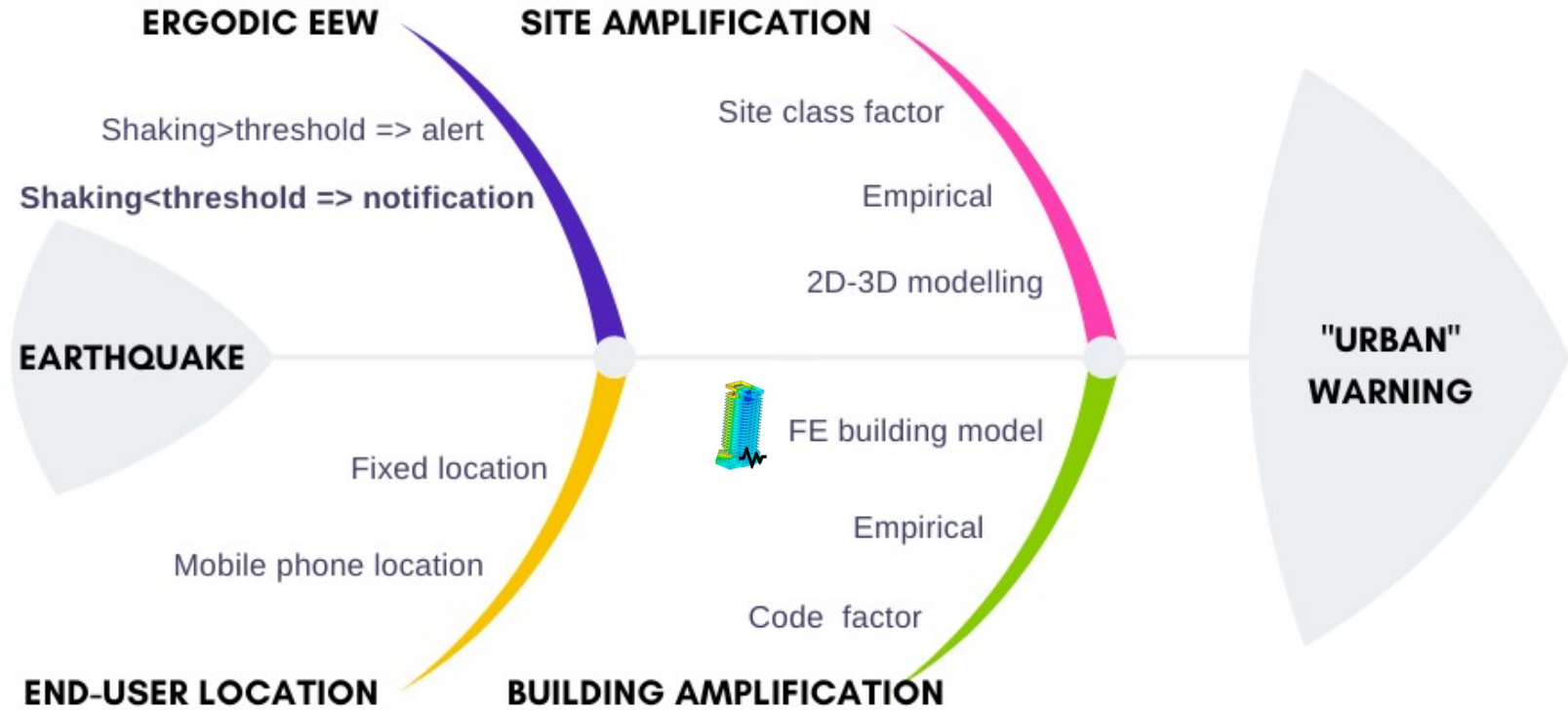
Current ergodic EEWS fail to consider complexities generated by the urban environment



- In New Zealand (NZ), over 85% of people live in urban areas
- Shaking intensity at the top of a multi-storey building can be 5+ times stronger than at ground level

A future NZ EEWS will consider the needs of a modern, socio-economic diverse population residing in different dwelling types in urban and rural area.

Urban EEWS for NZ

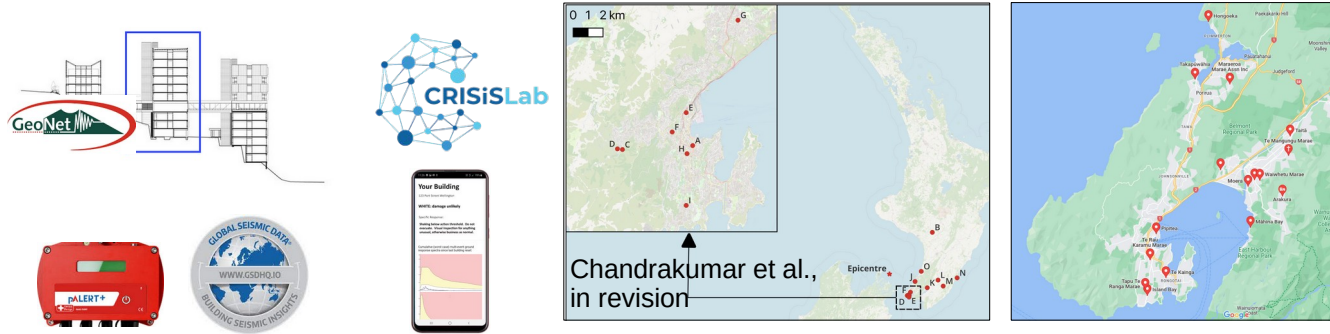


*Code factor (Haymes, Sullivan, & Chandramohan, 2023)

Urban EEWS for Wellington

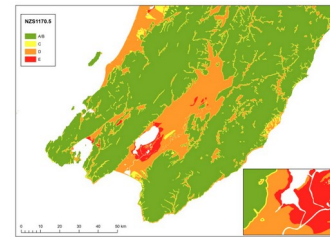
Existing infrastructures

- GeoNet building array
- Commercial building arrays
- WCC seismic network
- CrisisLab network
- Potential “marae network”

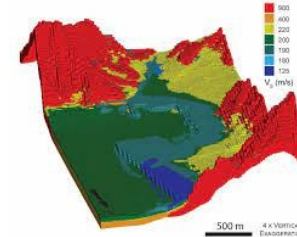


Existing databases

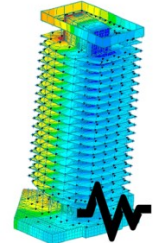
- Earthquakes!
- Site class map & 3D geological map
- Building amplification functions (14+y of eq data!)



Perrin et al., 2015



Hill et al. 2022



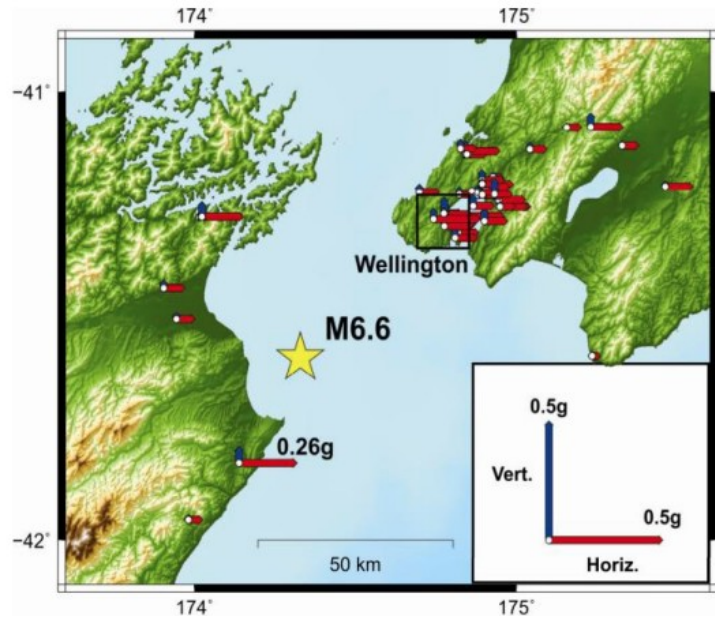
Ghahari et al., 2022

End-users

- Dense urban population
- Key organisations: central and local governments, EQC, universities, “Science Hub”
- Advanced social science studies of wlg population (Vinnell et al., 2022; Becker et al., 2022)

Urban EEWS for Wellington

2013 M6.5 Cook Strait earthquake



Holden et al., 2013

Earthquake characteristics

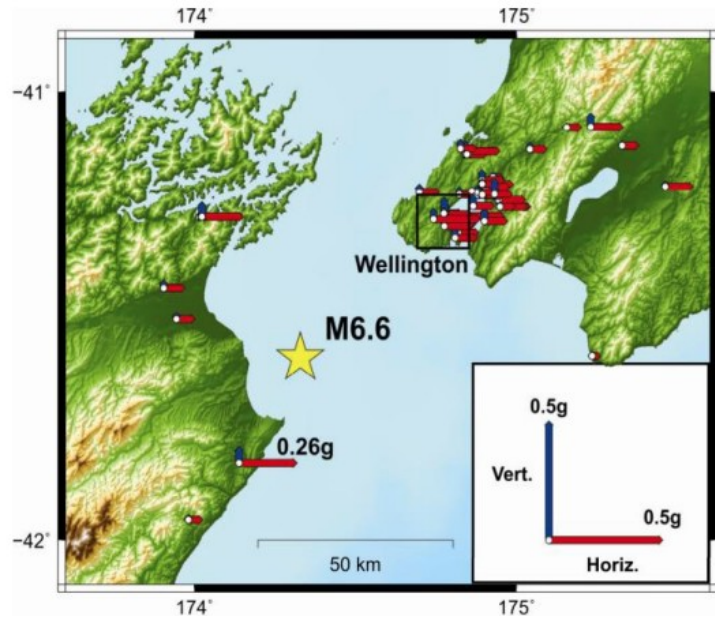
- M6.6
- 16 km depth
- 50 km away from Wellington

Shaking characteristics in Wellington

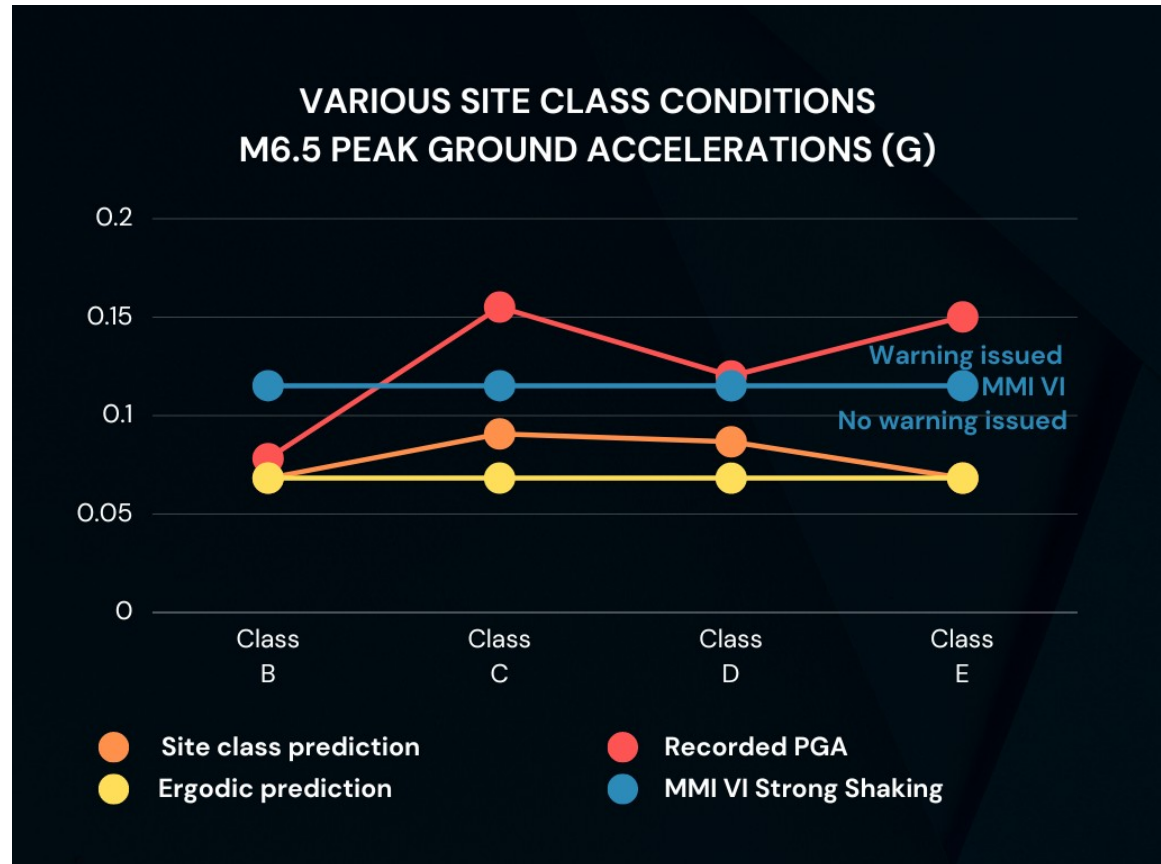
- Recorded at many GeoNet \neq site class sites
- Recorded at many GeoNet instrumented buildings
- PGA ranging 0.05-0.2g (light to very strong intensities)

Urban EEWS for Wellington

2013 M6.5 Cook Strait earthquake

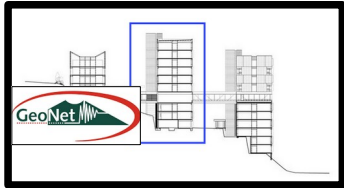
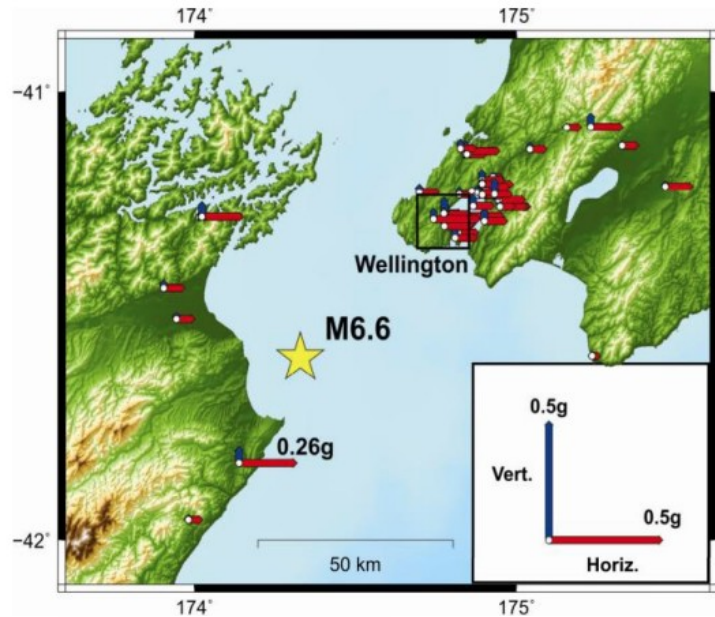


Holden et al., 2013

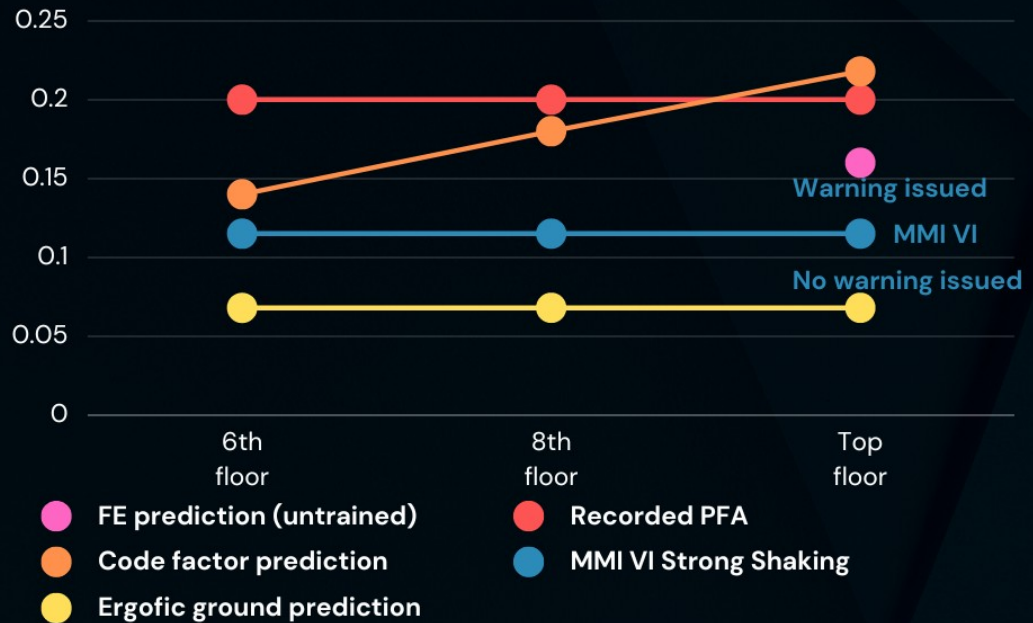


Urban EEWS for Wellington

2013 M6.5 Cook Strait earthquake



TE PUNI BUILDING M6.5 PEAK FLOOR ACCELERATIONS (G)

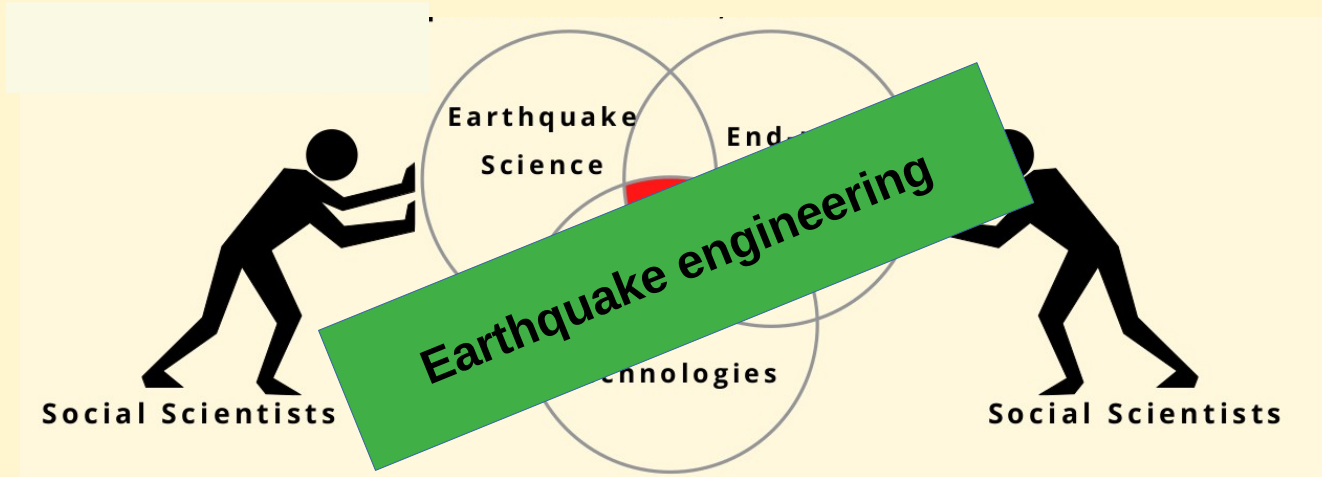


Urban EEWS for NZ

No official NZ national EEWS

- Hurting NZ's international reputation
- Missed opportunity of \$\$ saving via reduced injuries and damage
- Missed resilience opportunity (education, preparedness etc)

NZ has a world-class “in-house” team: social scientists, eq engineers, seismologists, comms engineers, industry and public support



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NZ starts building an enhanced earthquake early warning system (EEWS) suited to the rural AND urban set-ups of Aotearoa New Zealand.

Thank you

