

New Zealand: potential for collaboration and existing infrastructure related to subduction margin research

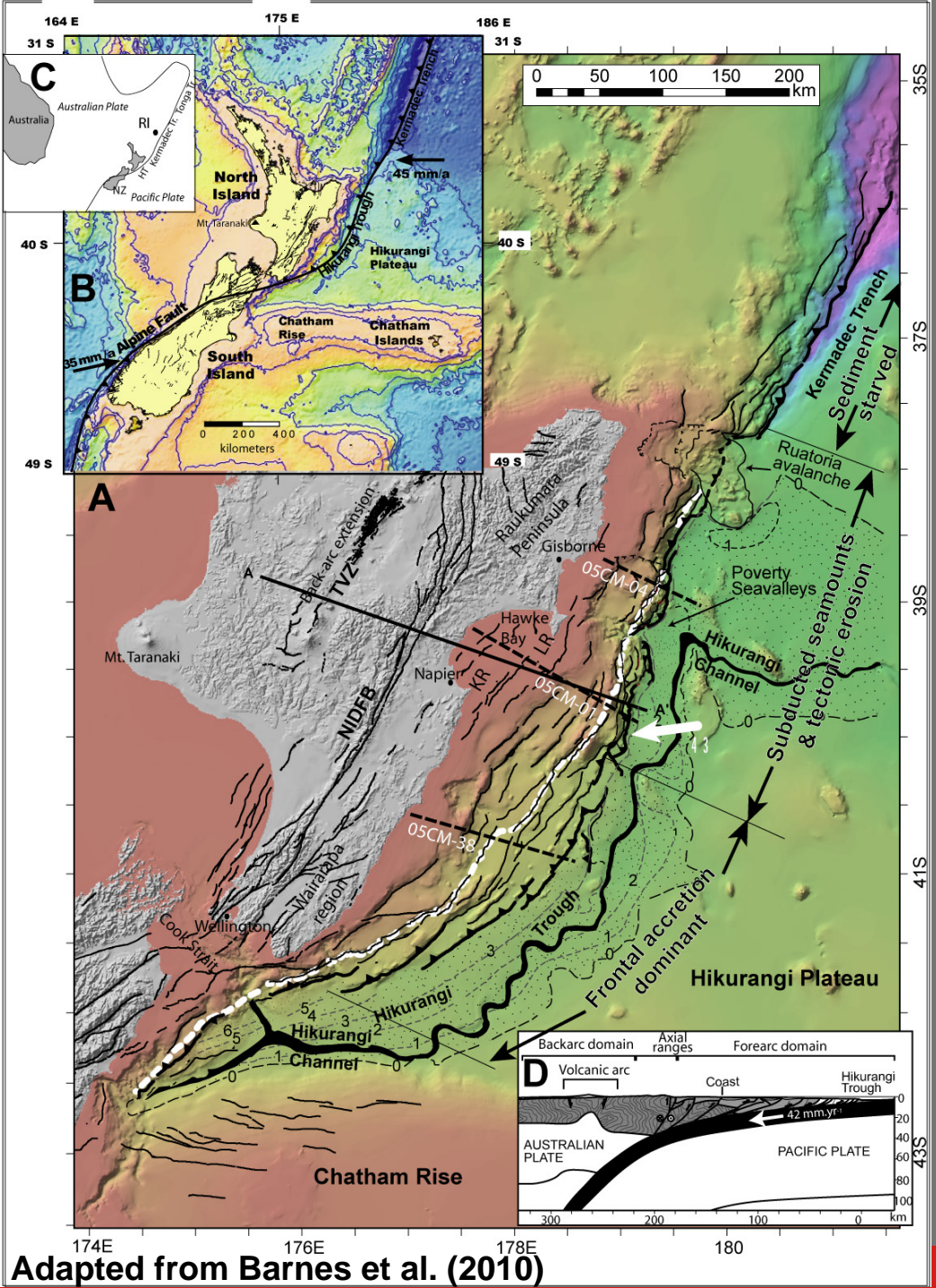


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NZ overlies two subduction zones, and there is currently a major effort underway to better understand these systems

- NZ groups with ongoing subduction related research programs include GNS Science, NIWA, and several of the Universities
- In the last 10 years, the NZ government has invested ~60 Million NZD in research and infrastructure directed at gaining a better understanding of the Hikurangi subduction margin, particularly in terms of the behavior of the subduction megathrust
- Primary funders of this work include NZ Foundation for Research, Science and Technology (FRST), Marsden Fund, NZ Earthquake Commission, and the Ministry for Economic Development (MED)



Adapted from Barnes et al. (2010)

There is excellent scope for collaboration between NZ researchers and those outside of NZ

- NZ researchers have a good track record of participating in and contributing to international research projects being conducted within NZ (SIGHT, NIGHT, SAHKE, gas hydrates project with Germany, Alpine fault deep drilling project, etc.)
- Northern Hikurangi was a focus area for the Margins Source to Sink (Waipaoa catchment). NZ-based collaborators on this were able to leverage several million NZD from NZ government sources to contribute to this effort. Some marine geophysical work was also undertaken with NZ research vessels as part of this
- GNS and NIWA have ~2.5 million NZD per year of stable funding related to subduction margin research—we are somewhat flexible as to how this is allocated
- Currently, ~1 million NZD per year is being spent by the Marsden fund on Hikurangi subduction-related projects
- There is good potential for leveraging additional, new science funding from the NZ government if major international research programs are focused on NZ-based problems (e.g., Margins Source to Sink example)

RV Tangaroa

\$20M Refit completed in 2010

(70 metre – 2291 tonnes)



DP2 Dynamic Positioning
Ice strengthened
Moon Pool – A 500mm diameter

- **OPTIONAL EQUIPMENT**
- Echosounders : Kongsberg Simrad EM 3002D multi beam sounder, 300 kHz
- Reson SeaBat
- Positioning : Fugro SkyFix XP/ HP systems, C-NAV
- Side Scan Sonar : C-MAX CM2 side scan sonar
- Subbottom profiler systems : 3.5 kHz, Knudsen subbottom profiler
- Geo Acoustics profiler boomer
- Multi-channel Seismic System : Geometrics GeoEel
- 48 channel, active section length 600 metres
- Compressors : Containerised Price SA35-W, 185 cuft/ min, and containerised Reavell 5436 75.8 cuft/min @ 2,000 psi
- Airguns array : GI-guns: 210 to 710 cu inch
- Magnetometer : SeaSPY towed system
- Gravity Meter : LaCoste and Romberg
- CTD-systems : SeaBird911, 24 and 12 bottles, many sensors
- Seabed sampling : Rock dredges and bottom corers
- Sonobuoy System : Sparton AN/SSQ-53
- Sound velocity calibration : Expendable bathythermographs (XBTs) : Digibar DB-1100, AML SVPlus sound velocity profiler
- Tide measurements : Current, level, etc meters
- Survey Launch *Pelorus* : 10 metre survey launch

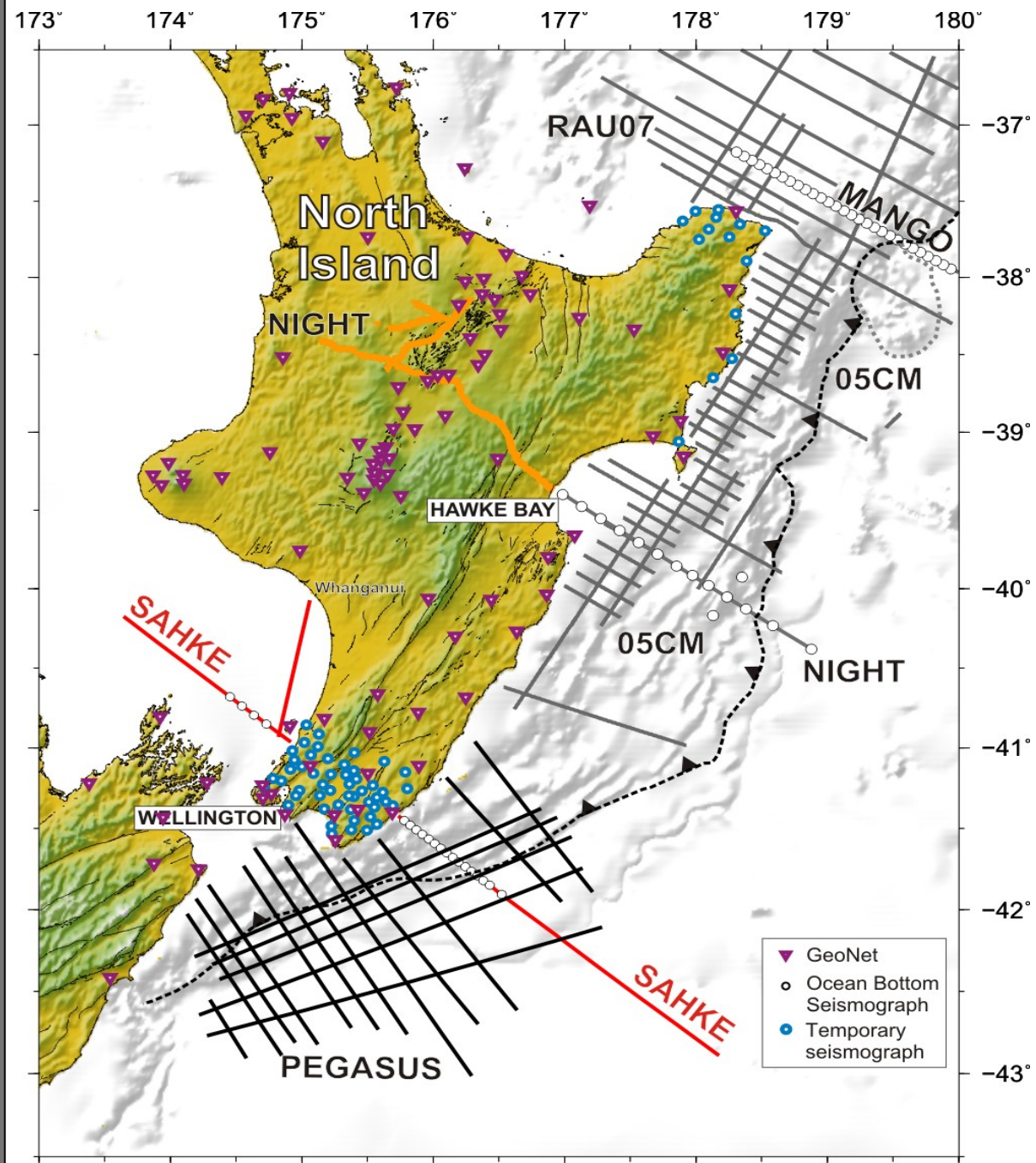


Major recent seismic acquisitions at Hikurangi

- NIGHT
- 05CM
- RAU07 / MANGO
- Pegasus/SAHKE

- 8,000 line km
- 200,000 shots
- 4140 cu inch, 2000 psi airgun source (05CM, etc)
- Marine streamer (mostly 8-12 km)
- Land
- OBS

SAHKE will be completed in May/June 2011 with the deployment of 900 Texans to record onshore shots (with ERI--Univ. Tokyo and U. So. Calif.)

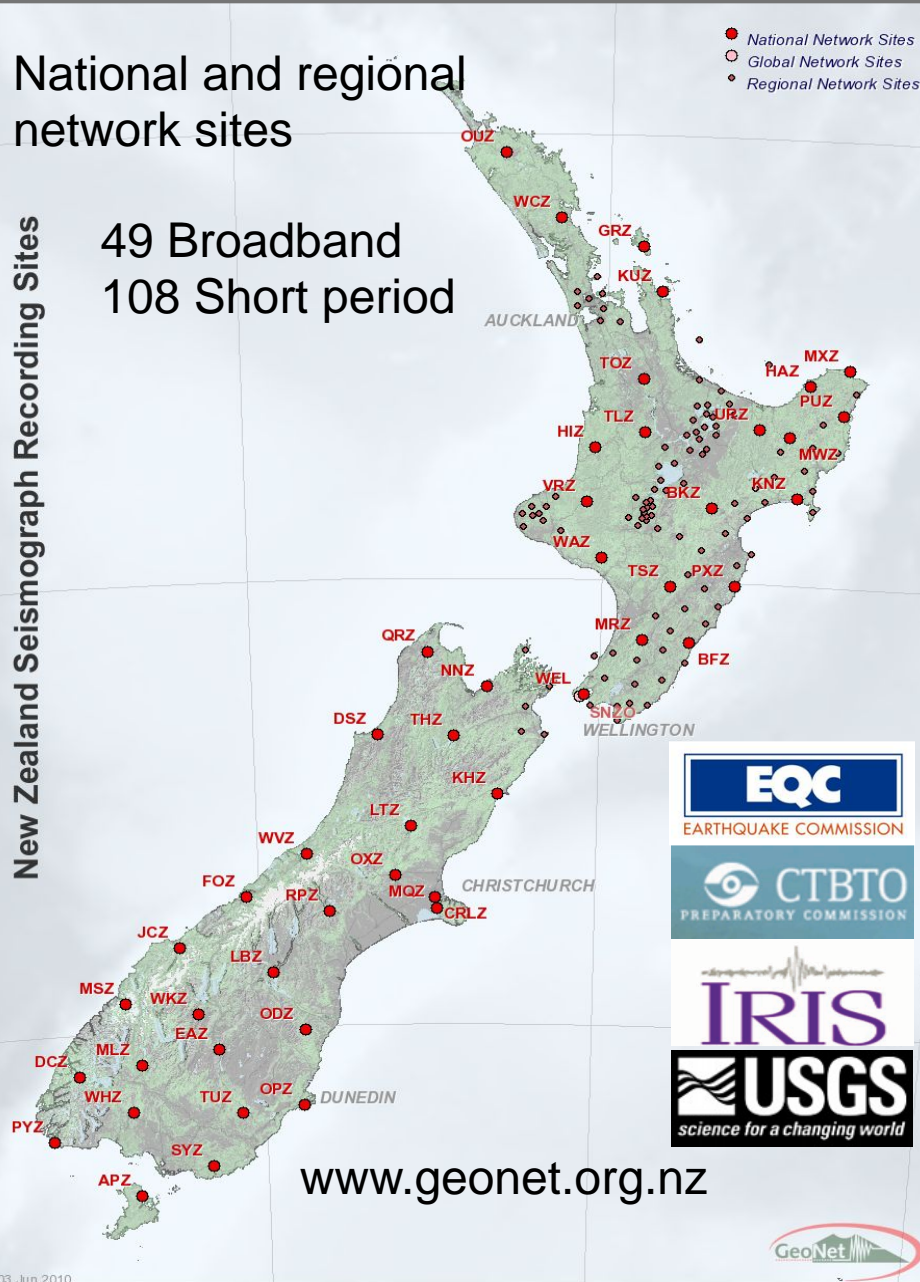


Seismic monitoring network in NZ—GeoNet project

National and regional network sites

49 Broadband
108 Short period

New Zealand Seismograph Recording Sites



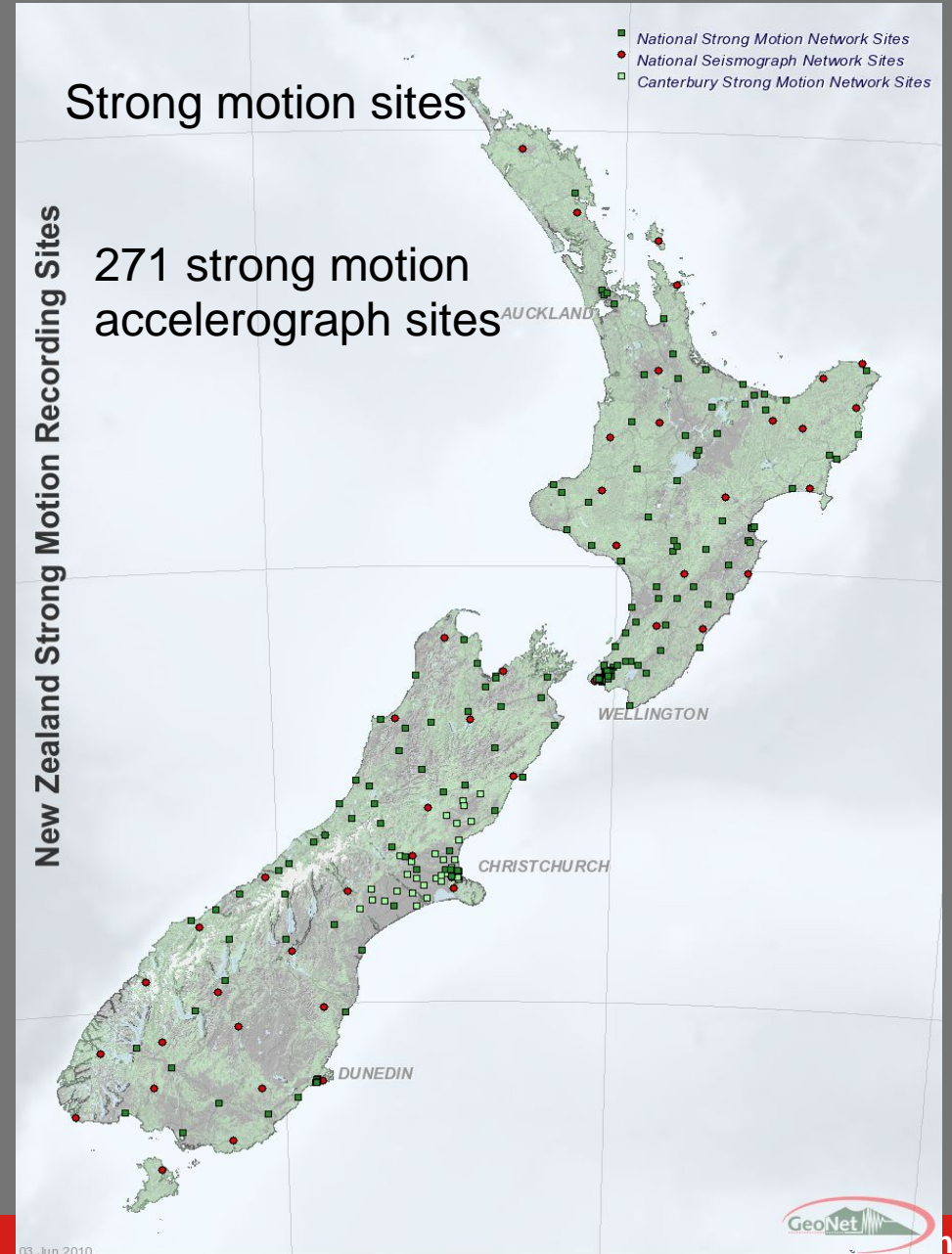
www.geonet.org.nz



Strong motion sites

271 strong motion
accelerograph sites

New Zealand Strong Motion Recording Sites



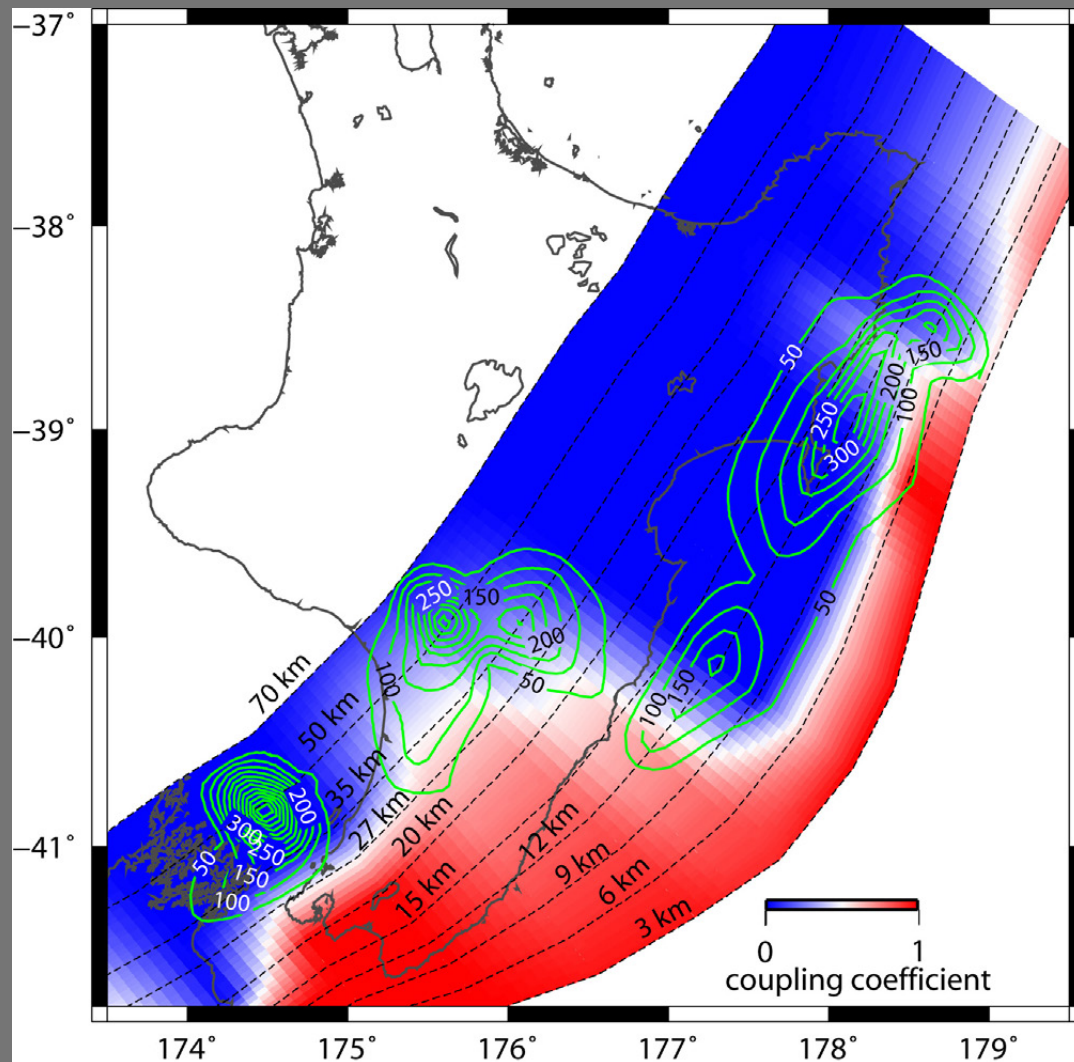
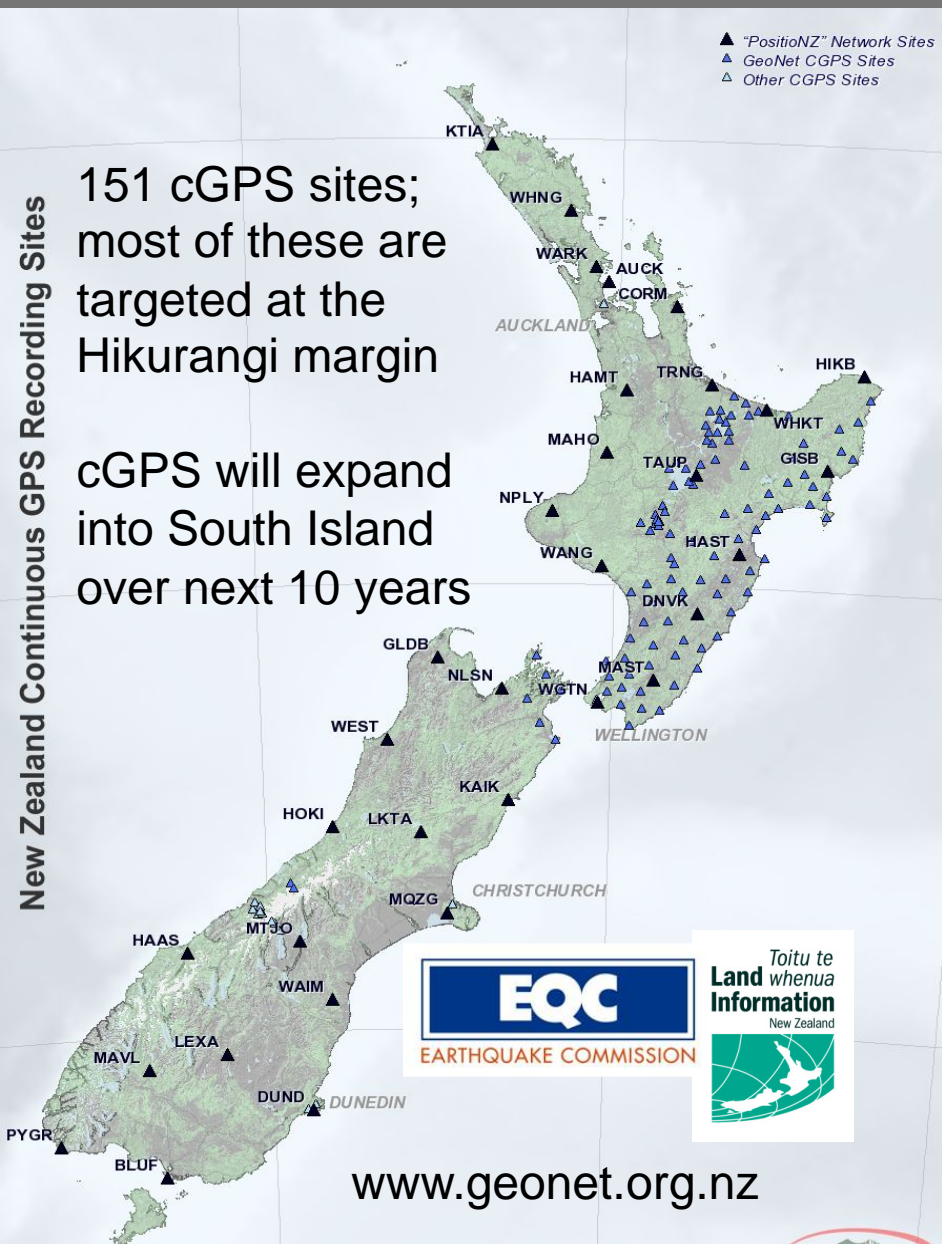
Deformation monitoring with continuous GPS--GeoNet

The cGPS network has enabled the detection of more than 15 slow slip events since 2002

New Zealand Continuous GPS Recording Sites

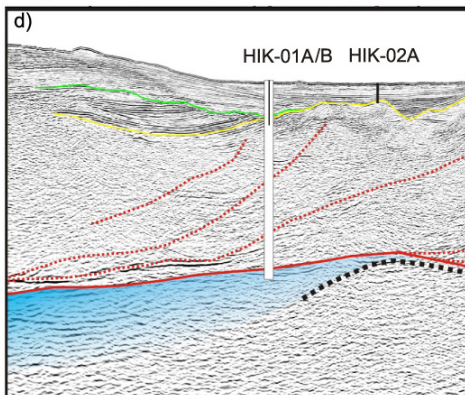
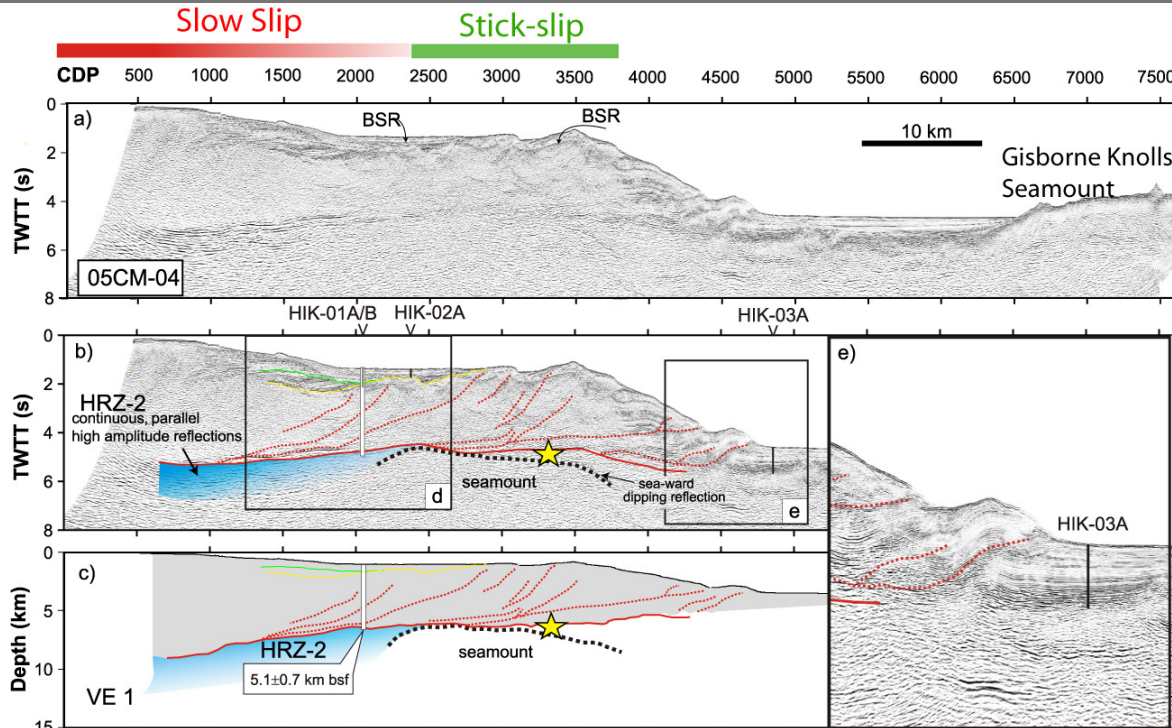
151 cGPS sites; most of these are targeted at the Hikurangi margin

cGPS will expand into South Island over next 10 years



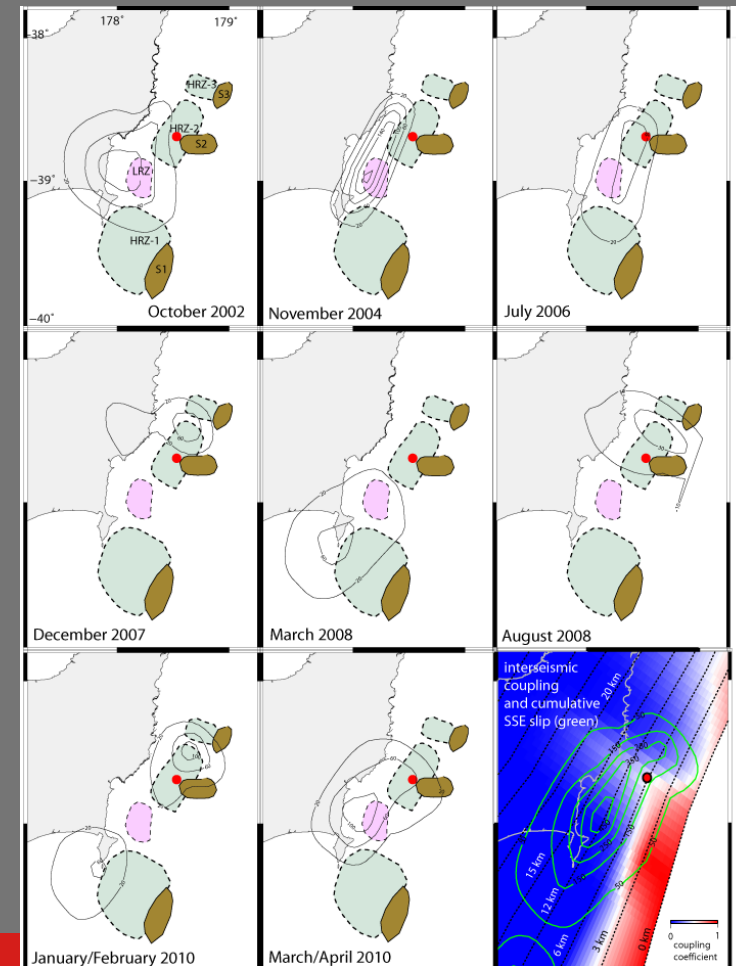
Wallace and Beavan, 2010, JGR

IODP proposal to sample and monitor source area of repeating shallow slow slip at northern Hikurangi



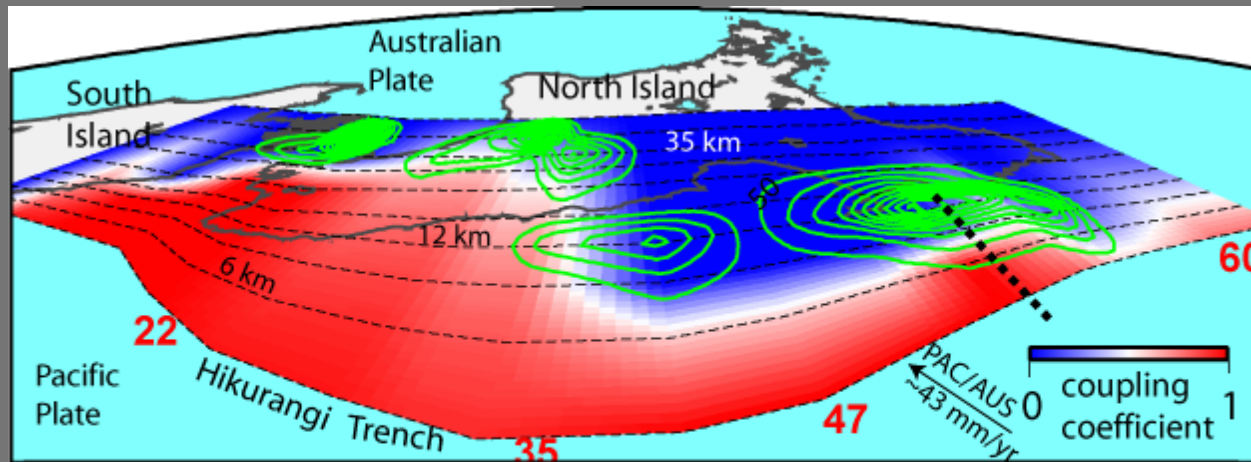
SSE source area coincides with high amplitude reflectivity (HRZ) on subduction interface imaged with MCS data.

Northern Hikurangi SSEs (black contours, below) occur at <5-15 km depth and recur every two years. Red dot indicates potential drilling target (at 5 km depth) to intersect the SSE source area



SSEP has requested a full Complex Drilling Proposal

Summary of along-strike changes in physical characteristics at the Hikurangi margin



Southern segment (Wairarapa)	Central segment (Hawke's Bay)	Northern segment (Raukumara)
<ul style="list-style-type: none"> ● deep slow slip events (SSEs) and strong interseismic coupling ● frontal accretion dominant ● few seamounts entering margin 	<ul style="list-style-type: none"> ● shallow SSEs and weak interseismic coupling ● tectonic erosion/moderate-low accretion ● numerous seamounts impacting margin 	<ul style="list-style-type: none"> ● tectonic erosion/negligible accretion
← increasing thickness of sediment on the incoming plate		
<ul style="list-style-type: none"> ● fluids emerging in forearc have no mantle component ● tectonic contraction and strike-slip in upper plate 	<ul style="list-style-type: none"> ● Seeps and springs in forearc have a strong mantle signature—from mantle of subducting plate? ● back-arc extension and strike-slip in upper plate 	
← increasing convergence rate at trench →		
<ul style="list-style-type: none"> ● wedge taper angle 4-6 degrees 	<ul style="list-style-type: none"> ● accretionary wedge taper angle 6-10 degrees 	