Hikurangi subduction as seen by ambient noise

Bill Fry
Ongoing work

• Tremor
• Anisotropy
• 3D Vs (slab and underlying LVZ)
• Onshore MT

• Traditional studies:
  – Mahia example
  – Gisborne example
Hikurangi tremor

SSE from L. Wallace, tremor from Fry et al., 2011, Kim et al., 2011, Ide, 2012, and Fry (unpublished)
Animation
Passive imaging

- Anisotropy
- 3D Vs (slab and underlying LVZ)
period: 010 s
number of paths: 221
knot spacing: 25 km

Norms: 0.16 0.16 0.20
Smoothenings: 0.10 2.20 2.90
Reference Velocity: 2.517426 km/s

Number of iterations, remaining variance: 8 0.751368
(saturated-scale limits are 1,0,1 of the max)
period: 0.18 s
number of paths: 213
knot spacing: 25 km

Norms: 0.16 0.16 0.32
Smoothenings: 0.80 2.10 2.80
Reference Velocity: 2.626620 km/s

Number of iterations, remaining variance: 8 0.860994
(saturated-scale limits are 1.01 of the max)
period: 044 s
number of paths: 85
knot spacing: 25 km

Norms: 0.16 0.16 0.30
Smoothings: 0.50 2.00 2.40
Reference Velocity: 3.357257 km/s

Number of iterations, remaining variance: 9 0.710493
(saturated scale limits are 1.02 of the max)
LVS under the HP
Important questions:

• What is the role of SSE in loading locked megathrust and upper plate faults?
• What is the stress state of the megathrust before, during, and after SSE?
• Can seismicity inform us about physical properties of the interface?
  • Heterogeneous attenuation?
  • Source parameters of interface events?
  • Frequency dependence of seismic observables (anisotropy, Q, Ta, etc)
• Time scales of triggering (or interaction between SSE, tremor, earthquakes, and potential great earthquakes.)
Mahia-Gisborne: seismic activity synchronous with 2010-Feb SSE

SSE inversion from L. Wallace and seismicity from S. Bannister
Swarms of larger events

Events > M4

Regional moment tensor solutions from J. Ristau
Thoughts:

• Seismic association with SSE includes tremor, micro-, and macro-seismicity

• Some SSE have no obvious associated seismicity, some do

• Shallow nature of plate interface offshore Gisborne yields increased sensitivity of monitoring equipment -> maybe we can “fill-in” the continuum of seismic and aseismic observations with OBS

• Time scales of triggering (or interaction between SSE, tremor, earthquakes, and potential great earthquakes.