

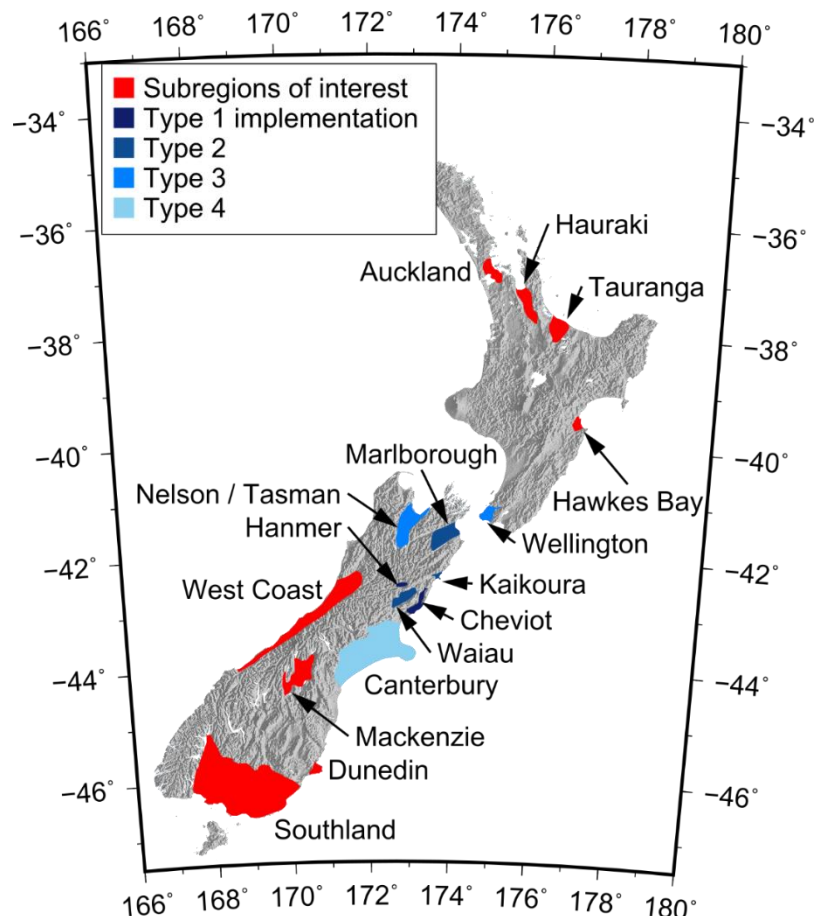
Field testing for the development of NZ basin models

Andrew Stolte and Seokho Jeong

FP1 GMSV Call

28 February 2019

NZ Basin Models



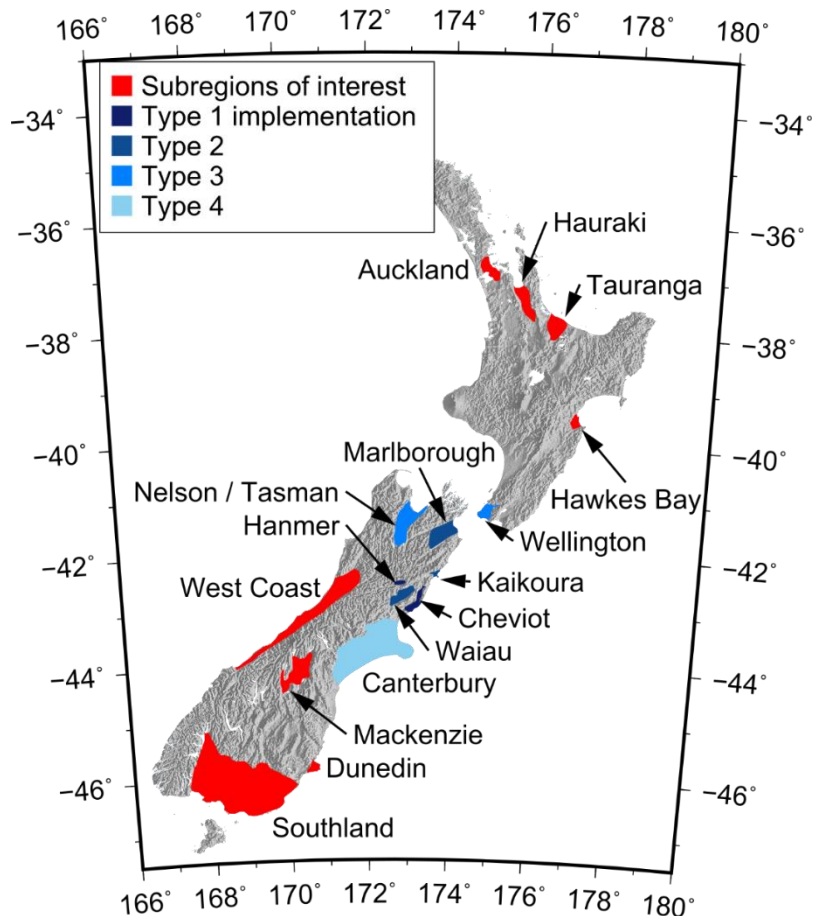
Initial basin models

- Topography
- Geologic maps

Refinement of models through field testing:

- $H/V \rightarrow$ Site Period
- Surface wave testing $\rightarrow V_S$

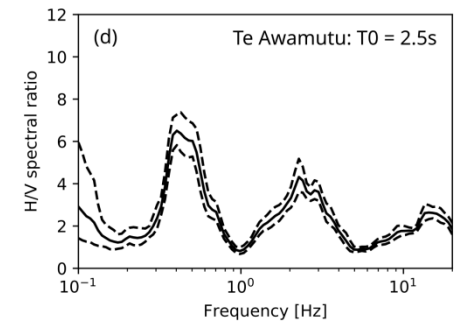
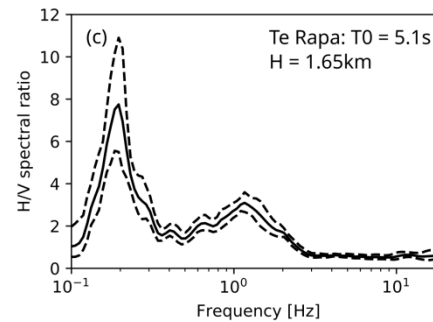
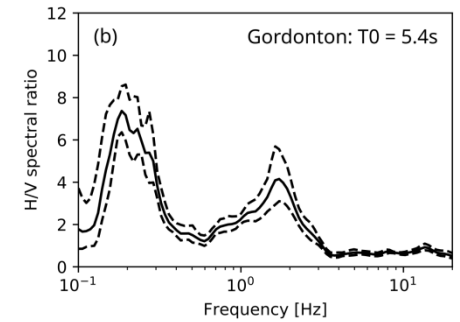
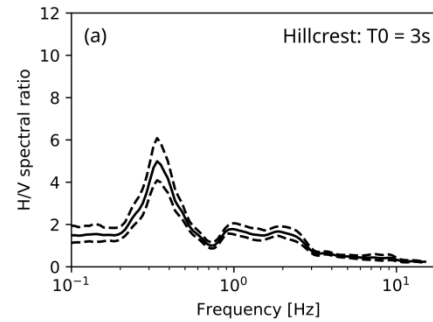
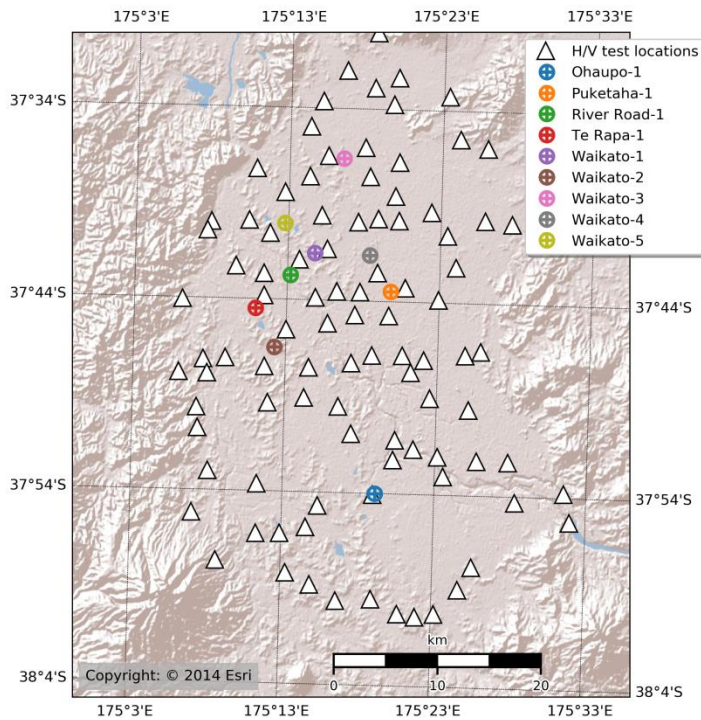
NZ Basin Models



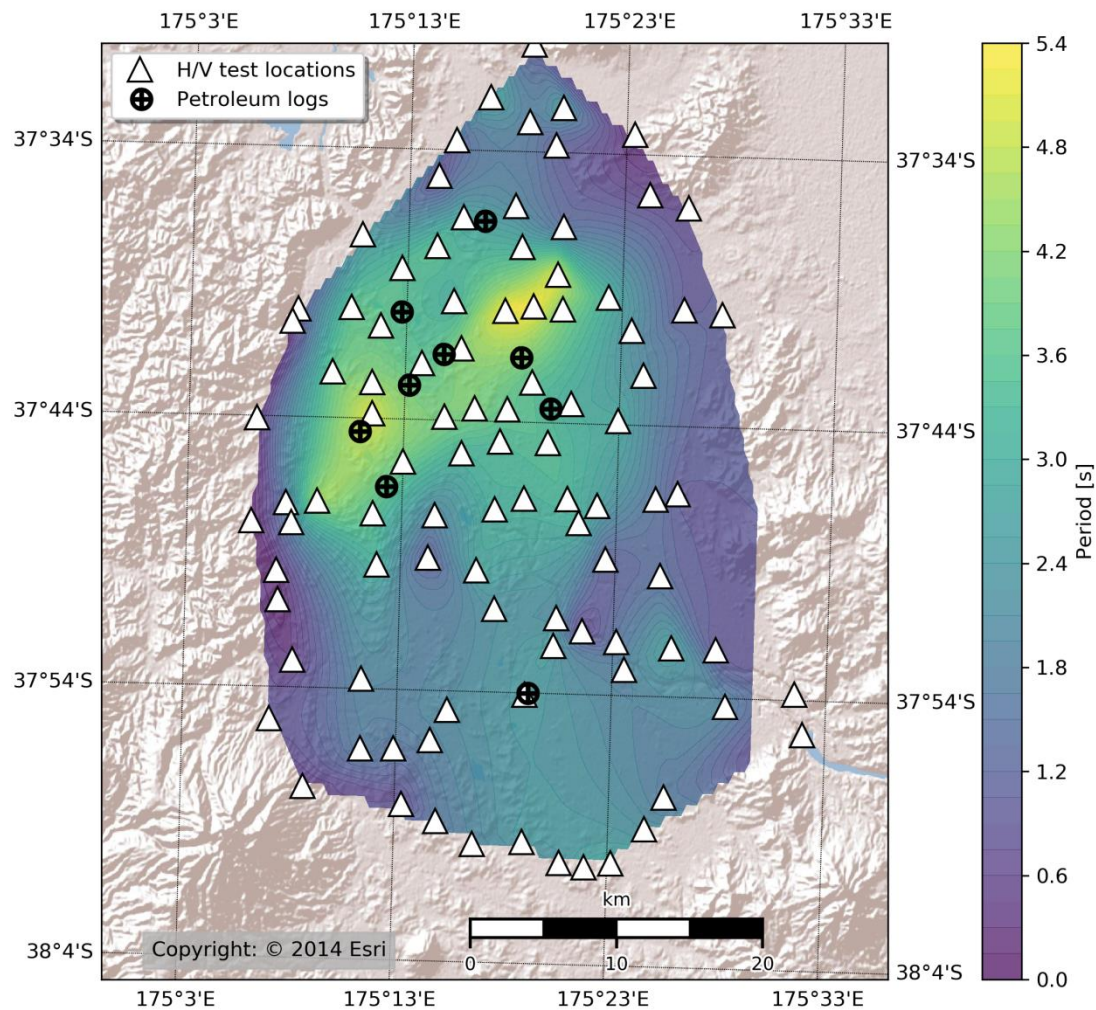
Recent field testing:

- Waikato
- Hawkes Bay
- Hauraki

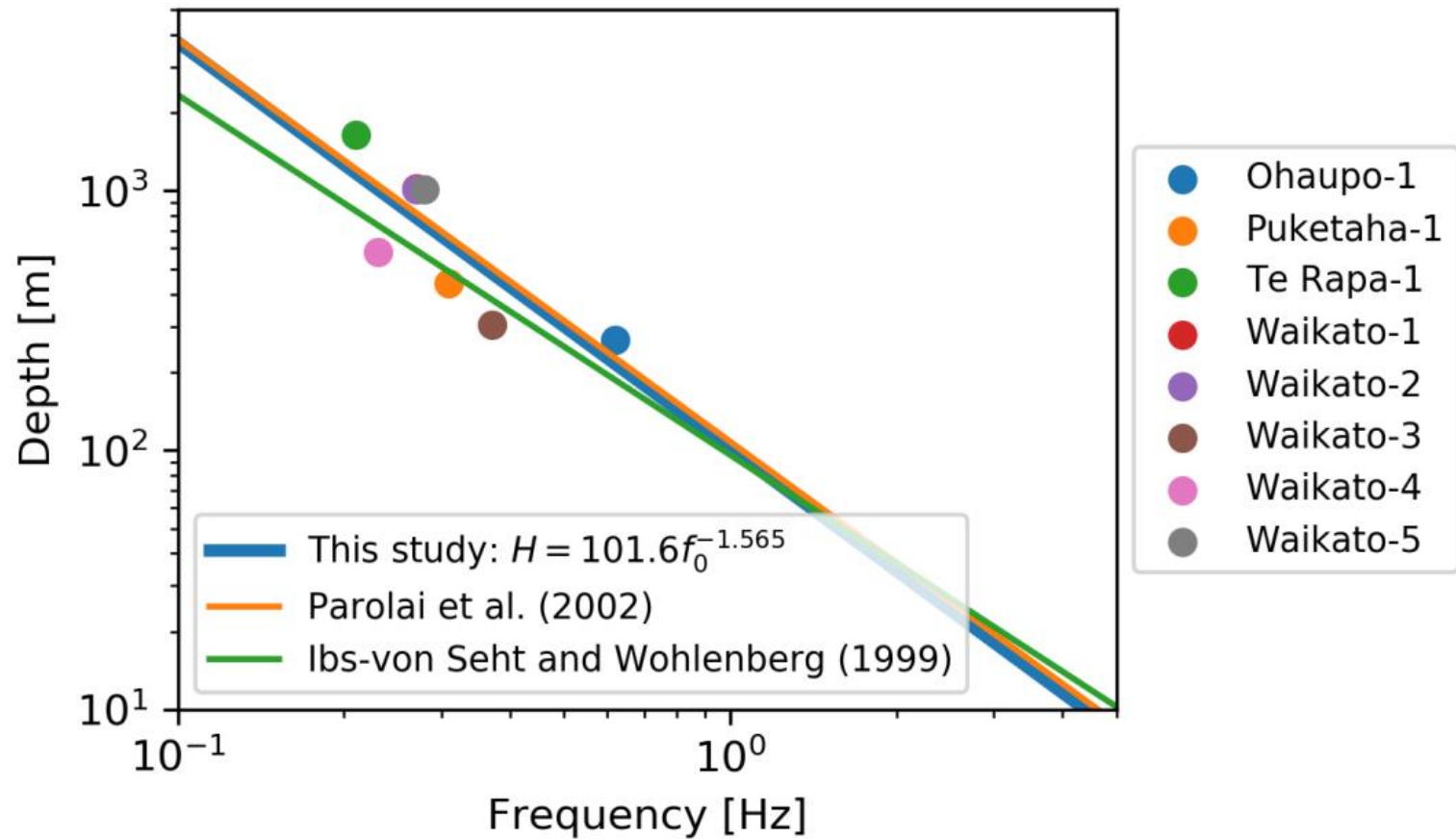
H/V tests in Waikato



T₀ map of Waikato



T_0 -basement depth correlation

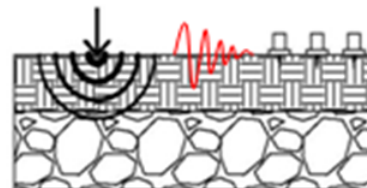


Surface Wave Testing

Acquisition

Field Data Collection:

Measurement of stress waves at the ground surface

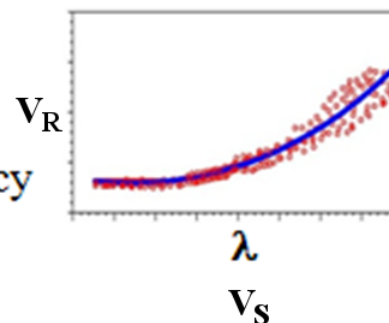


Active & Passive Methods

Processing

Dispersion Curve:

Rayleigh Wave Phase Velocity vs. Wavelength/Frequency



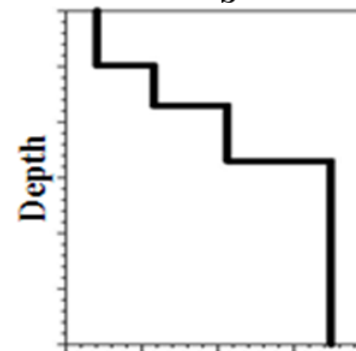
Active:
FK & FDBF in
MATLAB
Passive:
MSPAC & HFK
in Geopsy

Inversion

Shear Wave Velocity Profile:

Variation of Small Strain Shear Modulus vs. Depth

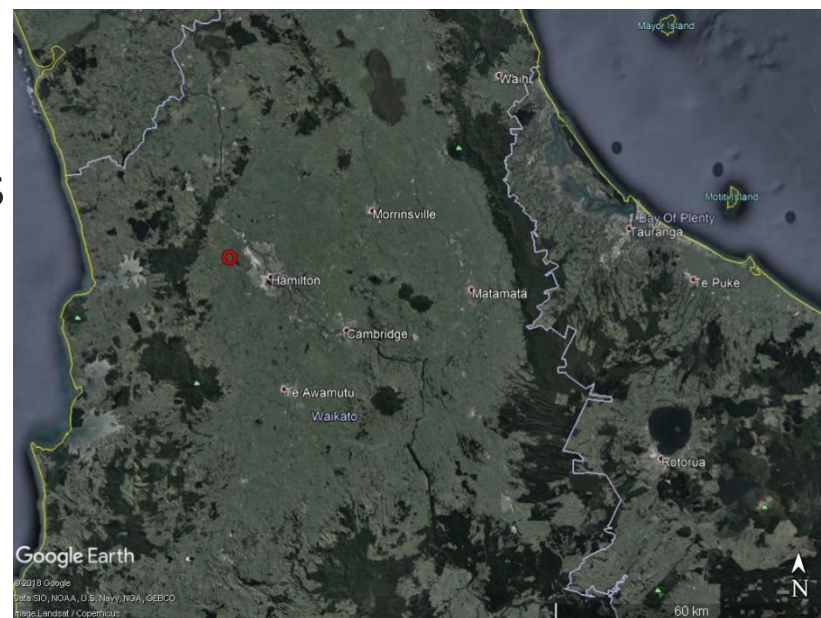
$$G_{\max} = \rho V_S^2$$



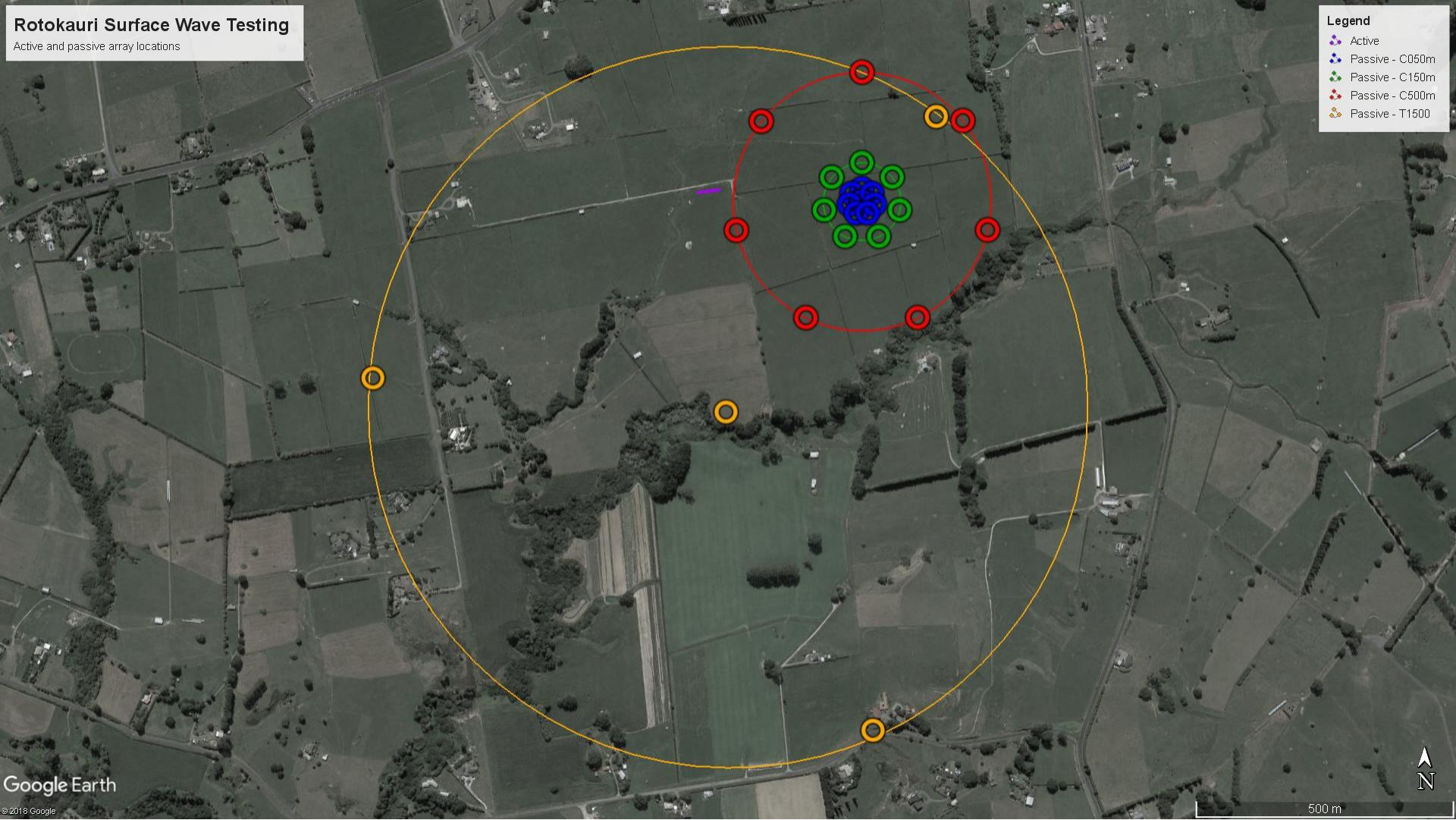
**Dinver and
MATLAB
Layering Ratio
method to
constrain
parameters**

Rotokauri Site

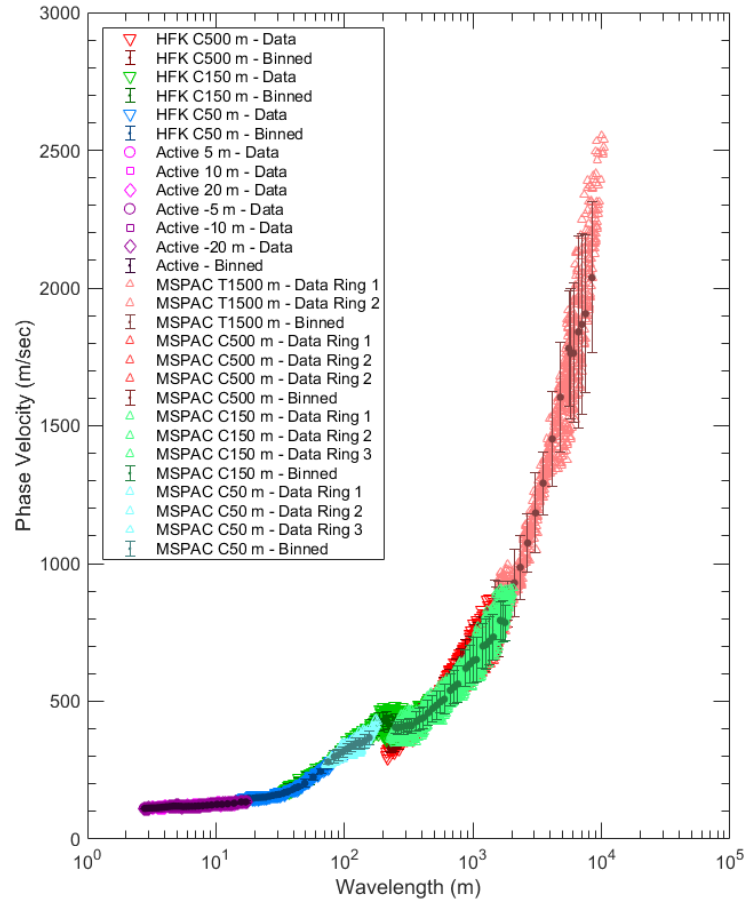
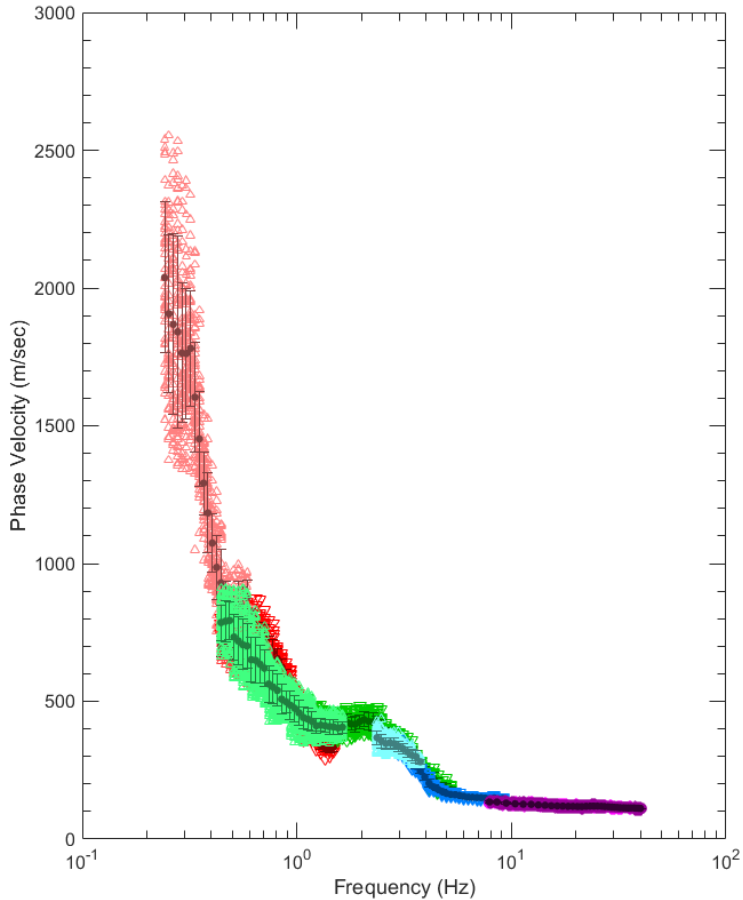
- Active Testing (MASW)
 - 24x Vertical 4.5 Hz geophones
 - 2-m geophone spacing
 - Source Offsets:
 - Both ends of the array
 - 5 m, 10 m, and 20 m
- Passive Testing (MAM)
 - Nanometrics Broadband Seismometers
 - Circular Arrays:
 - 50 m, 150 m, 500 m diameters
 - Triangular Array:
 - 1500 m “diameter”



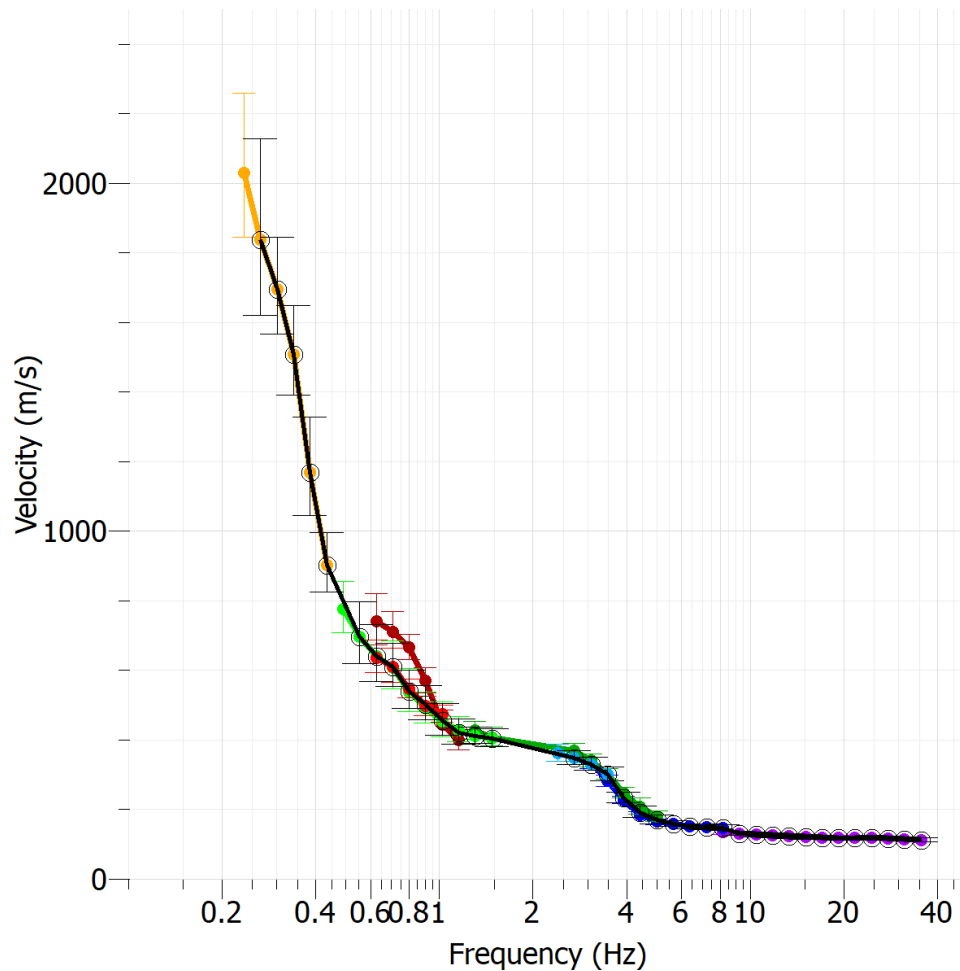
Rotokauri Site



Rotokauri Dispersion Curves



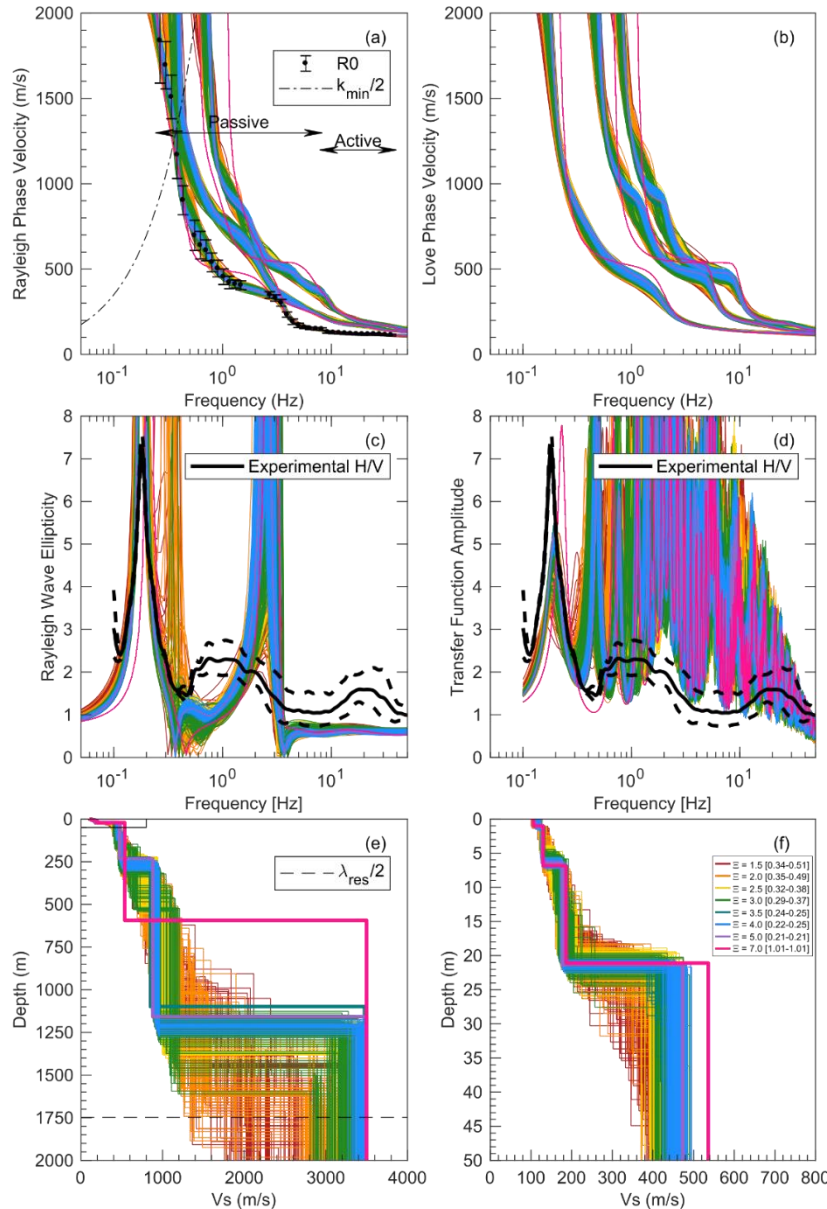
Rotokauri Dispersion Curves



Post-processing before
Inversion:

1. Import Binned DCs
2. Uniformly Resample DCs
3. Average DCs (black line)

Rotokauri Initial Results

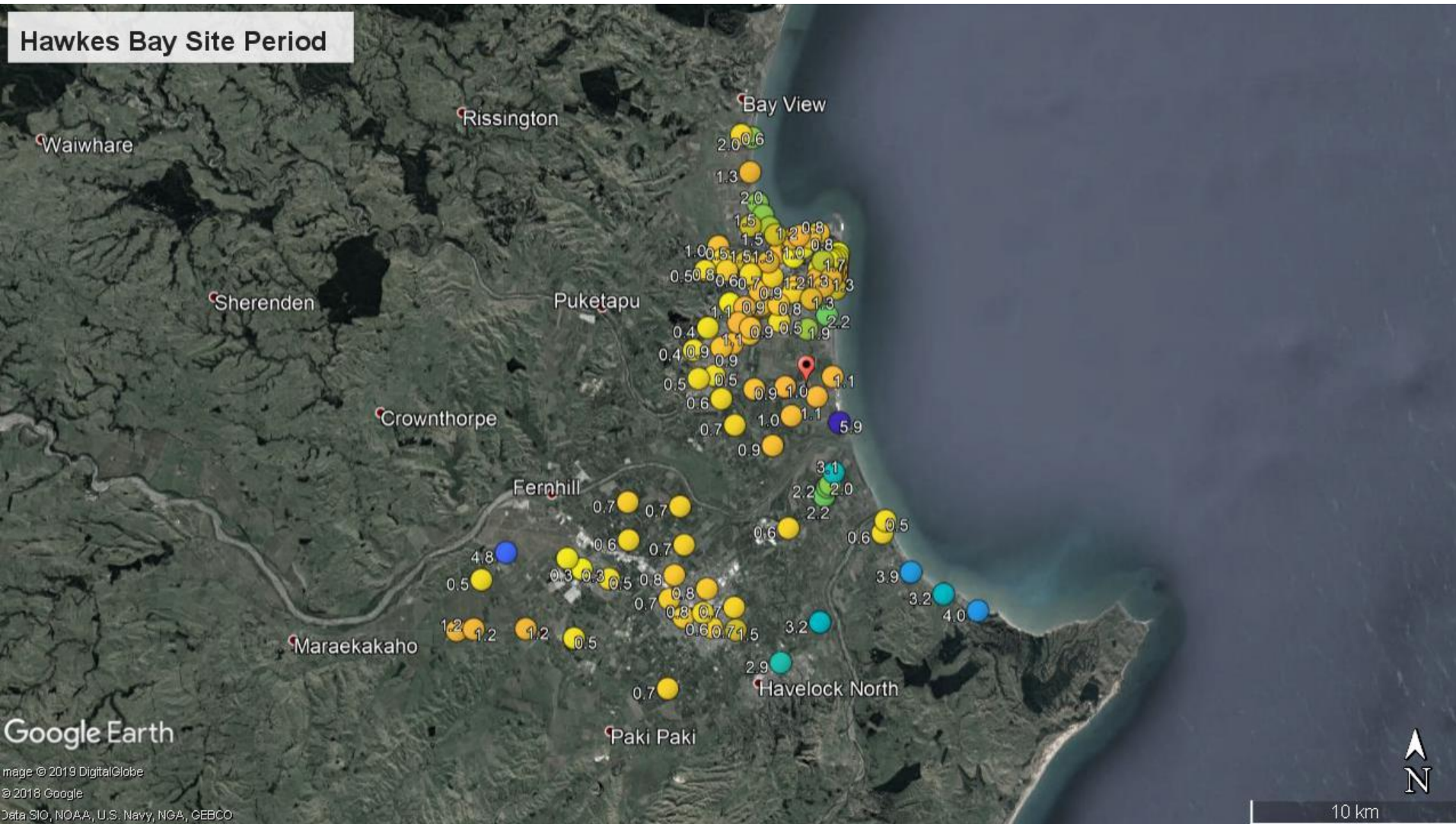


- Inversion Targets
 - R0 DC ($w=0.7$)
 - Ellipticity Peak 0.18 Hz ($w=0.3$)
- Layering Ratios:
 - Cox and Teague 2016
 - 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, and 7.0
- Inversions
 - Software: Dinver
 - Neighbourhood Algorithm (Wathelet et al. 2004)
 - For each LR:
 - 310,000 trial profiles
 - Keep 1,000 best profiles
 - 100 profiles shown here

Hawkes Bay H/V



Hawkes Bay H/V

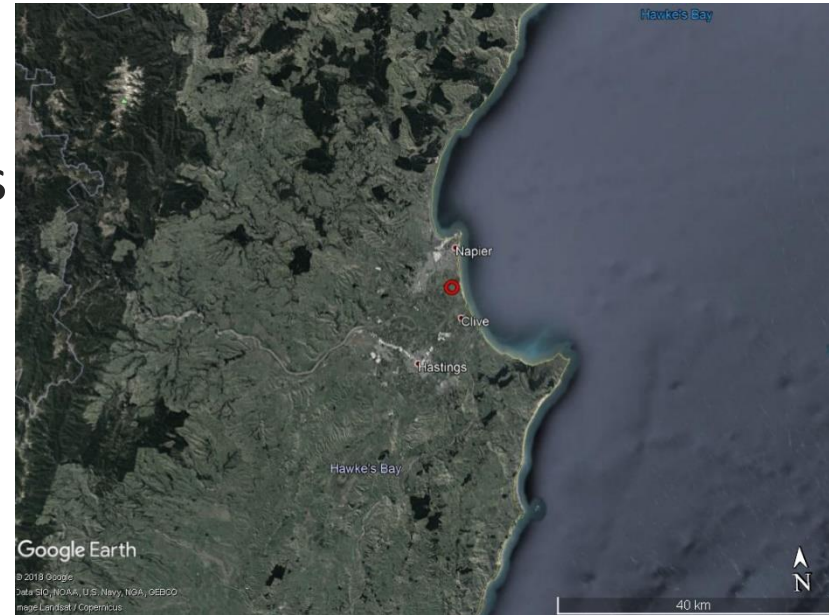


Hawkes Bay H/V

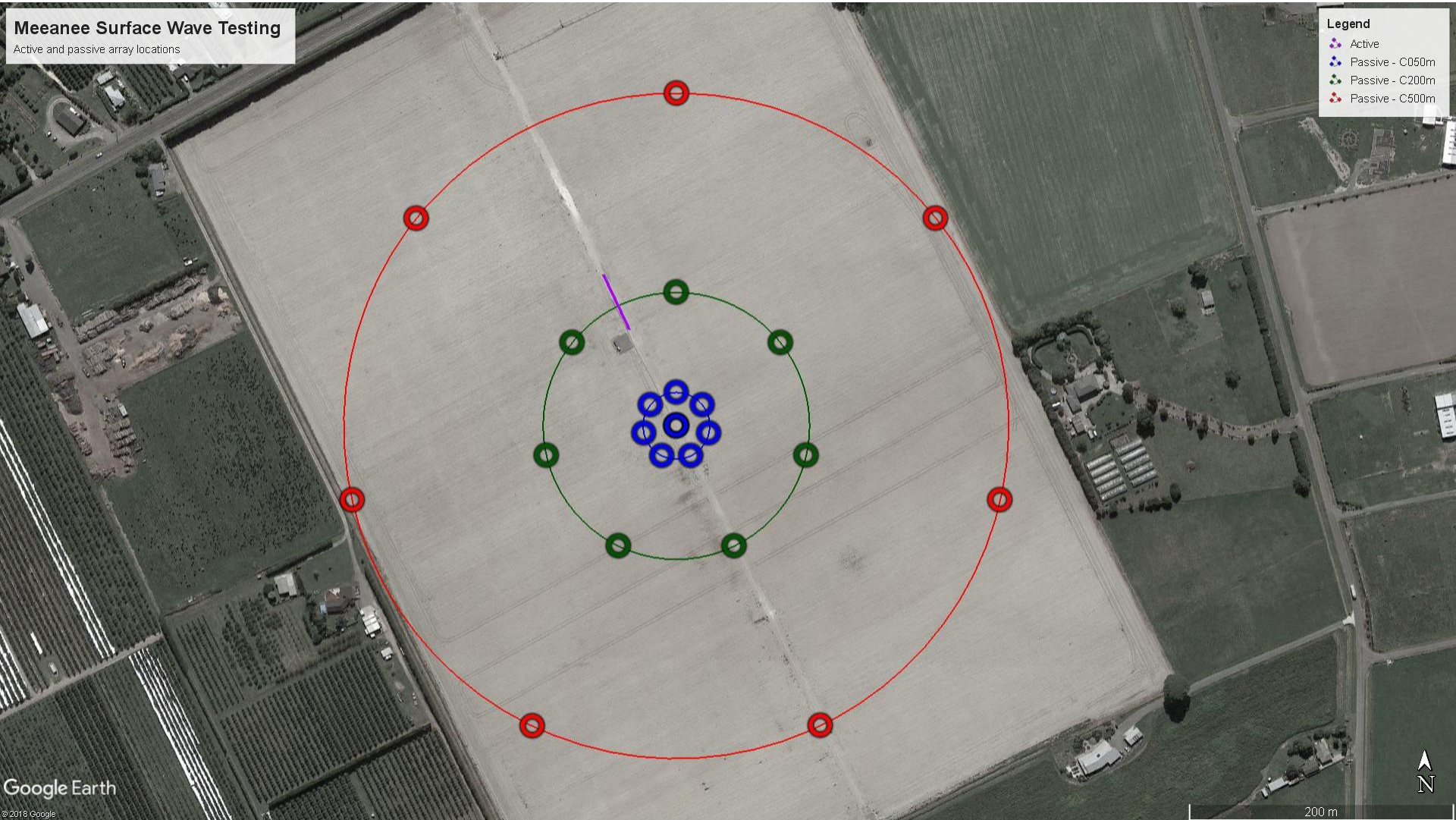


Meeanee Site

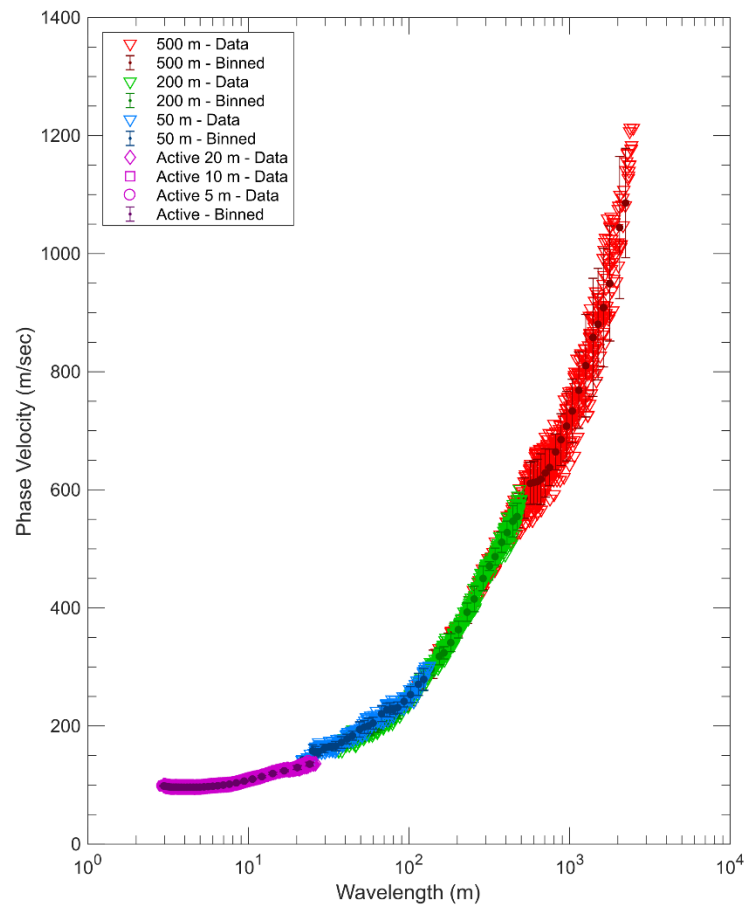
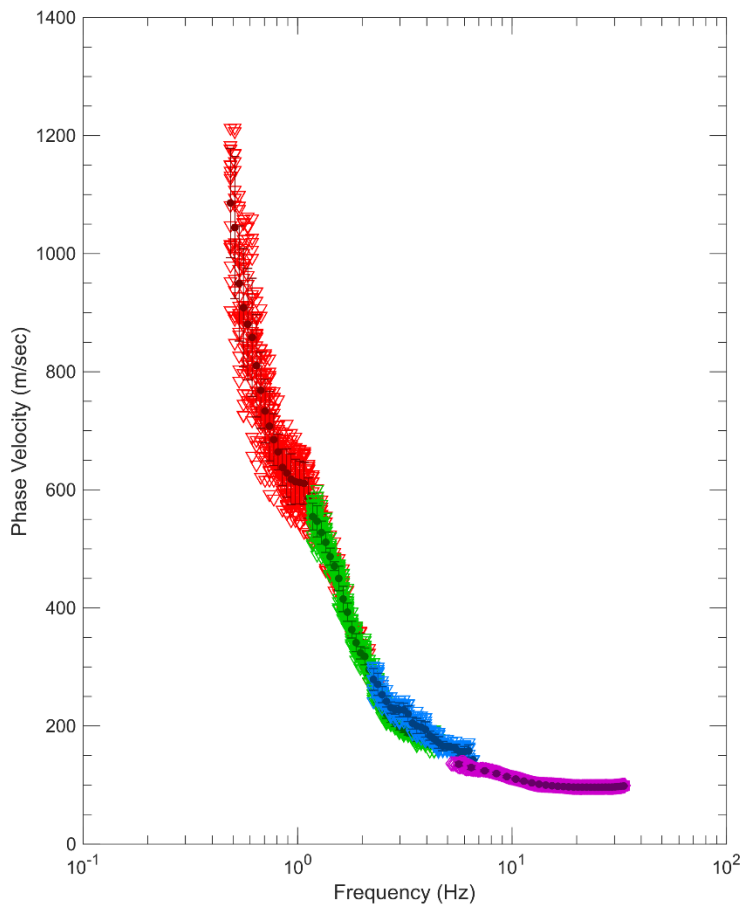
- Active Testing (MASW)
 - 24x Vertical 4.5 Hz geophones
 - 2-m geophone spacing
 - Source Offsets:
 - One end of the array
 - 5 m, 10 m, and 20 m
- Passive Testing (MAM)
 - Nanometrics Broadband Seismometers
 - Circular Arrays:
 - 50 m, 200 m, 500 m diameters



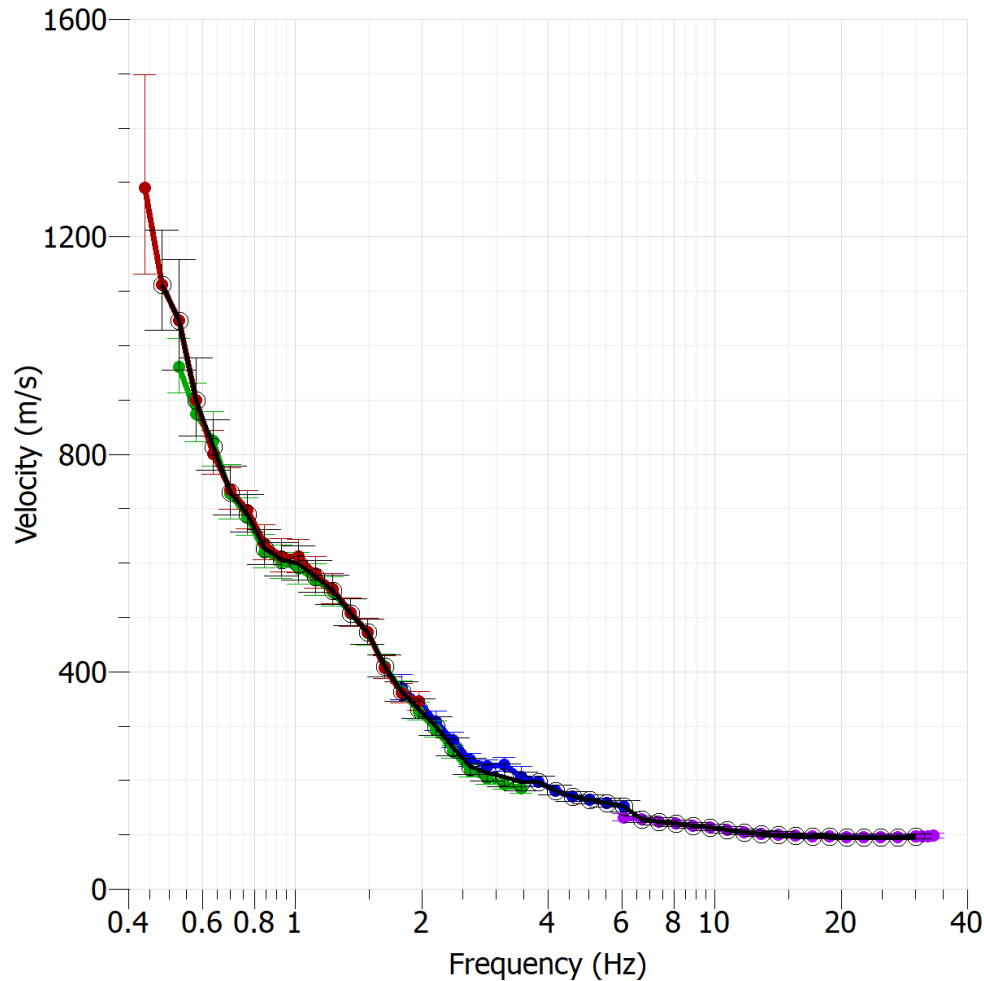
Meeanee Site



Meeanee Dispersion Curves



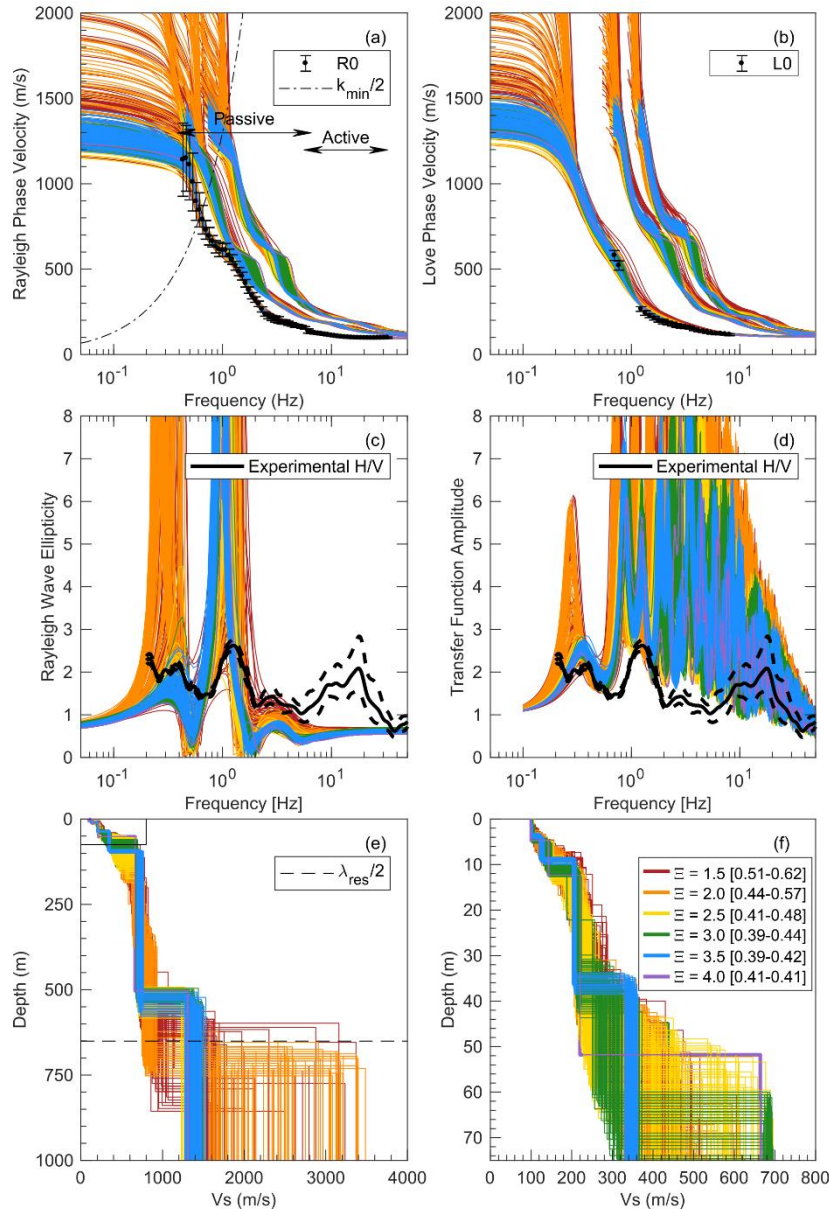
Meeanee Dispersion Curves



Post-processing before
Inversion:

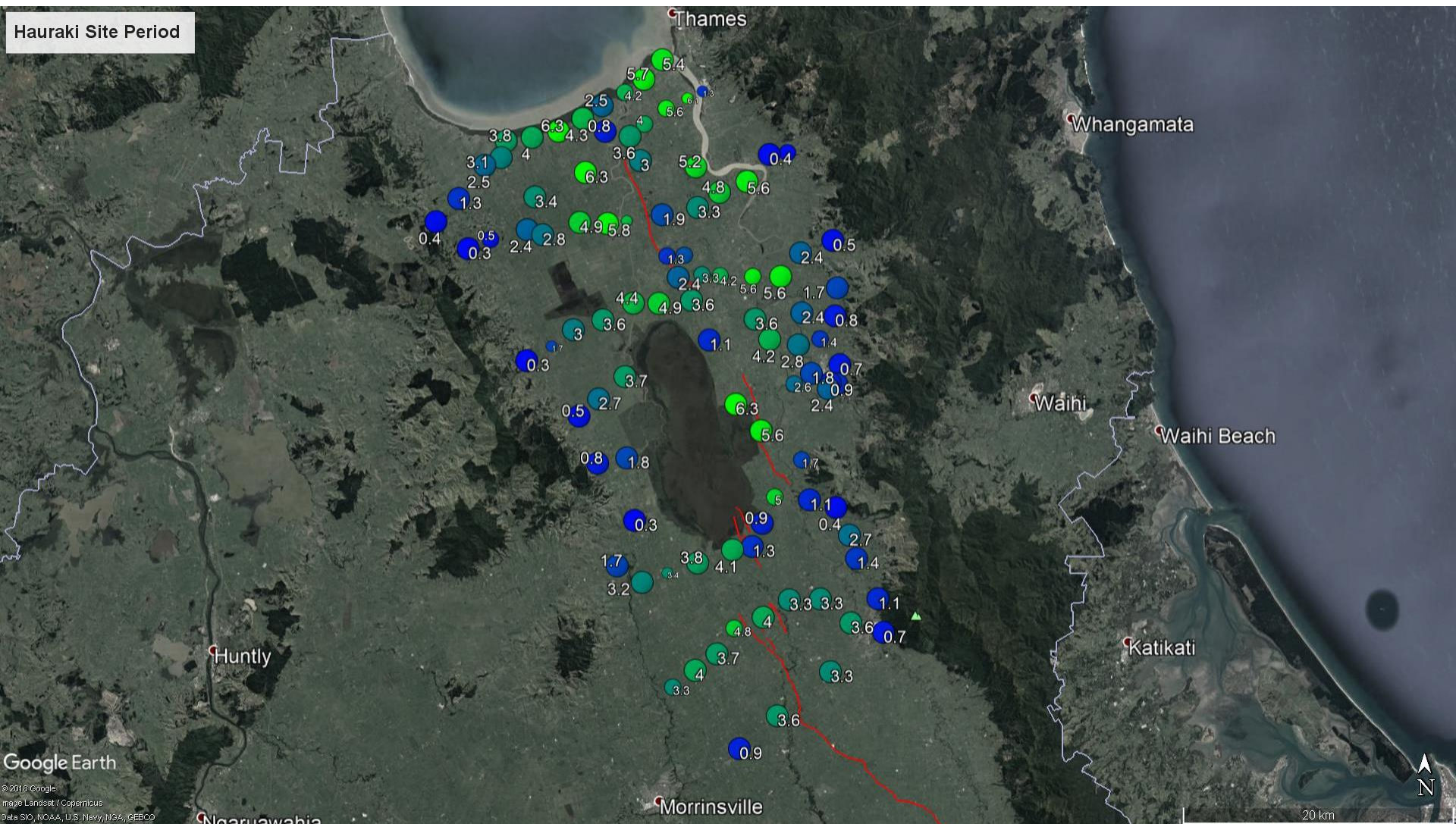
1. Import Binned DCs
2. Uniformly Resample DCs
3. Average DCs (black line)

Meeanee Initial Results

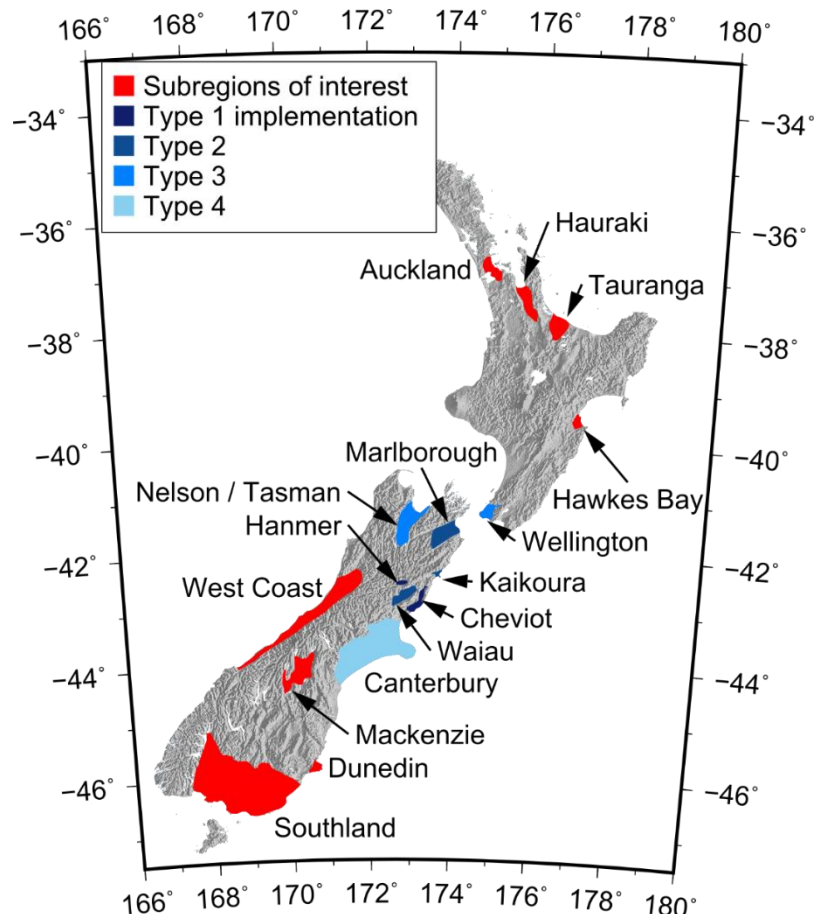


- Inversion Targets
 - R0 DC ($w=1.0$)
 - ~~Ellipticity Peak~~
- Layering Ratios:
 - 1.5, 2.0, 2.5, 3.0, 3.5, and 4.0
- Inversions
 - For each LR:
 - 310,000 trial profiles
 - Keep 1,000 best profiles
 - 100 profiles shown here

Hauraki H/V



NZ Basin Models



- Upcoming field work
 - Surface Wave Testing
 - Auckland
 - Hauraki
 - Tauranga
 - Waikato



QuakeCoRE

NZ Centre for Earthquake Resilience
Te Hiranga Rū

Thank you!

www.quakecore.nz

