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Ambient noise surface wave inversion using OBS data from the north Atlantic, north of the Gloria fault

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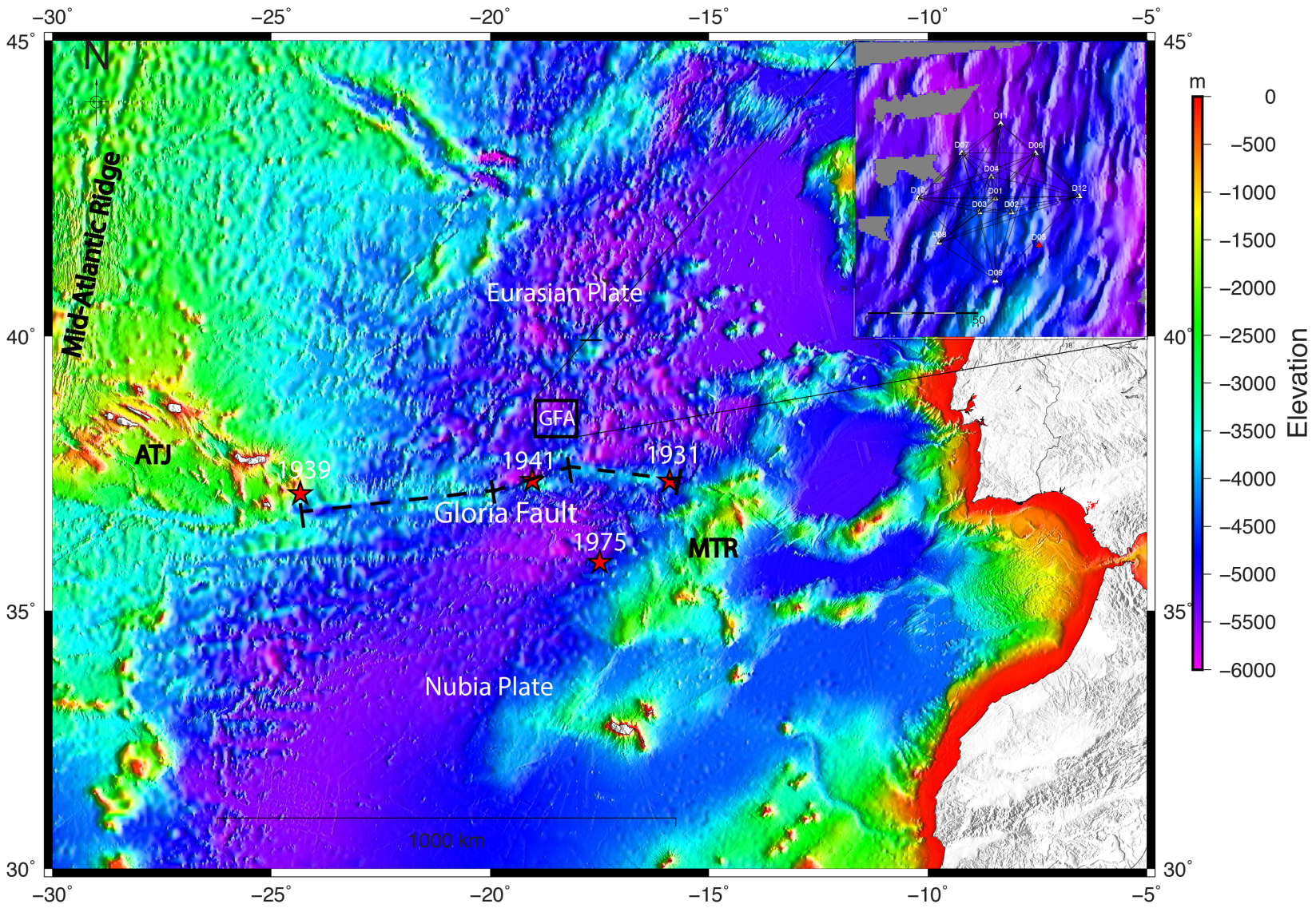
Gloria Fault

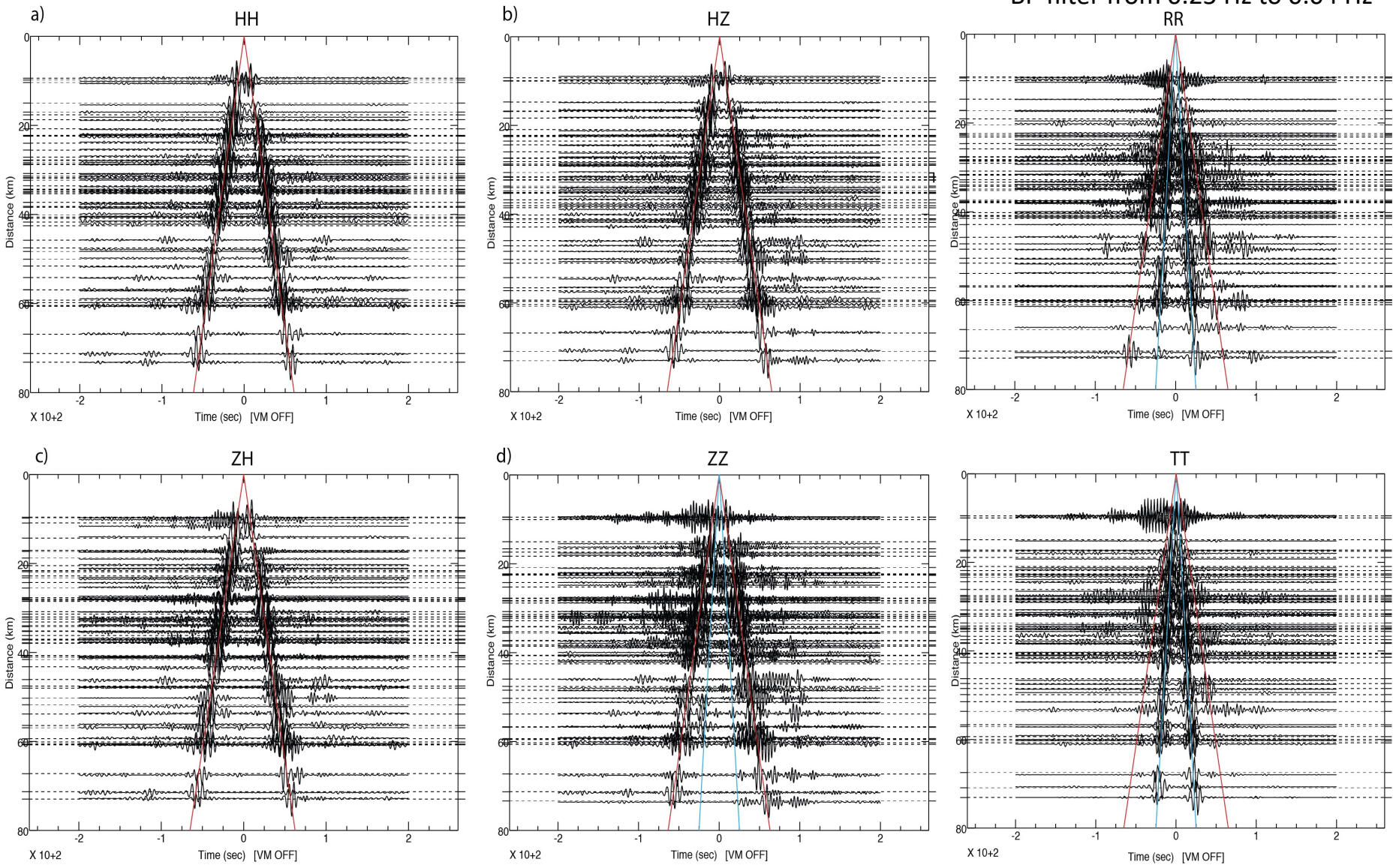
- Strike-slip fault with dextral transcurrent motion.
- ~1000 km.
- Oceanic crust between 50 Ma to 120 Ma.
- Four EQ > M7
- High Stress drop ~12MPa (Baptista et al., 2017).
- Oceanic crust ~7-8 km of thickness (Batista et al., 2017; Hannemann et al., 2017).
- LAB at ~70-80 Km (Hannemann et al., 2017).



Phase Cross-correlation method

BP filter from 4 Hz to 0.04 Hz

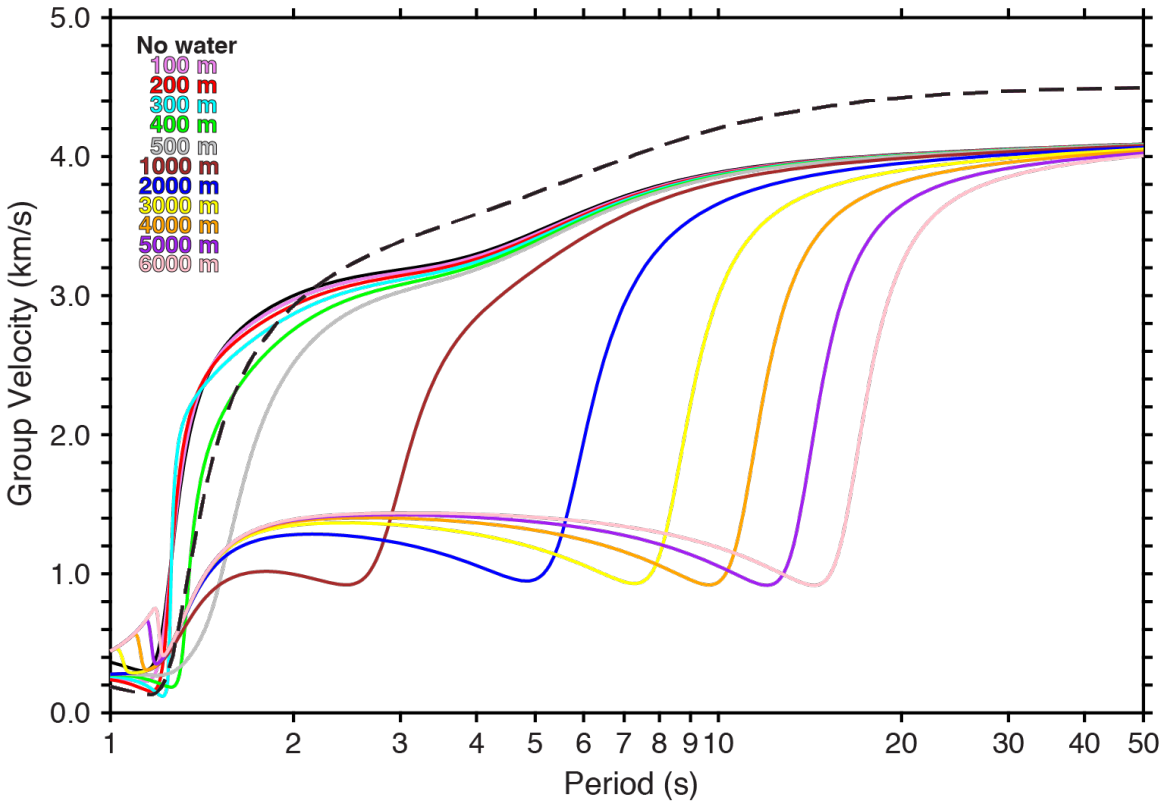
BP filter from 0.25 Hz to 0.04 Hz

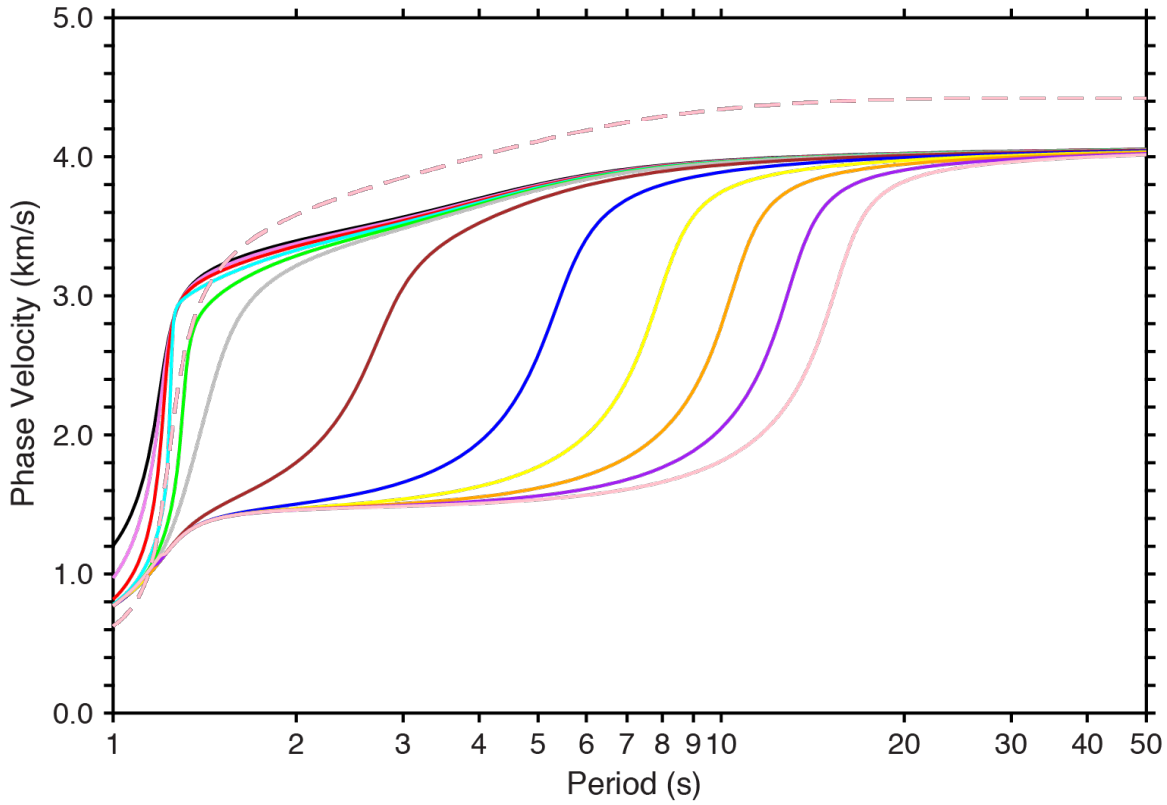


Schimmel et al., 2011

We cross-correlate all possible components including the hydrophone to extract the Rayleigh and Love waves EGF's.

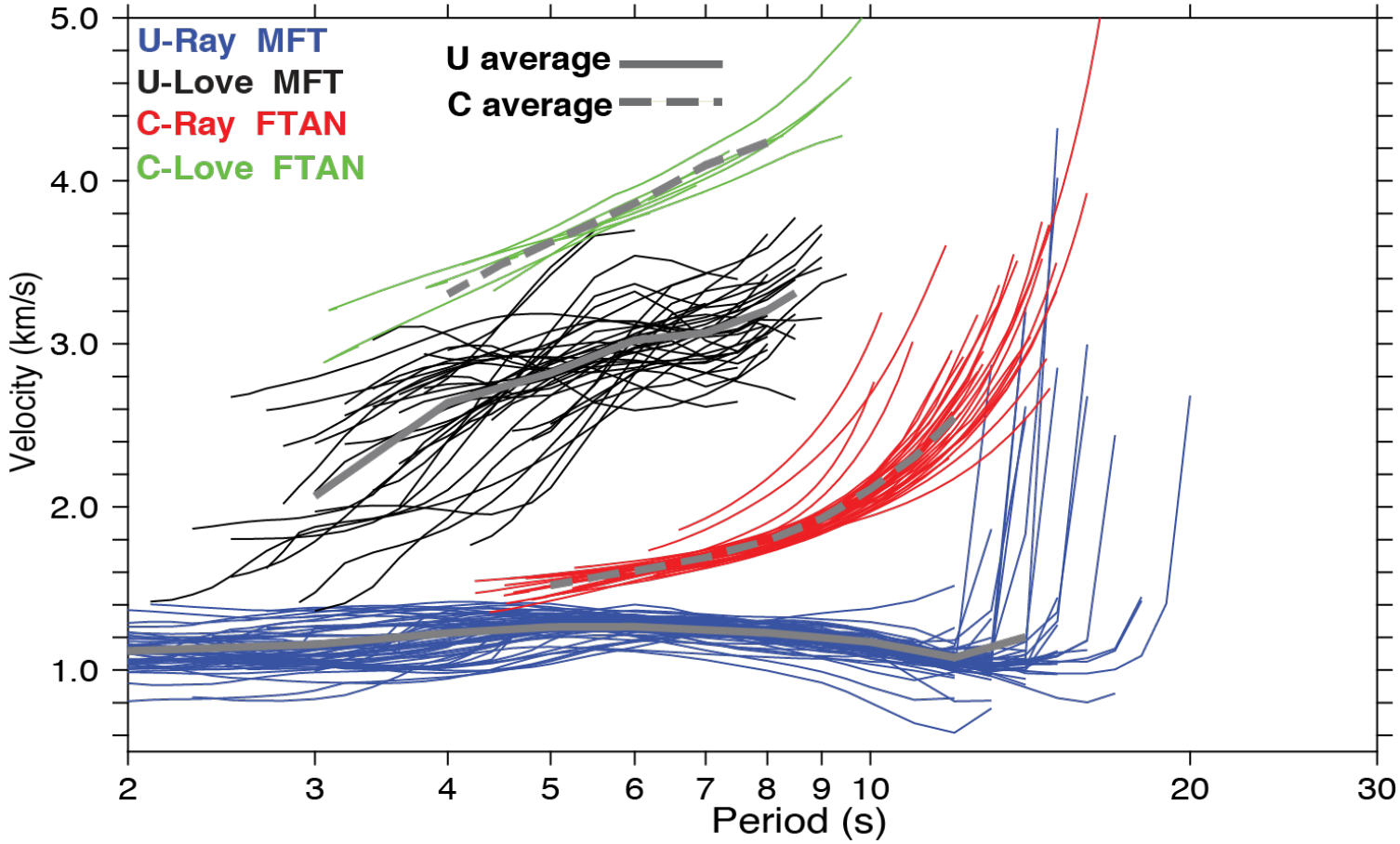
Synthetic dispersion curves using a variable water depth





Rayleigh wave group and phase velocity synthetic dispersion curves show the effect of the water layer above the OBS's (solid lines). Love waves on the other hand, are not affected by the water and thus, are a more valuable source of information (dashed lines). Our array has almost a homogeneous depth of ~5 km on average.

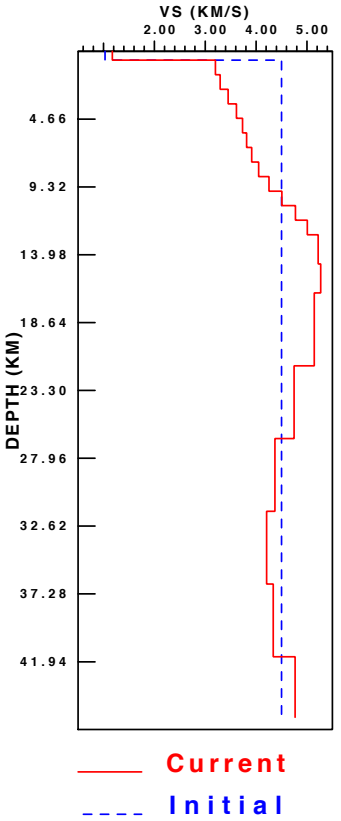
Group and phase velocity dispersion curves

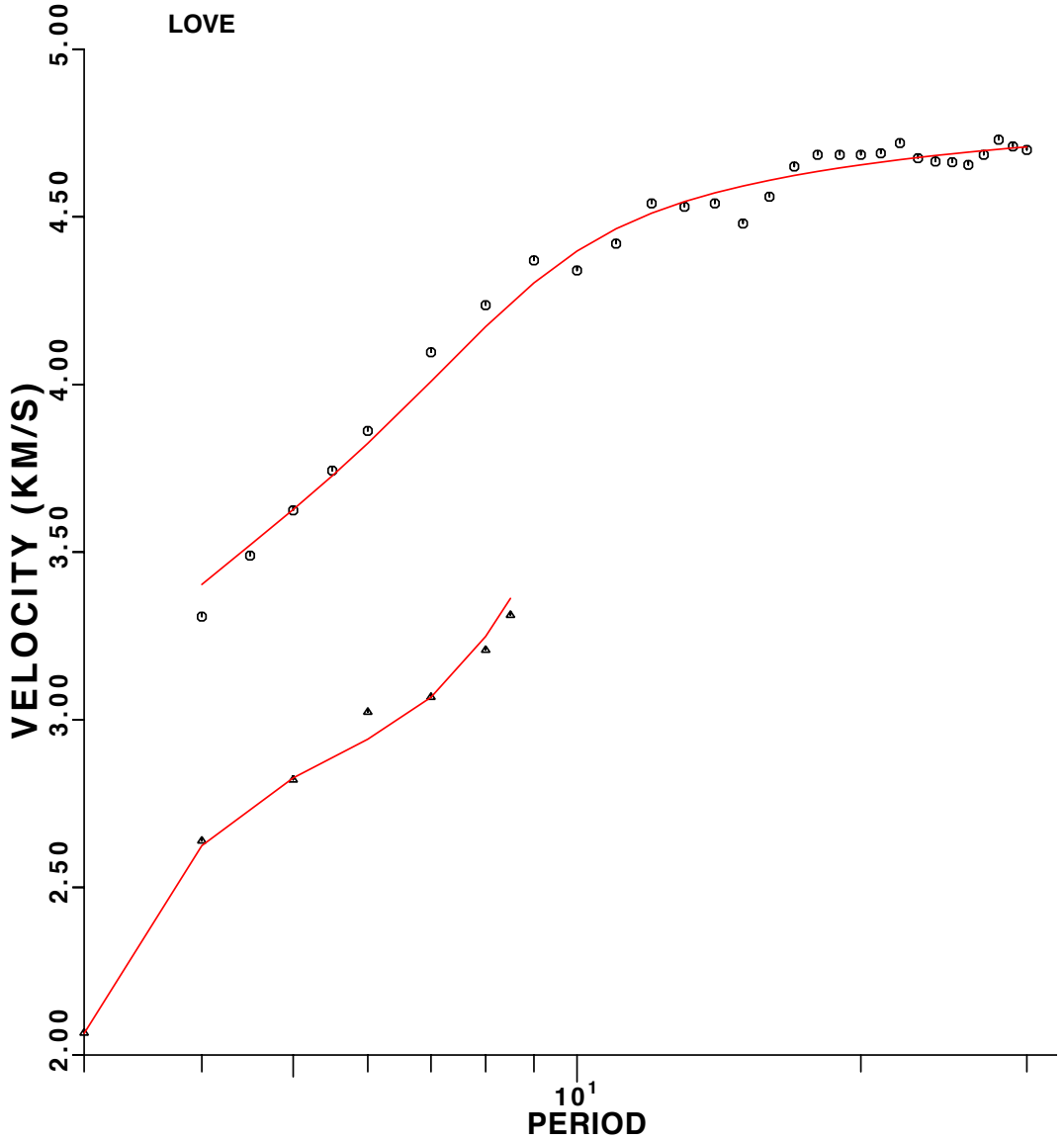


Rayleigh waves fundamental mode (blue), we could only extract the dispersion curves until 16 s maximum due to the array aperture that is 73 km. Love wave group velocity dispersion curves are more sensitive to the oceanic structure.

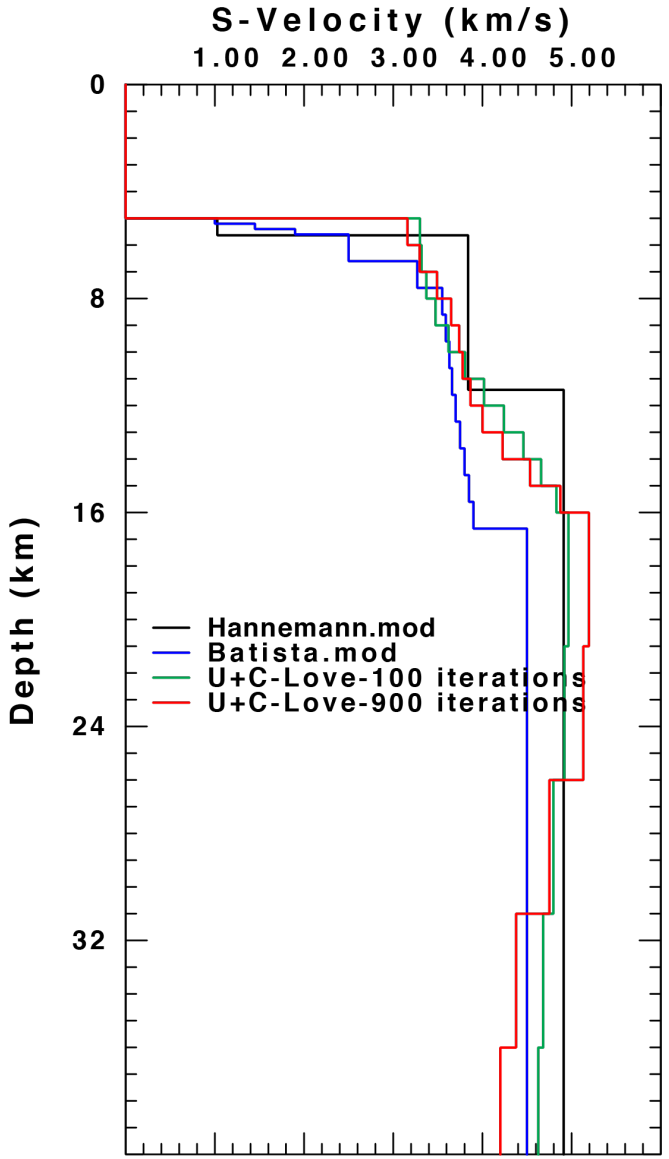
Multi filter technique (MFT) Herrmann and Ammon, 2004
Frequency-time analysis (FTAN) Levshin and Ritzwoller, 2001

Love wave Vs inversions





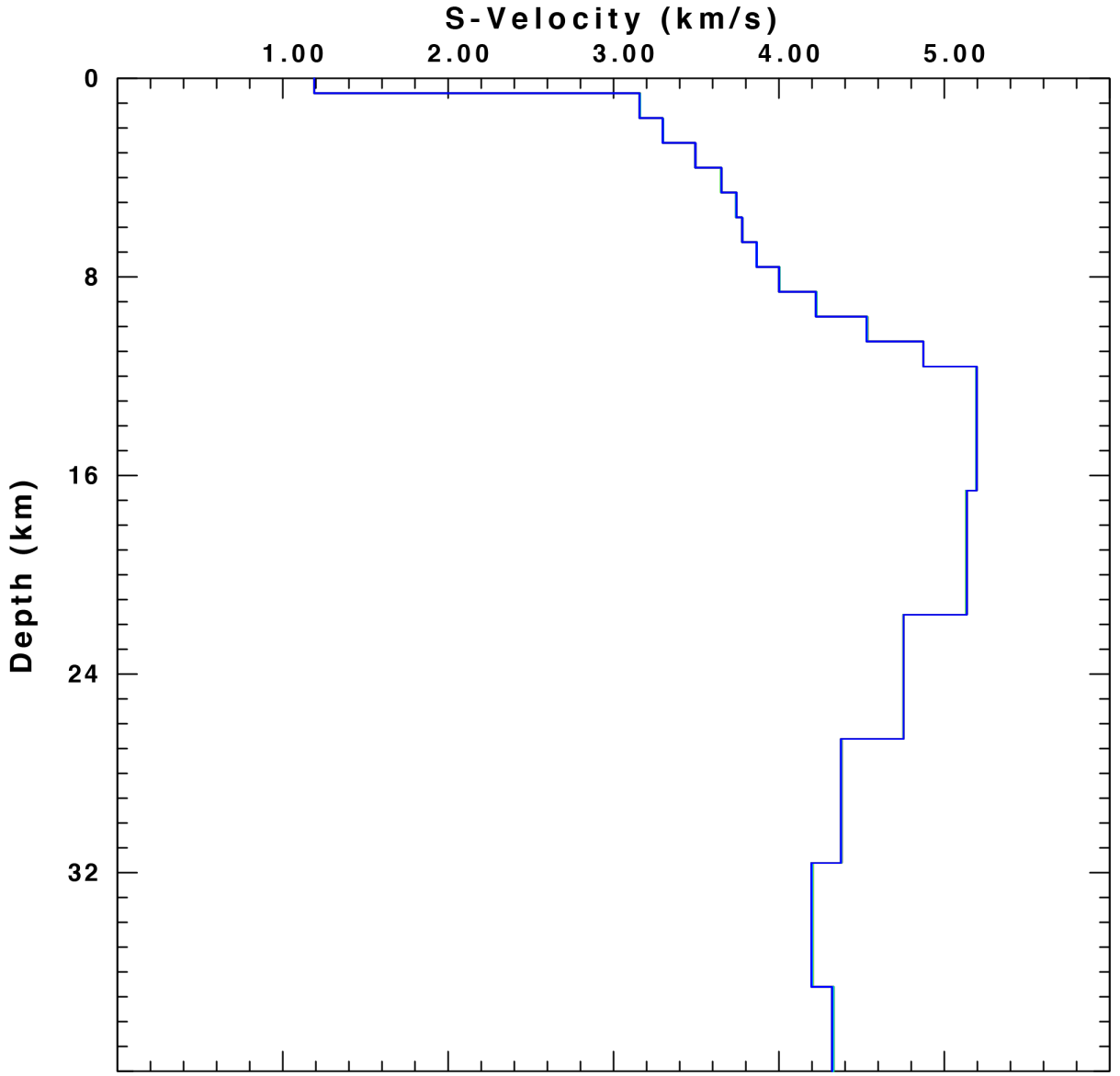
Iterated 900 times



Hannemann et al., 2016

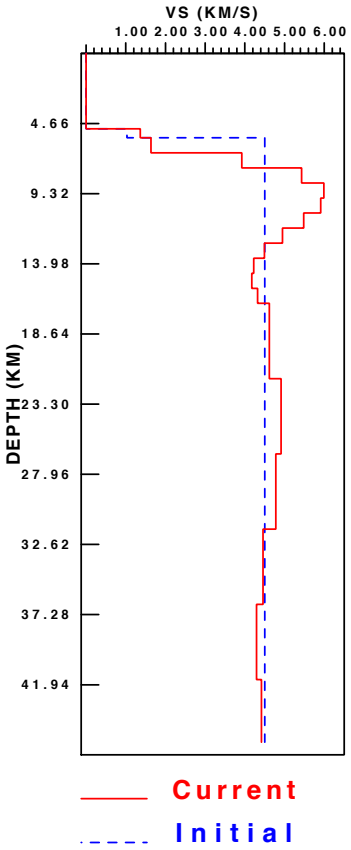
Batista et al., 2017

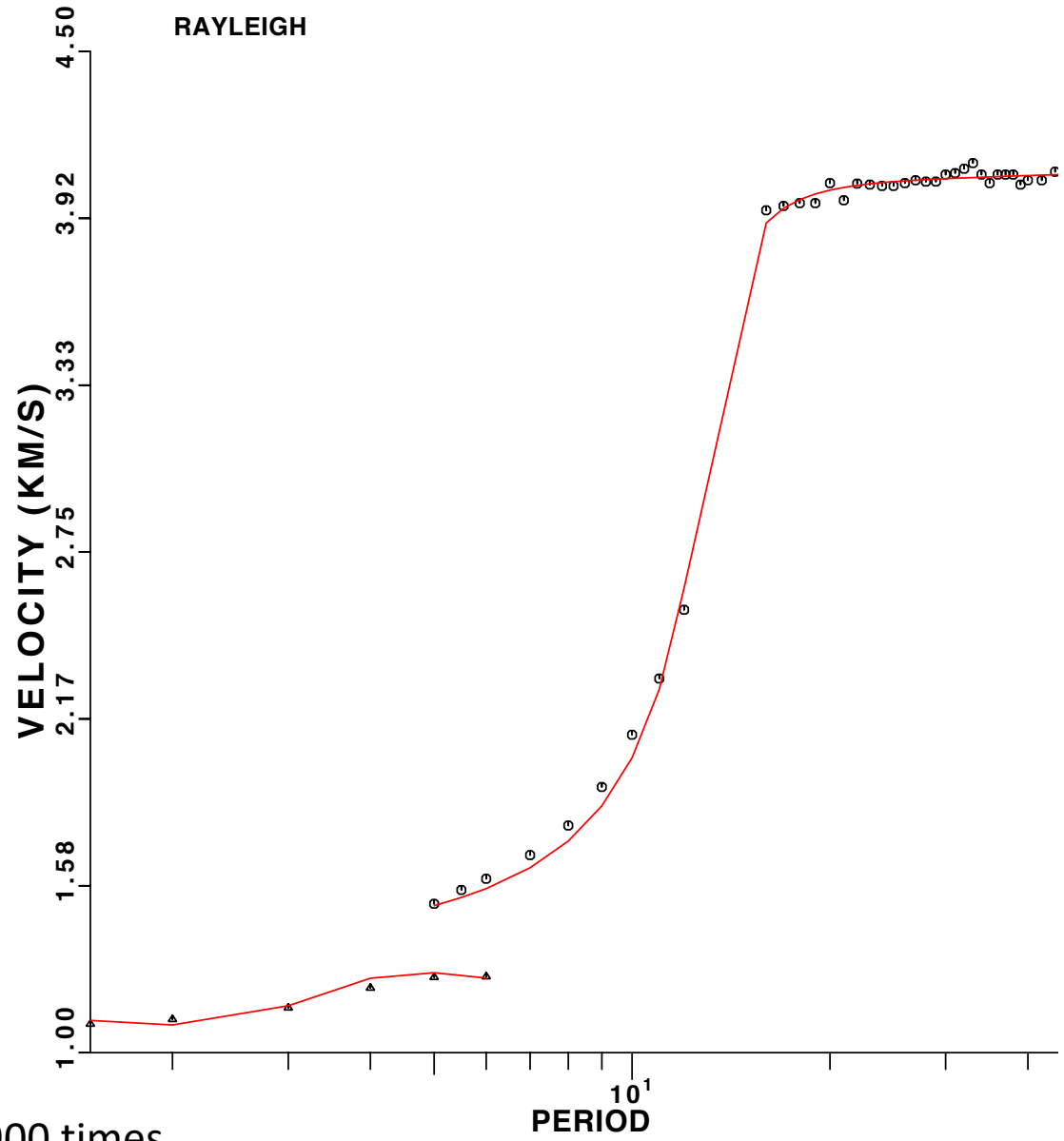
Love wave Vs inversions varying ± 10 % the initial velocity



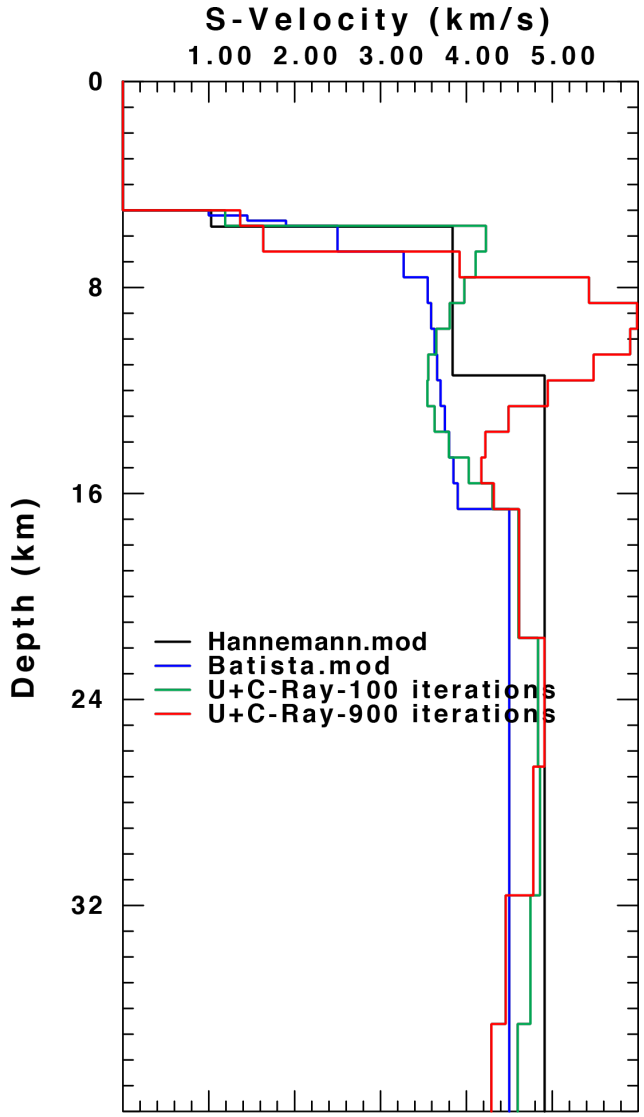
The Vs inversions shown that varying the initial velocity did not change the final model. Each final model were iterated 900 times and has a signal power fit of 99.988%

Rayleigh wave Vs inversions

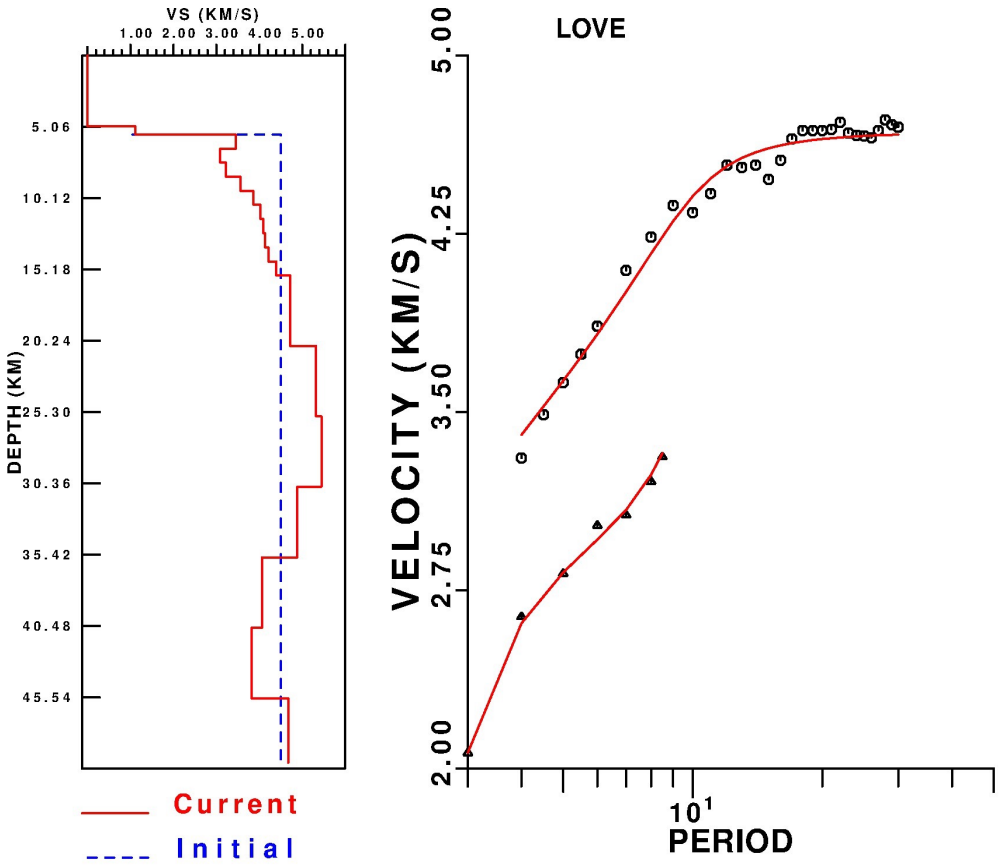


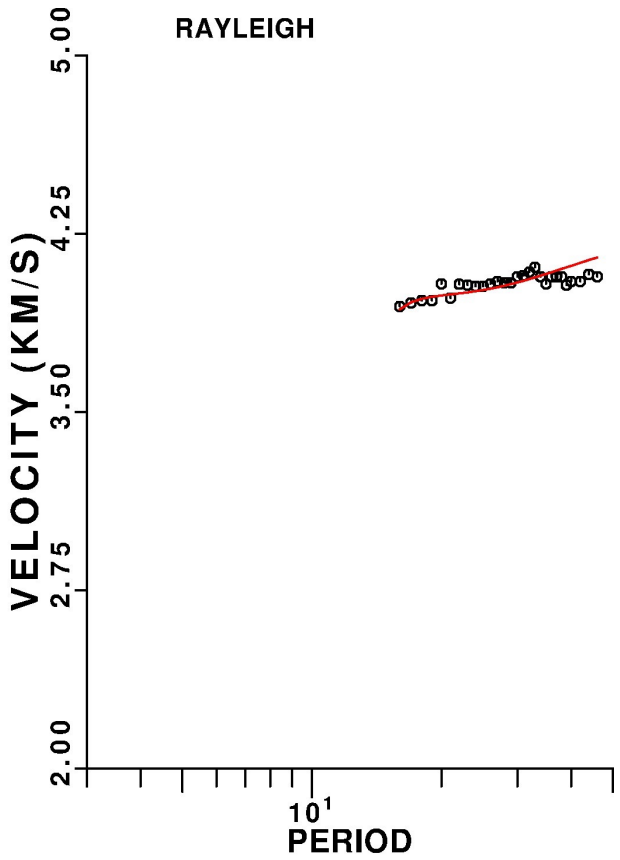


Iterated 900 times

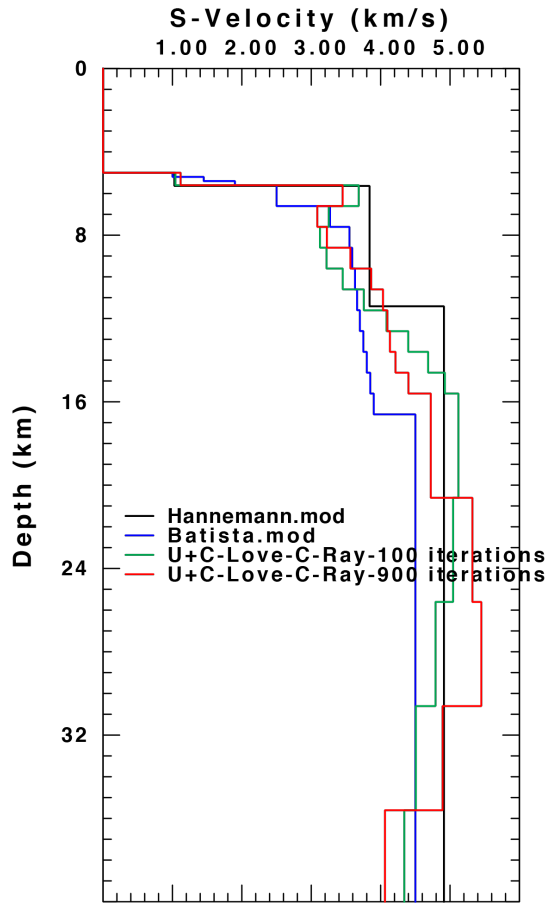


Hannemann et al., 2016
Batista et al., 2017





Iterated 900 times



Hannemann et al., 2016
Batista et al., 2017

Rayleigh and Love wave Vs inversions

Conclusions

- We extracted the EGF's of all the seismometer components including the hydrophone.
- We inverted with a thicker initial velocity model, and we obtained stable results.
- Additionally, we changed ± 10 % the velocity of the initial model and we observed very stable results.
- We obtained more consistent Vs inversions when Love waves are considered.
- Rayleigh wave Vs inversions show the problems that we face working with OBS's when the array has a very small aperture, a limited frequency band of dispersion curves and the influence of the water above the array. In our case, we can not only rely on Rayleigh wave inversions because even when these are the easiest to extract, it also show some limitations.

Thank you

References and Acknowledgements

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