Sweetwater Array

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Introduction

With the original Homestake array:

1. We demonstrated that we can achieve more than an order of magnitude seismic-noise cancellation between about 0.05-0.5 Hz using Wiener filters with only a few seismometers separated by a distance of order 500 m.
2. At least a factor 50 NN reduction should in principle be feasible at the Homestake site around 0.1 Hz (subject to assumptions about scattering).
3. We have showed that this subtraction performance can be achieved without regularly updating the filter, indicating that the average properties of seismic fields at Homestake do not change significantly over timescales of weeks in this frequency band.

Introduction (continued)

Caveats to the analysis:

1. Assumed that seismic scattering at the Homestake site is representative for seismic scattering of the entire region that needs to be included for NN estimates.
2. Array not large enough to explore optimal array design and the many technical issues asdociated with the calculation of Wiener filters based on a large number of reference channels
3. Residual spectra contained a microseismic peak ... why? (body waves and surface waves? scattering?)

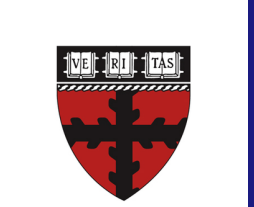
Introduction (continued)

Benefits of the Sweetwater array:

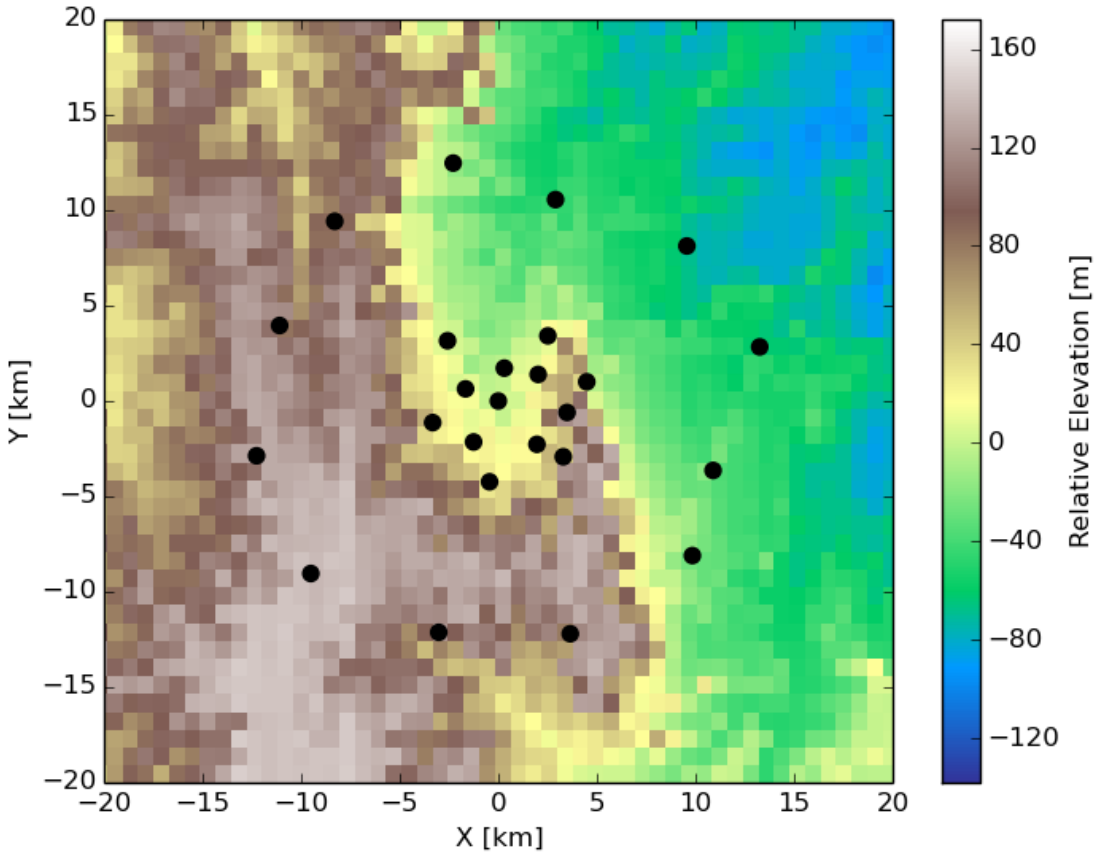
1. The array has significantly larger horizontal spacing than used in the Homestake analysis. The horizontal distances between the center of the array and other seismometers range between 2-14 km (whereas Homestake ranges between 295-1236 m).
2. Also has significant variation in elevation over the array, with a max elevation change between seismometers of about 250 m.

We can try to use the larger Sweetwater array to test these:

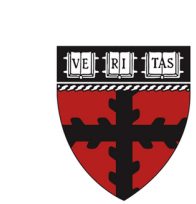
1. Distinguishing between body and surface waves
2. Whether a larger array with greater variation in station distances would yield even better subtraction over a broader range of frequencies



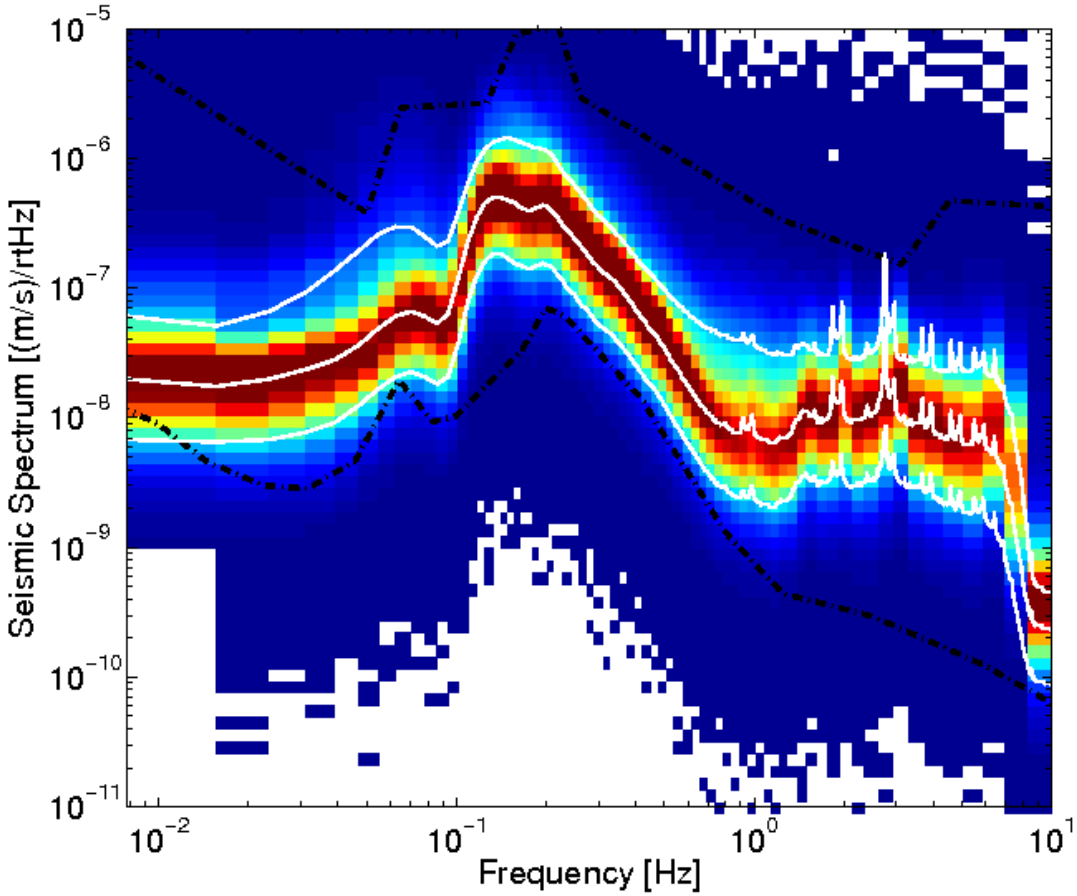
Array



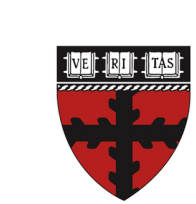
(a) Sweetwater array



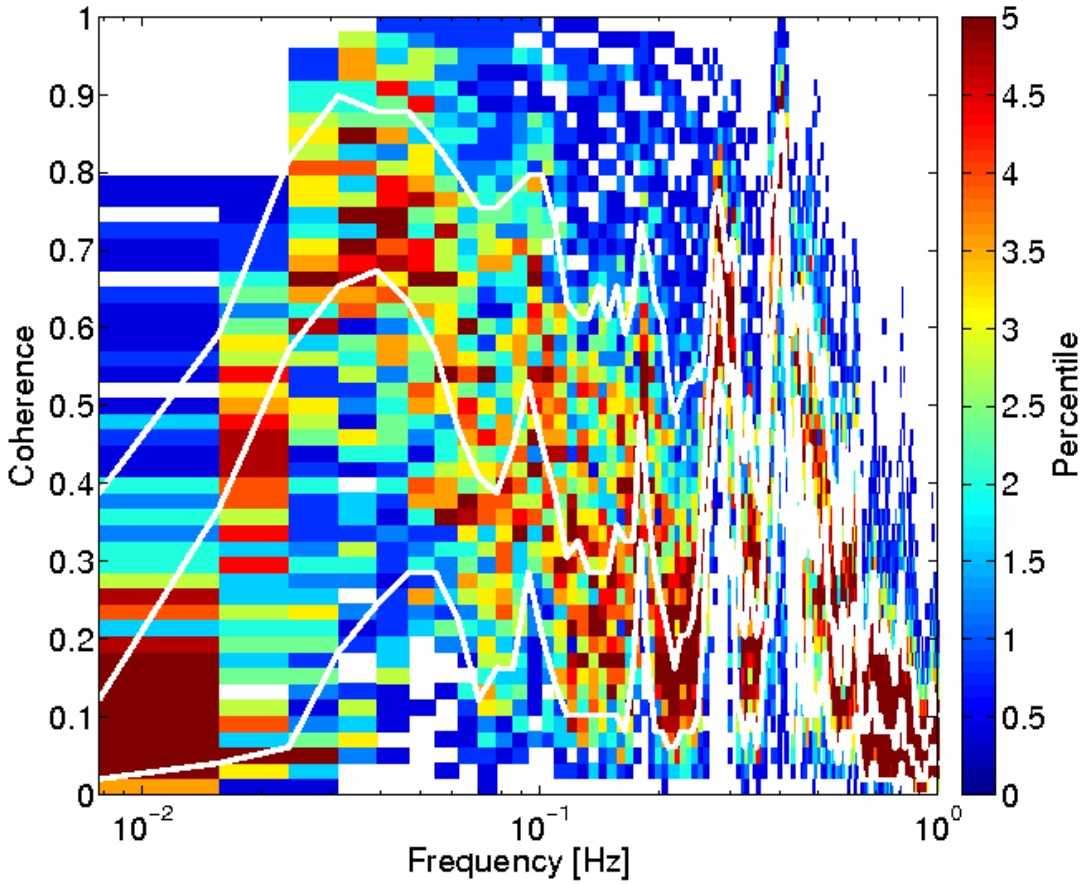
Seismic Spectra



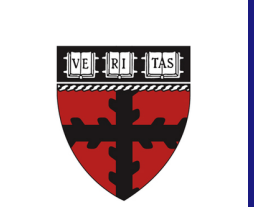
(b) Seismic Spectra



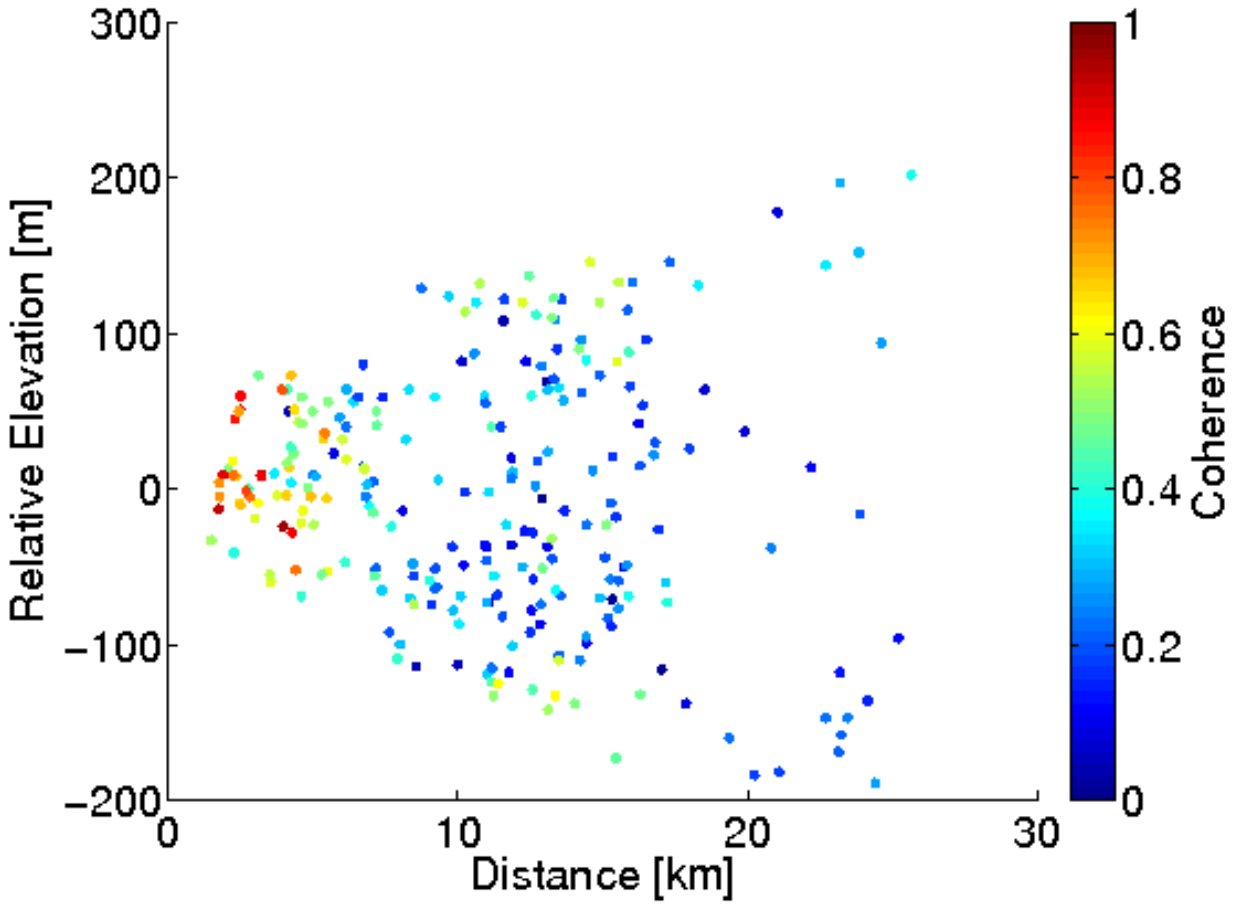
Coherence



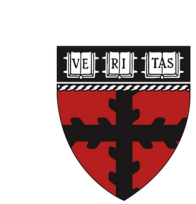
(c) Coherence between seismometers



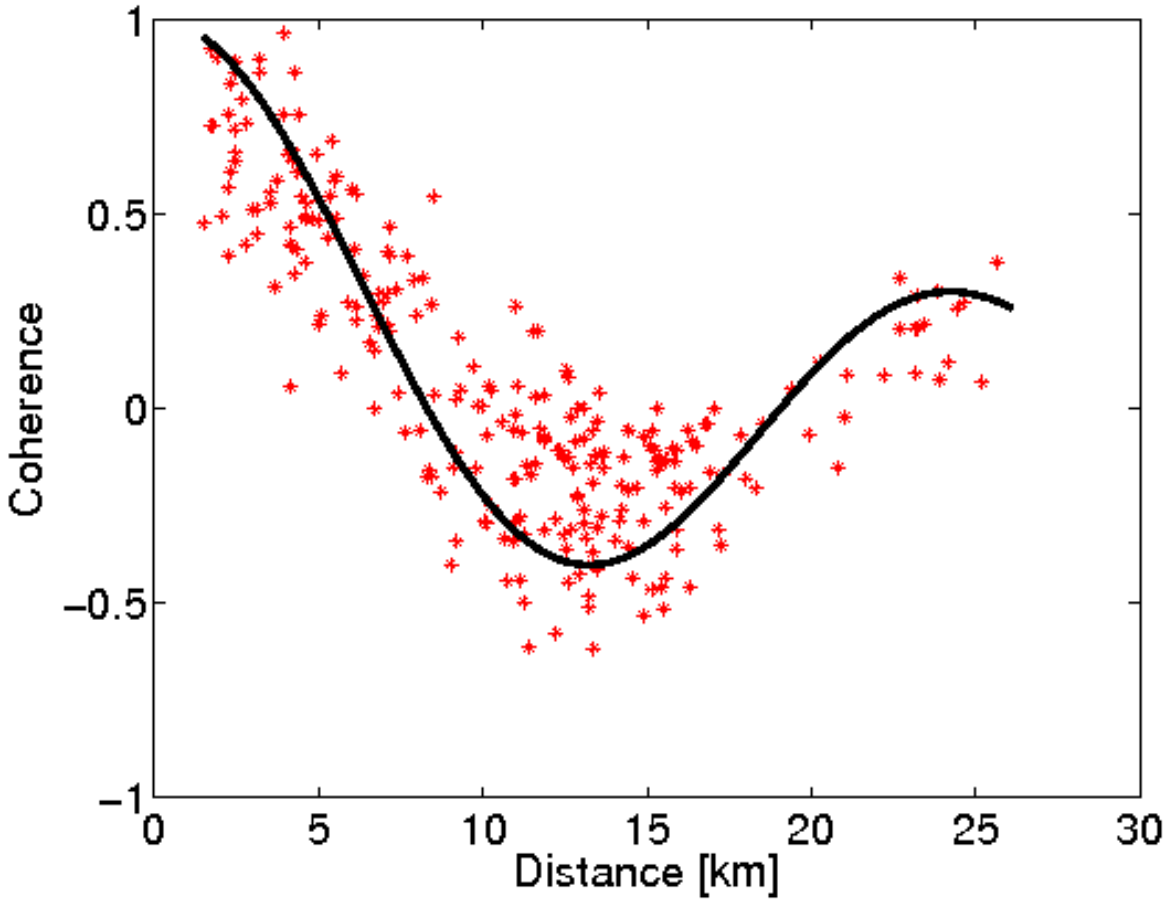
Coherence as a function of distance and elevation



(d) Coherence as a function of distance and elevation

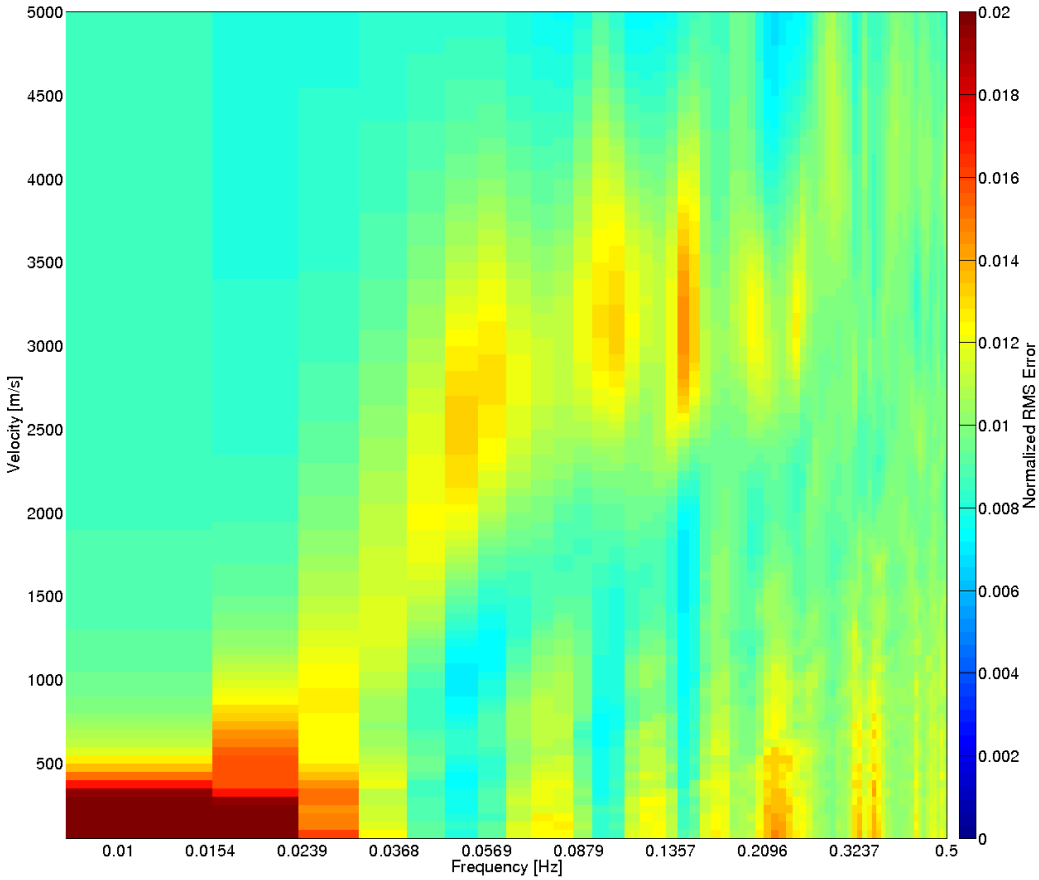


Coherence vs. Isotropic Rayleigh wave model

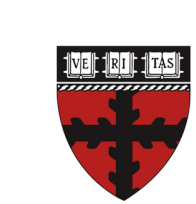


(e) Coherence vs. Isotropic Rayleigh wave model

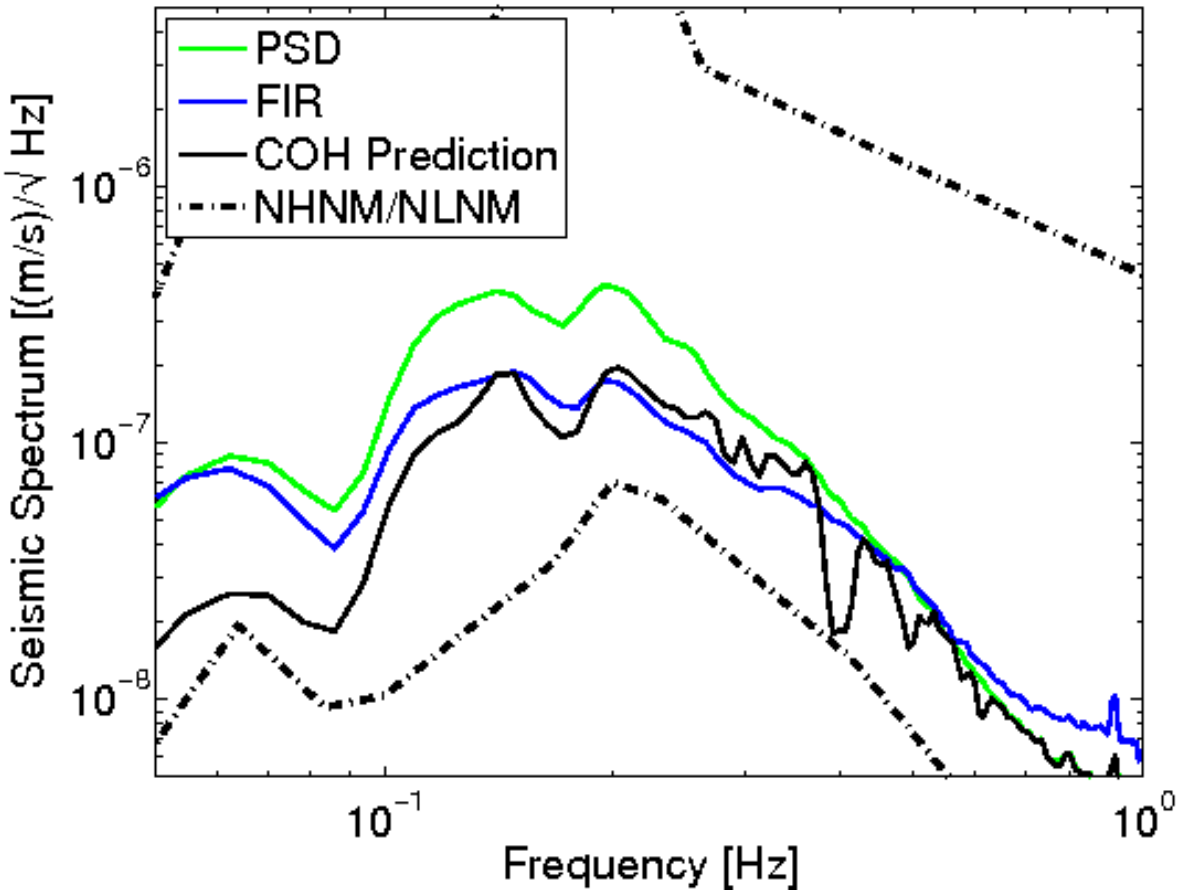
Velocity structure



(f) Velocity structure



Wiener Filtering



(g) Wiener filtering

Conclusions

1. The Sweetwater array covers a much wider aperture than that of the original Homestake array
2. We can use Sweetwater array to explore the effects of the assumptions of the original analysis
3. Coherence is loosely consistent with isotropic Rayleigh-wave field but there is significant scatter
4. Numerical issues seem to be limiting the efficacy of the Wiener filters