2015 Qadeemah Fault Survey and Supervirtual Inteferometry

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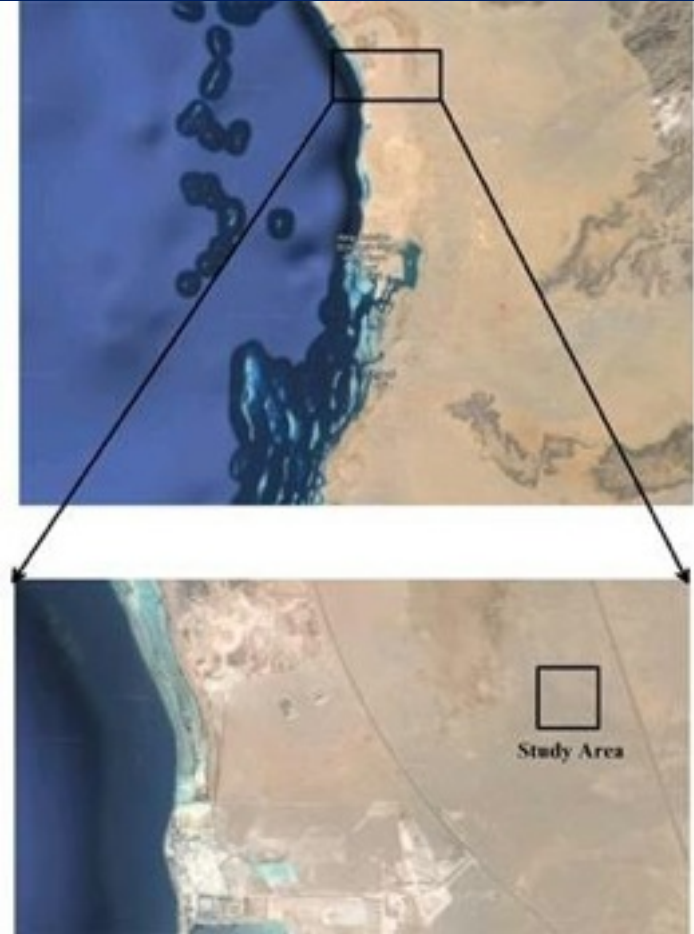
Outline

- Problem: Locating the Qadeemah Fault

- Survey Design: Location and Parameters

- Data Processing: Filtering and SVI

- Results and Interpretation: Pre/Post Proc. Results

- Conclusions and Limitations

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Problem

Location of Previous Survey

To accurately obtain fault parameters of the Qadeemah Fault through performing a near-surface, weight drop seismic survey at KAUST.

- Implications for regional EQ seismology
- Enables the usage of supervirtual interferometry algorithm on dataset

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Survey Design

Survey Length: 1200 meters
Geophone Spacing: 5 m   Time Sampling: 0.001 s
Total Stations: 240   Time Samples: 800(8 sec.)
Number of Shots: 240   Stack per Shot: 20

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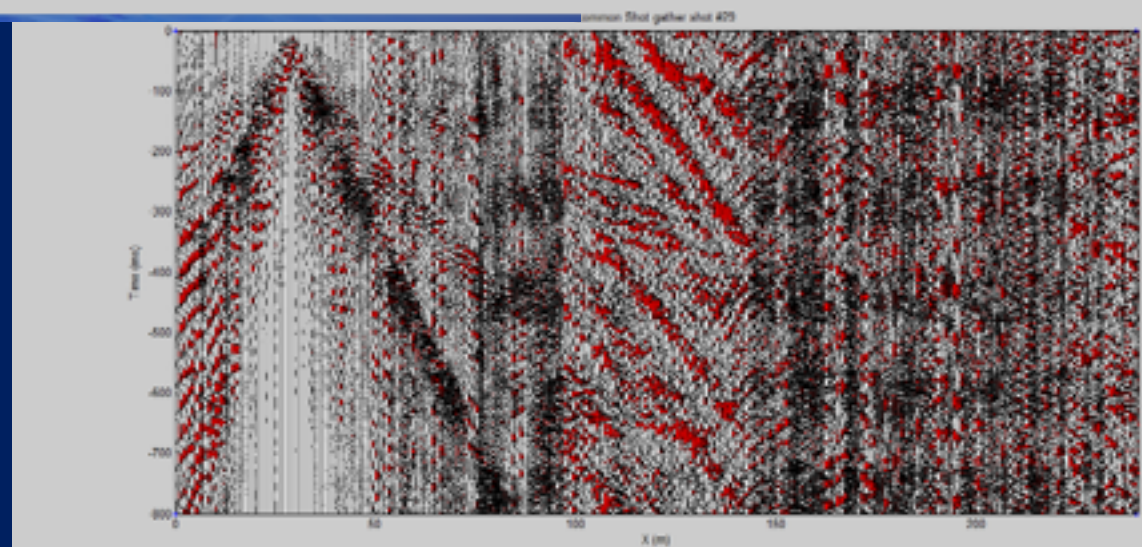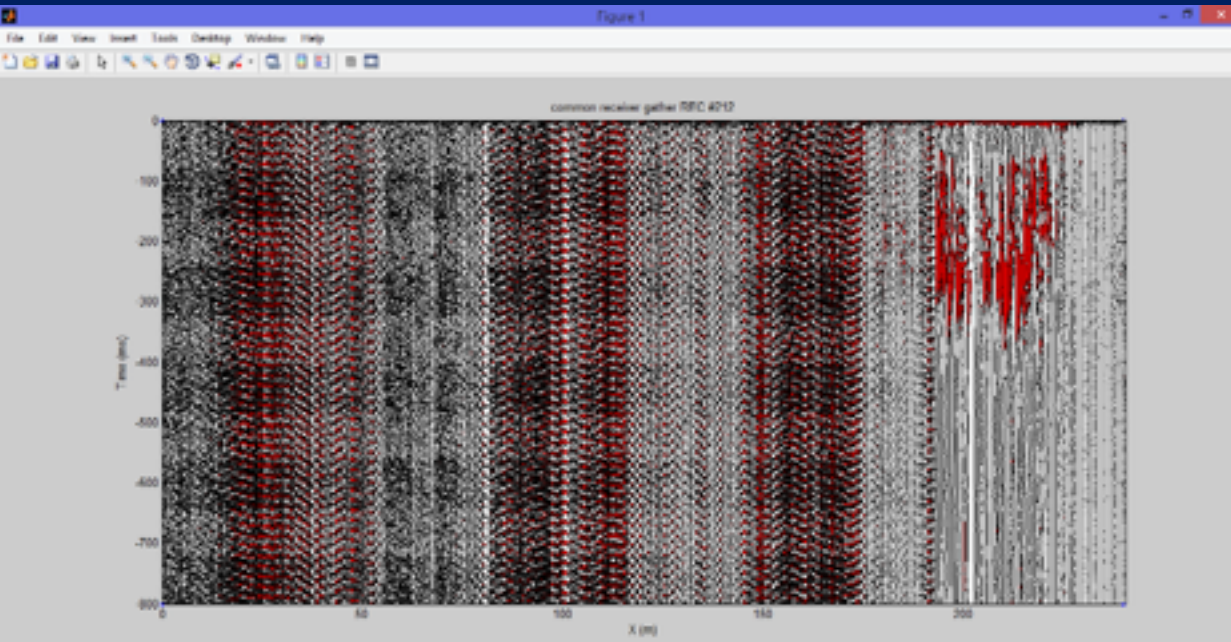# Data Processing - Noise

External Sources of Noise in the dataset:

- Survey located next to an active construction site
- Survey located next to an occasionally busy road
- High wind on most days
- Geophones #X-Y located on roadtop (stands)
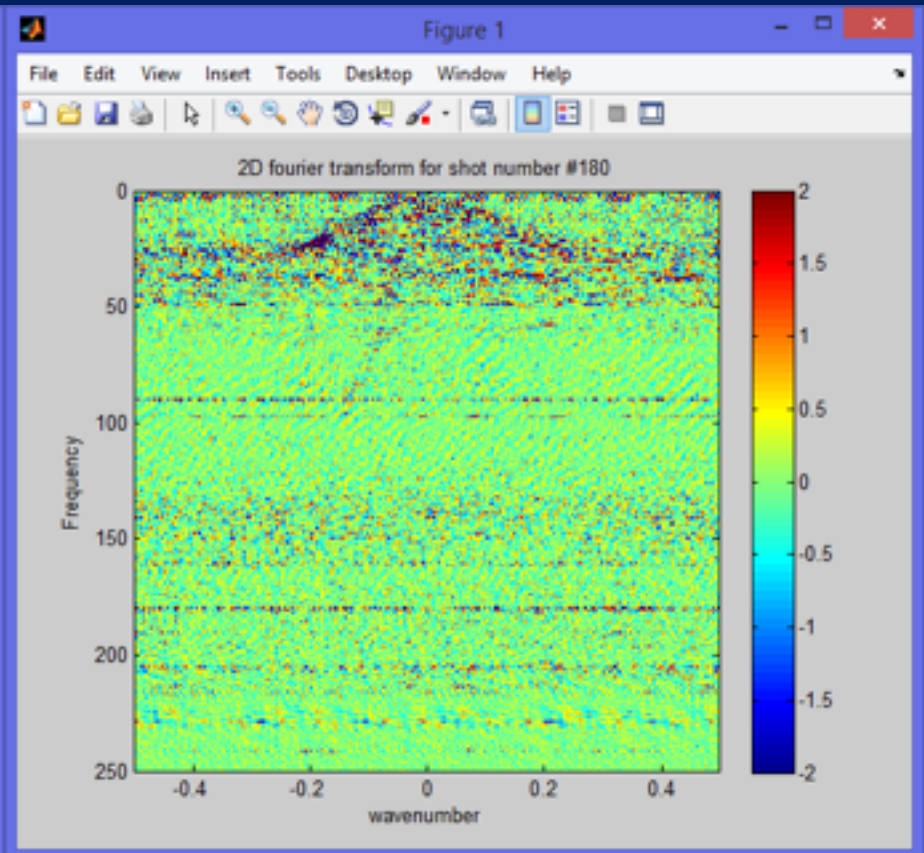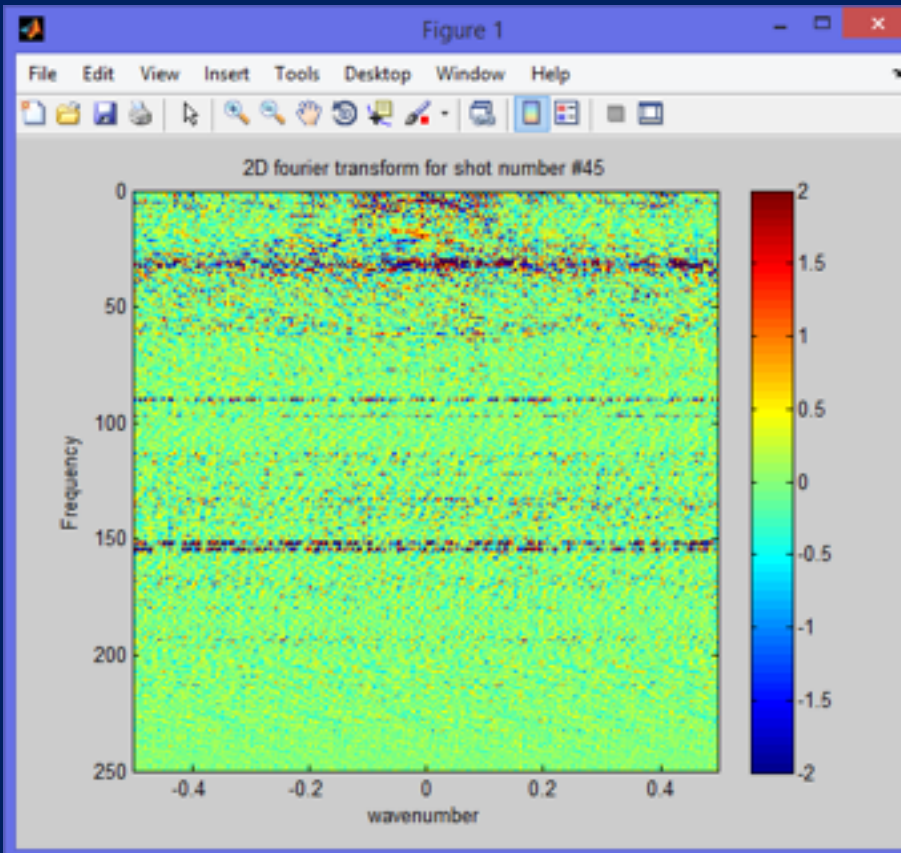
Errors in Survey Execution:

- Jerryrigged trigger mechanism on first survey day
- Broken and noisy geophones
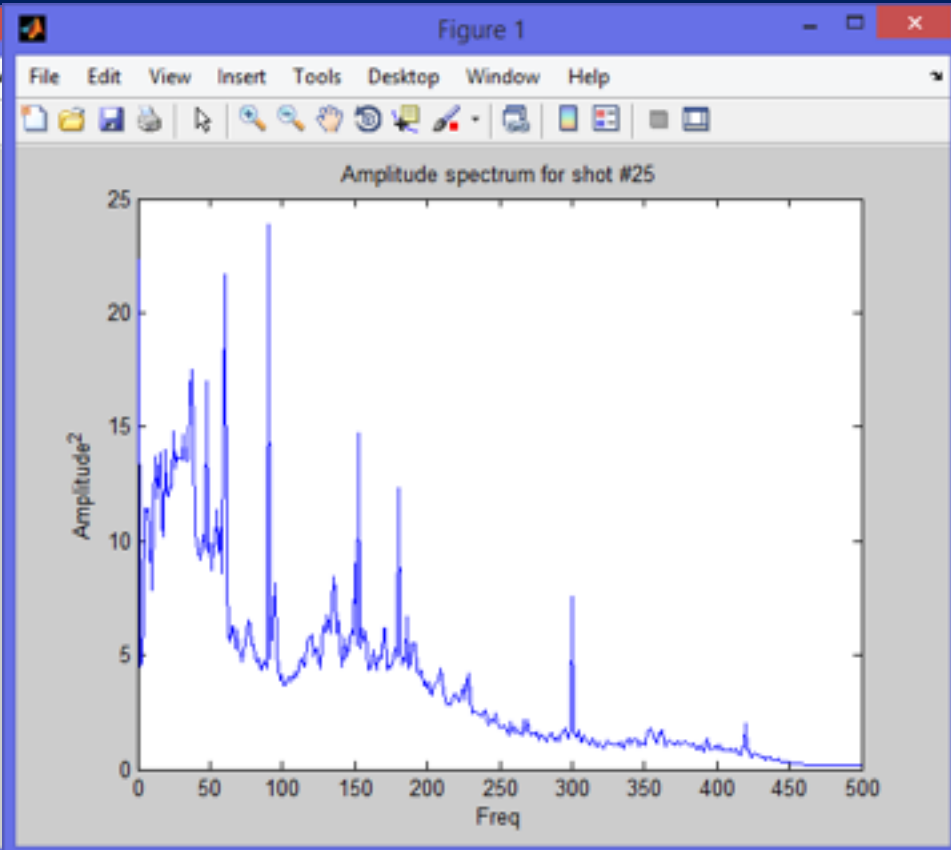- Weak source
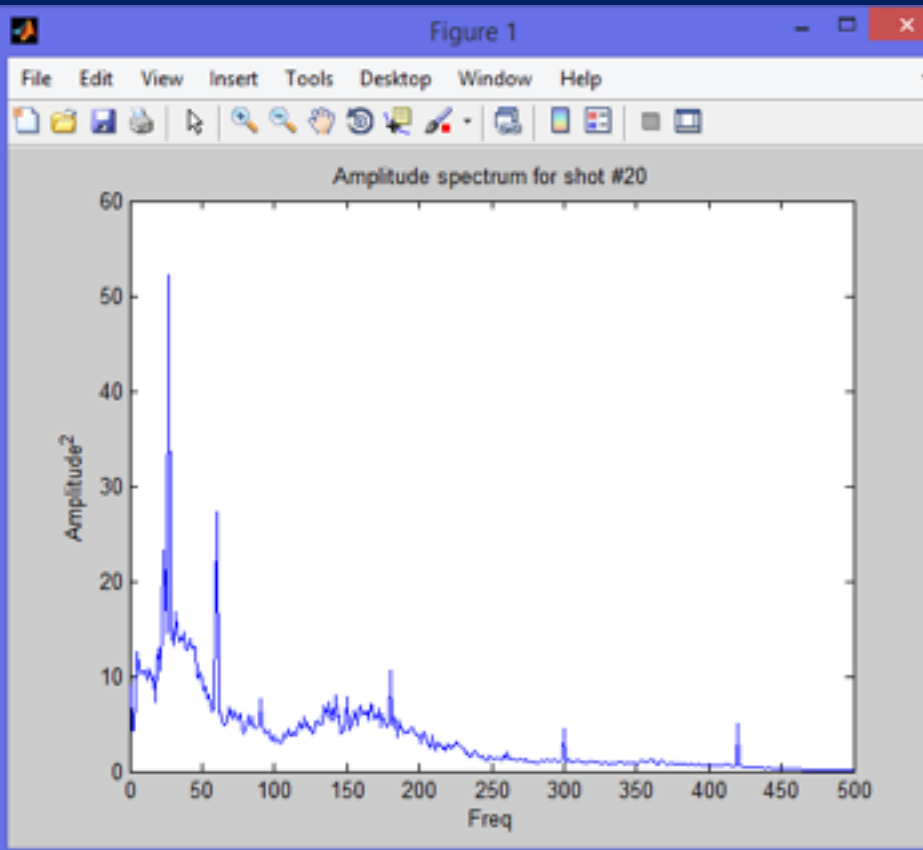- Insufficient stack for background noise level
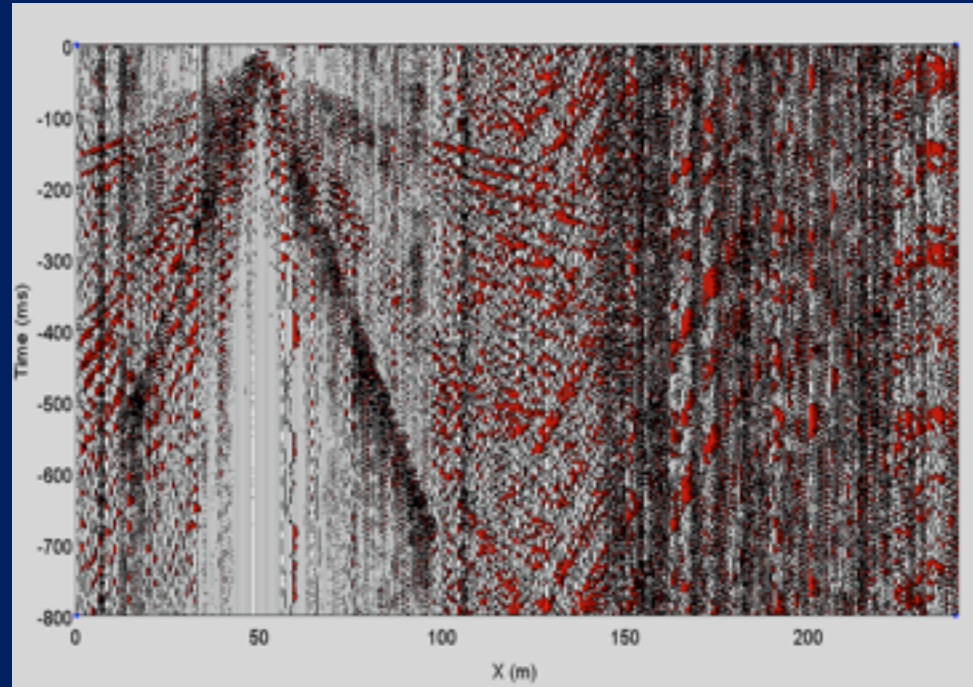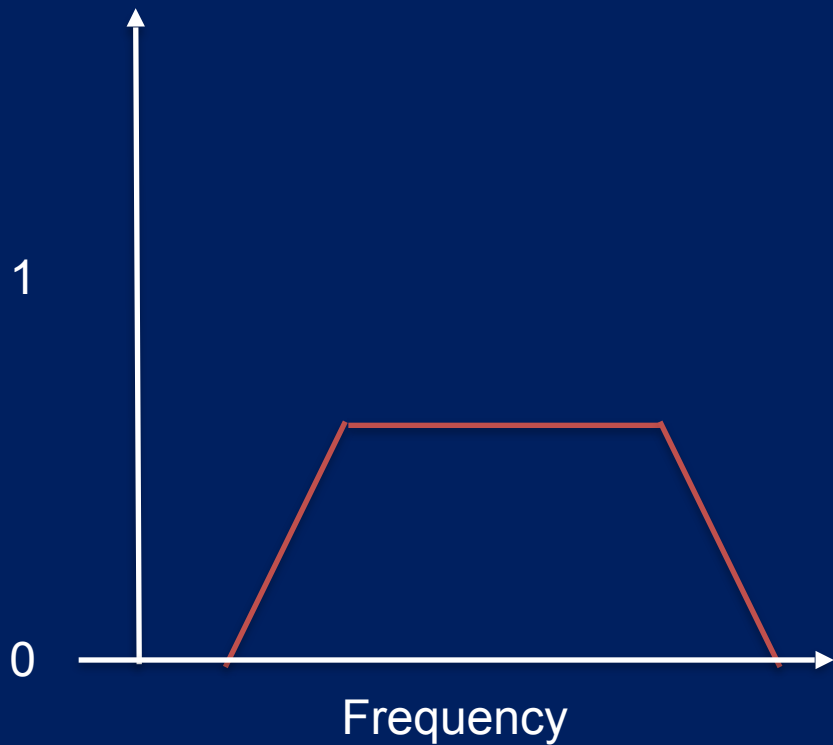
Data Processing - Noise

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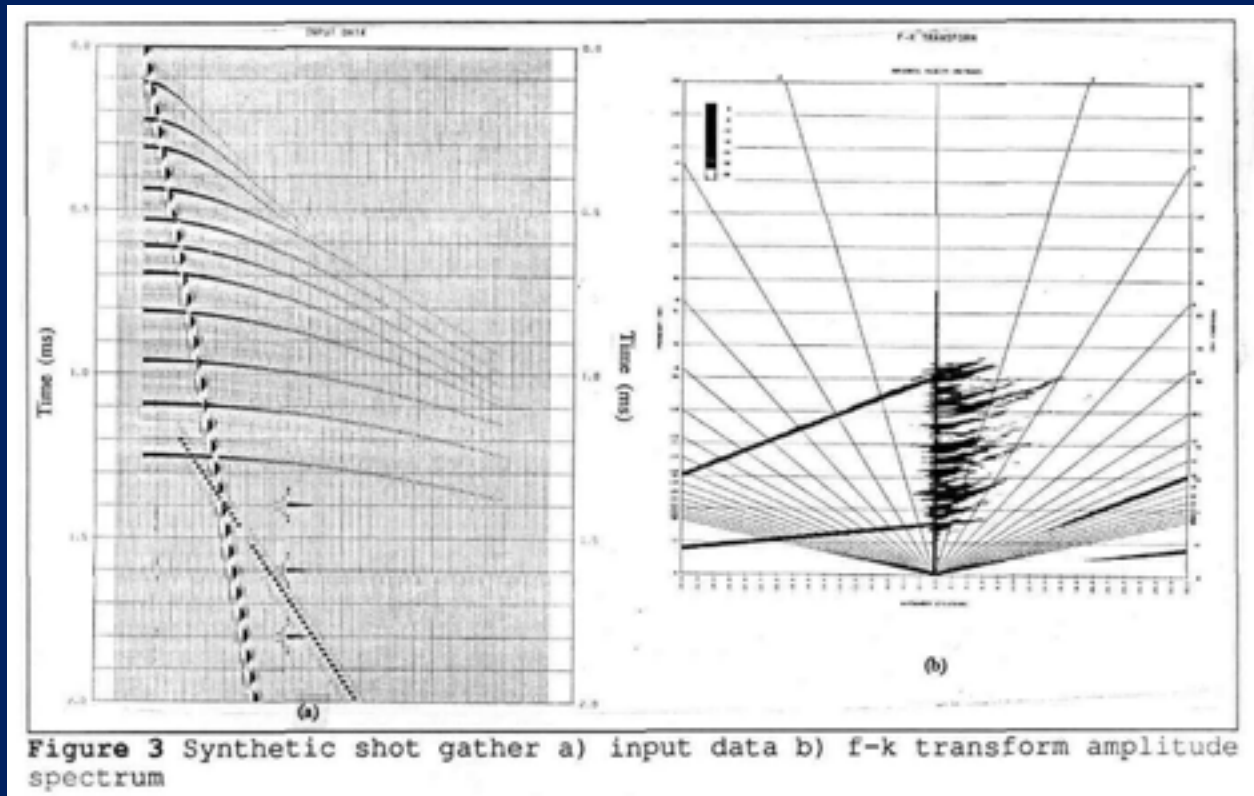
Data Processing - Noise

Data Processing – Bandpass Filtering

Simple bandpass filtering in the frequency domain to remove both high and low frequency noise in the dataset.

Data Processing – FK Filtering

Figure 3 Synthetic shot gather a) input data b) f-k transform amplitude spectrum

Removes noise spikes as well as attenuates the surface wave. Potentially useful in situation where one can only see near offset.

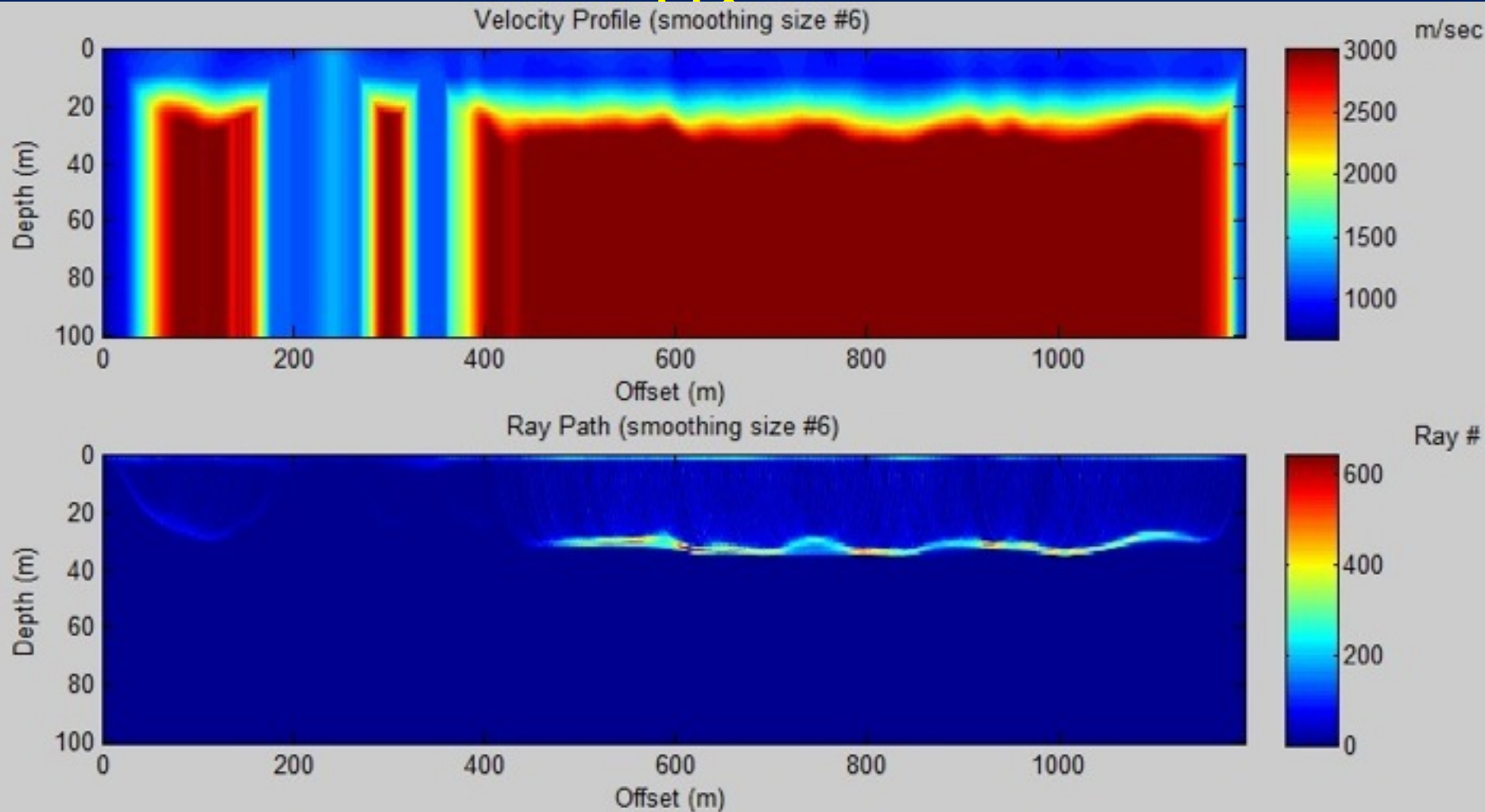# Data Proc. – Supervirtual Inteferometry

Data → Correlation → Convolution → Final Product

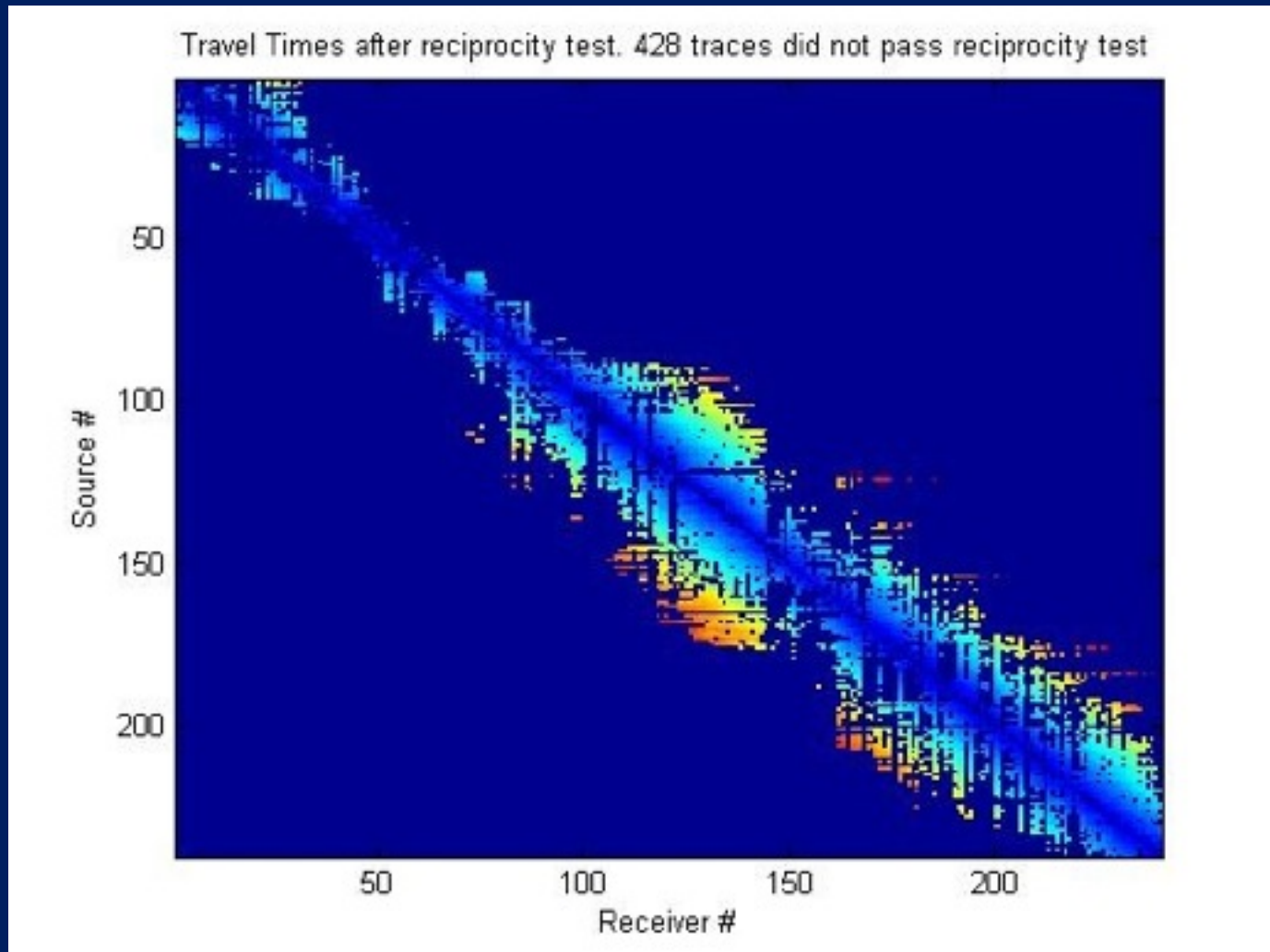Stack ↑ (to Correlation)

Stack ↑ (to Convolution)

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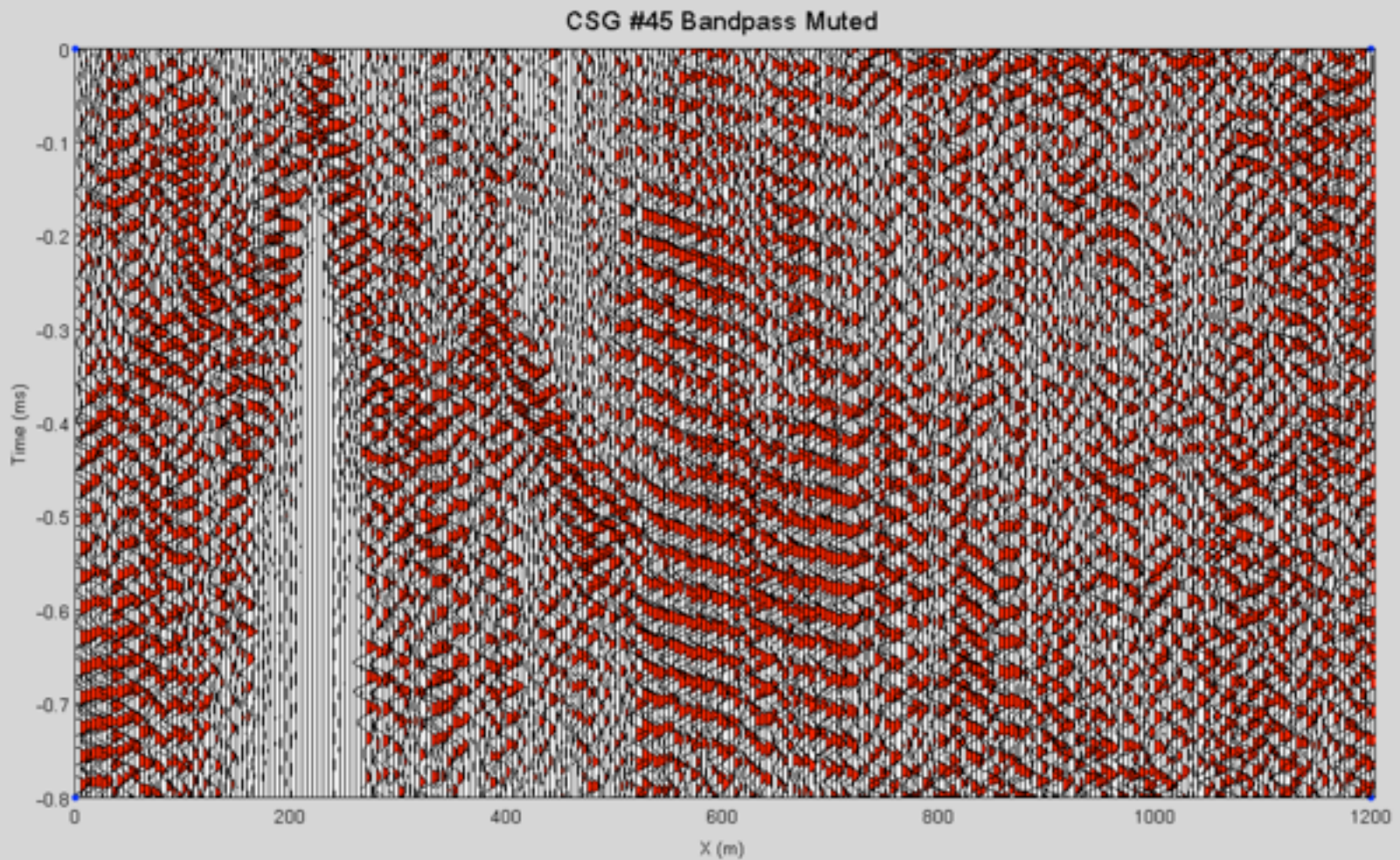- Conclusions and Limitations

Results – Raw Picks & Refraction

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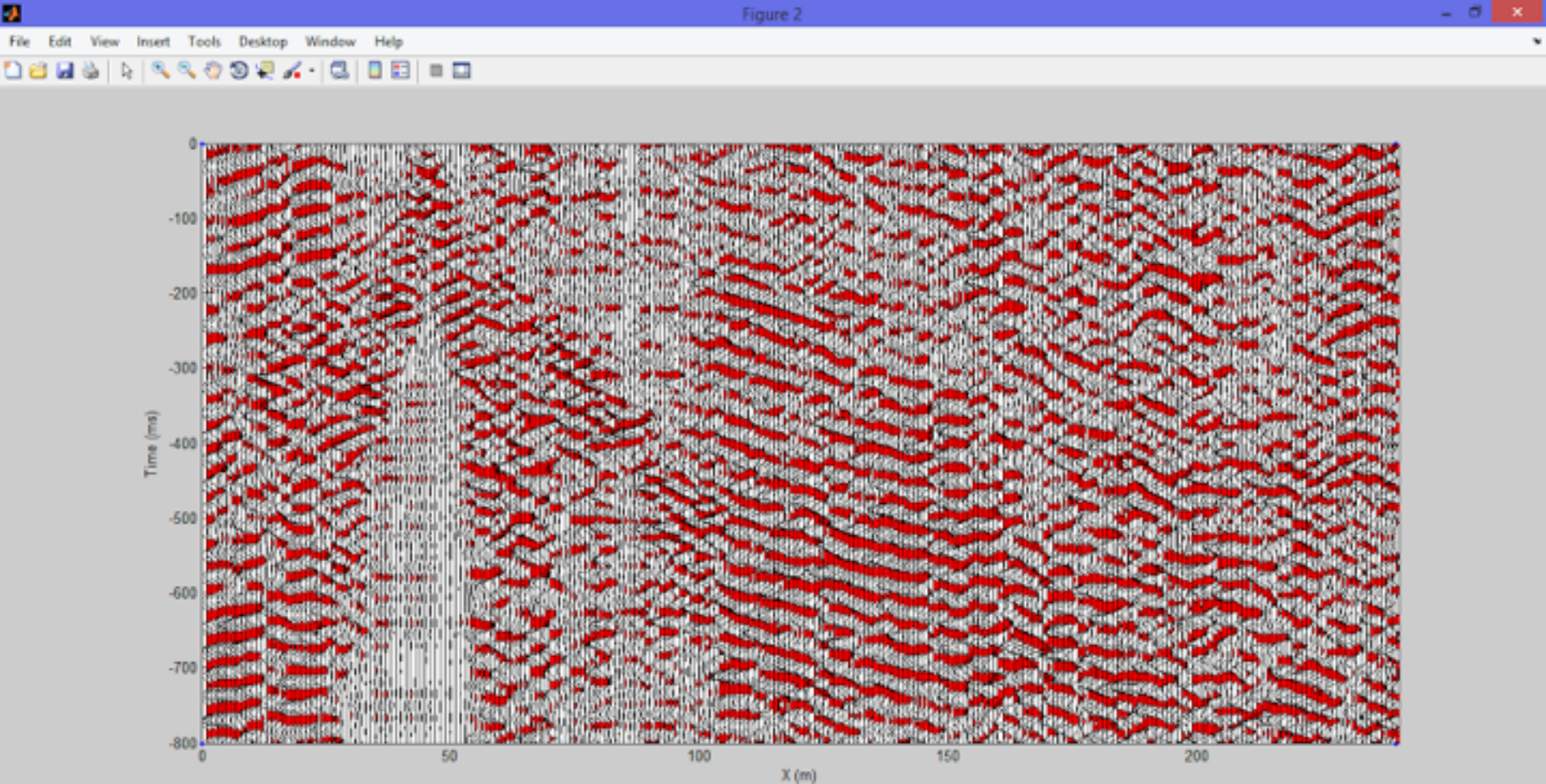

Travel Times after reciprocity test. 428 traces did not pass reciprocity test

Results – Bandpass Filtering
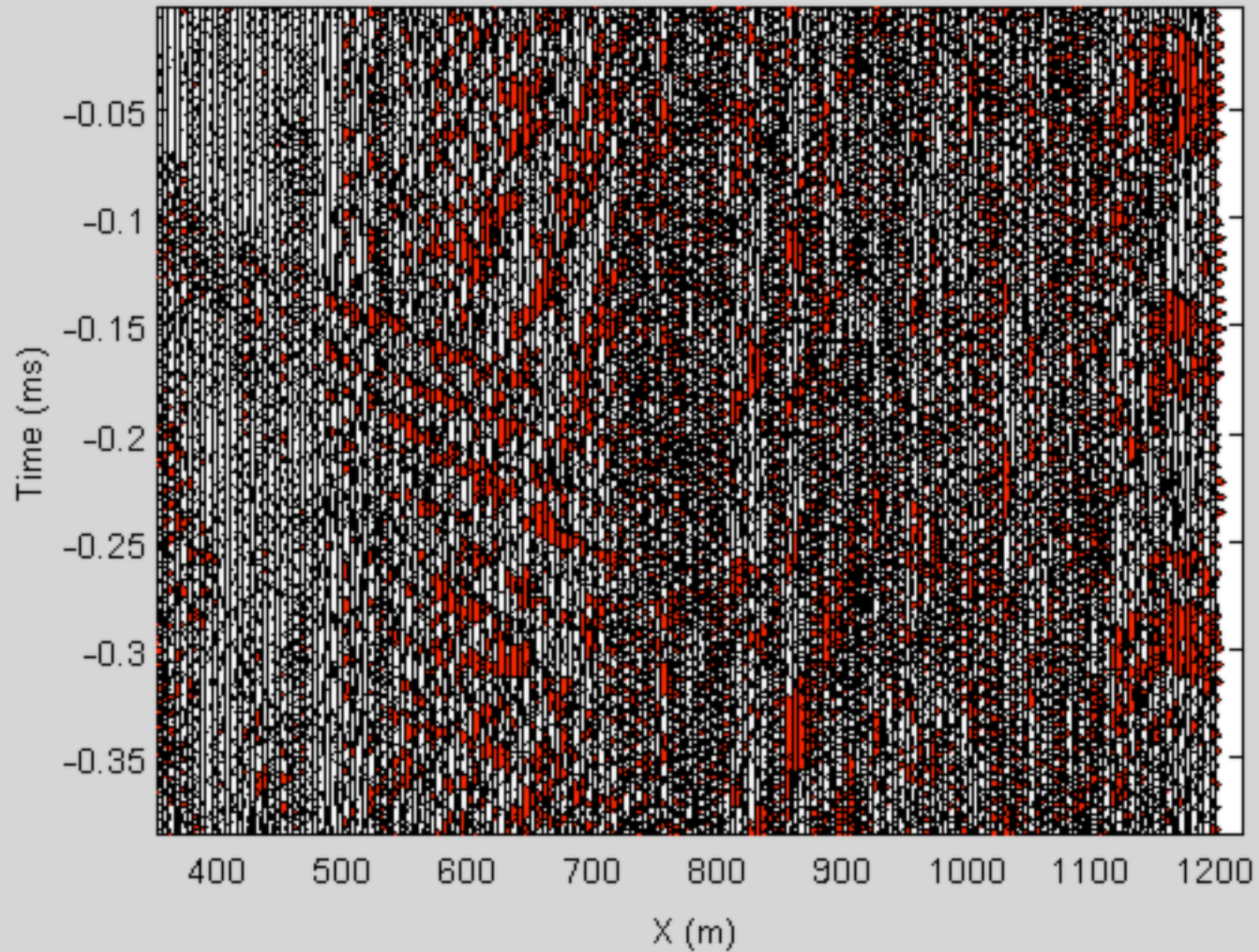

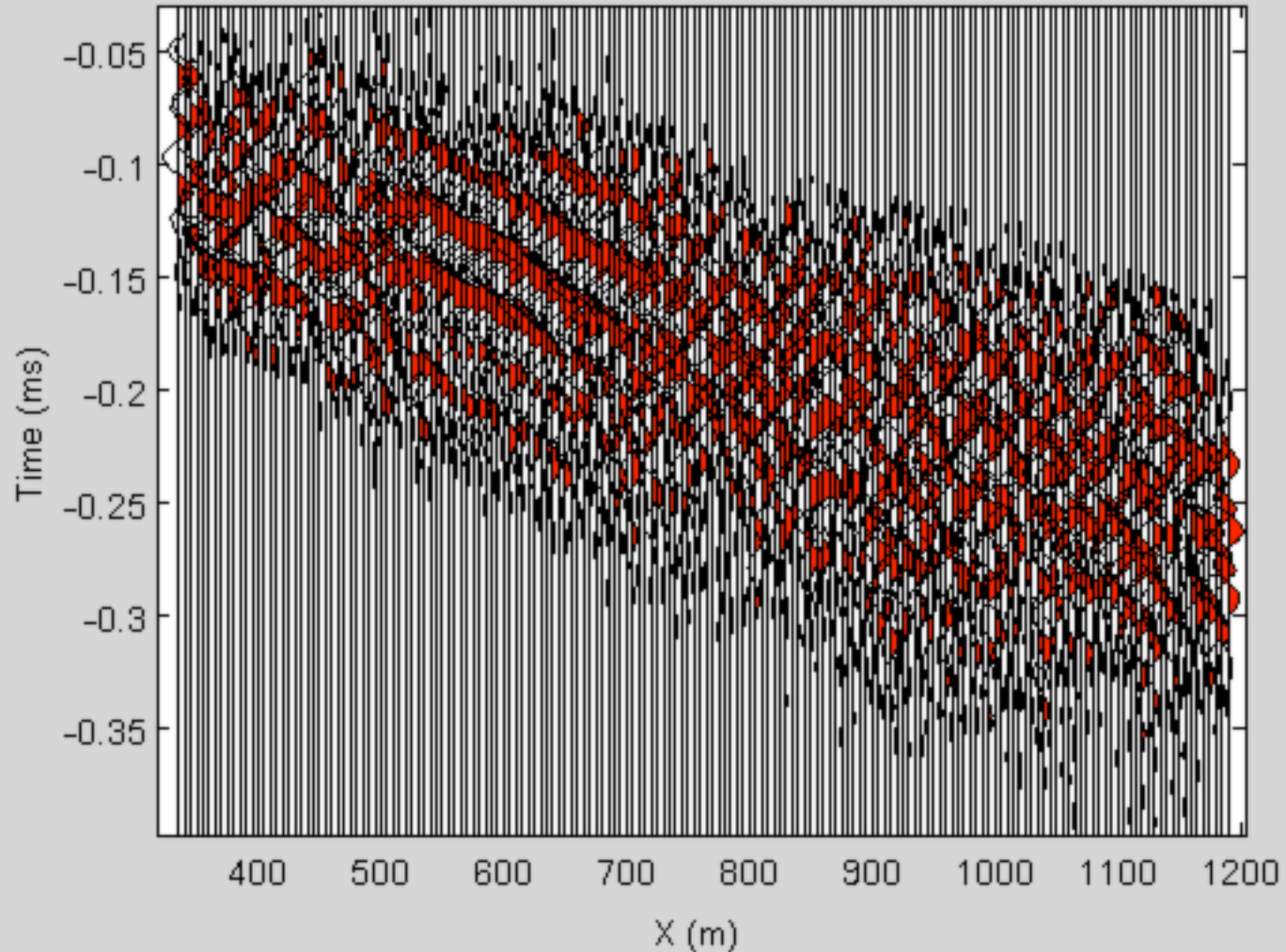CSG #45 Bandpass Muted

Results – FK Filtering

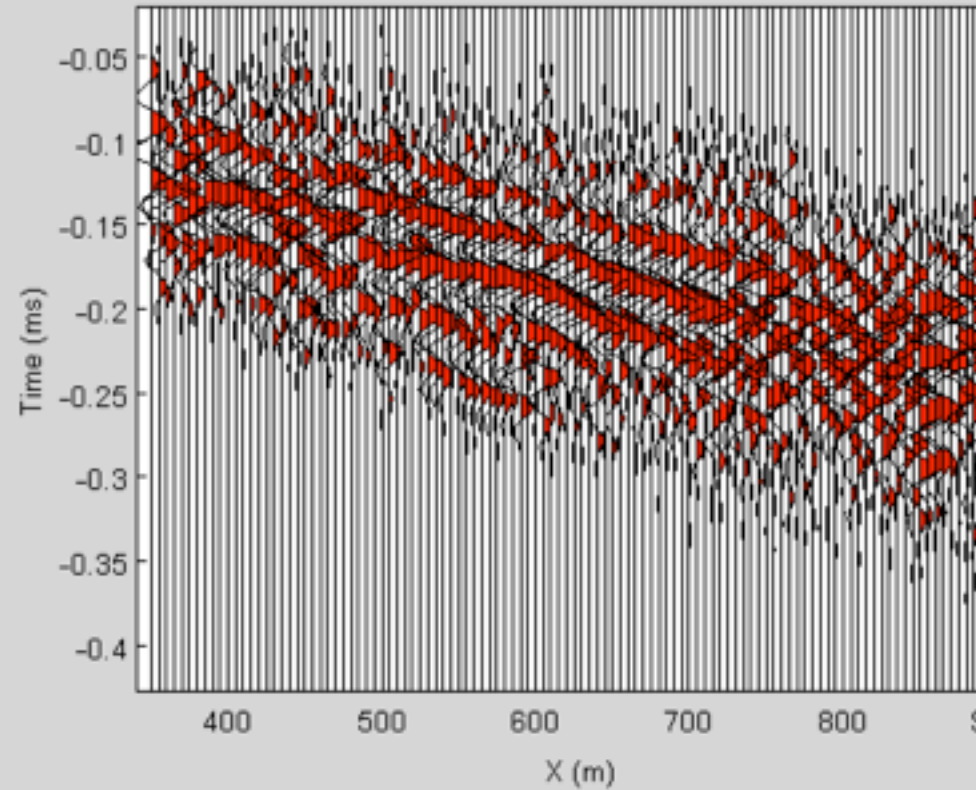# Results - SVI

Unfiltered, Shot #50
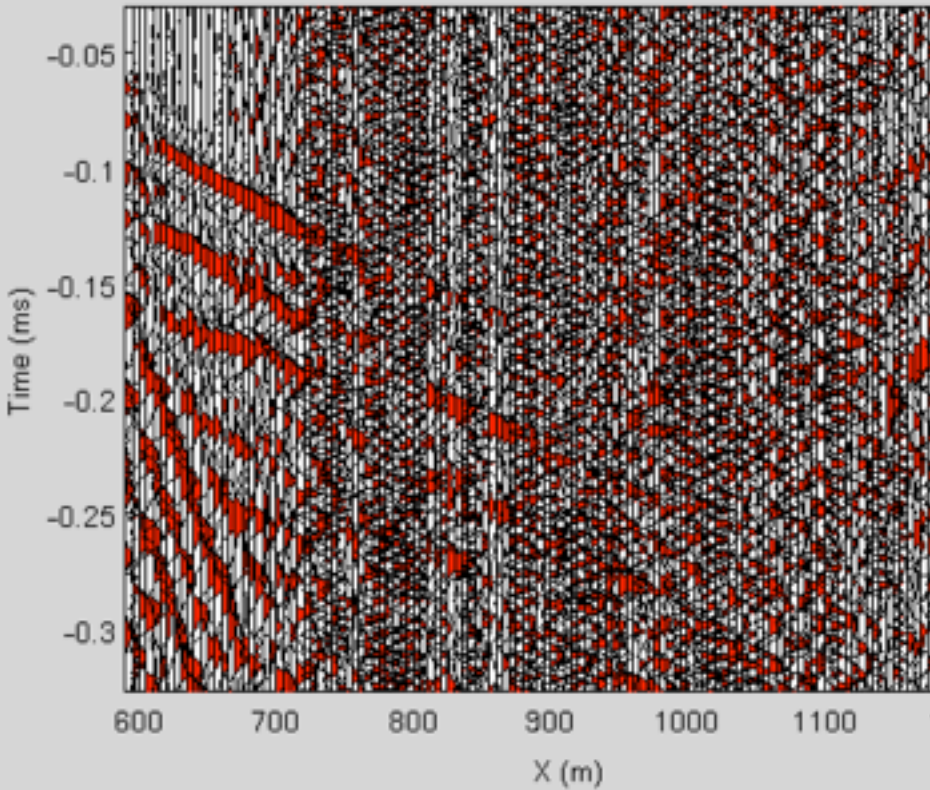
Results - SVI

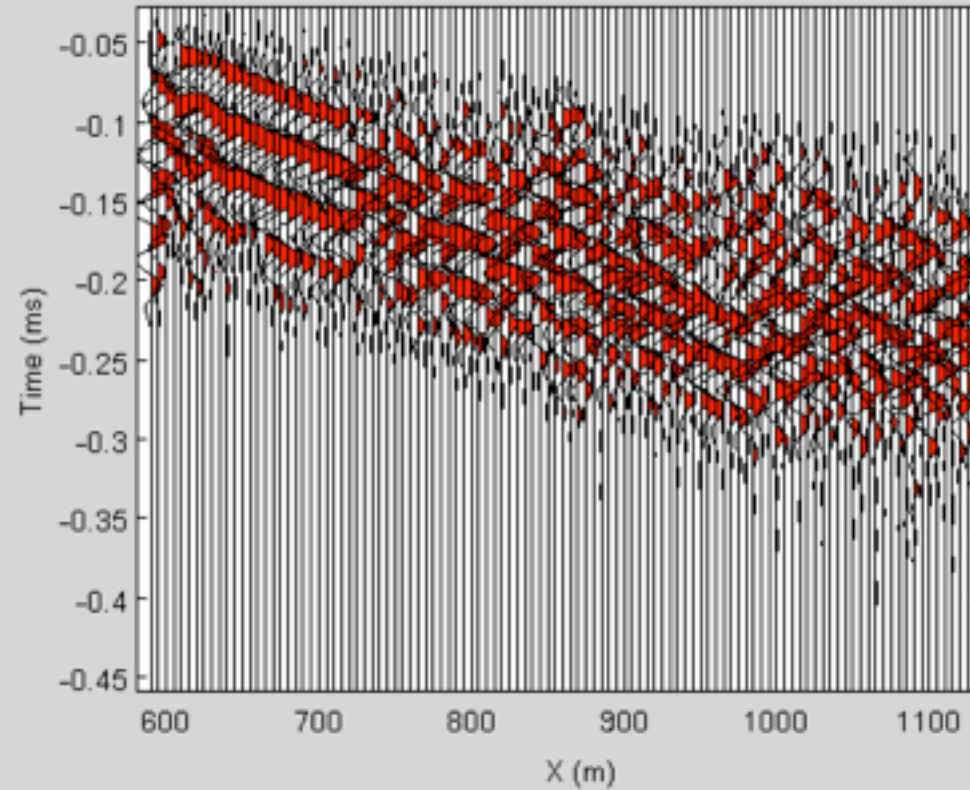SVI of BP, Muted shot #50

Results - SVI
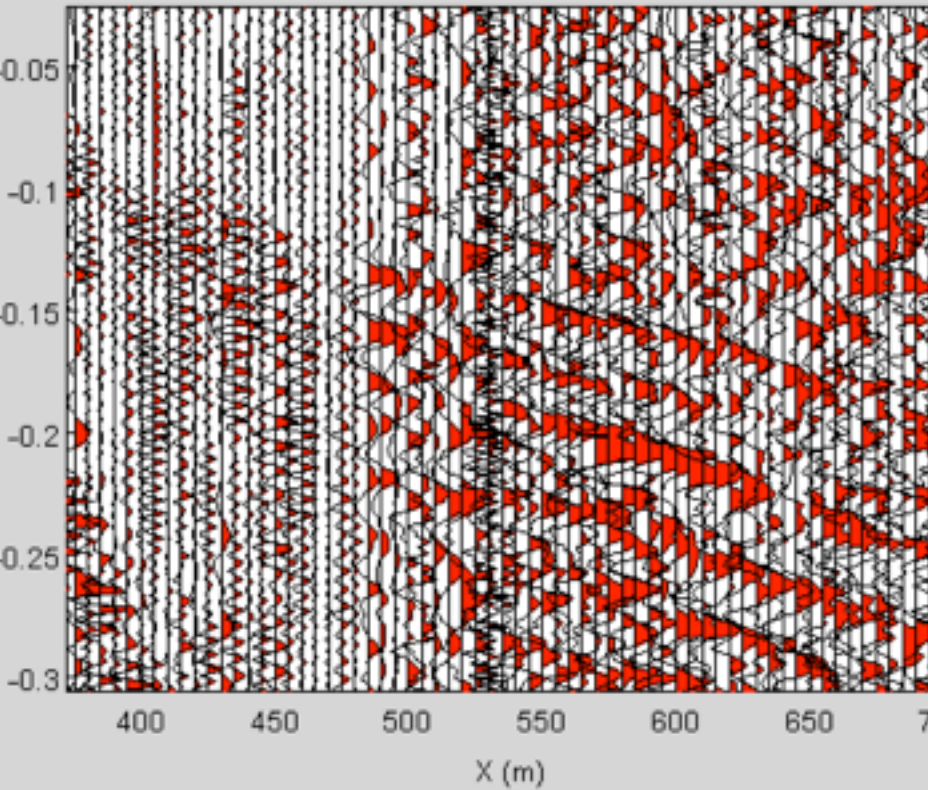
Results - SVI

Unfiltered, Shot #100

SVI, Shot #100

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Limitations of SVI and Filtering

•Need to have knowledge of where the refractors are before doing SVI. Doing an SVI on noise just makes more noise.

•With amount of noise we have in dataset (as well as the various sources), muting would have to be shot specific.

Conclusions

- While SVI and filtering have been proven effective on other datasets, in this situation they only marginally improve image quality.

- This dataset is beset by too many problems to prove useful in finding the Qadeemah Fault.

Questions?

Thank you