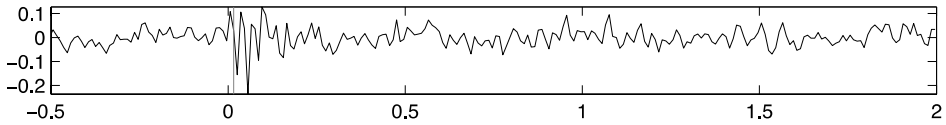
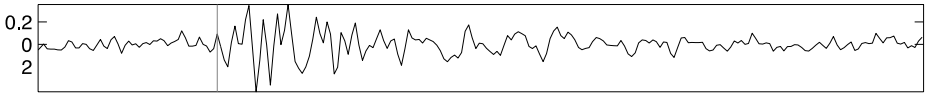
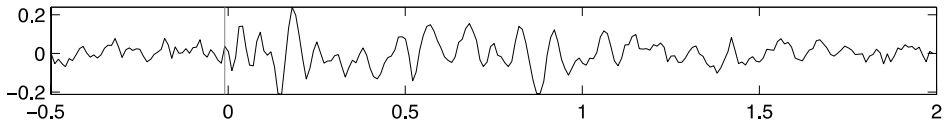
Supplementary Material

Microearthquake waveform examples. The observed signals range from nearly monochromatic to more complex waveshapes that could conceivably contain an *S*-wave arrival. Waveforms lacking potential S-wave arrivals are most representative of the catalog, describing ~90% of events. Here we show some example waveforms representative of the range observed in our data.

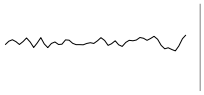
I. Event waveforms in which a secondary phase arrival is not evident







STIR−12:ELZ



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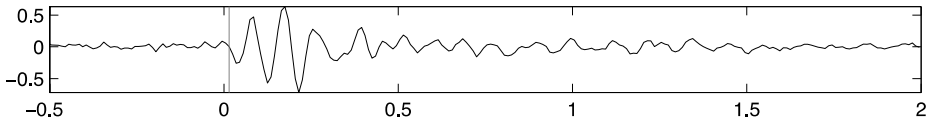

STIR−12:ELZ

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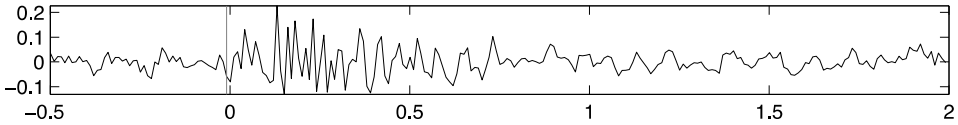

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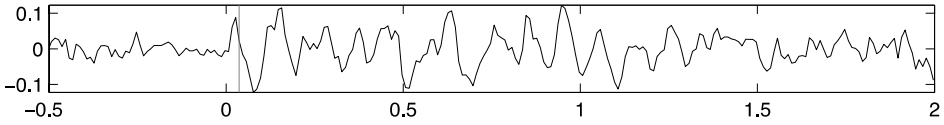

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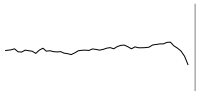

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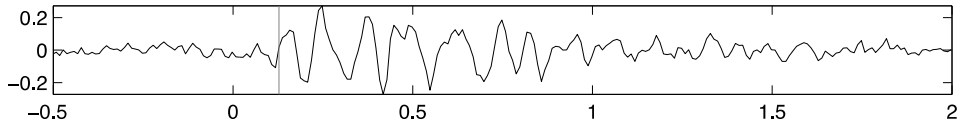

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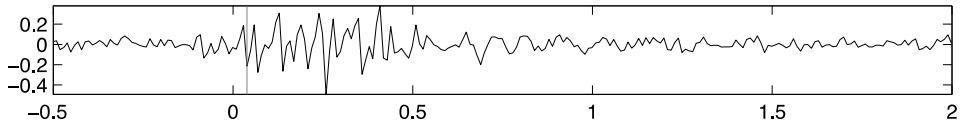

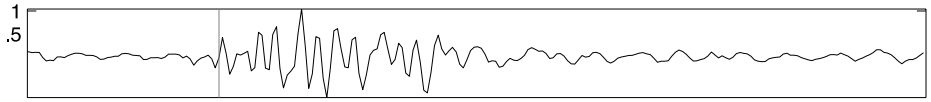

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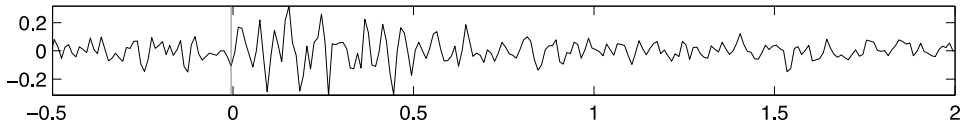

12:ELZ

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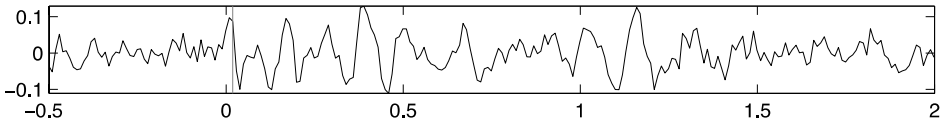

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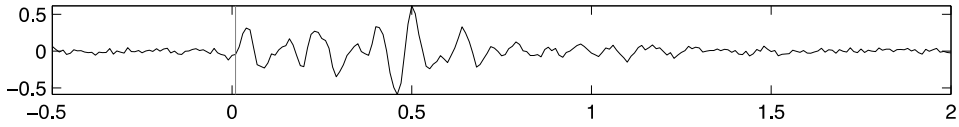

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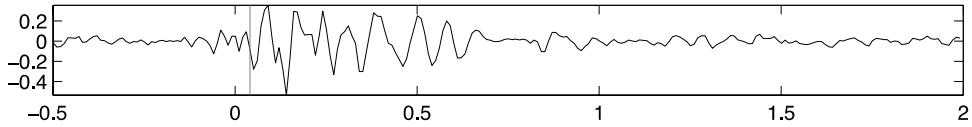
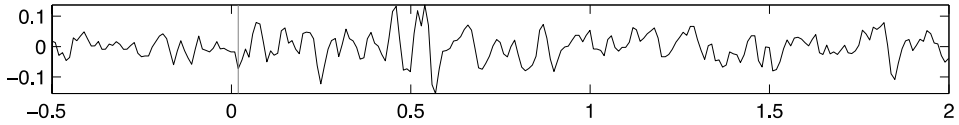
II. Event waveforms that could conceivably contain a S- wave arrival





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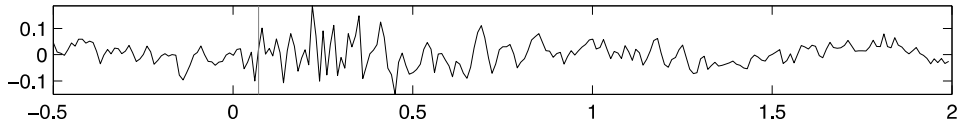

R−12:ELZ

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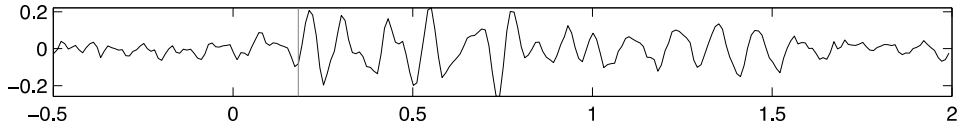

STIR−12:ELZ

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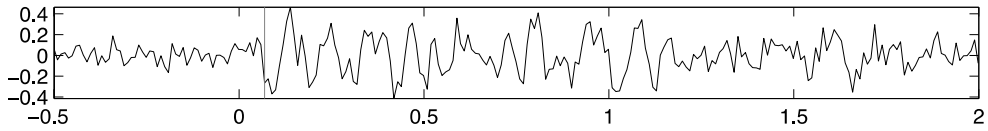
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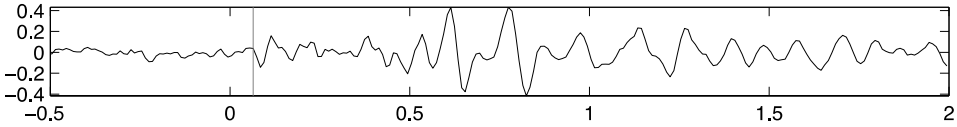
0.2
0
−0.2
−0.4
−0.5
0
0.5
1
1.5
2


STIR−12:ELZ

33


0.4
0.2
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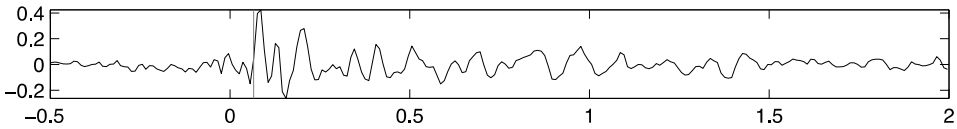
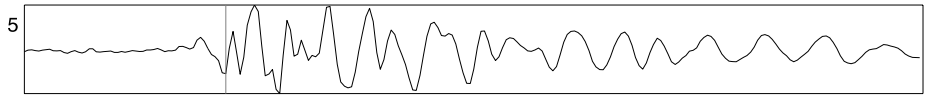
1
1.5
2


STIR−12:ELZ

34





III. Nonlinear clock drift on inner ring seismometers

Linear clock drift corrections were applied to data upon instrument recovery.

We cross correlate microseisms from each inner ring station pair in order to determine what nonlinear clock drift has not been removed from the seismic data. Microseisms are seismoacoustic waves excited by nonlinear interactions of ocean waves and are evident in the band from 0.1 to 5 Hz [*Webb*, 1992]. We assume that diffuse wavefields have non-directional sources. Data is band pass filtered and cross correlated in 10 minute windows randomly selected every hour within the 9 month catalog. Maximum time lag allowed is 5 sec. Windows with cross correlations higher than a threshold of 0.75 are assumed representative of clock drift between the stations. We fit a 4^{th} order polynomial to station lags with time.

Maximum nonlinear clock drift corrections applied are near 0.08 ms, which may have a significant effect on hypocenter location on the 200 m aperture ring network.

Station STIR-10 noise has very weak correlation with other inner ring stations. This may be due to the instrument- coupling effects. On a visual reconnaissance dive (Alvin Dive #), STIR-10 was observed to sit on hard lava pillows and did not appear well coupled to the seafloor. Poor coupling appears to have resulted in frequency-dependent damping of waveforms.