Temporal and Spectral Comparisons of Explosions recorded on Smartphones and Infrasound Microphones

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Introduction

A set of explosions were collected at Idaho National Laboratory (INL) to compare explosion signatures recorded on smartphones to those from a legacy B&K infrasound microphone.

Mission Relevance

Utilizing smartphones as a ubiquitous sensors network adding to the arsenal of non-proliferation monitoring.

Technical Approach

A smartphone (Samsung Galaxy S22) using the RedVox application along with a B&K infrasound microphone was used to record an explosion 860 m from the source.

The acoustic waveforms are compared in time, frequency, and time-frequency domains using Welch’s method, the Short Time Fourier Transform (STFT), and the Stockwell Transform (ST).

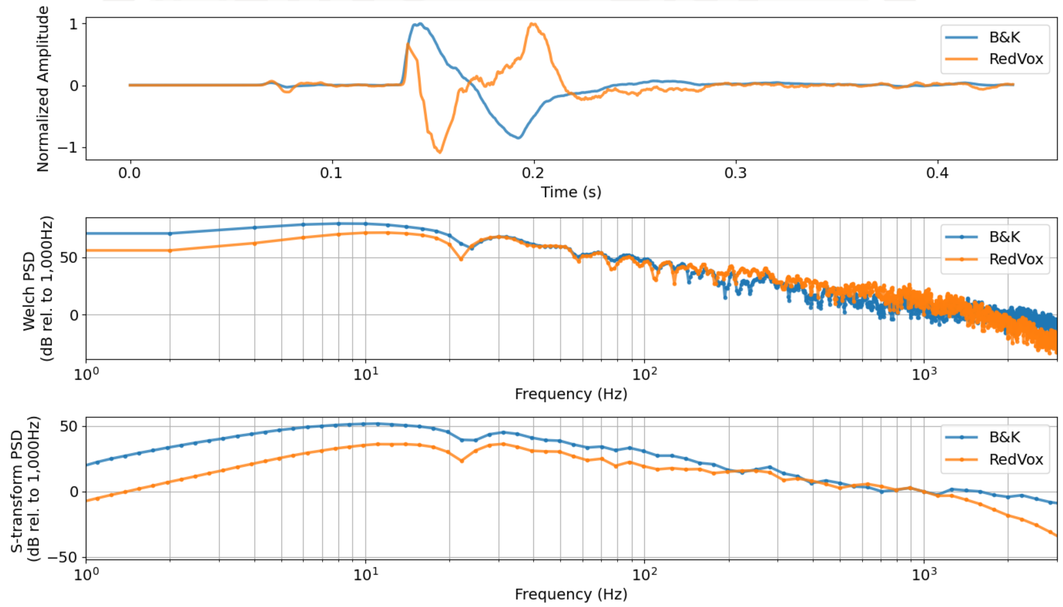
SCAN ME

Results

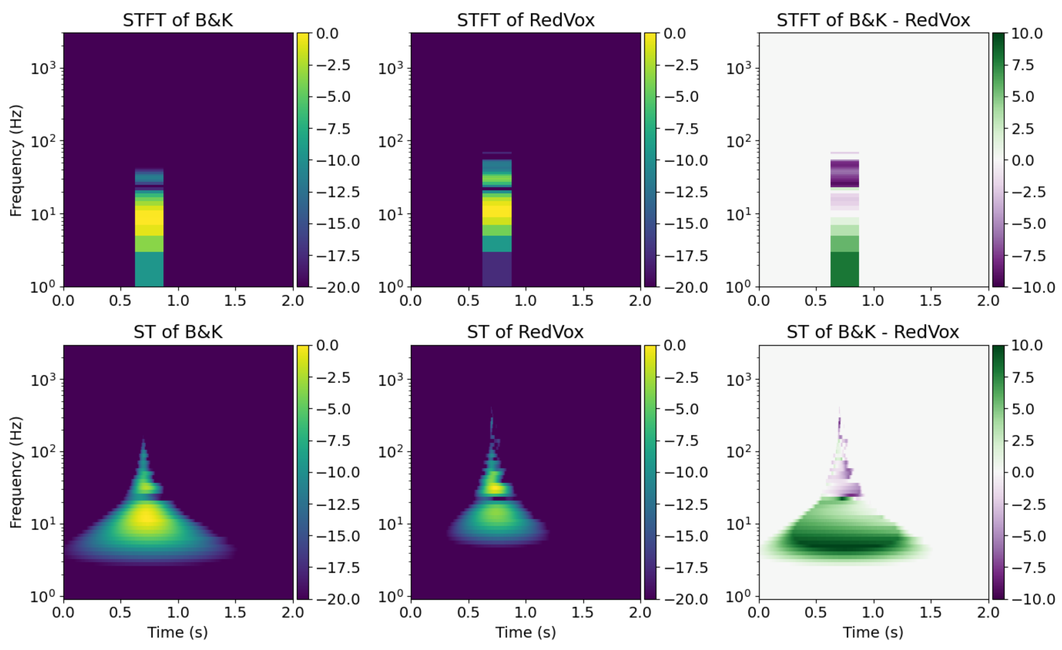
Fuel Air Explosive (FAE): Effective Yield of 12.7 kg

Welch’s method & STFT: window size of 0.5 s with 50% overlap

Aggregated ST & ST: constructed with 1/6 octave bands.



Time Frequency Representations (dB relative to maximum)



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MTV Impact

The data collection and research was conducted in collaboration with INL during a Summer 2022 internship.

The methods will be applied to the smartphone explosion dataset collected in partnership with INL and NNSS.

Expected Impact

The methods will used as a baseline comparison of smartphone sensors to legacy infrasound sensors.

Conclusion

The acoustic waveforms collected on smartphones are essentially high passed.

The similarities in the time frequency domain are promising for explosion analysis using cross correlation.

Next Steps

Continued explosion data collection with INL and NNSS.

A paper focusing on the FAE is in progress.

National Nuclear Security Administration