ID: **P3.5-348** Type: **E-poster**

Testing a Paired Neural Network to Characterize Aftershock Sequences

Thursday, June 22, 2023 9:18 AM (1 minute)

Large earthquakes and aftershock sequences substantially increase the burden of those who monitor seismic data for anthropogenic events. Fortunately, most aftershocks exhibit high degrees of similarity between their waveforms, making them well suited for detection and identification through waveform cross-correlation techniques. Such techniques pose some challenges, however, such as building and maintaining template libraries. To mitigate this, we test the effectiveness of using deep learning to detect and characterize aftershocks by training several paired neural networks (PNN) using different training datasets. The first PNN models we test are built with seismic data constructed by adding high SNR, real signals with real background noise at various amplitudes; we also include some overlapping event signals and apply different filters to the constructed waveforms to make our training datasets more realistic. These models, based on constructed data, are then tested with data from two real aftershock sequences in Chile and Nepal that were built in a prior cross-correlation study and then validated by an expert analyst. We will investigate the viability and limitations of this method by exploring model transportability to other geographic regions, further tuning existing models, and training new models using real events.

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Promotional text

The work presented here explores the applicability of a deep learning technique to rapidly characterize aftershocks, with the goal of reducing analyst workload.

Oral preference format

in-person

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Session Classification: Lightning talks: P3.5, P5.1

Track Classification: Theme 3. Monitoring and On-Site Inspection Technologies and Techniques: T3.5 Analysis of Seismic, Hydroacoustic and Infrasound Monitoring Data