On the Feasibility of Long-term Seismic Monitoring Using Freight Train Signals

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Recent studies (Brenguier et al., 2019; Pinzon-Rincon et al., 2020) have successfully retrieved body waves between seismic arrays through the correlations of train-generated seismic signals. It remains uncertain whether these train-derived body waves are suitable for long-term seismic monitoring, which requires repeatable measurements over the years. This study tests the feasibility of obtaining stable body waves between individual broadband stations, using freight trains as noise sources. We use stations close to the railroad as markers to identify trains and pinpoint their potential locations. We select proper station pairs and perform seismic interferometry, focusing on the time windows when trains are detected. We test our workflow in southern California, with the freight trains running through the Coachella Valley. We successfully retrieve stable body-wave signals over ten years. We perform a weekly stacking to improve the signal-to-noise ratio and estimate the relative time shift. Our preliminary time-shift measurements reveal a systematic long-term increasing trend for station pairs locating on two sides of the San Jacinto fault. The next step is to examine the results statistically to reduce the bias introduced by moving sources. Despite that the long-term trend still needs further study, our experiment demonstrates that it is possible to perform long-term seismic monitoring using train generated seismic signals.