Enhancement of body wave signals in the coda of seismic noise interferometry through random fluctuation suppression

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Abstract

The seismic interferometry function based on a finite amount of data contains predictable random errors in the direct surface wave and coda (e.g. *Liu & Beroza* 2018). These random fluctuations in the coda can hide the true signals, whether they are scattered surface wave or body wave phases. We present an optimization algorithm that squeezes the random fluctuations in the coda of noise cross-correlation by combining measured statistics of the noise cross-correlations (*Liu et al.*, 2016). We perform synthetic tests that embed wavelet signals in the coda of simulated noise cross-correlations that contain only random fluctuations and no scattered waves. Our results show that we can recover the wavelet signals if the signal amplitude is comparable to the standard deviation of the random fluctuation in the coda. We apply this optimization algorithm to continuous waveform data recorded on broadband stations in southern California as part of the linear LASSIE array that stretched across the Los Angeles Basin. We compare our results with the 1D seismic response of the AK135 Earth model, and find phases that correspond I arrival time to the body wave phases P410P and P660P. Spurious arrivals due to non-diffuse noise sources can be separated based on multiple-component cross-correlations (*Liu et al*. 2018). This method only requires one pair of stations and increases the applicability of seismic interferometry to imaging the deep interior of the earth.