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Data-adaptive filtering of seismic noise correlations

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Recent years have seen many studies using the cross-correlations of noise records at two seismic stations to reconstruct the elastic Green's function between them. These signals tend to be dominated be the fundamental mode Love and Rayleigh waves while the higher-order modes are often hidden beneath the incoherent noise level. Consequently, deeper structures undetected by the fundamental modes will not be constrained unless these higher modes can be identified. To extract just the fundamental mode usually entails cross-correlating data one day at a time and then stacking day-by-day over a period of months to sufficiently augment the signal to noise ratio. While it might be possible to reveal higher modes by stacking years of data in the same way, we turn to a data-adaptive filtering technique involving the S-transform time-frequency representations of these correlations to unveil these subdominant arrivals. Furthermore, the coherence of these signals across station pairs in close proximity allows for confident identification of these phases.