Retrieving surface waves from ambient seismic noise observations using multi-dimensional deconvolution

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Retrieving virtual-source surface waves from ambient seismic noise observations by crosscorrelation relies on the assumption that the noise field is equipartitioned. Deviations from equipartition reduce the accuracy of the retrieved waves. A point-spread function, derived from the ambient noise, quantifies the virtual source's spatial and temporal smearing. Multidimensional deconvolution (MDD) of the retrieved surface waves by this function has been shown to improve the focusing of the virtual source and the accuracy of the retrieved waves.

We tested MDD on data recorded during the Batholiths experiment, a passive deployment of broadband seismic sensors in British Columbia, Canada. The array consisted of two approximately linear station lines, the north and south lines. Using four months of recordings - bandpass filtered between 0.05 and 0.3 Hz - we retrieved fundamental-mode Rayleigh waves. For MDD, only noise time windows dominated by waves that traverse the northern line before reaching the southern were used. For the crosscorrelation method, all noise was used. MDD results show a reduction of artifacts in the surface-wave responses. For both methods, average phase velocities can be estimated successfully from the retrieved waveforms. However, those estimated from the crosscorrelation results deteriorate if the same data is used as for MDD.