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## Wavefield reconstruction inversion for ambient seismic noise

**Sjoerd A.L. de Ridder**<sup>1</sup>, James R. Maddison<sup>2</sup>, Ali Shaiban<sup>3</sup>, and Andrew Curtis<sup>3</sup>

<sup>1</sup>School of Earth and Environmental Sciences, University of Leeds, United Kingdom

<sup>2</sup>School of Mathematics, University of Edinburgh, United Kingdom

<sup>3</sup>School of GeoSciences, University of Edinburgh, United Kingdom

With the advent of large and dense seismic arrays, there is an opportunity for novel inversion methods that exploit the information captured by stations in close proximity to each other. Estimating surface waves dispersion is an interest for many geophysical applications using both active and passive seismic data. We present an inversion scheme that exploits the spatial and temporal relationships of the Helmholtz equation to estimate dispersion relations directly from surface wave ambient noise data, while reconstructing the full wavefield in space and frequency. The scheme is a PDE constrained inverse problem in which we jointly estimate the state and parameter spaces of the seismic wavefield. Key to the application on ambient seismic noise recordings is to remove the boundary conditions from the PDE constraint, which renders a conventional waveform inversion formulation singular. With synthetic acoustic and elastic data examples we show that using a variable projection scheme, we can iteratively update an initial estimate of the medium parameters and recover an estimate for the true underlying velocity field. Our examples show that we can reconstruct the full wavefield even in the case of strong aliasing and irregular sampling. This work forms the basis for a new approach to inverting ambient seismic noise using large and dense seismic arrays.