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Shirmohammadi, Faezeh; Draganov, Deyan

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Surface-waves suppression using seismic interferometry for imaging and monitoring of the Groningen subsurface

Faezeh Shirmohammadi[1] and Deyan Draganov[1]
[1] TU Delft, the Netherlands

High-resolution seismic reflections are essential for imaging and monitoring applications using data-driven methods such as seismic interferometry (SI) and Marchenko redatuming. For seismic land surveys using sources and receivers at the surface, the surface waves are the dominant noises that mask the reflections. We use SI to suppress surface waves from the reflection dataset. SI is a technique that allows the retrieval of new seismic responses at one receiver from a virtual source at the position of another receiver using, e.g., cross-correlation or convolution.

We processed a two-dimensional seismic reflection dataset acquired along a line in Scheemda, located in the Groningen province of the Netherlands. The sources are placed with a spacing of 2 m, and 601 receivers are placed every 1 m.

We implemented some pre-processing steps, including source signature deconvolution and filtering. Then, we applied SI by cross-correlation by turning receivers into virtual sources to estimate the dominant surface waves. Afterwards, we performed adaptive subtraction with different filter parameters for the matching filter to minimise the difference between the surface waves in the original data and the result of SI.

Comparing the retrieved results from SI with the original data in the time domain and the frequency-wavenumber domain shows that at least some parts of surface waves are suppressed from the dataset, which can help to better visualise reflections for future studies in imaging and monitoring the subsurface.