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TITLE: Receiver-pair seismic interferometry and the cosine method

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ABSTRACT BODY: The frequency dispersion of surface waves contains information about the seismic velocities as function of depth, allowing the estimation of velocity models. Initially, earthquake and controlled-source records were used to obtain dispersion curves that could subsequently be inverted for velocity profiles. Later, also a number of methods were developed to obtain the dispersion curves from noise recordings, e.g., the spatial autocorrelation method, the centerless circular array method and seismic interferometry (as preprocessing). With the latter three methods it is assumed that the noise comes from all directions. Especially for small recording times, this is rarely the case. Another method, the frequency-wavenumber technique, can handle strongly directional fields. However, a well sampled array of stations is required to enable unaliased transform to the wavenumber domain for a wide band of frequencies.

In this abstract, we consider the situation of a directionally strongly biased seismic (noise) field. We work out two new methods for estimating the backazimuth of the (noise) source(s) and extracting the dispersion curves from the recordings. We start with a well-sampled circular array of receivers and show that both dispersion and source directivity can well be estimated. Subsequently, we show that the desired parameters can still be obtained when violating the spatial sampling criterion. Furthermore, we show that only small errors are made when the receivers are not located on a circle. We illustrate the methods both with synthetic data and field data from the SPITS array (Spitsbergen, Norway).

KEYWORDS: 7255 SEISMOLOGY Surface waves and free oscillations, 7260 SEISMOLOGY Theory, 0902 EXPLORATION GEOPHYSICS Computational methods: seismic.

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Additional Details

Previously Presented Material: The theory part of this contribution was presented at the EAGE conference in London (June, 2013). The field-data application has not been presented before.

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