Seismic interferometry by multidimensional deconvolution as a means to compensate for anisotropic illumination

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It is well-known that under specific conditions the crosscorrelation of wavefields observed at two receivers yields the impulse response between these receivers. This principle is known as ‘Green's function retrieval’ or ‘seismic interferometry’. Recently it has been recognized that in many situations it can be advantageous to replace the correlation process by deconvolution. One of the advantages is that deconvolution compensates for the waveform emitted by the source; another advantage is that it is not necessary to assume that the medium is lossless. The approaches that have been developed to date employ a 1D deconvolution process. We propose a method for seismic interferometry by multidimensional deconvolution and show that under specific circumstances the method compensates for irregularities in the source distribution. This is an important difference with crosscorrelation methods, which rely on the condition that waves are equipartitioned. This condition is for example fulfilled when the sources are regularly distributed along a closed surface and the power spectra of the sources are identical. The proposed multidimensional deconvolution method compensates for anisotropic illumination, without requiring knowledge about the positions and the spectra of the sources.