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Seismic Interferometry using Sources at the Surface only

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Green's function retrieval using ambient noise has proved to be extremely successful. The theory behind seismic interferometry is solid, but based on several assumptions regarding the source distribution. Ambient noise is considered to originate from ocean microseisms. Not much is known about their source mechanism, but excitation is located close to the surface and their distribution is azimuthally inhomogeneous. We calculate synthetic noise records using random point sources located at the surface only. Using the exact interferometric equation, we estimate the Green's function from these seismograms and compare this to the exact Green's function. We find that with increasing vertical complexity of the medium, retrieval of the full wavefield becomes more successful. For a homogeneous medium, both the phase and amplitude of the Rayleigh wave are retrieved correctly. For a vertically complicated medium, higher modes (body waves) are retrieved as well. Higher modes are however less pronounced as compared to the fundamental mode. Imperfectly distributed source configurations can lead to spurious phases and other imperfections in the resulting Green's functions. In particular we investigated the pi/4 phase shift for surface waves introduced by having an imperfect azimuthal distribution of sources. Having sources at the surface only, does lead to the correct Green's function if the medium is sufficiently complicated in the vertical direction.