Application of seismic interferometry to teleseismic array data

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With the deployment of large arrays of receivers the crust and upper mantle under an array can be imaged without the occurrence of local earthquakes. Instead, transmitted waves are used which are due to earthquakes at teleseismic distances. Either stacks of receiver functions (mode conversions in the transmission responses) or the scattering potential (via the Inverse Radon Transform) can be used to image structure in the crust. The incorporation of free-surface-reflected phases (for example Ppdp, or Ppds) in an imaging scheme can significantly enhance the resolution of these images (because illumination from the surface is added).

Here, we present a seismic interferometry method that allows one to simulate a source at any receiver location (thus providing illumination from the surface) using transmitted teleseismic waves. This method works without assumptions on the model and without having to know accurately the earthquake locations. The method is based on the summation of correlations of responses from several earthquakes and essentially extracts the reflection response from the coda of the transmission responses.

Application of the method to synthetic and actual data from the Laramie broadband array (2000-2001) serve to discuss the practical implementation of the algorithm and issues related to the coverage of earthquakes.