Seismic Interferometry – Reconstruction of the Earth's Elastodynamic Reflection Response

Seismic interferometry is the process of creating new seismic records from the crosscorrelation of existing ones. In exploration seismics, we normally have recorders of seismic waves (geophones) at the surface, which can record the thee components of the Earth's seismic response. We let the geophones record the (transmission) response to many subsurface sources. We then take, say, the vertical component at geophone A and the horizontal component at geophone B. The result from their crosscorrelation is an observed vertical component of the reflection response at A as if from a horizontal surface source at B. In this way, we can reconstruct the complete reflection response in A due to a simulated source at B.

There are several potential benefits from the seismic interferometry reconstruction of the reflection response. The absence of explosive sources makes it possible to explore in cities and ecologically sensitive areas and further reduces the costs of such a survey. Another benefit is the possibility to obtain a dense and regular coverage of the exploration area with virtual source positions.

And yet another interesting potential application is to use this method for building subsurface pictures of the moon and Mars.