Subsurface Visualization using Seismic Interferometry

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Under the ground, there always exist various vibrations accompanying not only the natural vibration such as earthquakes and aftershock but also the social life, such as the running of trains, subways, or cars and civil constructions and factories. These vibrations are called as the micro seismicity. In this paper we use this seismicity as the source signal for the reflection seismology. This underground survey technique is called Seismic Interferometry or Daylight Imaging. The method intends to image the subsurface structure using the seismic wave observed on the surface as a transmission wave field and to simulate the pseudo reflective wave field by cross correlation of transmission wave data.

In 1968 Claerbout proposed the idea of daylight imaging, however, he had shown only the case of one dimensional acoustic model. About 30years later, Wapenaar (2003) derived the general relationship between the transmission response and reflection response of the three-dimensional earth model. The seismic interferometry can reconstruct the reflection seismic data by doing the cross-correlation of transmitted seismic data. When the seismic wave fields from underground buried impulsive sources are observed at two places A and B on the surface of ground, we can reconstruct the pseudo reflective wave field which corresponds the source at A and the receiver at B by cross-correlation of the time-series data at A and B. Applying this to reflection seismology, we can image the subsurface structures by transmitted seismic data without any controlled sources.

In this paper I will show the several subsurface sections which were produced by the seismic interferometry. In this method, when the many geophones are arranged on the survey line, we can simulate pseudo reflection shot records as many shot records as the number of the receivers. This is a great advantage for improving the signal to noise ratio.

reference

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