Geophysical Research Abstracts, Vol. 9, 10593, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10593

Application of seismic interferometry to teleseismic array data

E. Ruigrok (1), X. Campman (2), D. Draganov (1), K. Wapenaar (1), S. Rondenay (2)

(1) Department of Geotechnology, Delft University of Technology, The Netherlands, (2) Department of Earth, Atmospheric and Planetary Sciences, MIT, USA

Progress in the imaging of the crust and upper mantle is partially limited by the sparse distribution of natural sources; the earthquake hypocenters are mainly along the active lithospheric plate boundaries. The incorporation of free-surface-reflected phases (for example Ppdp, or Ppds) in an imaging scheme can significantly enhance the resolution of teleseismic images: the free-surface-reflection points act as secondary sources at the surface adding new illumination angles. The free-surface multiples are usually predicted using a velocity model, a simplified geometrical description of the incident P-wave front and knowledge of the earthquake location.

Here, we present an interferometric method that allows us to construct a source at any receiver location using transmitted teleseismic waves. This method works without assumptions on the model or geometry of the incoming wave field 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 response. In arbitrarily inhomogeneous media, our method requires responses to many earthquakes, but for a relatively simple layered structure (as may be expected for regional imaging studies) responses of just a few earthquakes from teleseismic distances suffice to extract the reflection response.

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