A method for computing synthetic seismograms for array data analyses: application of the injection method to global seismology

Nozomu Takeuchi[1]

[1] ERI, Univ of Tokyo

http://www.eri.u-tokyo.ac.jp/takeuchi/

Several dense broadband seismograph arrays (including F-Net, US-array and NECESSArray) are being developed in the world, and the data from these arrays are expected to provide novel information on Earth's deep structures. In this study, a useful method for computing synthetic seismograms in such analyses is developed. In the array analyses we usually use higher frequency component of the data to achieve higher resolution, but we often assume localized heterogeneities due to localized path coverage. Efficient methods for computing synthetic seismograms for models with localized heterogeneities are thus useful.

Several methods which improve the efficiency by utilizing the localization of the heterogeneities are proposed. In global wave propagation problems, CSEM (Capdeville et al. 2003, GJI) and a hybrid method (Wen & Helmberger 1998, JGR) were proposed. These methods compute synthetic seismograms by using semi-analytic solution for laterally homogeneous regions, using numerical solution for laterally heterogeneous regions, and appropriately coupling the computed results. The CSEM is a rigorous method based on wavefield continuation but has a problem in efficiency because it should assume that the heterogeneous region is spherical shell. The hybrid method has flexibility for the shape of the heterogeneous region but is questionable for accuracy and applicability to general problems because it is a method based on propagating wave continuation.

In this study the injection method proposed by Robertsson & Chapman (2000, Geophysics) is applied to global wave propagation problems. It is a method based on wavefield continuation and has larger flexibility for the shape of the heterogeneous region than the hybrid method. In the presentation I plan to show examples of computed synthetic seismograms and discuss the validity of the method.