Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS24-02 Room:315 Time:May 1 15:30-15:45

Quasi-cylindrical seismic waveform modeling considering surface topography

TOYOKUNI, Genti[1*] ; TAKENAKA, Hiroshi[2] ; OKAMOTO, Taro[3] ; ZHAO, Dapeng[1]

[1]RCPEVE, Tohoku Univ., [2]Okayama Univ., [3]Tokyo Tech

An accurate and efficient modeling of regional seismic wave propagation can be achieved by the axisymmetric modeling using the cylindrical coordinates. It assumes the structural model as rotationally symmetric along the vertical axis including a seismic source, and then solves the 3-D wave equation in cylindrical coordinates only on a 2-D structural cross section (i.e., 2.5-D modeling). Therefore, this method can correctly model 3-D geometrical spreading effects and the pulse shape, with computation time and memory comparable to 2-D modeling.

On the other hand, application of the conventional purely axisymmetric approximation is difficult in practice because the structure along the measurement line of the seismic survey is rarely symmetric with respect to the source location. To overcome this difficulty, Takenaka et al. (2003) proposed a "quasi-cylindrical approach". They developed a numerical scheme for seismic exploration using the finite-difference method (FDM). The FDM scheme had then been improved to include an arbitrary moment-tensor point source and the anelastic attenuation for further realistic modeling (Toyokuni et al., 2013, AGU Fall meeting).

In this work, we extended the scheme to treat land and ocean-bottom topographies. We adopted the cell-based staggered-grid FDM, which places the normal-stress components at the center of a unit cell, and applies the 2nd-order FD approximation around the free surface or fluid-solid boundary (Okamoto & Takenaka, 2005; Takenaka et al., 2009; Nakamura et al., 2012). In the presentation, we will show an application of the scheme to the waveform modeling for the volcanic areas in Japan.

Keywords: seismic waveform, finite-difference method, topography, fluid-solid boundary