Effects of seawater layer on broadband seismic wavefield

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Recently, some studies investigated the effects of seawater on seismic waves propagating through ocean area (e.g., Noguchi et al. 2013; Maeda et al., 2014; Nakamura et al. 2015). Detailed characteristics of seismic waves propagating around ocean area should be required for practical use of seismograms recorded at ocean bottom seismometer networks, such as S-net and DONET. In this study, to reveal the effects of seawater on broadband seismic wavefield, we conducted numerical simulations of seismic wave propagation using the model with seawater layer.
The model covered the zone of 512 ×512 ×128 km^3, which was discretized by a grid interval of 0.05 km. The propagation of seismic waves was calculated by solving equations of motion based on the staggered grid finite difference method (FDM) with fourth- and second-order accuracies in space and time. The background velocity structure was Japan Integrated Velocity Structure Model version 1 (Koketsu et al., 2012) and the seismic source was referred from CMT solution of F-net. Since minimum S-wave velocity of 0.9 km/s is assumed in this study, our FDM simulation can examine seismic wave propagation for broadband frequencies of 0.01-1 Hz.
We conducted a FDM simulation of seismic wave propagation for Mw 6.8 earthquake occurred at depth of 68 km beneath northwestern Chiba. Simulation result roughly reproduced observed seismograms at both land and ocean stations. We also conducted an additional FDM simulation in model without seawater and compared simulated waveforms at ocean area derived from model with and without seawater to examine the effects of seawater. Differences between simulation results more clearly appeared in vertical component seismograms than horizontal ones. Since S wave components are dominant in horizontal seismograms, the effect of seawater is not so large in the horizontal components. Amplification of the amplitude and increase of the duration were recognized in coda waves of the vertical seismograms due to the seawater layer. This indicates that P and Rayleigh waves in vertical component are strongly affected by seawater layer.

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Keywords: Seismic wave propagation, Seawater, Coda wave, Numerical Simulation

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