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Prediction of average S-wave velocity for deep subsurface structure from fundamental mode Rayleigh wave phase velocity

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In this paper, an empirical relationship between phase velocity for fundamental mode Rayleigh wave and average S-wave velocity of deep subsurface structure.

It is evaluated numerically using three-dimensional subsurface structure model proposed by National Research Institute for Earth Science and Disaster Prevention (Fujiwara, 2009). First, one-dimensional subsurface structure model is extracted from the three dimensional model. Then, phase velocity for fundamental mode Rayleigh wave in horizontally-layered medium is calculated for wavelength from 100 to 1000 meters using a program provided by Hisada (1997).

Calculated phase velocities are similar to average S-wave velocities in most cases. An average S-wave velocity over a certain length is empirically about 1.1 times as large as a phase velocity with the same wavelength.

It is expected that Average S-wave velocity, or S-wave profile, will be constructed with reasonable accuracy from micro-tremor array observation on ground surface in near future.

Keywords: Rayleigh wave, Average S-wave velocity, Deep subsurface structure, Phase velocity