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# Velocity structure inversion from H/V spectral ratios of earthquake data: Application to the Tohoku region, Japan

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## **Abstract 15<sup>th</sup> WCEE**

### **Velocity structure inversion from H/V spectral ratios of earthquake data: Application to the Tohoku region, Japan**

In this study, strong ground motion in elastic layered media is considered. All sites are assumed to be « sufficiently » flat layered sites and we restrict ourselves to earthquake sources with small epicentral distances and deep enough, such that surface waves are not dominant or do not appear yet. The surface waves can then be neglected and the illumination can be conceived as produced by incident plane waves. In that case, the average of normalized ground motion spectral densities will depend only on depth and a one dimensional description of wave propagation for a diffuse field of ground motions can be applied. Thus, the imaginary part of the Green function at the free surface when source and receiver are both at the same point is proportional to the square of the absolute value of the corresponding transfer function for a plane, vertically incident wave with unit amplitude.

Due to the multiple scattering, the ground motion is assumed to constitute a diffuse seismic field. Thus the average H/V ratio computed with a large enough number of seismograms is supposed to depend only on the site considered and not of the set of earthquake data used to carry out the computation. We use recordings of aftershocks of the 2011 Tohoku, Japan, earthquake in the Fukushima, Iwate and Miyagi prefectures. We study the variations of H/V ratio while magnitudes, depths, distances from site, peak ground accelerations, azimuths and wave angles of incidence vary. We verify that the variations of H/V ratio remain minor.

As the average strong motion H/V spectral ratio of observed data at a particular site depends only of the underneath geological structure, we can carry out inversions of P- and S-wave velocity logs using the average H/V ratio as an objective function. The H/V ratio is compared to the ratio of theoretical horizontal and vertical transfer functions corresponding to the 1D soil structure of the considered site. The theoretical transfer function is computed with the Thomson-Haskell propagator matrix method.

A series of soil column inversions is then carried out with a Genetic Algorithm code, following the proposed theory for earthquake H/V ratios. New velocity structures for stations of the K-NET and KiK-net networks in the Fukushima, Iwate and Miyagi prefectures are proposed.