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Author(s):
Lontsi, Agostiny Marrios; Shynkarenko, Anastasiia; Hobiger, Manuel; Bergamo, Paolo; Kremer, Katrina; Fäh, Donat

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Full microtremor horizontal-to-vertical spectral ratio inversion for the characterization of Swiss borehole and OBS sedimentary sites

Agostiny Marrios Lontsi¹, Anastasiia Shynkarenko¹, Manuel Hobiger², Paolo Bergamo¹, Katrina Kremer¹, Donat Fäh¹

¹ Swiss Seismological Service, ETH Zürich, Sonneggstrasse 5, 8092 Zürich, Switzerland (agostiny.lontsi@sed.ethz.ch)
² Federal Institute for Geosciences and Natural Resources, Stilleweg 2, 30655 Hannover, Germany

The microtremor horizontal-to-vertical (H/V) spectral ratio has emerged as a single-station method due to its capability to estimate the frequency of resonance at a site. Moreover, using additional constraints and sufficiently long recording times, a shear-wave velocity profile can be derived from H/V spectral ratios (Lontsi et al. 2015). The extracted information are of importance for seismic hazard assessment both onshore and offshore. We estimate the shear wave velocity profiles at two sedimentary sites in Switzerland. One site is located onshore at Buochs and is equipped with three strong motion sensors: one is located at the surface and two are located in boreholes at 26 and 100 m depths (Hobiger et al., 2021). We first analyzed the temporal variability of the estimated microtremor H/V spectral ratio for the receiver at the surface (Figure 1) and select an appropriate H/V curve, combined with H/V measurements at depths, for the inversion. The second site is located offshore Weggis (Lake Lucerne). With the advances in seismic instrumentation offshore, high quality data were recorded to help us characterize the internal sediment structure of the lake/ocean bottom, and to assess the volume of the sediment cover that could fail in case a seismic event occur. As we know that failed slopes could potentially lead to tsunamis (e.g. Hilbe and Anselmetti, 2015). Between 2018 and 2020, we used ocean bottom seismomenters (OBS) and performed ambient-vibration measurements at selected sites in Lake Lucerne where sediments are susceptible to failure or have failed before (Figure 1). Here we show preliminary inversion results at Weggis. The inversion considers one station only. The inversion would be much better constrained by adding for example H/V spectral ratio measured at depth, phase velocity dispersion curves obtained by array analysis (Shynkarenko et al., 2021), or layer thicknesses from seismic surveys. This is subject to further investigation.
Figure 1. Lake Lucerne: Bathymetry and nearby geomorphology. In total: more than 169 OBS deployments and recoveries between 2018 - 2020. The OBS station WED07 is later used in the inversion. The location of the borehole station SBUS is indicated with green color. NAMMU and LOBSTER indicate the two OBS types that were used in Lake Lucerne. The spatial variability of the H/V spectral ratio for one array at Weggis is shown. For the borehole station, the temporal variability for the surface station is presented.

REFERENCES