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Analysis of high-frequency ambient seismic noise recorded during XSodEx experiment in Finland

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Development of passive seismic methods is an important task for the solution of many practical problems where the study of shallow structure of subsurface is necessary (mineral exploration, microseismic zonic, groundwater study, etc.). Nowadays there are many techniques for estimating Empirical Greens Functions (EGF) from high-frequency seismic noise generated by industrial objects, transports or other human activity (Afonin et. al., 2016; Cheng et. al., 2015; Le Feuvre et. al., 2015; Nakata et. al., 2011; Shirzad et. al., 2014, etc.). Nevertheless, there is the necessity of using high-frequency ambient noise on quiet areas, for example, greenfield exploration tasks in remote territories. In this case, extraction of EGFs is difficult because of inhomogeneous distribution of sources and strong attenuation of high-frequency noise wavefield. That is why the study of high-frequency ambient noise behaviour in quiet areas is an important task for the development of passive seismic methods. For this purpose, we analyze ambient seismic noise recorded during XSodEx experiment by 24 3-component and 54 1-component DSU-SA MEMS seismic sensors with the autonomous data acquisition units produced by Sercel Ltd. The sensors were installed along about 1 km long line with intersensor distances of 7-15 m. The profile recorded continuous passive seismic data since 21.08.2017 to 23.08.2017 with the sampling rate of 500 sps. The data were processed by several steps including single station data analysis, prefiltering and cross-correlation of night-time records between all possible station pairs. The cross-correlation functions were used for EGFs estimation. The analysis of apparent velocities of cross-correlation functions and EGFs shows that there were several noise sources with frequencies of 1-20 Hz along the profile. In some cases, we extracted symmetric EGF from short time records (several hours), which indicates homogeneous azimuthal distribution of noise sources. Nevertheless, wavefields, generated by these sources distributed to about several dozen meters. In our paper, we concentrate mainly on details of our data processing routine and its influence on the quality of EGF extraction results.