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Crustal thickness and vp/vs-ratios from single-station auto-and cross-correlations of seismic noise

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Over the last years, the extraction of body-wave reflections from auto-and cross-correlations has become a valuable tool in the analysis of seismic noise for subsurface structure. Many studies use vertical component data and extract reflected P-waves in order to determine the Moho-depth or lithosphere-asthenosphere boundary beneath the seismic station. With respect to the upcoming planetary missions to Mars, and possibly Jupiter's moon Europa, single-station methods and the use of seismic noise are becoming more and more important, in order to learn as much as possible from the limited amount of data available.
In this study we calculate auto-and single-station cross-correlations from horizontal component data from broadband stations across central Europe in order to retrieve Moho-reflected S-waves. A priori information is included when locating and picking the lag times of changes in reflectivity. These picks are then used to calculate the vp/vs-ratios for the stations, by incorporating arrival times of P-wave reflections determined from vertical-component noise auto-correlations in a previous study. In addition, we calculate crustal thicknesses and compare them to results from other studies.
In general, it is more difficult to obtain clear results from the horizontal correlations in comparison to the vertical component auto-correlations. Having two horizontal component auto-correlations in addition to the two sides of the cross-correlation helps in identifying those reflectivity changes consistent across all correlations and in the estimation of uncertainty. Instead of an automatically picked specific lag time, we obtain a time range, in which the reflected wave is expected to arrive. The cross-correlations of horizontal with vertical components are then used to verify this time range. This translates into ranges for vp/vs-ratios and depths as well. The obtained results compare well with results from other studies and the results obtained from vertical component auto-correlations.