

Moho depth across the Trans-European Suture Zone from ambient vibration autocorrelations

Gesa Becker and Brigitte Knapmeyer-Endrun

Max Planck Institute for Solar System Research, Göttingen, Germany (becker@mps.mpg.de)

In 2018 the InSight mission to Mars will deploy a seismic station on the planet. This seismic station will consist of a three-component very broadband seismic sensor and a collocated three-component short period seismometer. Single station methods are therefore needed to extract information from the data and learn more about the interior structure of Mars. One potential method is the extraction of reflected phases from autocorrelations. Here autocorrelations are derived from ambient seismic noise to make the most of the data expected, as seismicity on Mars is likely less abundant than on Earth.

These autocorrelations are calculated using a phase autocorrelation algorithm and time-frequency domain phase-weighted stacking as the main processing steps in addition to smoothing the spectrum of the data with a short term-long term average algorithm. Afterward the obtained results are filtered and analyzed in the frequency range of 1-2 Hz.

The developed processing scheme is applied to data from permanent seismic stations located in different geological provinces across Europe, i.e. the Upper Rhine Graben, Central European Platform, Bohemian Massif, Northern German and Polish Basin, and the East European Craton, with varying Moho depths between 25-50 km. These crustal thicknesses are comparable to various estimates for Mars, therefore providing a good reference and indication of resolvability for Moho depths that might be encountered at the landing site. Changes in reflectivity can be observed in the calculated autocorrelations. The lag times of these changes are converted into depths with the help of available velocity information (EPcrust and local models for Poland and the Czech Republic, respectively) and the results are compared to existing information on Moho depths, which show good agreement. The results are temporarily stable, but show a clear correlation with the existence of cultural noise.

Based on the closely located broadband and short period stations of the GERESS-array, it is shown that the processing scheme is also applicable to short period stations. Subsequently it is applied to the mainly short period and temporary stations of the PASSEQ network along the seismic profile POLONAISE P4, running from Eastern Germany to Lithuania crossing the Trans-European Suture Zone.