Geophysical Research Abstracts
Vol. 21, EGU2019-5494, 2019
EGU General Assembly 2019

Properties of the high-frequency ambient seismic field recorded on a large seismic deployment in the Vienna Basin

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The Vienna Basin is the largest petroleum basin in Austria. As part of the ongoing seismic exploration for hydrocarbon resources in the basin, a large-N (N=10,530) dataset of continuous seismic recordings of the ambient seismic field was acquired in early 2018. Data were recorded on geophones (10-Hz corner frequency) and each location was made up of 12 or 24 densely clustered geophones, which were stacked to increase signal-to-noise ratio. Data were collected by these geophone clusters for up to 6 days, recorded only during day time. The station locations are distributed on a grid of roughly 40m by 400m and cover an area of about 500km2.

We are in the process of imaging the upper part (top few kilometers) of the Vienna Basin by surface-wave tomography using surfaces waves extracted from ambient noise. For this, we study the properties of the ambient seismic field at higher frequencies (more than 5Hz) to ensure that the ambient seismic field contains surface waves that are appropriate for our purposes.

Here, we present the first insights into the ambient seismic field in the Vienna Basin retrieved from this dataset. We perform beam-forming to detect noise sources outside of the study area, as well as Matched Field Processing to detect and locate noise sources at the surface inside of it. Generally, the field is dominated by cultural noise. Inside the network, the ambient seismic field at these higher frequencies is mainly generated by cars on streets, trains on railways, activity in town centers, and also wind turbines. Outside the network, we map the city of Vienna as a major contributor to noise. The ambient seismic field is comprised of body and surface waves and careful processing will be necessary to extract high-quality surface-wave measurements from the data.