



Improved Detection of Local Earthquakes in the Vienna Basin (Austria), using Subspace Detectors

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The Vienna Basin in Eastern Austria is densely populated and highly-developed; it is also a region of low to moderate seismicity, yet the seismological network coverage is relatively sparse. This demands improving our capability of earthquake detection by testing new methods, enlarging the existing local earthquake catalogue. This contributes to imaging tectonic fault zones for better understanding seismic hazard, also through improved earthquake statistics (b-value, magnitude of completeness).

Detection of low-magnitude earthquakes or events for which the highest amplitudes slightly exceed the signal-to-noise-ratio (SNR), may be possible by using standard methods like the short-term over long-term average (STA/LTA). However, due to sparse network coverage and high background noise, such a technique may not detect all potentially recoverable events. Yet, earthquakes originating from the same source region and relatively close to each other, should be characterized by similarity in seismic waveforms, at a given station. Therefore, waveform similarity can be exploited by using specific techniques such as correlation-template based (also known as matched filtering) or subspace detection methods (based on the subspace theory). Matching techniques basically require a reference or template event, usually characterized by high waveform coherence in the array receivers, and high SNR, which is cross-correlated with the continuous data. Instead, subspace detection methods overcome in principle the necessity of defining template events as single events, but use a subspace extracted from multiple events. This approach theoretically should be more robust in detecting signals that exhibit a strong variability (e.g. because of source or magnitude).

In this study we scan the continuous data recorded in the Vienna Basin with a subspace detector to identify additional events. This will allow us to estimate the increase of the seismicity rate in the local earthquake catalogue, therefore providing an evaluation of network performance and efficiency of the method.