

EGU2020-13714

<https://doi.org/10.5194/egusphere-egu2020-13714>

EGU General Assembly 2020

© Author(s) 2023. This work is distributed under the Creative Commons Attribution 4.0 License.



## Automatic transient signal detection and volcanic tremor extraction using music information retrieval strategies

Zahra Zali, Frank Scherbaum, Matthias Ohrnberger, and Fabrice Cotton

Institute of Earth Sciences, University of Potsdam, Germany (zali@uni-potsdam.de)

Volcanic tremor is one of the most important signal in volcano seismology because of its potential to be a tool for forecasting eruptions and better understanding of underlying volcanic process. Despite different suggested mechanisms for volcanic tremor generation, the exact process of that is not well understood yet. This signal usually comes along with large number of earthquakes happening during unrest period that affect the shape and amplitude of tremor. A delicate signal processing is required to separate earthquakes and other transient signals from seismic waveform to derive a time series of volcanic tremor which can provide a new insight into tremor source investigations. Exploiting the idea of harmonic and percussive separation in musical signal processing we have developed a method to extract volcanic tremor and transient events from the seismic signal. By using the concept of periodicity as underlying generation process of tremor, we are able to extract the volcanic tremor signal based on the self similarity properties of spectra in time-frequency domain. The separation process results in two spectrograms representing repeating (long-lasting) and non-repeating (short-lived) patterns.

From the spectrogram of the repeating pattern we reconstruct the signal in time domain by adding the original spectrogram's phase information, thus creating an modified version of the long-lasting tremor signal.

Further, we can derive a characteristic function for transient events by integrating the amplitude of the non-repeating spectrogram in each time frame. This function has non zero value in transient event instances and zero value in time periods devoid of such events. Considering transient events as earthquakes we apply an onset detector to time first arrivals of the transient signal by using the slope of the function. First we determine local maxima of the function showing good correspondence to even the tiniest transient signals. From the peak locations we calculate the slope of each point within a period of 6 seconds preceding each peak. The uncertainty of positive P peaks is up to 0.32 seconds which is equal to the hop size of the calculated spectrogram. The advantage of timing earthquakes through this method is the ability of detecting very low seismic events, although due to the small window size of short time Fourier transform the process is time consuming. The result of this study is promising, while further testing is on-going to validate the method as well as determine applications and limitations.