

## Impact of COVID-19 lockdown on seismic noise

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Seismometers continuously record ground velocity, therefore being the instrument of choice to record earthquakes. Nevertheless, the ground moves even when no earthquakes occur. This interferes with earthquake detection and is referred to as seismic noise. However, recent studies like Lecoq et al. (2020) utilize it to monitor Covid-19 lockdown effects. Seismic noise from traffic, industry and other human sources usually should not affect seismic records on remote sites. However, changes in noise levels due to Covid-19 lockdowns still occur, even at Conrad Observatory Seismometer CONA.

The Conrad Observatory is home to seismic broadband station CONA of the Austrian Seismic Network. The station continuously sends data to Vienna for earthquake analysis. Additionally, for 2020 we used the continuous data of the vertical component HHZ to analyse seismic noise with SeismoRMS by Lecoq et al. (2020). The frequency range from 4-14 Hz was selected, as it is affected strongest by human related noise sources. The RMS of the displacements were calculated for 30 minute-time-blocks for the whole year. Figure 1 shows these noise estimates, including the start of lockdown measures imposed in Austria.

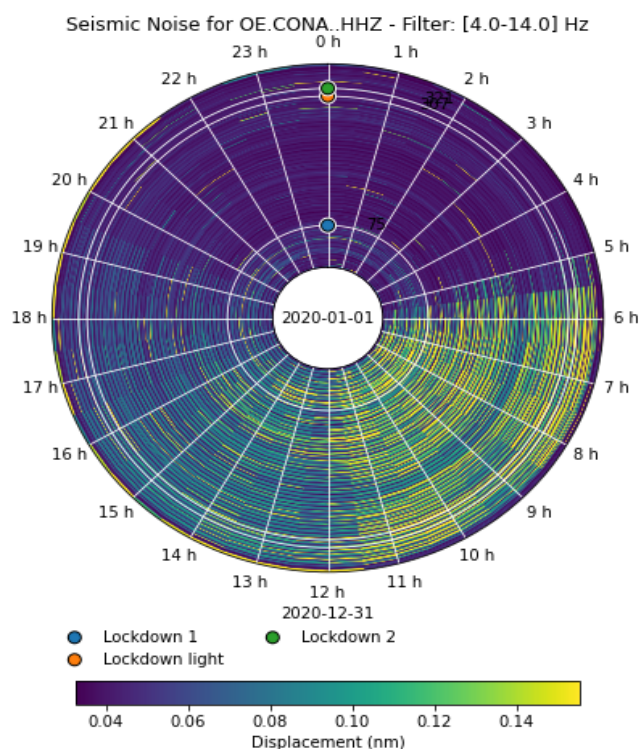


Figure 1: RMS of displacement in 30-minute time blocks for 2020. Circles mark lockdown starts due to Covid-19 (Lockdown 1: 16-03-2020, Lockdown light: 03-11-2020, Lockdown 2: 17-11-2020).

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The clock plot clearly shows the diurnal change of noise, with human activity. However, in 2020 there is an additional silent period in the middle of March: It coincides with the first lockdown due to Covid-19 in Austria (blue dot) and lasts approximately 2 weeks. The light and the second lockdown in November 2020 are barely visible (orange and green dots).

Figure 2 shows the long-time impact of the first lockdown for stations CONA and VIE (Hohe Warte, Vienna). Due to high variability of absolute background levels between the stations, the displacement RMS is calculated relative to pre-lockdown average for each station. Although most lockdown measures ceased earlier, noise levels stayed low much longer.

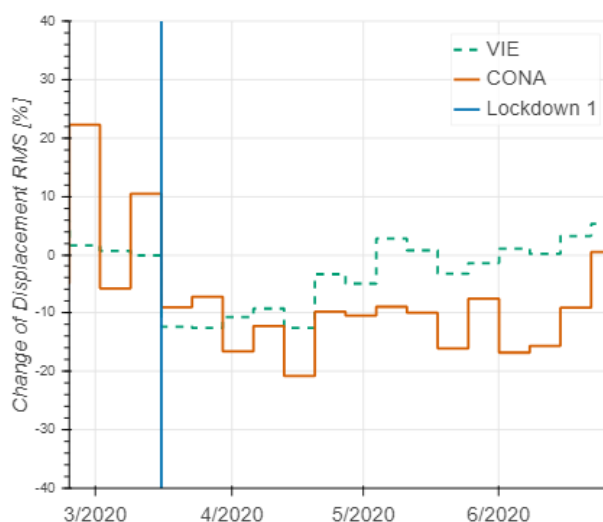


Figure 2: Change of displacement RMS in percent compared to 1 month before first lockdown on 16-03-2020 in Austria for broadband stations CONA and VIE.

**References:**

Lecoq et al. (2020) Global quieting of high-frequency seismic noise due to COVID-19 pandemic lockdown measures. *Science*. Vol. 369 Issue 6509  
 Lecoq, et al. (2020) SeismoRMS - A simple python/jupyter notebook package for studying seismic noise changes (Version 1.0)  
 ZAMG. (1987). Austrian Seismic Network. International Federation of Digital Seismograph Networks. <https://doi.org/10.7914/SN>

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