

Site effect investigation of seismic stations at the Conrad-Observatory

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This study investigates three co-located stations with different conditions (CONA in the tunnel, CSNA in the free field and a station located in a borehole) at the Conrad-Observatory, Austria. We found the borehole station showed the lowest noise level overall, while the tunnel station CONA presents a lower noise level than the free filed station CSNA. The borehole station is more sensitive to detect teleseismic signals and primary phases of mining induced events, while the free field station CSNA can well detect primary phases of local and regional explosions.

Seismic stations CONA, CSNA and COBA are located at the Conrad Observatory on the Trafelberg near Muggendorf in Lower Austria, about 50 km southwest of Vienna. The three stations are co-located with the maximum distance around 200 meters to each other. The tunnel station CONA is located inside of a 148-meter tunnel, while the free field station CSNA is situated outside of the Conrad Observatory. The borehole station (called COBA in this paper only) is found in a 100-meter borehole inside of the Observatory.

Noise spectra were calculated and averaged over three time intervals: 0 to 4, 8 to 12 and 12 to 16 GMT and compared in Figure 1 (only HHZ is presented). The top graph illustrated spectra from all stations over all three intervals. Benefitting from the borehole isolation from local noise and certain noise amplification, station COBA (blue) presented the lowest noise level. Compared to station CSNA (green), CONA (red) demonstrated a relatively lower noise level and confirmed effective noise isolation in tunnel. The bottom three graphs in Figure 1 compare noise for each time interval. A significant low noise level is found at station COBA in the high frequency range. In the night hours, the noise level at CONA is closer to the curves from CSNA but during the day hours, CONA noise level is only slightly higher than the one at COBA and much lower than the one at CSNA. In summary, the borehole is more effective to isolate stations from noise and to remove some noise amplification than the tunnel. The tunnel station shows lower noise level compared to the station in the free field.

To investigate the dependence of the detection performance on station sites, we re-ran the waveform data processing for a period of the entire month in May 2009 and compared the results with detections in our catalogue. Table 1 summarizes this comparison. Station COBA made not only the most valid detections but also the most false detections. Extremely high numbers of false detections for all stations were caused by some human activities close to the stations, since they only appeared between 7 to 15 GMT from Monday to Friday. Station COBA has a better performance in detecting teleseismic signals and primary phases of the mining induced events. Station CSNA is more sensitive to primary arrivals of local and regional mining but less capable to detect secondary phases of induced events and teleseismic signals. Generally all three stations delivered a poor performance in detecting secondary phases. Further investigation will be needed.

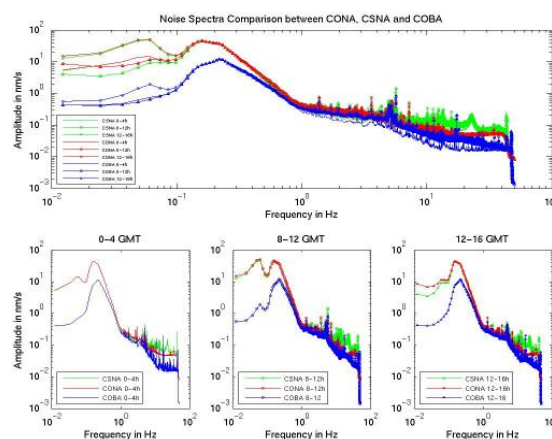


Figure 1: Noise spectra comparison between CONA, CSNA and COBA.

Table 1: Detection reprocessing.

Valid Detections	CONA	CSNA	COBA
Associated	130	124	131
Unassociated	97	100	100
All Valid	227	224	231
FalseDetections	1268	1239	1392

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