Station quality assessment based on time-dependent ambient noise from MUSTANG: Case study for CREST stations in Alaska

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Alaska's CREST seismic network provides ground motion data to improve hazard monitoring from tsunamis. Ambient noise recorded on seismometers can be analyzed as a spectrogram from the frequency domain as daily power spectral densities (PSDs) of acceleration. We analyze the quality of CREST stations by downloading PSDs from IRIS's MUSTANG service, then calculating spectrograms that reveal time-varying noise and by calculating a time-averaged spectrum. Time-varying noise is analyzed from two perspectives: (1) removing the time-averaged noise at a station and (2) from removing time-averaged noise of the average CREST station. We compare the time-averaged and establish a ranking system for station quality. Data from time-varying noise displays strong seasonal patterns for 0.1–1.0 Hz for all stations but seasonal patterns can exists for other frequencies for some stations. Our analysis shows that time-varying noise improves after the sensor casing is improved, after the sensor is replaced with a model with better performance characteristics, or after the sensor is buried deeper. The time-averaged noise analysis shows that the average CREST station has higher noise levels than the average TA station in Alaska across most frequencies. The ranking system shows that CREST stations in interior Alaska have lower noise levels than stations near the coast. Our approach offers a useful application of MUSTANG data products toward monitoring seismic station performance.

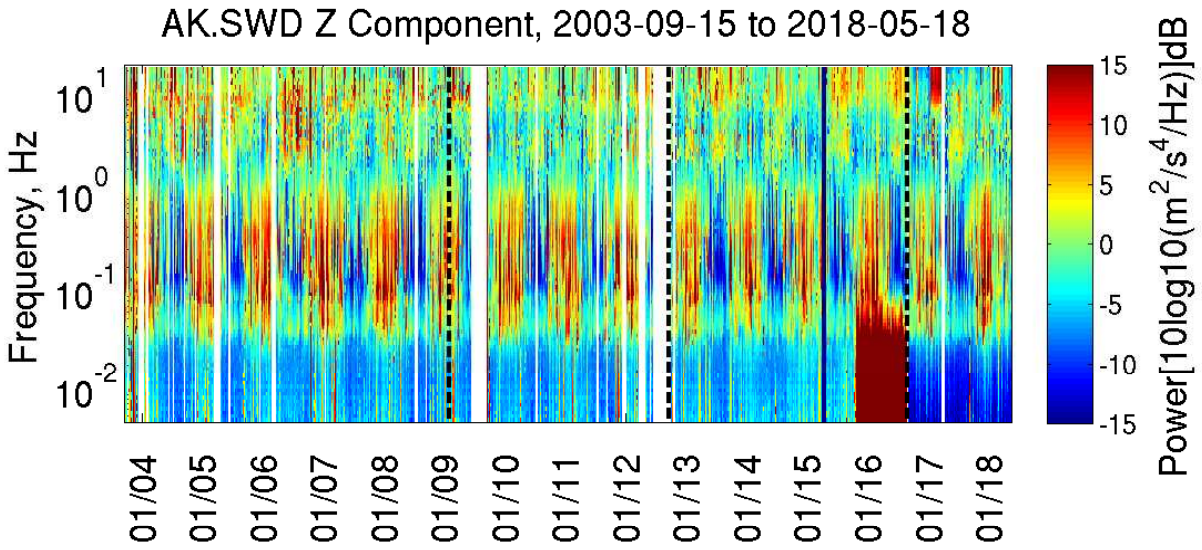

Figure 1: Residual spectrogram of ambient noise acceleration produced from removing the median stack of daily power spectral densities (PSDs) from the average CREST station. PSDs of ambient data were obtained from a web service from IRIS called MUSTANG which uses 60 minutes of ground motion data every 30 minutes. Vertical dashed lines show epoch times that relate to change in sensor instrument or location. Data shown is for SWD in Seward, Alaska for the vertical (Z) component. Seasonal variations exist for 0.1–1.0 Hz, with high noise in the winter and low noise in the summer.