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OBS noise reduction using music information retrieval algorithms

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Since the ocean covers 71% of the Earth's surface, records from ocean bottom seismometers (OBS) are essential for investigating the whole Earth's structure. However, data from ocean bottom recordings are commonly difficult to analyze due to the high noise level especially on the horizontal components. In addition, signals of seismological interest such as earthquake recordings at teleseismic distances, are masked by the oceanic noises. Therefore, noise reduction of OBS data is an important task required for the analysis of OBS records. Different approaches have been suggested in previous studies to remove noise from vertical components successfully, however, noise reduction on records of horizontal components remained problematic. Here we introduce a method, which is based on harmonic-percussive separation (HPS) algorithms used in Zali et al., (2021) that is able to separate long-lasting narrowband signals from broadband transients in the OBS records. In the context of OBS noise reduction using HPS algorithms, percussive components correspond to earthquake signals and harmonic components correspond to noise signals. OBS noises with narrowband horizontal structures in the short time Fourier transform (STFT) are readily distinguishable from transient, short-duration seismic events with vertical exhibitions in the STFT spectrogram. Through HPS algorithms we try to separate horizontal structures from vertical structures in the STFT spectrograms. Using this method we can reduce OBS noises from both vertical and horizontal components, retrieve clearer broadband earthquake waveforms and increase the earthquake signal to noise ratio. The applicability of the method is checked through tests on synthetic and real data.