EGUsphere, author comment AC1
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Reply on RC1

Zahra Zali et al.

Author comment on "Ocean bottom seismometer (OBS) noise reduction from horizontal and vertical components using harmonic–percussive separation algorithms" by Zahra Zali et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-823-AC1, 2022

We appreciate your comment on applying the HPS denoising algorithm to other OBS data with different noise sources. We have already used the presented algorithm to denoise data from the “KNIPAS” project (Schlindwein et al., 2018) and have found significant improvement when calculating receiver functions (Rein et al., EGU22, manuscript in preparation). We are therefore quite confident that the algorithm is able to significantly reduce noise from different sources as far as they are long-lasting narrowband signals, which is the signature of many important OBS noise signals.

Here we show one denoising example from the KNIPAS data set is one part of another paper under preparation. We have restrained from including more examples for different data sets in the submitted manuscript to avoid the need for presenting the different experiments and noise conditions that would inflate the size of the paper significantly.

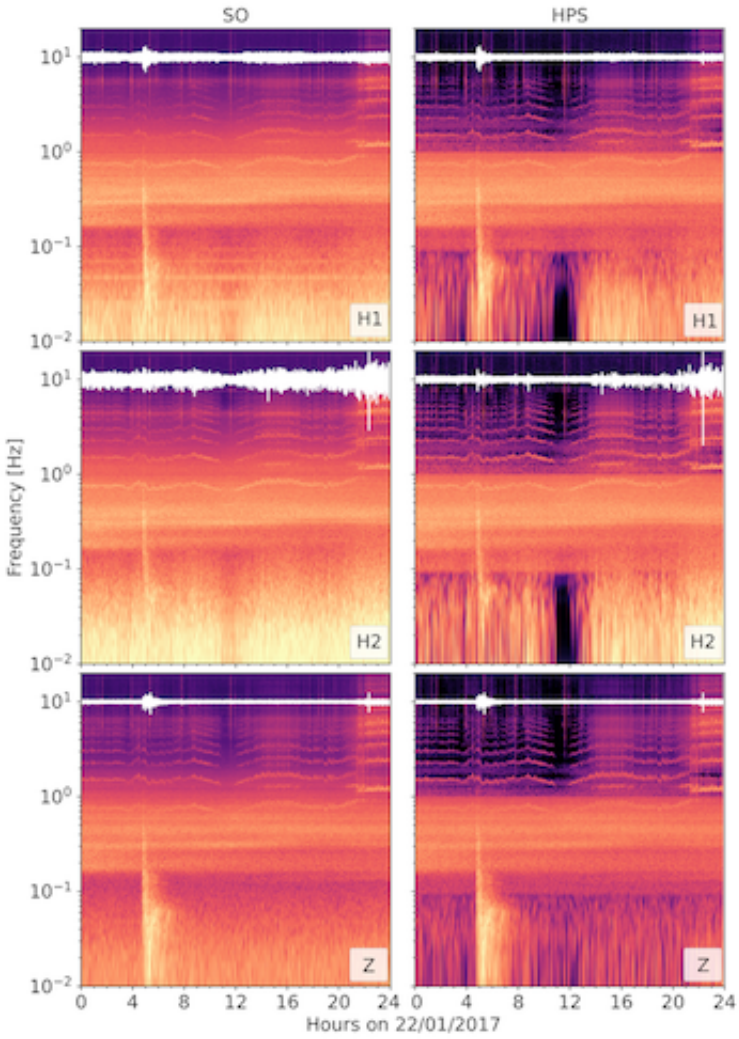

Figure1. Comparison of the spectrogram and waveforms (white traces) of SO and HPS signals from KNIPAS data (Rein et al., EGU22, manuscript in preparation). The comparison illustrates the noise reduction on the horizontal (H1 and H2) and vertical components.

L.148 - 154:

According to Essing et al., (2021), the noise source of the flagpole is most likely depending on the orientation of the OBS instrument, since it is fixed directly on the frame of the OBS. Essing et al. (2021) have analyzed the tremor noise sources in detail and did not observe any dependency of the tremor signal on OBS orientation. Therefore the head buoy is most likely the predominant noise source for the tremor events.

L. 351 - 353:

For generating the synthetics with qseis, we used a normalized square half sinus as STF with a duration of 2 s. A more realistic STF would change the source spectrum but not its wideband (transient) characteristic, which is the basis of the separation of the earthquake signal from long-duration narrowband noises using our HPS denoising algorithm.

L.356-358:

We ensured that these noise scenarios are not contaminated with other noise sources acting at frequencies below 1 Hz, however, even if other noise sources would exist, the

analysis is independent of the type of noises. As stated above, the denoising algorithm will remove mostly the long-lasting narrowband noise type, which is typical for OBS recordings.

L.542-551:

Thanks for the remark. We added the below sentence to mention the efficiency of the algorithm.

An example of one day OBS signal with a sampling frequency of 100 Hz is presented on the GitHub page. The average computation time for this example is about 7 minutes on a PC with an Intel core i7 (six-core) processor of 2.2 GHz and 16 GB of RAM.

Figure 1: We haven't shown the hydrophone channel since we feel it does not provide much additional information here. The main purpose of this study is to reduce noise from horizontal components and make use of consistent patterns determined from the spectrograms. Other algorithms (Crawford and Webb, 2000; Bell, et al., 2015) designed for denoising only the vertical component of OBS recordings certainly make use of the hydrophone channel. However, in this study, the hydrophone is not needed for the denoising of the vertical and horizontal components. Therefore we have decided to show only those components, which are used.

Figure 2: Thanks for the comment. The caption is modified and the information is added.

Figure 3: The earthquake shown in Figure 3 is the synthetic earthquake, which was added to the real noise data at the position of noise type N3. In this Figure we show the improvement of the HPS noise reduction algorithm on the R and T components, using the illustrated synthetic earthquake at N3 as an example. However, for N1-N3, we have ensured to only add earthquake-free noise data to the synthetic earthquake. We have changed the illustration of arrows in figure 3 to clearly point to the noise and not the earthquake signal.

References:

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