EGUsphere, author comment AC2
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Reply on RC2

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-AC2, 2022

We appreciate your comment on explaining the parameters of the algorithm in a more structured manner so that the reader can easily understand them. We reorganized the manuscript and add more information at the beginning. However, we keep the detailed explanation about the reason for the two frequency ranges in the method section after we explain SIM. The reason is that the reader needs to know how SIM works to clearly understand it. Now we mention this at the beginning of the method section as well so the reader knows that he/she will have a better understanding of this until the end of the section. We created a table, which contains all the parameters, which we used in our study. The explanation of the parameters is presented in the text.

- Figure captions: We modified figure captions; removed the unnecessary information which exists in the text, and added more information about the figure itself.

- Some language issues: We applied the suggested corrections as well as some further language modifications.

L53-59:

We shortened the text and removed details of microseism noise.

L82:

Thanks for this remark. We replaced “hydrophone data” with “differential pressure gauges”.

L136-141:

We removed this part from the manuscript.

L175-176:

The sentence is removed.

L180-192:

This is true. However, in this subsection, we only described the MED itself as the subsection title shows as well. In the following subsection 3.4 we described how we used MED and SIM in our algorithm.

L210-212:

We modified the sentence. OBS noise signals are more narrow-band compared to earthquake signals. The different frequency characteristic of earthquakes and the OBS noise is an important feature that makes HPS suitable for separating them.

L301-303 & L298-300 & L 214-215:

We reorganized and modified the text so some information has been moved to the beginning part of the algorithm description. However, for the reader, it is necessary to know how the SIM works to clearly understand the reason for dividing the frequency range into two parts. At the beginning of the Sect. 3.4 we mention the reason for this division briefly. Later we explain it in more detail after the reader knows how the algorithm works. The ranges are now shown in the table parameters as well.

L 235:

We use a threshold for picking the highest similarity. We choose the upper 2% of the time frames with the highest S values as the similar frames. We modified the sentence and added the term "the upper" to make it clear.

L306:

This is the output. We modified the sentence to make it clear.

L320:

As it is explained in the text (line 224), equation 1 separates X into its amplitude (V) and phase components (by looking at the equation it is clear that the phase component is: exp(1j* phi)) where phi is the phase of X (written in the text line 227). Naming the amplitude component as V helps to better understand figure 2, but it is not needed to write a specific name for the phase component.

Eq 7:

Within the whole manuscript, we used bold for the variables in the text and used italic for the equations.

L337:

In section 3.6 it is explained that for extracting narrow-band signals a high-frequency resolution is needed in the spectral domain. So it is clear that a long time window should be used for the STFT. We mentioned our recommendation, however, one can use other sizes for the FFT window as far as it is large enough to create sufficiently high resolution in the frequency domain to be able to capture the narrow band nature of noise signals. We have mentioned our choice both in the text and table for allowing the reader to reproduce the results.

L339:

Yes, this is relevant since we want to emphasize that the algorithm doesn't destroy the low-frequency content and that the corresponding waveforms are well-preserved/reconstructed after denoising.

L341:

We added more information about the kernel size and how to choose it. 80 is our recommended size but users may want to capture more noise at the cost of probable minimal waveform distortion, so they can choose a larger size. Using the exact recommended size is not critical for the algorithm, but the user should be able to understand the effect of this parameter and tune it based on the application. So we provide the information here and explain how to choose the kernel size. We also present the chosen value in the table.

L354:

We agree to describe the structure more precisely. We defined the Moho at a depth of 11.5 km, meaning that the Moho is at 11.5 km below sea level (water depth is 4.9 km, and oceanic crust thickness is 6.6 km). We adapted it accordingly in the main text.

L361:

This information is given in Table S1, which is referenced in line 370 in the main text. From all 46 events, some were used for SW analysis, some for RF analysis, and some for both. 9 out of the 46 events were used neither for the SW, nor the RF analysis.

L380:

It is now modified to “To quantify the improvements obtained when using our method”.

L388:

We agree that a high correlation coefficient solely doesn’t demonstrate that there is no waveform distortion. Also, there isn’t any specific threshold for which the coefficient shows good preservation since there is always some noise remaining after denoising and the amount of the remaining noise depends on the type of noise. However, a high correlation coefficient is an indication of signal preservation. Along with all the other tests, it helps to demonstrate the wanted earthquake waveform preservation. We adapted the text accordingly.

394-396:

We modified the unclear part and added more explanations to make it clear.

403-404:

We keep this since it is important to mention the peak on the arrival time of seismic phases and emphasis that the energy of seismic phases is preserved.

L406-7:

Figure 4d is not an overlapping plot of the lines in Figure 4C, but it is a comparison of the synthetic signal with the trace showing the “difference of SO and synthetic” and the “difference of HPS and synthetic”.

L438:

This sentence is removed.

L440:

Thanks for this remark. Now we used “situation” in all cases.

L445:

The dispersion maps show that noise energy in the range of the signal frequencies is removed successfully for periods between 5 and 20 s. Longer signal periods that are weakly visible in the noise-free image (Fig. 5d) can only partially be recovered.

L446:

We modified the sentence and mentioned that they can be only partially recovered.

L488-9:

Compared to SO. We changed the sentence to clarify the comparison between SO and HPS.

L508-511:

We modified these sentences and now they fit better in the conclusion section.

L514-515:

We mention this in the conclusion since this was not the purpose of the study, however, this could be an application of this algorithm. We don’t mention it in the discussion because we didn’t specifically extract the microseism signal but one can do so by applying a bandpass filter to the extracted noise signal.

L519-537:

We agree with the comment. We moved some details to the discussion and shortened the conclusion section.

L539-540:

The algorithm can extract and separate different signals in the OBS recordings. As mentioned in the previous comment, one can extract the microseism signal for further study on it. This is one application of this algorithm where the extracted signal is the wanted signal. Another application, which we focus on in this study, is noise reduction of OBS recordings where the extracted signals are considered as noise for the study of teleseismic earthquakes.

References and figures:

Thanks for the suggestions and corrections. We applied all. We also added other missing DOIs.