Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., referee comment RC2
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Comment on esurf-2022-10

Anonymous Referee #2

Referee comment on "A template to obtain information on gravitational mass movements from the spectrograms of the seismic signals generated" by Emma Suriñach and E. Leticia Flores-Márquez, Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2022-10-RC2, 2022

First of all, I want to kindly thank the authors for their submission of the manuscript entitled *"A template to obtain information on gravitational mass movements from the spectrograms of the seismic signals generated"* by Suriñach and Flores-Márquez to the journal of Earth Surface Dynamics.

The manuscript discusses the spectral analysis of mass movement signals, and how to extract specific signatures from spectra of seismic data by fitting an exponential to the envelope of the signal onset.

The analysis of the signal onset section is a smart and intuitive way for the classification of seismic events, yet I believe that the manuscript should be shortened significantly and focus on the concise description of the method and/or the given applications before it should be considered for publication. In the sections below, you can find specific comments and a more detailed arguments for my opinion.

One significant issue I see is the similarity between the presented manuscript and the publication by Suriñach et al., 2020 (geosciences). I believe it is important to elaborate on what is actually new in the presented manuscript over the existing publication.

General Comments

- As I understand it, the presented algorithm is fitting an exponential onto the envelope of the signal onset within the spectrogram, resulting in exponents specific for a given

type of mass-movements. This clear summary of the algorithm is missing, and instead is often circumscribed with unnecessarily complex paragraphs. Therefore, I believe the manuscript can be shortened significantly by removing redundant sections.

- What is the benefit of using the "template" instead of a thresholding of the fitted exponent values? Is the templating not an unnecessary additional step?
- The introduction reads more like an overview of interesting literature in related fields rather than a focused introduction working towards the main message of the manuscript. I believe that the manuscript would benefit from a more concise and focused introduction.
- If I understand and interpret this correctly, the same method as introduced and used in Suriñach et al., 2020 is used in this manuscript. To me, this was not clear when reading the manuscript. If this is in fact the case, I believe the manuscript could be shortened even more significantly, since the algorithm is already introduced in the above-mentioned publication.
- Please make sure that all acronyms are introduced. For example, PSD (Line 61), STA / LTA (Line 56) are not introduced properly. Also, for algorithms like STA/LTA, it would be great to have a citation in case someone is not familiar with these algorithms.
- The manuscript contains quite a number of redundant statements and paragraphs that contain not much information. Examples are in the paragraphs after line 75 and 125, where "code" and a developed "algorithm" are mentioned, but no information about the content is provided. I believe by removing such redundant and empty paragraphs, the manuscript could be shortened significantly by making it more concise.
- The word "considered" is repeated over and over, even in cases where other words might be more suitable (e.g., data were "used" instead of "considered", the SON section was "analyzed" instead of "considered").
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Specific Comments

Abstract:

- Line 10: you mention a "template" that you simply "overlay" over the data. When only reading the abstract, to me it is quite difficult to grasp what is meant by that. It would be great to get a better intuition of the workflow here, such that the abstract is clearer without reading the entire manuscript.
- Line 14: The way this is formulated is, that if a gravitational mass approaches the sensor, it will start emitting high frequencies. Is this not a path effect that for larger distances, the higher frequencies attenuate faster and do not reach the sensor, hence, the higher frequencies are only measurable closer to the sensor?
- Line 18: The specific values of beta' in the abstract without context (e.g., an equation, behavior (liner / exponential)) makes it more confusing for me to read. What does this mean? 0.003 / second of what? I would probably explain this more or leave the specific values out.

1 Introduction:

- Line 66: The spectrum is a representation of the time-series data that can be visualized, but it is not really only a “visual representation”?
- Line 75: This paragraph is quite generic and is in my opinion not really needed. Instead, I would briefly mention how you calculate the spectrograms in one sentence.
- Figure 1: Is c) really needed? It contains the same information as in b. Also, in b) the colorbar label is missing.
- Line 125 to 130: Here you redundantly describe that there is a code and an algorithm that was developed. This is rather generic and does not provide any information about the algorithm itself and contains no information.

2 Characteristics of the data used

- Instead of the information collected in text, it would be easier readable if the sensors, dataloggers and characteristics (including references) were in the form of a table.
- 1: This could be re-named to Data pre-processing?

3 Spectrogram vs spectrum

- I believe that this section is not really needed, since the concept of spectra and spectrograms can be referred to as common knowledge in the seismic and seismological community.
- Figure 2: is this Figure really needed?
- Figure 4: Please add colorbar labels. (Please add colorbar labels to all figures and subfigures where they are missing).

4 Spectrogram treatment (ST)

- This is basically the core of the manuscript, describing the algorithm that is used. I believe this chapter could be shortened and better visualized in the form of a simple flowchart.

5 Application

- Figures 7,9 and 11: In the earlier figures, the subfigures were labelled with letters. For consistency, please do this for these figures, too. Colorbar labels are missing.

- I believe that this chapter could also be significantly shortened. Since the manuscripts focus is on the "new method", I am not convinced that all the experiments and sites need to be introduced in such high detail, but I believe that the summary in Table 6 contains already a lot of the relevant information.

6 Discussion

- I really like table 6 and Figure 15. They are the main take-home messages for me

7 The template

- I have some worries about this section. As I understand, the shape (exponent) of the exponential is dependent on the type of mass-movement, the local geology and morphology (subsurface parameters and incidence angles) and distance of the mass-movement. This makes all the examples in 5. And 6. Site- and event-specific fits of an exponential line to the SON section. I am not yet convinced that the generalization into a template based on these findings adds a substantial benefit. Would it not be better to apply the algorithm in 4. In continuous time-windows to find signal onsets within your data, then calculate the exponents and use these for a classification, rather than "overlying" an arbitrary template on your spectrograms? What is the benefit of this template? I do not really see the reason to do this. Instead of using the template, could not a thresholding of the estimated exponents be a better approach for a classification, since all three investigated events fall within different order of magnitude ranges?

8 Conclusions

- See comments about section 7
- This section does more summarize the entire publication rather than draw conclusions.
- Have you tried the same approach for earthquake recordings or other events ? Might these overlap with the exponents of the shown data ?
- What happens in the absence of an event?

Mentioned literature:

Suriñach, E.; Flores-Márquez, E.L.; Roig-Lafon, P.; Furdada, G.; Tapia, M. Estimation of Avalanche Development and Frontal Velocities Based on the Spectrogram of the Seismic Signals Generated at the Vallée de la Sionne Test Site. Geosciences **2020**, 10, 113.

https://doi.org/10.3390/geosciences10030113