

## Review comments

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[Towards a standard typology of endogenous landslide seismic sources]

August 18, 2018

The manuscript presents a standard typology of seismic sources including slopequake, rockfall, and granular flow based on the features of seismic signal and characteristics of its frequency content, leading a possibility of the forecast of initiation of landslide rupture. The revised version of the manuscript significantly improved in overall quality and I think that the subject is relevant to publication in *Earth Surface Dynamics*. However, there are several places where I think a bit more explanation and minor-to-moderate revision are needed. Detailed comments are listed below.

### Abstract

(1) P1., Lines 6-8 "...We investigate the 1-100 Hz frequency band...":

The signal features (e.g., duration, the dissymmetry coefficient, the number of peaks of the envelop function) used in the typology analysis highly depended the filtered seismic signals. How changes in the pattern of the proposed classification shown in Fig. 11 if the authors use a bandpass filtering with different frequency range, for example of 1-50 Hz. I also found the claim of the authors "The signal features are always computed on the trace with the maximal amplitude band-passed in the range [ $f_c-50$ ] Hz" (P12., Lines 4-5). Is there a mismatching compared to the 1-100 Hz stated in the abstract? The frequency content of a few source events can be higher than 50 Hz, such as resulting shown in Fig. 2(a), Fig. 3(c,e), Fig. 5(a,b), Fig. 7(e). If the authors applied a band-pass filtering of  $f_c-50$  Hz, it would be an unfair comparison in the classification scheme using signals recorded at different sites from variable sources. The author need to clarify above discrepancy.

### 1. Introduction

(2) P3., Line 2 "Schöpa et al., 2017":

Please replace the reference of Schöpa et al. (2017) by "Schöpa et al. (2018) Dynamics of the Askja Caldera July 2014 landslide from seismic signal analysis: precursor, motion and aftermath, *Earth Surf. Dyn.*, 6, 467–485, <https://doi.org/10.5194/esurf-6-467-2018>" in the manuscript.

### 3.3 MS processing chains

(3) P9., Lines 9-10 "...For this kind of signal, location methods based on the inter-trace correlation of the surface waves (Lacroix and Helmstetter, 2011)..."

A location scheme based on the cross-correlograms of inter-stations was proposed by

Chen et al. (2013) for the determination of landslide source location. Please add the reference of “Chen et al. (2013) A Seismological Study of Landquakes Using a Real-Time Broadband Seismic Network. *Geophys. J. Int.*, 194, 885-898, doi:10.1093/gji/ggt121.”

## **5. Methodology**

(4) P11., eq.(2):

If I understand correctly the  $A_{\max}$  should be replaced by “ $T_{\text{corr}}$ ”. The value of  $A_{\max}$  is the maximal amplitudes of the waveform trace, which defined in the caption of Fig. 2.

## **6. Seismic description of the signals - typology**

(5) P12-P16:

Why do the authors use the vertical trace in typology analysis only? Maybe some of events were recorded by vertical geophone. Did you try to use the horizontal components that generally less noisy? The seismic phases excited by the sliding stage are likely composed primarily of Rayleigh wave or shear wave, which have relative large seismic energy in the horizontal components. Considering both vertical and horizontal signals also helps us to comprehensively understand the possible source type in seismic wave generation. For example, the impacts of rockfall can excite higher seismic amplitudes in the vertical component.

### **6.3.2 Complex Slopequake**

(6) P15., Lines 29-33:

Is the small-sized deeper earthquake (focal depth is relatively larger than inter-station distance) possible to be a seismic source of precursor signals? In cases of Fig. 9 a,b, the amplitude of precursor signals exhibits no obvious decay at different station sites. The amplitude ratio of vertical to horizontal for local deeper earthquake would be higher due to high incident angle of ray path of seismic waves. Three-component traces to discuss it would be helpful I think.

(7) P16., Lines 18-20, 31-32; P18., Lines 5-7; P19., Lines 31-32:

I also found the claim of the authors further investigations of precise source location and/or source mechanisms are needed to improve understanding different sources occurred at unstable slopes. However, the authors did not discuss more details in providing possible solutions to solve location and mechanisms of sources in accuracy. They (P16., Lines 18-20, 31-32; P18., Lines 5-7; P19., Lines 31-32) are weak statements in the current manuscript.

## **7. Discussion**

(8) P17., Lines 29-30 “Harmonic signals have been also been documented recorded at the Pechgraben and Super-Sauze landslides Vouillamoz et al. (2017)”:

The sentence needs some adjustments regarding the English grammar, please make it more easily readable.

(9) P18., Line 8 “Harmonic coda are also observe for certain signals (Fig. 3d, Fig. 9c) at high frequencies ...”:

It is not clear to me. Please highlight the portions of harmonic coda in the figures.

### **Figure 11.**

(10) What is the meaning of n-value shown in upper right corner of each radar chart? Is n-value the number of used traces in classification analysis? Please clarify it.