

Interactive comment on “Rapid Detection and Location of Debris Flow Initiation at Illgraben, Switzerland” by Fabian Walter et al.

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Reviewer: 1) As not all the readers are expert on seismic signal analysis, the writer recommends a better and wider explanation of the method for determining debris flow location through the analysis of seismic data.

Authors: We will include these details.

R: 2) An analysis of the influence of distance of seismometers from the initiation site on their efficiency in detecting the debris flow triggering is needed.

A: We will discuss this in more detail and include results of our site effect analysis.

Specific Comments

R: The proposed methodology for debris flow detection has been verified in an unique
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case, so that about title I propose the following: A case of Rapid Detection location of debris flow at Illgraben, Switzerland

A: As our method has been previously applied to lahars, we will change the context of our manuscript and consequently the title (see Referee #1: General Comments).

R: Abstract: The sentence at line 25 is understandable only after reading the entire paper. Please provide more understandable explanations.

A: Explanations will be provided.

R: Introduction: Moreover, what could it happen in the case of occurrence of other debris flows in the neighbouring areas? The proposed methodology could be able to identify the exact location of debris flow? The authors should also consider this eventuality in the introduction and conclusions: just write some sentences that clarify this aspect.

A: A seismic signal of such a remote debris flow is clearly distinguishable by its amplitude decay throughout our network. We will clarify and explain this.

R: Page 4: debris flow initiation: [...] I suggest the authors to adapt the description above in the explanation of debris flow occurrence at Illgraben.

A: We thank the referee for these references and will discuss them in the manuscript.

R: Seismic data: I suggest to eliminate IGB8 and renumbering the following seismometers.

A: We prefer leaving the station numbering to keep consistency with previous publications on this data set.

R: Seismic data: Panel A of Figure 5 shows that the amplitude of signal corresponding to the green bar is very large for IGB07 while this does not appear in panel C. What about the difference between normalized ground velocity and scaled ground velocity? Some explanations in the text is due.

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A: We will extend the caption (see equivalent comment by Referee #1).

R: Detection and location scheme: Points, 2, 3 and 4 at pages 6 and 7 look like statements rather than demands. They, together the explanations points to points below, could be presented at the beginning justifying the proposed approach.

A: We will move these points to an earlier part of the manuscript.

R: Detection and location scheme: The writer does not understand the computation of debris flow location through decay fitting. The analysis of the measured signal amplitude shows the exact moment of debris flow occurrence due to the high increase of the measured signal amplitude. About equation (1) A_i is a data and r is the unknown quantity. How AO can be determined? Moreover, some more explanations on the matching between RMS distribution and eq. (1) predictions could help the reader.

A: We will include more details on the location calculation and grid search.

R: Detection and location scheme: Equation (3): What is it fit? The RMS? This should be explained because most of readers are not expert on the analysis and use of seismic data.

A: We will include the requested details.

R: Results: Seismic noise ... Figures 6 and 7. The upper green triangle seems IGB10 rather than IGB9. Moreover, I suggest to label the black triangles corresponding to IGB01, IGB02 and IGB03.

A: Sorry for the mislabeling. We will correct this.

R: Results: Seismic noise ... Figure 6 caption. What about black cross? I do not see them.

A: We will make the black cross more obvious.

R: Results: Seismic noise ... Line 31 of page 9. The writer does not understand

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the distance from variance reduction maximum: in the caption of Figure 9 there is no information about distance from variance reduction maximum as the ordinate of the panel B. Moreover, add the label 1000 and 3000 in the vertical axis.

A: We will add explanations and labels accordingly.

R: Discussion: detectability and background noise and Conclusion: Please add some comment about the influence of the distance of the seismometer station from the debris flow occurrence location. Panel C of Figure 5 shows that only signal from IGB01, IGB02 and IGB03 are marked. Were also the other signal from IGB04-IGB10 used for computing decay fitting? In the case that station IGB01, IGB02 and IGB03 are missing the results from seismic data are the same? Please add some comment explanation.

A: We intend to include another panel in Figure 5, which shows the debris flow seismograms at a different time from Panel C. This should make clear how amplitudes at different station subsets participate in the location grid search at different times.

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