This study presents the results of 10 years of debris flow monitoring in Real catchment, SE France. Presented data are original and novel and have potential to be further exploited, especially in DF modelling studies where physical parameters need to be defined. The authors mention that they present a ‘protocol’ to analyze DF but I don’t see that clearly in present structure of the study (or what do you actually mean by ‘protocol’? is it a methodology how you prepare Table S1? maybe a flowchart figure could help to understand that; please clarify or consider re-framing). Apart from that framing issue, I recommend some additions (see details below) and I have a couple of comments:

Thank you for the very precise and helpful review. We considered this a protocol as it is a method for post processing raw monitoring data, but we acknowledge how this can be misleading. This will be corrected to correspond more to accurate vocabulary. The aim of this submission is to present a methodology for peer review, the provided data are an application of this method and are here for illustration and to show the potential of using this method on multiple station. The introduction will be slightly modified to make this framing more clear to the reader. Thank you for your constructive comments on this paper both on precise sections and on this framing issue.

L28-30: apart from scientific publications, I wonder whether the DRR authorities or other authorities in charge of DF management / monitoring collect and could provide more data?

There are no monitoring stations managed by authorities in France as of today. There are some detection devices installed mainly to manage road safety problems (traffic lights triggered by sensors). However, some projects are being developed (very early planning), so we think now is a good time to agree on a unifying peer-reviewed methodology.

L52-54: does this open access database already exist? Is it planned to be created? How would you motivate people to contribute their data?

In addition to the data provided in the appendix of this paper, the idea is to make the database completely available online, including raw data from research team willing to share them. We are currently opening a dedicated repository on an online open repository. We will most likely provide a DOI link toward this first sample of the dataset in the next versions of the paper. Meanwhile, this paper will help to disseminate and share the idea one how to identify debris flow surges. We will present it in the next conferences and looking for collaborators to feed this database. The aim of this current paper is to have a first peer-review of the methodology so that we can apply it to more sites and then jointly publish analyses that would not be site specific and would have a broader interest because based on the bigger dataset .

L57: in a catchment

Thank you, done.

L62: is this your ‘protocol’? if so, please name it accordingly (please also consider visualization of individual steps in a flowchart figure; see above)

Section 2.1 will be renamed correctly. We see the advantage of a flow chart and initially decided to skip one due to an overcrowding of figures in the paper, but we will add one or modify Fig.1 for clarification in this section.

L89: please provide a reference to this hypothesis

Thank you, described in [1]. Reference has been added in the paper, thank you.

L89: Focusing on data processing

Thank you, done.

L100-103: is this seismic signal analysis something you actually used and presented in the results of your study? If not, it should be removed from Materials and Methods section

Geophones record the vertical component of the seismic signal. We are using this vertical component of the seismic signal for sections 2.1.2 and 2.1.3. The signal is a proxy of a PSD made analogically (all frequencies are combined as one value). We agree that this might be misleading and it will be clarified in text.

Fig. 2: please clarify what is the use of geophone data in your study? How does it contribute to summarizing Table S1

See section 2.1.2 and 2.1.3 where the geophone signal is used to determine surge extent and velocity.

L141-150: I don't understand what you mean here; if you aim at presenting widely-applicable methodology (protocol), you should be as instructive as possible

We agree with you that this needs to be as instructive as possible. This will be reformulated accordingly, for example : "Accounting for the variability in channel is necessary (e.g. width, bed level, shape). Due to the debris flow event, scouring or filling can occur both vertically and horizontally to the cross-section. For each station, assumptions on cross section shape have to be made, and questions about variability in the channel have to be answered. For example, assumptions on cross section shape and change must answer to whether the channel can be scoured/ filled in that section and whether there is a difference in the preferred channel between low and high flows. Assumptions have to be as precise as possible using the information on the channel at this point (e.g. local obstructions to the flow are known, non erodible banks, ...)."

Fig. 3: is dotted red line for max (isn't it rather form min) and vice versa?

Max hypothesis means hypothesis which maximalizes the sediment volume transported, and maximalizes the effective height, which corresponds to the dotted red line. This will be clarified in text.

L151: please consider separate 'study area' section with more details on general physical geographical setting

A more thorough description of the study site will be added as well as reframing this section more precisely. The complete description of the site can be found in Hürlimann et al [2] and Bel [3].

Fig. 5: please consider adding information about elevation (basic contour lines)

Thank you, done.

L178-179: not clear, please clarify what you did at this step?

For one surge, the cross correlation coefficient was not satisfactory. The visual method consists in taking 4 points : two on the first geophone signal : before and after the first front; and two on the second geophone signal : before and after the first front. This can also be done on the flow peak depending on flow shape. Figure S3 in supplementary data presents this specific case. We are going to reformulate this section to clarify.

L181: I don't understand point (ii) -in Table S1, you present rainfall data with precision to 1 decimal place

Table S1 only presents maximal values and cumulated values, but temporal signals are saved in the database. They are of no use for this study so they are not presented any further but will be present in the database.

L184: I suggest to consider re-naming this section (e.g. observed DF, or similar)

Thank you, done.

L185: how do you defined 'significant' evet? Is this where the seismic signal comes into play? Please clarify

This is an arbitrary decision. We decided from knowledge on the types of flows we record on these stations. This will be clarified in the text.

L190: how do you know there was natural variability if the measurements didn't work?

The flow stage sensors did not work correctly but the geophone signals did, and they showed only debris flood and debris flow activity during this time.

L202: please unify Froude numbers to L194

Thank you, done.

Fig. 6: does it make sense to plot measurements from three monitoring stations in one curve? Considering erosion / depositional processes on a way, I suggest plotting separate curves for individual monitoring stations

The goal of this work and this figure is not to analyze site specific events on this precise torrent, but rather to provide ranges for natural debris flows, which are often not available in the literature. Rather than making multiple figures, we found more striking to show that the three stations have similar ranges.

Fig. 7: what is the reason for plotting these values? Would you expect correlation or causality? I suggest you to quantify possible correlations.

Due to mixture composition and difference in flow hydrographs shape observed in debris flows (e.g. see [4]), the expectation is that there would be a variable but we would not know at which range. In

section 4.1, different interpretations are explained and the links between variables is explored. The expectations in term of causality and correlation will be more clearly added to section 3.2.

The dataset is too small to explore properly correlation between variables in the statistical sense, but this would be of interest once collaborations allow to have more data.

L212: lack of trend or no correlation?

Thank you, done.

L218: this value is beyond what is shown in Fig 7a (max 2 000 m3/km2); please check

Thank you, done. One datapoint was not shown indeed.

L243: viscosity varies

Thank you, done.

L245-247: this is not clear to me, please reword this sentence

This parts deals with the variability of flow hydrograph. Reworded to “Debris flows have a very variable flow hydrographs [4, among others] due to a wide range of flow mixture. This leads to similar volumes of debris flow surges to be caused by different types of flow hydrographs : shallow surge which last for a long duration or very intense, high, but short surges.”.

L256: there is no part b-c in Fig. 1

Sorry, Fig.5, now corrected.

L259-271: I’m not sure I get what you want to say here

If we intend to perform sediment balance studies, a measure of the bed-load transport is necessary. The current monitoring and the data presented in this paper alone does not allow for the sediment cascade to be studied. Figure 8 shows a cycle of sediment scour and filling in the channel which is a proof that the sediment activity is high in this catchment. However, such cycles cannot be detected in Figure 9. If it were possible to see this geomorphic cycle, the cumulated volumes of the surges passing at S1 would be found to be equal to the cumulated volume at S2 over the years. Any of the deposit at S1 or between S1 and S2 would then be exported downstream. To summarize, debris flows alone are not sufficient for sediment balance investigation in such catchment and bed load has a significant impact (which is consistent with [5]).

L272: insights from multitemporal high-resolution images might help to answer some of the remaining questions raised in this section (e.g., a remobilization of material deposited by previous event(s))

Agreed, but no such multitemporal high resolution images are available on this period.

Thanks for the comment, added to the text.

L297-298: see above

Correct.

L312: ranges of what?

Thank you, changed to Analysis of the ranges of the physical characteristics of the events.

L321: what do you mean by ‘proof of concept for data processing?’; were there any doubts about it?

Changed to conceptualization of a widely applicable protocol for debris flow data processing.

L323: in the paper, you don’t say much about how this collaboration and common database should like

More information on this will be added. This paper is meant to begin the collaboration by having a protocol every station can use. see reply to L52!

L329: your data are site-specific rather than representative

We completely agree. This is why we want to have a collaborative database. We are purposefully waiting for the collaborations to be in place to publish the database. This paper intends to publish the methodology and the illustration on a specific site so that other sites can apply a methodology that has been peer reviewed.

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To sum up, some interesting field data are presented and I recommend acceptance of this study as soon as some moderate revisions are made.

We would like to thank you for the time spent on this very helpful and valuable review. The comments made will help our paper to be more clear and straightforward to read.

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