Response to the comments made by the Associate Editor

Dear Claire Masteller,

We appreciate your valuable comments regarding the fluidity of the text and the several suggestions you have made to improve the readability of figures. Your comments, questions and suggestions were helpful to improve the manuscript. We agree with most of your suggestions, and have made the modifications accordingly. Below, your comments are reported in italics, and our responses in normal font (blue color). The indicated line numbers refer to the tracked-changes version of the revised manuscript including our new modifications.

Comment 1: *Dear authors,*
Thank you for your submission to E-Surf. Three reviews of the manuscript were generally positive and agreed that the results represent a novel and important contribution towards a generalized calibration for measurements of bedload flux via the Swiss Plate Geophone system. The reviewers asked for some clarifications throughout the manuscript that I feel have been sufficiently addressed - thank you for your thoughtful engagement with reviewer comments.
I have gone through the revised manuscript and am suggesting some minor edits for clarity and in order to streamline some sections of the manuscript. I have also made a number of suggestions on figure design to improve readability and clarity. Please find these suggestions in the attached PDF.
ecause these are mainly comments on the text, not on the methods or analysis, I am marking these as minor revisions.

All the best,
Claire Masteller

Response: We are very happy to learn that the concerns raised by the three reviewers were sufficiently addressed during the first revision stage. We agree that the clarity and fluidity of several sections could however still be improved, especially in Section 3.3 (starting on Line 410). We are also very grateful for your excellent suggestions on how to improve the figures and definitely recognize that the choice of the greyish background color in multiple figures was not as ideal as we initially thought. Thank you!

Comment 2: *Line 15: "towards the development of"*

Response**:** We have rephrased the sentence as suggested (see Line 15).

Comment 3: *Line 16: Can this be replaced with "channels"? - i recognize that what you've used is a more generic phrase, but also may be a bit abstract*

Response: We agree with you and have changed the wording accordingly (see Line 16).

Comment 4: *Line 17: This is a bit vague - consider revising towards a more specific statement such as "bedload mass flux" or "the intensity and characteristics of transported bedload"*

Response: We have rephrased the sentence following your second suggestion (see Lines 17-18).

Comment 5: *Line 20: "outside of"*

Response: Thank you for having spotted this oversight. We have added the missing word "of" (Line 20).

Comment 6: *Line 20: Deleted word "here"*

Response: We have deleted the word "here" (Line 21).

Comment 7: *Line 21: Second use of calibration in this sentence - may consider revising to "direct field measurements"*

Response: The sentence has been modified as suggested (Line 22).

Comment 8: *Line 28: Deleted comma*

Response: Modified as suggested (Line 29).

Comment 9: *Line 31: "including"*

Response: Modified as suggested (Line 32).

Comment 10: *Lines 44-45: sort of awkward phrasing - maybe "errors spanning multiple orders of magnitude"? "errors on the scale of multiple orders of magnitude"?*

Response: The sentence has been rephrased following your second suggestion (Lines 46-47).

Comment 11: *Line 46: But is this ultimately true for SPG? the measurements are ultimately fairly concentrated whereas something like seismic monitoring would integrate measurements from wider areas*

Response: Correct. With regard to seismometers, the SPG system has a relatively limited coverage. This statement, however, specifically refers to the integration of bedload transport over entire river cross-sections, and in that sense we think that the SPG system represents an important improvement in term of coverage as compared to direct sampling techniques. To be more precise, we have replaced the term "large spatial coverage of river transects" by "complete coverage of selected river transects" (see Line 49)

Comment 12: *Lines 57-58: I suggest adding relevant citations for each of the applications listed here where possible- many from this group!*

Response: We have added multiple citations to each application and have attempted to include various research groups (see Lines 60-65).

Comment 13: *Line 85: I suggest replacing this with laboratory or eliminating the word controlled all together - I think the fact that they are controlled is reasonably implied.*

Response: We agree that the word "controlled" is not necessary and have eliminated it throughout the manuscript (see Lines 19, 75, 79, 90, 157, 158, 511 and 679). At some locations we have replaced the word "controlled" with the word "flume".

Comment 14: *Line 97: "with a minimum diameter of 10 mm"*

Response: Modified as suggested (see Line 102).

Comment 15: *Lines 100-101: Deleted "the outdoor"*

Response: Removed as suggested (see Line 106).

Comment 16: *Line 101-102: Replacing "ranging from a few seconds to one hour" by "for the full duration of each measurement event, ranging in duration from a few seconds to one hour."*

Response: Rephrased as suggested (see Lines 105-107)

Comment 17: *Line 102-106: This statement seems a bit out of place - The last sentence of this paragraph that was removed put this statement into context more clearly. I am not sure if this is ultimately necessary? Consider revising*

Response: We agree that this statement is not necessary to understand the content of this study. Since the manuscript is already quite long, we have decided to remove these lines (see Lines 107-111).

Comment 18: *Line 104: "rather"*

Response: Please refer to the response to your previous comment.

Comment 19: *Figure 1: I suggest that you add text labels next to one and two that say "uniaxial geophone sensor" and "elastomer element" for clarity*

in B, i find the numeric axes labels to be smal and ahrd to see and the lines representing the therhsold amplitudes hard to see. I might recommend changing the aspect ratio of this figure so the panels are vertical so B can be larger? an increase in line weight would also help

Response: We have followed all your suggestions related to Figure 1 and we think that the content of the new figure is now easier to read (see line 112).

Comment 20: *Line 115: replace with field?*

Response: We have followed your suggestion since the word calibration already appears in the title as well as in the following sentence (see Line 120).

Comment 21: *Line 119: channel morphology*

Response: We have added the word "morphology" as suggested (see Line 124).

Comment 22: *Line 120: Deleted "full"*

Response: This sentence has been removed since similar information was already given on Line 106.

Comment 23: *Line 120: Deleted "carried out"*

Response: Deleted as suggested (see Line 125).

Comment 24: *Figure 2: For non-swiss readers, it may be helpfult to include a general map of these locations*

Response: This is a good idea, thanks! We have modified the figure and the caption accordingly (see Lines 137-144).

Comment 25: *Line136-137: a) also has a crane-mounted sampler*

Response: We have rephrased the caption to avoid any confusion (see Lines 141-144).

Comment 26: *Line 151: Deleted "Controlled"*

Response: Deleted as suggested (see Line 157).

Comment 27: *Line 152: Deleted "Controlled"*

Response: Deleted as suggested (see Line 158).

Comment 28: *Line 154: a bit vague, do you mean the GSD?*

Response: We have replaced bed characteristics with "bed slope and bed roughness" (see Line 160).

Comment 29: *Lines 154-155: At the downstream end?*

Response: The plates are embedded at the downstream end of the paved section. We have added this information to the sentence (see Lines 161-162).

Comment 30: *Lines 158-159: This reads as if it assumes full familiarity of the previous paper. Revise to be a bit more general*

Response: We have rephrased the sentences on Lines 165-168 to better introduce the term single-grain-size experiments.

Comment 31: *Line 162: Report duration?*

Response: We have added some information on the duration of one repetition on Lines 170-171.

Comment 32: *Line 165: I am assuming that the j is site specific or for each size class? Can you modify the definition from "mean particle size" to something more specific to make that part more explicit for the reader*

Response: This is a good remark, thanks. At this stage we have indeed not introduced the subscript *j*, which stands for the size class. We have added this information to the definition on Line 174.

Comment 33: *Line 167-168: this statement is a bit confusing based on the statement in the last paragraph on L158-159 - I suggest revising this for clarity*

"paper, we primarily use the single-grain-size experiments conducted in 2018 with the flume configured to match conditions at the Albula field site

Response: We agree that this was confusing. We have rephrased the entire paragraph (see Lines 176-183).

Comment 34: *Line 171: Just for AdN site or across different site set-ups? I find this section to be a bit confusing - would suggest revising for clarity/consistency*

Response: Please refer to our previous answer.

Comment 35: *Line 170: Deleted "and"*

Response: We have rephrased this sentence (see Line 181).

Comment 36: *Figure 3: Please add word annotations to the figure for each label for ease of reading*

Response: Good suggestion, thanks! We have added annotations (see Line 185).

Comment 37: *Lines 176-179: This detail should be in the main text of the paper I think*

Response: We have added this detail on Lines 168-169.

Comment 38: *Line 215: Change to comma*

Response: Modified (see Line 226).

Comment 39: *Line 218: Deleted space*

Response: Modified (see Line 229).

Comment 40: *Line 228: "for the differentiation of multiple"*

Response: Rephrased as suggested (Line 239).

Comment 41: *Line 229: "the"*

Response: Modified (see Line 240).

Comment 42: *Line 257: "of"*

Response: Modified as suggested (see Line 268).

Comment 43: *Line 271: "Best separate apparent packets from real packets"*

Response: Thank you for this suggestion. The sentence has been rephrased (see Line 282).

Comment 44: *Line 272: "identified as apparent packings using this criterion"*

Response: Again, thank you for this suggestion that clarifies the sentence. The sentence has been rephrased accordingly (see Line 283).

Comment 45: *Line 284: "allow for the"*

Response: The word "for" has been inserted and the sentence rephrased (see Lines 294-295).

Comment 46: *Line 286: I thought earlier in the paper that the apparent packets introdued bias for the lower threhsolds, which are associated with smaller particles? Do you mean that larger particles generate more apparent packets because they have larger energy and that energy is more likely to show up on the geophones even if the particles arent making direct contact? Can you clarify this*

Response: You are pointing to the core of the problem. Due to signal attenuation, the apparent packets generated by large impacting particles outside of the plates' boundaries are characterized by small amplitudes, i.e. amplitudes attributed to smaller grain-size classes. This explains the significant scatter of signal responses for the five largest grain-size classes.
We have rephrased this section in order to clarify the origin of this increased scatter visible in Figure 5 (see Lines 297-301).

Comment 47: *Line 288: Deleted "see the red boxplots in"*

Response: Deleted as suggested (see Line 302).

Comment 48: *Line 290: Deleted "see the blue boxplots in"*

Response: Deleted as suggested (see Line 304).

Comment 49: *Figure 4: I suggest adding words to the axes albels for clarity -there are a lot of variables for readers to keep track of in this manuscript and I think it would aid in reading and digestion of the figure*

Response: We agree that this could be a good help. In all the following Figures, we have added as many words as possible to the labels, while taking care to not overload the figures too much. Since the variables contained in the labels are also described in the captions, we believe that the current state is a good compromise (see Line 306).

Comment 50: *Figure 5: same comment as last figure*

Response: Please refer to our previous answer (see Line 311)

Comment 51: *Lines 301-303: Is this detail included in the main text of the paper? it seems like it may be useful to make these clear in the text prior to readers encountering this figure*

Response: Yes, this information can be found on Lines 292-296.

Comment 52: *Line 306: Deleted "calibration"*

Response: Deleted as suggested (see Line 320).

Comment 53: *Line 306: Deleted comma*

Response: Deleted as suggested (see Line 320).

Comment 54: *Line 307: allow us to derive the*

Response: Modified as suggested (see Line 321).

Comment 55: *Line 340: performance of the two calibration methods?*

Response: Modified as suggested (see Line 355-356).

Comment 56: *Line 345: Deleted "too"*

Response: Deleted as suggested (see Line 360).

Comment 57: *Line 348: Deleted "as" and ", rather than apparent"*

Response: Deleted as suggested (see Lines 363-364).

Comment 58: *Line 350: Deleted "as mentioned earlier"*

Response: Deleted as suggested (see Line 365).

Comment 59: *Figure 7: On c and D it would be helpful to add a second x axis where the grain sizes associated with each of the size classes are delimited in units of length*
The use of C1-10 for threshold values is different terminology than how these thresholds have been refered to in the main text, I suggest revising the legend to make this consistent
Challenging to see the raw data in A due to the overlay, I might suggest puting those boxes behind the data because in this case they are vertically consistent and no important aspects would be obscured

Response: Regarding your first comment on Figure 7, we think that it may be confusing to add the grain size corresponding to the size class. In fact, subplots c and d indicate the number of packets $PACK_j$ located within the class boundaries, and not the size of the particle at the origin of the packet. To clarify, this we have modified the x-axis label.
We have followed your two other suggestions and have modified the figure accordingly (see Line 377).

Comment 60: *Line 365: This shielding should be pointed out in the experiment set up more explicitly*

Response: We have rephrased the paragraph on Lines 176-183 to set a stronger focus on the shielding.

Comment 61: *Line 376: Figures should be introduced in order - modify sentecne to be consistent and have a appear before B*

Response: We have decided to keep only one reference to Figure 8 (see Line 391).

Comment 62: *Figure 8: Again add words to axes labels*

The utility of the grey shaded area is unclear to me, it just looks like it is covering the entire region of the plot and ultimately makes all of the envelopes extremely difficult to see

It also introduces som ambiguituy in the interpretaiton of the legend. I am assuming that the grey area in the legend is just indicating generically that each colored envelope goes from 5-95th percentile, but then when you look at the plot you can interpret the grey background as that first legend entry. I would suggest modifying the background to be white (which may lead to a change in the erlenbacj color if the issue is the visibility of the yellow)

the overlapping envelopes may not be opaque e nough to differentiate, one way to address this could be to also put solid lines on the boundaries of the envelopes to better distinguish them/ highlight the degree of overlap. I would suggest making the median line thicker and adding thin lines on the upper and lower bounds of the envelope for visual clarity

Response**:** We agree with all your suggestions and have changed Figure 8 accordingly. We have not added words to the y-axis label because, in our opinion, the units given in parenthesis give sufficient information about the meaning of the variable $k_{b,i,j}$ (see Line 401).

Comment 63: *Table 4: Include grain size classes explicitly*

Response**:** Changed as suggested (Lines 407-408).

Comment 64: *Line 396: "use" or "apply"*

Response**:** We have replaced the word "insert" with "apply" (see Line 411).

Comment 65: *Line 397: unit width?*

Response**:** We have changed "the unit fractional flux" to "the fractional flux per unit width" (see Line 412).

Comment 66: *Lines 398-399: This sentence is unnecessary, more streamlined to cite figure 9 in previous sentence*

Response**:** As suggested, we have removed this sentence and have added a citation of Figure 9 in the previous sentence.

Comment 67: *Lines 400-408: This is a bit tedious as the text just points to details of the figures and tables which will be hard to jump back and forth between once the article is typeset, can you summarize these results more explicitly highlighting important quantitiative valuyes are results directly in the text rather than just saying it is in the figure?*

I think this would also help streamline things for the reader in what is a fiarly long article.

Response**:** We agree with you that these two sections were not clearly written and would have hampered a fluent reading. We have rephrased several sentences and have inserted in the text several important values from Table 5 to better underline changes of the accuracy of estimates (see Lines 416-438).

Comment 68: *Line 409-418: Same comment as previous paragraph. A sentence or two dedicated to each point on this list with more explicit demonstration of that result/concluision would go a long way in terms of readability*

Response**:** Please refer to our previous comment.

Comment 69: *Figure 9: Missing figure caption? Same comments re: labels and grey background as previous figures. Factor 5 is not clear, please modify legend label to make this explicit*

Response**:** Following a comment made by one of the reviewers, Figure 9 had been replaced by a new one using three lines of subplots. We had kept it in the tracked-changes version to facilitate a comparison. We have now removed the old version and have applied your suggestions to the new Figure (see Line 458).

Comment 70: *Figure 10: This metric should be introduced in the main text to better prepare the reader to digest this figure. The axes labels should include words for clarity*

Add text labels to each panel to indicate which represents which method

Having now looked at figure 11, I would suggest a revision of the box pltos so readers can more directly compare between the methods

Response**:** This metric is already described earlier in the text (see Lines 475-476). But we have followed your other suggestions and have added text to the labels and grouped the boxplots into one subplot (see Line 482).

Comment 71: *Lines 453-455: Report values to support this interpretation*

Response**:** We have added the values of the Avançon de Nant site to illustrate the less substantial improvement obtained through the application of the AF method, as opposed to the best improvement observed for the Erlenbach data already mentioned in this paragraph (see Lines 496-498).

Comment 72: *Figure 11: Remove grey background - it makes the transparent points and boxes harder to see*

The way the boxplots are presented to compare methods is not consistent with the previous plot. I would suggest revising towards consistent presentation so the reader is already primed to interpret what they are looking at.

Thte use of transparency for the box plots specifically is a bit confusing and makes me feel like I want to ignore the transparent boxes in favor of the opaque ones, by establishing a visual hierarchy that I don't think is necessary. I would suggest perhaps making both boxes opaque but differentiating them in a different way that doesnt place an emphasis on one method as drastically over the other.

Response**:** Thanks for these good remarks. We have changed Figure 10 as well as Figure 11 along with their captions to make them consistent and avoid emphasis on one method (see Lines 482 and 501).

Comment 73: *Line 482: "was" instead of "were"*

Response**:** We have kept "were", since we were referring to "the optimal linear coefficient and exponent of the criterion…" (see Lines 522 and 523).

Comment 74: *Line 492: Can you provide a quantitative metric to describe the scale of difference? This statement is a bit vague*

Response**:** Please refer to our answer to your next comment.

Comment 75: *Lines 493-494: I think there is a typo in this sentence??*

What do you mean by "important number of packets"?

Response**:** We have rephrased this sentence and have added quantitative information to describe the amount of packets suppressed by the use of AF thresholds (see Lines 534-535)

Comment 76: *Lines 498-503: Is this necessary? The result isnt entirely surprising - and I am not sure that this revised method is really introduced anywhere, so in order to streamline the paper, I might suggest removing this*

Response**:** We agree that the "improvement introduced by the adapted AH method" for the Erlenbach is not surprising. However, the fact that this approach does not improve the signal conversion to fractional transport rates for other sites is also an interesting result that is worth to be reported. Therefore, we decided to keep this paragraph (see Lines 540-545).

Comment 77: *Lines 504-508: This paragraph seems to come out of nowhere - especially the mention of the shortcoming of lacking flow velocity measurements. While this may be an important point, I would encourage some revision here to better place this last paragraph into the context of this section*

Response**:** You are right, this paragraph does not suit very well to this section. We have moved it further down at the end of Section 4.5 (see Lines 650-653).

Comment 78: *Figure 12: Same stylistic comments as previous figures*

The data is so discrete in terms of Vf that it is hard to discern any differences at any individual site as a function of flow velocity

I miGHT SUGGEST adding best fit lines to each populdation of data to see if there is any trend in r with v (except for the erlnebach)

I would suggest rather than adding random noise to the EB data, just making a box plot - I do not think its appropriate to add random noise here if you don't have measurements because it is likely to misinterpreted by a reader

Response**:** In addition to the modifications related to the background color and the text in the labels, we have replaced the data points of the Erlenbach site by a boxplot and have adapted the caption (see Lines 654-659). However, we have decided not to add best fit lines because in our opinion it is already clear enough that there is no obvious trend inside the data. (It might be more helpful to fit a trend line representing all data points, e.g. fitting one to the mean/median values for each velocity class.)