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Earth Surface Dynamics Discussions

Interactive comment on "Impacts of a large flood along a mountain river basin: unravelling the geomorphic response and large wood budget in the upper Emme River (Switzerland)" *by* Virginia Ruiz-Villanueva et al.

Anonymous Referee #2

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This paper studied the channel widening and LW dynamics through a post-event survey carried out after a large flood in a mountain river basin in Switzerland during the summer 2014. After detailed statistical analysis the authors find out control factors for the studied phenomena, among which they highlight the precipitation.

The paper is well written and structured and presents a solid methodology and the results presented in this paper are highly valued to better understand this kind of phenomena. The kind of data presented in this paper are highly valuable because, as commented in the paper, the data are still scarce and relevant for river management.

Therefore, I suggest the paper to be published. However, I have few comments that I hope help the authors to improve the present manuscript and make it clearer for the reader. These comments are divided in sections.

GENERAL COMMENTS I think that the authors talk about flood response but they mainly analysed channel widening (not other phenomena such as landslides) so I would suggest specifying this in the title, as well as in the text and use channel widening rather dan flood or channel response.

INTRODUCTION The introduction is very complete and well structured.

Line 85. The specific aim described here is not tackled in the rest of the manuscript (there is no quantitative information of debris flows, landslides etc, so I suggest rewriting this to focus the goal on the channel widening from the beginning.

Line 92. The hypothesis is not very clear, in which terms do you describe similarity of the river? What it seems quite obvious is that if you analyse similar rivers (from the morphology of the channel and the catchment) one that was affected by severe precipitation and other that did not, the response would be different. Maybe you can specify better this, if they had similar morphology and similar precipitation, but their response to the flood is different, and in this case, what would explain the difference.

Line 93. Maybe you could already introduce which parameters you used for the analysis. Material and methods This section leads to some issues that are not clear, I have tried to point them out so that the authors can clarify them.

Line 121. Maybe you can move this paragraph together with the first paragraph of the section. Also, you can refer to the different parts of the figure in the text, like (Fig 1.b) in the paragraph of the line 105 and the Fig 1.c in the paragraph of the line 101.

Fig.1. This is a good figure. The photos d and e are easy to locate with the caption, but not the f., Räbeli bridge is located near Räbloch?

Table 1. This table has a lot of information and I am not sure if I is relevant, like the sub

reaches and the Total number of transects, maybe you can consider removing them.

Table 2. In the note of the table (*) you talked about two sections, but it is only marked in Räbloch. Maye or comparison you could add a column with the specific peak discharge (m3s-1km-2), but it is true that it can be calculated with the data present on the table. Maybe you could include these sections in the map of the Figure 1 similarly as you did with the raingauges.

Line 228. I suggest deleting “and mapped in GIS” and talk about it more in detail in the next section. Maybe you can give more details about how you measured the wood deposit and where. Also it would be interesting to know more in detail (maybe in the GIS section) about how you extrapolated the information from two tributaries and the Emme river to the rest of the basin.

Line 233, change <10 cm to >10 cm so it is according to the definition made in the line 231. The classification into size classes was made in the field for all the LW deposited pieces in the studied reaches?

Line 152, maybe you can describe the mean max and minimum length of the sub reaches.

Line 260. Could you specify which where the post flood units? Did you map them as polygons?

Line 262. It is not very clear for me why you used transects for obtaining the width if you had already mapped the channel before and after the event and had the length of the channel or centreline you could calculate the average width of the subreaches. In the case of the transects, the different parameters are measured along exactly the same transects? What was the active channel used to obtain the centreline, the pre- or the post-event? If they are the same, it may be that the width is not measured perpendicularly to the flow in one or the other case. Cold you also explain why the transects interval ranged from 20 to 50 and why?

Line 277, could you specify where this equation is coming from (the regression coefficients and so)? I think that in the case of this catchment, where the precipitation had big variations, using an approach based only on the Area could lead non realistic data. Maybe you could apply a simple rainfall-runoff model calibrated with the data of the Table 2 to better estimate the peak discharge or specific peak discharge of each tributary.

Line 282. The use of SPI may be appropriate when you have similar specific peak discharges in the catchment, but in this case, when there are large variations in precipitation (and possibly discharge) to relate the stream power just to morphological characteristics of the catchments could lead to errors. Maybe you can discuss on this.

Line 282. This comment is not for this line, but I think you should add also in this part how you calculated the sinuosity.

Line 284. I would add also discharge or stream power here, even if in the end you did not see the correlations.

Line 287-289. I think that this hypothesis should be better in the introduction rather than in the methods section. However I think this hypothesis is a little weak, maybe you could add the precipitation could be considered in case that the morphology, landuse and the geology of the catchments compared were homogeneous, otherwise the hydrological response of the channel would be different. I agree with the authors that having the chance to understand complex responses through the rainfall is a nice starting point, because the data on precipitation is much easier to get than peak discharges after an event, but I think that an accurate data on discharges (complemented with other morphological variables) could lead to better estimations.

Line 304. Specify which channel area did you used to normalize the wood volume (pre or post-event)

Line 307. Add the date when the video was filmed

Line 309. Could you calculate the volume deposited at each site or the total volume for each subreach with that information?

RESULTS The analysis presented in this section are very interested, however the amount of information provided in the manuscript and in the supplements can be overwhelming for the reader and it may benefit from a reduction of the amount of data provided and analysed that are not useful for the paper. For example, in the Figures with Spearman Rank correlations (that could be named as tables), the authors may consider to avoid showing all the correlation of all the variables, since some of them are not meaningful, this can be done by showing the correlation between analysed parameters and analysed control factors (some of them, like the widening ration, can be in both sides, but it does not make sense to show the correlation of the mean and max precipitation, for instance. Another example is the regression graphics of parameter with control factors that have been shown to not to have correlation (ie. figure 7. b and c). Also the logistic regressions table provide large information of data that are shown in the end to not to be that explanatory, I would suggest to try to summarize to the main points that are relevant and specify more clearly the maybe in the results but also in the discussion the limitations of these variables to be used in the future (due to the large scatters and uncertainties)

Line 348. In the S5 figure caption maybe you can add which statistical test you used for the analysis of the differences among the Emme and Tributaries.

Line 363. Maybe you can explain why you highlight these channels in the figure 4.

Figure 4. Is there any reason why some subreaches are highighed with numbers and not the Sadelgrabe and the Gärtelbach?

Line 382. In the supplement material, change the caption Figure S78 to Figure S8

Line 390. The threshold of 1.2 was chosen according to a specific criteria based on literature or was it decided for this specific study site?

Line 471. In this paragraph you should refer to the Table S1 and S2. (In the Table S2 S4, S5 caption you could specify what is the last column? Is it p-value?)

Line 424. Mean, max or both?) for the logistic analysis you only showed the maximum, right? I have doubts about this value, as I have understood it, you took the maximum accumulated precipitation in a pixel 1x1 km of the catchment, right? Could you discuss (maybe not in this specific location) about the relation of this value to the catchment size and the representativity of it with respect to the average accumulated precipitation in the catchment? And in case of nested catchments (like the Emme, that includes the catchment of the tributaries, you choose the maximum value of the entire catchment?).

Line 438. The Gäartelbach does not seem to be among the tributaries with bigger LW volumes recruited according to Fig. 3, it seems that the Chaltbach and the Leimbach have recruited more wood. Could you check or explain?

Line 441. Specify if the stream hectar was before or after the flood.

Lines 459-460. May this be because you are correlating two variables that include the channel width within it (LW volume /channel width x length) and (Channel width post/ channel width pre)?

Line 476 change wi thsub-reaches → with sub-reaches

Line 536. I think that pointing out the uncertainties are up to 50% is not needed in the table Title. In this table however the budget should be 0 for an extreme event according to the available equations. How did you calculated the exported?

Line 549. Which segment? Could you point it out in figure 1 or name the subreaches that were included in this segment?

Table 5. Same as comment for the table 4. And also the wood budget should be 0, so you could could assume that 501 m3 (+- uncertainties) must have come from upstream reach of the analysed segment. Does the deposit along the river does not have uncertainty? (line 563-565)

DISCUSION This section summarizes the results and compared with the available literature when the authors wrote the manuscript. My main comment on this section would be to discuss a little more on hydraulic parameters to explain the widening and LW recruitment, on the difficulty to obtain that values, or why the data about discharge you could retrieve and calculate is not considered reliable.

Line 588. You did not analyse the entire catchment for the LW dynamics and budget.

Line 590-591. These thresholds are not so clear according to your data and analysis

Lines 600-603. You could point out that in these studies hydraulic and morphological controls were analysed.

Line 608-610. This sentence can be a little contradictory with your previous statement of the need to analyse the entire basin.

Line 674. What about the work of Steeb et al, 2017?

Line 699-701. I think this sentence should be explained in the methods and removed from here.

Lines 706-710. Maybe this is also because, if I understood correctly, you only quantified some deposits and not all the LW deposited along the affected channels, as the cited papers, where the LW may have been transported less distance.

Lines 713-724. I think this paragraph could be moved right before the previous, to connect it with the LW budget.

CONCLUSIONS The conclusions section is well written and supported by the presented data in this study.

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