

## ***Interactive comment on “Rapid and objective characterization of channel morphology in a small, forested stream” by Carina Helm et al.***

**Anonymous Referee #1**

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General comments:

The topic of the paper is interesting and tackles an important question related to the efficient field measurements of the river systems, which are having forest canopy. The paper is overall good, and especially the researchers from the fields of remote sensing and fluvial geomorphology will be interested in reading it. The authors have done huge work in field and with data processing. The methods are up-to-date and the paper is unique. However, before being possible to publish it, the manuscript would need clarifications in many sections, and rearrangement of the sentences / paragraphs. The terminology related to the spatial scales would be needed to define more precisely, so that readers would understand more easily what is meant with large, small etc. Overall, precision in the statements would make the paper more easily readable. The justifica-

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tion of the paper would be needed to write more clearly in the introduction section. The texts and figures presented in the results and discussion sections would need also re-arrangement. Also attention should be paid to the sub-titles. Overall, clarification of the text and justification of the importance of the selected topic, methods and gained results would be needed throughout the paper. Therefore, major modifications are suggested.

Specific comments:

Title of the paper: Consider deleting words rapid and objective from the title. Introduction or aims do not include these words, and justification and need of the rapidness of the techniques does not come clearly evident from the introducing sections. Or, if wanting to keep those words, add description about the rapidness and objectivity of the approach in the introduction section. I also suggest that the close-range remote sensing approach could be good to appear in the title some way or another.

Abstract: The following sentence is slightly contradictory, as you talk about both large areas and small streams. “This paper seeks to demonstrate an objective method for characterizing channel attributes over large areas, using easily extractable data from RPA imagery collected under the forest canopy in a small (width = 10 to 15 m) stream..” What do you mean with large areas? Could you clarify and modify the sentence so that it does not cause the reader to be confused between the different spatial scales under question.

Abstract: “The results demonstrate that sub-canopy RPA surveys provide a viable alternative to traditional survey approaches for characterizing these systems, with 87% coverage of the main channel stream bed.” Could you specify already here, what are the traditional survey approaches? Does this relate to the flight altitude? In addition, it would be actually important to also mention the flight altitudes (etc. details, which show how your method differed from the traditional approaches) in the abstract, as I would imagine that in the sub-canopy flights the height of the platform was low.

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Lines 20-22: You mention that “These characteristics can lead to a high degree of spatial variability and . . .”. Could you clarify the sentence, especially “spatial variability” of what? Both the first and second sentence of the introduction are slightly vague, and would need clarification, so that the start of the introduction would be stronger. It feels like there is repetition also in those first two sentences. Thus, make the beginning of the introduction sharper. In addition, it would be good to mention already in the first paragraph in detail what are the channel characteristics, which are important for the “management”, and for the study, and why those are important? Is it only gradient, as that is the only one mentioned? The justification for the variables/metrics and their wider applicability does not come clear from the introduction. Therefore, the sharper beginning of the introduction and also more clearer justification for the study (parameters, and why their detection is important) would enable the reader to understand the uniqueness and importance of the paper more clearly.

Lines 50-54: The authors refer to Kasvi et al. (2019). That study has been done in a river system, having small channel width especially during the low flow periods. Therefore, please clarify the sentences so that the readers do not get an idea that Kasvi et al. (2019) paper has been done in larger river system. Again, please, define also in those lines 50-54, what do you mean with larger system / how do you define larger system?

Line 57: What is meant with “continuous RPA-derived data”? Is that spatially or temporally continuous?

Lines 100-101: What is the altitude of the low-level flights? Please, specify already here (i.e. where you first time mention these flying specifications), and not in the later sentences.

Lines 100-102: You write “The RPA survey involved low-level flights conducted in tandem with placement of Ground Control Points (GCPs) that were surveyed with a Leica TPS 1100 total station.” Did you take the reference points from the sub-water

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areas also? Or how do you calculate the accuracy of the bathymetry cells, which you talk about in results section 4.1? Please add in the methods section clearly, how the reference points for these RMSE and ME calculations were measured, and did you measure them also from the sub-water area and how (also with a total station similarly as the dry land areas and the GCPs)? Thus, some clarification and sharpness would be needed to the methods section also.

Line 114: You mention riparian vegetation here for the first time. How high is the riparian vegetation and what are the species. Was there grass and shrubs, or do you mean the “dense forest canopy composed of both coniferous and deciduous tree species”, which you talk about in the study site section? In addition to mentioning the heights of the riparian vegetation (which were cleaned away from the data based on the filters), it would be good to also introduce the riparian vegetation in the study site section.

Relates to the methods and discussion section: Did the canopy effect on the pixel values of the water area? As you defined the bathymetry based on Dietrich et al. (2017) method, did the shadows and reflections of the canopy harm the water pixel colors and bathymetry calculations? What was the turbidity of the water? That information would be important to add, from the measurement times. The success of the Dietrich et al. (2017) method could depend on how turbid / clear the water was. Please, discuss about this in the discussion, and present how the turbidity was taken into account in the methods section.

Lines 139 -145: The authors introduce here the method for grain size estimation. However, this is the first time grain sizes are mentioned in the manuscript. Thus, there is no background literature in the introduction section, or justification why this calculation is important to conduct. You mention “a metric often of interest to river managers”, but it would be important to justify here, why these metrics are important for your study. Please, add in the introduction and/or in the methods section, why the grain size is needed to be defined. To some readers the necessity to define the grain sizes is not

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self-evident.

Line 173: I am not a native English speaker, but I think this following part of the sentence is missing one preposition “data along the first” -> change it as “data along WITH the first”.

Many of the figures appear only within the discussion section, and the results defined in some of the figures are not analyzed in detail in the text of the results section. For example, Fig. 8 appears on page 15, but it is talked with two sentences on the page 10. Thus, rearrange the appearance of the figures so that the text and figures appear “hand-in-hand”. Despite the channel morphology was one of the main topics talked in the introduction section, the channel variables and the results of the morphological detection have not been given full attention in the results section. So, please, add text in the results section related to the morphological characteristics and their spatial variation.

Discussion: Many of the sentences (such as on lines 249- 255, and 278–285) should already be presented in the results section. Therefore, rearrangement of the discussion would be needed. I am not pointing out all of the sentences in question, as there are many of them. My advice is that when you present something for the first time based on your analysis or the data sets, move those sentences under results section. Discussion is then reflection of your results (presented already previous sections) against other studies.

Many of the sub-titles of the results and discussion section are methodological in their nature. Go through the titles of the manuscript and modify them so that they show that it is results and discussion in question, and not an introduction to the methods. Now the titles give slightly different idea of the content than what the content actually is: such as, “5.2 Classification approach” sounds like the section would include an explanation how the classification method was used, even though it is discussed about the “success of the classification approach”. Thus, the titles of the results and discussions sections are

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misleading.

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2020-33>, 2020.

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