

Comments by Associate Editor (Rebecca Hodge)

Many thanks for undertaking these edits on the paper. Both the original reviewers have provided a set of comments on the revised paper and agree that the edits have improved the paper. The new comments are mainly points of clarification and should be straightforward for you to address. Referee #2 has provided an extensive list of copy edits. You should consider all the suggestions, but it's up to you to decide which ones to implement. Personally, I don't think that all of them are necessary. I do not agree that the paper requires significant improvement in scientific writing, and note that the paper will undergo copy editing prior to publication anyway.

[We thank the Associate Editor for this positive evaluation of our work and these recommendations. We have in turn modified our manuscripts following these guidelines.](#)

Comments by Referee #1 (Benjamin Purinton)

Dear Authors,

I applaud the effort revising the paper. In particular I find the qualifications of the trial-and-error approach and additional schematic figures (Fig. A1 is great, thank you) and text to be very helpful in understanding the steps and limitations of the algorithm, and this will certainly aid other researchers when they are seeking to apply this. I briefly tried the matlab code and it seemed to run without errors (though admittedly I did not closely inspect the resulting segmentation). The paper is ready for publication following some minor changes/additions that I detail below.

Sincerely,
Benjamin Purinton

[We are very grateful to Benjamin Purinton for his work on our manuscript which has clearly helped increasing its quality. We have modified our manuscript to account for these minor comments.](#)

Supplement:

The phrase is "on the contrary" (noted a number of times). Maybe rephrase "dichotomic approach", I don't quite understand what you mean. Typo: "Figure S38b".

[Corrected](#)

Main Text:

There is a recent citation that would be good to include in Section 4.3 in a couple of sentences. I think it's vital that this paper is cited as it presents an alternative 3D segmentation approach to G3Point:

A. Walicka and N. Pfeifer, "Automatic Segmentation of Individual Grains From a Terrestrial Laser Scanning Point Cloud of a Mountain River Bed," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 15, pp. 1389-1410, 2022, doi: 10.1109/JSTARS.2022.3141892.

[Thanks for pointing out this ref, that we now mention in the introduction and in section 4.3.](#)

P6L25: should be "give water"

[Done](#)

P8L6: "curved" how? Maybe it would be better to write "concave"? Although that would mean alpha should be > 45 degrees? In which case maybe just note that > 45 degrees indicates a concave

border.. If I'm understanding this correctly. Basically, a little guidance / explanation about concavity vs. convexity regarding this angle and the merging would be helpful.

Actually, we do not compute the curvature, but the change in normal orientation (even if the two are obviously related when relating our measure to a distance). We have slightly rephrased this sentence to try clarifying it.

P8L18: Same as above, some guidance on how beta relates to convexity / concavity of the borders.

It is the same measure than the one performed for Criterion 3.

P8L21-22: "greater than or equal to", two locations it is worded incorrectly

Done

P9L3: "Figure" capitalized

Done

P14L29: Missing a "x" multiplication symbol in " $\sim 2 \cdot 10^5$ "

Done

P16L7: "constrain" should be "constraint"

Done

P19L16: "a q-q diagram" or "q-q diagrams"

Done

P20L27: "study areas"

Done

P22L8: "time spent"

Done

P22L11: "provide, in a few minutes, thousands"

Done

P24L22: "If both models accurately infer of the major and intermediate axes"... rephrase, I don't understand this.

Done

Comments by Referee #2 (Anonymous)

The resubmission addressed most of the previous comments. The manuscript structure is clear, and the writing is much better. However, I still have two major comments.

We are very grateful to the second referee for his work on our manuscript. We have modified our manuscript to account for some the comments identified.

It is unclear how G3Point conducts grain segmentation. First, how does G3Point select the initial points to start grain segmentation? I.e., do you select every point in a point cloud to find a path to the summit? Or do you randomly sample points to find their summits? If I understand correctly, based on the description of the FastScape algorithm, only a path or a stream is found. The adjacent nodes in the path have the steepest gradient. How does the path with a list of nodes result in a segmented patch? It is important to clarify this point because the computing efficiency is related to the number of summits, which are the results of the grain segmentation.

The Methods section already addresses these comments. In nutshell: the FastScape algorithm is applied to all the points of the point clouds (there is no random selection of some points). FastScape

generates one acyclic graph for each watershed, which relates each point of this watershed to the summit (the “outlet” node). Each watershed is therefore readily obtained and provide a labellisation of each grain.

The quality of this research is good for an ESurf publication. However, that’s only after significant improvement in scientific writing. I appreciate the proposed methodology, validation, and discussion. Although the writing of this resubmission has been improved, publishing this work still requires much more work. Please see the minor comments for some suggestions.

We below account for most of the minor comments identified by Referee #2, as suggested by the Associate Editor.

Minor comments.

Title: 3D point clouds: 3D is redundant because it is implied in point cloud.

We agree that it is a bit redundant but using “3D” and “point cloud” makes it very clear that the point cloud must be a real (x,y,z) and not a 2D raster. Therefore, we kept “3D point cloud”.

P1 L7: The grain-scale morphology and size distribution of sediments are important factors controlling the efficiency of erosion, sediment transport and the quality of aquatic ecosystems.

>> The grain-scale morphology and size distribution of sediments are important factors controlling the erosion efficiency, sediment transport, and aquatic ecosystem quality.

Done

P1 L8: In turn, constraining the spatial evolution what do you mean by "constraining"? It does not make sense. Do you mean "obtaining"?

Changed for "characterising"

P1 L12: methodological approach >> methodology

Done

P1 L13: geomorphological >> geometric

Done

P1 L14: remove “applied here to 3D point clouds”. Redundant

P1 L15: remove “applied to each sub-cloud”. Redundant.

We kept these two sentences to prevent any confusion.

P1 L16: "conceived" is an inappropriate word here

Removed

P1 L23: I understand why the authors want to use this word, in-situ, but in-situ has a specific meaning when talking about sampling and measuring method. In this case, it is better to avoid such ambiguity. Please refer to google scholar results of in-situ:

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C3&q=in-situ&btnG=

We believe there is no possible confusion in the context of the paper and therefore, we did not change the text.

P1 L23: remove “and grain cluster”. Redundant with grains

Done

P1 L24: “The main limit of this method is that it is only able to detect grains with a characteristic size significantly greater than the resolution of the point cloud”. This limitation is very obvious.

Authors should be more open to unique problems of the presented method. Or you can remove this sentence.

We had feedbacks from the first reviews and from people using G3Point that this limitation was not that obvious for users. We therefore decided to make it very explicit and we kept this sentence in the revised manuscript.

P2 L1: remove “on the”

Done

P2 L20: potentiality >> potential

Done

P2 L21: documenting >> inventorying

We believe documenting is the correct word here

P2 L23: remove “most”. You need to conduct comparison or include reference to make “the most” statement.

Done

P2 L23: “This method consists in measuring” >> This method measures. “consist in” is overly misused in the entire manuscript. Please modify them accordingly.

Done

P2 L24: Suggested writing: The grid-by-number method is simple to implement and similar to a volumetric sampling xxx

We removed the commas and "which" to simplify the sentence.

P2 L29: Collection of a data set >> Collecting a data set

Done

P3 L1: misused “consists in”

Done

P3 L24: suggested writing: Structure-from-Motion (SfM).

Done

P3 L35: Suggested writing: considering point clouds obtained from SfM to check its xxx.

Done

P4 L8: remove “any type of”

Done

P4 L9: remove “summarized by”.

Done

P4 L9: remove the sentence, “A 3D point cloud ...”. Point cloud is not new. It is unnecessary to explain.

Done

P4 L11: remove “2”. It causes confusion.

Done

P4 L13: remove “will”

Done

P4 L14: how do you deal with background points such as dirt and mud?

Sentence has been changed to clarify that the point cloud must contain only grains to be segmented.

P4 L14: this task >> this denoising task

Done

P6 L7: remove “will”

Done

P6 L14: remove “despite this main disadvantage”

Done

P6 P16: is performed using >> uses

Done

P6 P21: You may need a transition sentence before mentioning “the FastScape algorithm”. It is unclear how the FastScape algorithm is related to the point cloud algorithm you mentioned above.

We added “To perform the watershed segmentation” at the beginning of the sentence.

P6 L21: order is ambiguous word. Do you mean “make the points in a sequence” ?

Order (or ordering) is the word that is used by Braun & Willett (2013) and by most graph libraries.

P6 L25: giver >> donor. You should have consistent terms through the entire manuscript.

Done

P7 L7: “This algorithm only imposes one scale”. What do you mean by a scale? Scale is an ambiguous word.

We added “spatial”.

P7 L23: Fig A1b. missing or you mean Fig S1b?

Fig. A refers to the figure in Appendix A.

P7 L25: “Instead of xxx”. Long sentence. It’s difficult to follow.

We split the sentence in two.

P7 L30: what k value do you choose here?

The same as in previous section, therefore we have kept the same name of variable.

P8 L8-10: If I understand this correctly, the number of summits is determined by the number of initial points. However, how initial points are selected is unspecified. This point is important because your algorithm efficiency is quadratic and thus limited by the number of summits.

We do not fully understand this comment. But no, the number of summits is not determined by the number of initial points (all the points are considered) but depends on the number of grains and their size.

P8 L17: consists in merging >> merges

Done

P9 L10: "The most pertinent and simplest xxx". how do you know this? have you done with comparison? or please cite references that draw this conclusion. Otherwise, be cautious about "the most" statement.

We removed "most pertinent".

P9 L19: respected >> satisfied

Done

P9 L30: consists in computing >> computes

Done

P11 L10: "with an error less than 1.061% when $p=1.6707$ ". how do you know? please clarify or add citation

See <https://www.johndcook.com/blog/2021/03/24/surface-area-ellipsoid/> or https://www.web-formulas.com/Math_Formulas/Geometry_Surface_of_Ellipsoid.aspx

P11 L33: "lab or natural environments". Adding a data description at the beginning (after this paragraph and before 3.1), such as data quality and acquisition method, will help audience understand.

Data were acquired in different settings and with different methods. Therefore, we describe the data acquisition and quality at the beginning of each sub-section rather than at the beginning of the whole section. This prevents non-linear reading. In addition, this is a section dedicated to the validation of the method. Advices and recommendations for data acquisition are in the Discussion.

P12 L14: "For this purpose". It is unclear what purpose you are referring to.

Removed

Section 3: Your writing in describing experiment processes is much more clear than describing method ideas. The validation work is solid.

Thanks

P14 L30: "To segment grains, xxx". This is why I asked about the dirt and mud? how can your algorithm manage them? If not, you should add an assumption at the beginning.

G3Point is a segmentation algorithm, not a classifier. Therefore, the point cloud must contain only grains to be segmented. We believe there is no possible confusion in the revised version.

P20 L26: remove sentence, "G3Point can also perform grain size, xxx", unless you had experiments on such large study areas.

We did not modify this sentence because G3Point can apply on any point cloud. The algorithm can be apply on large point clouds providing that the computer has enough capacity.

P20 L30: "If G3Point can be directly applied to point clouds, xxx". I don't understand why the authors mention this assumption in the context. also, how does a user without any G3Point experience know if G3Point can be applied to their studies?

We removed the beginning of the sentence.

Section 4.1. The authors seem to talk about calibration instead of validation. I think it's better to use a known grain size to calibrate the hyperparameters as other semi-automatic approaches do. Adding a calibration process overcomes the problem of your trial-and-error exploration.

We do mean validation as there is no calibration in G3Point.

P21 L14: “removing points”. how? does G3Point have any algorithms for this? or users should manually do this?

P21 L14: “which is a built-in option”. What do you mean by this?

We rephrased this sentence to clarify that G3Point has an option to remove the points located at topographic minimas if needed.

P21 L20: “the point clouds processed by G3Point must be xxx”. mentioning this earlier as an assumption will help audience understand.

We moved this sentence to P4.