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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Wavelet and index methods for the identification of pool–riffle sequences" *by* M. Mounir et al.

Anonymous Referee #1

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The manuscript "Wavelet and index methods for the identification of pool–riffle sequences" by Mahdade et al. presents two novel methods for the identification of pools and riffles in natural streams. These methods also allow the assessment of the main geometrical features of pools and riffles. The manuscript states that appropriate geometric description of pools and riffles is pivotal for flood modelling. I think this statement is correct when modelling floods (and flash floods) at the local scale. Conversely, previous studies have shown that simplified representations of river geometry can be a cost-effective solutions for flood modelling at the large (basin to continental scale). In fact, I believe that an accurate representation of river geometry is essential for the implementation of hydrodynamic models used for the investigation of local flow conditions and sediment transport. The scope of the paper could thus be extended to biological

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and environmental modelling (oxygen exchange, fish habitat, sediment transport) and not only limited to flood forecasting.

The paper is interesting, sections 1 and 2 provide a comprehensive literature review; sections 4 and 5 provide a detailed explanation of the methodologies; the presentation and discussion of the results in section 6 is quite extensive. However, I think that a number of major modifications should be introduced before the publication of this study.

Firstly, I think that the research gap and the novelty of this study should be clearly stated. Why did the authors propose two novel methods for the identification of pools and riffles? What are the advantages of these two novel methodologies when compared to the existing ones? I believe that these aspects should be clearly stated in the manuscript.

Second, the results of the new methods are compared to the results of the BDT method. Is the BDT method used as benchmark or to validate the new methods? Is the BDT method considered more accurate than the new methods? If so, why? What are the advantages of using the two methods rather than using the BDT method? Would it be possible to validate the results of this study using field data?

Third, the computation of the index method relies on the results of the numerical model. Have the authors considered the impact of the uncertainties in the results of the numerical model on the results of the index method?

Furthermore, I suggest discussing the transferability of the new methods to other reaches. In other words, how easy would be to implement the proposed methodologies to other study areas? Are the data and algorithms required easy to collect and implement? Can other researchers implement the proposed methodologies?

Moreover, I think the manuscript should clearly state which methods are recommended. A more explicit presentation of the conclusions of this study would highlight

its scientific and practical relevance.

Finally, I believe that some sentences are a bit convolute and difficult to understand (please see below).

Regarding the structure of the paper, I would like to recommend two modifications: - Section 2 lists a large number of studies and it is a bit hard to follow. More specifically, I think it is difficult to appreciate the differences between the large number of criteria listed in this section. The authors might consider adding a table to summarise their literature review. - I suggest adding "Section 7 – Conclusions". This section should clearly summarise the aim of the study, its results, its "take home messages" and, if appropriate, its limitations.

I hope the authors will find my questions and recommendations useful to improve their manuscript.

I listed below a number of minor recommendations.

Page 1, lines 7-8: the sentence "To better take this high-frequency variability in bed-forms into account in hydraulic models" is a bit convolute. The authors might consider improving the structure of this sentence.

Page 1, abstract: the abstract should clearly state the research gap, the aim, and the novelty of the study.

Page 1, line 9: the abstract mentions "several methods", however, only three (two novel methods and one benchmarking method) are listed explicitly.

Page 1, lines 12-13: the authors might consider avoiding the repetition of the word "compared".

Page 2, lines 14-15: I am not sure whether this is the final format of the paper, however, I suggest positioning each figure after a full stop (Figure 1 is currently positioned in the middle of a sentence).

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Page 2, line 15: please correct “dimensionless reach wavelength”.

Page 3, lines 4-5: this sentence is a bit hard to understand. Do the authors mean that the overarching purpose of their study is to provide a methodology for the prediction/modelling/assessment of cross sections variability?

Page 3, line 8: words such as “methods” or “techniques” might be more appropriate than “studies”.

Page 3, line 11: could please the authors clarify the meaning of “descriptions of the water surface characteristics”? Is “water surface slope” (mentioned in Line 8) included in this latter category?

Page 3, line 14: I suggest clarifying the sentence “because it changes less with discharge”.

Page 3, line 20: please rephrase “goes with the notion”.

Page 3, line 22: please rephrase “allows one to extract”.

Page 3, line 30: please rephrase “using a threshold on a criterion index.”

Page 4, Figure 2(A): I believe that this figure is not mentioned in the text.

Page 4, lines 3-4: I think this sentence should be moved to the section 6.2 as it motivates the choice of the benchmarking method.

Page 5, line 7: “the areal difference asymmetry index by Knighton” has not been mentioned before, the authors might consider adding more context to this statement.

Page 5, line 32: the manuscript states: “a common geomorphological and hydrological” methods, I suggest specifying these methods.

Page 6, line 8: was the channel width/channel bankfull width used to compute dimensionless values of wavelength? I think this sentence is not clear.

Page 6, line 9: what do the authors mean with “certainty”?

Page 6, line 14: I suggest avoiding colloquial expressions such as “a great deal”.

Page 6, line 32: I suggest rephrasing this sentence and avoid the use of “we”.

Page 7, line 5: I believe that information on slope has been previously provided in page 6, line 32. Could please the authors explain the added value of this sentence?

Page 8, line 11: please clarify the sentence “It is based on interpolations rather than extrapolations”.

Page 8, line 13: “visually”: do the authors mean that they performed a manual calibration of the hydraulic model?

Page 8, line 14: please remove the second full stop.

Page 8, line 14: “multi-section flows”: do the authors mean that the numerical model is used to predict a number of quantities (e.g. the elevation of the water surface, wetted perimeter, wetted surface,...) at a number of cross sections?

Page 8, line 3: why is the minimum discharge used for the implementation of the method?

Page 8, line 6: does “it” stand for “relevant information”? The authors might consider editing the structure of this sentence.

Page 8, line 8: I believe that “the trend” has not been explained before. I suggest clarifying this sentence. What does “detrended variables” mean? How are these variables computed?

Page 8, line 13: “contain the most explained variances” do the authors mean that those directions can explain the variability of the data? I suggest clarifying this sentence.

Page 8, lines 18-20: does these results confirm/contradict previous studies?

Page 9, figure 4: could please the authors explain the meaning of Dimension 1...9?

Page 9, lines 5-6: I think this sentence is unclear. What is the relationship between bed

elevation and hydraulic radius? The statement seems to be contradictory. Moreover, I was wondering whether any correlation between bed elevation and hydraulic radius is meaningful. Bed elevation is a geometric characteristic at the point scale. The hydraulic radius depends on discharge, river bed slope, cross section area.

Page 9, lines 6-8: the explanation based on hydraulic radius and Froude number is reasonable and (almost) intuitive. I suggest to clarify the added value of this finding compared to the existing literature.

Page 9, line 9: I suggest clarifying the importance of bed elevation.

Page 9, line 10: what do the authors mean with “we smooth” the data?

Page 12, lines 11-13: I suggest improving the readability of this sentence.

Page 12, lines 16-18: please improve the structure of this sentence: “have been interested. . .but working”, both the verbs have the same subject.

Page 12, line 18: “analysis” is repeated.

Page 14, line 12: I suggest replacing “evacuate” with something more appropriate (an option could be “remove”).

Page 15, line 3: please clarify “It also represents” (what does “it” stand for?)

Page 15, line 11: could please the authors better explain why this correction is applied?

Page 15, line 15: please correct the structure of this sentence: “we limit the study only with univariate analysis”. Moreover, could please the authors justify this choice?

Page 15, line 26: please clarify the meaning of “multivariate case”.

Page 17, Table 3: Table 3 and Table 2 show the results of the two methods for the same river reach. The authors might consider displaying these tables in the same page in order to allow a straightforward comparison of the results.

Page 18, lines 2-4: I think that this sentence is unclear.

Page 19, line 3: I believe that these results demonstrate a good level of agreement between the two methods. In my opinion, these results do not provide explicit information on the accuracy of the methods.

Page 19, line 5: the BDT methods is used to “validate” the results of the proposed methodologies. This choice implies that the BDT method is more accurate than the new methods introduced in this manuscript. Is this correct? If so, what are the benefits/advantages of using the two proposed techniques?

Page 19, lines 19-20: please clarify this sentence.

Page 19, line 23: the manuscript states that the results of BDT “are closer to the other methods and to reality”. I strongly recommend to better substantiating this sentence. Which are the “other methods”? What does “reality” mean? Was the BDT method compared with field data? In which case study?

Page 20, lines 3-4: could please the authors clarify this sentence?

Page 20, lines 6-7: please rephrase this sentence.

Page 21, line 2: a Froude number of 0.30 looks a bit large. Could please the authors explain this result?

Page 21, line 3: it seems that the average values are driven by the results of the Graulade river, Are the average values representative of the sample?

Page 21, line 10-17: these lines present a comparison between the results of this study and some of the previous studies. The authors might (or might not) consider using a table to summarise these comparisons.

Page 21, line 21: I suggest motivating this sentence. Why aren’t the previous methods considered quantitative?

Page 22, line 1: is “crossing” the most appropriate word?

Page 22, line 3: please clarify this sentence.

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