

Relevant and interesting contribution that can be improved to better reflect the title and clarify the text.

This paper deals with the determination of the ‘thalweg’ based on DTMs. Determining the thalweg supports the delineation of stream networks. The content of the article is, thus, relevant to the hydrological community. The paper is structured, gives credit to most of the related work and indicates the own contribution to the specific field. The methods used are described, assumptions outlined and results presented in an appropriate way. Still there remains one major and some minor comments as well as a few technical corrections, which should be considered to better reflect the chosen title and clarify the text. In one or two cases reasoning and description of workflow and chosen methods is not precise enough to ensure unambiguousness. The discussion is rather short and suggestions are given below how it could be expanded and improved.

After incorporation of the following points I would suggest the paper for publication in HESS.

1.1. Major comments:

- 1) Article title: From the article’s title the reader expects to get information about the robustness of the new approach, which would be quite valuable. You also claim that the approach is robust (e.g., (893:13) and so you should prove this in the article. A suggestion would be, to extend the article by testing the approach, using DTMs of different resolution or DTMs with added errors to prove that your algorithm actually is robust. You announce such an analysis for the future (894:16ff) but it would fit well into this article and therefore could/should be included. Not only consider DTMs with high but also with low resolution (see 894:11).

1.2. Minor changes

- 1) (880:11) and (884:11) Be more precise with and versus or: “...plan curvature **or** the convergence index.” You are comparing but not combining them!

similar:

(884:11): “Two indices are used: First ...and then ...” infers you are using them after each other especially if you are talking about a three-step method (884:9).

- 2) (887:12-17): Use a clearer formulation and rewrite this part. Give the reader more details how you do it. If it is the main idea, it is probably worth illustrating it in a sequence of figures showing results of intermediate steps?
- 3) (Chapter 3.3): You mention that you are using skeletonisation and vectorisation operations (888:8) but even if you refer to Molly and Stepinski (2007) the reader should be given more details, how this is done, especially as it is not trivial. How is “the reduction of the shape to its main curve” (888:9,10) done?
- 4) (890:7ff) Give a better description of the stream-to-stream comparison. Did you use a 2-buffer here as well? When do you consider two streams to be matching? What kind of tolerance do you accept? If you use your geometric comparison approach (891:19) it is sufficient to define it once in detail and then you can refer to it. But make sure the reader knows if the stream-to-stream comparison is or/is not similar to the geometric comparison.
- 5) Classical method: Within the text and the figures you are using the term “classical method” and you later define it at (891:23). However, give the definition, when you use the term the first time. (890:19). At (890:19) you refer to chapter 3.2 for details but there you do not link the term “classical method” with the approaches chosen. As you are mentioning the D8-algorithm in chapter 3.2 as well, it’s not completely clear, how the classical method is defined without scrolling back and forth.
- 6) (chapter 3.2): You could also mention/refer to multiple-direction flow algorithms: Quinn, (1992); Seibert & McGlynn (2007).
- 7) (892:4) (Fig. 6): Over-detection: Can you clarify “less informative”. Are less thalweg-segments automatically worse? For that reason show the reference network mapped in the field in Fig 6. to allow the user to see the performance of the different approaches. Actually the CI-approach is over-detecting in the western part of the basin, whereas the PC-approach is better there! See Fig. 7 Include over-detection more clearly in your discussion. Compare over- and under-detection of all used methods, not only CI (892:25ff). You could do this in form of a table; not only mention it in the text. It also makes a difference, which stream-sections are over- or under-detected. Consider the stream order to show this. This would be interesting from a robustness point of view.
- 8) Geometric comparison (891:19): Clarify how the geometric comparison is performed in detail. First question: How are streams defined? Are these sections between river junctions? Second question: When do you consider the stream section to be consistent

and not consistent, respectively? What kind of tolerance do you apply? Do you use a 2m buffer (892:19)?

9) (chapter 4.1) and (Fig. 5): How was the reference network of the virtual DTM (shaded grey) determined? You mention that the PC-approach shows less thalweg-segments. O.K. But your assessment might be dependent on the way you determined the reference-network.

10) (893:22): “In the few forested areas, the interpretation is fuzzier.” Move this sentence to (893:25-27) where you talk about forested areas. Discuss in more detail the fuzziness of interpretation. Does fuzziness tell us about robustness and thus would it be worth analysis forested areas in your basement in more detail? E.g., performing similar geometric comparison in restricted areas covered with forest. Again: How did you extract vegetation from your DTM or did Bretar et al. (2009) use last pulse LiDAR-Data information to generate the DTM, which are less prone to vegetation?

1.3. Technical remarks and recommendations:

Explanation: Words or phrases in *italic* should/could be included to clarify.

(title and throughout the text): thalwegs-network: would singular (thalweg-network) be better? If so, make sure you are consistent throughout the text.

(880:15): “... reference network *mapped in the field*”.

(880:11) ~~curve~~ use course

(881:15): You mean manual image interpretation? If so, make clear you are not thinking of automatically delineation methods.

(881:23): list some of “various drainage algorithms” here or at least refer to chapter 3.2 where you do so.

(882:6): specify the exact page-number in your citation when using a direct quote!

(882:6): Provide the reader with a description/definition of key elevation scaling laws.

(883:25): Which interpolation algorithm was used for DTM interpolation? Did Bretar et al (2009) use the LiDAR point cloud? Mention how vegetation was removed (see also above). This is relevant as you later state (893:22) that your algorithm might be affected by vegetation.

(884:2): give details about the altimetric error of both DTM. This is particularly interesting from a robustness point of perspective. Important: Clarify, which DTM did you use for your work?

(884:22): Two main recent studies ... (citation missing!)

(884:22): Why do these two studies propose to integrate curvature parameters? Tell the reader about their conclusions and how these conclusions are valid for your study.

(885:1,2): You use the plan curvature because of the successful results of the two studies but why not the tangential curvature? It seems they were both successful (884:24,25)? And further on: Why do you use the CI? I assume because of successful results by Bretar et al (2009). Put your arguments in an order, easy to follow for the reader.

(885:15): Include citation of the convergence index here as well even if you did it on p. 884.

(887:28): ~~Although...~~

(888:1,2): Did you have to “fill” your DTM? Make clear which calculations you performed on the “filled” and which ones on the original DTM. Is the modification due to the filling considerable? Does it influence the robustness of your approach?

(888:8,9): improve wording

(888:11-14): Can you specify what you mean by sinuosity and why it seems reasonable to assume it for your basin? How are artifacts defined in your study? Rewrite this part to make it clearer and give more details.

(888:16): How is this thinning done? Describe the procedure as it is not trivial. Do you incorporate flow direction?

(888:18): How is it filtered? O. K.: You mention it in 888:20, but is it filtering or removing?

(888:18): Define the “tree-network representation hypothesis” and/or provide a citation.

(888:18): Describe “loop development”

(888:23): Which stable topologic indices? List them.

(889:23): Normalized by what? By the total length of the thalweg-network? If so, did you use the derived or the mapped thalweg-network to define total length?

(890:19): “The classical method is the kinematic routing algorithm *combined with a unique threshold approach* (detailed in sect. 3.2).” Mention both of the components of the approach. The cross-reference to chapter 3.2 is good!

(890:24): “more ~~significant~~”? Do you mean: more realistic? The term “significant” would be related to statistics.

(892:7): How was the reference thalweg-network determined? From aerial photographs or by manual mapping in the field?

(892:14-17): What do you mean by: “it could be weighted ...” Can you improve wording?

(892:18): “Notice that ~~the~~ each ...”

(892:25): What are the global results? Define it! If the global results are good, why don't you show them (can you refer to figures?).

(893:1): “..., this assessment... ” Which one? the stream-to-stream assessment?

(893:8): Can we actually weight the scale considerations? Probably not quantitatively. You could use the word *incorporate*.

(893:11, 12) “... are based on a unique threshold *and a routing algorithm (e.g., D8 or kinematic routing approach)*, the presented ...

(893:15): ~~reality~~ -> use accuracy

(893:15,16): “... highly disrupted in geometry and topology”: Can you explain this in more detail? Do you mean a mismatch of geometry and topology compared to a mapped reference-network, or gaps and discontinuities in the network? Can latter actually occur?

(893:21): More ~~informative~~ *realistic*

(893:22): Suggestion: ”... especially for bare ~~soils~~ *landscapes*.

(893:23) badlands area (use singular -> badland area)

(893:24): "... results are less ~~effective~~ *accurate*..."

(894:1): "~~Results are available~~ *Quality of results has been tested* for a given spatial resolution of DTM (*1 x 1m*)."

(894:11-12): Rewrite to make more clear.

(894:16): "... as we intend *to* achieve ..."

(894:17): What about the DTM with very low resolution. (see also major remarks) You should include these tests in this paper to answer the question of robustness.

(894:20): "From this ~~value~~ *threshold* ..."

(894:23): What are base documents? Explain!

(894:27): INSU; mention full name as well.

Figures, Tables:

(885, 886): Formulas: use * for multiplication sign! Then it's clear and unambiguous that PC is not P*C but DH is D*H!

(897, 898): Table 1: include abbreviations in the table heading. Table 1 and table 2: Refer to the text or chapter where you describe the assessment-method in detail. How are streams defined?

(900): Explain θ_i in figure caption.

902): "Inconsistency of the assessment-*method* ..."

(903): "Examples of *thalweg*-networks derived from two *artificial* DTM: ..."

(904): Fig. 6: Include a map of the reference network, mapped in the field, like you do it in Fig. 7.

(904): I assume Fig. 7 is a "zoom-in" of Fig. 6? Can you show the test area presented in Fig. 7 in the reference map Fig. 6 (e.g., red rectangle)?

(905): "Comparison of ~~three~~ *thalweg*-networks obtained by *three methods tested in this paper*, with a reference ..." (*For location of test area see Fig. 6*).