

## ***Interactive comment on “Predicting discharge capacity of vegetated compound channels: uncertainty and identifiability of 1D process-based models” by Adam Kiczko et al.***

### **Anonymous Referee #1**

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The paper addresses an important and highly relevant topic and is of great importance for the professional community to improve the capabilities to accurately model the complex flow in vegetated compound channels. However, I identified various issues that should be addressed and clarified by the authors. In general, the paper has been written with great care, but there are many passages that should be improved stylistically and where the language should be improved (see my detailed comments below; I recommend that the language is cross-checked by a native speaker). I also found that the terminology should be better introduced and defined to help the reader to better understand the complex content of the manuscript. For example, it became not really clear to me what is meant by, for example, identification data points, verification data

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points, computation points, observation points etc. Overall, the manuscript focuses on a statistical analysis of different approaches regarding uncertainties associated with input parameters. This is highly relevant, but the manuscript is mostly written from a statistical (probabilistic) point of view. However, in practice the tested approaches are typically used by hydraulic or environmental engineers, and it would be nice to outline the chosen approach more generally at the beginning of the manuscript, so that the significance of the results becomes clearer for the target-audience. In this context, I am not an expert in statistics and this fact triggered many questions (see below). In my opinion, this manuscript could make a real impact if it would be written in a way that practitioners will better understand what has been done. Also, more specific statements related to the parameter variation would be helpful. I acknowledge that this is partly addressed in the discussion, but it becomes not really obvious from the preceding sections. To summarize, this is an interesting manuscript. However, the presentation of the material should be improved. As I have many specific comments, I am afraid that I have no other choice than to recommend returning the manuscript to the authors for major revisions. I hope the authors will find my comments useful.

#### Specific comments

Please note that the number of comments decreases towards the end of the manuscript - this is due to the fact that various issues have already been highlighted at the beginning.

Title: I am not sure that I understand what is meant by "identifiability" – I guess a "statistical" meaning is meant, but that becomes not clear. P2, L22: What is meant by stability? P2, L25: I find this a bit confusing, as there is some redundancy with the sentence before. This could be formulated better. P2, L27: What exactly is meant by "regions"? I assume the different channel parts are meant (but one could also think about different geographical regions). P2, L33: Is this approach really simple? I would delete the latter word. P2, L36: Please check language. P2, L41: Which relationship is meant here? P2, L42: Check language P2, L43: Check language P2, L44: Why

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"should"? P2, L47: The approach was published in 1991, and the only reference for its successful use is from 2020? I doubt that it took 30 years that it was successfully used... P2, L48: Please check language P2, L49: Why referring specifically to Pasche, and not to Pasche & Rouvé? P2, L53: Please check language P2, L55: Check how reference is included into the text. P3, L57: I doubt that all of the cited approaches have been developed to parametrize the two-layer approach. Some of them deal more with the parameterization of vegetation properties. P3, L58: Please check the sentence ("... for in..."). P3, L60: Please improve "Methods like Pasche and Rouvé (1985)..." - Pasche and Rouvé are the names of the authors who developed the method (a similar comment can be given regarding the reference to Västilä and Järvelä in the same line). P3, L62: Is this really true? Remote sensing methods have significantly developed, and dependent on regions and countries, such information may be available... P3, L65: In my opinion, this is not an argument for simpler methods. Such a non-physical based black-box will not help to better understand the problems at hand and requires manual and arbitrary calibration. P3, L67: Why disused? What is meant by this? P3, L68: Fr typically defines the Froude number – but I guess here the word "For" is meant? I stop here giving particular comments on the language, as I already have provided many such comments showing the need to improve the paper. P3, L69: I do not understand this statement – "when bathymetric data do not account for the true complexity of the river geometry" – what is meant by "true complexity of the river geometry"? P3, L70: This example is not really related to the topic of the paper... P3, L72-75: This is difficult to understand – please improve. P3, L77: Which answer? In other words, what is the question? P3, L81: "...comparing to the Manning..." – this part of the sentence remains unclear to me. P3, L86: I do not understand what is meant by "parameterized in a sense of their distributions" P4, L93: Improve stylistically (...Järvelä Järvelä...) P4, L95: Which study? This one? P4, L99: "The overall goal of this paper is to compare the uncertainty, parameter identifiability and physical interpretation of the parameters of discharge capacity methods characterized with different levels of parameterization". This sentence is very difficult to understand. P5, Figure 1: Please improve the caption

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and the description of the figure; I find it difficult to understand (note also that not all parameters have been defined) P5, L120 – 125: Please improve – this could be explained more clearly in my opinion. P9, L242: "...are plant species..."? I am not sure that I understand what is meant. P9, L247: This depends on the level of submergence – otherwise 20% of the discharge may be neglected... P9, L251: This depends – for the typically used rigid cylinder analogy, Bx will basically be constant. P9, L253: What exactly is  $I_l$  and  $I_r$ ? In this context, a sketch would be helpful. P10, L264: The model of Luhar and Nepf was already mentioned before - it may be a good idea to restructure the manuscript and to present this approach earlier? Also, this is not the "original formula" (which should be stated more clearly), as the hydraulic radius is used while Luhar and Nepf used the water depth. P10, L269: Check writing style (... "formula 9...", "...three parameter one...") etc). P10, L280: Remove the full stop after "experiments" P10, L290: Strictly speaking, uniform conditions are impossible to achieve by this setup - I would prefer if the terminology "quasi uniform" is used. The flume slope (or the slope range) should also be given - I could not find this information in Koziol (2010) as this paper seems to be in Polish language. P10, L291: How were water levels recorded and what was the spacing between the measurements? P11, L300: What kind of vegetation? P13, Ö320: What is constrain 5? Is equation 5 meant? P13, L328/330: Please use another notation for the number of observation points - before, n was used to define the Manning coefficient, and this is confusing (see also my comment below; L336). In this context, what exactly is meant by observation point? It could also be the number of points Also, it should be mentioned that only floodplain flows were investigated (for convenience of the reader). P13, L334: Not necessarily - in some (or many) cases there exist data for high flows that can be used for calibration. P13, L336: I am partly confused here, n is the number of observation points which could also be the number of readings taken for the water depth measurement. Please be more specific. P13, L346: Please improve cross-references - e.g., here it should be Figure 4a. Figure 4d-f: Why are the lowest two points characterized by the same discharge? P15, L349: I am not sure that I can follow - this could be explained better

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(what is exactly is meant by computation points). P16, Table 2 (also Table 1): Could you comment on the used parameter bands in the text (why were these bands chosen)? P16, L353: What exactly are identification data points? P16, L355: But the Pasche model results are not included in Fig. 5? This is confusing. P16, L356: (5a, 6a) - does this refer to the Figures? Please improve throughout the manuscript. P17, Figure 5: I am not sure that I understand what is meant by "Ratio". P17, L365: This definition could have been given earlier. P17, L369: Here, equation is used, at other places formula is used and at some places numbers are just given. Please improve - this is confusing. Also, the used model could be specified more precisely (the same applies to "other unspecified models"). P17., L370: Now n is the ensemble count - this is confusing. P18, L374: I am not a statistical expert (although I have some knowledge regarding statistics), but this is a bit confusing.... P18, L378: Why is 1 an extreme value? P18, L380: This fact could be explained in some more detail when outlining the approach. I am getting a bit lost here... P18, L383: Vegetation characteristics of Ritobacken have not been defined; what is meant by a "flexible approach"? P19, L396: I have trouble understanding this - a more general outline of the procedure would be helpful (this should be provided earlier, not here in the presentation of the results). P26, L416: I am not sure that I understand what is meant here. I stop giving more comments here on chapter 3 as I have problems to understand what exactly was done - the procedure could be outlined in some more detail P31, L492-498: It would be good to explain all his earlier in some more detail. P31, L508: Isn't this rather obvious? By the way, what about errors in the measurements - how would they affect this analysis? P33, L578: Numerical experiments are mentioned - but I doubt that detailed numerical simulations were carried out (no statements are given in the manuscript); this again shows the need to formulate statements more precisely.

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