

Interactive comment on “A structure generator for modelling the initial sediment distribution of an artificial hydrologic catchment” by T. Maurer et al.

Anonymous Referee #3

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1 General Comment

This paper introduces a process-oriented structure generator that reproduces typical sediment patterns occurring in re-cultivated open cast mine sites. The model is applied to an artificial catchment for which detailed knowledge on subsurface heterogeneity is available. Ultimately, the authors fail in reproducing the specific sediment patterns at the site, because they have not included all land-forming processes in the model yet (missing sediment redistribution with bulldozers). Therefore this subsurface model is of limited use for subsequent hydrological modeling at that site. Further, the only validation they present is a visual comparison of one realization with an aerial photograph.

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Despite of the weaknesses of this study, it is of interest for the readers of HESS due to the novelty of the structure generation model. However, I suggest to revise the paper and include all processes that have formed the catchment. This would be an excellent achievement that is definitely worth to be published in HESS. If this is not possible in the near future I would suggest to shift the focus of the paper as detailed below.

2 General Assessment

1. Does the paper address relevant scientific questions within the scope of HESS?
- YES
2. Does the paper present novel concepts, ideas, tools, or data? - YES
3. Are substantial conclusions reached? - partly
4. Are the scientific methods and assumptions valid and clearly outlined? - YES
5. Are the results sufficient to support the interpretations and conclusions? - partly
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? - YES
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? - partly
8. Does the title clearly reflect the contents of the paper? - YES
9. Does the abstract provide a concise and complete summary? - yes, but only if a concluding remark on the specific achievements is added
10. Is the overall presentation well structured and clear? well structured yes - but clarity is impaired by the lengthy method section

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11. Is the language fluent and precise? - YES
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? - YES
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? - YES, see below
14. Are the number and quality of references appropriate? - partly - see below

3 Specific comments

I fully approve the concerns and comments of the other reviewers regarding the readability of the figures, the lengthy method section, the strong focus on future work in the conclusion section and some missing links between the introduction and the results. Hence, I will not repeat everything in detail, but only my major concerns:

In the introduction section you state correctly that the heterogeneity model can never perfectly reproduce the actual subsurface structures and this uncertainty needs to be assessed (P4645, L10-14). It is hard to soundly tackle this uncertainty by generating only one realization and validation against a single aerial photograph. Of course, the comparison with the photograph is valuable and should have a prominent role in the revised paper with a discussion on whether the general patterns are resembled well or not (if not, why?). However, uncertainty needs to be assessed also by examining the impact of input parameters to model output, especially for those that were defined in advance.

You have a strong focus on the final sediment body of the Chicken Creek catchment,

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but what you are actually aiming at with the structure generator so far is an intermediate state before the central trench was filled by sediment redistribution. This should be pointed out more clearly in the introduction. I admit that this shifts the entire focus of the recent paper, but it also leaves more space to elaborate on the concerns mentioned above.

On the 2D sections: I wonder if I have understood the details right. This misconception may originate from ambiguities in the figures. The generation of the cross sections in Fig. 5c and 11a is not novel but has been published by Buczko & Gerke (2001), right? If so, you could shorten the section on that matter and state that the input parameters in Table 4 have been obtained elsewhere. Further, since the particle segregation and compaction effects are of such great importance for the heterogeneity model, I would like to see some more referencing than only the original paper and a poorly published study from the 60's in German (Leibiger, 1964). With a quick Internet search I stumbled across Lebron & Robinson(2003):Vadose Zone Journal 2:330-337 and I'm sure you will find some more. The original contribution of your study is the concatenation and superposition of subsequent spoil cones like in Fig. 5b and 8, right? I suggest that you change Fig. 5c and 11a accordingly (or present a frontal and sagittal view). Further, I like the idea of a flow chart (Fig. 6) but it is poorly connected to the text - e.g. could you depict a sketch at the left hand side on how the cone looks like after every step?

On the 3D model: In section 2.3 you put a lot of effort in the reconstruction of the original spoil ridge trajectory. For two reasons I wonder if that is really necessary, or you could have just assumed an arbitrary (but reasonable) trajectory for this study: (i) I reckon that the uncertainty that originates from the unknown texture composition on the conveyor belt is much higher. (ii) The aim of this paper is not yet to adequately reproduce the exact subsurface of the chicken creek catchment. Because then you would have to resubmit this paper only after you have finished modeling the sediment

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redistribution by bulldozers. I'm sorry if that sounds provoking, but perhaps this encourages you to rethink the objectives of this paper. What if you generate a couple of realizations and examine the variability with respect to visual resemblance to Fig. 13f, or mass balances in section 3.4. This is all you can do at the moment since you do not have any other hard data. In other words, what is the advantage of the trajectory you estimated in comparison to any other reasonable one in the light of high uncertainty?

Results and discussion: The information you provide on volume changes, substrate compaction and mass balance is comprehensible and interesting. Yet, it is only loosely connected to the structure generator. If you explicitly include the leveling by bulldozers as an additional process into your model, these numbers may serve as an excellent source for model validation.

4 Technical comments

P4650 L20-21: You jump from texture information about the catchment (table 2) to texture data on the excavation site (table 3). Mention this in the text so that the reader can follow (I couldn't in the beginning)

P4650 L25-26: Actually it does not include the leveling yet.

P4651 L8: missing word

P4653 L3: missing word

P4657 L10: How did you obtain this distance of 10-30m. Is it an educated guess or published elsewhere? What is the impact of changing this distances on the model output?

P4662 L10-13: If you used these aerial photographs from later stages for digitization, say so. If not please omit the sentence.

P4666 L8: Writing 'first model scenario' suggests that you have already generated more. Is that true? If so, you could compare them (visually or by means of geostatistics).

P4667 L16: Use 'averaging' instead of 'upscaling and interpolation'

P4667 L24-25: What heterogeneity features do you mean when you say 'similar'?

P4670 L27-28: Please be more specific. I was convinced by the random mixing approach in the texture definition section. How do you want to improve your understanding on the conditions on the excavation site retrospectively? Fig. 5a states that you aim at batch-wise excavation. Please explain.

P4689 Fig. 4: Please draw a new sketch with a scale bar, a hatched area that indicates what has been excavated and omit the borehole data.

P4690 Fig. 5: Typo in subfigure A: hut?

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P4692 Fig. 7: light gray and dark gray is not distinguishable. Change the background to white and use different colors or/and line styles.

P4699 Fig. 14: Explanations on Fig. 14 are missing in the text, there is too much information in the figure and the caption does not explain the figure sufficiently well. Do you plot A and B because of the change in textural composition between the eastern and western trench - P4648 L20-22. The difference is actually not noteworthy so you could omit either A or B? What is the control volume of C? Is it like in A, then omit B. Is it like in B, then omit A. What is depicted in Fig. A2,B2,C2?

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