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Hydrology and Earth System Sciences Discussions

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

Anonymous Referee #1

Received and published: 8 June 2011

General comments: The paper developed a model that reproduced the sediment heterogeneity of an artificial hydrologic catchment. This was done based on detailed knowledge of the processes during the sediment deposition by stacker dumping. The authors modelled the properties of 2dim cross section (texture, bulk density) based on the sediment dumping and the 3dim pattern in the catchment based on the trajectories of mass dumping. They outlined the relevance of structure knowledge on the modelling of hydrologic catchments.

The paper is of interests for the readers of HESS and the approach is of clear novelty. The methods are described in detail and are robust. The paper is well written and overall good structured. The methods and results lead to appropriate conclu-

sions. The introduction gives a good overview of the state of the art and shows clearly why this study is needed. The abstract summarizes the paper well and the title is good. Some extra work has to be done to improve the figures of the paper and in the result/discussion section of the paper (details see below). A limitation occurs since several described parameters were chosen a priori. It is often not reported based on what assumptions/information these parameters are determined. Small changes in the parameter values might have a significant effect on the modelling results. This is especially of concern since an uncertainty analyses (based on the estimated parameter values) is missed and the validation of the approach falls short (for understandable reasons). Overall the paper can and should be published in HESS after some minor changes.

Scientific concerns: In the introduction it was not always clear if the authors refer modelling to the modelling of the geological structure or the modelling of hydrological processes. This should be clarified in the revised version of the manuscript.

The authors validated there result by comparing the resulting pattern of sediment heterogeneity with an aerial photo of the catchment, that shows some sediment heterogeneity. Is this just a visual inspection? In the conclusion the authors report that a next step of the work will be the comparison to field data. I think the authors should add a small section to their results were they compare the spatial observed sediment pattern of the chicken creek catchment to the generated variability and underpin the validation with some numbers. If the data is not yet measured, or the authors disagree with my suggestions, at least an uncertainty analysis has to be added to the paper. Since the authors determine several parameters like the dumping height etc. a priori without giving the basis of these estimates, the effect of changing parameter values (and their sensitivity) on the resulting sediment pattern has to be evaluated. It would be very interesting to see how changing parameters change the resulting sediment pattern, since this will also have an impact on hydrological modelling. I think such an uncertainty analysis is needed since the parameters are pre-defined, this will also

complete the paper, and improve the strength of the results

Work has to be invested in different figures. In the printed reviewer version, it is often very difficult to read the text, due to the small font size. So please adjust the size to an improved readability. See details at the end of the specific comment section.

Specific comments: Page 4653 L3-5: It is only the ideal conception of catchments, reality often leads to more complex systems with no impermeable layer.

P4653 L14-16: I think this sentence does not lead over directly to the next one, since the cited study only deals with the effect of spatial heterogeneity on the hydrology and not on the reasons for the spatial distribution of hydraulic properties. It may make more sense to cite the studies that show the relevance of spatial heterogeneity on hydrology at first and than lead over to studies that deal with the reasons for spatial heterogeneity.

P4653 L18: Hill-Vi, please add the reference to the model. Please also add what the authors found in their study.

P4354 L7: (Sciuto and Diekkrueger, 2010)... Here again, what did they found?

P4646 L8: change (Gerke 2006) to (Gerke, 2006) P4649 L15-P4650 L2: On how many samples the material composition was determined? Can that be used for an uncertainty estimate?

P4650 L3-5: How many soil samples? What was done with these samples? Are these the samples that define the sediment material? So it would be better to move this sentence at the beginning of the section.

P4651 L9: Is GOCAD an abbreviation? What is the program exactly doing? Maybe a better description latter in the paper?

P4651 L20: "Each node represents the position..." Does that mean the location within the catchment?

P4651 L21/22: "By varying the density ... can be adjusted". I did not understand what

you exactly want to say. Please explain in your response (and maybe clarify in the manuscript)

P4652 L1: "pre-defined layer thickness" Based on what you pre-defined that? What does a change of this value mean for your results?

Page 4652: Maybe a figure that shows the parameters with the characteristic lengths of a spoil cone can enhance the understanding of this part. I was not always completely sure, which specific length the parameters describe.

Page 4660 L20: "DA is chosen ex ante". Again a parameter that is fixed, but not explained based on what the parameter is determined.

Page 4660 L21ff.: Just for my understanding. You have the information of a 1cm^2 area and in the next step you aggregate this information to a 9cm^2 grid cell?

P4661 L10/11: Did you construct the DEM in this study or was it done in the study of Maurer et al. (2009). Reformulate: "Maurer et al. constructed a DEM based on XY, this was used within this study" (or similar)

P4661 L11-14: An analyses with GIS to determine the catchment area? It was based on the clay layer surface?

P4662 L1: "eroding" How did you eroded the grid cells?

P4662ff L22,L23,L26 ff: (s_clay), (s_0511), { s_0511-s_clay}; Why do you use different types of brackets? Please follow the same style in the manuscript. Several times on later pages.

P4663ff: How did the bulldozing changes the pattern of the sediment distribution? How was that included in the model?

P4663 L20: What is the Wolkenberg site? It is mentioned here the first time. Is it?

P4663 L22/23: "Thus, ...composition" What do you mean with this sentence? Is there

something missing? Please rewrite.

P4664 L20: change “sampling method..” to “sampling method.” AND: Why this can be ascribed to the applied method?

P4664ff: Results and discussions: I think the authors should improve the discussion in a way that they link it better to the cited literature in the introduction sections, and compare their achievements to the status before there study. And again: What is the effect of using fixed parameter a priori on the results?

P4665 L14: Is there really no field data that you can compare to your bulk density of 1.84 g/cm^3?

P4666 L18: “(1-2m)” Does this fluctuation have an effect on the results/validation of the model?

P4666 L23: Here no brackets with s_0410

P4667 L24: How is "similar" defined? Is it just a visual impression? Is it possible to determine that more objective?

P4667 L25/26: “However,... approach” Is that true for the model, for the real field conditions or for both?

P4668 L10: Here the uncertainty is mentioned; please give the range of this uncertainty.

P4668 L13: Why first realization? Are there more in this paper?

P4669 L9: Please give the original mass

P4669: If there is no field data existing, may it be possible to validate the spatial heterogeneity of the sediment distribution by comparing it to the pattern of stream channel that may erode the sediment in a preferential way?

P4670: Conclusions: I think the authors should give more focus on their achievements

within this study, than giving the outlook to points that might be done. It gives the impression that this work is incomplete.

P4670 L18/19: The modelling might only be possible if a detailed knowledge about the underlying processes exists.

P4670 L25/26: Why no validation here?

Fig1: Increase font size, black font on dark background difficult to read

Fig2: Increase font size

Fig4: reduce the figure to the needed information, it is to crowded with needless information.

Fig5: hardly to decipher, rework

Fig7: Difficult to distinguish dark and light grey. Is a black background necessary? Better a bright background and black or coloured lines

Fig8: Extend figure captions for an improved understanding. Based on the captions it is very difficult to get the information. Is this figure necessary at all?

Fig9: Necessary? The gained information content is low.

Fig10: Blue lines (ridge) difficult to see. What does to colour scale show?

Fig11: increase font size. What does the colour scale of figure 11B presents? You have bulk density for A and medium sand content for C.

Fig12: Font size

Fig13: D shows all cells with fine sand between 0-40% and E shows cells with fine sand between 40-70%. Shouldn’t cells that are coloured in D be white in E and backwards? It is probably a relict of the 3D image? So it is very difficult to get the information, maybe there is a way to improve the 3D illustration

Fig14: use A1, A2 in the captions, Increase font size at the axis

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