Hydrology and Earth System Sciences

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Discussions

Interactive comment on "Statistical analysis and modelling of surface runoff from arable fields" *by* P. Fiener et al.

P. Fiener et al.

auerswald@wzw.tum.de

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Reply to the comments of the anonymous Referee #2 (published on 2013-07-25)

The anonymous referee #2 gave three important general comments that we address as follows:

1. Scale issue, plot scale vs. larger scales

We are grateful for this comment! We now specify better already in the introduction on which scales different processes or different models operate and we then define in our objectives on which scale our model is intended to operate: " This model should operate on the plot scale (1-10 m^2) representing single events (resolution of minutes) but it

should also take into account the variation of driving variables occurring on the scale of crop rotations and within larger catchments." Moreover, we inserted 'plot runoff' or 'runoff generation from plots' at several passages in the text to make it clearer which scale is discussed.

2. Experimental set-up is not clear

We substantially reworked the methods section to give the experimental set-up in more detail.

3. Cite suitable references as much as possible for broader discussion in results and discussion section to support the discussed topics

We strictly restricted references to underline or contradict our findings to the discussion section where already a large number of citations were used. However, we agree that more references support our findings and therefore introduce some more important ones, e.g. regarding the effect of stones on initial abstraction.

<Specific comments>

Reviewer: P3667, L5-12 or whole Introduction I think the authors should clarify at which scale you focus on surface runoff? ....

Reply: see general comment.

Reviewer: P3667, L24. I suggest you cite suitable references for the models of "Green and Ampt", "Philips", and "Horton".

Reply: References have been introduced now.

Reviewer: P3668, L3668-P3669, L2 I suggest you explain why you take a statistical approach before this part...

Reply: The statistical approach had already been justified in the Methods section. It was due to the failure to identify the mechanisms that results from near-identical be-

havior of all infiltration equations despite their fundamentally different assumptions. Furthermore, it resulted from the intended scale of application. In order not to misguide the reader, we justify the statistical approach now already in the Introduction after the definition of scales: "This [definition of scales] also required choosing a statistical model and not a process model, because it would be impossible on these scales to identify the underlying processes. For instance, a return flow had been indentified on some plots by the use of tracers despite a plot length of only 4.5 m (Haider 1994) while this information was missing for most other plots because no tracers had been analyzed and it would also be missing in the application case."

Reviewer: P.3669, L4 I wonder if the sub-heading of "Rainfall simulations" are suitable here.... I suggest you reconsider the sub-heading or the structure of "2. Material and methods".

Reply: The subheading was changed to "Rainfall simulations and range of examined conditions"

Reviewer: P. 3669, L7 I wonder if Horton-type equations and Green-Ampt-type equations are enough for your objective and discussions. This decision may narrow the spectrum of your results and your conclusion. I think you should explain for this point here.

Reply: We agree that more equations could have been tested but the small RMSE made it unlikely that any equation could perform better because the RMSE was equal to the unexplained variance in a geostatistical analysis (Fiener at al. 2011) that does not force any theoretical equation through the data and thus yields the best possible fit. (was added)

Reviewer: P3671, L10-20 I think you should explain by using equations, as what you explain here is very complex and it is not easy to understand perfectly without equations.

Reply: We improved the explanation of our approach.

Reviewer: P3671, L21 Please specify what you mean by "the same variables. . .

Reply: Was changed to "same soil properties".

Reviewer: P3672, L3 I think your citation for the "split-sampling cross-validation approach" would be helpful for some of readers.

Reply: We give a reference now. Following this reference we changed the terminology to "ten-fold stratified cross validation" and we improved the description.

Reviewer: P3672, L21 Please explain how you derived equation (1).

Reply: Explanation is given in Material and Methods (chap. 2.2. Statistical analysis and model development; Page 3670; Line 26 ff.)

Reviewer: P3673, L7 Please explain Q_P20, Q_P30, and Q_P40.

Reply: Explanations are given already on page 3670 L 22.

Reviewer: P3674, equation (3) Please double-check the required format of the HESS for this type of equation. It seems underdone for me.

Reply: We agree with the referee that the layout of equation (3) was somewhat messy which resulted from the fact that the equation stretches over several lines. However, we followed the guidelines of HESS. We changed the abbreviations of the variables and the presentation of the equation and hope that it looks better in the layout of the final paper.

Reviewer: P3674, L16-18 I think the author would need to explain this issue at a very early stage of this paper such as "2. Materials and method" with a special focus on the magnitudes of the errors.

Reply: We added the quantification of random error within an event in chapter 2.2 Statistical analysis and model development and describe the errors that remain constant

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for all runoff measurements within an event. Given that the detailed description of error estimates is already published in Fiener et al. (2011) we refer to this citation.

Reviewer: P3676, L5-8 I think you should explain this part in method (and introduction) about the 2-step procedure. I think this is an explanation of method.

Reply: We disagree with the referee here. If we would explain this in Methods we would also need to explain the results of the analysis of initial abstraction and runoff (which both are part of results) in the Methods section. Therefore, we think that this is a result of the analysis and not a method.

Reviewer: P3676, L9-10 I think you should explanation why runoff rates and volumes decreased with increasing C_org for readers.

Reply: We have separated Results and Discussion and in consequence this explanation is given in the discussion of the hydrographs (chapter 4.2; page 3678, line 7 ff)

Reviewer: P3676, L23-24 I think you need to explain why "Runoff volume again was modeled more accurately than runoff rate".

Reply: Explanation why runoff volume is modeled more accurately than runoff rate is already given in the previous chapter 3.2: "Random errors during measurements of runoff rates partly explained the lower performance of modelled runoff rates as compared to runoff volumes....".

Reviewer: P3677, L3-27 I think you should discuss about the scaling issue in hydrology first and then you focus on your scale of interest here. Also, I think you need to explain the experimental set-up in detail here or somewhere else such as your section 2. Some photos, diagrams, or sketches would be helpful to imagine the experimental environment for us.

Reply: Now we define scale in the Introduction. To this paragraph we briefly added information about the experimental setup to illustrate our argument. However, given

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that the data result from very different measuring campaigns and research groups, a more detailed description would be rather long, distract from the topic and repeat what we have written in Fiener et al. 2011, that exclusively was intended to describe the experimental environments.

Reviewer: P3678, L5-6. Please cite a suitable reference for "many other surface runoff estimates".

Reply: Citation is given now.

Reviewer: P3679, L15-19 I think this is one of your major contributions to current hydrology and I suggest you highlighting more in abstract and results by allocating more sentences.

Reply: We added a sentence to the Abstract to highlight this finding and two sentences to the Discussion

Reviewer: P3679, L29-P3680, L7 These discussions would be beyond our understanding or imagination, as you did not explain enough for the experimental set-up for the field data corrections. I think your detailed explanations are necessary in the Section 2 to share the prerequisite of this research with readers.

Reply: See comment to Remark "P3677, L3-27".

Reviewer: Whole Please check technical errors you made in the paper by tracing all words in the paper. Some examples are listed in my list of <technical corrections>. Also, there seems to exist some grammatical error in the main text, hence I suggest you to have an English proofreading service.

Reply: We carefully checked for technical errors and corrected them. The manuscript has been proofread by a native speaker.

<Technical corrections>

Reviewer: P3668, L.3 surface generation ! surface runoff generation?

Reply: We inserted 'surface runoff generation'.

Reviewer: P3668, L5 Largerscale ! Larger scale?

Reply: Was changed to 'larger scale'.

Reviewer: P3672, L16-17 It looks as (range 0. . .25 %) and (0.063. . .2 mm) on my computer display. Are these same as you typed? I think "-" or "" would be better here. To be accurate, please check the guideline for authors of HESS, too. Also, my display shows "!!!" just after (range 0. . .25 %) and hence it may be caused by the difference of language environment. Please double-check these points if you revise the paper.

Reply: We replaced ". . ." by " to " to avoid any ambiguity with the minus sign

References:

Fiener, P., Seibert, S. P., and Auerswald, K.: A compilation and meta-analysis of rainfall simulation data on arable soils. J Hydrol, 409, 395-406, 2011.

Haider, J.: Herbizide in Oberflächenabfluss und Bodenabtrag - Feldversuche mit simuliertem Regen. Diss. thesis, Technische Universität München, 1994.

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