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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Modelling water, sediment and nutrient fluxes from a mixed land-use catchment in New Zealand: effects of hydrologic conditions on SWAT model performance" *by* W. Me et al.

Anonymous Referee #3

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Review comments Journal: HESS Title: Modelling water, sediment and nutrient fluxes from a mixed land–use catchment in New Zealand: Effects of hydrologic conditions on SWAT model performance Author(s): W. Me et al. MS No.: hess-2015-119 MS Type: Research Article

GENERAL COMMENTS

The manuscript is a modeling exercise trying to simulate river discharge, sediment and nutrient concentration in a 77 km2 catchment in New Zealand. The authors used SWAT

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as hydrologic simulator and SWAT-CUP as a calibration tool to adjust model results to observations. There are a couple of interesting issues which were raised in the paper (e.g. model sensitivity to parameters in various flow stage- base flow/quick flow, or temporal dependence of model parameterization on hydrological condition). However the authors test design and discussions are not adequate to derive the intended conclusions. The model configuration, calibration process are not adequately reported. Uncertainty analysis is missing.

My general comment is that the study can be accepted if the authors are able to address the following shortcomings in sufficient detail and only after a major revision.

SPECIFIC COMMENTS

a) Abstract

- Page 4316, line 10, "comparison of simulated daily mean discharge . . ... Allowed the error in the model prediction to be quantified". The authors failed to properly address the claim they raised here, in the main body of paper.

- The authors suggested hiring higher frequencies of observation in order to overcome the base and quick flow dependent regimes limitations in current model. (Page 4316, line 15). Please explain how this improve the model performance? Do you also consider sub-daily simulations? Please clarify that in the proper section in the main text.

- Abstract, page 4316, line 17, again you are thronging an idea that your study has implications in identifying uncertainties but you are very inexact in explaining how?

- Please be very specific of the outcome of this study in your abstract. Make 2-3 bullet points of what you achieved during this study.

b) Introduction

- Page 4318, line 10, "They found that the logarithmic form of the Nash-Sutcliffe efficiency (NSE) value provided more information on the sensitivity of model performance

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for simulations of discharge during storm events, while the relative form of NSE was better for base flow periods." this is not what Krause et al (2005) had been reported. In their paper they clearly stated that: "To reduce the problem of the squared differences and the resulting sensitivity to extreme values the Nash-Sutcliffe efficiency E is often calculated with logarithmic values of O and P. Through the logarithmic transformation of the runoff values the peaks are flattened and the low flows are kept more or less at the same level. As a result the influence of the low flow values is increased in comparison to the flood peaks resulting in an increase in sensitivity of ln E to systematic model over- or underprediction". Beside they used natural logarithm and not log 10. I also couldn't find the justification for the threshold number "0.1". Please clarify this.

c) Parameter calibration (I would call it model calibration!)

- Page 4321, line 9. Latin hypercube method is a sampling methods that insures the samples cover the entire parameter space and that the optimum solution is not a local minimum. LH is not quantifying uncertainties.... please correct for that.

- The calibration process is very vague to a non-swat user. Please give adequate information on calibration steps. You jumped from LH to R factor and P factor... describe your calibration procedure in short but sufficiently.

- Page 4321, line 16, "produce narrower parameter range", how?

- Page 4321, line 17, "optimal value.." how do you know? ref?

- You referred to R factor and p factor but you didn't perform uncertainty analysis or at least you didn't report it! This indices are not used later on in the text!

- Your calibration set up is unclear. How many simulations you had? How many iterations? How wide is the uncertainty range? What are the possible explanation for that? How did you select your parameters at first place? Did you perform some sensitivity analysis prior to calibration? What are the fitted value for the selected parameter after calibration (best parameter set)? Did you calibrate discharge and sediment and nitrate

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all together or one after the other?

d) Model evaluation

- Page 4322, line 1-10, SWAT accounts for initial amount of Nitrate in shallow groundwater and the corresponding parameter is NO3 sh,o. To the extent of my knowledge you can also set your background N in soil layers. “Model general underestimation” is not a valid justification to add 0.44 mg Nl-1 to your model simulation. You need either to adjust your input or have stronger argument for doing so.

- page 4323, line1, again there is very little information on your model set up, time steps, methods used to calculate surface runoff, routing, etc... here you stated that you had hourly measurements. Why compare it to daily mean simulations then? Did you run your model sub-daily? Would that be an option?

- The efficiency criteria presented in table 4 are widely known. You don’t need this table. Besides, you presented what is considered as satisfactory and unsatisfactory in table 5.

e) Hydrograph and contaminant load separation

- All the three water quality constituents are load separated with base and peak flow. Is the characteristics of all three elements the same? Are they all following the river discharge regime? Can you elaborate on that? Sensitivity analysis

- Why log 10, why the threshold of 0.1? Page 4324, line 15, and figure 2 need a proper reference. Results

f) Model performance

- Please add efficiency criteria to all 8 figures in figure 3 both for calibration and validation periods. It is much easier to have them on the graphs rather than in table 5.

- Page 4326, line 1-10. Figure 4 and the explanation are very unclear. The symbols used in the figure are not distinguishable. I am not sure what the main point of this

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paragraph and the figure is! What is the main idea of “discharge weighted daily mean concentration” and then comparing them to simulated mean? What did this analysis reveal?

- In general the model provides poor results in water quality representation. It is always easy to blame the model not to represent the process adequately! There might be processes that are going on in the catchment and you are not including them in the model. e.g. fertilizer application... Maybe you need to revisit your conceptual model. That’s exactly why you need uncertainty analysis! Parameter sensitivity

- Figure 5 is impossible to read. You need to change the symbols. There is absolutely no explanation on this figure in the text. What are you trying to convey by presenting this figure? Again, what are the key points?

- Figure 6 and the corresponding text: you need to explain the method better. It is very unclear right now. Discussion

g) Temporal dynamics of model performance

- In general, I would suggest that you combine result and discussion. This way you have more space to provide more in depth analysis and you avoid repeating yourself.

- Page 4329, line 5, please clarify how your results show that.

- Page 4329, line 21, is process under-representation the only reason? What about input uncertainties (for example)? That’s exactly where uncertainty analysis come to play!

h) Temporal dynamics of parameter sensitivity

- Page 4331, line 3, if you are not using SCS curve number method, why the parameter is in your calibrating parameter list then? Of course the model will be insensitive to it!

- Page 4331, line 3, “was not found to be sensitive” → was found to be insensitive

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- It would be very interesting to see how the model performance changes in high flow and low flow while feed in different parameter set at the two stages. The main question will be then: does a temporal dynamic parameterization improve model performance? So far, you showed that the model is sensitive to different parameters in high and low flow which is also valuable.

- Page 4332, line 15-17, very nicely said!

- The title can be shortened and become more informative of the main research question.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 4315, 2015.