

## ***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 #2**

Received and published: 2 June 2015

General Comments: The paper entitled “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. is a very interesting paper, that brings new discussions and more in deep analyses of some aspects. Although many of these questions are known to affect watershed modelling and SWAT, they have not been very analyzed until today, some of the scientific subjects that the paper discuss are: the dynamic dependence of parameter values on flow regimes; the temporal variability of water quality parameters, SWAT limitations (as for example on groundwater nitrogen

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concentrations), the need of a robust calibration and validation, and that a calibration of a particular situation may lead to a greater uncertainty on scenario analyses, that should be considered, and may be in several studies be underestimated. The manuscript is clear, has good language use, and is very concise. That being said the reviewer believes the manuscript can be improved still. Making all the text more fluent and easy to follow, consider re-organizing a few topics of the paper, and also the authors should address better “the need of a robust calibration and validation, and that a calibration of a particular situation may lead to a greater uncertainty on scenario analyses”, and in this sense, it is important to clarify better how the particular case study calibration was conducted and what parameter values were obtained. As well as, if not quantify uncertainties for this paper, but to introduce some discussion regarding the uncertainties and limitations of the methodology used, the monitored data, and separation of the hydrograph contributions (base and quick flows), and concentrations. And also pass the key findings to the reader in the end.

Specific Comments: 1) The title could express better the main question and discussion of the paper;

2) Abstract is clear and it catches the reader attention for the paper, but should also incorporate the main findings of the application on the watershed studied and possible implications;

3) The methods section: Although the authors discuss more about the watershed's conditions on the discussion section, it would be valuable for the reader to be able to understand it before, to follow better the discussion. As what are the main processes, average precipitation, slope, characteristics, land uses, soil types, etc. What would be typical base flow, quick flow, lateral flow contributions. . .

4) The same goes for the SWAT model application, it is not clear for the reader, if the authors used the default configuration with default equations, or if different methods within SWAT were used. As for example, which method was used to calculate PET?

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Which for curve number? Which for routing? Also it is not clear in this section if the authors used the hourly input and ran SWAT with hourly data, using Green & Ampt, or if the data was aggregated on daily beforehand, and SCS method was used. Or for example what was the warm up period used? It would be important to write the chosen methods of the model in the methods section.

5) The paper has a great amount of information for this section, as for example plant parameters, wastewater applications, etc. Tables 1 and 2 were good to concise a lot of this information. And of course this is not the main point of the paper, but it has to be sufficient for reproduction. So we advise a better description of model configuration, and also of the calibration process;

6) In the calibration: please cite more literature, and although the algorithm and software (SUFI-2 and SWAT-CUP) are mentioned, there is a need to explain how the calibration process was. Was flow calibrated first? And then suspended sediment? And then water quality related parameters? Was it all at once? Why the authors calibrated TP manually and the others with SUFI-2? No Sensitivity analysis was done prior to calibration, why? What was the Objective function used?

7) I believe the section 2.1, 2.2 and 2.3 can be better organized. In the end of section 2.2 there is some description of the model used - SWAT, and in model evaluation a small description of calibration and validation, please revise.

8) Table 1: Please state clearly that the 15 min data was aggregated; the acronyms SS, TP and TN are in Table 1, but they were not presented in the text that is before Table1; please also explain in here why there are the two validation periods with a short sentence as a footnote, for example, just to be clear. Consider separating into two sections the point sources, in the contributions: spring, etc; and the abstractions, with related sources. Also, why were the spring discharges constant, if there was measured data, if it was not enough for a daily series, how were they “based” on the measured data?

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9) Table1: Soil characteristics, make it clear if all the SWAT needed parameters were directly from data, or how they “were determined using key physical properties” were pedo-transfer functions used? Meteorological data section: include the airport station as source; For the “Agricultural management practices” would be nice to subdivide to attribute what is source of what, if feasible.

10) The phrase starting with “A validation period was chosen...” in the 2.3 section is not clear, specially the “compared with weekly”, please revise.

11) Calibration - Table 3: Please include calibrated values, and how the parameters were changed within the given range; For example was CANMX changed for all crops? CN2 and slope parameters etc were changed as relative parameters, or were they changed arbitrarily within the given range? Were the physical characteristics of the catchment considered, how?

12) Calibration – Table 3: There are some parameter values here that seem very high. As for example CANMX, LAT\_TTIME (1800?) etc, please revise, and justify;

13) Do we need any of these 3 formulas? Formula 1 is a weighted average; formula 2 and 3 are the same, just changing the left side, and are mass balance. Consider leaving only citation, especially since they are also on Figure 2.

14) Figure 2 is nice, but please include the citations/sources in the figure for the methods used. Also please revise the phrase on text that calls figure 2: “Methods used to quantify parameter sensitivity...”, since figure 2, explains all this methods, including the previous described separations of section 2.4;

15) In the text of section 3.1 please cite the performance rating criteria used directly from Moriasi et al., 2007 (yes, I know Table 4 brings all information), but reading the text only should be clear the source.

16) What about the statistics for the separated quick and base flows?

17) Please revise and make clearer the section 3.2. It does bring a nice

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discussion. Would also suggest changing the phrase: "Those sensitive flow parameters... particularly sensitive"

18) Discuss why use log 10 Nash here, and not before or in both analyses?

19) It is interesting and it would be expected that since the model was calibrated when wastewater was being applied that in the previous years used for validation the water quality components would be underestimated. But therefore a deeper discussion on the calibrated parameters may play an important role, since, are the parameters changed, so the physical meaning has also been decreased and therefore if no application is done, it underestimates, or is the model and algorithms, not replying well to different forcings? Therefore is it a limitation of the calibrated set of parameters only or/and method?

20) Section 4.2 is very valuable and dense, a final "closure" with key findings in the section 4.2 is advised; as maybe a small discussion of how regional the sensitivity analysis results are, or how they could be extrapolated to base flow and quick flow, it is difficult, but would be valuable.

21) In the 4.2 section: would also like to see what is the average percentages of lateral flow to the flow contribution on the region, both simulated and from local knowledge;

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