

## ***Interactive comment on “A daily salt balance model for representing stream salinity generation process following land use change” by M. A. Bari and K. R. J. Smettem***

**Anonymous Referee #1**

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### 1. General comments:

The authors present a new and innovative model approach for simulation of salt balance/stream salinity. This conceptual approach is a component of a coupled salt and water balance model to represent stream salinity generation. They discuss the influence of forest clearing on the stream salinity of two Australian test sites.

After an introduction a surprisingly short presentation of the research area is given. In a third chapter processes of salinity generation are discussed, partially in general and partially in context to the research area. Also some additional information about the experimental setup and the changing conditions due to the specific landuse change are discussed here. In a fourth chapter the architecture of the model approach as

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well as the basic equations are presented, followed by some short information about the model calibration and model parameter requirements in chapter 5. In chapter 6 the application of the model for daily, monthly and annually simulations were presented and partially discussed. Finally in chapter 7 a summary and conclusion should be given. This chapter contains more information about the model approach which are partially redundant to the abstract and not many conclusions can be found in this part.

Generally this manuscript is an interesting and innovative contribution to the journal. The authors present a novel and substantial method of analysing salt balance processes and its influences on stream salinity also in a quantitative way. The scientific questions discussed in the manuscript are in the scope of the journal.

However, the manuscript needs some substantial improvements in its structure but also additional information/ discussion is needed at some chapters to ensure its definite comprehensibility. The overall presentation of the assumptions and scientific results is partially rather confusing. The manuscript lacks from a clearer structure beginning with the discussion of the considered scientific problem or question (as partially done in the introduction but some of these information are spread all over the manuscript), the state of the art, open questions and research needs to highlight the motivation, methods, results and discussion. Especially the discussion of the miscellaneous results and what we can learn (for instance if the prediction of your model over/under estimates the reality) is mostly to short and not sufficient.

Other important information are totally missed. The introduction of the research area as well as of the experimental setup is insufficient. It is necessary to specify some of the main characteristics of the research area, give more detailed information about parameters which have been observed (why, where, how), about the spatial and temporal characteristics of the experimental investigations (especially because the model was calibrated against these observed data one has to know about their quality). Some insufficient information about experimental setup are contained in chapter 3 - these parts have to be revised/restructured.

Furthermore there is additional information needed about the water balance simulation part of the model and its assumptions and processes. Although this information might be given in a previous submitted paper 'A daily water balance model for representing streamflow generation process following land use changes, Hydrol. Earth Sys. Sci. Discuss., 2, 821-861, 2005' this manuscript should be understandable as stand alone and these information are substantial to understand the salt balance simulation approach presented in this manuscript. There is a significant lack of information regarding the model characteristics in terms of spatial resolution, consideration of spatial heterogeneities etc. Furthermore it is not completely clear how the coupling of the salt and water balance parts of the model work.

A discussion of the transferability as well as of the model limitations is missed. I would expect a sensitivity analysis of the two model parameters which control the salt balance at least. In chapter 6 the model has been applied and tested. I am not sure if the data are valid enough for the assumptions made in this chapter. On the other side a lot of effects as systematically over / under estimations have not been discussed for their reasons - there might be also a potential for a better understanding of the simulated processes due to analyses of the model failures. Also the overall salt balances (simulated) might be discussed in more detail - do they fit? I would advice to analyse model efficiency more detailed, for instance sequentially (pre cutting, post cutting, wet, dryĚ.).

Additionally the title of the manuscript promises the analyses of changing conditions due to landuse changes but only one alteration of land use, deforestation, has been considered. Thus, the title has to be changed to be less general. Otherwise a discussion/declaration is needed to proof how this single landuse change do reflect all possible/characteristic changes of this typical landscape - but again, also in this case a specification of the title would be required. More detailed information need to be provided about vegetation influences in the model concept. How is vegetation reflected, parameterised, which parameters are effected and in which direction?

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I would expect a more detailed discussion about the variable simulation goodness. Additionally the NSE or R2 alone might not be enough in some cases to evaluate the goodness of model fit.

## 2. Specific comments:

p1148/22: R2 for annual stream salt load is only partially presented in the text, also for other results (monthly  $\checkmark$ ) R2 is presented sometimes, sometimes not - please consequently - give always at least the NSE

p1149/13 'new hydrological equilibrium' is rather unspecific - please specify

p1149/15/29 is confusing due to disordered arguments - better structuring needed, for instance bring 17 - 29 before 'For example in Queensland $\checkmark$ '. So you reach a line of arguments 1. Western Australia is different $\checkmark$ ., 2. Characterisation of West Australian conditions, 3. Comparison to 'rest of the world'

p1550/1551 chapter 2 'The study catchments' is much to sketchy - please revise this part and improve/provide also information concerning the physical/natural characteristics of your test sites (including soils, landuse etc), hydrological characteristics, runoff components, experimental setup $\checkmark$ .

p1551/9 again - how was salt fall measured and where?

p1551/17-18 regarding shallow interflow - what is the origin and background of this information - do you know it from experimental investigations, previous studies - where does this information come from?

p1552/10et sqq this is much to vague and needs to be specified.

p1153 as mentioned above - before giving a description of the salinity component please give a brief but sufficiently detailed introduction into the water balance part of your model

p1153 et sqq an additional figure would help to better understand the processes pre-

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mented by the storages of the model and its adjacent transfers between storages - this could be presented in chapter 3 in order to give also a better presentation of the actual processes described there

p1154/13 the use of one single lumped parameter for all of these processes needs to be discussed and justified

p1155/1156 again it would help if abbreviations used in the equations are given for the parameters used in the text additionally

p1156/19 the initial estimation of salt in SG is not understandable at this stage: how observed, how many boreholes, how variable (spatially/temporally), has it been interpolated and if yes - how?

p1558 et sqq this chapter seems to be a little bit sloppy, significant results are lacking, please rewrite and give more detailed information about :

i) the definition of your initial conditions ii) eventually warm up periods iii) what criteria/parameter have been compared for calibration iv) what is the extend of the parameters you calibrated by 'trial and error' v) sensitivity analysis of your parameters?

p1160/8 what is observed, what predicted, fig. 5a shows the dry store content only!

p1160/10 observed and predicted data are of the range but seem to be not similar!

p1161/3 there is the reference to a figure lost?

p1661/8 'hydrographs were very similar....' - this statement, and also in the following is to unspecific

p1163/4 what is the NSE for Fig. 12a - in general I would advice to include the NSE also in your figures (there is enough space left) or at least in the figure captions

General discussion: again, also this part needs to be improved significantly - I miss a general discussion of the result (see annotation made above)

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p1164/16-19 this reference / information does not belong into this chapter - or you have to bring it better into a context of your results

p1164/23 et sqq '15-20 m below' does this mean the groundwater table increase until 1987 was 20m ?!

in regard to technical comments made for figure 1 - how has the watershed delineation been carried out (also for the groundwater) and how similar are surface and subsurface (groundwater) watersheds?

3. Technical corrections:

p1553 et sqq generally for the model description it would be easier for the reader to follow when you always give also the abbreviation of the parameters in the text. This is done sometimes but not always

Generally, the figure captions are rather short and need to be improved, especially when the Figure contains different parts (a, b, c)

Figure1: is of a to bad quality, captions are partially not readable due to overlap with the scheme

Is it right that the Ernie catchment covers only one side of the river? How can the salinity status of the river than be brought into context of the Ernie catchment only - what's about the influences of the catchment/landscape on the other (southern) river side - can these be neglected?

Figure 2: please shift the lower caption, there is an overlap with the lower scale

Figure 5a please adapt the scale at salt storage axis (values vary between 3.36 and 3.4 only)

Figure 5b why do you present stream zone salinity data for the last 2/3 - generally: please include also information about modelled and observed character of the data presented

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Figure 7 - 9 observed graph might be too weak - the figures could additionally be improved due to modification of the time scale (half of the axis presents not simulated time periods)

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**HESSD**

2, S634–S640, 2005

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