Hydrology and Earth System Sciences Discussions

Interactive comment on "A daily water balance model for representing streamflow generation process following land use change" *by* M. A. Bari and K. R. J. Smettem

Anonymous Referee #4

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General comments:

The processes occurring in the research area are quite distinctive to other areas in the world. This means that the possibilities to compare this study with other studies are little. However, this should not mean that the results are as easily accepted as it is written in the paper. The lack of an appropriate calibration and validation overview, including objective function performances and parameter sensitivity analysis makes the paper a kind of black box, with a statement that the model is successful, but no explanation except a comparison with previously used models and some single point measurements (shallow boreholes). The 'downward approach' is used to define the model structure, with added complexity when needed. This is a proper way to improve model performance, but, as mentioned in the paper (pg.824), a balance should be found between

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model complexity and model performance. Maybe, with adding more complexity the performance would even increase. However, no such analysis is undertaken, neither on the performance nor on the complexity. The used model is very flexible, due to the presence of two calibrated probability distribution functions in line, one for the Dry Store depth and one for the Wet Store depth, with a third one with (I assume) fixed values for the Subsurface Store. Adding even more non-linearity by the (ia) parameter makes the model capable of predicting many different runoff reactions. It is therefore not surprisingly that the model is successful. But what physical meaning do the internal storage volumes have? Can this be more accurately verified, by comparison with more field data? So the main question is: How is the spatial distribution of these storage volumes translated to the field. As a final remark, the paper is innovative is such a way that the topic is rare, especially with such a big influence of the land use change. However, the study is limited to the optimization of a highly flexible model to the measured groundwater and runoff data, without a clear description of the advantages in, e.g. the use of this methodology or the regional applicability of the model or any research objective whatsoever, except for applying the model on measured basins with (similar) land use change prospective. Therefore, the objective to understand changes on flow and salinity generation processes following clearing (pg.825) is not reached, while model structure and process verification has not been performed.

Specific comments: I guess a certain over-parameterization is present in the model structure, looking at the list of variables in which a total number of 10 free parameters are given, not to mention the additional variables that need to be measured or calibrated (soil conductivity values, interception related constants, transpiration related constants, stream and soil morphological aspects). With which and how many measurements were these variables determined? The way in which the calibration is performed should be stated and is missing in this paper. Also the way the results are presented is weak, with only a few vague pictures of single year results. The use of more common comparative performance measures, like the coefficient of efficiency (Nash-Sutcliffe) of RMSE values are more indicative, as long as the data series are

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explained well. The statement that the model performs successful is not acceptable as such. Then on page 842 it is mentioned that some parameters are important, but some of them are a priori determined. How certain are these values, knowing the importance of their influence? A final statement is the question about the rainfall records, while its uncertainty is mentioned to be high (pg.843), but is it still low enough to be this convinced about level of model complexity and the successfulness of its results?

Technical corrections: -For the equations, separate the' if'-statements more from the equation itself. -Don't use a reference twice for the same statement (about downward approach, Klemes, pg.826). -Don't show the two soil evaporation and transpiration equations, without explaining where they come from and why these are used (pg.828). -Paragraph 6.1 is not part of the results or discussion, while it is a part of the previous known behaviour of the ground water system -Use a better example of why the model represents the shallow groundwater system 'very well' (pg.838). -A range between 2-10-Explain more why the daily model performs better than the monthly model (pg.840). -In figure 11, the line should be y=x, to be able to judge the R-squared.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 821, 2005.

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