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Comment on hess-2022-169

Anonymous Referee #1

Referee comment on "Improved representation of groundwater-dominated catchment using SWAT+gwflow and modifications to the gwflow module" by Estifanos Addisu Yimer et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-169-RC1>, 2022

The manuscript "Improved representation of groundwater-dominated catchment using SWAT+gwflow and modifications to the gwflow module" by Yimer et al. is about the development of a new groundwater module for SWAT+ to provide an opportunity to consider a more process based groundwater interaction with the soil and consequently with discharge. This study tries comparing the basic SWAT+ and the newly developed SWAT+gwflow. For this, both model versions are applied on the Dijle catchment, which is non for groundwater dominance.

In general, a more process-based representation of groundwater within hydrological models and additionally a more easy to handle and fast model application should be interesting to the hydrological community. The current manuscript has a string focus on the SWAT model and is mostly written in a form of a technical note. Especially the beginning of the introduction deals with technical details of SWAT, which might be not relevant for all hydrological modellers. Consequently it might be worth to rethink the form of presenting this study.

In the following I am going to summarise the most critical shortcomings of the manuscript:

L. 33 - 58: This seems to be a technical summary about SWAT. It is unclear why such detailed information of SWAT is provided at this position. What is the demand for further research regarding the general hydrological community?

L. 59: There are several efforts to improve groundwater representation in hydrological models. Since the authors are focused on SWAT, it would be scientifically sound to mention and discuss these efforts at least for current and previous SWAT versions and to work out

the necessity to consider other approaches (e. g. the current study).

L. 60: This seems to be the motivation of this study?

L. 93: Limitations of SWAT were also shown in Luo et al. (2012), Pfannerstill et al. (2013), Nguyen and Dietrich (2018), Shao et al. (2019). Additionally, these studies provided solutions to improve the representation of groundwater within SWAT.

L. 97: Please provide a clear structure: what are the gaps? which problems need to be solved? how are the problems solved? The introduction ends up with a rather technical information, which is not appropriate to guide readers through this study. It would be more helpful to provide the aim of this study at the end of the introduction.

L. 151: The introduction ends up mentioning the integration of pumping. This part is not mentioned here?

L. 215: Please provide references.

L. 274: It is unclear which parameters and which ranges were used for the sensitivity analysis. This is very crucial to reproduce the results of this study and to check if this method is appropriate.

L. 285: The whole section about sensitivity is unclear due to missing information (selected parameters, parameter ranges).

L. 286: It would be better to provide a table with calibrated parameters.

L. 302: It is impossible to follow the author's opinion and conclusion about poor/good model performance and the comparison between the different model structures.

1. Please provide a table with calibrated parameter values for both model setups.

2. Please provide appropriate figures for simulated/observed discharge. Figure 5b does not show any meaningful information since data is very compressed. A flow duration curve

would be helpful to show the deviation between simulated and observed discharge magnitude. Furthermore, it seems that several flow events are not adequately reproduced by timing and magnitude. This may be due to the fact that a weather station inside the catchment is missing! What about other performance measures? Poor model performance, especially for the basic SWAT, might be related to the selection of inappropriate performance measures or imbalanced weighting.

L. 355: The evaluation based on monthly discharge should play a minor role. Of course, groundwater processes are more time-delayed and could be checked at a monthly time scale. However, other crucial hydrological processes happen immediately on a precipitation event. For a consistent model behavior, all relevant processes need to be represented and of course they need to be evaluated. Consequently, it is necessary to focus to an appropriate extent on daily discharge.

L. 343: Are these model results realistic? Are there any options to evaluate this?

L. 356: Please provide discharge for the validation periods with an additional figure.

L. 377: It is impossible to reproduce this conclusion since necessary information was not provided (parameters, parameter ranges, appropriate figures for daily discharge).

L. 389: This conclusion cannot be confirmed due to missing information.

L. 392: This aspect is fully new and was not mentioned before.

Due to the mentioned shortcomings I see the necessity for a major revision.