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Hydrology and Earth System Sciences
Discussions

Interactive comment on "GlobWat – a global water balance model to assess water use in irrigated agriculture" *by* J. Hoogeveen et al.

Anonymous Referee #1

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The paper describes the development of a global hydrological model and the calculation of irrigation water use by application of the new model. Estimates of irrigation water use are required for many applications while previous research identified a considerable uncertainty in estimates across different models and input data used. Therefore, more research is required to reduce these uncertainties and studies like the one presented here are in general highly appreciated. The model developed as part of this study is well described by the authors and the article is well written. However, I would like to suggest several changes that may further improve the manuscript. My major points of criticism are:

1.) The structure of the manuscript is very uncommon. A general guideline for scientific publications is to structure the manuscript in a materials and methods section,

a section presenting the results and a section discussing the achievements by comparison to independent data and findings of other studies. Each of the three sections should roughly cover 30% of the manuscript. The current version of the paper has 13 pages belonging to materials and methods (sections 2-11), 2 pages results (section 12) and two pages discussion (section 13). Furthermore, the results section (section 12) is merged with the description of the model calibration (belonging to materials and methods) and the model validation (belonging more to the discussion). To reduce this imbalance I suggest to create a materials and methods section containing sections 2-11 of the current manuscript and the description of the model calibration. The new section can be shortened by moving the equations and the related detailed description of the methods into an appendix while focusing in the main text on a general description what has been done and why it has been done in this way (e.g. the reasoning for selecting specific methods and for simplifications and assumptions). The main text should then refer to the details explained in the appendix when required. In contrast, the results and discussion sections need to be extended. For example, it is hard to understand why the cropping pattern on irrigated land is represented in the model in very high spatial and categorical detail (with regard to crop shares and the parametrization of their cropping period) while no result is shown with regard to specific crops. On the other hand, non-agricultural vegetation and soil properties are represented in the model in a very simple way. Shouldn't it be vice versa when the simulation of realistic water balances is the objective of the study? I suggest therefore to focus in the results and discussion sections more on how the new model helps to fill current gaps of knowledge. What is the specific advantage of the model presented here in comparison to all the other models? The calculation of crop specific water requirements in high spatial and temporal resolution is certainly one strength of the model . . . . So why not presenting and discussing these results? Alternatively, the authors may consider submitting the manuscript to other journals. The current article structure would fit, for example, much better to the requirements of Geoscientific Model Development. This journal has more a focus on model development and model description while a detailed analysis

of model results is not required.

2.) The literature review and the discussion section need to be extended and updated by referring to the latest versions of the presented alternative models and consequently to the most recent articles. Many improvements and adjustments made in the last years to other models are neglected in the current version of the manuscript.

3.) Some very basic decisions made by the authors when developing the model need to be described much better, e.g. the choice of the variables that are calibrated and the information used in the calibration. For many readers it will be hard to understand why the model is calibrated against country specific information obtained from the Aquastat database (e.g. see Tables 4 and 7). In many cases this information does not really represents measured data, more likely these are estimates, expert guesses or information obtained from other models. I think that the reason for this choice is that the model is designed to complement other models and databases at FAO so that consistency maybe more important than accuracy for specific variables. Just to illustrate this: in order to convert irrigation water requirements to irrigation water withdrawals, the authors use irrigation efficiencies so that the calculated water withdrawals fit to the data reported in Aquastat. In other models irrigation efficiency is simulated (e.g. described in Wada et al., 2014 (paper in GRL)), taken from the literature (LPJmL) or based on the water source used for irrigation (e.g. Doell et al., 2014). The authors assume in their calculation of irrigation water requirements that water supply for optimal irrigation is always ensured while other studies suggest that actual irrigation water application maybe only 70% of the volume required for optimal plant growth (Doell et al., 2014). In any case the reasoning for the specific structure of the model presented by the authors and their assumptions need to be explained much better.

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