

Interactive comment on “Hydrological impact of rainwater harvesting in the Modder river basin of central South Africa” by W. A. Welderufael et al.

Anonymous Referee #1

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The authors present and discuss the results of an interesting study concerning the potential impacts of infield rainwater harvesting on various hydrological fluxes in a catchment in South Africa. The subject is highly relevant for the future of smallholder agriculture in Sub-Saharan Africa, and presents some major scientific challenges. The scientific significance of this paper for HESS is hence, in my view, high. However, quite a bit of work remains before the article can be considered of publishable quality. Below I highlight my major remarks. These are then expanded on and supplemented by more detailed remarks in the attached file.

* It is not clear in the text how this study is different from previous work (Mwenge Kahinda et al. 2009 etc.). Please clarify how this study adds to the present under-

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standing of IRWH potential in the area.

* Ensure to present the most important statistical results in the abstract so that the reader directly understands the main point of the article.

* Please ensure to justify various claims with proper statistical justification (see attachment).

* If I understand right the calibration period is only 1 year, and there is no validation period. As explained in the attachment, the authors need to justify this, and an independent validation period is needed.

* Please provide a clearer and more detailed definition and justification of scenario setups.

* Parameter non-uniqueness is a commonly observed issue when calibrating SWAT (see e.g. Andersson et al. 2009 in HESS, www.hydrol-earth-syst-sci.net/13/2329/2009/). Can you elaborate on the possible effect of alternative equally likely parameterizations on the scenario results?

* The methods section needs to be revised considerably. The structure is poor and a lot of information on the actual procedure is missing. I suggest a structure along the lines of: 2.1. Study site: details about the area, 2.2. Input data: which datasets were used (DEM, soil, landuse, climate (precipitation, maximum/minimum temperature?) incl. references), if/how were they modified (e.g. were the climate records complete or did you do some infilling?), 2.3. Model & setup: basic model function, model version, reference to detailed description of the model, how sub-basin delineation was done, how PAST, Agri-CON and Agri-IRWH were parameterized (enough detail so that a person familiar with SWAT can reproduce it) etc., 2.4. Sensitivity, calibration & validation: method(s), objective functions, period of calibration & validation, gauging stations used. 2.5. Scenario definition/description: detailed description of how the different scenarios were simulated (How much was CN changed? Which tillage functions were used?), if they

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were simulated the same way everywhere and in all seasons, and a justification for the approach (Why is CN+[tillage function X] a good way to simulate IRWH?), 2.6. Statistical analysis: What methods were used to judge if scenario outcomes were significantly different? Justify the choice.

Finally, I agree with the comments raised by the editor-in-chief Prof. Savenije regarding appropriate use of units and referencing key papers in the field. I advice the authors to follow his recommendation. In addition I would like to highlight a few more references, which are highly relevant to this paper:

* Andersson, J.C.M., Zehnder, A.J.B., Rockström, J., and Yang, H. (2011). Potential impacts of water harvesting and ecological sanitation on crop yield, evaporation and river flow regimes in the Thukela River basin, South Africa. *Agricultural Water Management*, 98 (7), 1113-1124, doi:10.1016/j.agwat.2011.02.004.

* De Winnaar, G. and Jewitt, G. (2010). Ecohydrological implications of runoff harvesting in the headwaters of the Thukela River basin, South Africa. *Physics and Chemistry of the Earth*, 35, 634-642, doi:10.1016/j.pce.2010.07.009.

* Vohland, K., and Barry, B. (2009) A review of in situ rainwater harvesting (RWH) practices modifying landscape functions in African drylands. *Agriculture, Ecosystems and Environment*, 131, 119-127, doi:10.1016/j.agee.2009.01.010.

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/8/C2736/2011/hessd-8-C2736-2011-supplement.pdf>

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