Hydrology and Earth System Sciences Discussions

Interactive Comment

Interactive comment on "Water availability, water demand, and reliability of in situ water harvesting in smallholder rain-fed agriculture in the Thukela River Basin, South Africa" *by* J. C. M. Andersson et al.

Anonymous Referee #3

Received and published: 21 September 2009

1. Does the paper address relevant scientific questions within the scope of HESS?

Yes

2. Does the paper present novel concepts, ideas, tools, or data?

The paper investigates fundamental research questions on how to address multiple hydrological scale impacts, in this case using an open source modeling tool to evaluate how small scale (farm/field) soil interventions may be affected by water availabil-

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ity within a local spatial unit. In addition, which is still original, the team consistently uses uncertainty indicators to present and discuss results/outcomes. This presents the reader with 1) better knowledge, and 2) highlight weaknesses in analysis and tools, which needs to be addressed in further research

3. Are substantial conclusions reached?

Yes

4. Are the scientific methods and assumptions valid and clearly outlined?

Yes

5. Are the results sufficient to support the interpretations and conclusions?

Yes, although some improvements are suggested for clarification

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes

8. Does the title clearly reflect the contents of the paper?

Suggest changing: Assessing uncertainty in use of insitu water harvesting by smallholder farmers in Thukela, SA by using SWAT modeling tool

9. Does the abstract provide a concise and complete summary?

10. Is the overall presentation well structured and clear?

Yes.

11. Is the language fluent and precise?

Mostly. Suggestions are made in attached draft manuscript

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Mostly. Suggestions are made in attached manuscript

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

See attached draft.

Move section page 4934 line 25 to page 4935 line 9, and fig. 7, to a Supplement section: This section, although relevant, cannot be directly compared as the two models use different landuse for input... In addition, the authors do not attempt to explain in detail why the models diverge when exceeding 250mm runoff (fig .

14. Are the number and quality of references appropriate?

Yes. Some references could be added to Table 1 (if the intention is to be comprehensive), for example (there may be more):

Mbilinyi et al 2007: GIS based decision support... Ph Ch Earth

Mati B., De Bock T., Malesu M., Khaka E., Oduor A., Nyabenge M., Oduor V. 2006. Mapping the potentials for Rainwater Harvesting technologies in Africa: A GIS overview on development domains for the continent and ten selected countries. Technical Manual No. 6 Nairobi, Kenya: World Agroforestry Centre (ICRAF), Netherlands Ministry of Foreign Affairs. 116 p. + x p.; includes bibliography.

Prinz, D., T. Oweis and A. Oberle (1998). Rainwater Harvesting for Dry Land Agriculture - Developing a Methodology Based on Remote Sensing and GIS. Proceedings, XIII. International Congress Agricultural Engineering, 02.-06. 02.1998, ANAFID, Rabat,

Morocco

Alternatively, only focus on South Africa relevant references in table.

15. Is the amount and quality of supplementary material appropriate?

General comments and question marks to the authors:

i) There are some inherent issues with the application of the selected modelling tool in the smallholder farming systems which would be beneficial to explore further:

- The land use: a fairly small proportion of the basin is crop systems (8+8+2 %), and even a smaller % is the focal area, smallholder rainfed farming system: It would be good to have some idea of the overall model sensitivity to principal changes in these focal areas: If CRC is changed, how does this affect overall runoff? How does this affect the uncertainties? This is where the principal change of in situ WH would manifest itself in the model,

- The crop development growth function /water productivity: This function is not verified substantially for local conditions, although local crop parameters are used. Nor is any sensitivity analysis done on these crop parameters. In view of the importance for WP assessments and also in the following uncertainty analysis, some improved check of the validity of this function should be done. This could potentially alos improve the very large uncertainty associated with yields (Fig 2). (This uncertainty is almost unacceptable from a reality perspective as it suggests upto 100% variation in yield. . . This alone should motivate the authors to check the crop growth function in more detail)

- The HRU: The authors should indicate how many HRUs the basin consist of, and how many HRUs each sub basin consists of in Materials and Methods. Ideally, the HRUs containing smallholder farming systems (the scope of the paper) should be shown. Overall the area of these systems is fairly small in the basin.

ii) General about the manuscript: The manuscript tackles on one part water productivity in smallholder farming systems in the basin, and one part on the uncertainty and,

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implicitly, viability, of in-situ WH in the smallholder farming systems.

Although both topics are relevant, the water productivity does not add any new scientific insights. In the manuscript the WP is generated as a function of modeled yield (ie by a crop growth function limited by temp, available water an available nutrients) and output actual evapotranpiration (assigned symbol ET). The ET is thus a function of the modeled crop growth (ie LAI). If the crop growth function is not well representing the local crop growth (which is not checked/validated by the authors) there is a systematic error in both parameters. The crop growth function should be discussed and analysed/verified for local conditions further. The manuscript does not adequately link the analysis of WP with the following in-situ WH analysis: An obvious question is of course how much could WP be improved by the proposed in-situ WH. In addition, as the smallholder farming systems constitute a fairly small proportion of the basin, perhaps larger WP gains can be made elsewhere?

Terminology: use "rainfed"; use "dry spell"

Additional specific comments are in manuscript attached.

Please also note the Supplement to this comment.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4919, 2009.

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