

## ***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.***

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### **General comments**

**Comments:** “The manuscript tries to make an interesting bridge between the quality of hydrological simulation (i.e. calculating discharges) and crop simulation (i.e. estimating yields). Also the in situ water harvesting is of interest to an international audience. One problem with this manuscript is that the double objective of contributing to a better

C2404

insight in water harvesting and the objective of the combined simulation (crop yield and river discharges) leads to often to a lack of focus in different sections of the manuscript. Restructuring of the text is needed, so that paragraphs and sections focus more clearly towards one objective at a time within the same paragraph(s). Also the authors have to reflect on what is appropriate in the introduction, materials and methods, results and discussion with conclusions. Now a lot of sections are mixed in nature. The discussion is relatively short partly because of the presence of too much discussion in the results section. Because of both shortcomings I advised major revisions; but I am optimistic that the authors can restructure their manuscript.”

**Response:** We thank referee #2 for helpful comments on how to improve our manuscript. We have made substantial revisions to the manuscript along the lines suggested by referee #2. The focus of a number of sections has been further clarified (the Section 2.4 heading, the new heading hierarchy of Section 3 and the refined focus in Section 4). We have revised the Results and the Discussion sections and moved all major discussion points and comparison with the literature from Section 3 to Section 4.

### **Specific comments**

**Comment 1:**” page 4920 line 10 SUFI-2 algorithm; please do not use too many abbreviations in an abstract. So write SUFI-2 in full as Sequential Uncertainty Fitting algorithm, so that the abstract can be read without reading the article. Sequential Uncertainty Fitting algorithm (SUFI-2) is explained in section 2.3.”

**Response:** We revised the abstract accordingly

**Comment 2:**” page 4921 line 10: "aerial" expansion. In the air ? Probably not; funny typo in a text which reads well.”

**Response:** Typo indeed. We changed it.

**Comment 3:** “PPU not clearly defined; neither in the abstract nor on page 4928 line 7.”

C2405

**Response:** We clarified the definition in the text. We do not include the full definition in the abstract because it would become too lengthy.

**Comment 4:** "Page 4928 line 10: copy/paste: "A dual-objective calibration against ten nested discharge stations on daily temporal resolution, as well as against annual basin-wide maize yield in the smallholder and the commercial production systems was carried out for 1 January 2002 to 31 December 2006". This section should be restructured in a more systematic way. One could firstly elaborate the two objectives separately and explain them more explicitly. After the separate definitions the combined objective function can be introduced. After this the calibration strategy and sensitivity analysis can be given. The current section 2.3. requires puzzling bits and pieces together in order to understand the section. Good understanding of this section is also quite critical for the entire manuscript."

**Response:** We have made substantial revision of the structure and formulation of Section 2.3 to improve the logical flow of the text. We begin by defining the focus of the calibration and explain the database for each calibrated variable explicitly. We go on to explain the calibration and uncertainty method (SUFI-2). This section is put before the objective function section because the latter depend on a clear understanding of "iteration" and "simulation". Then follows the parameter selection through the sensitivity analysis. Subsequently, details on the simulation-level analyses are given: a) the objective function for each discharge station, b) the objective function for all discharge stations combined, and c) the objective function for crop yield. Then follows an explanation on how the three output variables were simultaneously calibrated. Finally, the iteration-level analysis of the uncertainty band (95PPU) and its performance is given (building on the previous simulation-level analyses and setting the scope for Section 2.4).

**Comment 5:** "Page 4929 page 20: "However, the crop parameter calibration was carried out conjunctively with the hydrological calibration on a qualitative basis in order to capture inter-linkages affecting all output variables." Not clear what exactly is meant

C2406

here."

**Response:** We clarified it in the revised Section 2.3.

**Comment 6:** "Page 4929 line 3 "R2 is the coefficient of determination" As there is some confusion in hydrology about the definition due to DR Legates & GJ McCabe, 1999, in their Water Resources Research-article, it is necessary to define R2 either as correlation coefficient or as real coefficient of determination (or also called Nash-Sutcliffe efficiency)."

**Response:** We clarified the definition

**Comment 7:** "Page 4930 line 13-15: "For completion, the commercial systems were incorporated in the simulation and calibration process. However, all further analysis centred on the smallholder system in accordance with the objectives." Not clear what is meant here."

**Response:** We rephrased it.

**Comment 8:** "Page 4932 line 7. Figure 2 is not clear. A continuous line is used while the year results are better represented in a discontinuous way. The box-and-whisker plots on the figure are very small and virtually invisible."

**Response:** We redrew the figure in a discontinuous way as suggested. We also removed the box-and-whisker plots and put the main information in the text.

**Comment 9:** "Page 4932 line 14: Figure 3 is too small and very unclear. Fewer but larger graphs would be better; e.g. one for a good and one for a poor simulation."

**Response:** We redrew the figure and included fewer but larger graphs (for three stations).

**Comment 10:** "Section 3 (pag 4931-4936) should be confined to results and contains a lot of comparison to literature and discussion. In contrast section 4 ( pag 4936-4939) contains too little discussion and too little comparison to other research. An example

C2407

of Rain Water Harvesing in East Africa is the work by dr Nuhu Hatibu.”

**Response:** We have revised Section 3 and Section 4. We moved all major discussion points and comparison with the literature from Section 3 to Section 4. We added several additional comparisons to various articles from the literature in Section 4, including Hatibu et al. (2000).

**Comment 11:** “Pag 4969 Table 1 tries to put too much and too small text in the table and contains a rather limited amount of examples.”

**Response:** We have made the formulations more brief. The submitted table size was full-page. The reduction in HESSD to half-page reduced the font size. We have also added two more examples of WH suitability studies: Mbilinyi et al. (2007) studying the Makanya catchment in Tanzania and Mati et al. (2006) studying the entire African continent.

**Comment 12:** “Page 4949: most figures are too small.”

**Response:** We modified the size.

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