

# ***Interactive comment on “Grey water footprint reduction in irrigated crop production: effect of nitrogen application rate, nitrogen form, tillage practice and irrigation strategy” by Abebe D. Chukalla et al.***

## **Anonymous Referee #1**

Received and published: 26 May 2017

The authors make an assessment of the grey and total water footprints of irrigated maize grown in Badajoz, Spain. They use the APEX model to study the effects of 56 management packages to determine the options giving the highest yields and the lowest grey and total water footprints.

I think the subject is interesting for its application to agricultural managements, (after still may improvements) possibly ending in recommendations to agricultural stakeholders in order to decrease water consumption, improve water quality and increase crop yield. The authors have made a full exploration of results based on the results given by

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the APEX model.

However, as it is now, the manuscript has more drawbacks than qualities. The problems are the following:

1. Presentation: The language at the beginning is of considerably low quality. Although it improves along the manuscript, the sloppy writing of the introduction, methods and beginning of results puts off the reader. I would recommend improving sentence structure, grammar, term usage, etc, with a professional service. I mention at the end some examples.

2. Site description, Methods. Incredibly the only information of the study site is packed in three words, Spain, maize and Badajoz. Where is this? What are the hydroclimatic characteristics (precipitation, temperature, PET, relative humidity, soil moisture content, water stress), any map? size of the plot, water source, time period of study, elevation, etc. This contrasts with the huge explanation on the parametrization of the APEX model.

3. I know that water foot printing models/ET estimate models on land cover climatic information are not generally calibrated or validated hydrologically. Such appears to be the case of APEX. Although this drawback is well known, the authors do not justify why they are omitting any effort to do so . At least some effort should be done in the manuscript to perform a hydrologic (and/or nutrient load) calibration/validation of APEX in this region, or at least mention and justify why this is impossible to do. Worst case, a good sensitivity analysis of the main parameters regulating the water and N fluxes and/or exhaustive literature review of similar studies shedding some light on the initial parametrization of the model should be included.

4. Does the APEX give an opportunity to choose the PET model? Is Penman-Monteith adequate for this region? Recent studies have found that this model over predicts PET [Milly and Dunne, 2016]. What parameters did you put into Penman Monteith if you didn't have any data?

Milly, P. C. D., and K. A. Dunne (2016), Potential evapotranspiration and continental drying, Nat. Clim. Change, 6(10), 946–949, doi:10.1038/nclimate3046.

4. Based on points 2, 3 and 4, how can you tell which of Tier 1 and Tier 3-APEX is better if you really don't know how accurate are both options due to the lack of observations and real data or calibration or validation? As you state in 489, "the precise values presented here should be taken with caution" and "the outcomes are subject to uncertainties inherent to any modelling effort". This makes me wonder on the real point of reading the manuscript.

Other issues: L. 36-37. First sentence is the worst of all the manuscript. Check language. L. 42 - three quarters of what? L. 66- tillage pan formation? L. 66- no-tillage develops mulch cover? L. 49- Application rate , form of N applied are not practices. L. 50-52 This does not make sense L. 75-79 and and and or or or L. 96 what is a systematic model-based assessment? L. 103 is this really more advanced? in what way? L. 103-104 mention the ties in this sentence first. L. 109 approach applying an approach L. 99-101 Bad English L. 114. I don't think you can determine the added value as it is now. L. 127 "are" partitioned L. 130 Quick and slow component? L. 126-136 It sounds to me as you are just putting in words the ticks/options and numbers that you are entering in the fields of the model. L. 138-145 This is not necessary. Figure 1 has some strange arrows going nowhere. What is a unit of heat accumulation? L. 201 or to surface water through runoff? L. 192-195 Isn't this the main objective of the article? L. 204 Is  $\alpha <$  or  $>$  than  $\beta$ ? L. 212 Eqs. 2 and 3? L. 219 what? L. 229 full irrigation? L. 236 derogation? and check units L. 287 why is it important to be zero? L. 338-352 Isn't this a discussion? Fig. 4 The definition of the three region seems a little bit arbitrary? Why do you put some much emphasis in Region 1 if it is almost the same for all packages? Considering the uncertainty of the analysis I would assume the are really no differences. Figure 6. Nothing makes sense in this figure. Check axis and data on grey and consumptive WF. Or is the difference in magnitude due to green water consumption? Is GW consumption so big in Spain? I don't think so. Everything

here needs explanation. ....

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2017-224, 2017.

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