

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## **Comment on hess-2021-631**

Anonymous Referee #2

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Referee comment on "Net irrigation requirement under different climate scenarios using AquaCrop over Europe" by Louise Busschaert et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-631-RC2>, 2022

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### **Review of "Net irrigation requirement under different climate scenarios using AquaCrop over Europe", by Busschaert et al. (2022)**

The paper "Net irrigation requirement under different climate scenarios using AquaCrop over Europe", by Busschaert et al. (2022), presents scenarios of irrigation water requirements in Europe, given different emission scenarios and climate models. The paper is well written and fairly easy to follow.

However, although I can follow the line of arguments in the paper, I have some questions and concerns about the paper. I am puzzled by some of the content, methods and conclusions. These issues are explained below.

#### *Novelty*

Several studies on irrigation water requirements today and in the future have been published since the first study by Döll et al 20 years ago. The study by Busschaert et al. (2022) would have been a welcomed addition to the literature 20 years ago, but in 2022 I am struggling to see where Busschaert et al. (2022) provides new insights in the scientific area. Several single model studies and multiple model studies have been presented, not the least coming out of ISIMIP, so what does this paper include that isn't well covered in the existing literature? My recommendation is that a more convincing presentations of why this study is needed must be included, if this paper is to be published in HESS.

### *Model setup*

The authors have chosen to perform the study at a fairly coarse spatial resolution, and with only one crop type all over Europe. I agree with what reviewer #1 has said on the choice of crop type, and the fact that you analyze summer months only. These seems like questionable and outdated decisions.

### *Evaluation – comparison to satellite observations*

The evaluation (comparison to satellite observations) are performed at different timescales for SIM1 and SIM2, as you mention. However, if you are going to compare the comparisons, I think you must try to make them a little more comparable, e.g. by including similar comparisons for SIM1 as you have for SIM2. Also, and what really puzzles me, is that as far as I understand, for SIM1, no irrigation is included in the simulations, whereas in SIM2 it is. These simulation results are both compared to satellite estimates, and both are deemed "reasonable". Consequently, I will argue that irrigation doesn't really impact your evaluations much, is that true? What does this say about your irrigation water use and your evaluations? How does the coarse scale and your irrigated areas impact the evaluation results? In any case, I think you must do both comparisons with the same model setup. Also, for the evaluation of results using GCM input you state that you use climatology for 6-10 years, depending on the data product. I would argue that for GCMs, nether 6 nor 10 years is not enough to call it "climatology", and your results can be very much impacted of what happens in that 10-year period, and I do not think you should rule "reasonable" on the background of 6-10 years. Any thoughts?

SIM1 and SIM2 are evaluated in very different ways, and I find it problematic that you still put the evaluations in the same figure and to some extent compare them in the text. Are you comparing apples and potatoes, and how can you make the evaluations and analyses more consistent?

### **Minor issues**

*Clarifications needed:* I think you only model agricultural areas, and specifically agricultural areas that are irrigated, is that right? I can't, however, see that you refer to any dataset used to define these areas? Also, if I understand this right, you simulate the entire cells at 0.5x0.5 degrees with the C3 crop type. Do you account for this when comparing to satellite observations, or are the soil moisture estimates performed point by point without regarding how much is actually irrigated (see also above)? If you do not account for partially irrigated cells, don't you think that you overestimate soil moisture in many cells?

*Evaluation:* Do you compare nearest neighbour of the satellites and simulation cells, or how is it done?

*Irrigation method:* You inject water into the root system. Do you know how large part of the European irrigation is this efficient? Possibly add some thought on choice of irrigation method and how it may influence your results?

*Discussion:*

- I miss some thoughts on your irrigation water use estimates compared to already published estimates. You write that comparisons are difficult, which I agree on, but I still think it should be included.
- In the results part, you say you find decreases in  $I_{net}$  in locations along the Mediterranean coast. To me this is surprising, and I think it deserves a sentence or two in the discussion. What are the underlying factors causing this?
- What can these results be used for? You touch the topic slightly in the discussion, but it would be favourable if you could link your results to adaptation issues somewhat closer.