

Thank you for submitting your revised manuscript "Advancing Crop Modeling and Data Assimilation Using AquaCrop v7.2 in NASA's Land Information System Framework v7.5" and for your thorough responses to the reviewers' comments. Both reviewers recommend minor revision, with which I concur. The paper makes a valuable open-source crop model contribution and the three showcases are well-structured and scientifically transparent about limitations.

We thank the editor for the constructive suggestions. We followed all the recommendations. The comments are shown below in black fonts and we provide answers in blue fonts, *with updated text in italic (additions are underlined)*. The line numbers in our response refer to our updated manuscript without track changes.

Before acceptance, please address the following points:

1. Abstract and conclusions: The yield validation in Showcase 3 is very modest (R for Det, OL and DA ranges only from 0.09 to 0.13, accompanied by worsening RMSD and bias following DA). Please ensure this limitation on model yield performance is communicated more explicitly in the abstract and conclusions, so that readers are not left with an overly optimistic impression of the AquaCrop v7.2's current capability for yield estimation.

Sure, we edited as follows.

L.13 (abstract): The spatiotemporal variability of simulated yield is poor due to strong model (parameter) constraints, and the assimilated satellite-based canopy cover observations are not sufficiently informative of yield. Furthermore, the exact fields of the reference yield data are unknown and thus hard to compare to simulations.

L.577-580 (conclusions): The model on its own already performs well in terms of mean absolute yield values (root mean square difference RMSD < 1.5 t.ha<sup>-1</sup>), but performs poorly in spatiotemporal variability (correlation R=0.07 for ensemble open loop). Data assimilation cannot yet much improve the yield estimates (R=0.12, RMSD=1.67 t.ha<sup>-1</sup>) because of strong model constraints related to the timing of the crop stages, the maximum canopy cover, fertility and harvest index as parameters. The assimilated satellite-based canopy cover observations are likely also not sufficiently informative of yield...

2. Response to Reviewer 1, Comment 5: The justification for using only three years in the ensemble analysis of Showcase 2 ("this is a showcase; ensemble simulations are computationally intensive") is insufficient. Nowadays, computational cost can barely be a true obstacle and sufficient justification. Please add a brief but substantive discussion in the manuscript — for instance, noting whether the selected years capture meaningful climate variability, or acknowledging this as a limitation — rather than simply asserting it is adequate.

We agree that computational cost alone is not a sufficient justification. In the revised manuscript, we clarify that the selected period captures sufficient interannual and spatial climate variability across Europe, including both relatively wet and dry conditions in different regions, and that a longer period is not needed for the purpose of this showcase.

L.313-L.327: Simulations for 3 years, from 2015 through 2017, are used to compute the multi-year average ensemble standard deviation (also called 'spread' below) in root-zone soil moisture and B for all croplands in Europe. This period covers contrasting hydroclimatic conditions across Europe, with considerable interannual and spatial variability in

*precipitation and soil moisture regimes, resulting in both water-limited and energy-limited conditions depending on the region. This variability is sufficient for the purpose of this showcase, namely to demonstrate the feasibility of large-scale ensemble simulations with AquaCrop, and to quantify spatial patterns in ensemble spread of root-zone soil moisture and B. The spread in CC is not further discussed, ...*

3. Response to Reviewer 1, Comment 9: The reviewer's request to show an observed vs. deterministic scatter plot for yield (Figure 10) was declined without strong scientific justification. Please either include this plot (e.g. in Fig. 10 or supplement) to provide a complete baseline comparison. The yield comparison is a key limitation of the current model. So I recommend following the reviewer's comment to more clearly show the model's limitation on yield estimation across three run cases.

We have now added the figure with deterministic output, and edited the text and caption accordingly:

L.500-503: *Figure 10a shows that the simulated variation in the deterministic yield (spatially aggregated over the municipality) across all years and municipalities is low and does not agree with the reference data ( $R=0.09$ ). The OL in Figure 10b has a higher negative bias (-0.43 t.ha<sup>-1</sup>). DA introduces variability in Figure 10c, leading to a slight improvement in spatiotemporal yield pattern ( $R=0.12$ ).*

*Figure 10: Spatiotemporal performance of the deterministic, OL, and DA simulations for end-of-season yield against in situ data, ...*

4. Figure captions — abbreviations: Please ensure that all abbreviations introduced in figures are defined in their captions as well as in text. In particular, as noted by Reviewer 2, the parameters Zn (minimum rooting depth) and Zx (maximum rooting depth) should be defined in the caption of Figure 3. Please check all other figures for similar omissions.

Per the editor's request we added Zn and Zx in the caption of Figure 3, along with the parameters for the CC evolution. There are no unexplained abbreviations left in any of the figures: everything is introduced in the text and captions.

5. Minor: Reviewer 2 pointed out several specific typos and technical errors such as in Figure 3 and Appendix C. Please double check the correctness of all main and appendix figures, tables and captions, and cross-reference in text.

We double checked and confirm that these issues were all addressed in our previous responses.