

Interactive comment on “Assessing uncertainties in global cropland futures using a conditional probabilistic modelling framework” by K. Engström et al.

Anonymous Referee #2

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Dear authors,

The manuscript provides an interesting insight into the source and magnitude of uncertainty surrounding global crop-land areas under different SSP scenarios. You provide a detailed methodology to quantify uncertainty ranges for various socio-economic parameters. However, I feel the complex methodology is not easy to follow from the way the manuscript is currently structured. My additional comments:

1. Does the LPJ-GUESS model used to derive actual and potential yields contain a representation of crop response to heat stress? Under climate scenarios modelled (particularly RCP8.5) temperature changes in several countries will result in certain crops becoming unviable.

C1

2. Do actual yields from LPJ-GUESS consider the influence of pests and diseases, and how the influence of this may change over time under different climate scenarios?

3. Following from comments 1 and 2, is the LPJ-GUESS model overestimating actual crop yields (and perhaps potential)? Given that you state agricultural land use is highly sensitive to uncertainties in crop yield growth rates how does this impact your results?

4. You state scaling factors have been applied to both LPJ-GUESS yields (P3 L24) and yield calculated by PLUM (P3 L30) but it is unlikely that these factors should be constant through time.

5. The probabilistic futures F1-F5 are not clearly linked to specific SSPs. I also think the manuscript would benefit from a description of each SSP (even if only very brief) within the manuscript in addition to those in the appendix.

6. Whilst the study has considered uncertainty of socio-economic variables in great detail, it's unclear how indirect climate uncertainties have been incorporated within the study, for instance, uncertainty within the yield modelling. The study concludes that uncertainties arising from climate variability do not strongly affect the range of global cropland futures but perhaps uncertainty in climate influences are under-represented in the methodology? For the two sets of monte-carlo simulations 3600 runs have been conducted for purely socio-economic parameter investigation (or 720 per SSP) and in conjunction with the 4 RCPs this number increases to 7200 (or 1440 per SSP). So the sampling across an individual SSP-RCP matrix is sparser in comparison.

7. P13 L3: This sentence is confusing. From the previous description of the methodology it seems simulations under RCP8.5 were conducted based on the probability of this scenario within SSPs. Yet this sentence indicates the potential impact of RCP8.5 is under-represented (links to previous comment).

8. The discussion should explore further why F2, 4 and 5 strongly converge, and why F1 and F3 diverge, linking this to SSP storylines.

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9. Fig 4: It is difficult to distinguish between scenarios in this image, even in colour.

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