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Discussions

Interactive comment on "Effects of environmental and management factors on worldwide maize and soybean yields over the 20$^{\mathrm{th}}$ and 21$^{\mathrm{st}}$ centuries" *by* Tzu-Shun Lin et al.

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Reviewers' comments are in **bold**, the authors' responses are in normal font, and the suggested changes for the text in *italics*.

Although the impact of climate change on future crop yields has been subject to a large number of previous studies (e.g. Lobell et al. 2008 Science), the presented manuscript is innovative in terms that it considers the different influences of not only climate but also management practices. It is not an

incredible discover but deserves publication given the well-organized and concise presentation.

The authors would like to thank the Anonymous Reviewer 2 for his/her valuable comments and suggestions to strengthen the analysis presented in our manuscript. We also thank the reviewer for the encouraging comments about our study.

I have only a few minor comments: Abstract: it should be finished with the implications of these results to climate change adaptation in the agricultural sector.

Thank you for your suggestion. Here we propose to add the following statement in the abstract.

Moreover, climate change adaptations through N management and irrigation will benefit crop yield, particularly for the maize, under the higher emission scenario.

L118: Please provide the reference for the irrigated land extension in addition to the reference to Text S2.

We propose to add references in the following line:

The irrigated fraction area for each grid cell is assigned based on three datasets (Hurtt et al. 2020; Monfreda et al. 2008; Portmann et al. 2010) (Text S2).

L220: Isn't the fact that maize is a C4 grass and soybean is a C3 plant a more

precise explanation for this?

We thank the reviewer for this point and revise the text as follows:

The yields for both crops increase across all regions due to the CO2 fertilization effect, but the increase is stronger for soybean than for maize, because soybean is a C3 crop and maize C4 crop. Therefore, photosynthesis for soybean is relatively less saturated under ambient [CO2] (McGrath and Lobell, 2013).

L225: I wonder if the yield increase due to CO2 fertilization wouldn't change nutritional contents (e.g. C:N ratios) of harvested parts of soybean.(?)

It is suggested that there is not much change in the C:N ratios of the harvested part of the soybean due to CO2 fertilization under growth chamber conditions (Zheng et al. 2020).

To address your points, we will add the following statement:

It has been found that the C:N ratios of the harvested part of the soybean do not change much due to CO2 fertilization under growth chamber conditions (Zheng et al. 2020).

L246: The sentence ends abruptly, please revise.

We revise the sentence as follows:

higher temperatures enhance the CO2 fertilization effect on net photosynthesis rate, because with rising temperature, both the specificity of Rubisco for CO2 and solubility

of CO2 in water decline relative to O2 (Bernacchi et al. 2006; Ruiz-Vera et al. 2013).

L256: Statements like "not shown here" are increasingly less recommended by scientific journals like Biogeosciences. I suggest this spatial comparison is shown in the supplementary material.

Thank you for your suggestion. We will add the following figure to the Appendix section.

Figure SX is attached as a Supplement Document

Figure SX. The spatial pattern of ISAM (a-b) and AgMIP maize and soybean yield changes (percent) under the RCP8.5 scenario in 2076-2085 (or ca. 2080) relative to 1996-2005. AgMIP estimated are the median (c-d) values for the 30 ensemble runs (six crop models results based on five climate model forcing data) (Deryng et al., 2016). The crop areas are masked based on the MIRCA2000 data set.

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