

Interactive comment on “Potential impact of climate and socioeconomic changes on future agricultural land use in West Africa” by K. F. Ahmed et al.

Anonymous Referee #2

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The manuscript “Potential impact of climate and socioeconomic changes on future agricultural land use in West Africa” addresses role of climate change and socioeconomic changes for possible future changes in land use in Western Africa. This assessment is conducted using a particular algorithm that considers both societal and physical drivers in the attempt to meet all demand for food with an adequate local/regional supply. Results are presented for the middle of the 21st century using climate scenarios from two different sources. These are compared to the current situation.

While I think that this is an interesting aspect that definitely deserves some attention (particularly given the expected societal pressures on agricultural production in that region in the coming decades), I am not sure that the proposed algorithm provides the

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methodological basis to successfully tackle this question. There are several issues with the model that I would like to address in the following:

First, there is the question of scale. The authors use land use data at the scale of 0.5 degrees resolution, which is quite substantial if you consider that the size of individual farms employed in the production of food crops is considerably smaller. When the results of the simulations in this paper indicate a land use change in a particular pixel, does this mean that a large number of farmers simultaneously alter their production patterns? Is this realistic?

A second aspect is that the assessment merely compares two different points in time (middle of the 21st century and today). Both societal development and changing environmental conditions are dynamic processes and therefore the state that is reached in the middle of the 21st century depends on the development trajectories between the two points in time that are considered. A gradual environmental change has a distinctly different impact on the adaptive capacity of agricultural production than a development with few but drastic changes. This is a critical point that definitely should be addressed in the model setup as it has a profound influence on the simulation results.

When looking at the comparison between the different climate change scenarios that are analyzed, I find hardly any difference between MIROC and CESM. What does this actually imply? Does this mean that the algorithm is particularly stable with regard to changing climate conditions? Or are both climate scenarios practically the same to start with so that such similarity in the results can be expected? If the latter is the case, why do you analyze both? Here it would be really helpful to obtain more details on these assessment results.

Furthermore, the assessment does not consider an aspect of current economics that is fundamental to all areas of the world: trade. We cannot consider a single area without its connection to surrounding regions and the rest of the world. How do food imports into the region ease the pressure on land from the demand side? In my view this

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has a substantial impact on the development of land use as obviously there will be a fundamentally smaller demand on additional agricultural land if local production can be substituted or augmented by imports.

Finally, there are many instances in the manuscript, in which the language is a bit awkward or definite and indefinite articles are placed incorrectly. I suggest a language check after the completion of the revision of the manuscript. All in all, I propose major revisions to address the methodological issues and to further highlight the key results of the assessment.

Special comments:

p. 1133, lines 10-15: The first part of this paragraph is hard to understand. Please rephrase to make it clearer what you intend to say.

p. 1134, lines 5-10: Are these the research questions that you all want to address in this paper? While some aspects are touched upon, e.g. the aspect of human decision-making is not picked up again in detail (only mentioned briefly on p. 1146). So why is this mentioned here then?

p. 1134, line 16: Why is this particular comparison chosen?

p. 1134, line 25: Where does this gap come from?

p. 1135, eq. 1: Some variables are attributed to the future, some to the present. Why is this? Here a justification for your choice appears necessary.

p. 1136, lines 1-5: Here a more detailed description of "best" and "worst" would be helpful.

p. 1137, lines 8-10: This is a very strong assumption that should be justified.

p. 1140, lines 1-10: Here, some reference to the dynamics between the future and the current state would be helpful.

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p. 1140, lines 10-18: Two significant digits are too many in the given description of model results as this suggests a precision of the results that is definitely not there. Instead, it appears useful to include uncertainties of the results as well.

Several adjustments would have to be made to the results section to account for possible updates in the methodology.

p. 1145, lines 20 ff.: The farmer's adaptive potential is a very important point that should be stressed. Considering that the success of agricultural production is highly dependent on the farmers' actions, I think that this actually is the critical point in the attempt to address the increasing pressures on agricultural systems worldwide.

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