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Earth System Dynamics
Discussions

Interactive comment on "Future supply and demand of net primary production in the Sahel" *by* Florian Sallaba et al.

Florian Sallaba et al.

jonathan.seaquist@nateko.lu.se

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We thank RC2 for their statements regarding our manuscript. What follows is a point-by-point response to these comments.

RC2: This manuscript does NOT satisfies your editorial criteria as described at http://www.earth-system-dynamics.net/peer_review/review_criteria.html This manuscript perhaps intends to make contributions to regional studies of the socioeconomic implications of global change, particularly about the Sahel and its delicate balance between supply and demand of natural resources, with a focus on its implications for food production; however some of its methods are flawed and the use of information weak. This paper deals with very delicate topics that deserve honour and

credit, but using the wrong tools to address them, for which the authors deserve no mercy. Therefore I recommend the rejection of this manuscript.

Authors' Response: Thanks very much for your general opinion. Please read through our responses below and our responses to the first and third reviewers which we hope will allay some of your concerns.

RC2: LPJ and the like models are normally very rough on their predictions, if you simplify them more, then your results might be useless.

Authors' Response: We concur that 'LPJ and the like models' can be 'very rough on their predictions,' which is the reason for taking an exploratory approach (rather than a predictive one) in this study. We emphasize a structural analysis of NPP supply-demand outcomes across a range of scenarios, using simplified models that can easily be coupled across sectors. One of the purposes of the manuscript is to demonstrate such a framework. We re-iterate our rationale, taken from p. 2 lines 3-12 of our original manuscript:

"Developing such tools requires coupling of specific models that address different sectors, such as a model for supply and a model for demand that can be run across multiple future climate, socio-economic and CO2 concentration scenarios. However, the supply-demand system in the Sahel is complex and the future cannot be precisely evaluated. This is because there are many uncertainties associated with the assumptions that underpin the natural and socioeconomic drivers that lead to particular supply-demand balances. As such, an exploratory modelling approach is required, where an emphasis is placed on a structured analysis across a range of outcomes. This approach capitalizes on future indeterminacy for developing adaptive policy insights (e.g. Kwakkel and Pruyt (2013)). As the goal of exploratory frameworks is not prediction, they often employ parsimonious or simplified versions of more complex models (often referred to as meta-models in the latter case) that run across a range of scenarios (e.g. Harrison et al. (2016)). Another benefit of using such simplified models lies in the ease

to which they can be coupled to other sectoral models (e.g. Kebede et al. (2015)).”

RC2: Pg. 4 line 25, you evaluate the performance of your model against another model (LPJ)? Why this is good science deserving publication? This is bad science. Have you thought about doing it against data?

Authors' Response: The rationale for evaluating the performance of BME against LPJ-GUESS is to verify that BME (a meta-model based on LPJ-GUESS) captures the magnitude, interannual variation and trends in LPJ-GUESS across the historical climate record. In accordance with specific requests by Thomas Pugh (R#1) and AR#3, we have also compared our LPJ-GUESS and BME NPP with MOD-17 (absolute values, interannual variability, and trends) for the years 2000-2006, as well as against trends in crop yields found in the literature. We have also performed a validation of LPJ-GUESS and BME for all biomes used to develop BME. Please see our responses to R#1 and AR#3 for details.

RC2: You do a regional level study using GCM data? Not good practice. See what other Swedish colleagues do with regional data there: http://www.smhi.se/en/research/research-departments/climate-research-rossbycentre2-552/an-ensemble-of-cordex-africa-climate-projections-simulated-by-rca4- 1.25312

Authors' Response: PLUM is a global scale model (see Engström et al. 2016a, 2016b) that links all countries via international trade to help regulate the balance of feed and food. The implication is that the supply and demand generated in any one country or world region (e.g. the greater Sahel) is a function of supply-demand dynamics across the globe. GCM output is therefore consistent with the level of organization at which PLUM operates (global) and requires global level climate projections. Spatial resolution may certainly be a factor but as the Sahel does not exhibit large topographical variation we hypothesize that the effect of downscaling will not be large. Indeed, Blanke et al. (2016) also conclude that there is no large gain in LPJ-GUESS simulations of C and N

stocks when using regionally downscaled, bias corrected climate products compared to GCM simulations, at least for Europe.

RC2: What you intend to argue, deriving insights from NPP into food production related arguments, is very weak in methodological terms, and although your rationale and arguments are sensible, the methods you use disqualify the support you use for the argumentation. Then you use a convenient “technology improvement factor”? and close the yield gap with it? I am sorry, again, this is bad science, and it should not be published.

Authors' Response: Please see our responses to your previous comments, as well as our responses to the other two reviewers that deal with various methodological issues. The 'technology improvement factor' is the aggregate result of parameterizing three technology related parameters (trends in technology, change in yield with GDP per capita, as well as how agricultural management practices are transferred both within and between countries) that are consistent with the scenario storyline of each SSP. Parameter ranges have been empirically determined based on analysis of data between the years 1995 and 2005. Yield gaps are not necessarily closed, but are decreased. Please see Engström et al. (2016b) for details, particularly Appendix A2.

References in our responses

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