Geoscientific
Model Development
Discussions

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Interactive
comment

Interactive comment on "The GGCMI Phase II experiment: global gridded crop model simulations under uniform changes in CO_2, temperature, water, and nitrogen levels (protocol version 1.0)" *by* James Franke et al.

Anonymous Referee #1

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The manuscript by Franke et al., details the experimental design for the Phase II GGCMI crop model comparison. The goal is to provide a set of simulations to synchronize a variety of crop models and compare the responses from perturbations of temperature, precipitation, CO2, and nitrogen fertilizer. The result is a dataset of thousands of simulations that can be used to emulate statistical crop model response under varying inputs of climate change. The authors provide some analysis of the dataset, providing examples of non-linear behavior under multiple variable perturbations between temperature, precipitation, and CO2. Furthermore, the authors provide access

to other users for additional analysis. The manuscript is well written, the message is clearly defined, with a logical flow throughout, and void of technical errors. The authors did a good job detailing some of the more complex features of their study.

My main concern with this manuscript is I find the approach toward the perturbation experiments somewhat unrealistic. I understand the difficulty in generating simulations across different models in a way that is uniform, and I find the large number of simulations included in the dataset impressive but having such a large set of parameters for the simulations makes interpreting the output difficult and negates the heterogeneous (in space and time) behavior of climate. Wouldn't it be easier to use CMIP output to drive simulations which could reduce the number of model runs? Perhaps the authors could provide more discussion on this choice. Also, since these are offline runs, they don't include feedbacks between the atmosphere and land (e.g. irrigation feedbacks to temperature), which are important.

I did not find the A1 simulations discussed anywhere. They seem to be included in the methods section but are not included in the analysis. Perhaps they should be omitted. Similarly, the nitrogen simulations are also missing from the analysis (except for the correlation with observations).

General Comments:

P. 7, Section 2.3: The 12 models included in the study are very different types of models. I know this was discussed in the original paper describing protocol I, but it should also be noted here. How did the model differences inform the experimental design (or limit the scope of the study)?

P. 9, L. 10: If some models don't output the anthesis date, why is it considered mandatory?

P. 15, L. 6: Is the negative impact on yield from increasing temperature due to shorter growing seasons or from actual heat damage to the crop?

P. 15, L 11-13: The change in yields at different latitudes is unrealistic because of the design of the experiment. Simply increasing temperature uniformly and not accounting for the seasonal differences in temperature change (i.e., stronger winter increase in temperature and weak or no summer increase) results in an unrealistic "warming" during the growing season that might not exist. This is also the probable cause of the increase in yield from the least realistic simulations (Pl. 15, L 28-29).

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