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Earth System Dynamics
Discussions

Interactive comment on "Climate change imposed limitations on potential food production" *by* Philipp de Vrese et al.

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1.10 a) Page 4 third paragraph: It is unclear whether you here talk about global sums only or about regional patterns (i.e. is increased demand met globally or in the very regions); in any case more focus and examples on specific regions are needed.

Indeed, it was bit unclear that we were talking about the general behaviour on the land surface. To clarify this, we edited this paragraph (see below). For the RCP4.5 and RCP8.5 it is valid to omit a more detailed regional analysis as it is really only very few grid boxes whose behaviour deviates from the description. For RCP2.6, however,

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there are a few areas in which the increased water demand can not be met, which we added to the manuscript.

The scenarios that exhibit a strong temperature rise also show a substantial increase in precipitation over land (Fig. 3d). For RCP4.5 (IR45) mean precipitation rates increase by up to 20 mm year^{-1} and in IR85 they increase by about 60 mm year^{-1}, which amounts to more than 8% of the terrestrial precipitation as of 2005. Increased precipitation rates do not only reduce the water stress for rainfed crops, but between 2025 and 2100 they also increase the water available for irrigation; globally by roughly 500 km^{3}year^{-1}, for IR45, and by almost 2000 km^{3}year^{-1} for IR85 (Fig. 3e). As a consequence, the increased water demand of irrigated and rainfed crops resulting from higher temperatures can be met to the extent that, after 2025, there are only very few areas in the world in which farming becomes unsustainable. This however is only the case when fully accounting for the potential benefits due to the CO_2 fertilization effect (CFE; see below). For the simulations with only a small increase in GHG concentrations (IR26) there is no permanent increase in precipitation, i.e. after a peak in the 2040s the rates decline to their initial levels, while the average temperature at the land surface increases by $\approx$ 1K. Here, the plant's increasing water requirements can not be met everywhere and in some dry regions in South and Central Asia, the Sahel zone and Australia farming becomes unsustainable after 2025 and cropland areas have to be abandoned.

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