EGU24-1910, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-1910
EGU General Assembly 2024

Attributed and projected climate change impacts on maize yield in Cameroon as mediated by heat-tolerance adaptation

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Sub-Saharan Africa is projected to be exposed to substantial climate change hazards, especially in its agricultural sector, so adaptation will be necessary to safeguard food security. However, tropical and subtropical maize production regions approach critical temperature thresholds in the growing season already in today's climate, and climate change might already be contributing to this. Projecting future, and attributing already observed, yield impacts due to anthropogenic climate change under adaptation assumptions can thus provide valuable context to future adaptation needs. No adaptation impact studies currently exist for heat-tolerance of maize in West Africa, let alone one that combines projections and counterfactual historical simulations to this effect.

Here, we report on a study in which we focus on maize in Cameroon to model the effect and potential of crop-varietal heat-tolerance adaptation. We use climate reanalysis data (mainly W5E5), historical and counterfactual bias-corrected and downscaled CMIP6-DECK and -DAMIP simulations along with ISIMIP3a data, and future projections from CMIP6/ISIMIP3b. The two climate change scenarios SSP1-2.6 and SSP3-7.0 were analysed for 2020-2100 and historical simulations for 1984-2014.

The process-based crop model APSIM was run in a spatially disaggregated, grid-based approach as to represent Cameroon's diverse agro-ecological zones. The impact of heat tolerance adaptation in maize was assessed by parametrising one unadapted baseline variety and one synthetic heat-tolerant variety in APSIM and comparing yield outcomes.

Yields are substantially higher for the heat-tolerant variety. Either variety experience similar losses in the projected future compared to now, increasing with climate change scenario and time. Impacts on maize yield are dominantly attributed to heat stress. Already observed climate change impacts compared to counterfactual climate further indicate that adaptation to present-day climate can be considered climate change adaptation beyond development.