Statistically bias-corrected and downscaled climate models underestimate the adverse effects of extreme heat on U.S. maize yields

Objective

Many studies rely on bias-corrected and downscaled climate information for coupled human-environment analysis. We quantify potential biases of this approach in the agricultural sector.

Approach

We use an ensemble of statistically bias-corrected and downscaled climate models (NEX-GDDP), as well as the corresponding parent models (CMIP5), to drive a statistical panel model of U.S. maize yields and analyze uncertainty in hindcasts and projections.

Impact

Most CMIP5 models considerably overestimate historical yield variability while the NEX-GDDP models underestimate the magnitude of the largest yield shocks, which we attribute to the effects of downscaling and bias-correction on temperature extremes. We also find large differences between the ensembles in projections.

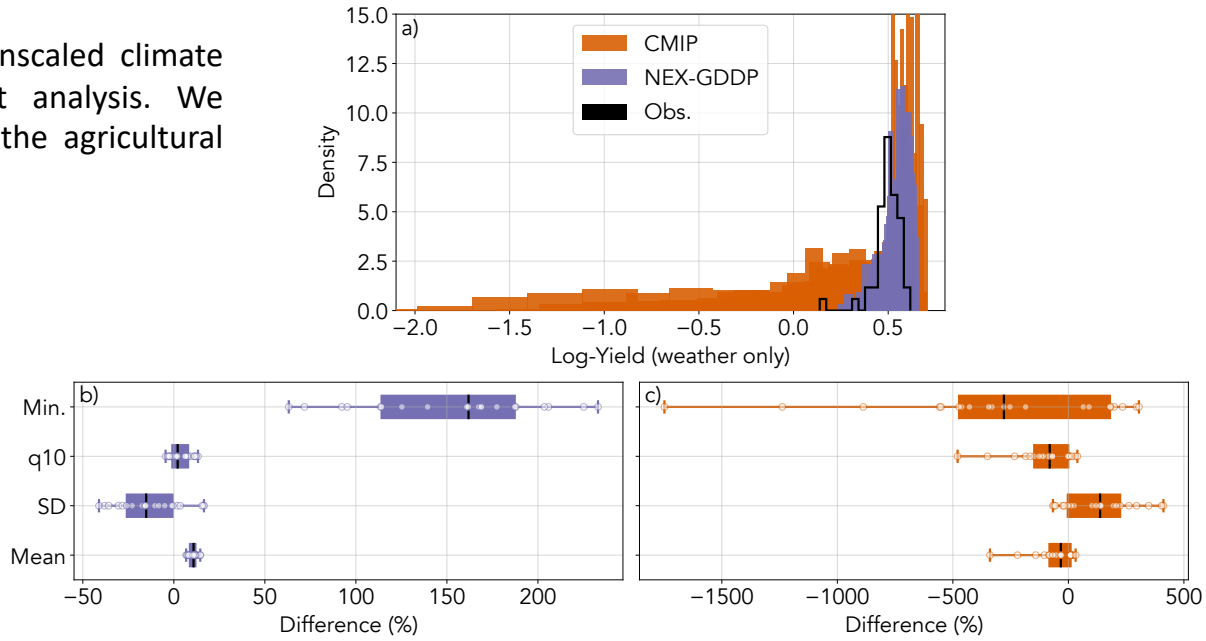

Figure: National-level evaluation of NEX-GDDP and CMIP5 maize yield hindcasts. Panel a) shows historical (1956-2005) national-level log-yield distributions from each CMIP5 model (orange), NEX-GDDP model (purple), and the observational data (black). Panel b) shows percentage differences between each individual NEX-GDDP model and the observational data, for our chosen summary statistics: the mean, standard deviation (SD), 10th percentile (q10), and minimum (Min.). Panel c) shows the equivalent to b) but for the CMIP5 models.

Lafferty, D. C., Sriver, R. L., Haqiqi, I., Hertel, T. W., Keller, K. & Nicholas, R. E., Statistically bias-corrected and downscaled climate models underestimate the adverse effects of extreme heat on U.S. maize yields, *Commun Earth Environ* **2**, 196 (2021). https://doi.org/10.1038/s43247-021-00266-9