Geophysical Research Abstracts
Vol. 19, EGU2017-4758, 2017
EGU General Assembly 2017

Characterizing bias correction uncertainty in wheat yield predictions

Andrea Monica Ortiz (1,2), Julie Jones (1), Robert Freckleton (3), and Adam Scaife (4)

(1) Department of Geography, University of Sheffield, Sheffield, United Kingdom (amdortiz1@sheffield.ac.uk), (2) Grantham Centre for Sustainable Futures, University of Sheffield, Sheffield, United Kingdom , (3) Department of Animal and Plant Sciences, University of Sheffield, Sheffield, United Kingdom, (4) Met Office, Exeter, United Kingdom

Farming systems are under increased pressure due to current and future climate change, variability and extremes. Research on the impacts of climate change on crop production typically rely on the output of complex Global and Regional Climate Models, which are used as input to crop impact models. Yield predictions from these top-down approaches can have high uncertainty for several reasons, including diverse model construction and parameterization, future emissions scenarios, and inherent or response uncertainty. These uncertainties propagate down each step of the ‘cascade of uncertainty’ that flows from climate input to impact predictions, leading to yield predictions that may be too complex for their intended use in practical adaptation options.

In addition to uncertainty from impact models, uncertainty can also stem from the intermediate steps that are used in impact studies to adjust climate model simulations to become more realistic when compared to observations, or to correct the spatial or temporal resolution of climate simulations, which are often not directly applicable as input into impact models. These important steps of bias correction or calibration also add uncertainty to final yield predictions, given the various approaches that exist to correct climate model simulations.

In order to address how much uncertainty the choice of bias correction method can add to yield predictions, we use several evaluation runs from Regional Climate Models from the Coordinated Regional Downscaling Experiment over Europe (EURO-CORDEX) at different resolutions together with different bias correction methods (linear and variance scaling, power transformation, quantile-quantile mapping) as input to a statistical crop model for wheat, a staple European food crop. The objective of our work is to compare the resulting simulation-driven hindcasted wheat yields to climate observation-driven wheat yield hindcasts from the UK and Germany in order to determine ranges of yield uncertainty that result from different climate model simulation input and bias correction methods.

We simulate wheat yields using a General Linear Model that includes the effects of seasonal maximum temperatures and precipitation, since wheat is sensitive to heat stress during important developmental stages. We use the same statistical model to predict future wheat yields using the recently available bias-corrected simulations of EURO-CORDEX-Adjust. While statistical models are often criticized for their lack of complexity, an advantage is that we are here able to consider only the effect of the choice of climate model, resolution or bias correction method on yield. Initial results using both past and future bias-corrected climate simulations with a process-based model will also be presented. Through these methods, we make recommendations in preparing climate model output for crop models.