



Changes in mean and variability of local to European scale annual crop yields

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Potential and rain fed crop yields in Europe are likely to change due to climate change. The sign of this change is highly dependent on location, climate scenario and crop, but the projected change is on average small. Most studies focus on average yields and its variability on very local scale. Yet, it may be more interesting to assess the yield variability on national or even European scale.

The use of Regional Climate Model (RCM) output as input for crop yield models can help to identify changes in spatial variability and thus changes in temporal variability of spatial aggregates. RCM output, however, is usually biased with respect to the “observed climate” and therefore not directly applicable as input in impact models.

This study explores the potential of the use of bias-corrected RCM output to investigate changes in average yields and temporal variability from local up to European scale. For this research we applied the output of a transient simulation (1950-2100) with the RCM RACMO₂ of the KNMI. This simulation is nested in a simulation with the Global Circulation Model ECHAM5 forced by the A1B emission scenario. For the crop modeling we used the crop growth model WOFOST.

The applied bias corrections are relatively simple (correction for mean and daily variability), but appear very effective. Potential yields (i.e. with sufficient water supply) show some increase in the North of Europe and some decrease in the southern part. The changes are associated with changed timing and length of the growing season and it is expected that the decreases can be largely compensated by adjustment of the crop varieties and management. Rain-fed yields tend to decrease all over Europe as a result of the drier future conditions according to RACMO. Regionally the absolute variability of the yields can considerably change but at European scale those changes are limited, especially with respect to the changes in the mean. The largest changes are usually found where the regimes change from (almost) nearly optimal conditions to regimes where optimal conditions are varied with less optimal meteorological years.