Spatial Analysis of Weather-induced Annual and Decadal Average Yield Variability as Modeled by EPIC for Rain-fed Wheat in Europe

Nikolay Khabarov (1), Juraj Balkovic (1,2), Erwin Schmid (3), Alexander Schwartz (1), Michael Obersteiner (1), and Ligia B. Azevedo (1)

(1) International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, (2) Faculty of Natural Sciences, Comenius University in Bratislava, Bratislava, Slovak Republic, (3) Institute for Sustainable Economic Development, University of Natural Resources and Life Sciences, Vienna, Austria

In our analysis we evaluate the accuracy of near-term (decadal) average crop yield assessments as supported by the biophysical crop growth model EPIC. A spatial assessment of averages and variability has clear practical implications for agricultural producers and investors concerned with an estimation of the basic stochastic characteristics of a crop yield distribution.

As a reliable weather projection for a time period of several years will apparently remain a challenge in the near future, we have employed the existing gridded datasets on historical weather as a best proxy for the current climate. Based on different weather inputs to EPIC, we analyzed the model runs for the rain-fed wheat for 1968-2007 employing AgGRID/GGCMI simulations using harmonized inputs and assumptions (weather datasets: GRASP and Princeton).

We have explored the variability of historical ten-year yield averages in the past forty years as modeled by the EPIC model, and found that generally the ten-year average yield variability is less than 20% ((max-min)/average), whereas there are mid/low yielding areas with a higher ten-years average variability of 20-50%. The location of these spots of high variability differs between distinctive model-weather setups.

Assuming that historical weather can be used as a proxy of the weather in the next ten years, a best possible EPIC-based assessment of a ten-year average yield is a range of 20% width ((max-min)/average). For some mid/low productive areas the range is up to 50% wide.