ID: 734

Multi-Grid Spatial Modeling of Wheat Yields within the Impact of Climate Change in Southeastern Türkiye

Arthur Borges Bringel Machado[1], Omer Vanli[2], Virginia Louise Covert[1], Shelia Vakhtang[1]

[1]*University of Florida, Agricultural and Biological Engineering Department, USA*
[2]*İstanbul Teknik Üniversitesi, Türkiye*

Abstract

Southeastern Türkiye, particularly the provinces of Gaziantep and Şanlıurfa, faces increasing threats from climate-induced thermal and moisture stress, making it a critical wheat production corridor. Accurate regional yield estimation is essential for developing localized adaptation strategies; however, the impact of spatial resolution on model precision remains a key challenge. This study utilizes a high-resolution modeling approach to estimate wheat productivity by integrating the DSSAT crop model within two distinct spatial frameworks: the Pythia platform and the CCAFS Regional Agricultural Forecasting Toolbox (CRAFT).

The study methodology employs a comparative grid-based analysis, utilizing Pythia at a coarse resolution of 55 km and CRAFT at a finer resolution of 10 km to capture localized environmental heterogeneities. Climate forcing data were derived from the GFDL, MPI, and UKESM1 Earth System Models under multiple Shared Socioeconomic Pathways (SSP1-2.6, SSP3-7.0, and SSP5-8.5) to project yield trajectories through the mid-century and end-century. Furthermore, the study evaluates the efficacy of different adaptation measures, such as sowing date, to mitigate the projected shortening of the grain-filling period.

Preliminary results indicate that the 10 km CRAFT-based simulations provide significantly more granular insights into yield anomalies and climate "hotspots" compared to the 55 km Pythia output, particularly in the topographically diverse areas of Gaziantep. This multi-scalar assessment demonstrates that while coarse-resolution models are effective for broad regional trends, 10 km grid-based modeling is necessary for province-level agricultural planning and for optimizing sowing dates. The findings provide a robust evidence base for policymakers to enhance food security and implement precision adaptation strategies in Turkiye's Mediterranean climate hotspot.

Keywords: *Wheat Yield, Climate Change, SSP, sowing dates*