Title: Simulating wheat adaptation to climate change in Europe using an ensemble approach with impact response surfaces

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Abstract:

Adaptation can reduce climate change risks to crop production and is best analyzed at local scales considering regional specificities. Uncertainty inherent in modelling adaptation options is due to climate projections, downscaling and imperfections of crop models. The challenge of making effective adaptation decisions requires powerful approaches for exploiting the potential of genotype by environment by management interactions, and for generating projections informed with uncertainty.
Here we present a methodology that constructs impact response surfaces (IRSs) from an ensemble of crop models and applies these to explore the adaptation potential of rainfed winter wheat at Lleida (NE Spain) in a water-limited environment. The simulation experiment includes: 1) a systematic sensitivity analysis to changes to baseline temperature and precipitation (1981-2010) through a delta change approach that accounts for seasonal differences, 2) three levels of CO2 representing present-day and future conditions until 2050 (A1B scenario), and 3) soil profiles representative for the variable conditions around Lleida. The adaptation simulations represent adjusted management practices about sowing, supplementary irrigation, and the thermal and vernalisation requirements of cultivars used.
A pre-selection of the adaptation options was done iteratively, in ranges supported by literature review of crop adaptation in the Mediterranean (e.g. shifts from current sowing date between -30 and +45 days). This procedure allowed to identify a limited number of effective and feasible adaptations to be evaluated combining IRSs and probabilistic projections of climate change.

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