Synthesis and Review: an inter-method comparison of climate change impacts on agriculture

Objective

Alternative methodological approaches—such as process models, statistical models and integrated assessment models—have been used to estimate climate impacts on agriculture, not always with consistent results. The purpose of this focus issue is to provide a better understanding of the magnitude and causes of differences in results from alternative methodological approaches.

Approach

This letter synthesizes the set of articles in the focus issue that have been tasked with providing a systematic assessment of how results from these different methodological approaches compare and why they are different. From this synthesis, we offer thoughts on research priorities going forward to fill key voids in the literature on this important topic.

Impact

A common theme that emerged from most of these studies is that the estimates are more accurate
if the different methodological approaches are combined in some way. A valuable outcome of the inter-method comparison studies included in this focus issue is the identification of important research areas that require much further attention.

Key Findings:

1. Economics of adaptation: most studies lack a strong representation of adaptation responses. Statistical approaches, to some extent, capture adaptation that is reflected in the historical record, but adaptation in response to large changes that are out of sample are not captured.

2. Better understanding and communication of the CO2 fertilization effect: the results in Moore et al (2017a), sensitivity analysis in Ruane et al (2017), and prior work discussed in Lobell and Asseng (2017), underscore the importance of understanding and incorporating the CO2 fertilization effect in these estimates.

3. Expansion of the number of crops: most studies are limited to a narrow set of crops. Even if they represent the bulk of the global calorie intake, they do not cover most of agricultural production in value terms. Economic models usually adopt some heroic assumptions regarding yield changes in these other crops yet without any direct evidence on climate impacts.

4. Pursue hybrid or combination approaches in future studies: a common theme that emerged from most of these studies is that the estimates are more accurate if the different methodological approaches are combined in some way; e.g. Roberts et al (2017), Calvin and Fisher-Vanden (2017), and Ruane et al (2017).

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