

Addressing challenges and uncertainties for the use of agro-ecosystem models to assess climate change impact and food security across scales

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Abstract

Simulation models are state-of-the-art tools to predict future climate and its impact on worldwide agricultural production, trade and food security. Two major research activities were recently launched to bring modellers from different research communities together to investigate the predictive power of the available models and to apply them jointly in climate change impact assessments. The Agricultural Model Intercomparison and Improvement Project (AgMIP) is a community-driven international effort that pools climate, crop, and economic modellers to improve their models and produce a next generation of climate impact projections for the agricultural sector. AgMIP aims to improve substantially the characterization of world food security under a changing climate and to enhance adaptation capacity across the globe. It addresses the complete chain of models interacting across scales and themes – from global climate models to small-scale crop models, and back to large-scale economic models – and investigates the impact of climate variability on crop yields and related market mechanisms of global economy. Different cross-cutting themes address aggregation, uncertainty, and the development of Representative Agricultural Pathways (RAPs).

In Europe, a number of EC-funded COST actions prepared what was recently launched as a knowledge hub of agricultural modellers: Modelling European Agriculture with Climate Change for Food Security (MACSUR) gathers modellers of 73 research groups from Europe and Israel for cropping systems, livestock systems and trade modelling. Digging deeper into regional details than AgMIP, the crop modelling (CropM) component of MACSUR concentrates on overcoming weaknesses in crop modelling approaches and tools with specific attention to exploiting data on crop rotations and farming systems, including

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grassland. Both actions aim to (i) compare available crop model to detect methodological short-comings, (ii) compile data in support of model improvements, (iii) advance scaling methods and model linkages, (iv) improve climate scenario data and impact uncertainty analysis and (v) build research capacity. MACSUR furthermore works towards integrating models of different scopes at different scales to assess the mitigative effect of different adaptation measures and to trigger interdisciplinary studies and interaction with a diverse range of stakeholders for climate change impact assessments.

For economic themes, global change also includes demographic development, changing nutrition habits and policy changes. MACSUR's TradeM aims at promoting the enhancement of economic models across scales, better integrating crop and livestock production, developing improved adaptation and mitigation strategies and offering a forum for researchers, stakeholders and policymakers to exchange ideas, while AgMIP's economic team focuses on the development of standardized scenario variables and consistent RAPs for the global and the regional scale.