The Agricultural Model Intercomparison and Improvement Project (AgMIP)

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http://www.agmip.org
Why AgMIP?

- **Agricultural risks growing, including climate change**
  - Climate extremes affecting major agricultural regions
  - Regional and world food crises driven by multiple environmental and economic stresses
  - Decisionmakers demanding improved information for risk management

- **Consistent approach needed to enable agricultural sector analysis across relevant scales and disciplines**
  - Difficult to compare climate impact studies across regions and models
  - Lack of a transdisciplinary community connecting climate scientists, crop modelers, economists, and IT specialists
  - Need for improved climate assessment based on multi-model capabilities and better defined uncertainties

- **Long-term process lacking for rigorous agricultural model testing, improvement, and assessment**
  - Agricultural model evaluation and assessment lagging behind climate model intercomparisons and projections
  - Need to make better use of available data and methods
  - There is a need for a continuing process i.e., AgMIP 1 ➔ AgMIP2 . . .
AgMIP Objectives

- Incorporate state-of-the-art climate products as well as crop and agricultural trade model improvements in coordinated regional and global assessments of future climate impacts
- Include multiple models, scenarios, locations, crops and participants to explore uncertainty and impact of data and methodological choices
- Collaborate with regional experts in agronomy, economics, and climate to build strong basis for applied simulations addressing key climate-related questions
- Improve scientific and adaptive capacity for major agricultural regions in the developing and developed world
- Develop framework to identify and prioritize adaptation strategies
- Link to key on-going efforts
  - CCAFS, Global Futures, MOSAICC, Yield Gap Analysis, SERVIR, MACSUR ...
  - National Research Programs, National Adaptation Plans, IPCC, ISI-MIP ...
AgMIP Two-Track Science Approach

Track 1: Model Improvement and Intercomparison
Track 2: Climate Change Multi-Model Assessment

Rosenzweig et al., 2012
AgMIP Teams, Linkages, and Outcomes

Cross-Cutting Themes
- Uncertainty
  Contributions of each component to uncertainty cascade
- Aggregation across Scales
  Connecting local, regional, and global information
- Representative Agricultural Pathways
  Link to RCPs (Climate) SSPs (Economics)

AgMIP Teams
- Climate
- Crop Models
- Agricultural Economics Models

Key Interactions

Information Technologies
- Online Project Guidance, Archive, and Clearinghouse

Expected Outcomes
- Assessments
  - Regional
  - Global
  - Crop-specific

- Improvements and Intercomparisons
  - Crop Models
  - Agricultural Economics Models
  - Scenario Methods
  - Aggregation Methodologies

Capacity Building and Decision Making
- Regional Vulnerability
- Adaptation Strategies
- Trade Policy Instruments
- Technological Exchange

Rosenzweig et al., 2012
AgMIP International Workshops

~490 members of AgMIP list-serv
Workshop Goals

• Report progress on AgMIP research and integrated assessment activities
• Refine framework for the global AgMIP community of science
• Formulate the next phase of AgMIP initiatives
AgMIP Teams

- Crop Modeling
- Economics
- Climate Scenarios
- IT

AgMIP Cross-Cutting Themes

- Aggregation and Scaling
- Representative Agricultural Pathways
- Uncertainty
Global Gridded Crop Modeling and Global Economic Modeling

• Global Gridded Crop Modeling
  – Seven modeling groups, multiple crops, five GCMs from CMIP5, 4 RCPs, with and without CO2 fertilization, with and without irrigation

• Global Economic Modeling
  – 10 Global Economic Models participating in AgMIP
AgMIP Regions

North America, South America, Europe, Sub-Saharan Africa, South Asia, Asia*, Australia*

* In development
AgMIP Regional Integrated Assessments

AgMIP Region Projects
Sub-Saharan Africa

AgMIP Region Projects
South Asia
Wheat (27 models), Maize (25), and Rice Model (~15) Pilots underway

Pilots under development for sugarcane, millet/sorghum, soybean, groundnut, and potato
New Initiatives

• Livestock and Grassland Model Intercomparison

• AgMIP Databases and Data Management Policy

• The Coordinated Climate-Crop Modeling Pilot (C3MP)
  – Point-based crop model intercomparison in which participants submit baseline and sensitivity run results for sites/models/cultivars with which they already have familiarity and have run before

Next phase
AgMIP Global Research Alliance

Draft Charter

To accomplish the overall goal of improved modeling capability for future food security will require an integrated effort by the world agricultural research community to

1. Create and share 21st-century comprehensive data systems for rigorous agricultural model improvement and assessment
2. Improve agricultural (crop, livestock, and economic) models to take account of climate extremes and threshold events in order to enhance usability and accuracy
3. Apply linked climate, crop, and agricultural trade models in ensemble simulations to evaluate future impacts of climate change on agricultural productivity and food security outcomes
4. Utilize agricultural models to develop and evaluate potential adaptations in agricultural systems to ensure food security
AgMIP Global Research Alliance

**Draft Charter**

- Is open to all regional and national programs and projects of the world agricultural community, including the private sector involved in agricultural model intercomparison, improvement, and policy application
- Engages the worldwide community interested in improving food security, and significantly raises the level of technology transfer in food systems in the next decades
- Convenes the annual Global Workshop of the Alliance to report results and plan future activities
- Promotes efforts to intercompare and improve agricultural models and to document these efforts through meetings and publications
- Is governed by an International Scientific Steering Group, with representation from major agricultural regions and programs
- Ensures that membership in the Global AgMIP Research Alliance does not impose a financial obligation on the members. Each member finances participation costs through their own resources, and helps to develop specific programs and policies to assist members from developing countries
- New members may request membership through the Steering Group at any time.
AgMIP Lessons Learned to Date

• Great interest in agricultural modeling community for intercomparison and improvement
  - 27 wheat models, 21 maize models, 16 rice models, 10 global economic models participating

• Definitional differences key to utility of results
  - Climate data and scenario methodologies, field trial data interpretation, crop and economic model inputs and outputs
  - ET cannot be generated centrally, but must be calculated by each model and considered part of model uncertainty – places extra emphasis on the quality of moisture and wind data products

• Agricultural inputs are sensitive to climate conditions

• Pathways for calibration are unique to each model
  - One model’s safe assumptions can be fatal to other models

• Aggregation methods from site to region critical
Next Steps and Upcoming Events

• Projects underway in Sub-Saharan Africa and South Asia
• AgMIP leading agricultural sector in ISI-MIP
• Coordinated Climate-Crop Model Pilot
• Regional and Global Workshops
  – Global Workshops just prior to ASA annual meeting in US: Long Beach, October 2010; San Antonio, October 2011
  – Europe Wheat Pilot: Amsterdam, April 2011
  – South America: Campinas, August 2011
  – Rice Pilot: Beijing, August 2011
  – Sub-Saharan Africa: Kenya, January 2012
  – South Asia: Hyderabad, February 2012
  – North America: Ames, September 2012
  – Sub-Saharan Africa Workshop, Accra, September 2012
  – South Asia: November 2012
The Coordinated Climate-Crop Modeling Pilot

**Objective**
To improve understanding of the impact of climate change on future agricultural production by utilizing site-calibrated crop models to coordinate simulations of crop response under probabilistic climate change scenarios.

**What is C3MP?**
- Point-based crop model intercomparison in which participants submit baseline and sensitivity run results for sites/models/cultivars with which they already have familiarity and have run before
- Will help supplement approach to AgMIP Track 2: Climate Change multi-model assessment

**How do I participate in C3MP?**
- Participants run baseline (1980-2010) simulations with their own climate data (if available) or Bias-Corrected MERRA data (A. Ruane, *in prep*)
- Participants run 200 experiments (baseline + sensitivity) with CTW changes, generated by uniform sampling of CTW space (Climate Team Provided)
- Participants submit results to C3MP/AgMIP database for analysis, generation of response surfaces and uncertainty assessments

**How do Participants Benefit?**
- Participants will benefit from early access to analyses, access to all datasets and model results, will be named contributors to a global project, will have access to global network of modeling communities and collaborators, will be able to publish high-impact studies to aid in improving their model’s development

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