



AgMIP Town Hall



Alex Ruane and Cynthia Rosenzweig, NASA GISS

Page Kyle, PNNL; Bruno Basso, Michigan State University,
Jonathan Winter, Dartmouth College, and Senthold Asseng, University of Florida

AGU 2015 Fall Meeting
December 15, 2014

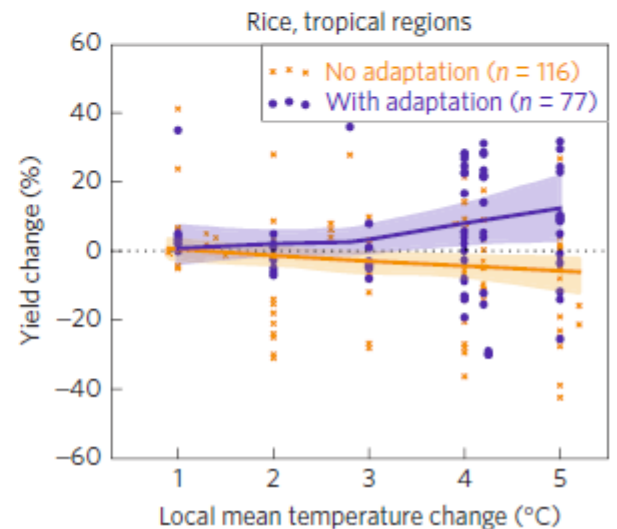
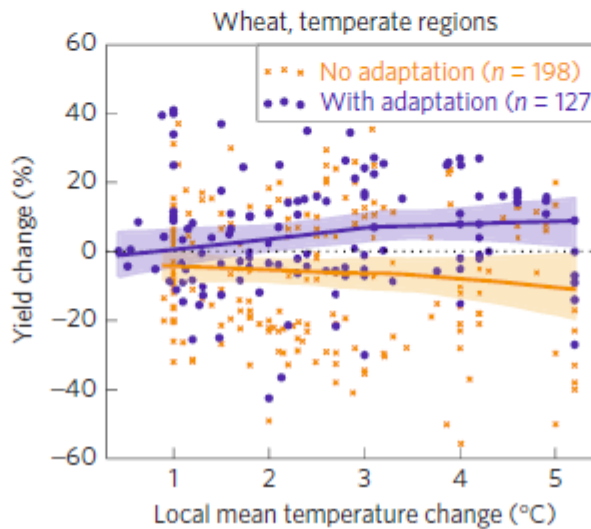
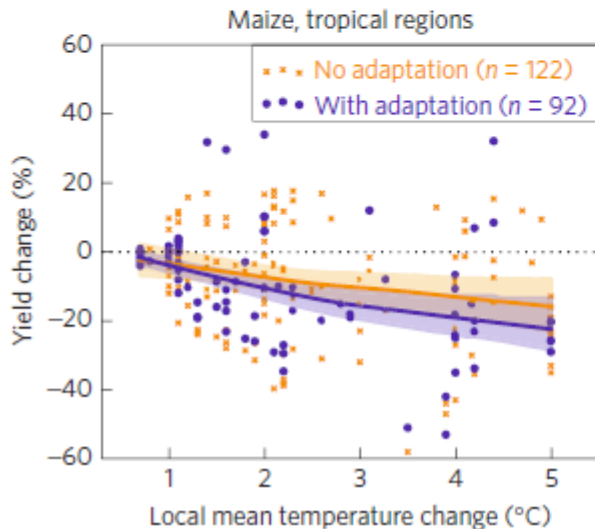
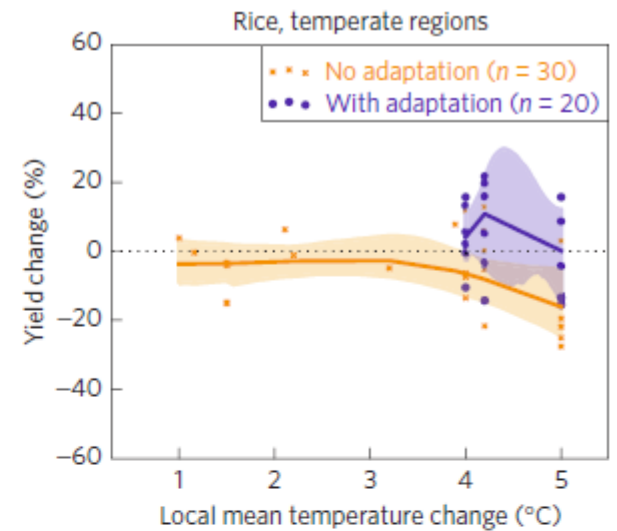
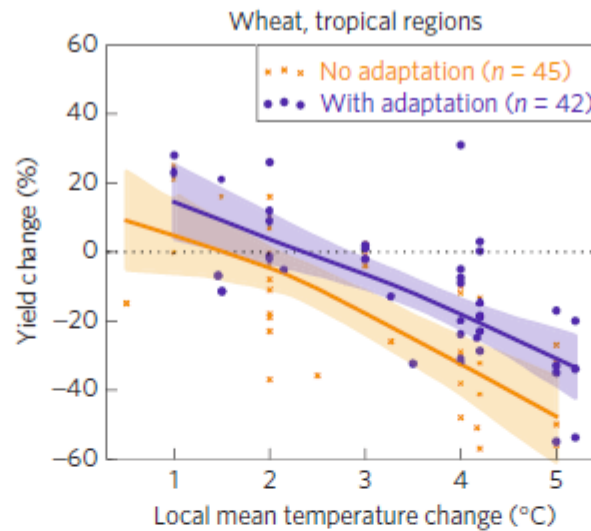
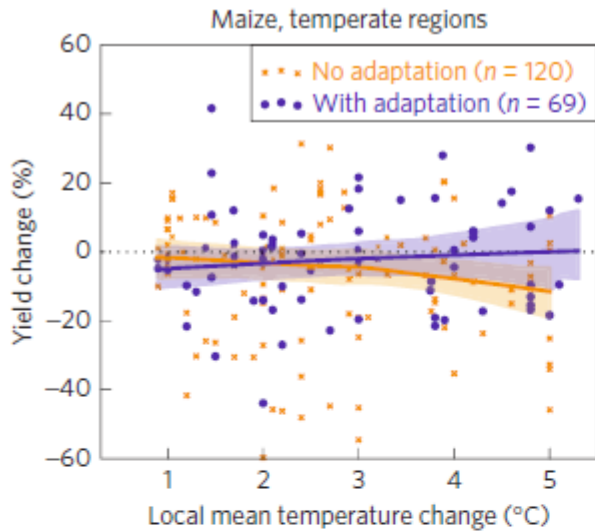


RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security



Crop Responses are Not Clear

(Meta-analysis by Challinor et al., Nature Climate Change and IPCC WG2)



Difficult to make sense out of incredibly diverse studies



The Agricultural Model Intercomparison and Improvement Project (AgMIP)



1st Global Oct 2010



2nd Global Oct 2011



4th Global Oct 2013



5th Global Feb 2015



Sub-Saharan Africa #3



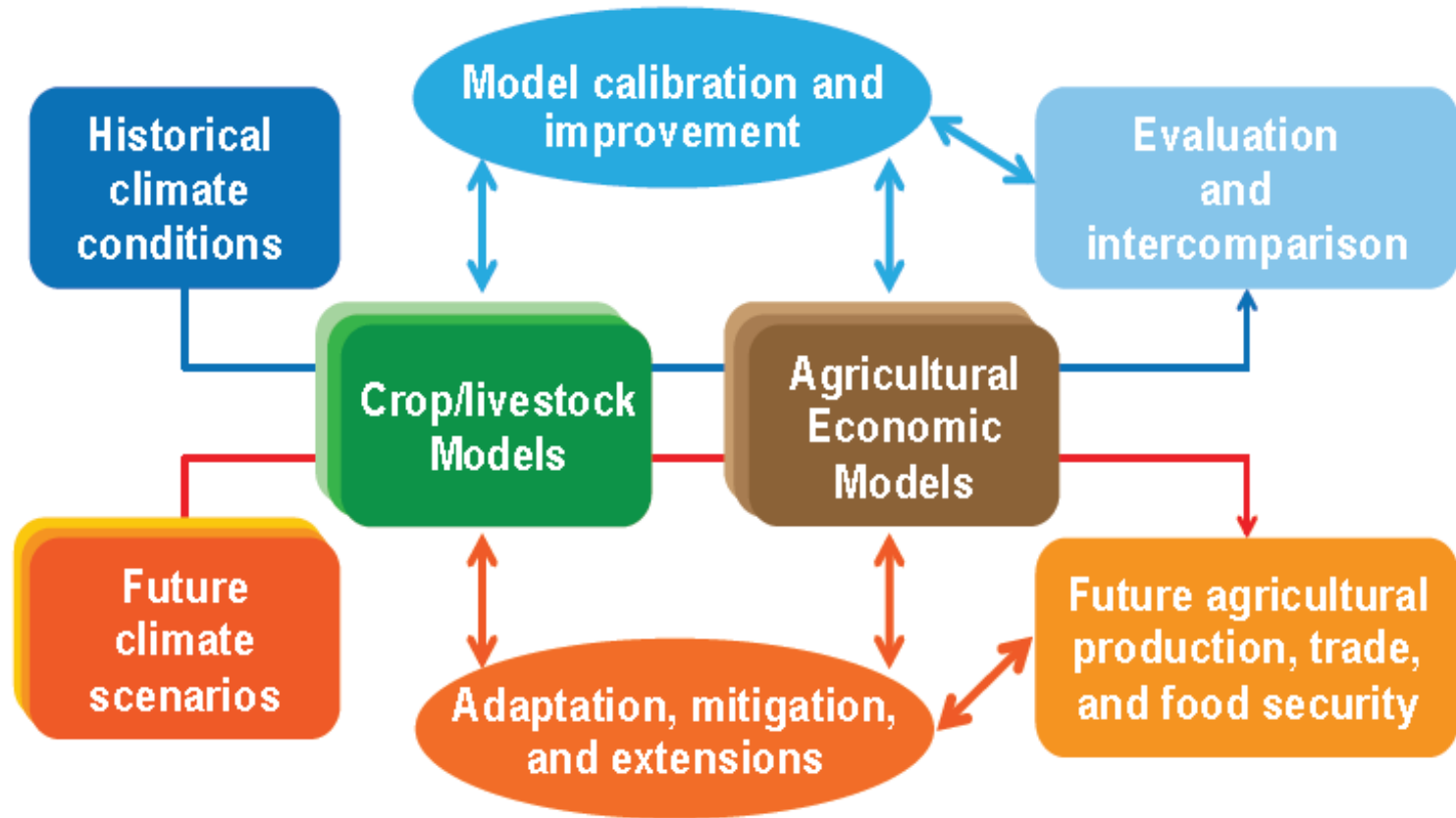
South Asia #3



3rd Global Oct 2012

Provide effective **science-based agricultural decision-making models and assessments of climate variability and change and sustainable farming systems to achieve local-to-global food security**



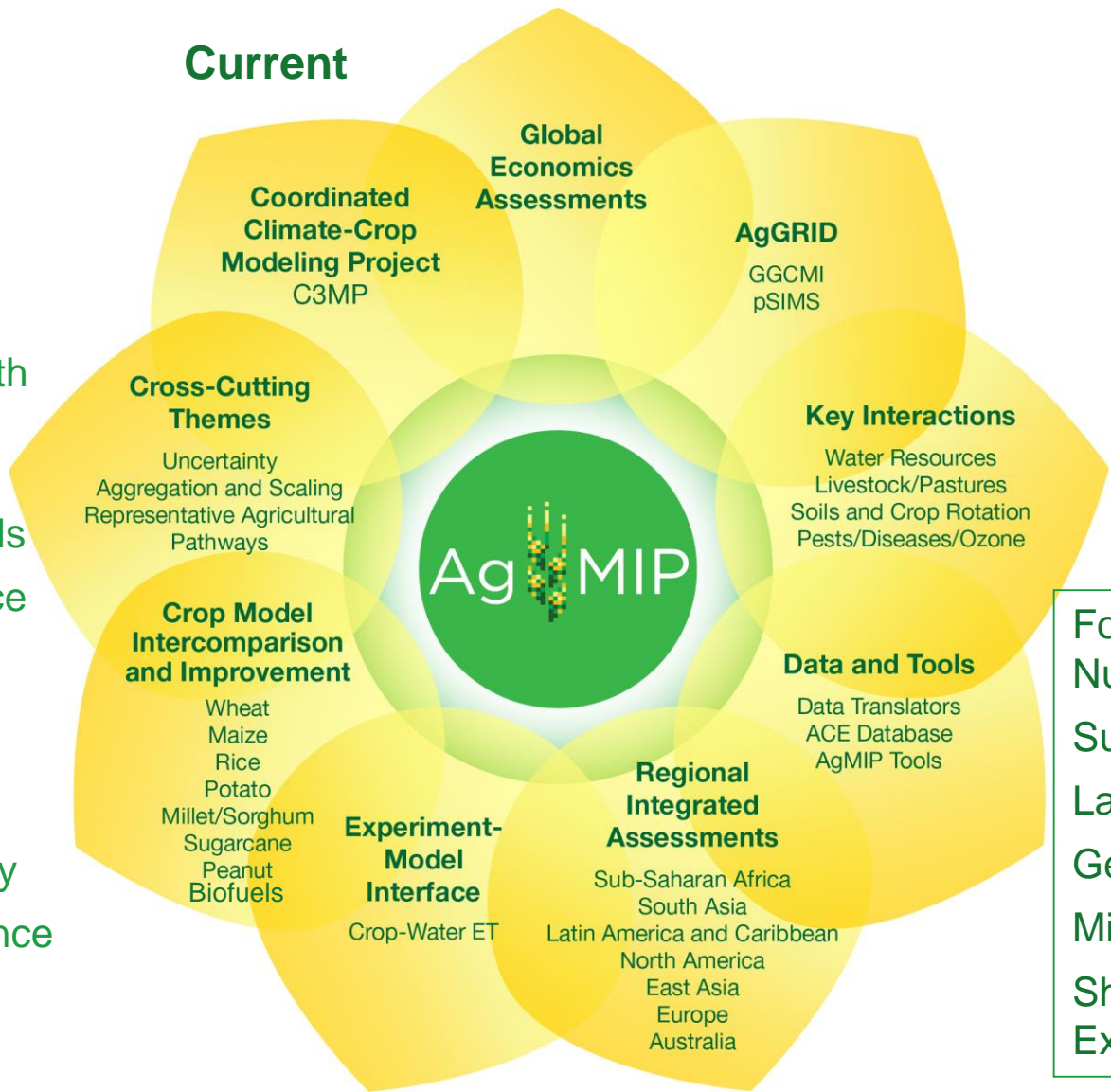


Rosenzweig et al., 2013 AgForMet

AgMIP is an international community of 800+ **climate scientists**, **agronomists**, **economists**, and **IT experts** working to improve models, data, and assessments of sustainable **agricultural systems** and **future food security**

Protocols for new AgMIP Teams or Activities:

- Co-Led
- Written plan with short and long-term goals
- AgMIP protocols
- External science advisors
- Review & attribution
- Budget and funding strategy
- Quality assurance

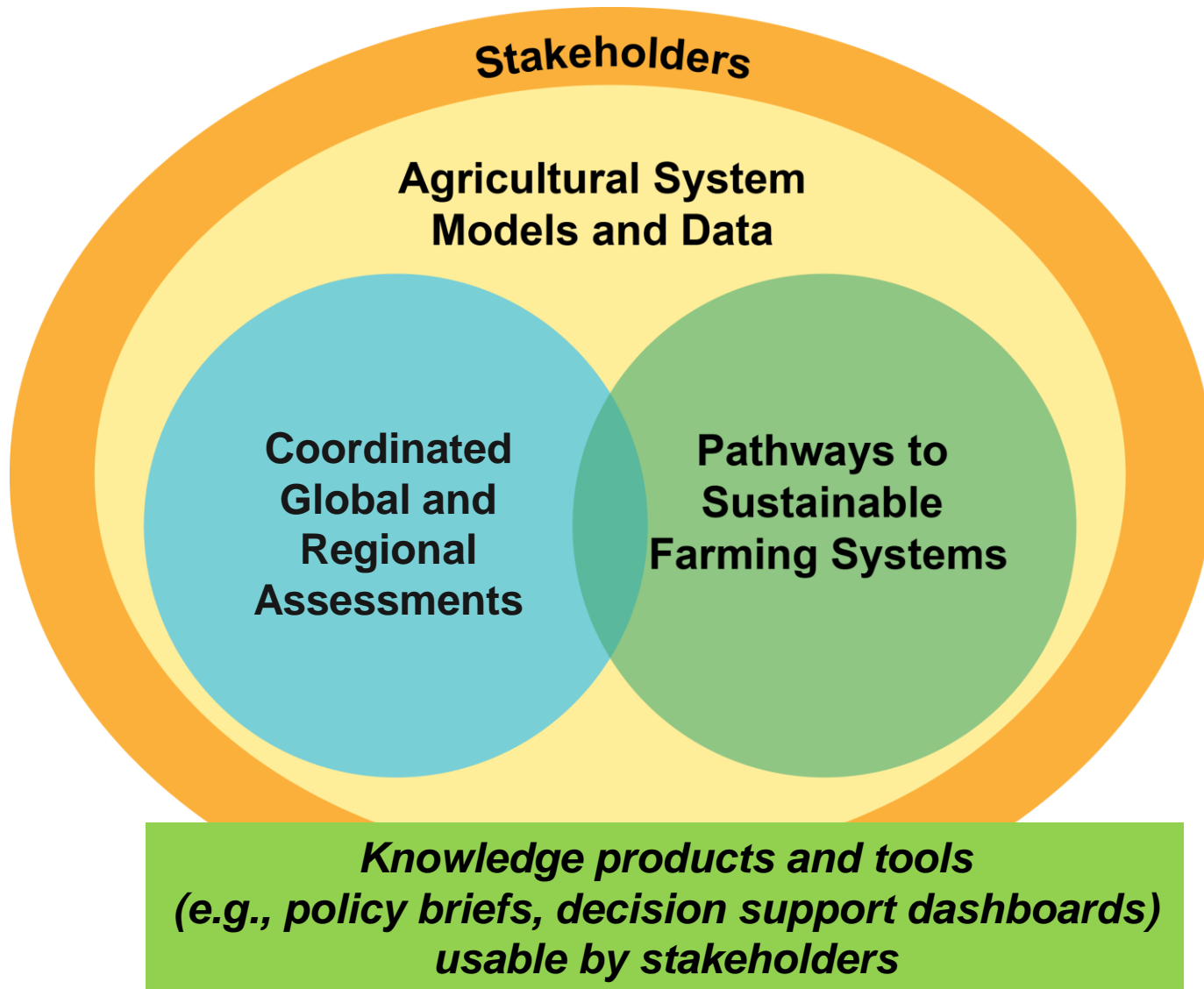


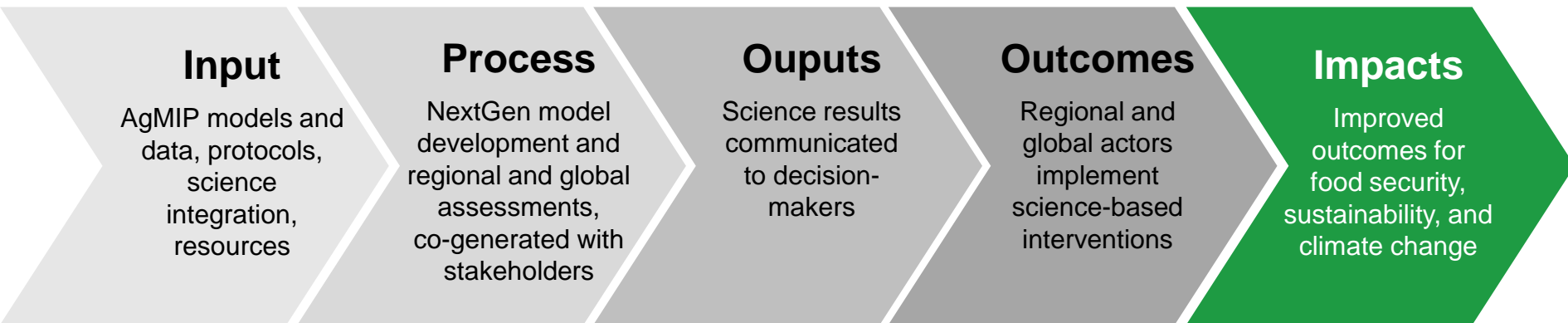
Prospective

- Food Security & Nutrition
- Sustainable Systems
- Land Use
- Gender & Livelihoods
- Mitigation
- Shocks and Extremes

Global Economics	Hermann Lotze-Campen, Keith Wiebe, Dominique van der Mensbrugge
Rice	Tao Li
Wheat	Senthold Asseng, Pierre Martre, Frank Ewert
Maize	Jean-Louis Durand
Sugarcane	Abraham Singels, Fabio Marin, Matthew Jones, Peter Thorburn
Bioenergy	David LeBauer and Gopal Kakani
Potato	David Fleisher
Livestock	Jean-Francois Soussana and Fiona Ehrhardt
MACSUR/CropM	Reimund Rötter, Frank Ewert, and Martin Koechy/Martin Banse
AgGRID/GGCM	Christoph Mueller and Joshua Elliott
C3MP	Alex Ruane and Sonali McDermid
Data harmonization/IT	Cheryl Porter and Sander Janssen
FACE-IT	Joshua Elliott and Cheryl Porter
RAPs	Roberto Valdivia and John Antle
Uncertainty	Daniel Wallach, Linda Mearns, Mike Rivington
Crop ET	Ken Boote and Jerry Hatfield
Aggregation and Scaling	Frank Ewert and Lenny van Bussel
Stakeholder Engagement	Amy Solomon and Wendy-Lin Bartels
Water Resources	Jonathan Winter
Soils and Crop Rotation	Bruno Basso
Maize/Millet	KPC Rao and Sibiry Traore
Latin America	Eduardo Assad and Roberto Valdivia
East Asia	Fulu Tao
NextGen	John Antle, Cynthia Rosenzweig, and Jim Jones
Coordinated Global and Regional Assessments	Cynthia Rosenzweig
Maize model improvement	Thijs Tolenaar and Ken Boote







Outputs as public goods, data and knowledge products
Reaching all the way to the farm level and vulnerable populations
Including small-holder farms in the developing world

Stakeholder-scientist co-generated systems research leads to improved capacity, climate risk information, pathways to sustainable agricultural systems, and food security.

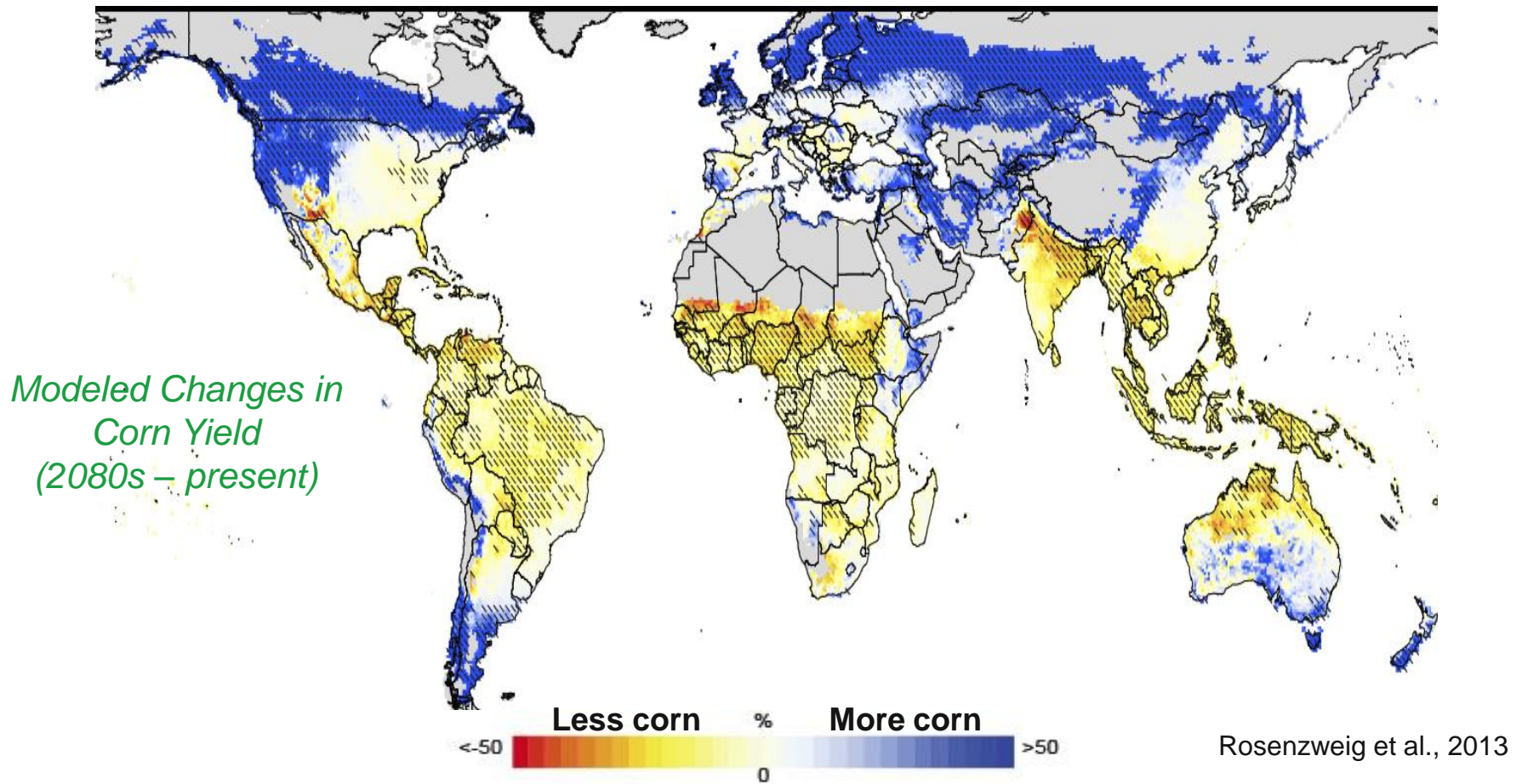
A scenic landscape featuring lush green terraced fields in the foreground, a small village with several buildings in the middle ground, and a range of mountains in the background under a sky filled with large, white and grey clouds. The text "AgMIP Research Activity Highlights" is overlaid in the center in a bold, blue font.

AgMIP Research Activity Highlights

- ◆ **Activity 1** – Sensitivity analyses (CO₂, temperature, rainfall, & management; 4 sentinel sites; standardized protocols)
 - ◆ Wheat team (Asseng, Ewert, Martre)
 - ◆ Maize team (Bassu, Durand, Lizaso, Boote)
 - ◆ Rice team (Li, Hasegawa, Zhu, Yin, Boote)
 - ◆ Sugarcane team (Singels, Thorburn, Marin)
 - ◆ Recent teams: potato (Fleisher, Quiroz), sorghum-millet (----), peanut (Singh)
 - ◆ New teams: bioenergy (Kakani/LeBauer), canola (Wang)
 - ◆ Soils (Bassu)

- ◆ **Activity 2** – Model Improvement (time-series and end-of-season data. Improve code!)
 - Water-ET - Maize Model Impr. - Tcanopy/heat stress - wheat

- ◆ **Activity 3** – Evaluate climate-smart adaptations/technology effects

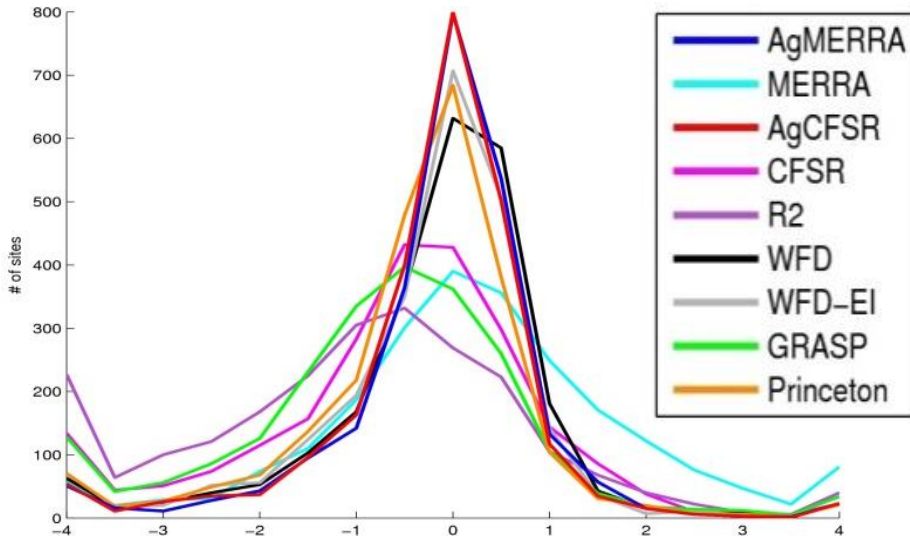


GGCMI now includes more than a dozen models

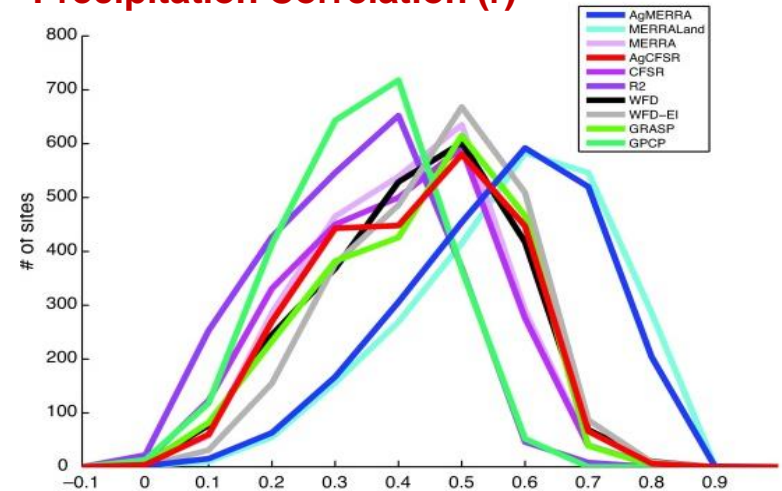
Phase 1: Historical period intercomparison

Phase 2: CTWN-A response

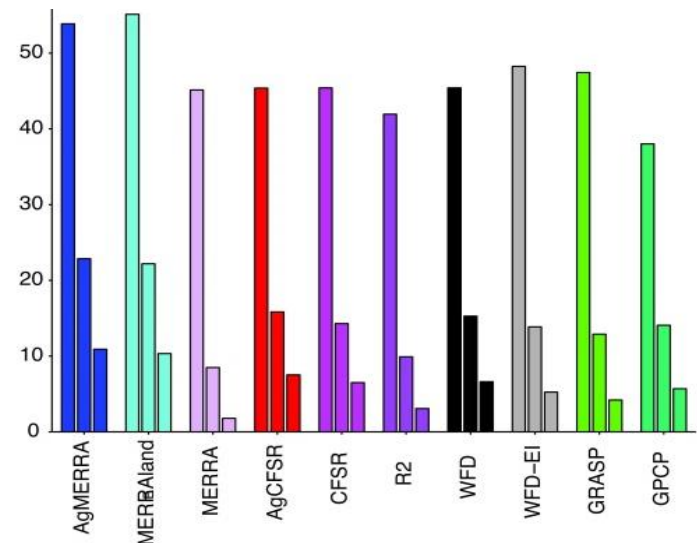
Avg of Tmax and Tmin Biases (° C)



Precipitation Correlation (r)



Threat score for 1, 25, and 50mm precipitation events (%)

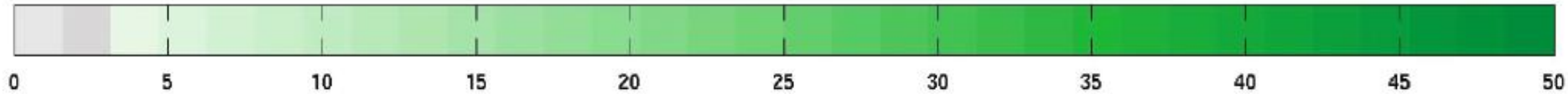
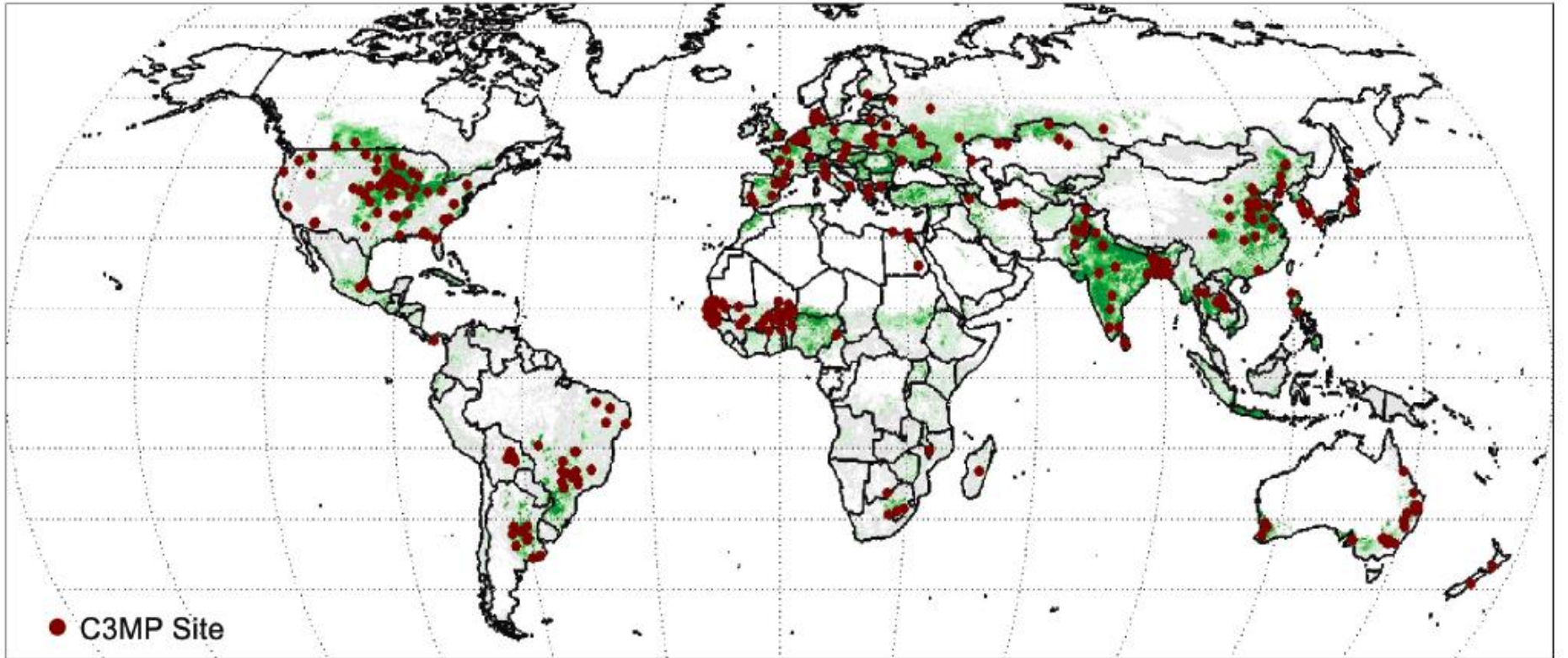


AgMERRA features:

- improved solar radiation
- Improved precipitation variability
- fine spatial patterns of rainfall from satellites
- an adjustment to diurnal temperature range
- relative humidity at Tmax

AgMERRA better captures rainfall distribution and actual sequence of extreme events

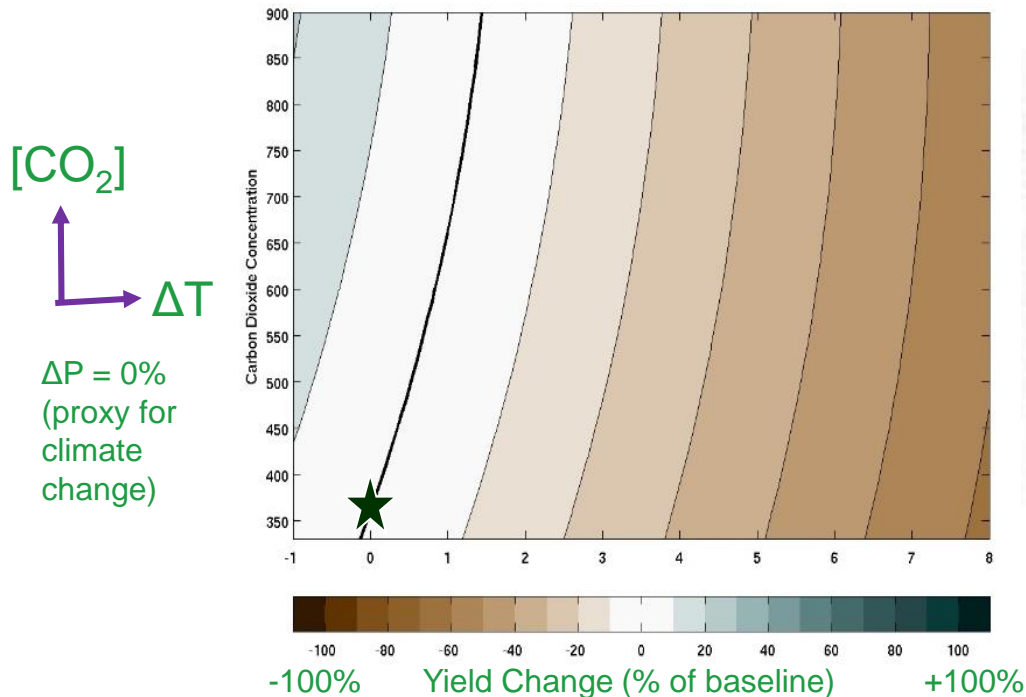
All C3MP Submitted Sites and Major Croplands (Percentage Area)



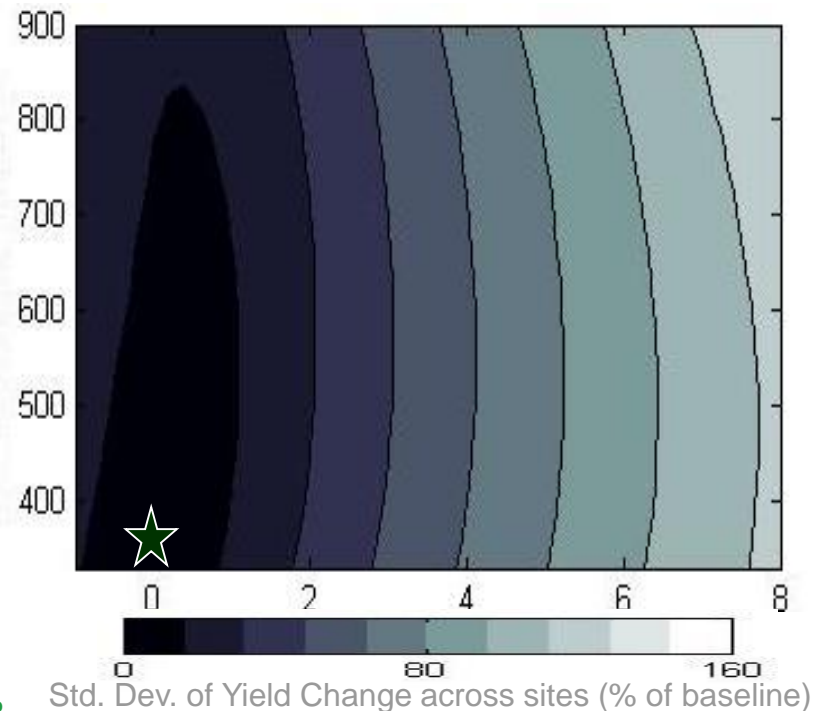
● C3MP submitted site (1137 sites as of August, 2015)

Several approaches to understand uncertainty in crop responses

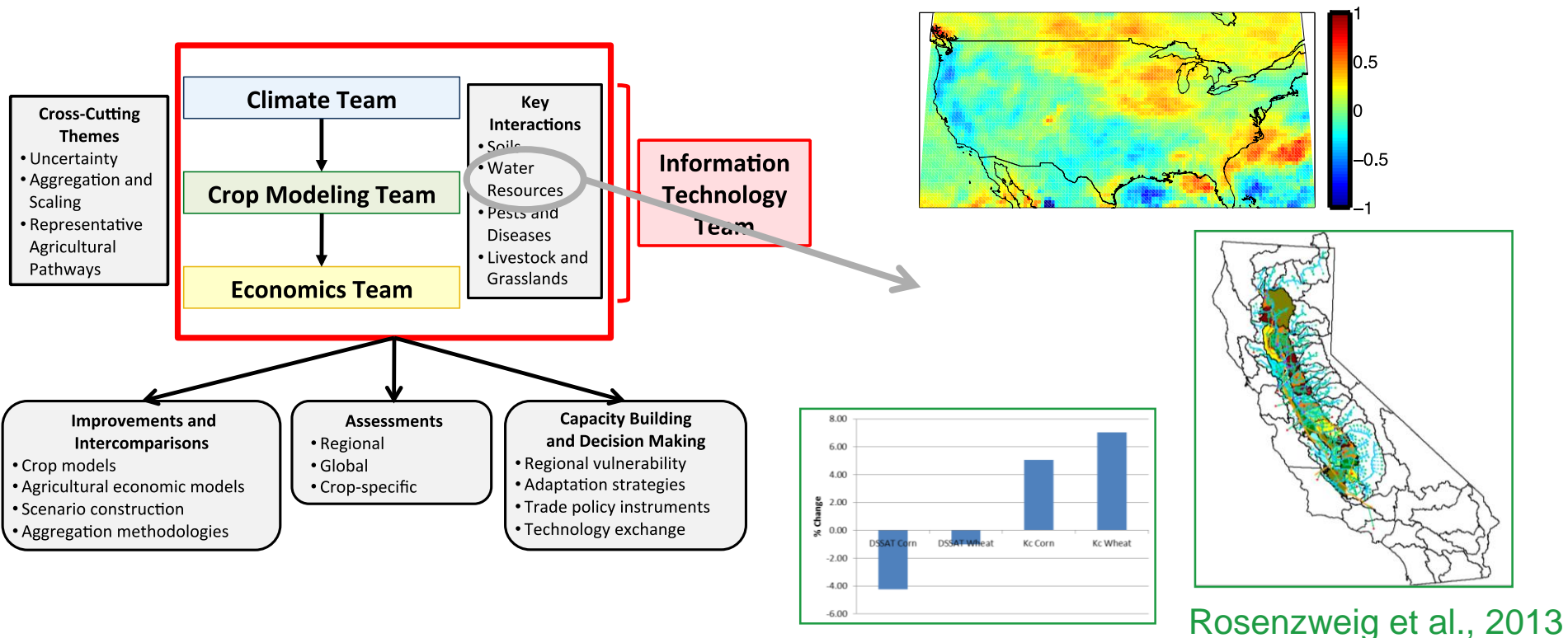
Mean % Change in Mean Maize Yield (126 Rainfed Maize Sites)



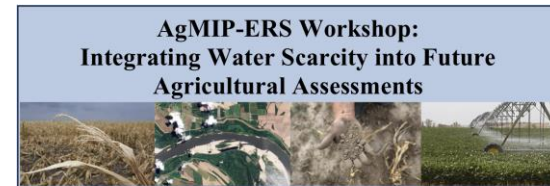
Standard Deviation of % Change in Mean Maize Yield



Develop projects that assess the effects of climate change and variability on irrigated crops in the United States and throughout the world, as well as build collaborative opportunities to create a portfolio of research at the interface of water and agriculture within the AgMIP framework.



- Current:
 - NASA-funded AgMIP Water pilot project that links a hydrologic and crop model to simulate irrigated agriculture in California under future climate
 - AgMIP – USDA Economic Research Service Water Workshop, which brought together over 35 scientists to create strategies for improving the representation of water supply and demand in agricultural assessments
 - NIFA-funded Coordinated Agricultural Project (CAP) on Water-, Nutrient-, and Climate-Smart Agriculture
- Future:
 - Postdoctoral researcher (José López Bóbeda) starting in January
 - Global Collaborations – Link to national and international efforts at the water-agriculture nexus
 - More proposals – Continue to pursue funding to build individual projects that explore facets of climate impacts on water resources and agriculture
- Questions, comments, suggestions?
 - jwinter@dartmouth.edu



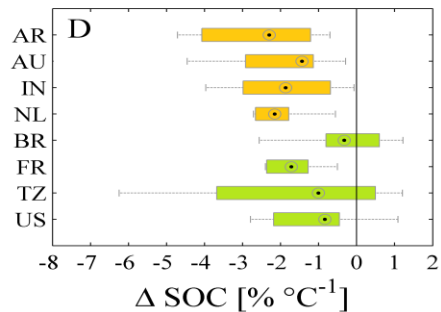
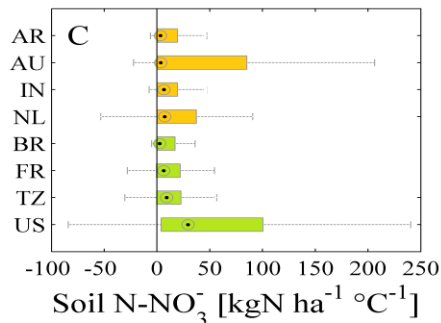
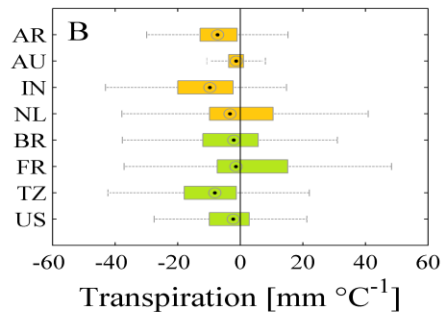
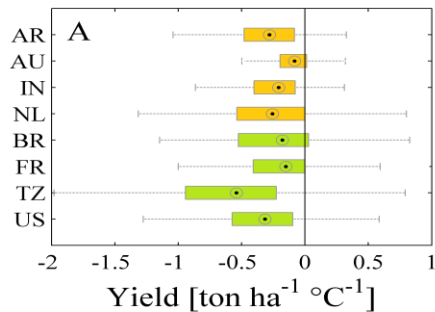
NASA Goddard Institute for Space Studies
New York, NY
April 30 - May 1, 2013

This workshop will bring together leading scientists in climate, hydrology, water resources management, agronomy, and economics to create strategies for integrating water supply and demand into AgMIP assessments of the agricultural sector. Specific objectives include:

1. Survey key existing climate, hydrologic, water resources management, agricultural, and economic modeling efforts
2. Identify and prioritize critical areas of uncertainty within and cascading across climate, hydrologic, water resources management, crop, and agricultural economic models
3. Leverage expertise in the fields of climate, hydrology, water resources management, agronomy, and economics to improve integrated assessment studies
4. Establish a research community to develop an AgMIP project exploring the impacts of water supply and demand on future agriculture

Contact: Jonathan Winter (jw2893@columbia.edu)

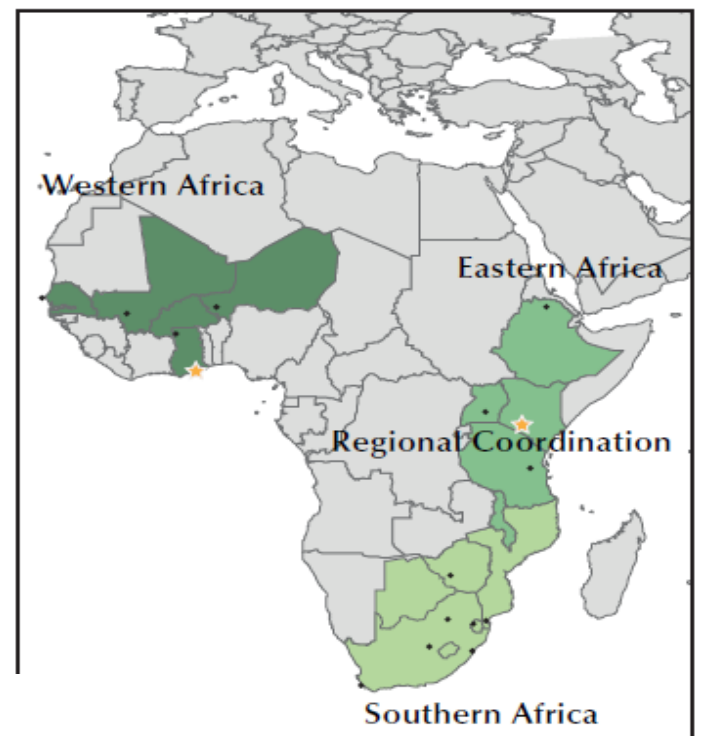
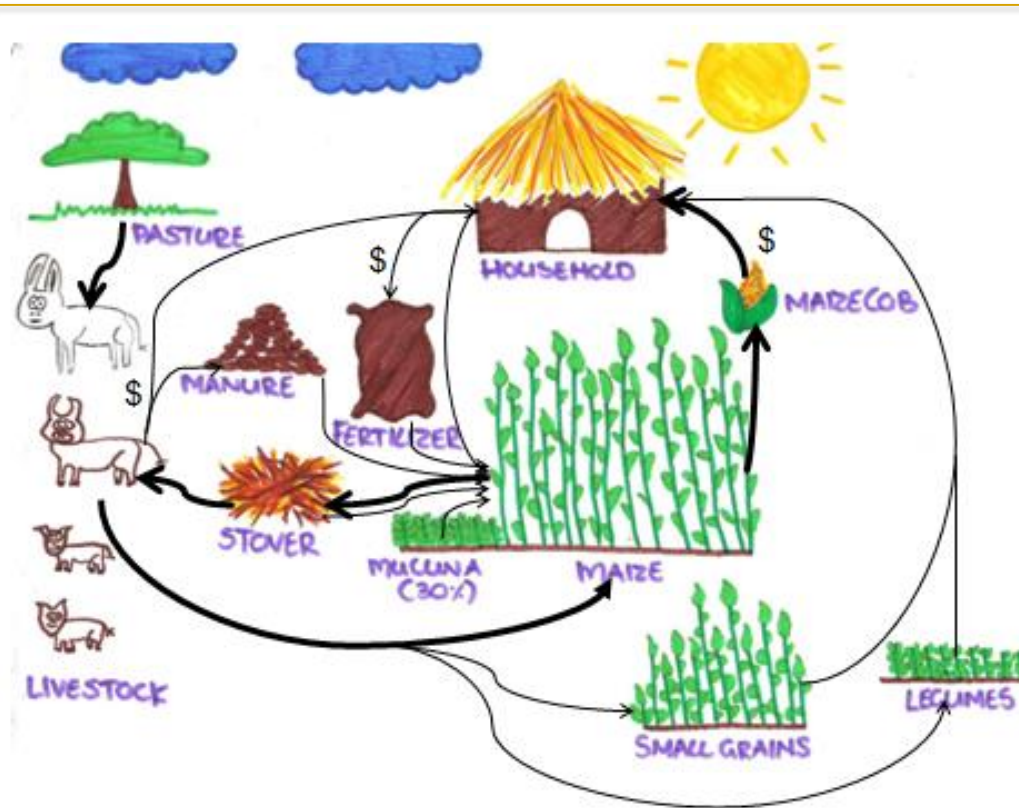
- To assess crop models variability in a long-term maize-fallow and wheat-fallow crop rotation under different management strategies.
- To evaluate the carry-over effects of the interactions between soil, climate and management on yield, and soil carbon, ET.



■ With the temperature increase models on average showed:

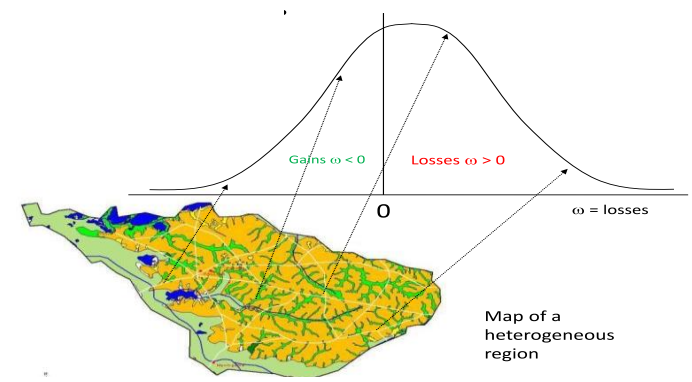
➤ increase in Soil N-NO₃⁻

➤ Decrease in SOC



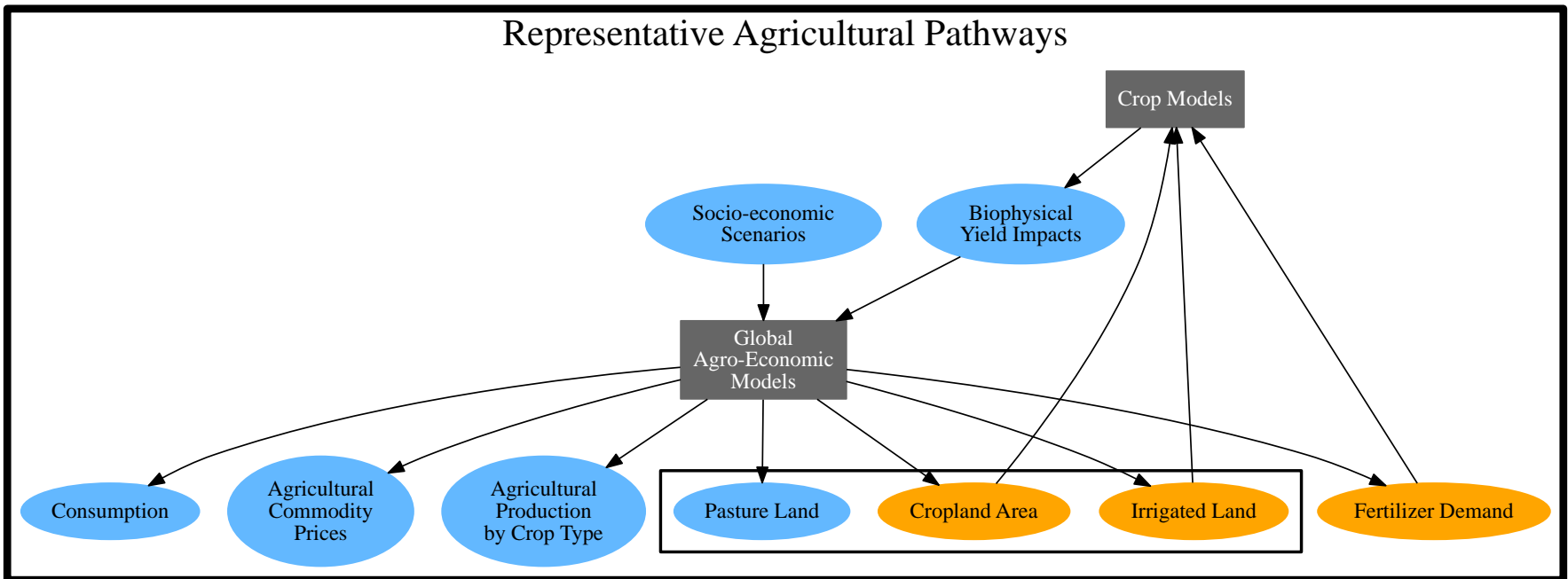
AgMIP-DFID Regional Integrated Assessments:

7 teams across Sub-Saharan Africa and South Asia conducting multi-model integrated assessment of **climate impacts, policy choices, and adaptation strategies**

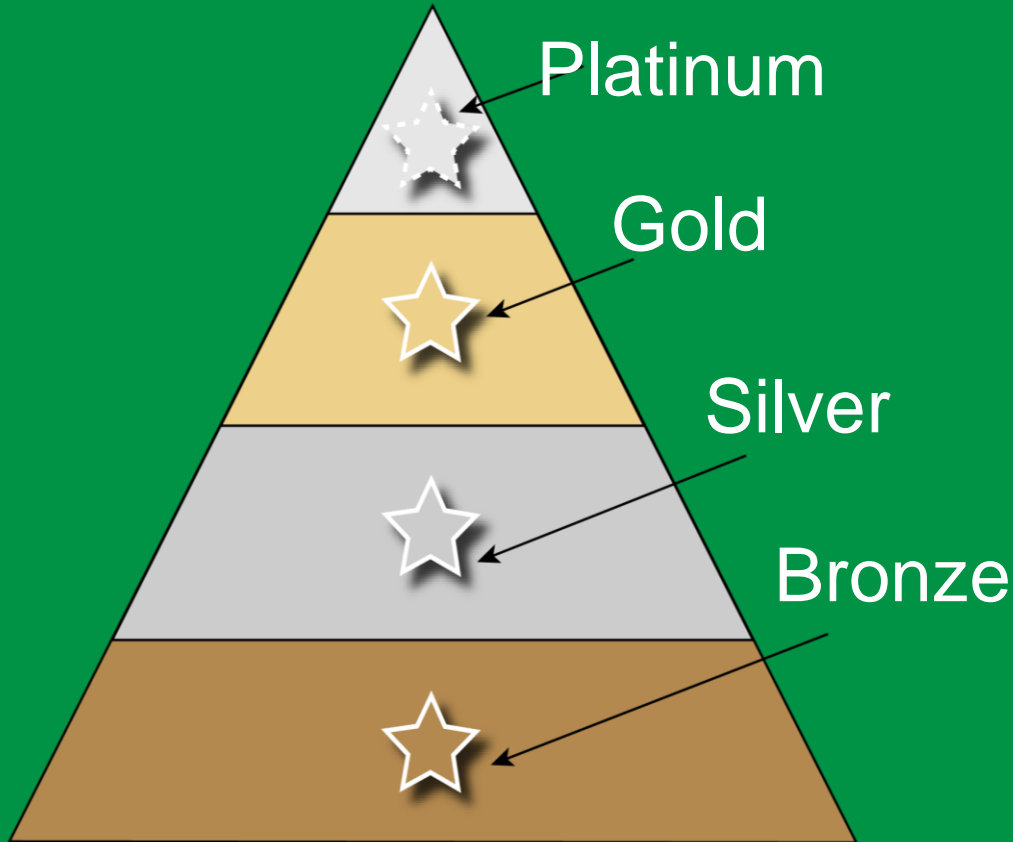


- Objective: multi-decadal simulation of the agricultural sector in the context of changes in broader interacting human/Earth systems
- Current work focuses on constructing “Representative Agricultural Pathways, ensuring consistency between models

Representative Agricultural Pathways



AgMIP Sentinel Sites



AgMIP Data

Harmonized Formats
Standards
Ratings
Archives
Climate Datasets

Focus on identifying data and making them more useful for applications

Boote et al., 2016 (forthcoming)

AgMIP Coordinated Global and Regional Assessment



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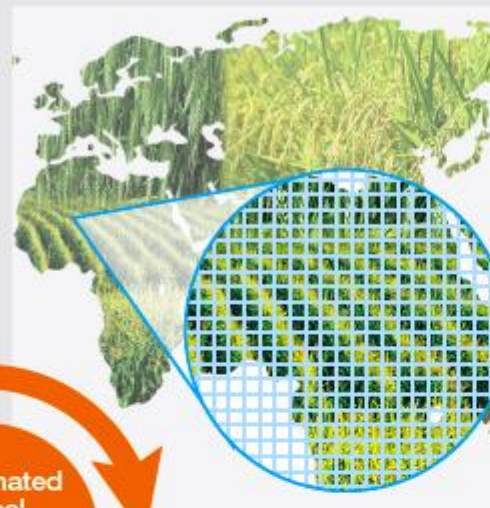
Core Question: How can we manage risks of and develop resilience to extreme weather, climate change, and other disruptions for agricultural production and food security, now and in the future ?

- **Question #1:** What are the capabilities of and limits to **adaptation** to extreme weather and climate change, now and in the future?
 - **Key Topics:** Technology trends vs specific adaptation strategies; Management; Genetics
- **Question #2:** What are the effects of **agricultural mitigation** policies, now and in the future?
 - **Key Topics:** Effects on land use and prices; Biofuels; Soil carbon
- **Question #3:** How does extreme weather and climate change affect **food security/nutrition**, now and in the future?
 - **Key Topics:** Availability; Access; Utilization/diet; Stability
- **Question #4:** How do **policies** affect agricultural production and food security, now and in the future?
 - **Key Topics:** Trade; Governance; Property rights; Institutions; Water; Land;

Building Blocks to allow telescopic scales, feedbacks, and details

Regional research

on farming systems using biophysical and socioeconomic models



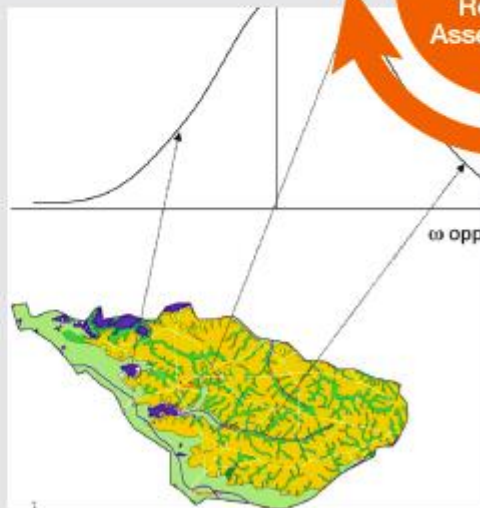
High-resolution gridded crop modeling

for gap-filling and aggregation in each region

Coordinated Global and Regional Assessments

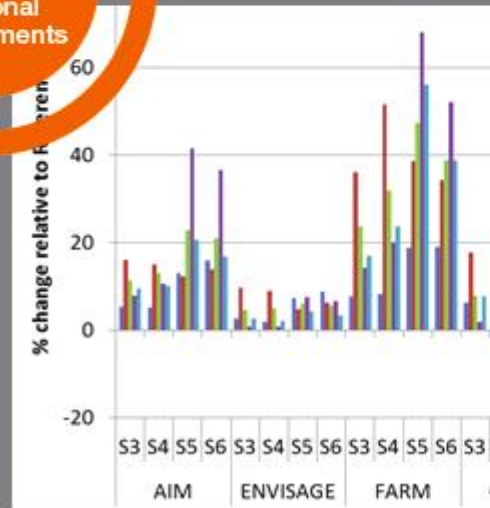
Production systems and regional economics

to respond to price changes

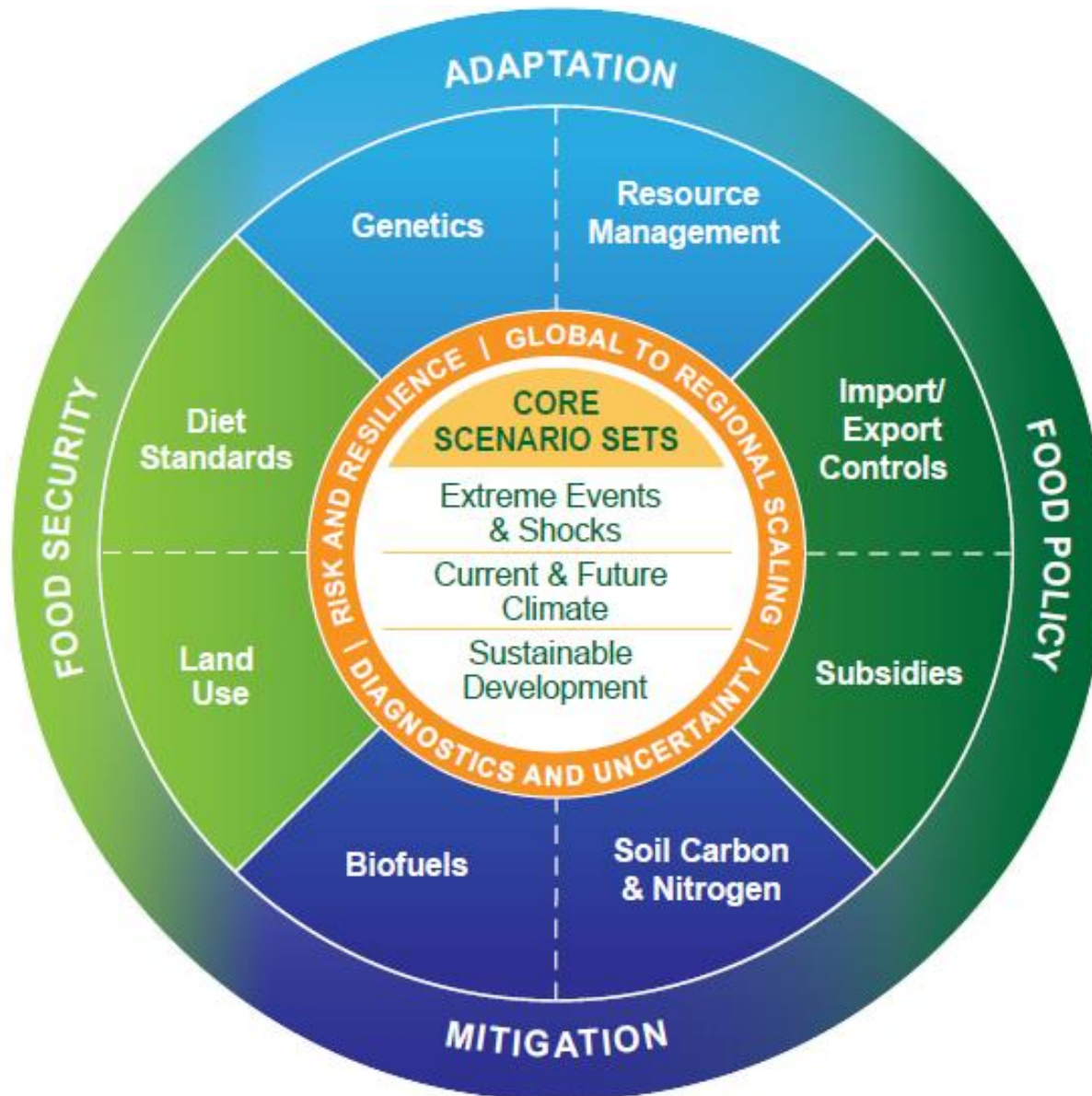


Global economics

with analysis of world and regional prices



CGRA Scenario Sets – Core Risk and Resilience Framing



- **Disciplinary linkages:** Linked biophysical and economic models
- **Scale linkages:** Consistency from local to global scales
- **Resolution of human outcomes:** Connections to nutrition and health
- **Continuum of time scales:**
current variability and extremes
near- and long-term outlooks
- **Scenarios** of adaptation, mitigation, food policy, and food security



Join us!



- **iCROPM Workshop**
Berlin, Germany
March 14-16, 2016

- **AgMIP6 Global Workshop**
Montpellier, France,
June 26-28, 2016



*For protocols, up-to-date events and news,
and to join AgMIP listserve* – www.agmip.org*

**Discussion – Questions;
Ideas; Opportunities?**



1. Scientific Integrity

AgMIP projects and activities must be based on good science and public-good products.

2. Conflict of Interest/Bias

AgMIP Steering Council, Principle Investigators, Team Leaders, and Partner Leads identify possible conflict of interest (NAS) and biases.

Advocacy

AgMIP promotes the best science for development, evaluation, and application of agricultural models

3. Open Data and Models

AgMIP endorses the use and development of open-source/open-access models, data and methods

5. Participation

AgMIP is committed to community building and strives to enable its teams and members in their regions, activities, and funding applications. AgMIP activities are open to all interested researchers and facilitate transdisciplinary integration.

6. Attribution

AgMIP publications attribute all intellectual contributions, including those related to both models and data

7. Flexibility

AgMIP is structured to facilitate the ongoing evolution of agricultural systems science

8. Investment in Future of Systems Research

Encourage new field, younger scientists, uptake of methods to curricula for education

Setup: Stakeholder Interactions Throughout!

- Building blocks self-organize
- Regions self-organize
- Science Integration Team determines driving scenarios
- Each region determines a network of representative crop/livestock modeling sites
- Crop/Livestock Teams identify additional sites of interest between regional networks
- Each region determines network of representative regional integrated assessments
- Climate team provides climate scenarios for each site/grid
- Regional experts work with global modelers to improve parameters

Execution:

- Crop/livestock modeling sites run by multiple models
- Global gridded models run
- Results compared and hybrid product created
- Global economic models run with hybrid crop/livestock drivers
- Regional economic models run RIAs with global economic model prices
- Food security models and metrics created
- Results provided to central, public-facing database

~2020: IPCC AR6 published

2019: CGRA research published

2018: CGRA conducted

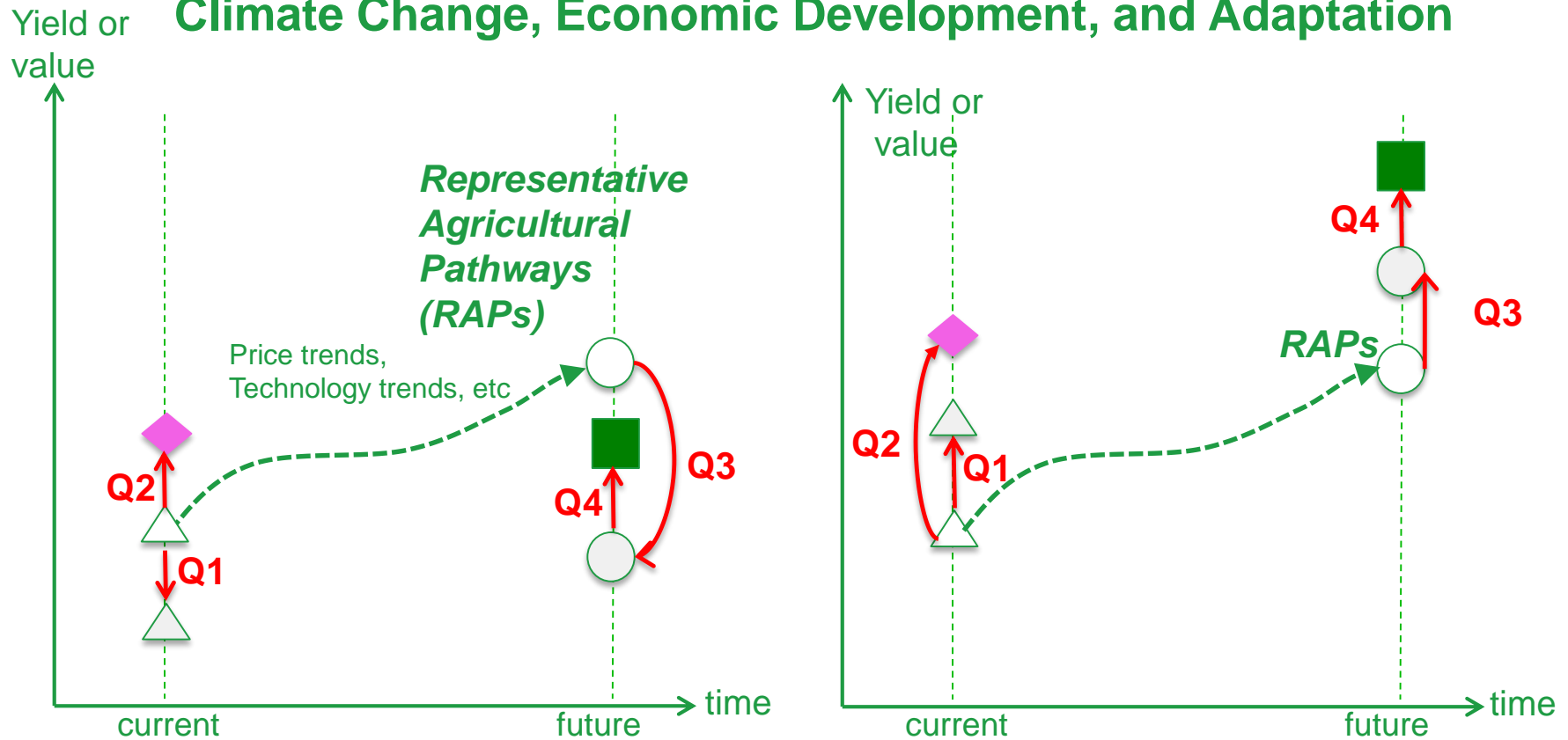
2017: Protocols finalized and CGRA begins

2016: Pilot projects for connections and protocols

2015: CGRA launch and coalition-building

AgMIP Core Research Questions:

Climate Change, Economic Development, and Adaptation



Q1: What is the sensitivity of current agricultural production systems to climate change? This question addresses the isolated impacts of climate changes assuming that the production system does not change from its current state.

Q2: What are the benefits of adaptation in current agricultural systems? This question addresses the benefit (e.g., economic and food security resilience) of potential adaptation options to current agricultural systems given current climate

Q3: What is the impact of climate change on future agricultural production systems? Assessment of climate impacts on the future production system, which will differ from the current production system due to development in the agricultural sector

Q4: What are the benefits of climate change adaptations? Assessment of the benefits of potential adaptation options in the future production system

AgMIP Regional Research Teams RAPs Trends Table: SSA (AgMIP, Phase I)

Variable	CLIP – R1 Zimb	CLIP – R2 Zimb	CLIP – R1 Mozamb	CLIP – R2 Mozamb	East Africa Embu, KE	West Africa R1 Nioro	West Africa R2 Nioro	SAAMIP South Africa	SAAMIP Namibia
Soil degradation									
Pest and diseases									
Extreme events									
Water availability									
Farm size									
Household size									
Herd size									
Livestock Productivity									
Fertilizer prices									
Fertilizer use									
Subsidies (inputs)									
Off-farm income									
Improved crop use									
Information availability									
Public invest in Agriculture									
Labor availability									

Direction and magnitude	
No change	
Small increase	
Moderate increase	
Large increase	
Small decrease	
Moderate decrease	
Large decrease	
Not included in RAP or under revision	

BAU Pessimistic

SSP2, period 2050