

## Joint Research Centre (JRC)



### MARS-AGRI4CAST Activity, 2011

Marcello Donatelli, Gregory Duveiller\*



## IES - Institute for Environment and Sustainability

*Ispra - Italy*

<http://ies.jrc.ec.europa.eu/>

<http://www.jrc.ec.europa.eu/>



## The IES MARS-AGRI4CAST Action runs:

The Crop Growth Monitoring System (CGMS), providing in season production estimates to DG AGRI;

Scenario analysis of climate change impact on agriculture, providing software tools, inclusive of data and models;

## MARS-AGRI4CAST activities have led to the development of:

Several weather database covering Europe, and areas in Latin America, Asia, and Africa;

A modelling platform, BioMA (Biophysical Model Applications), which allows running an extensible set of modelling solutions against a spatially explicit database.



### **The IES MARS-AGRI4CAST contribution to the EUROCLIMA project aims at:**

Developing a modelling platform for analyzing climate change impact on agriculture, and making it available, along with the necessary data, to Latin America stakeholders, starting with EUROCLIMA partners;

Develop sample analyses, with the target of making available concrete applications of the tools provided, to be used as walk-through examples to approach the modelling platform.

**The BioMA platform, along with data relevant to Latin America, is going to be made available to Latin American stakeholders;**



**Weather data are available as first option for baseline (ECMWF - European Centre for Medium-Range Weather Forecasts) and climate change scenarios (Hadley3 and NCAR Global Circulation Models);**

**Other layers of data, even at different spatial resolution, can be added, allowing for comparisons and/or ensemble runs;**

**The envisioned level of abstraction for the analysis to be run is “crop”, water and disease limited, at 25 x 25 km level;**

**The framework allows local re-use with more information, targeting more specific contexts, in this case including nitrogen and pesticides;**

**Simulations are carried out via modelling solutions;**

**A modelling solution is a discrete simulation engine where different models are selected and integrated in order to carry out simulations for a specific goal;**

**BioMA, the modelling platform, can be extended autonomously by third parties adding new modelling solutions;**

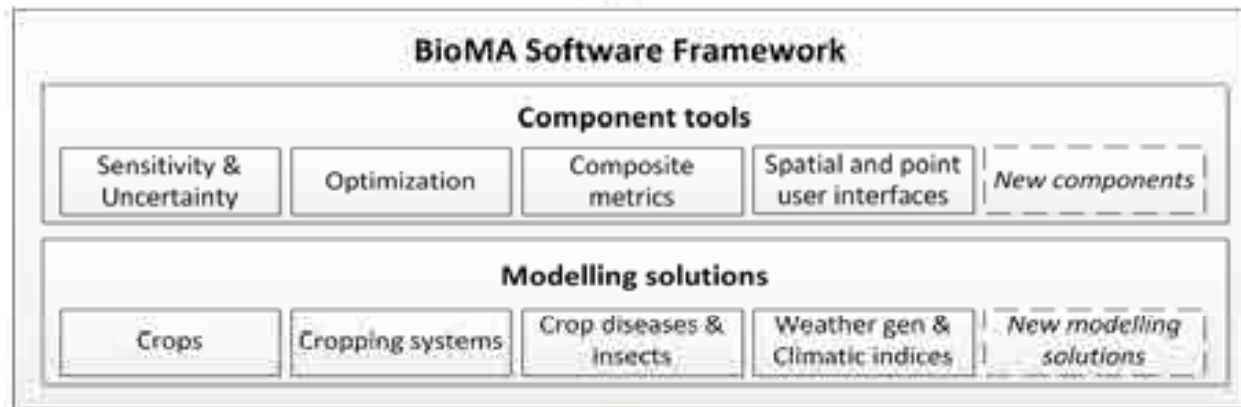
**The modelling solutions currently available are:**

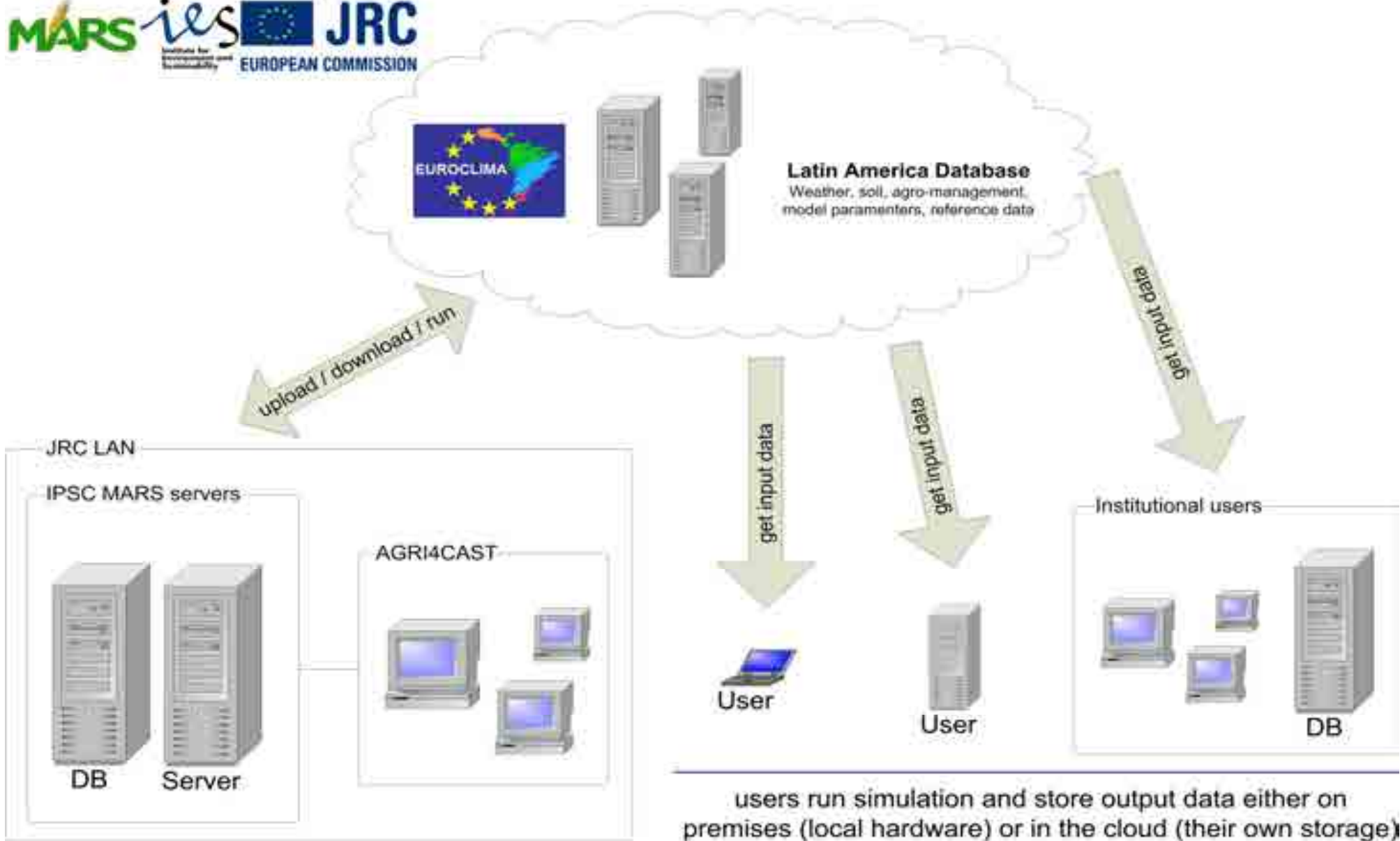
WARM-BlastDisease-Sterility	(rice)
CropSyst-Water Limited	(multiple-crops)
WOFOST-Water Limited	(multiple-crops)
APES	(cropping systems)
PotentialDiseaseInfection	(plant diseases - potential infection )
Diseases	(plant diseases - linked to crops)
ClimIndices	(weather indicators)

- **BioMA is an extensible platform for running biophysical models on generic spatial units.**
- **It is based on discrete conceptual units codified in software components (both for simulation engines and user's interface)**
- **The guidelines followed during its development aim at maximizing:**
  - Extensibility with new modelling solutions
  - Ease of customization in new environments
  - Ease of deployment

**BioMA hence neither is “a model” nor it suggests that a model should be used; instead it allows using known and new modelling approaches.**

Bio-physical Model Applications Framework







# ACTIVITY 2011

### **Development of the data layers:**

- Prototype time series (GCM:Hadley3 - NCAR; SRES: A1B, B1; ref.year 2020 and 2050);
- Soil DB for biophysical simulation;
- Crop masks and basic crop agro-management;
- Preliminary crop simulation (maize, soybean, wheat, rice), water and diseases limited.

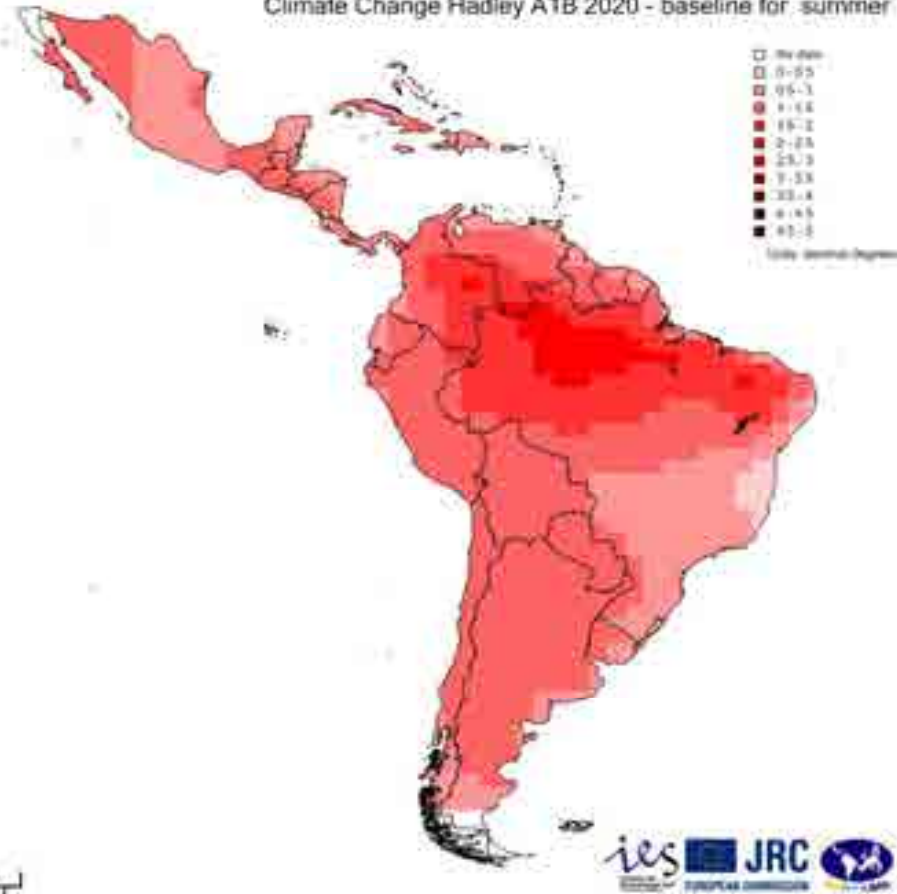
### **Development of BioMA modelling solutions and tools:**

- Web portal and Latin America map layers;
- Modelling solution for simulation of crops coupled to diseases;

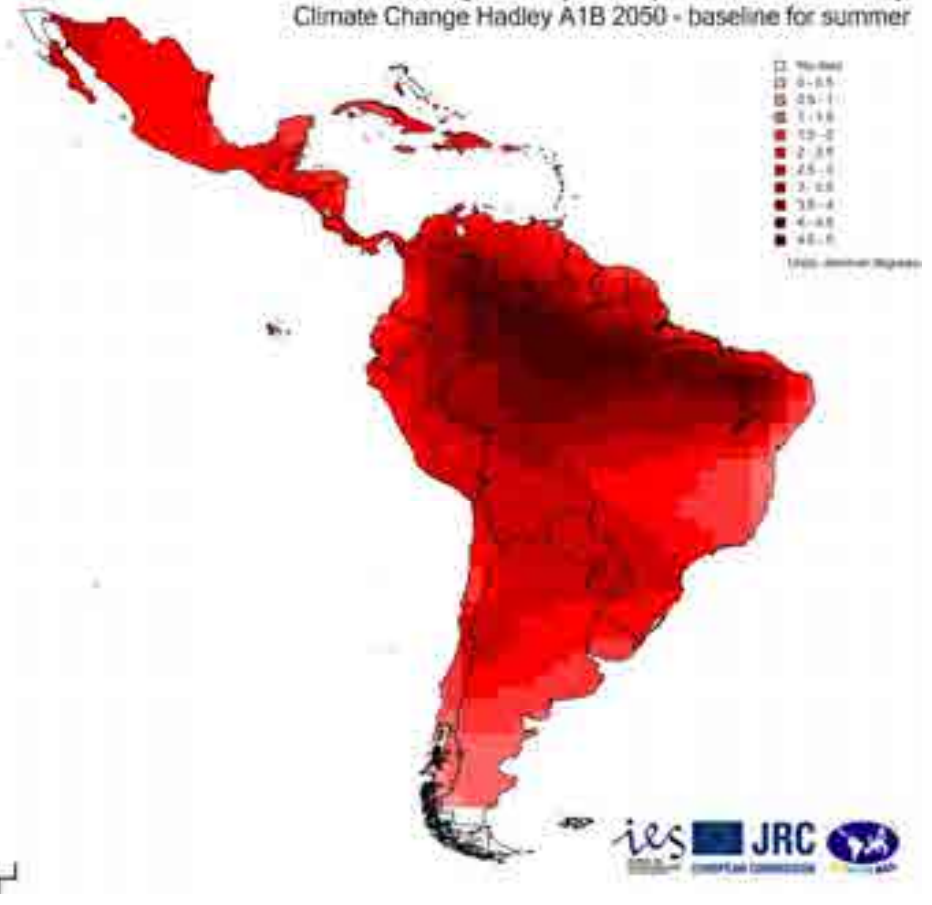
### **Workshop in Campinas, Brasil, August 2011.**



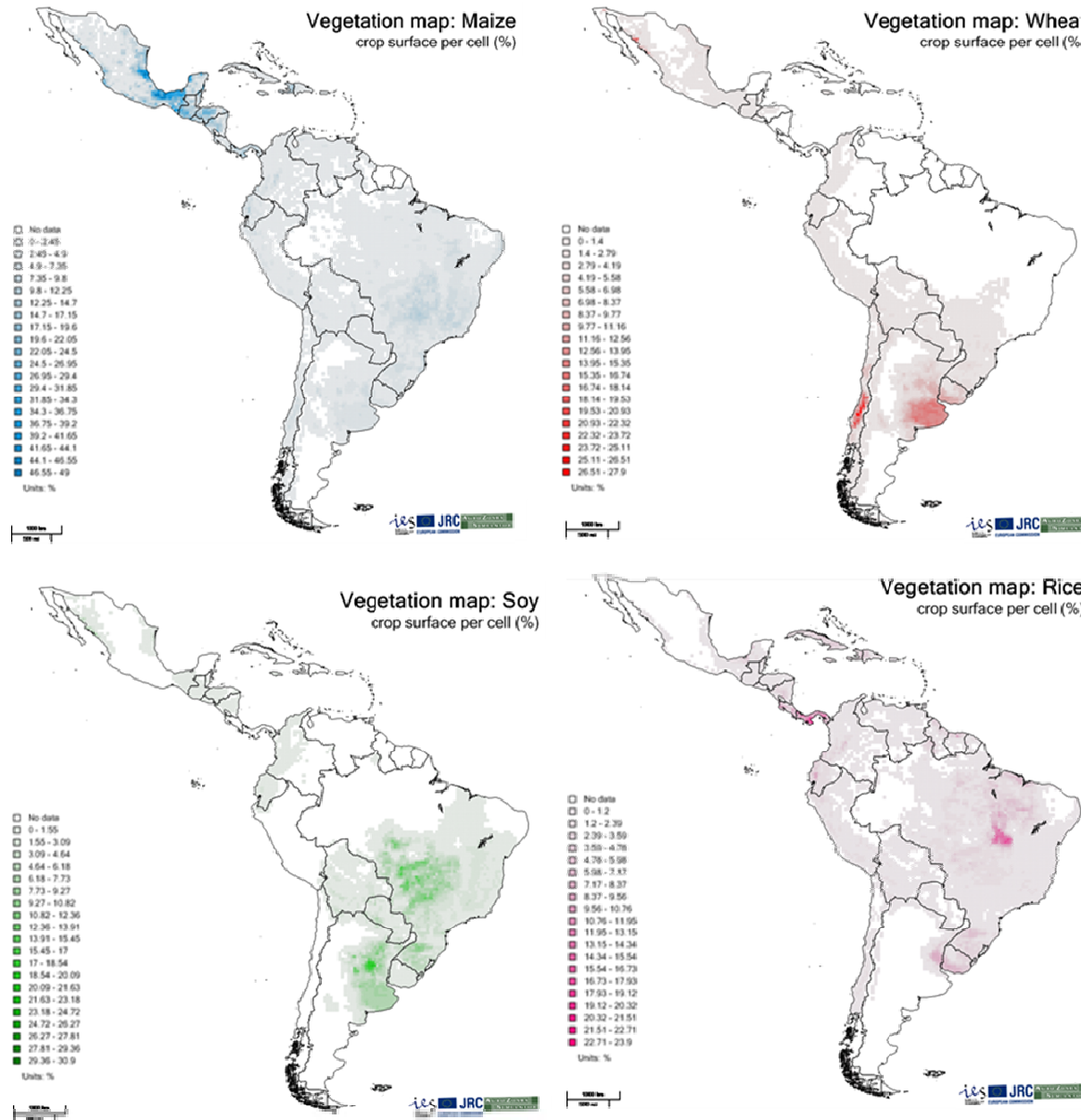
**Average Daily Temperature Anomaly**  
Climate Change Hadley A1B 2020 - baseline for summer

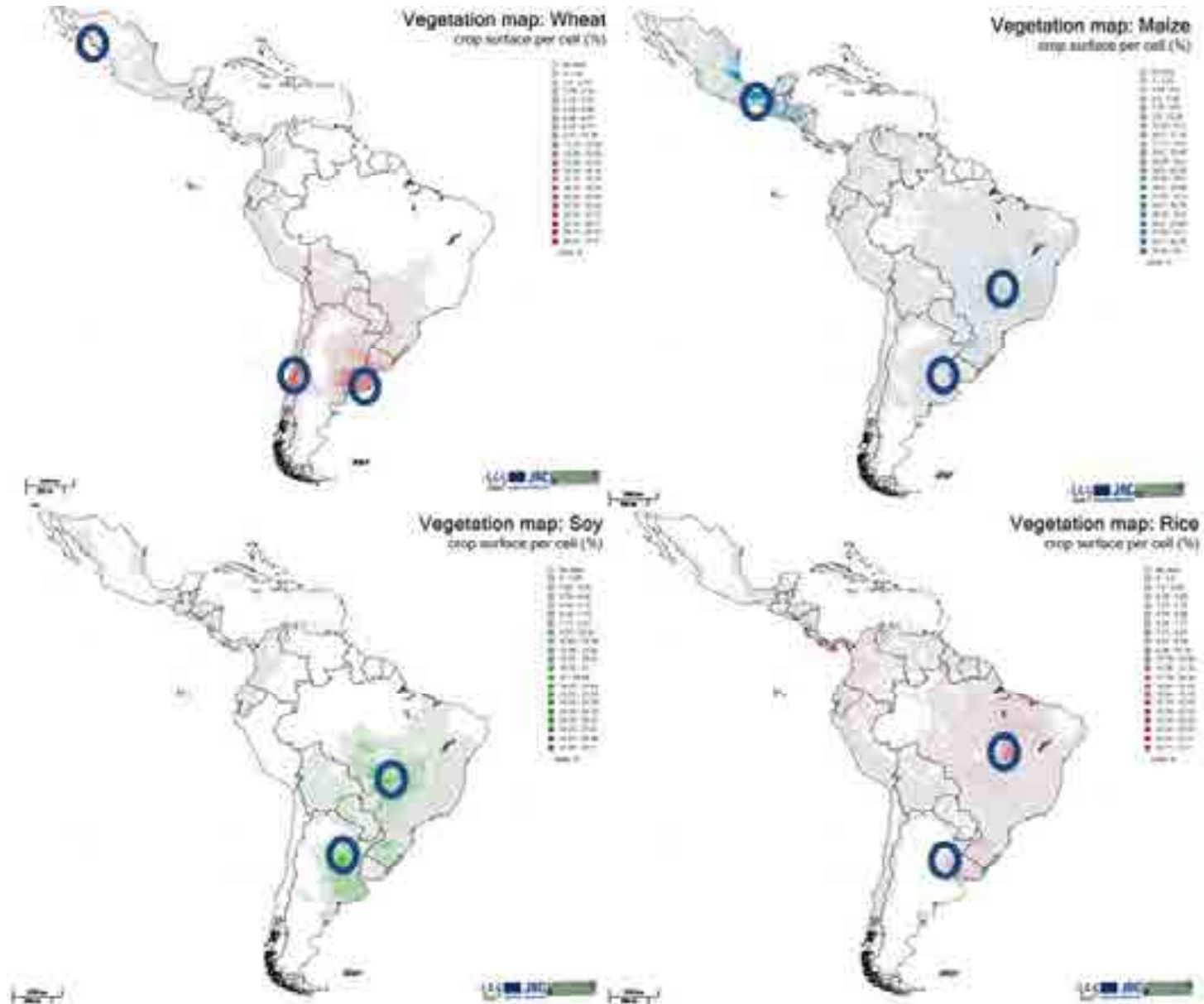


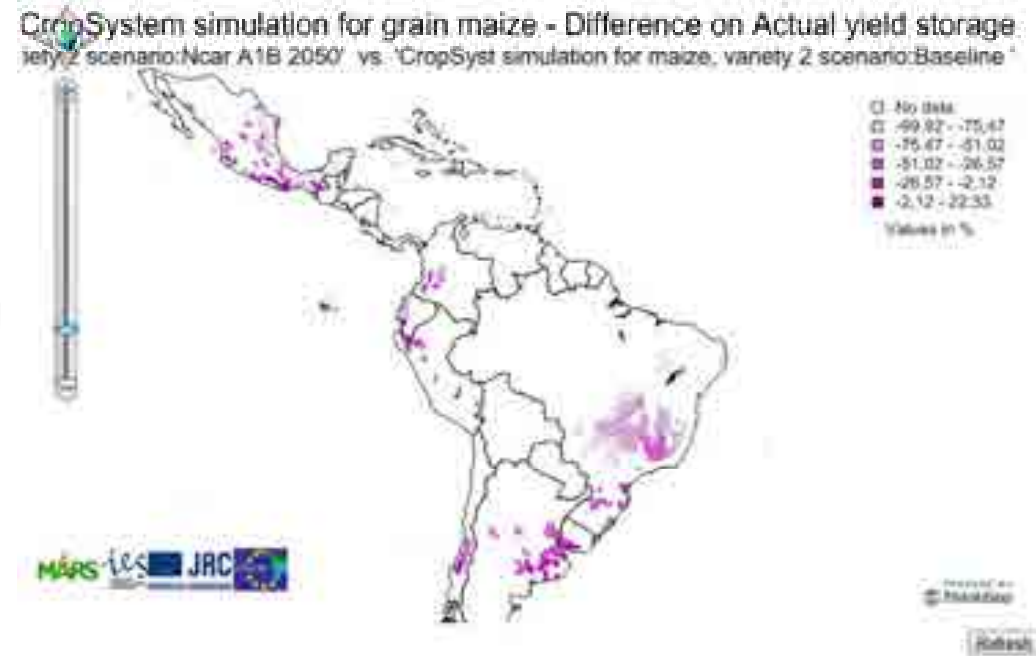
**Average Daily Temperature Anomaly**  
Climate Change Hadley A1B 2050 - baseline for summer







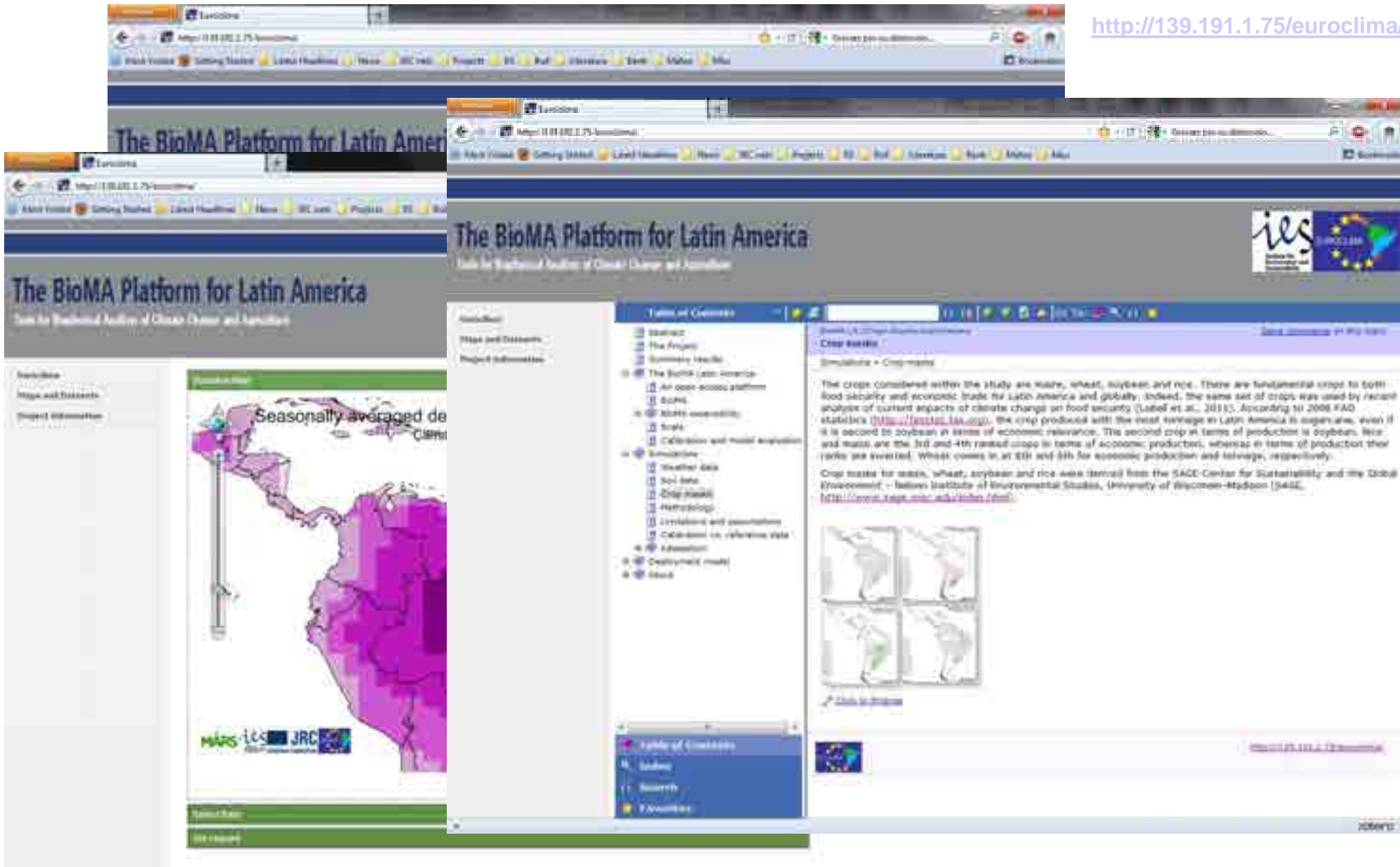








<http://139.191.1.75/euroclima/>



**The BioMA Platform for Latin America**  
Link to National Institute of Climate Change and Innovation

**Table of Contents**

- Abstract
- The Project
- Summary Results
- The BioMA Latin America
  - An open access platform
  - Data
  - Climate scenarios
  - Simulation
  - Weather data
  - Soil data
  - Crop models
  - Hydrology
  - Vegetation and pasture
  - Cadastral vs. reference data
  - Assessment
  - Deployment mode
  - About

**Crop status**

The crops considered within the study are maize, wheat, soybean and rice. These are fundamental crops to both food security and economic trade for Latin America and globally. Indeed, the same set of crops was used by recent analysis of current aspects of climate change on food security (Lal et al., 2011). According to 2008 FAO statistics (<http://www.fao.org>), the crop produced with the most tonnage in Latin America is sugarcane, even if it is second to soybean in terms of economic relevance. The second crop in terms of production is soybean, rice and maize are the 3rd and 4th ranked crops in terms of economic production, whereas in terms of production their ranks are inverted. Wheat comes in at 5th and 6th for economic production and tonnage, respectively.

Crop traits for maize, wheat, soybean and rice were derived from the SAGE Center for Sustainability and the Global Environment - Illinois Institute of Environmental Studies, University of Wisconsin-Madison (SAGE). (<http://www.sage.wisc.edu/index.html>)

## The Latin America and Caribbean Project on Climate Change and Agriculture: A Bio-Economic Analysis



AGRO ZONES  
SIMULATOR

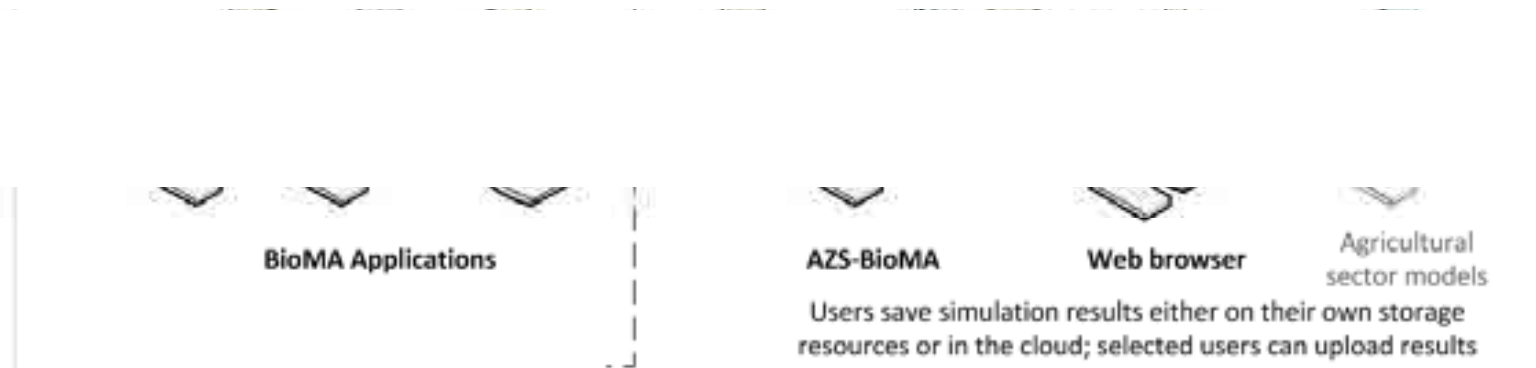




## Report:

### **LCSAR – The World Bank Assessing the Impacts of Climate Change on Agricultural Productivity in Latin America and the Economic Implications. (2020 – 2050)**

**Confalonieri, R., Donatelli, M., Tubiello, F., van der Mensbrugge, D., Soliman, A., Nash, J., and Fernandes, ECM. [TTL, LCSAR]  
5/31/2011**



**Muchas gracias por su atención...**

**JRC MARS-AGRI4CAST**

<http://mars.jrc.ec.europa.eu/mars/About-us/AGRI4CAST>

