An open-source geospatial cyberinfrastructure for interdisciplinary collaboration and broader engagement

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Universities

• Resources and expertise
  + High performance computing
  + Scientific data
  + Scientific models
  + Geospatial data processing, visualization
  + Research on policy impacts
  + Data curation
  + ... ...

• These tend to be
  – Developed in silos
  – Do not play with each other
  – Low usability (e.g., outside small groups)
  – High learning curves
  – Sustainability challenge (funding, etc)
  – ... ...
Going beyond laptop computing

More computing power

Visualize geospatial data

Publication linked to data and model, and always available!

Data management, version control

Share data, and code

Ag economist studying cropland supply -> SIMPLE-G

Pre-saved grid-cell level estimates, containing 'iso'

Merge by 'iso'

User-defined mapping file, containing 'iso'

Merged file

Choose Market Access

Aggregate grids to 'region'

- CET elasticity
- Land supply elasticity
- Land conversion area

Update grid-cell value

Map
It is definitely not trivial to deal with geospatial data (processing, displaying, exchange/sharing, etc).

Choices, choices, choices ...
What we really need ....

• A seamless cyberinfrastructure that encapsulates
  ▪ High performance computing resources
  ▪ Data management
  ▪ Geospatial data capabilities
  ▪ Multi-scale data transformation and models
  ▪ Sharing and collaboration around data

• And also
  ▪ Easy to use
  ▪ Open access
  ▪ “Lights on” all the time
What is GeoHub?

A web portal?

- **GLASS**: Global to local analysis of systems sustainability to meet the Sustainability Development Goals on a changing planet with limited land and water resources.
- **Useful to Usable (U2U)**: Transforming Climate Variability and Change Information for Cereal Crop Producers, is an integrated research and extension project working to improve farm resilience and profitability in the North Central Region by transforming existing climate information into usable knowledge for the agricultural community.
- **GABBs – Geospatial Building Blocks**: An NSF Data Infrastructure Building Blocks project to integrate geospatial capabilities in HUBzero and make it easy for non-GIS experts to store geospatial data, create, and deploy interactive applications on the web.
- **Water hub**: Water HUB is an open platform for connecting hydrologists through sharing of hydrologic information, data, models, and simulation tools, connecting researchers and students to high-performance computation and data resources, and connecting science and people through shared knowledge and decision-making tools and information.
GeoHub

A comprehensive cyberinfrastructure

Hub Installation

Web Server

Execution Host

Execution Host

G·A·B·B·S
geospatial data analysis building blocks

PURDUE UNIVERSITY

XSEDE

Geoserver

PostGIS

Solr

iRODS

 Globus online

Web Server

Hub Install
Role of GeoHub in GLASS

- Maps, Data Visualization & Exploration
- Analysis of Tradeoffs and Synergies Policy Briefs
- Modeling Frameworks & Computation
- Community Interactions and Group Collaboration
- Training, Courses, Crowd Sourcing
RESEARCH HIGHLIGHTS

Employing Global-to-Local Analysis of Systems Sustainability Approach

Evolution of the Irrigation vulnerability index over the period: 2005-2050

SIMPLE-on-a-Grid (SIMPLE-G) - a multi-region, partial equilibrium model of gridded cropland use, crop production, consumption and trade.

Historical Irrigation Dataset (HID) – A global dataset of the extent of irrigated land from 1900 to 2005.

Impacts of climate change on crop yields and economic welfare: meta-analysis of process-based and statistical models.
SIMPLE-G – SIMPLE on a grid

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SIMPLE-G

Category: Tools
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Abstract

SIMPLE-on-a-Grid (SIMPLE-G) is a multi-region, partial equilibrium model of gridded crop land use, crop production, consumption and trade. It is an extension of the SIMPLE model that has been applied to study long run sustainability issues in the global food-water- environment nexus. Rather than looking at regions or country aggregates, SIMPLE-G divides the world into georeferenced grid-cell units. This allows SIMPLE-G to explicitly incorporate local environmental constraints in its projections, account for sub-national heterogeneity of global drivers such as climate change and water scarcity, and assess local land and water use given future trends in the global farm and food system.

In SIMPLE, the world is split into sixteen economic regions. Regional consumption is disaggregated into four commodities: crops, livestock, processed foods
Set up, Run, & Visualize
FLAT – Fine-scale Land Allocation Tool
Other relevant tools

AgMIP Data Aggregator

Climate Scenario Aggregator (CMIP5 data)
Global Change and the Challenges of Sustainably Feeding a Growing Planet

This online resource contains materials for teaching a graduate-level course on global agricultural change and food sustainability. It heavily draws from the textbook "Global Change and the Challenges of Sustainably Feeding a Growing Planet" by Thomas Hertel and Urs Lantz Baldos including supplementary reading materials and lab assignments using the SIMPLE model.

Feeding the world's population while ensuring the environmental sustainability is one of the world's 'grand challenges'. As we look ahead to the middle of this century, will the world's agricultural resource base be up to the task of meeting the diverse demands being placed on it by growing population, rising incomes, growing biofuel production and rising demand for land-based environmental services?

This online resource contains materials based on a graduate-level course offered at Purdue University on global food sustainability. It heavily draws from the textbook "Global Change and the Challenges of Sustainably Feeding a Growing Planet" by Thomas Hertel and Urs Lantz Baldos including supplementary reading materials and lab assignments using the SIMPLE model.

The course is designed for 14 weeks with each week allotted to a topic on global agricultural change. Beginning the week with an overview lecture by a faculty member with expertise in this area, followed by student-led discussion of the readings and book chapter - leading into discussion of the lab assignments and a review of the basic principles of economics.

Half a dozen lab assignments which use the SIMPLE model are spaced out over the first 10 weeks of the semester. The labs are drawn from the empirical examples at the end of each chapter, sometimes consolidating several themes into one assignment.

For comments / questions / recommendations, please contact Urs Baldos (ucbaldos@gmail.com)

Data Modified: 07/2016
Geospatial data is interesting!

Middle & high school students at summer camp
In addition to common science gateway functions:

- **Integrated** data management environment with **built-in** geospatial data support
- Toolkits for rapid application development, **no GIS programming expertise** required
- Data visualization builders and tools that require **no programming**
- Production system open to research and education use, 24x7 (**all related servers, services**)