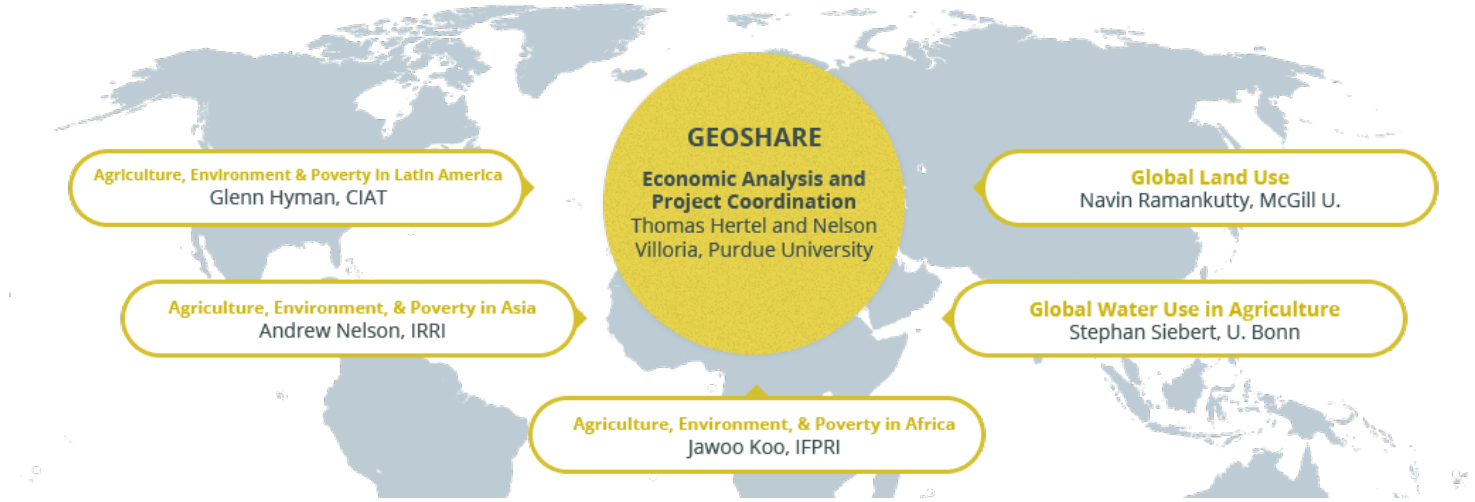
AgMIP Data Aggregator: Leveraging Globus Online and HUBzero To Make Global Spatial Data Accessible

Lan Zhao, Carol X. Song, Nelson B. Villoria, Hongjun Choi, Steve M. Clark
Purdue University

What is GeoShare?

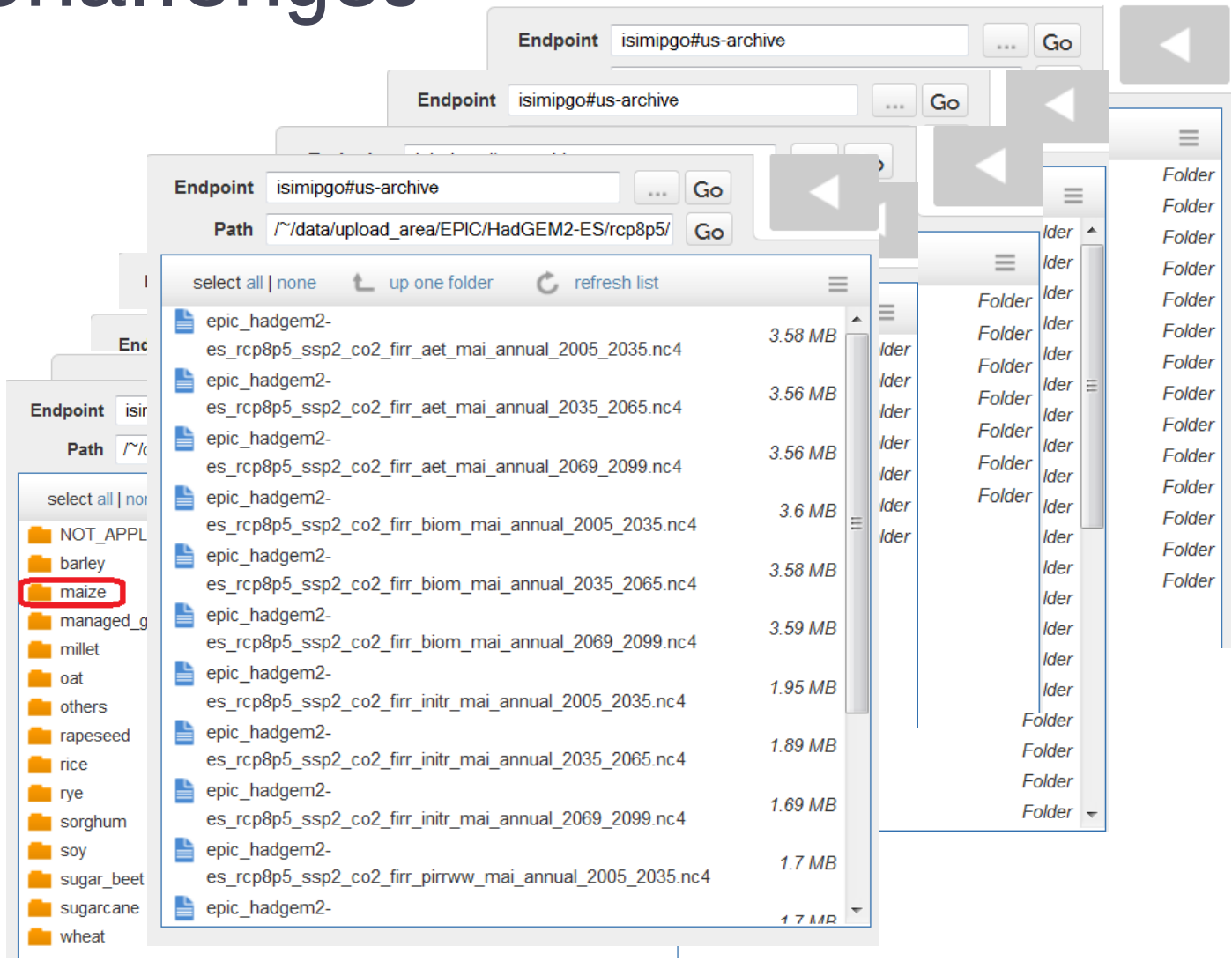
- **Ge**ospatial **O**pen **S**ource **H**osting of **A**griculture, **R**esource & **E**nvironmental Data for Discovery and Decision Making
- Develop and maintain a freely available, global, spatially explicit database on agriculture, natural resources, and the environment accompanied by analysis tools and training programs for **scientists, decision makers, and development practitioners**



The AgMIP Data Initiative

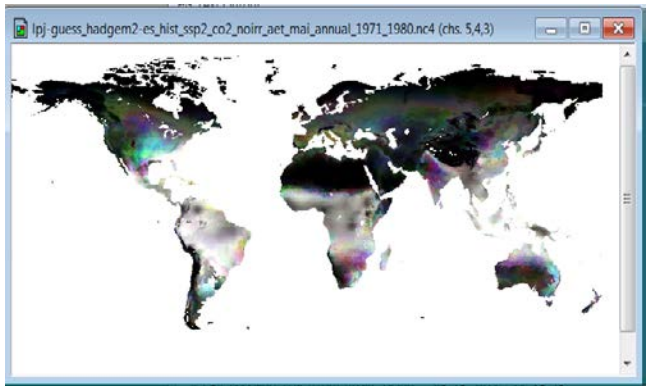
- **Ag**ricultural **M**odeling **I**ntercomparison and Improvement **P**roject
- To improve models used for analysis of climate impacts on agriculture
- Fast-track multi-model multi-sector climate impact assessment (part of ISI-MIP/AgMIP):
  - 7 Crop Models
  - 5 Global General Circulation Models
  - 5 Representative Climate Pathways (RCPs)
  - CO2 Fertilization and irrigation
  - 12 Crops
  - All the combinations ran from 1971 to 2099
- + 36,000 0.5^0x0.5^0 grids with crop yields
- isimipgo#us-archive

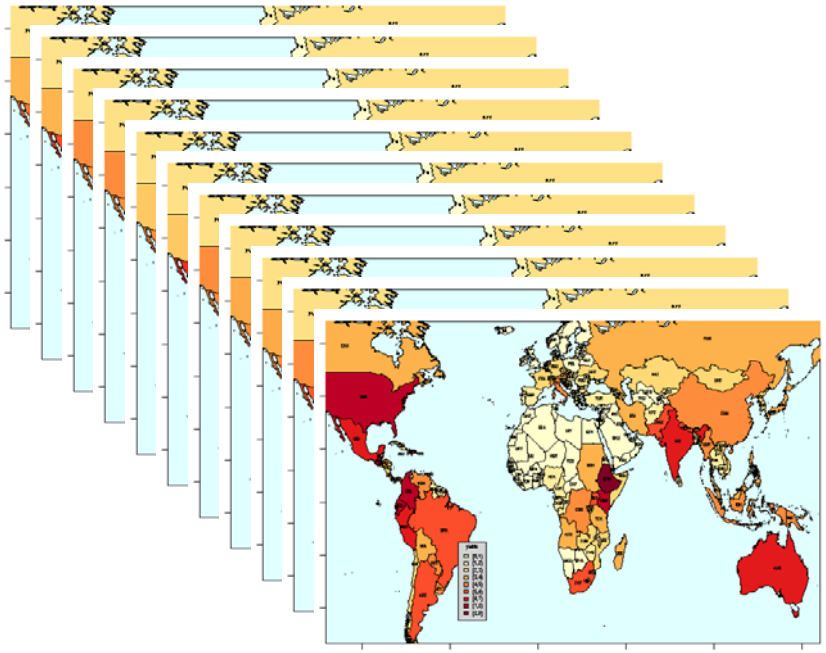
The Challenges



The Challenges

lpj-guess_hadgem2-es_hist_ssp2_co2_noirr_aet_mai_annual_1971_1980.nc4





Total Number of Pixels = 259,200
10 Channels
360 lines, 720 columns

10 ascii files aggregated to country level

The Challenges

- Data discovery
  - Difficult to navigate and locate data
- Data download
  - Globus Connect
- Data processing
  - Netcdf4 format, 5-10 year slices
- Data storage

AgMIP Data Aggregator

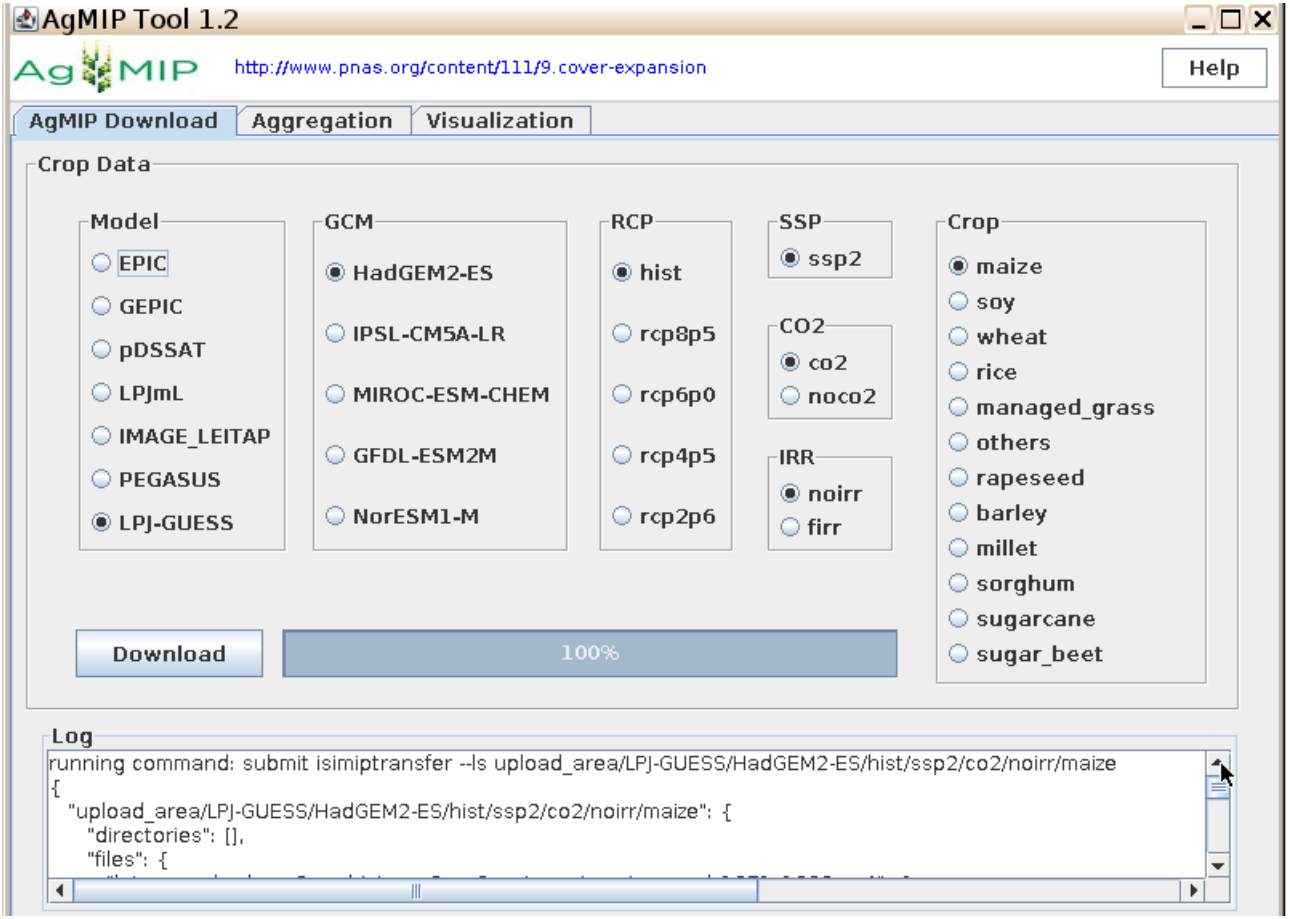
- Integrate Globus Online into HUBzero
  - Globus connect end point on the web server
  - Service wrapper to globus client commands

    $ submit isimiptransfer –help

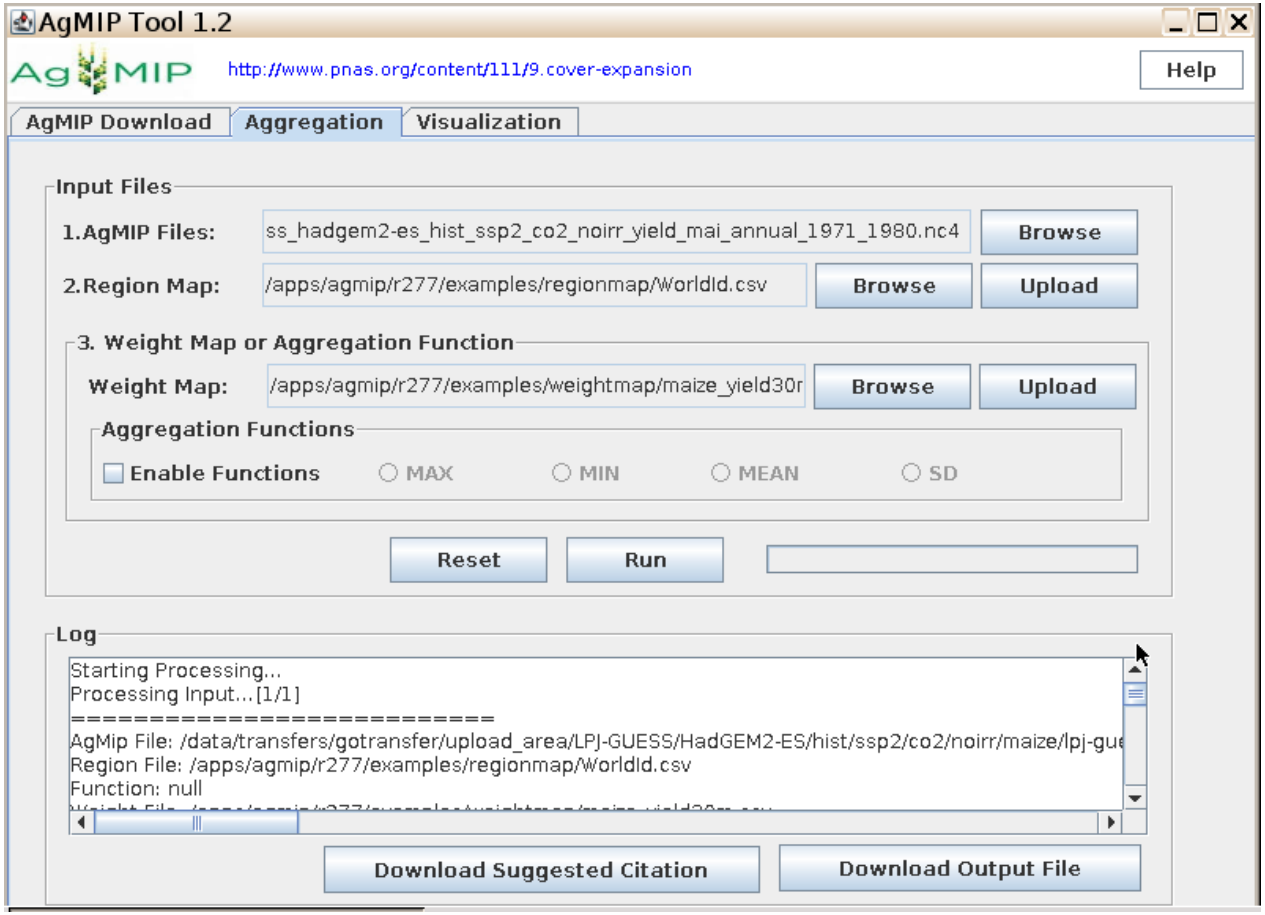
    Usage: isimiptransfer.py [huboptions]

    Options:
    -h, --help show this help message and exit
    -l DIRREQUESTS, --ls=DIRREQUESTS
    --lsroot
    -g GETREQUESTS, --get=GETREQUESTS
  - Can be extended to connect to other end points

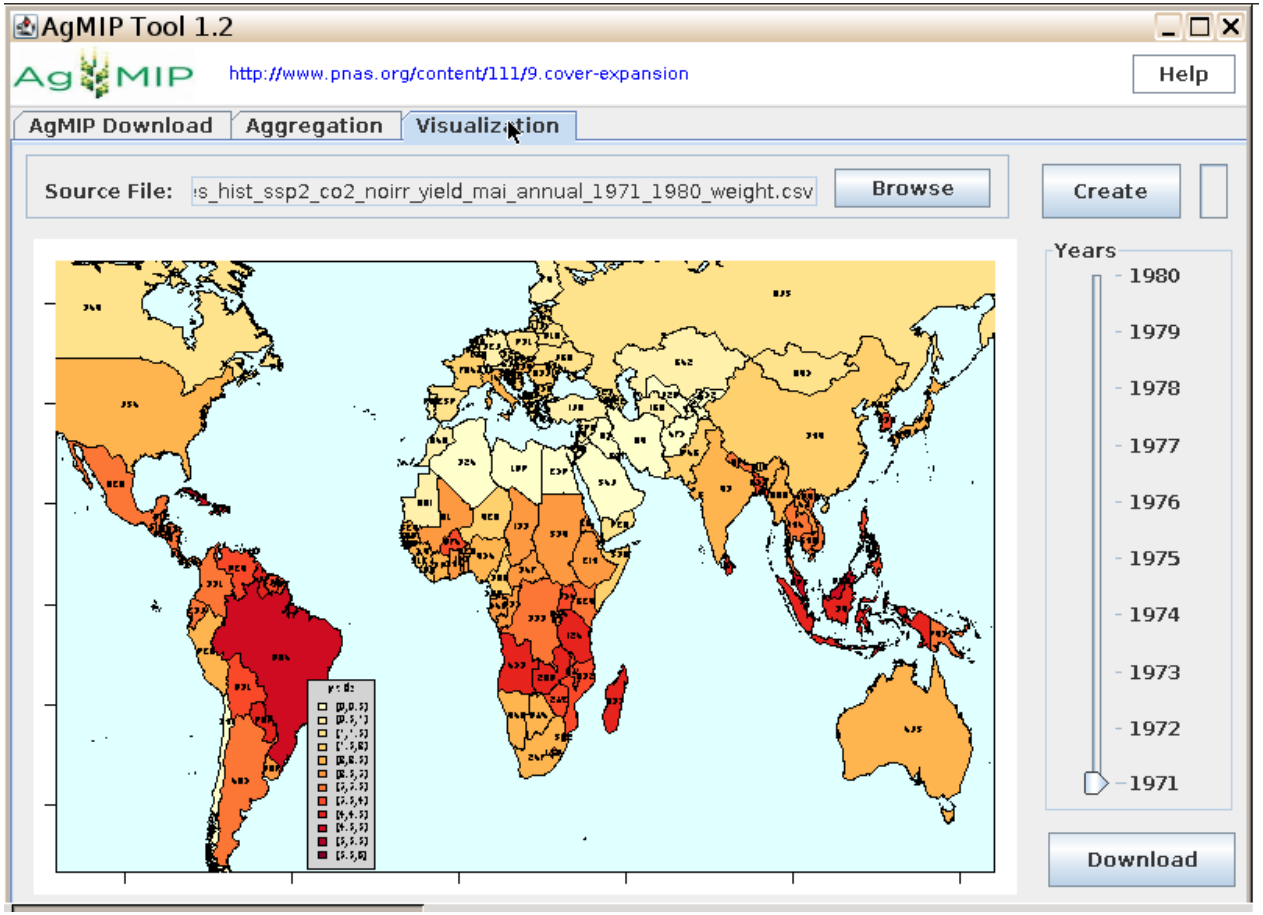
AgMIP Data Aggregator



AgMIP Data Aggregator



AgMIP Data Aggregator



AgMIP Data Aggregator

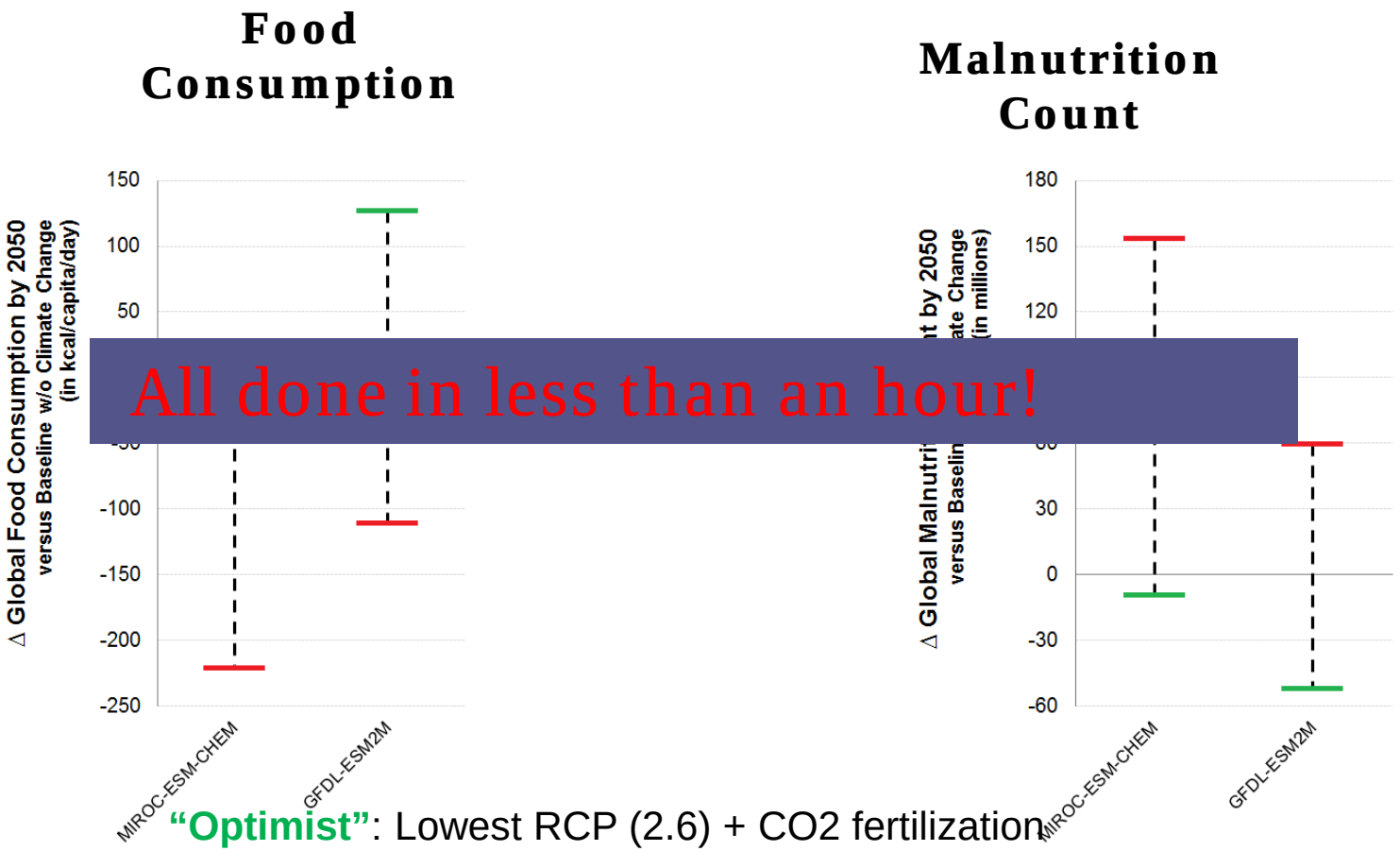
- Easy to use user interface to select data to download
- Integrate with HUBzero GO service at the backend
- R script to aggregate the AgMIP output to any user defined levels using different functions
- Map Visualization
- Metadata

Use Case

- Climate change impacts on food security in 2050 by Uris Baldos
  - Climate impact on yield scenarios:
    - Crop model: PEGASUS
    - GCMs: MIROC-ESM-CHEM, GFDL-ESM2M
    - No CO2 fert./RCP8p5 pessimist vs. CO2 fert./RCP2p6 optimist
  - SIMPLE: an economic model of agriculture
  - Change in crop prices, caloric consumption, caloric malnutrition headcount in 2050

Courtesy of Uris Baldos, Purdue University

Use Case



"Optimist": Lowest RCP (2.6) + CO2 fertilization

"Pessimist": Highest RCP (8.5) + no CO2 fertilization

Courtesy of Uris Baldos, Purdue University

Future Work

- Work with the GABBS project to develop geospatial building blocks
  - GlobusOnline data transfer
  - Geospatial data aggregation
  - Publish/share model output
  - Geospatial data driven modeling workflows

- GeoShare hub: https://geoshareprojects.org
- AgMIP tool: https://mygeohub.org/resources/agmip
- AgMIP: http://www.agmip.org/