



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

Geospatial-enabled Data Exploration and Computation through Data Infrastructure Building Blocks

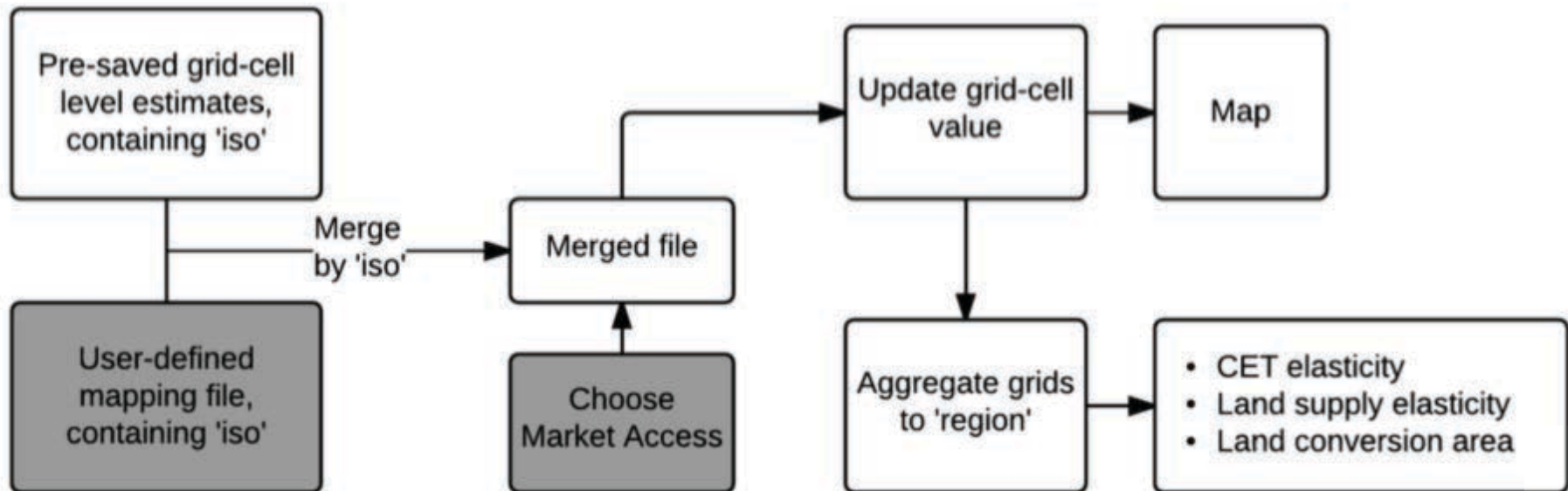
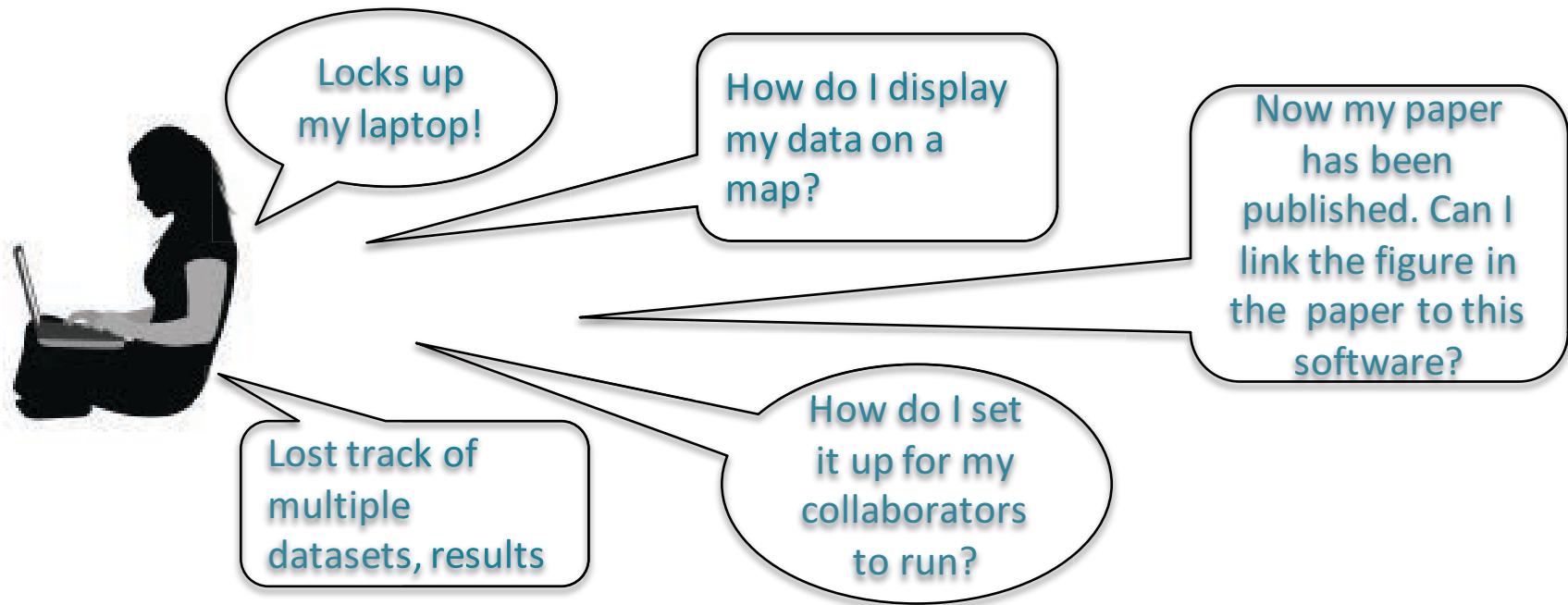
Carol Song, Larry Biehl, Venkatesh Merwade (Purdue University)
Nelson Villoria (Kansas State University)

Presented at:

AGU Falling Meeting, Dec. 18, 2015

IN51C: Exploiting Big Earth Data: Computation, Testing, and CyberGIS II

Today, a scientist... ..



What if ...

Result: Predicted Cultivation Probability

Lat/Long: 13.363°, 39.257°

Layers

- OSM Map
- Landuse Probability

0 1

Opacity

1 result

< Input

Simulate >

Upload data: Africa regions (example mapping data)

Upload file:

```
"iso" "region"
"ZAF" "S"
"LSO" "S"
"NAM" "S"
"SVZ" "S"
"BWA" "S"
"MOZ" "E"
"MDG" "E"
"ZWE" "E"
"AGO" "C"
"ZMB" "E"
"MWI" "E"
"COD" "C"
"ZEA" "E"
"COD" "C"
"KEN" "E"
"BDI" "E"
"GAB" "C"
"RWA" "E"
"UGA" "E"
"SON" "E"
"GNQ" "C"
"CMR" "C"
"CAF" "C"
"SDN" "N"
"ETH" "E"
"LEB" "W"
"CIV" "W"
"NGA" "W"
"CHA" "W"
"TOG" "W"
"BEN" "W"
"SLC" "W"
"GIN" "W"
"COD" "C"
"BFA" "W"
```

Market access: 500

Land cover category: Forest

Simulate >

Tool created by
Jing Liu & Nelson Villoria,
Agricultural Economics



Users need more than maps

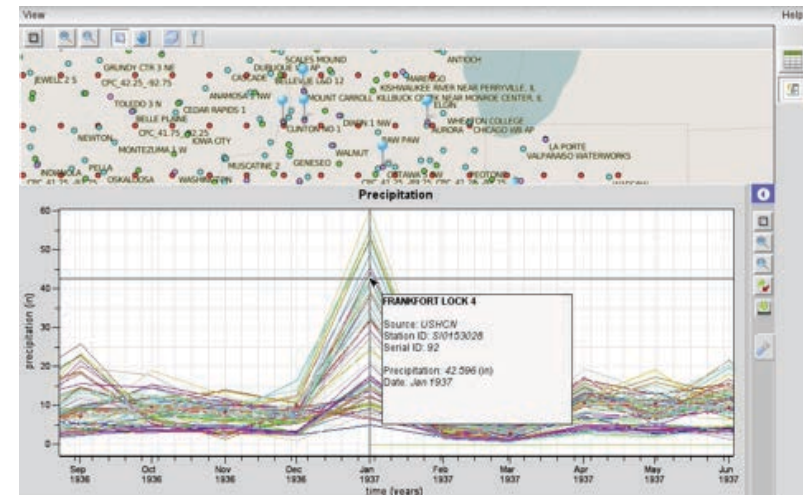
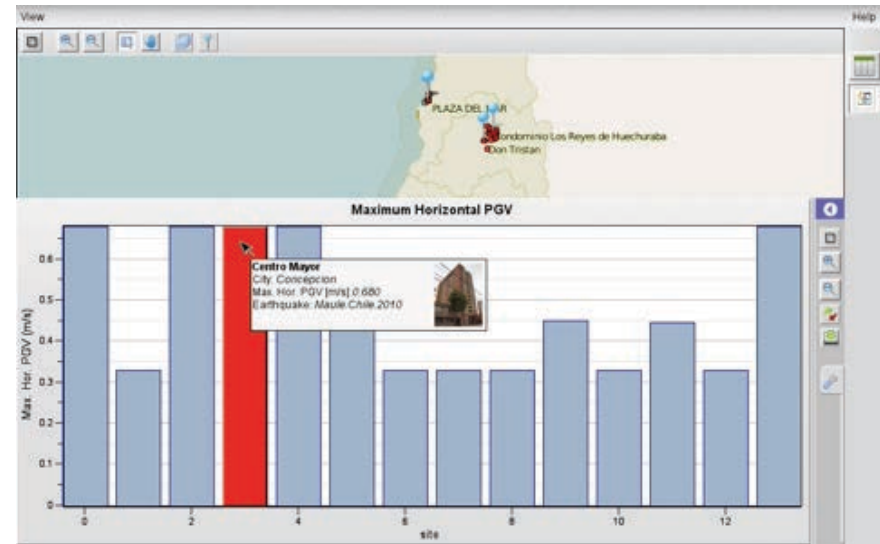
Systems to support various computation paradigms

City	Closest Station ID	Distance To Closest Station (km)	Stories above Ground	Typ. Plan Shape
Viña del Mar	8	1.38426297580296	15	Empty
Viña del Mar	8	1.23945717169273	14	Top 10
Concepcion	25	1.20363834359778	15	Bottom 10
Concepcion	25	1.47988955193215	13	L shape
Concepcion	25	0.624913522391941	22	Other
Concepcion	25	0.416509087044445	17	Rectangular
Coronel	9	16.349826071998		Rectangular

Spreadsheets



Image galleries



Plots / bar graphs



GABBs: Geospatial Data Building Blocks

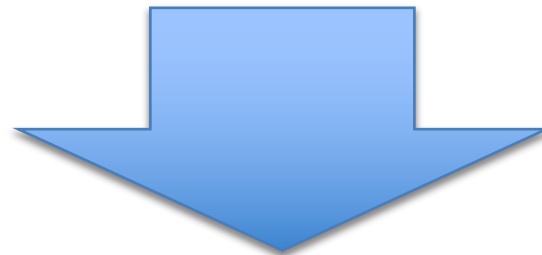
An NSF Data Infrastructure Building Blocks (DIBBS) project

Lower the **barrier**

Make it easy to **visualize** geospatial data

Make it easy to **share** geospatial/georeferenced data

Open source, community driven



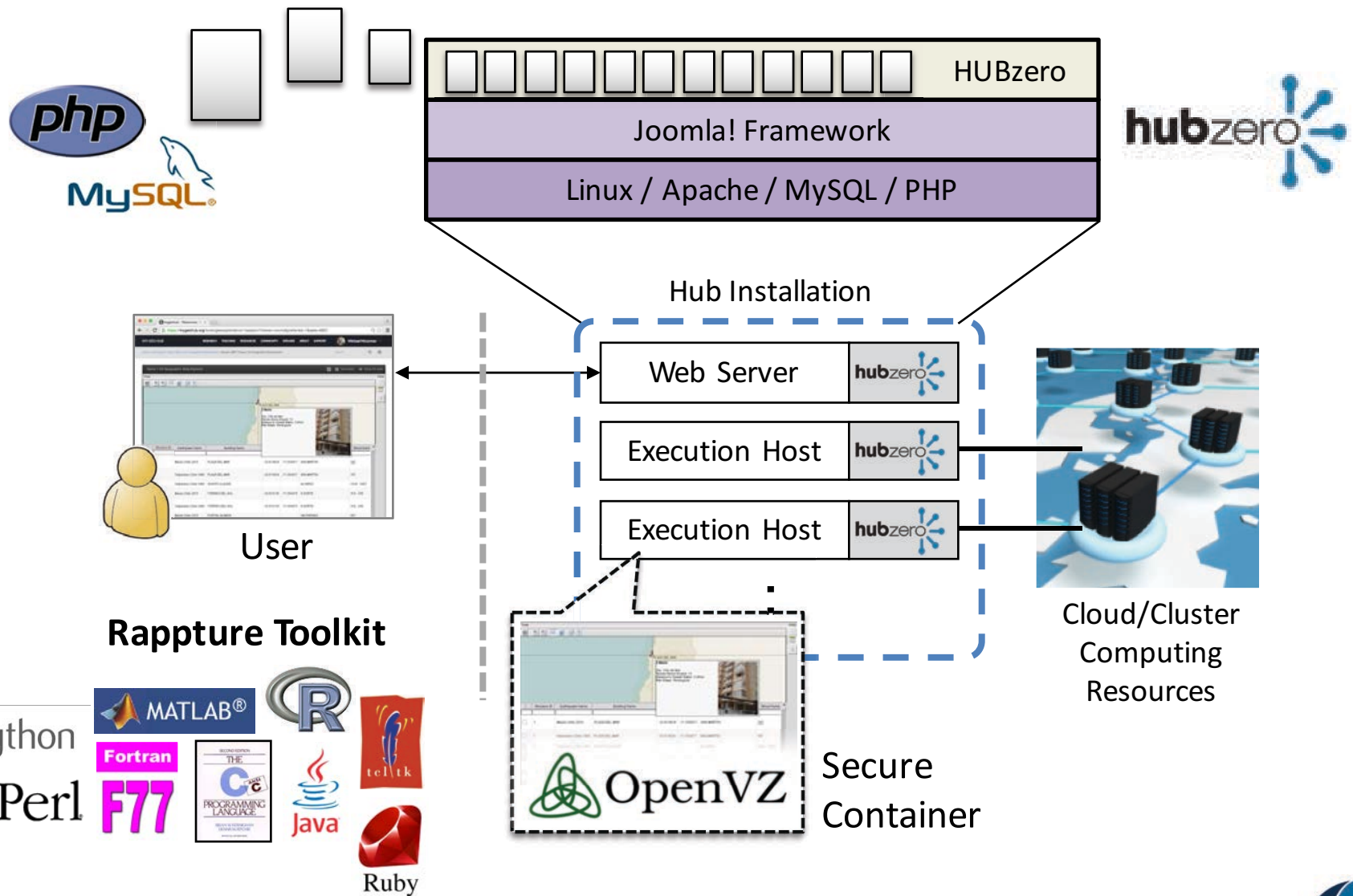
Broaden participation

Faster **dissemination**

Enhance **learning**



HUBzero Platform for Scientific Collaborations



GABBs Architecture

End User

Compute and analyze Explore and visualize data Share & Publish

New Capabilities

Maps Control widgets Data presentation Remote servers

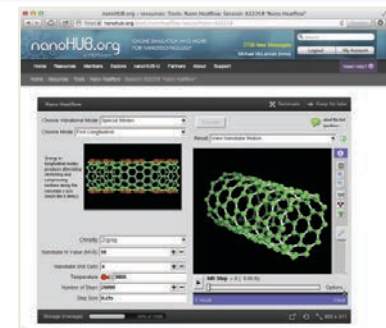
Overlays Data processing Tool builder

Geo-processing Data formats Standard protocols

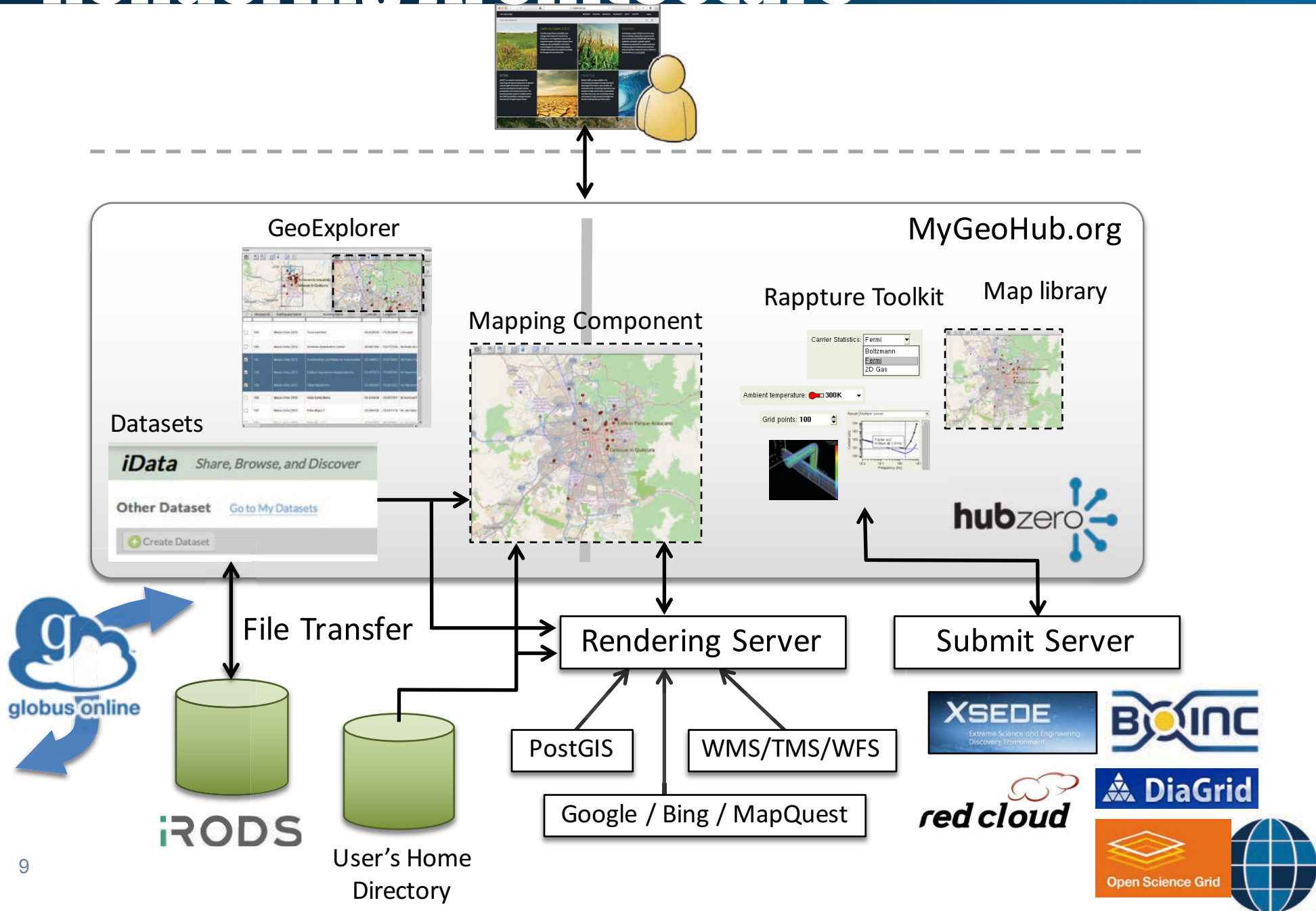
Data management Data sharing Data-Tool connectors



HUBzero Platform for Scientific Collaboration
 Computation tools and online databases, Content publishing, Collaboration (group, project), Learning (courses, self-help), Support (tickets, Q&A), Community (forum, review, calendar)

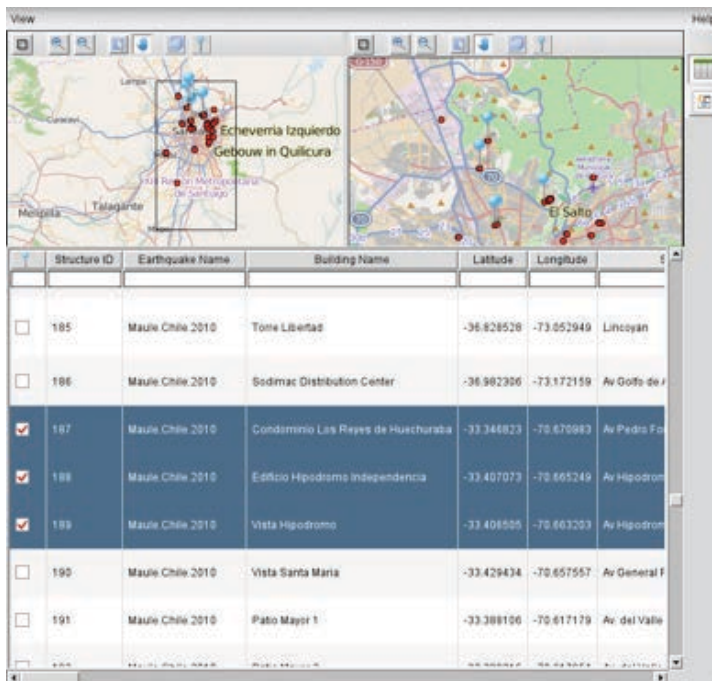


Rendering Architecture

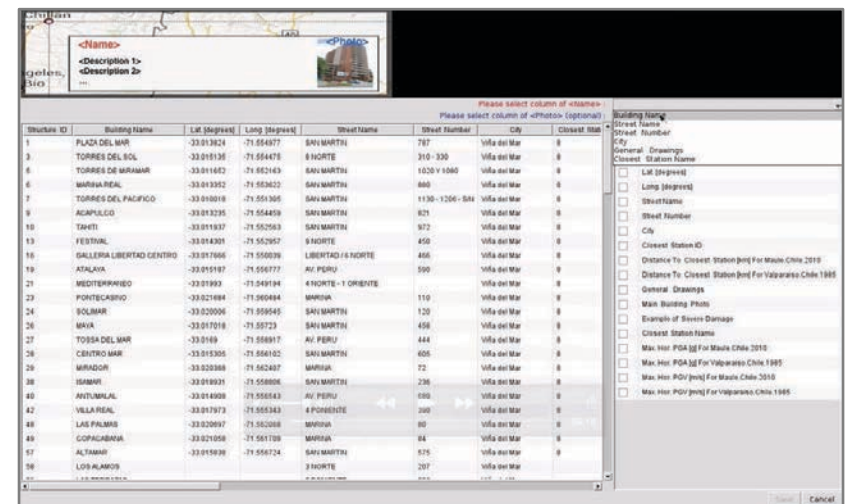


GeoExplorer

GeoExplorer/MapBuilder



Data importer



- ✓ Visualize maps, spreadsheet data
- ✓ Explore interactively

- ✓ Upload new datasets
- ✓ Configure/save and ultimately publish datasets



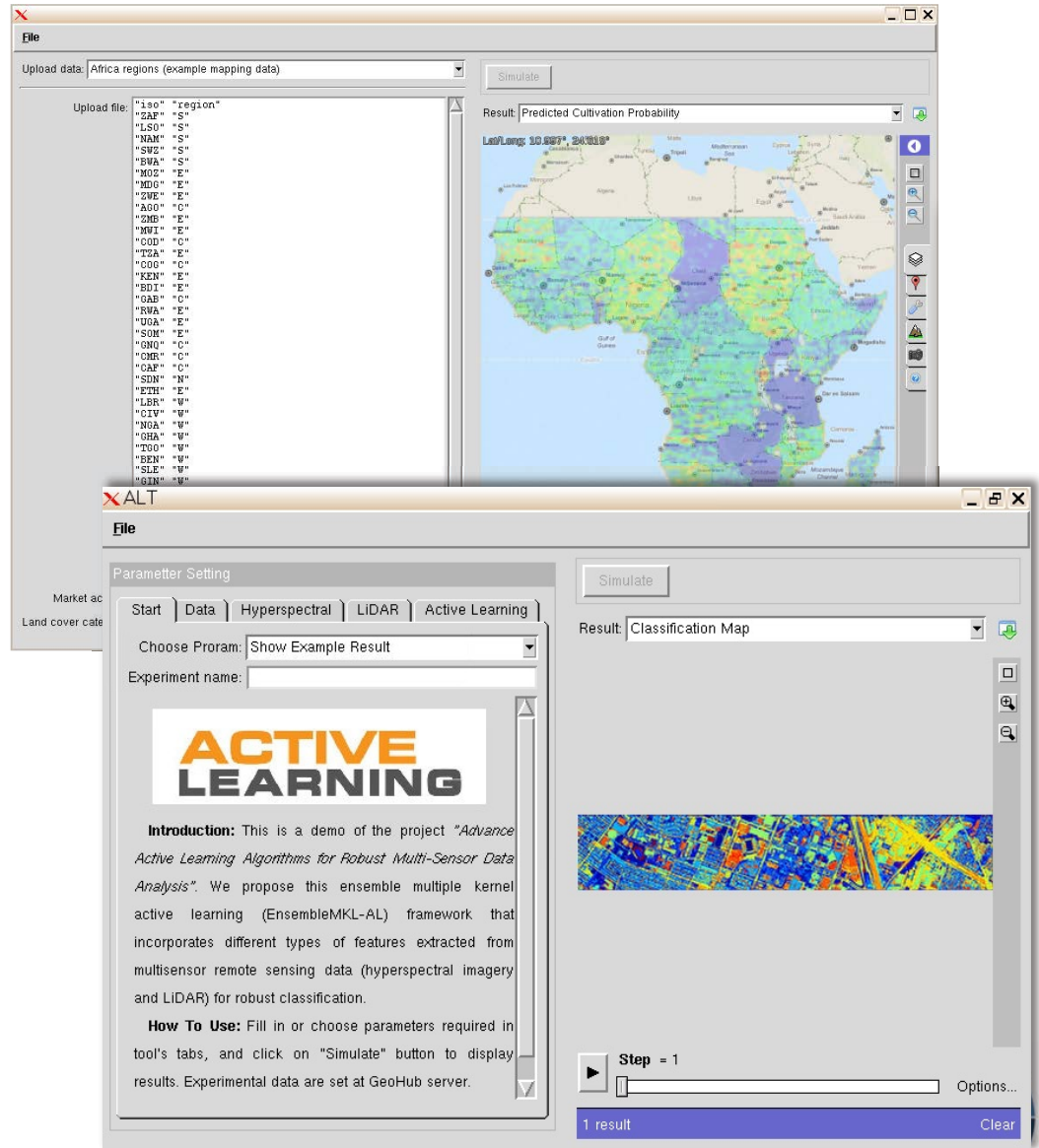
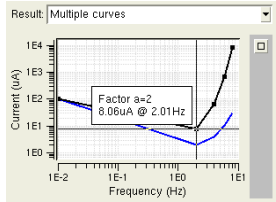

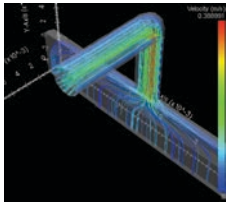
Rappture Toolkit

Rapid Application Development Toolkit

Carrier Statistics: Fermi
Boltzmann
Fermi
2D Gas

Ambient temperature: 300K

Grid points: 100



Upload data: Africa regions (example mapping data)

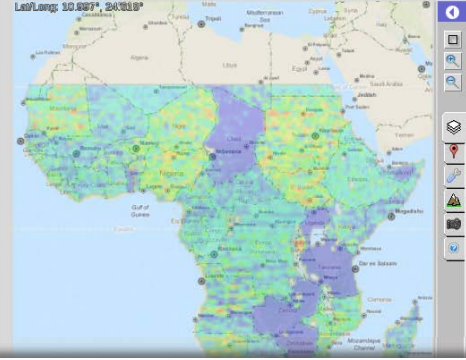
Simulate

Upload file:

```
["iso" "region"  
"GAB" "C"  
"LSO" "S"  
"NAM" "S"  
"SWZ" "S"  
"RWA" "S"  
"MOZ" "E"  
"MDG" "E"  
"ZWE" "E"  
"AGO" "C"  
"ZMB" "E"  
"MWI" "E"  
"COD" "C"  
"TZA" "E"  
"COD" "C"  
"KEN" "E"  
"BDI" "E"  
"GAB" "C"  
"RWA" "E"  
"GHA" "E"  
"SON" "E"  
"GNO" "C"  
"CHD" "C"  
"GAB" "C"  
"SDN" "N"  
"ETH" "E"  
"LBN" "W"  
"CIV" "W"  
"NGA" "W"  
"GHA" "W"  
"TGO" "W"  
"BEN" "W"  
"SLE" "W"  
"GIN" "W"]
```

Result: Predicted Cultivation Probability

Lat/Long: 10.587°, 24.111°



Parameter Setting

Start | Data | Hyperspectral | LIDAR | Active Learning

Choose Proram: Show Example Result

Experiment name:

ACTIVE LEARNING

Introduction: This is a demo of the project "Advance Active Learning Algorithms for Robust Multi-Sensor Data Analysis". We propose this ensemble multiple kernel active learning (EnsembleMKL-AL) framework that incorporates different types of features extracted from multisensor remote sensing data (hyperspectral imagery and LIDAR) for robust classification.

How To Use: Fill in or choose parameters required in tool's tabs, and click on "Simulate" button to display results. Experimental data are set at GeoHub server.

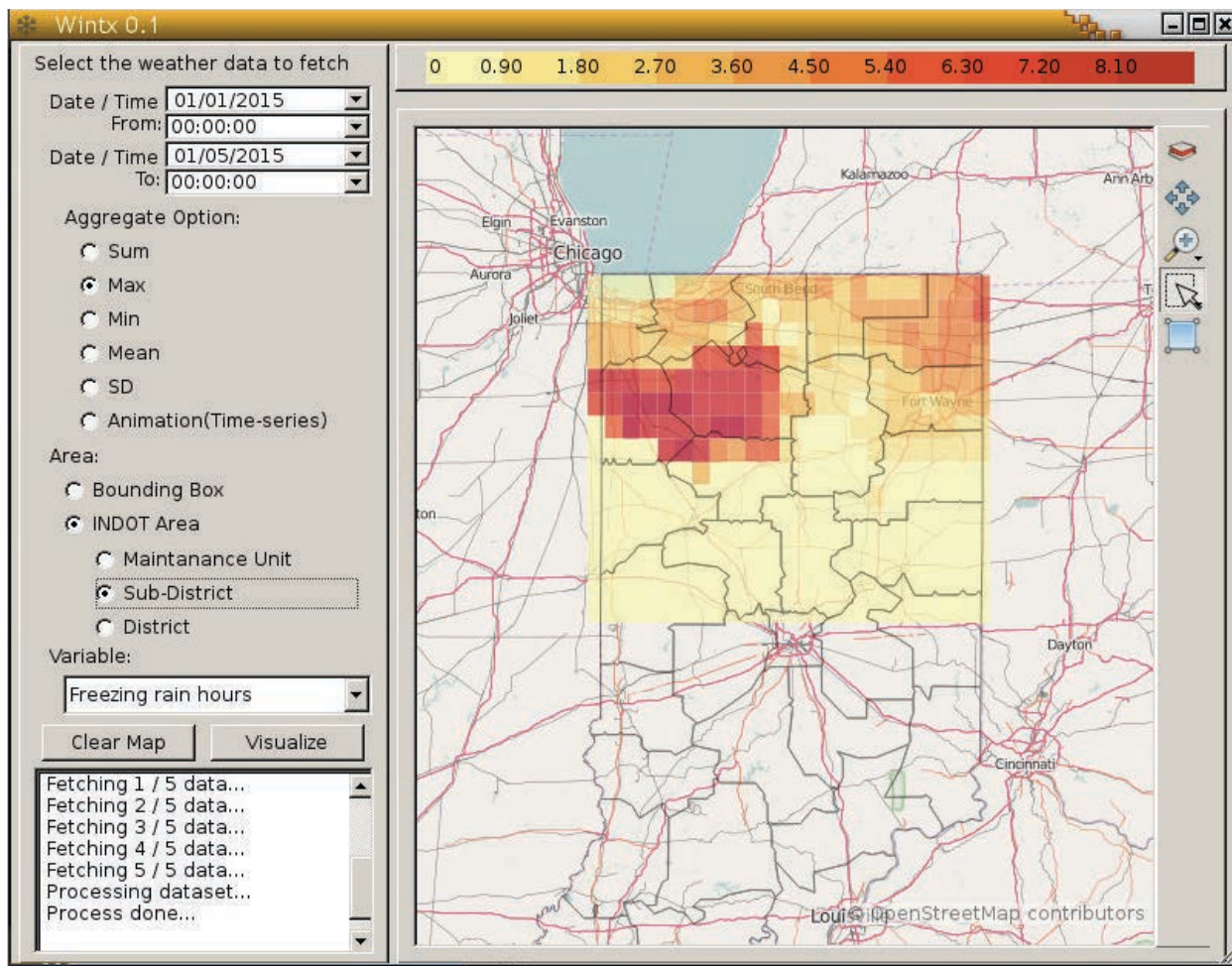
Step = 1

1 result Clear

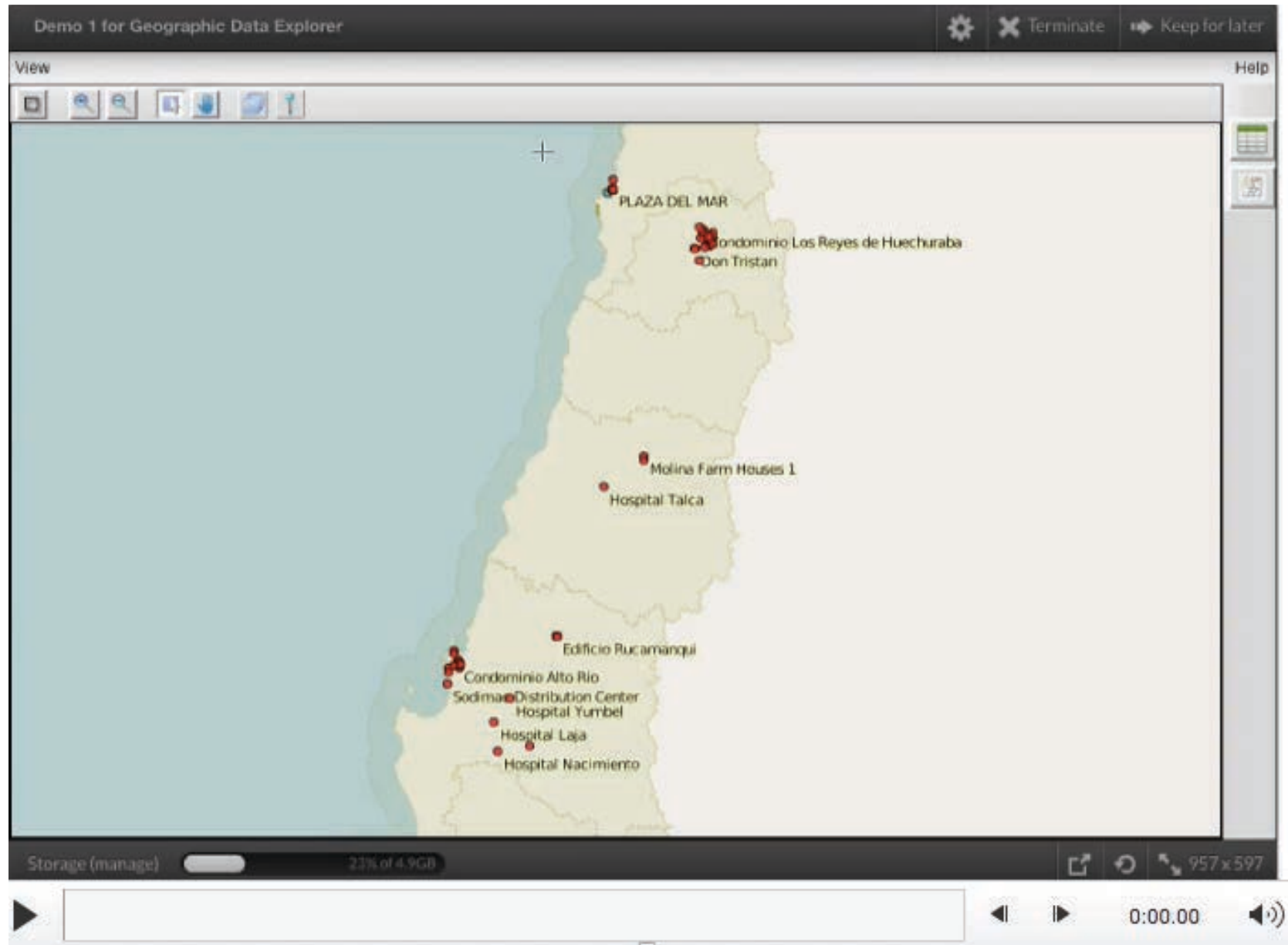
- ✓ Mapping component
- ✓ Build new applications
- ✓ Many programming languages

Versatile Map Library

- ✓ Python wrapper of QGIS for creating basic map objects
- ✓ Built-in map controls for user interaction
- ✓ Map widgets that can be embedded in user-created online tools without programming



GeoExplorer



OSGEarth Rendering Engine



14 2 minute video



Data Publication – Searchable on a Map

Search Reset

Enter text for metadata search:

Or, highlight a search area on the map: **Latitude: 15.0 to 59.0, Longitude: -110.0 to -49.0**

Search Results [Go to Datasets](#)

Dataset	File	Size (bytes)	Created	Modified
Lake Data	lakes.shp (go to folder)	24200	4/1/2015 10:39 PM	4/1/2015 10:39 PM
Maize Data	econ_maize_yield.nc (go to folder)	9345268	5/10/2015 11:07 PM	5/10/2015 11:07 PM
Unidata2015	econ_maize_yield.nc (go to folder)	9345268	6/17/2015 6:13 PM	6/17/2015 6:13 PM
Unidata2015	INDOT_maintenance_units.shp (go to folder)	92120	6/17/2015 11:20 PM	6/17/2015 11:20 PM
Unidata2015	INDOT_Districts.shp (go to folder)	36276	6/17/2015 11:20 PM	6/17/2015 11:20 PM
Unidata2015	INDOT_Subdistricts.shp (go to folder)	56412	6/17/2015 11:20 PM	6/17/2015 11:20 PM
Unidata2015	tax_bced_1960_1999_hadgem2-es_rcp2p6_2005-2010.mm.nc (go to folder)	74660200	6/22/2015 5:56 PM	6/22/2015 5:56 PM
ClimateData	tax_bced_1960_1999_hadgem2-es_rcp2p6_2005-2010.mm.nc (go to folder)	74660200	6/7/2015 9:39 PM	6/7/2015 9:39 PM
it Joseph Watershed	tempg1.shp (go to folder)	240	2/27/2015 10:32 AM	2/27/2015 10:32 AM
it Joseph Watershed	outlets1.shp (go to folder)	1724	2/27/2015 10:32 AM	2/27/2015 10:32 AM
St Joseph Watershed	Riv2.shp (go to folder)	119172	2/27/2015 10:33 AM	2/27/2015 10:33 AM
Landsat8_Monroe_County	Monroe_2013_09_06_LCB(chs.4,3,2).tif (go to folder)	6750606	5/12/2015 8:59 PM	5/12/2015 8:59 PM
Landsat8_Monroe_County	Monroe_2013_09_06_LCB.tif (go to folder)	6750606	5/12/2015 10:09 PM	5/12/2015 10:09 PM
U2U	gdd_forecast_accumulated_allmodels_modelSeq.tif (go to folder)	42209280	3/26/2015 2:35 PM	3/26/2015 2:35 PM
U2U	gdd_forecast_accumulated_allmodels_daySeq.tif (go to folder)	42209280	3/26/2015 2:35 PM	3/26/2015 2:35 PM
U2U	gdd_forecast_accumulated_current.tif (go to folder)	8442400	3/26/2015 3:56 PM	3/26/2015 3:56 PM
Active learning data	ne_10m_admin_0_countries.shp (go to folder)	8008932	6/7/2015 6:35 PM	6/7/2015 6:35 PM

Base Provider Show

Base Layer Hide

Google Roadmap

Google Satellite

Google Terrain

Google Hybrid

Overlays Hide

econ_maize_yield_Maize_Dat_1015_b1

Selected Features

Colors Show

Click on map to get feature info for location.



From Publication - Launch Tools

The screenshot shows the 'MY GEO HUB' website interface. At the top, there is a navigation bar with 'RESEARCH PROJECTS', 'WORKING PROJECTS', 'RESOURCES', 'COMMUNITY', and 'ABOUT'. The user 'Rajesh Kalyanam' is logged in. The main content area features a publication titled 'Maize Harvest Yields' by Rajesh Kalyanam from Purdue University. A red circle highlights the 'Start Tool' button, with a blue arrow pointing from it to a software interface. The interface includes a 'Download (NC)' button, a version history entry for 'Version 1.0 - published on Feb 24, 2015', and a Creative Commons license. On the right, there is a '0.0 RANKING' section with options for citations, questions, and reviews, along with social media sharing icons. Below the main content, there is a blue bar with a message: 'This is a live publication with the page and content publicly available. Manage this publication.' and a link to 'from project Rajesh's Test Project'. At the bottom, there is an 'Abstract' section and a 'RECOMMENDATIONS' box that says 'No results found.' The software interface shown at the bottom consists of three windows: 'Demo 4 for Geographic Data Explorer' showing a street map, 'Result 3D Map' showing a 3D terrain model, and 'Set SICOA Cluser Specifications' showing a dialog box for configuring clustering parameters.



Future Publications

1748-9326_4_3_034004.pdf (page 1 of 8) — Edited

IOP PUBLISHING ENVIRONMENTAL RESEARCH LETTERS
Environ. Res. Lett. 4 (2009) 034004 (8pp) doi:10.1088/1748-9326/4/3/034004

Climate volatility deepens poverty vulnerability in developing countries

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² Purdue Climate Change Research Center, Purdue University, IN, USA
³ Department of Earth and Atmospheric Sciences, Purdue University, IN, USA
⁴ Center for Global Trade Analysis, Purdue University, IN, USA
⁵ Department of Agricultural Economics, Purdue University, IN, USA

E-mail: sahmed20@worldbank.org

Received 20 March 2009
Accepted for publication 20 July 2009
Published 20 August 2009
Online at stacks.iop.org/ERL/4/034004

Abstract
Extreme climate events could influence poverty by affecting agricultural productivity and

0:00.00



Acknowledgement



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Thank you!

Questions, suggestions,
and feature requests
are welcome!

carolxsong@purdue.edu

NSF project info: <http://mygeohub.org/groups/gabbs>

Join us on MyGeoHub.org!

