CyberGIS for Scalable Spatial Data Synthesis

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NDS Consortium Workshop
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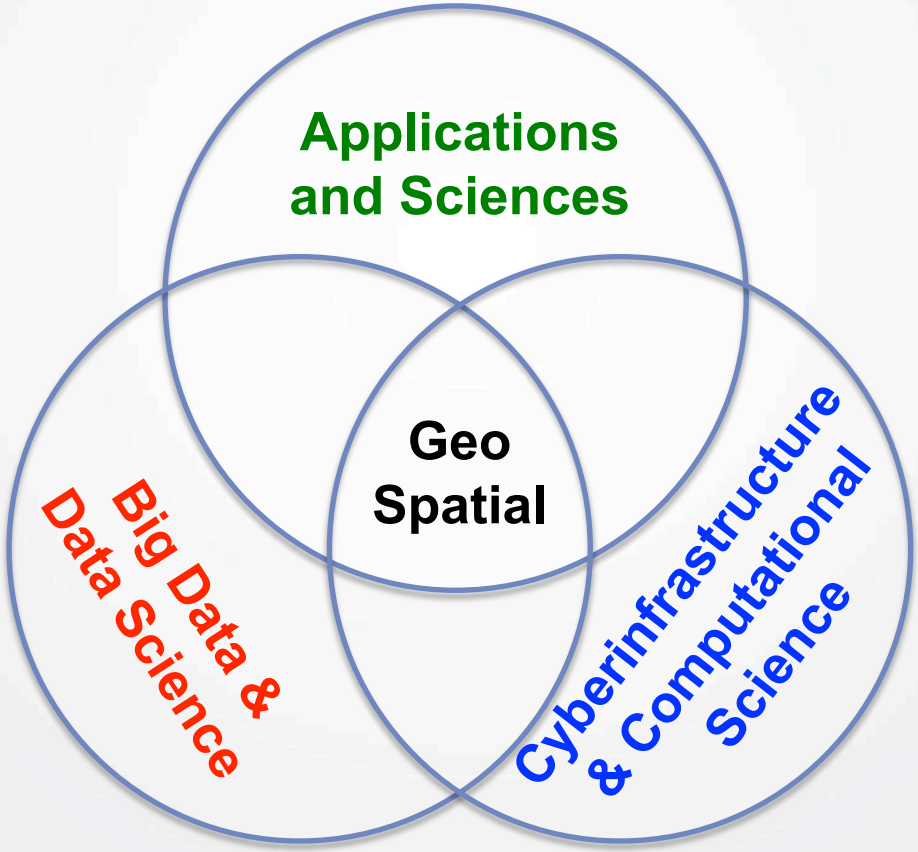
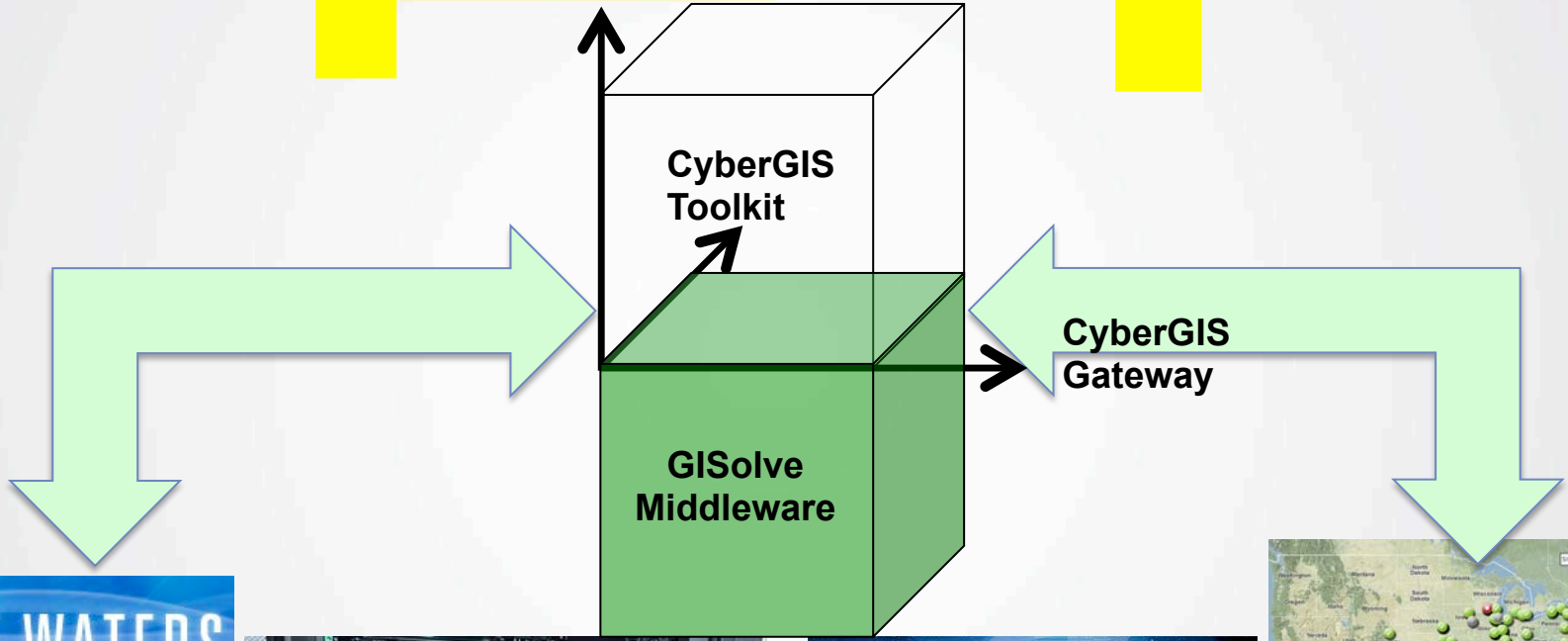
CyberGIS Ecosystem



Agriculture and Food, Disaster and Emergency, Earth and Environment, Energy and Water Resources, and Health and Wellness

Geospatial Discovery and Innovation



BLUE WATERS
SUSTAINED PETASCALE COMPUTING

www.ncsa.illinois.edu/BlueWaters/

http://cybergis.illinois.edu

www.xsede.org

www.opensciencegrid.org

Core Data Synthesis Capabilities

- Spatial Data Processing
- Spatial Data Integration
- Spatial Data Presentation
- Data Retrieval and Storage

TopoLens

On-Demand Visual Analytics for High-Resolution Topographic Data

USGS science for a changing world | The National Map | USGS Home | Contact USGS | Search USGS

3D Elevation Program (3DEP)

The National Map Home >> 3D Elevation Program (3DEP)

3DEP Resources

- The 3DEP Elevation Program - Summary of Program Direction (USGS Fact Sheet 2012-3089)
- National Enhanced Elevation Assessment (NEEA)
- 3DEP Executive Forum
- Alaska Mapping Roundtable

3DEP '*In the News*'

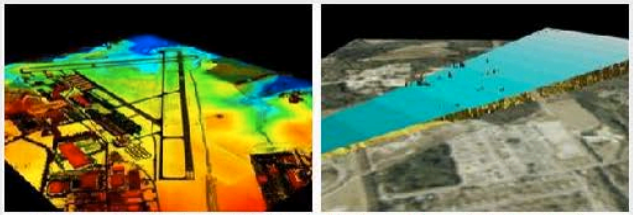
- A Huge Laser-Mapping Project Is Redrawing America
- Remapping Coastal Areas Damaged by Hurricane Sandy

3DEP State Fact Sheets

- Alaska
- California
- Colorado
- Idaho
- Minnesota
- Rhode Island
- Texas
- Virginia
- Washington
- Wisconsin

Contact Us

Introduction and Goals



Lidar is used to detect potential obstacles that present hazards to air navigation.

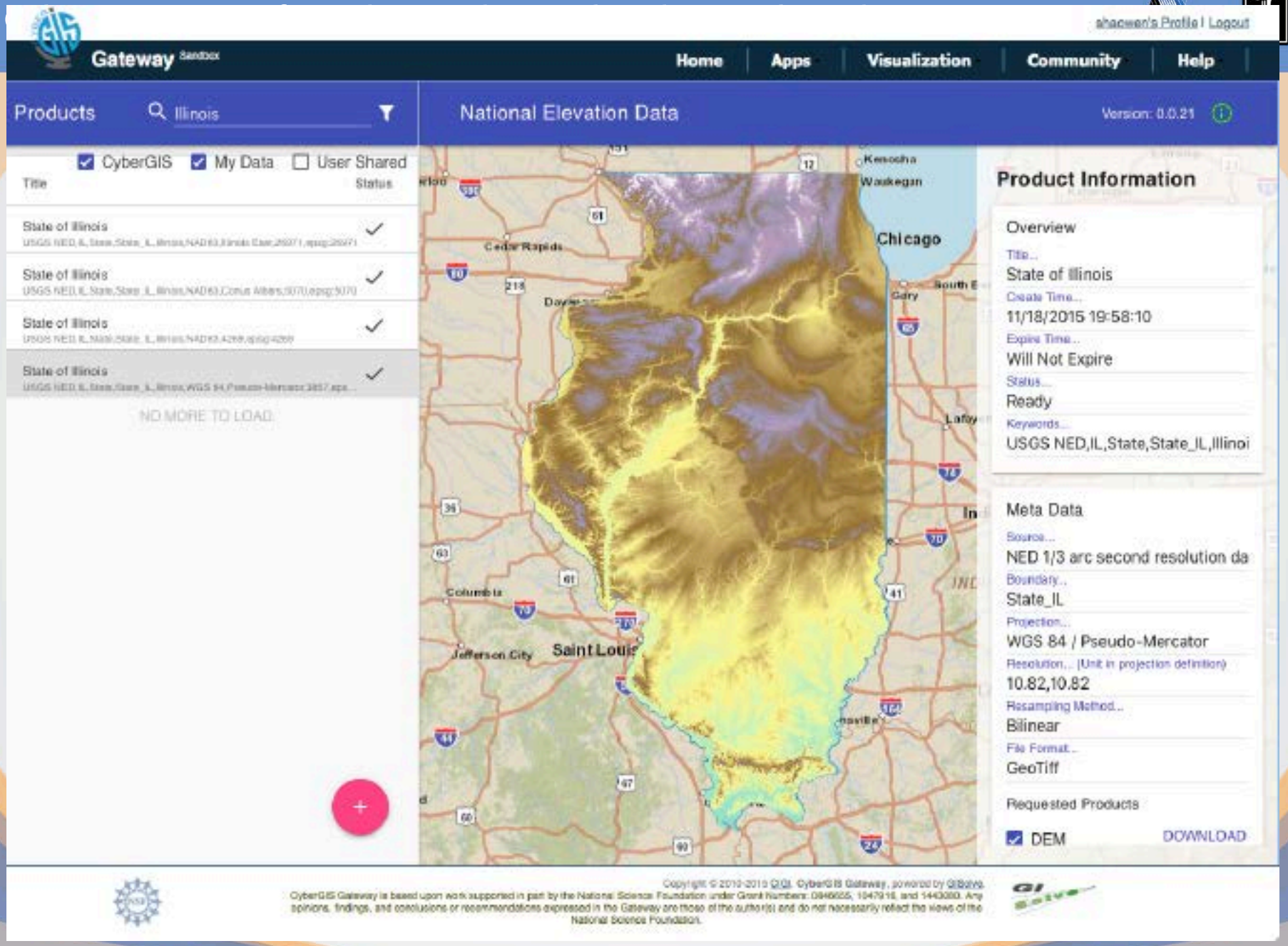
The 3D Elevation Program (3DEP) initiative is being developed to respond to growing needs for high-quality topographic data and for a wide range of other three-dimensional representations of the Nation's natural and constructed features. The primary goal of 3DEP is to systematically collect enhanced elevation data in the form of high-quality light detection and ranging (lidar) data over the conterminous United States, Hawaii, and the U.S. territories, with data acquired over an 8-year period. Interferometric synthetic aperture radar (ifsar) data will be collected over Alaska, where cloud cover and remote locations preclude the use of lidar over much of the State. The 3DEP initiative is based on the results of the National Enhanced Elevation Assessment.

Applications - A Few Examples

3DEP will provide expanded benefits to a range of Federal, State, local, and private industry applications. Some examples of the value of improved elevation data include:

- The Federal Emergency Management Agency (FEMA) expects that a national enhanced elevation program could reduce the amount of time needed to update its flood maps. These enhanced data could provide significant benefits to the communities and citizens that are customers of the National Flood Insurance Program. For example, updated information could be delivered to affected communities and homeowners more quickly.
- Using lidar data, U.S. Geological Survey (USGS) scientists discovered a surface rupture along the Tacoma fault in the State of Washington. This discovery led to a redesign of the structural elements of a $735-million suspension bridge across the Tacoma Narrows. When lidar data enable the identification of active faults near major infrastructure, mitigation steps may be taken to avoid potential catastrophes.
- In the State of Alaska, poor-quality elevation data pose an ongoing threat to aviation safety. Improved elevation data for cockpit navigation and flight simulators may save lives each year by reducing accidents resulting from the inability to safely fly over obstacles in airspace.
- In 2010, an estimated 262.3 million acres of farm lands were harvested in the United States at total product values of $356.2 billion. The value to America's farmers of public domain lidar for all precision agriculture nationwide is believed to be potentially worth up to $2 billion annually.

Transition to 3DEP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National Elevation Data
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Cedar Rapids
Saint Louis
Jefferson City
Columbia
Product Information
Overview
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State_IL
Projection...
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Bilinear
File Format...
GeoTiff
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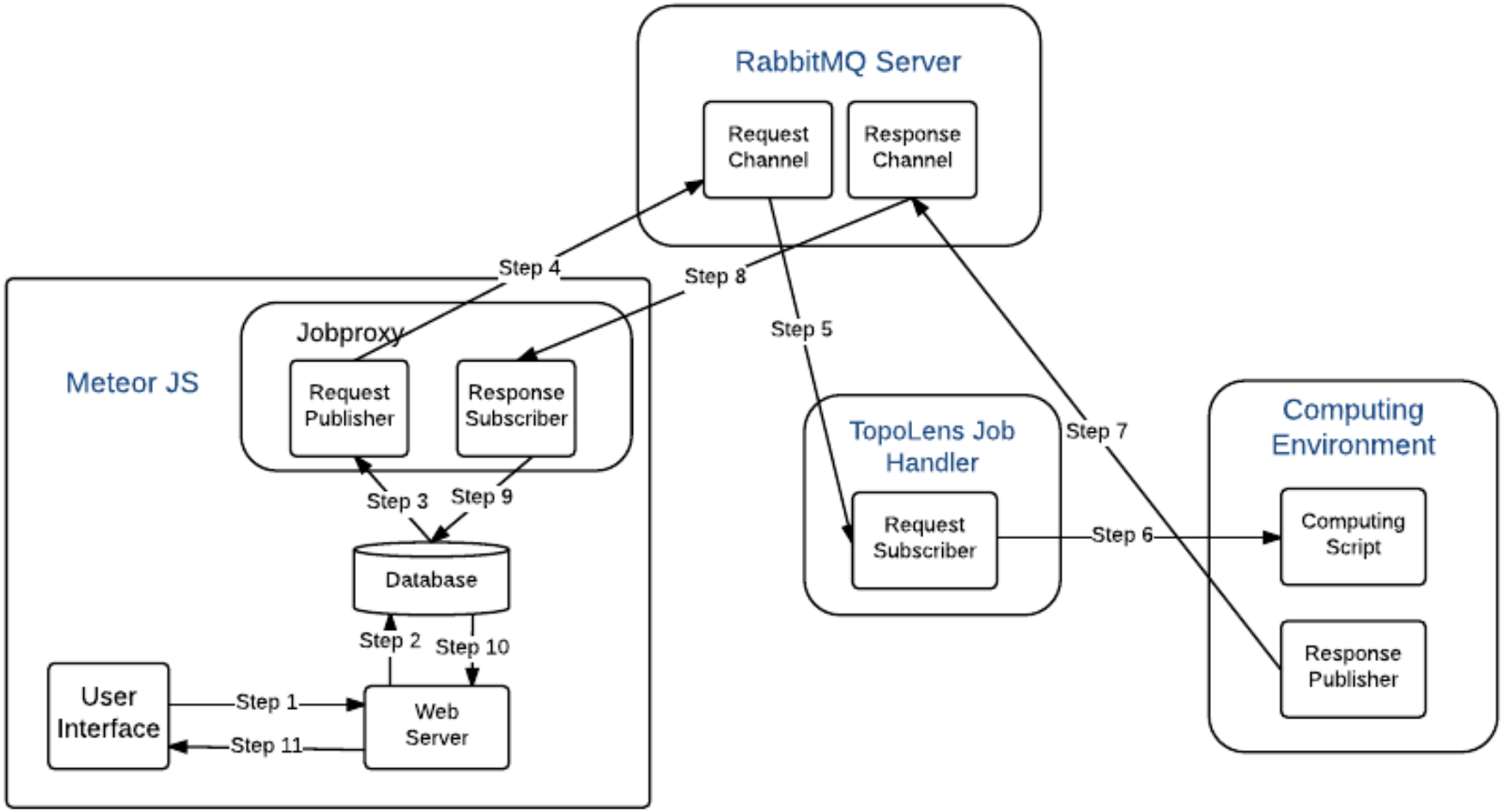
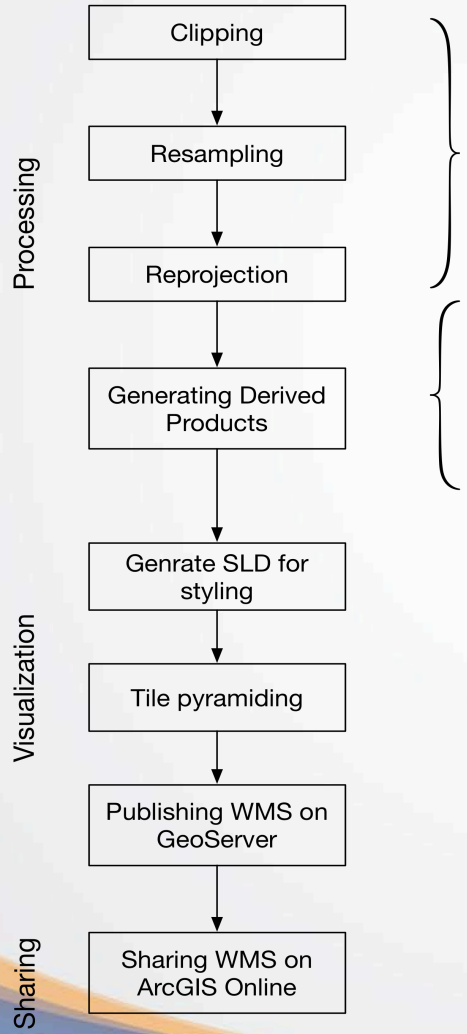
Architecture



TopoLens Data Processing and Sharing Pipeline



Related Functions

gdalwarp. In GDAL implementation, clipping, resampling and reprojection are handled in one function call.

gdal_translate. Perform LZW compression on raster data with flag *-co "COMPRESS=LZW"*.

gdaldem. GDAL command that generates derived products, including *slope* and *hillshade*.

geotiff-split.py. A function to handle large raster data due to the file size limitation in TauDEM.

pitremove. TauDEM command that generates *pitremove* product.

VizSLDGen. Generate Styled Layer Descriptor file to rending raster.

gdal_retile.py. GDAL function that retiles a set of tiles and build tiled pyramid levels.

cybergis-viz/VizMain.py. CyberGIS visualization package that publishes WMS to GeoServer.

WMSToAGO.py. Register WMS layer to ArcGIS Online for sharing purpose.

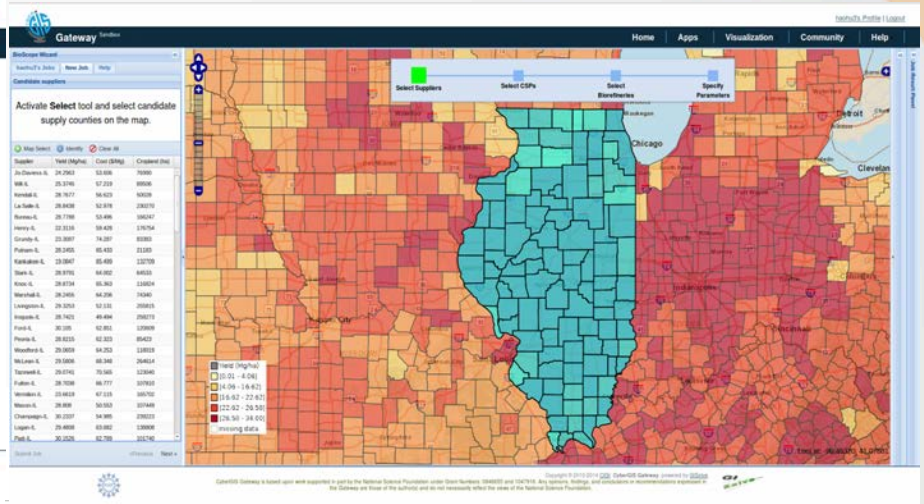
Other Notes

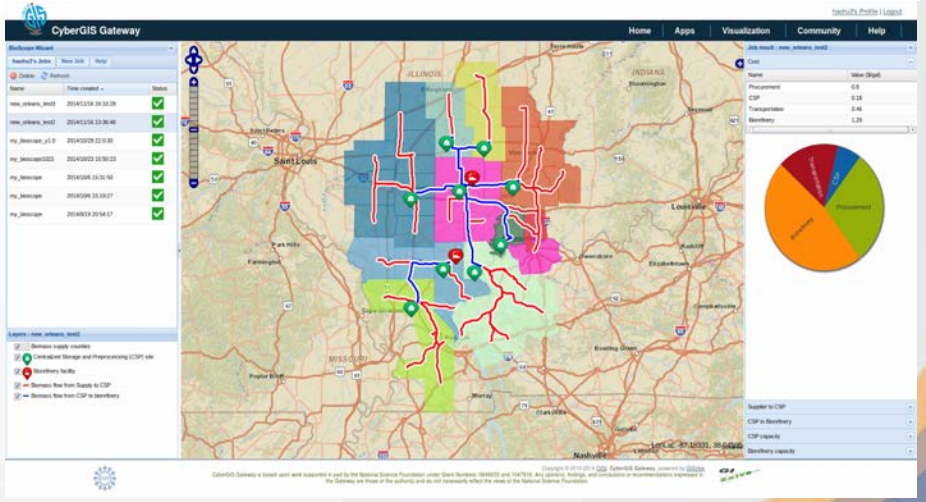
1. Study area boundary is a required parameter.

2. Resampling, reprojection, and derive products are optional depending on user request.

3. Sharing the data on ArcGIS Online is optional depending on user request.

CyberGIS-Bioscope





- Spatial decision making
- Integrating a number of datasets at multiple spatial scales and resolutions (e.g. soil, yield, weather)
- Stochastic programming approach
- Uncertainties in supply and demand accounted for
  - Biomass availability varies spatially and temporally
  - Market demand is spatially distributed

Collaborative Work by *Hao Hu, Tao Lin, Yan Liu, Luis F. Rodríguez, and Shaowen Wang*

CyberGIS Supercomputer – ROGER

(Resourcing Open Geospatial Education and Research)

- ~6 petabytes of raw disk storage with high input/output (I/O) bandwidth
- Solid-state drives for applications demanding high data-access performance
- Advanced graphics processing units for exploiting massive parallelism in geospatial data and computing
- Interactive visualization supported with a high-speed network and dynamically provisioned cloud computing resource

NSF MRI: Acquisition of a National CyberGIS Facility for Computing- and Data-Intensive Geospatial Research and Education

CyberGIS'16

The Third International Conference
on CyberGIS and Geospatial Data Science

and

NSF Workshop on Geospatial Data Science
in the Era of Big Data and CyberGIS

http://cybergis.illinois.edu/events/cybergis16/

Acknowledgments

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    - BCS-0846655
    - EAR-1239603
    - IIS-1354329
    - XSEDE
  - US Department of Agriculture (USDA)
  - US Geological Survey (USGS)
- **Industry**
  - Environmental Systems Research Institute (Esri)
  - John Deere
  - Nvidia

Further Contact Information

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