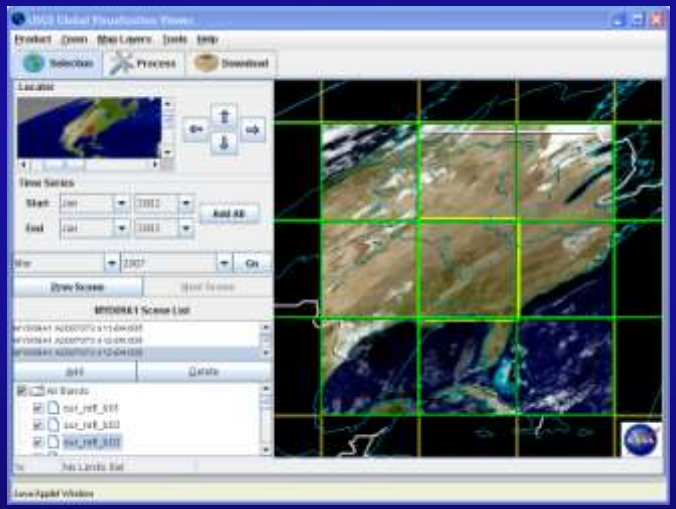
Land Processes DAAC Update

MODIS-VIIRS Science Team Meeting
May 15, 2008



Tom Maiersperger[§]

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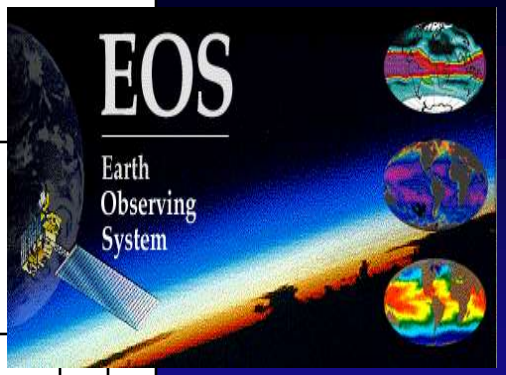
U.S. Department of the Interior
U.S. Geological Survey

LP DAAC Scope & Organization

- Part of NASA's Earth Observing System (EOS) Data and Information System (EOSDIS).
- Located at USGS EROS.
- Archive and distribute Moderate Resolution Imaging Spectroradiometer (MODIS) land products derived from data acquired from the Terra and Aqua satellites.
- Archive, process, and distribute Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data from the Terra platform.
- Support interdisciplinary study and understanding of the integrated Earth system.

NASA Earth Observing System (EOS) Program

EOS is a long-term, interdisciplinary, and multidisciplinary research mission to study global-scale processes that shape and influence the Earth as a system.



Earth Science Data and Information System (ESDIS) Project

The ESDIS Project is an organization that contributes to, and complements the services provided by NASA's Earth Science Enterprise. The ESDIS Project develops, implements, and operates the data and information system called EOSDIS.

Earth Observing System (EOS) Data and Information System (EOSDIS)

EOSDIS is a system whose purpose is to acquire, archive, manage, and distribute Earth observation data to a diverse group of users.

EOSDIS Core System (ECS)

ECS will provide scientists the computing architecture needed to accomplish EOSDIS goals. ECS has been designed to enable evolution to support a broad range of data partners.

Data products from EOS and other NASA Earth science missions are stored at several Distributed Active Archive Centers (DAACs) to support interactive and interoperable retrieval and distribution of data products

USGS Earth Observation Systems Project at EROS

Land Processes Distributed Active Archive (LP DAAC) at EROS

- ECS Science Data Processing Segment (SDPS)
- DAAC Unique Extensions (DUEs)

USGS

NASA

USGS Earth Resources Observation and Science

Data Archives:

To safeguard and expand the national archive of remotely sensed land data

Data Acquisition/Access:

To ensure that scientists, businesses, decision makers and the public have ready access to land information

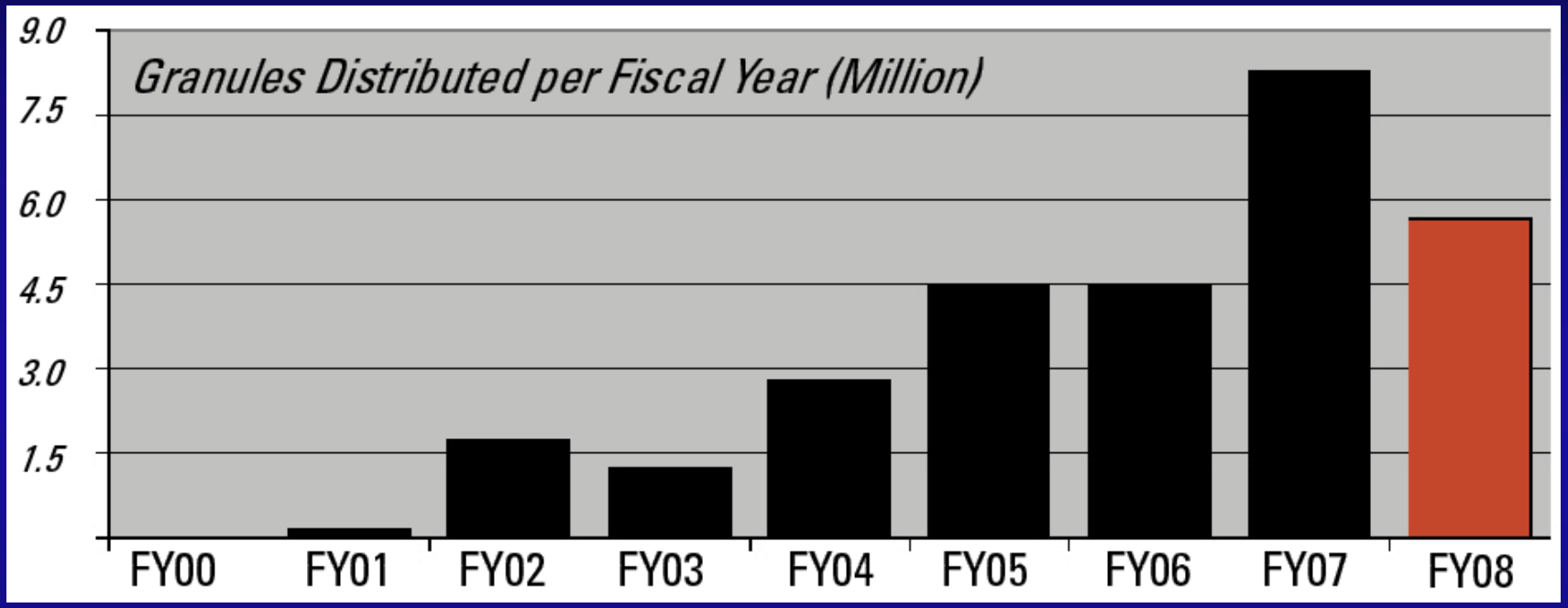
Science:

To promote applications, knowledge and use of land information to better understand our planet

USGS

NASA

LP DAAC Historic Trend in User Demand



Total ~30 million to date

Through 2nd quarter

EOSDIS Evolution 2015 Vision Tenets

Vision Tenet	*Vision 2015 Goals*
Archive Management	**NASA will ensure safe stewardship of the data through its lifetime.** **The EOS archive holdings are regularly peer reviewed for scientific merit.**
EOS Data Interoperability	**Multiple data and metadata streams can be seamlessly combined.** **Research and value added communities use EOS data interoperably with other relevant data and systems.** **Processing and data are mobile.**
Future Data Access and Processing	**Data access latency is no longer an impediment.** **Physical location of data storage is irrelevant.** **Finding data is based on common search engines.** **Services invoked by machine-machine interfaces.** **Custom processing provides only the data needed, the way needed.** **Open interfaces and best practice standard protocols universally employed.**
Data Pedigree	**Mechanisms to collect and preserve the pedigree of derived data products are readily available.**
Cost Control	**Data systems evolve into components that allow a fine-grained control over cost drivers.**
User Community Support	**Expert knowledge is readily accessible to enable researchers to understand and use the data.** **Community feedback directly to those responsible for a given system element.**
IT Currency	**Access to all EOS data through services at least as rich as any contemporary science information system.**

LP DAAC ECS Evolution

Rearchitect ECS to simplify sustaining engineering and automate operations

Features:

- **Simplify software architecture (eliminate 15 components & 750K SLOC)**
- ***Move towards disk-based archive***
- **Leverage new hardware technology (e.g., commodity-based systems; shared storage) to reduce hardware maintenance costs**

Benefits:

- **Low risk approach based on proven technology**
- **Increased system automation; simplified hardware/software configuration**
- **Reduction in operational costs at ECS DAACs**
- ***Improved data access due to increased on-line storage and commodity disks/platforms***

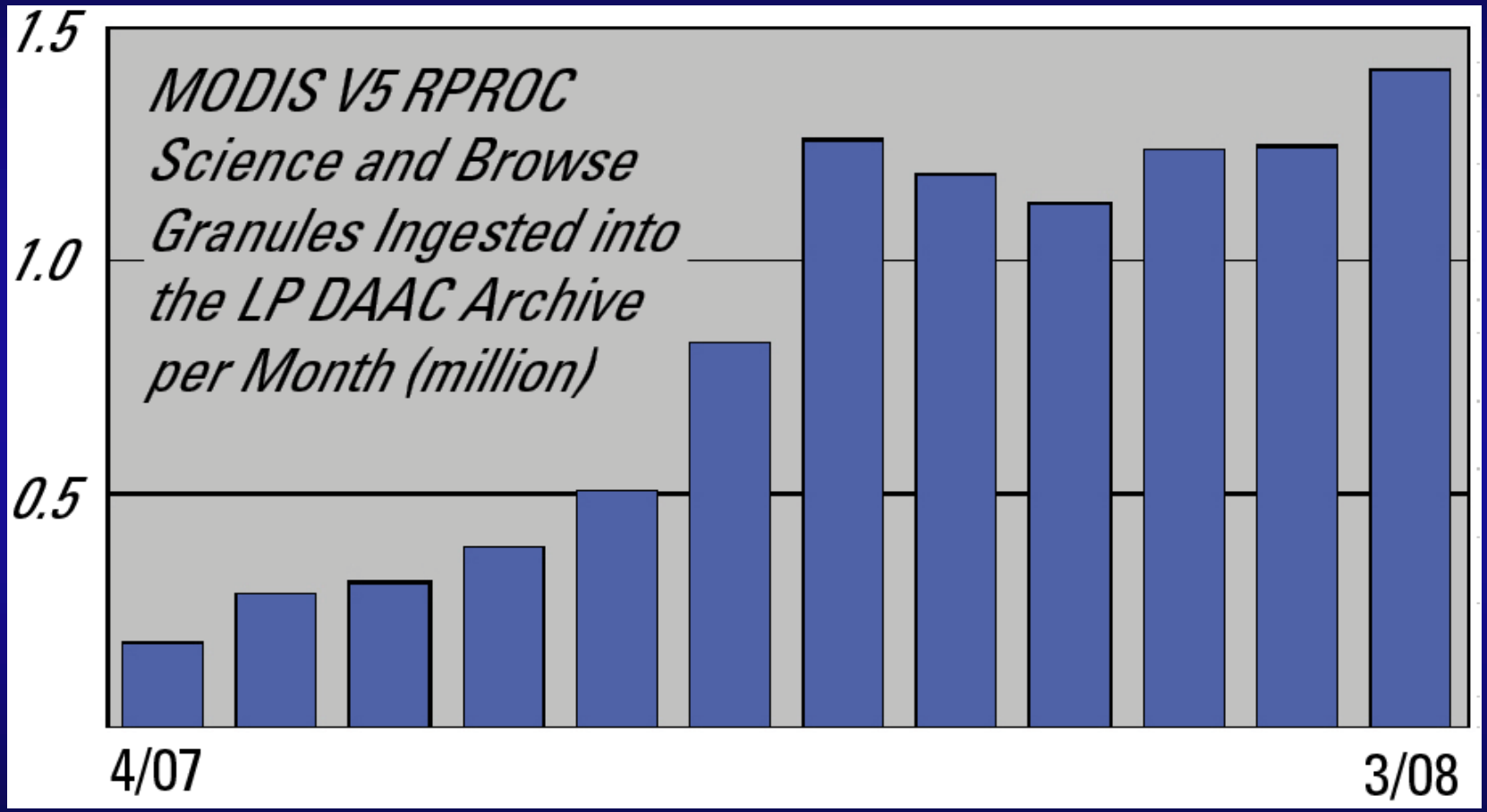
LP DAAC Online Holdings

Recent Past: For MODIS, the "Data Pool" contained a 1-year rolling cache of Collection 4 products except the daily L2Gs (rolling 8-day)

Currently: Expanding Data Pool + Collection 5 = enough for 10-day rolling L2G cache + *everything else,* assuming incremental volume increases every year

Near Future: All holdings online (golden copy), retire tape silos, install modern tape backup systems

LP DAAC Support of Faster MODIS V5 Reprocessing



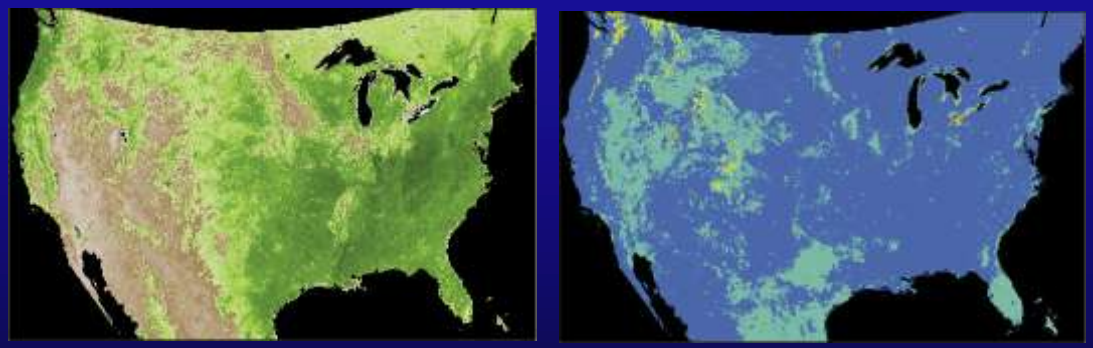
Overview of Access Methods

- EOS Data Gateway (transitioning to ECHO/WIST)
  - All EOS products, complex searches, saved searches, shopping cart model
- LP DAAC Data Pool
  - Limited holdings, instant FTP access (human pull or scripted push) or GUI for search, select, and application of limited data conversion services (Coming Soon – MRTWeb)
- GloVis
  - Browse-based visualization, selection, and order
- Spatial Subscription Service
  - Automated means of receiving email notification or FTP-PUSH of incoming ASTER and MODIS data sets in the forward stream
- Machine-to-Machine Gateway
  - Parameterized by user, script-based ordering to retrieve large amounts of historical archive by FTP-PUSH

MRTWeb – A new access tool

User demand for MODIS data delivery services:

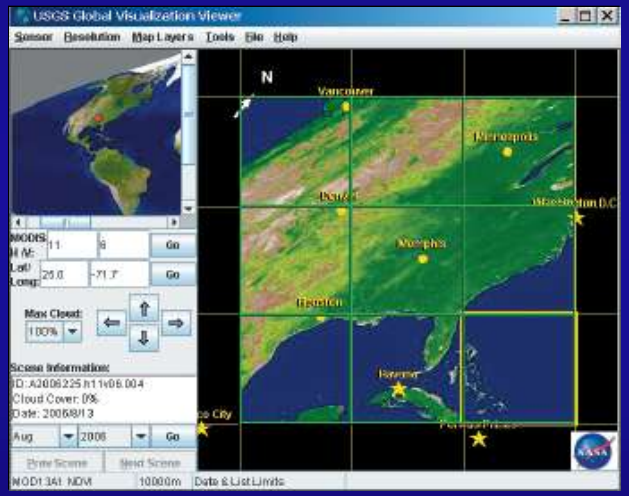
- **Alternative projections and formats**
- **Spatial and spectral subsetting**
- **Mosaicking and time series extraction**



MRTWeb – Design Concept

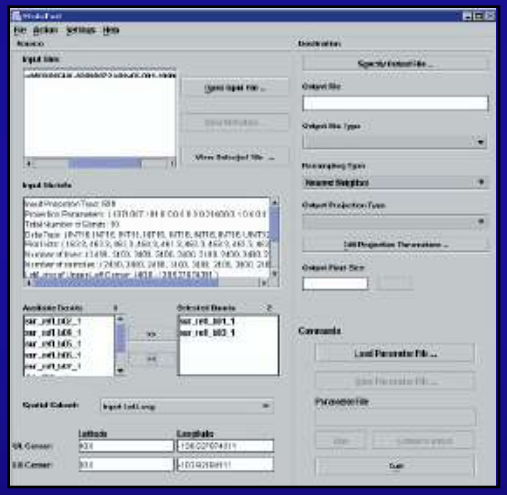
Integration and adaptation of two familiar tools

GloVis
(Selection Interface)



+

MRT
(Processing Tool)



Browse tiles within map context
Navigate through time and space
Select tiles of interest for processing

Mosaic tiles
Subset an area from a tile, mosaic, or time series
Eliminate unwanted bands or layers
Define projection
Set resampling options
Choose file format

USGS

NASA

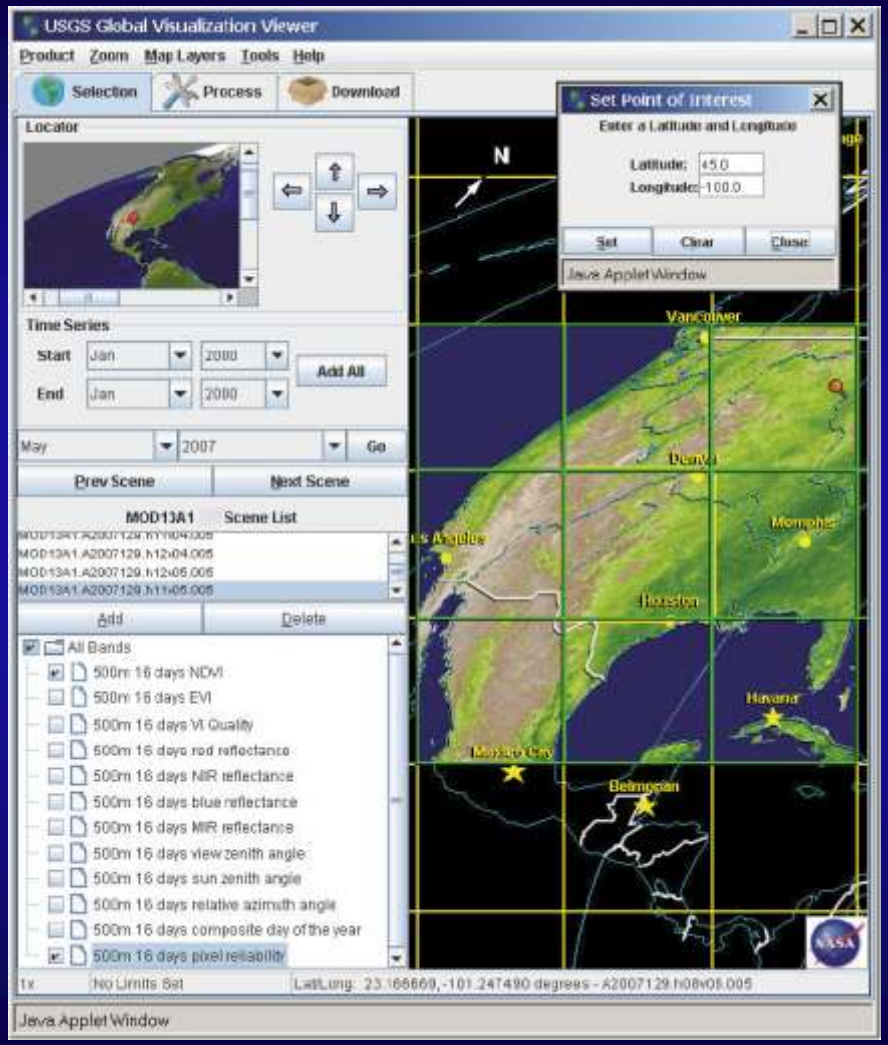
MRTWeb – Create Regional Mosaic

Select

Product
Tiles / Date
Bands / Layers

Continue

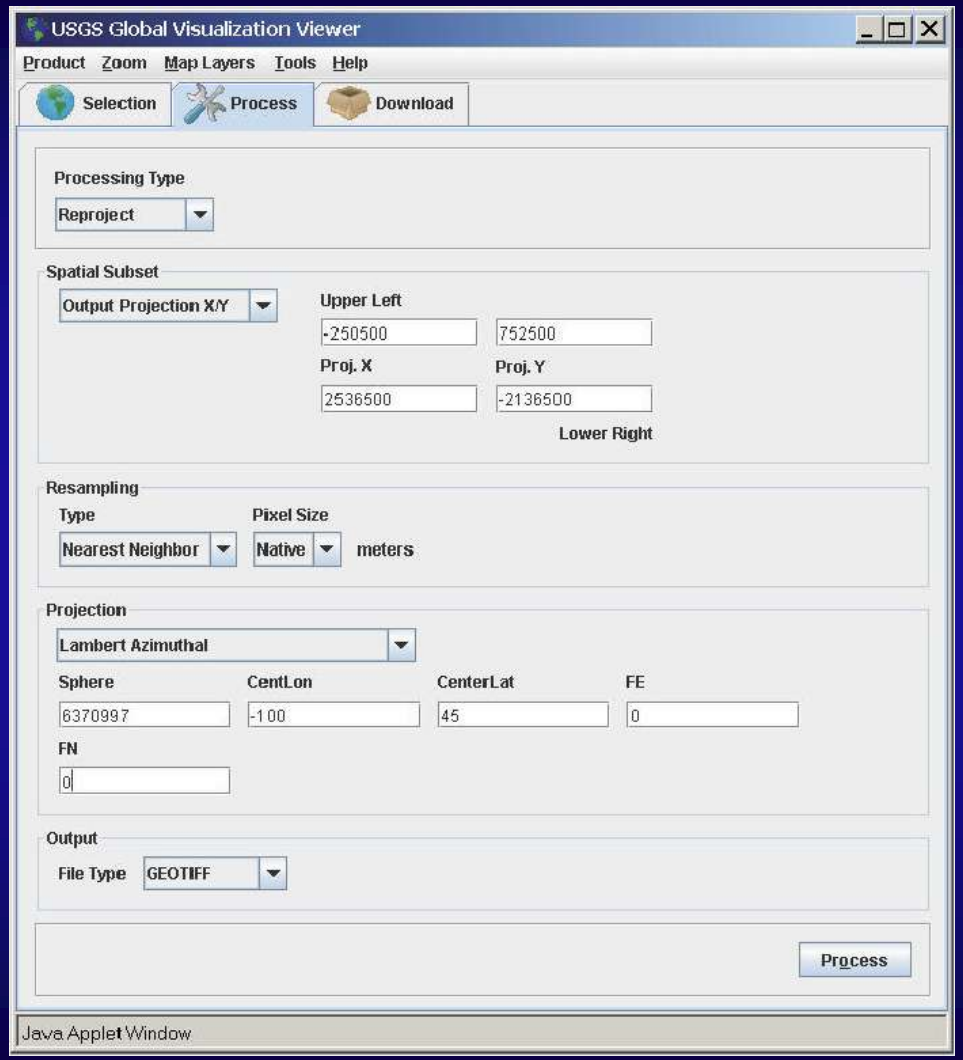
to Process Tab



MRTWeb – Create Regional Mosaic

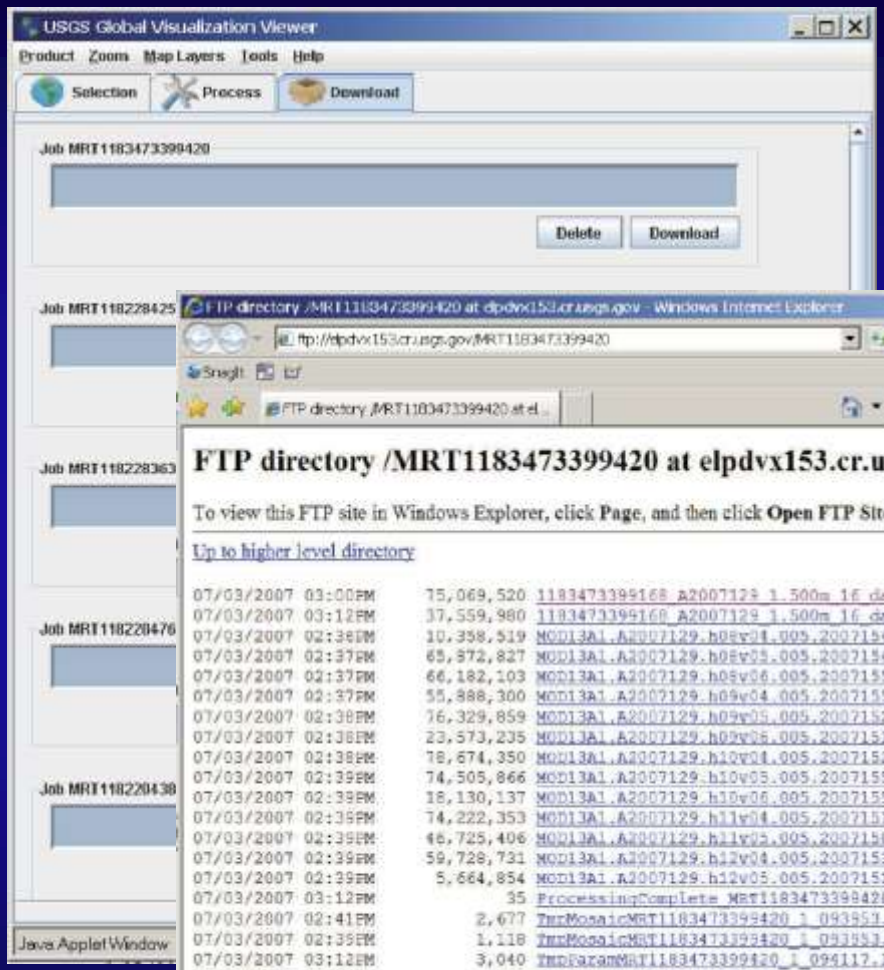
Specify processing options…

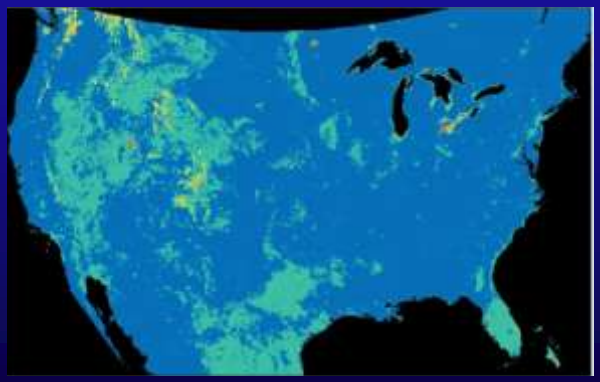
Continue to Download Tab…



MRTWeb – Create Regional Mosaic

Monitor & Download

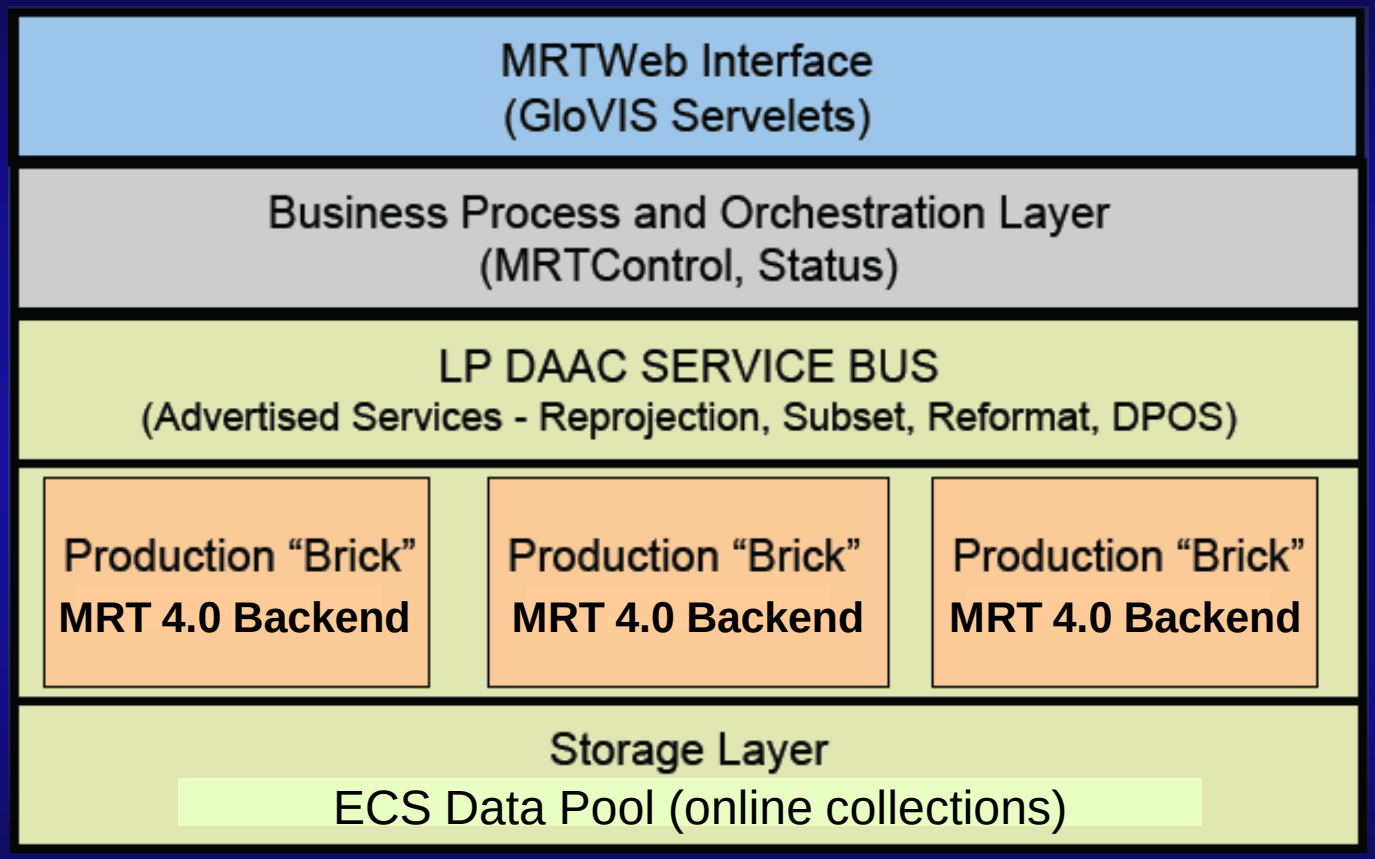




USGS

NASA

MRTWeb - Architecture



Prototyping OGC Services

LP DAAC

Web Server Demonstration System

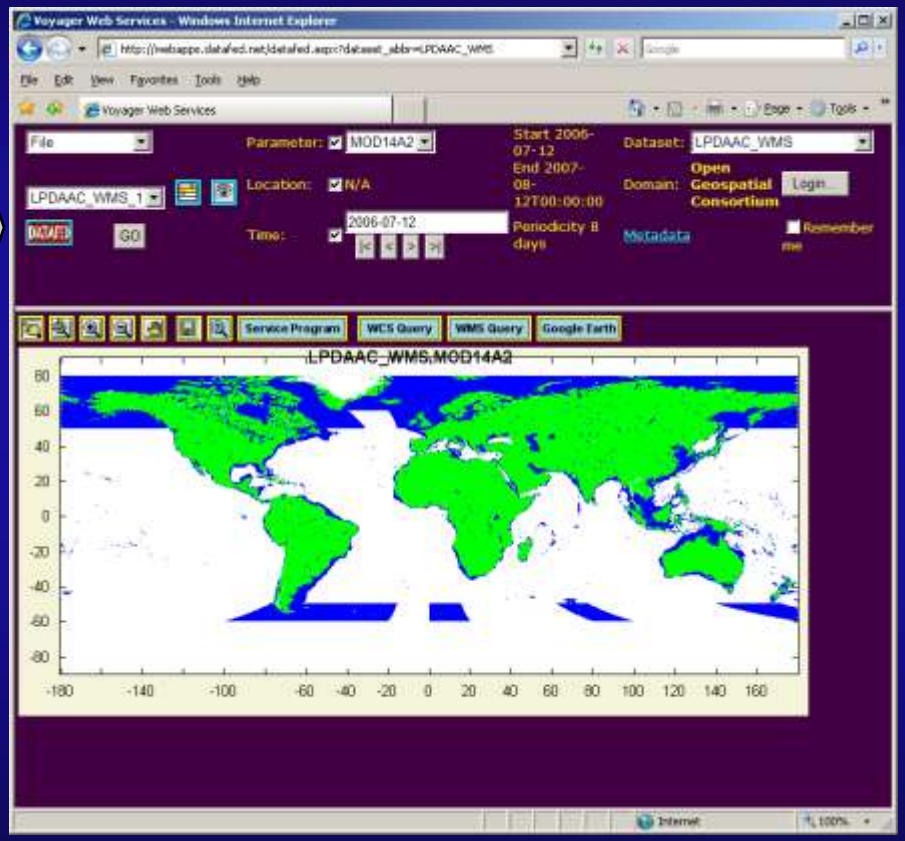
Public Web Server (Proxy)

Firewall

OGC Services (WCS, WMS)

On-Line Data Layer (MOD14)

DataFed



OGC Prototype

Lessons Learned

- Use of open source implementation of OGC WMS/WCS proved to be viable alternative
- Exposing standard NASA products from the DAAC on-line archive technically feasible
- Enhanced performance may be possible by re-sampling data at lower resolution for overviews
- WCS is a sufficient standard for delivering data in alternative formats

User Working Group

Tom Sohre[1] (USGS, acting LP DAAC Manager)
Tom Maiersperger[2] (SGT contractor to USGS/EROS, LP DAAC Scientist, vice-chair)
Jeanne Behnke[2] (NASA ESDIS representative)
Woody Turner[2] (NASA HQ Science representative)
Mike Abrams[2] (JPL, ASTER Science Team representative)
Alfredo Huete[1], (University of Arizona, MODIS Science Team representative)
Kirsten de Beurs[1] (Virginia Tech)
Robert Brackenridge[2], (Dartmouth)
Kevin Gallo[2] (NOAA NESDIS, UWG chair)
Matt Hansen[1] (South Dakota State University)
John Mars[1] (USGS)
John Melack[2] (UC Santa Barbara)
Jeff Morisette[1], (NASA)
David Turner[1] (Oregon State University)
Mark Carroll[1] (University of Maryland)
Susan Ustin[1] (UC Davis)

1 New member
2 Continuing member

Selected 2007 UWG Recommendations

- Pursue new data holdings which make up and extend the land remote sensing record (e.g., VIIRS land, Decadal Survey Missions, investigator-led data sets).

- Facilitate meetings between USGS and NASA leadership to develop long-term archive plans for ASTER and MODIS data.

- Expand visibility of alternative data access methods (e.g., via hands-on demonstrations at conferences, tailored tutorials available online for use by interested parties, advertising within order notifications, increased visibility in google search).

LP DAAC Outreach Events FY08

- Fall American Geophysical Union (AGU), San Fran., Dec. 10-14
- South Dakota State Annual Geography Conference, Brookings, Mar. 27-28
- Association of American Geographers (AAG), Boston, Apr. 15-19
- American Association of Petroleum Geologists (AAPG), San Antonio, Apr. 20-23
- USGS Land Remote Sensing Science Symposium, Flagstaff, March 11-14
- NASA Ecosystems & Biodiversity Workshop, College Park, Apr. 28-May 2
- American Society for Photogrammetry and Remote Sensing (ASPRS), Portland, Apr. 28-May 2
- Association of State Floodplain Managers (ASFPM) Annual Meeting, Reno, May 18-23
- Integrated Geospatial Education and Technology Training (iGETT), Corpus Christi, June 23
- International Geoscience and Remote Sensing Symposium (IGARSS), Boston, July 7-11
- Ecological Society of America (ESA) Annual Meeting, Milwaukee, August 2-7
- ESRI International User Conference, San Diego, Aug. 4-8

MEaSUREs and EOSDIS Data Centers

NASA Guidance:

- **Products generated by MEaSUREs Projects will be stored and distributed to users from the projects for their duration**
- **“Final versions” of products will be migrated to a designated EOSDIS Data Center for archiving and distribution**
- **Some of the MEaSUREs proposals already include collaboration with one or more EOSDIS Data Centers**
- **Interfaces need to be defined between MEaSUREs Projects and EOSDIS Data Centers**
- **Products to be migrated must be vetted through respective DAAC User Working Groups (by ~ 36 months after project start)**
- **No guarantee that all proposed products will qualify and find a “permanent home”**

- **NOTE: “Vegetation Phenology and Enhanced Vegetation Index Products from Multiple Long Term Satellite Data Records” was funded, Kamel Didan PI, Maiersperger & Jenkerson among Co-I’s (for web-enabled access portion)**

LP DAAC Top 10 Products (first half FY08)

1. TERRA MODIS MOD13A2 - Vegetation Indices 1km 16-day Tile
2. TERRA MODIS MOD11A2 - Land Surface Temperature / Emissivity 1km 8-day Tile
3. TERRA MODIS MOD15A2 - LAI / FPAR 1km 8-day Tile
4. TERRA MODIS MOD09A1 - Surface Reflectance Bands 1-7 500m 8-day Tile
5. TERRA MODIS MOD14 - Thermal Anomalies / Fire 1km Swath
6. TERRA MODIS MOD11A1 - Land Surface Temperature / Emissivity 1km Daily Tile
7. TERRA ASTER AST_L1A - Reconstructed Unprocessed Instrument Data 15/30/90m Scene
8. TERRA MODIS MOD13Q1 - Vegetation Indices 250m 16-day Tile
9. AQUA MODIS MYD14 - Thermal Anomalies / Fire 1km Swath
10. TERRA MODIS MOD14A1 - Thermal Anomalies / Fire 1km Daily Tile