OPEN SOURCE GEOINFORMATICS: GRASS AND R

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http://wgbis.ces.iisc.ernet.in/foss

Free - open source - Meaning

Open source software’s refer to those computer software’s with their source code made available to the users under a copyright license providing the rights to study, modify and distribute the software’s to any user.

Free software’s are those software’s that can be used, modified or distributed without any restrictions.

FOS GIS Examples

- GRASS GIS
- QGIS
- Open Jump
- R
- Net Logo
- Star Logo
- Dinamica
- Apache
- Geoserver
- UMN Mapserver, ……..

GRASS

Can perform:

- image processing
- graphics production
- spatial modelling
- data management
- visualization of many types of data

- GRASS (GEOGRAPHIC RESOURCES ANALYSIS SUPPORT SYSTEM) is a free GIS software used for
  - GEOSPATIAL DATA MANAGEMENT AND ANALYSIS,
  - IMAGE PROCESSING,
  - GRAPHICS/MAPS PRODUCTION,
  - SPATIAL MODELLING, AND
  - VISUALIZATION.
- ONE OF THE WORLD'S BIGGEST OPEN SOURCE PROJECT,
- OFFICIAL PROJECT OF THE OPEN SOURCE GEOSPATIAL (OSGEO) FOUNDATION.

GRASS Mirror Site (Tier 1) in India at CES, IISc

http://wgbis.ces.iisc.ernet.in/grass

GRASS Mirror site:
http://wgbis.ces.iisc.ernet.in/grass

GRASS GIS
The world's leading Free GIS software

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Latest News

Page 1 of 11 > >>

Jan 18, 2014
GRASS GIS @ Vienna Code Sprint 2014
The GRASS GIS Community Sprint will join the Vienna Code Sprint in March 2014!
[More]
Jan 4, 2014
GRASS GIS 7 Addons Manuals online
GRASS GIS 7 Addons Manuals now generated on a weekly basis
[More]

User map

Mirrors

Official master site via HTTP/FTP

- Official master site at OSGeo.org (HTTP) - Web statistics - ~~Mirror Web statistics~~

We use cascaded mirroring:
Tier-1 mirrors: These mirrors read daily from the master site and also act as rsync servers.
Tier-2 mirrors: These mirrors read from the tier-1 mirrors (these sites may be 1-2 day(s) behind the master site)

GRASS GIS Wiki mirror:

- GRASS (read-only) Wiki mirror (Czech Technical University in Prague)

African Web site mirrors HTTP:

- Namibia (Tier 2, Polytechnic of Namibia)
- South Africa (Tier 2,TENET)

Asian Web site mirrors HTTP:

- ~~India~~ (Tier 2, Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India)
- Japan (Tier 2, Osaka City University)
- ~~South Korea~~ (Tier 2, Gyung-Nam National University of Science & Technology)

European Web site mirrors HTTP:

- Poland (**Tier 1**, Wroclaw University) - master mirror
- Romania (Tier 2, University of Bucharest, Faculty of Geography)

US Web site mirrors HTTP:

- USA (**Tier 1**, Quintex)

US Web site mirrors FTP/rsync:

- USA (**Tier 1**, Quintex)
- rsync://mirror.quintex.com::grass

Become a GRASS GIS Web site mirror!

GRASS GIS

- Grass – FOSS GIS
  - Can track the change the codes
  - can be legally given for free, copied and shared
  - useful for students, researchers, teachers, scientists wanting to use legal software, appropriate to their needs

- Can store, process and visualise spatial (raster, vector and point) data along with associated attributes.

- GRASS uses GDAL library for raster and OGR library for vector data analysis.

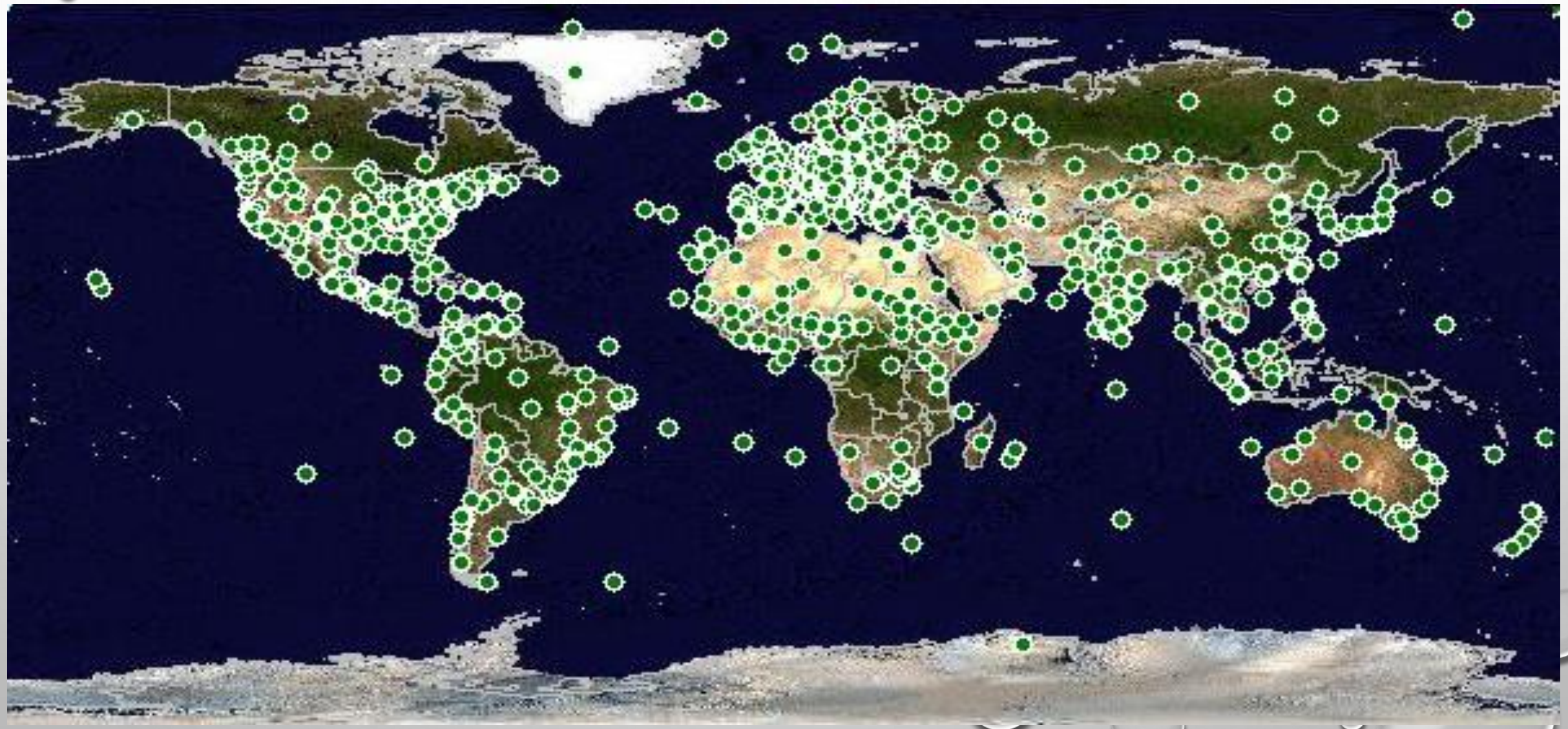
GRASS GIS

- GRASS is a freeware under the GNU General Public License (GPL).
- GRASS consists of more than 400 programs (in C) and tools to render maps and images on monitor and manipulate raster, vector, and site data; process multi spectral image data; and create, manage, and store spatial data.

Supported platforms

- GRASS is written in ANSI-C (C-API)
- Architectures: Intel x86, AMD X64, Motorola PPC, Sun SPARC, etc.
- Operating systems: Linux (32/64bit), Unix variants, Windows, Solaris etc.

GRASS Users Worldwide



GRASS Community:

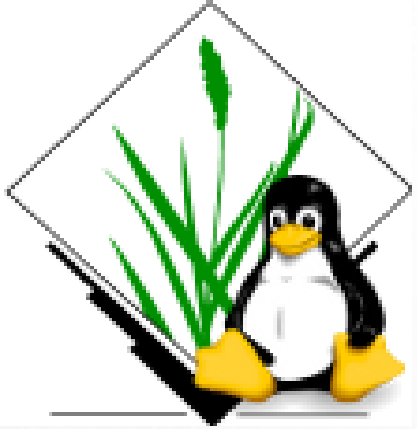
http://wgbis.ces.iisc.ernet.in/grass/community/support.php

- Announcements
- User support Mailing list: for discussion about problems and solutions using GRASS
- Development related Mailing list
- Localized mailing lists
- News groups
- Documents
- Bugs

GRASS Development

http://wgbis.ces.iisc.ernet.in/grass/devel/index.php

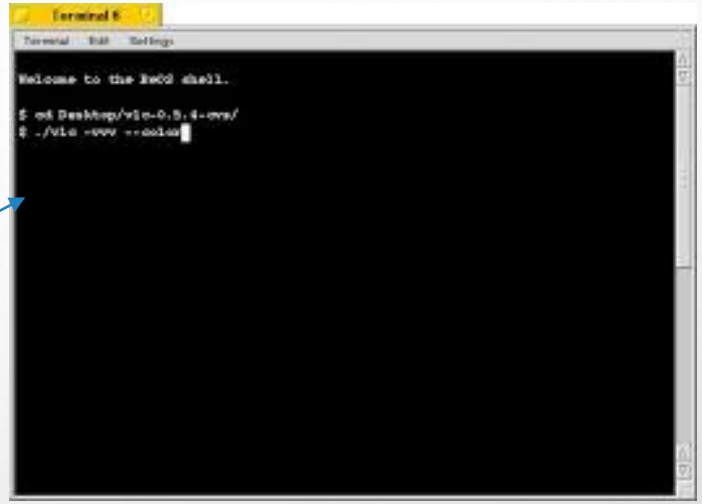
- Mailing list
- Compiling GRASS
- Programmer's Manual
- Code submission
- Quality Control
- GRASS related software



Installation of Grass

After installing Linux (Ubuntu) In Linux

Applications -→ Accessories → Terminal



Just update the installation of linux repositories

Now type: sudo apt-get update

Once this completes

Type: sudo apt-get install grass

Hurray!!! Grass is installed

Applications -→ Accessories → Terminal → grass –text

Applications -→ Accessories → Terminal → grass –tcltk

```
                        GRASS 6.4.0RC5

DATABASE: A directory (folder) on disk to contain all GRASS maps and data.

LOCATION: This is the name of a geographic location. It is defined by a
          co-ordinate system and a rectangular boundary.

MAPSET:   Each GRASS session runs under a particular MAPSET. This consists of
          a rectangular REGION and a set of maps. Every LOCATION contains at
          least a MAPSET called PERMANENT, which is readable by all sessions.

         The REGION defaults to the entire area of the chosen LOCATION.
         You may change it later with the command: g.region
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

LOCATION:   MODIS_2010_____________   (enter list for a list of locations)
MAPSET:     vish___________________   (or mapsets within a location)

DATABASE: /home/vishnu/grassdata_____________________________________________



          AFTER COMPLETING ALL ANSWERS, HIT <ESC><ENTER> TO CONTINUE
                        (OR <Ctrl-C> TO CANCEL)
```

Location

Location is a geographic extent of interest that contains data sets

Every location has a PERMANENT directory which stores some basic information about the whole location, and is a place to store base files.

We can think of a location as a data library for a region of interest.

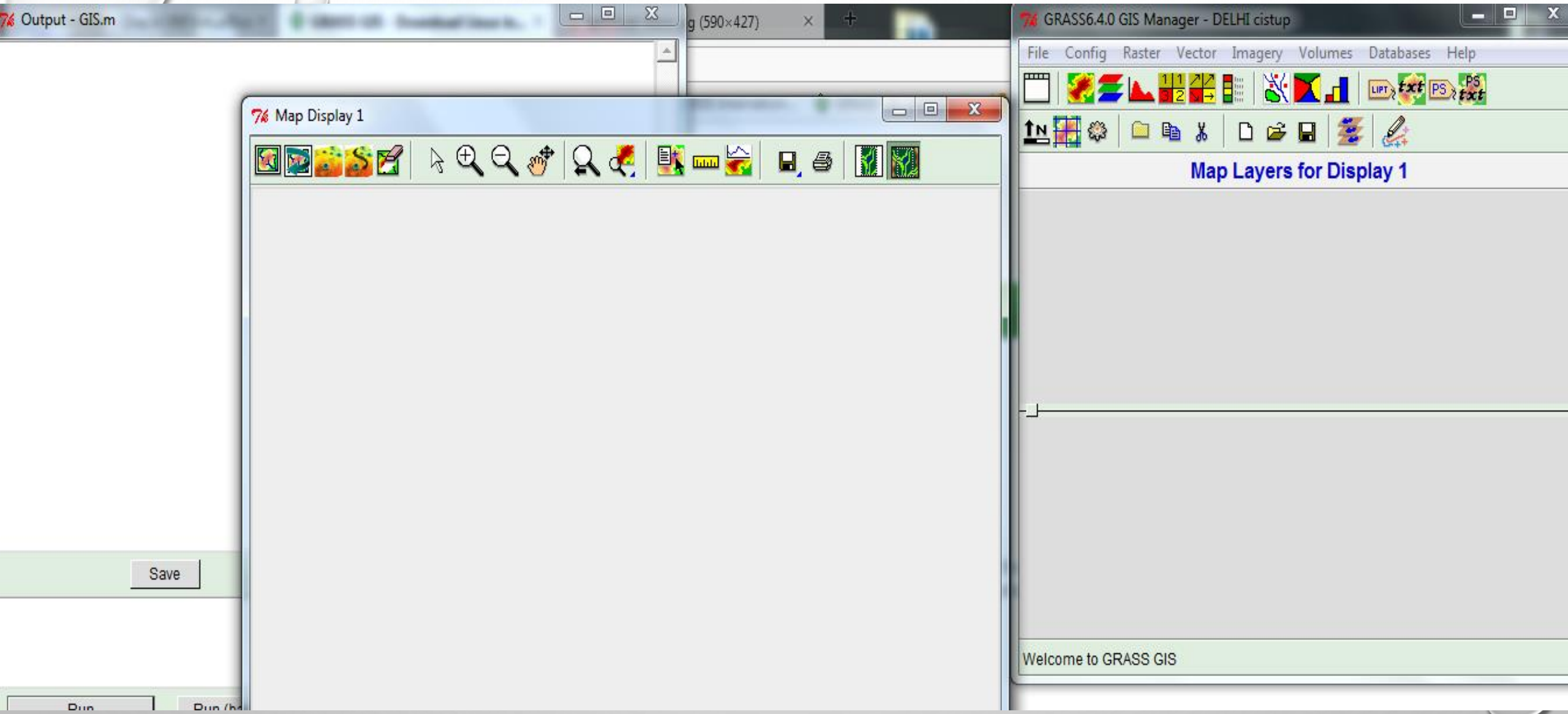
MAPSET

A MAPSET may be a geographical subset or as large as the parent LOCATION.

Technically they are subdirectories under any location .

The "PERMANENT" mapset usually contains the read-only base maps like the elevation model, while the other locations are readable and writable by their owners.

The "PERMANENT" mapset also contains some information about the location itself that is not found in other mapsets thus it must exist in every location.


Output - GIS.m
g (590×427)
GRASS6.4.0 GIS Manager - DELHI cistup
File Config Raster Vector Imagery Volumes Databases Help
Map Display 1
Map Layers for Display 1
Save
Welcome to GRASS GIS

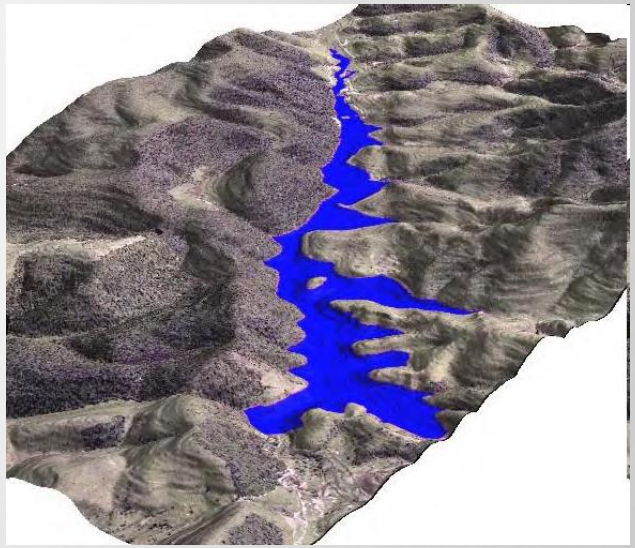
How to start with GRASS:

http://wgbis.ces.iisc.ernet.in/grass/intro/index.php

- Installation Guide:
  http://grass.osgeo.org/wiki/Installation_Guide
- First day documentation: GRASS 6 Terminology, Basic GIS concepts, GRASS Quick Start …
  http://grass.osgeo.org/wiki/GRASS_Help#First_Day_Documentation
- Tutorial and courses: http://grass.osgeo.org/gdp/tutorials.php

Applications:

- Remote Sensing
- Search and Rescue
- Environmental Protection and Monitoring
- Risk and Hazard Management
- Climate Change Studies
- Archeology
- Agriculture
- Energy calculations
- Geology
- Geomorphometry
- Geophysics
- Hydrological Sciences - including ice cover and groundwater flow
- Marine Science
- Meteorology
- Planetary mapping
- Public Health
- Epidemiology
- Medical Diagnostics
- Soil Science
- Wildlife Zoology
- ...



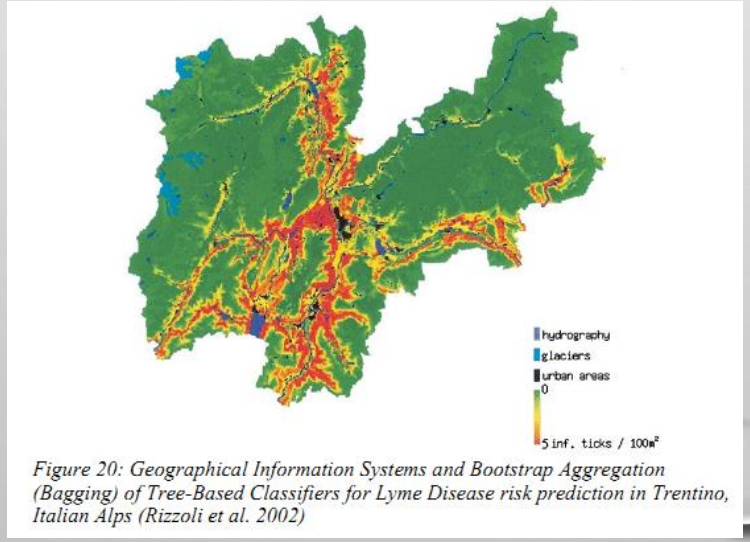


Figure 20: Geographical Information Systems and Bootstrap Aggregation (Bagging) of Tree-Based Classifiers for Lyme Disease risk prediction in Trentino, Italian Alps (Rizzoli et al. 2002)

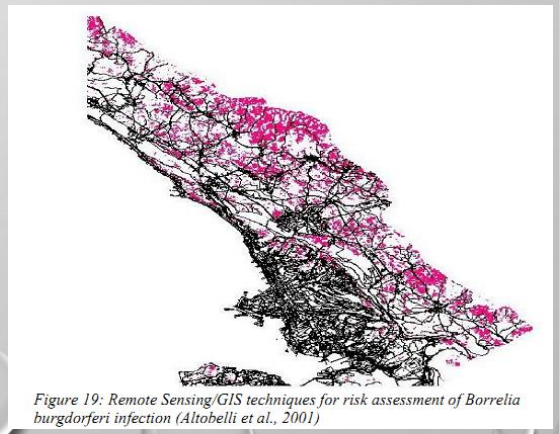


Figure 19: Remote Sensing/GIS techniques for risk assessment of Borrelia burgdorferi infection (Altobelli et al., 2001)

GRASS http://wgbis.ces.iisc.ernet.in/grass	QGIS http://www.qgis.org/	Open JUMP http://openjump.org/
http://www.php.net/	http://www.tcl.tk/	http://qt.nokia.com/
Apache HTTP SERVER PROJECT http://www.apache.org/	MAPSERVER http://mapserver.org/	JabRef reference manager http://jabref.sourceforge.net/
openModeller http://openmodeller.sourceforge.net/	ILWIS http://www.itc.nl/ilwis/	gdLibrary http://www.boutell.com/gd/
http://www.r-project.org/	gstat http://www.gstat.org/	INKSCAPE http://www.inkscape.org/
MySQL http://www.mysql.com/	PostgreSQL http://www.postgresql.org/	PostGIS http://postgis.refractions.net/
ATutor- Content Management System	Drupal	Joomla! http://www.joomla.org/

Downloading Data

Step 1:

URL

https://lpdaac.usgs.gov/

Step 2:

Click PRODUCTS

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ATTENTION: Welcome!

NEWS FEED | SITE MAP

Welcome

Products

Lists the satellite images available from the two sensors, MODIS and ASTER.

Get Data

Guides you through the steps needed to acquire the satellite images.

Tools

Some tools to help you work with the data.

News

04/16/2010
GloVis Supports Additional MODIS Data Products

04/16/2010
MRTWeb Supports Additional MODIS Data Products

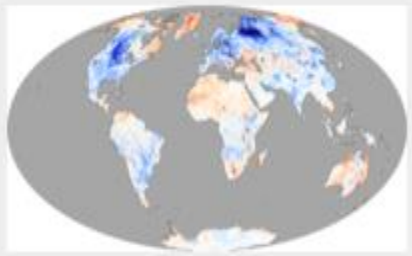
04/08/2010
LP DAAC ASTER L1B Rolling Archive Maintenance

02/23/2010
Changes to WIST Order Size and LP DAAC Order Download Time

Data in Action

Temperature Anomalies, Winter 2009-2010

03/25/2010



When climate scientists calculate Earth's average temperature each year, they reduce a year's worth of seasonal highs and lows for hundreds of millions of square kilometers of land and ocean into a single number. This

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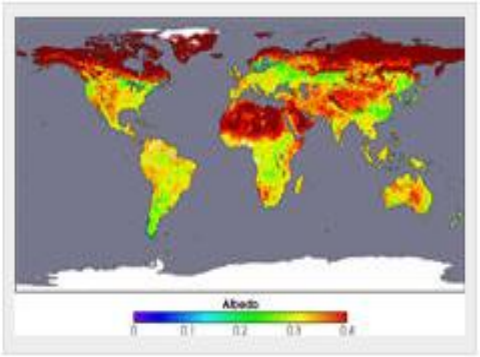
- ASTER Policies
- MODIS Products Table
- MODIS Policies
- ASTER Overview
- ASTER Products Table
- Other Data Links

> Products

NEWS FEED | SITE MAP

Products

LP DAAC MODIS Data



MODIS Overview · Details about naming conventions, temporal, and spatial resolutions and metadata.

MODIS Products · Sortable table of LP DAAC MODIS products with links to product-specific information.

MODIS Policies · MODIS pricing and distribution policies.

LP DAAC ASTER Data

ASTER Overview · What Makes ASTER Unique? Details about

MOD13A1	Terra	Vegetation Indices	Tile	500m	16 Day
MOD13A2	Terra	Vegetation Indices	Tile	1000m	16 Day
MOD13A3	Terra	Vegetation Indices	Tile	1000m	Monthly
MOD13C1	Terra	Vegetation Indices	CMG	5600m	16 Day
MOD13C2	Terra	Vegetation Indices	CMG	5600m	Monthly
MOD13Q1	Terra	Vegetation Indices	Tile	250m	16 Day
MOD14	Terra	Thermal Anomalies & Fire	Swath	1000m	5 Min
MOD14A1	Terra	Thermal Anomalies & Fire	Tile	1000m	Daily
MOD14A2	Terra	Thermal Anomalies & Fire	Tile	1000m	8 Day
MOD15A2	Terra	Leaf Area Index - FPAR	Tile	1000m	8 Day
MOD17A2	Terra	Gross Primary Productivity	Tile	1000m	8 Day
MOD44B	Terra	Vegetation Continuous Fields	Tile	500m	Yearly
MOD44W	Terra	Land Water Mask Derived	Tile	250m	none
MYD09A1	Aqua	Surface Reflectance Bands 1–7	Tile	500m	8 Day
MYD09CMG	Aqua	Surface Reflectance Bands 1–7	CMG	5600m	Daily
MYD09GA	Aqua	Surface Reflectance Bands 1–7	Tile	500/1000m	Daily
MYD09GQ	Aqua	Surface Reflectance Bands 1–2	Tile	250m	Daily
MYD09Q1	Aqua	Surface Reflectance Bands 1–2	Tile	250m	8 Day
MYD11_L2	Aqua	Land Surface Temperature & Emissivity	Swath	1000m	5 Min
MYD11A1	Aqua	Land Surface Temperature & Emissivity	Tile	1000m	Daily

• Improved aerosol retrieval

Overview | Links | Layers | Policies | Get Data | Help

Overview

Data Set Characteristics

Temporal Coverage	July 4, 2002 -
Area	~10 x 10 lat/long
File Size	~64 MB
Projection	Sinusoidal
Data Format	HDF-EOS
Dimensions	2400 x 2400 rows/columns
Resolution	500 meters
Science Data Sets (SDS HDF Layers)	13

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publications.

Change Points of Interest

- Reduced file volume: internal compression
- Improved aerosol retrieval

Overview | Links | Layers | Policies | Get Data | Help

Get Data

Data Access Tools

The complete data record for this product is available through the **WIST** and **GloVis** search and order interfaces. A near-complete record is available on-line through the **Data Pool**.

Please find links to (and information about) these data access tools on the Get Data Section of this Web Site.

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- GloVis
- Data Pool
- MRTWeb
- ASTER Tasking

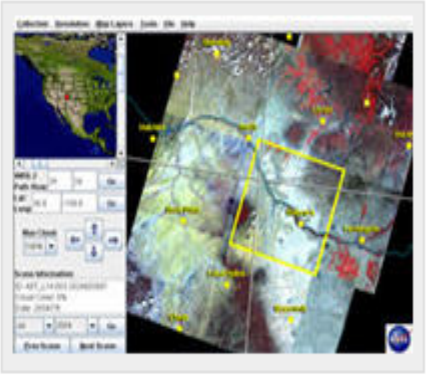
> Get Data

Get Data

NASA Warehouse Inventory Search Tool (WIST)

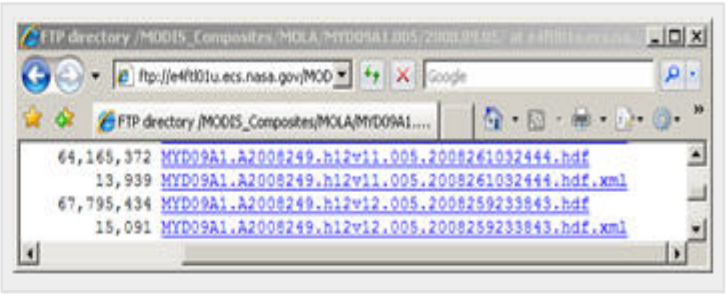
All LP DAAC data holdings available · Search and order earth science data from all NASA data centers · Replacement for EOSDIS Data Gateway (EDG). More Information · Launch WIST

USGS Global Visualization Viewer (GloVis)



All LP DAAC ASTER and selected MODIS data holdings available. Landsat 7 ETM+, Landsat 4/5 TM, Landsat 1-5 MSS, EO-1 ALI, EO-1 Hyperion, MRLC, and Tri-Decadal data sets also available. Browse-based for enhanced visualization. More Information · Launch GloVis

LP DAAC Data Pool



Selected LP DAAC ASTER and MODIS data holdings · Direct FTP access · All data are at no charge. More Information

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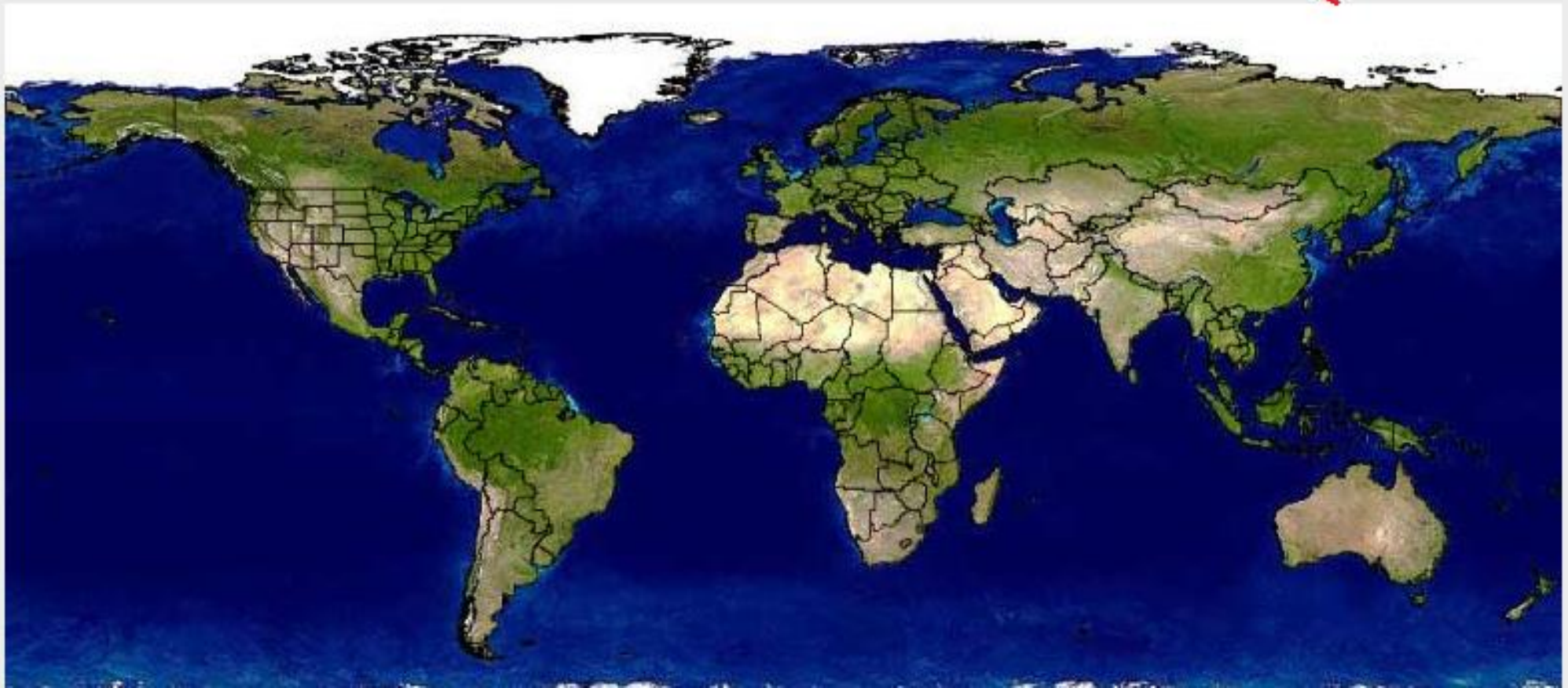
Earth Resources Observation and Science Center (EROS)

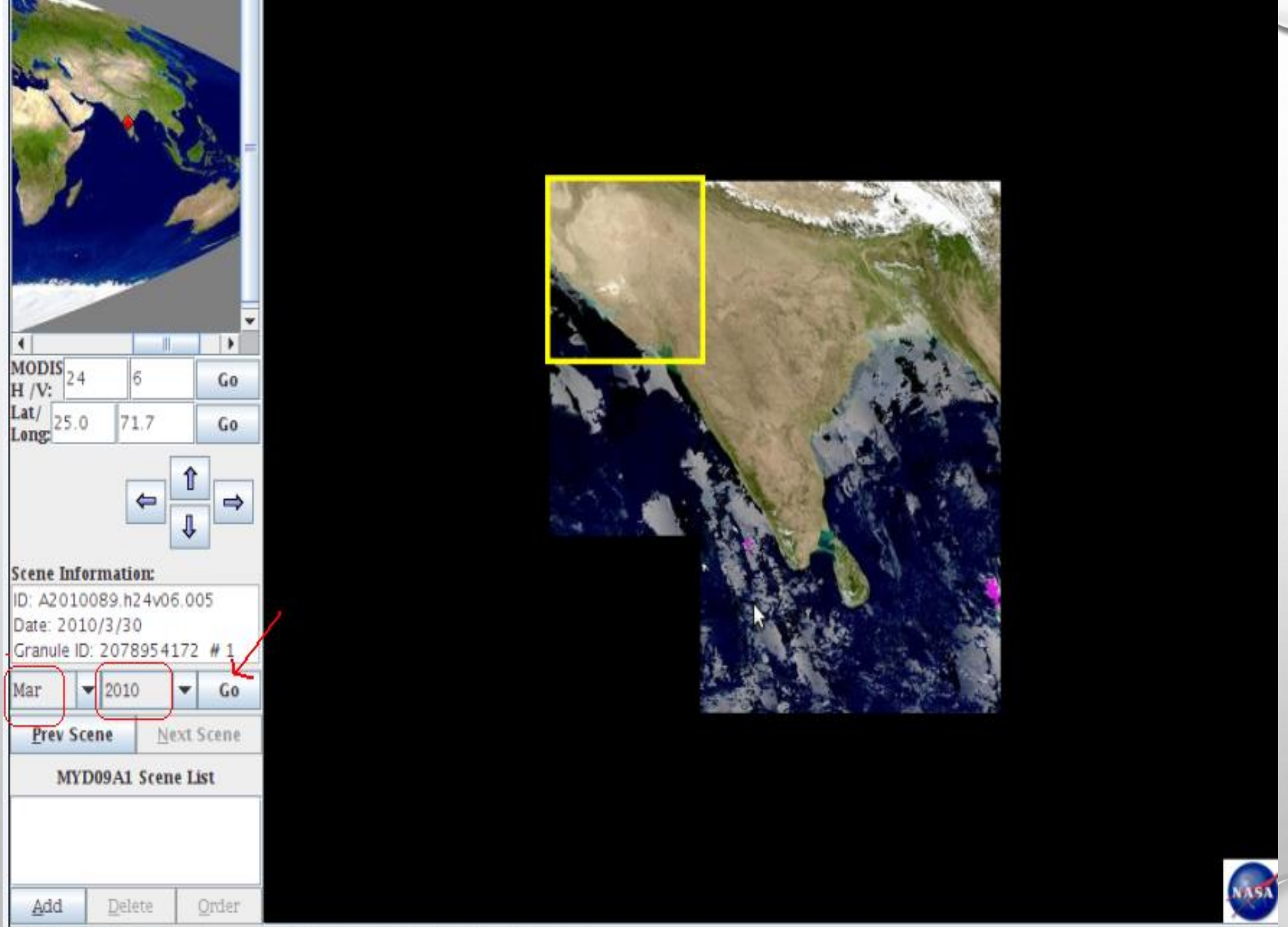
USGS Global Visualization Viewer

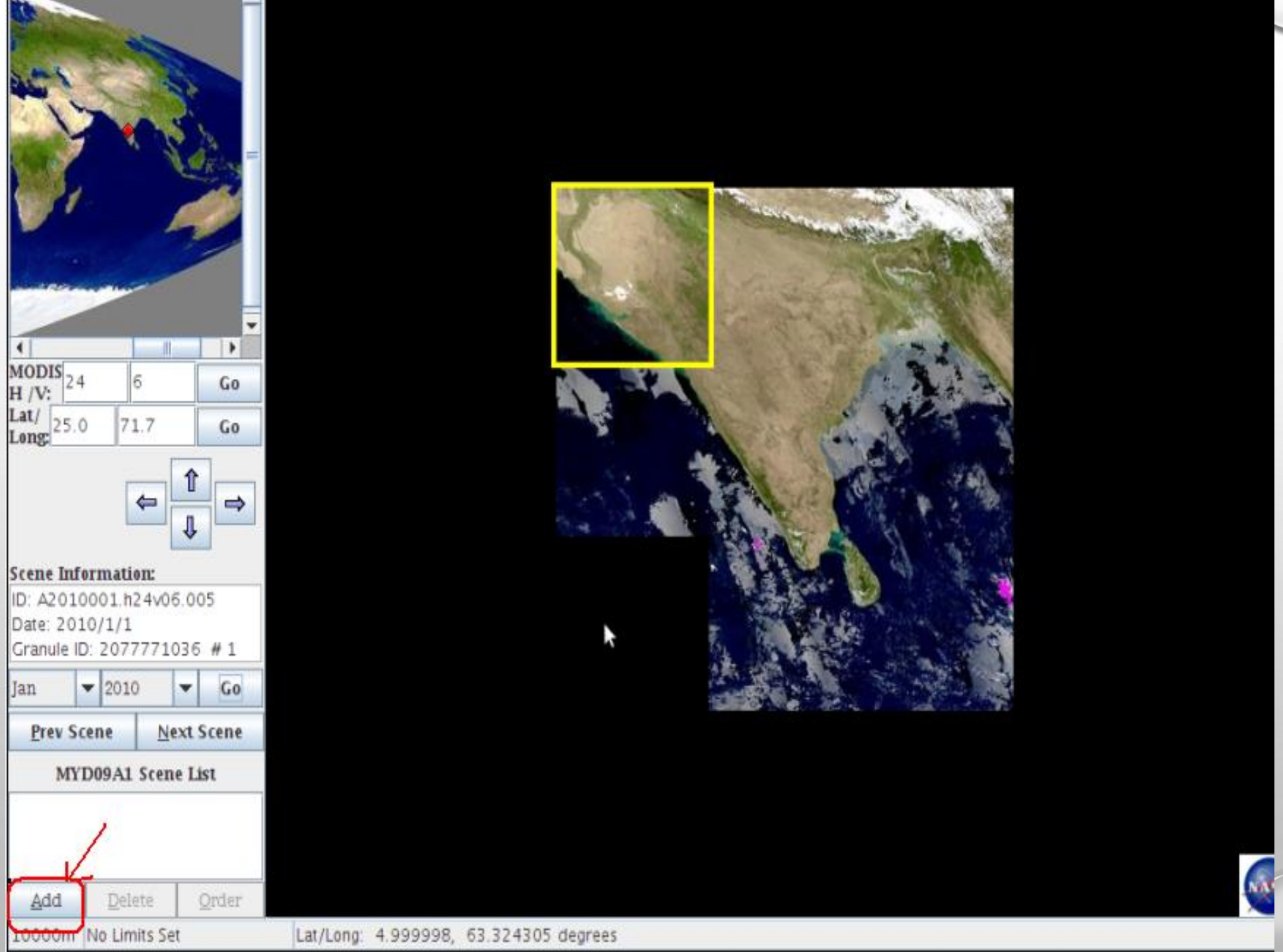
Select a collection, then click on the Global Locator Map to view satellite browse images in that area.

Select Collection MODIS Aqua MYD09A1 View Images

Latitude Longitude




MODIS H /V:
24
6
Go
Lat/ Long:
25.0
71.7
Go
Scene Information:
ID: A2010089.h24v06.005
Date: 2010/3/30
Granule ID: 2078954172 # 1
Mar
2010
Go
Prev Scene
Next Scene
MYD09A1 Scene List
Add
Delete
Order
10000m
No Limits Set
Lat/Long: 6.166668, 73.927771 degrees


MODIS H /V:
24
6
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25.0
71.7
Go
Scene Information:
ID: A2010001.h24v06.005
Date: 2010/1/1
Granule ID: 2077771036 # 1
Jan
2010
Go
Prev Scene
Next Scene
MYD09A1 Scene List
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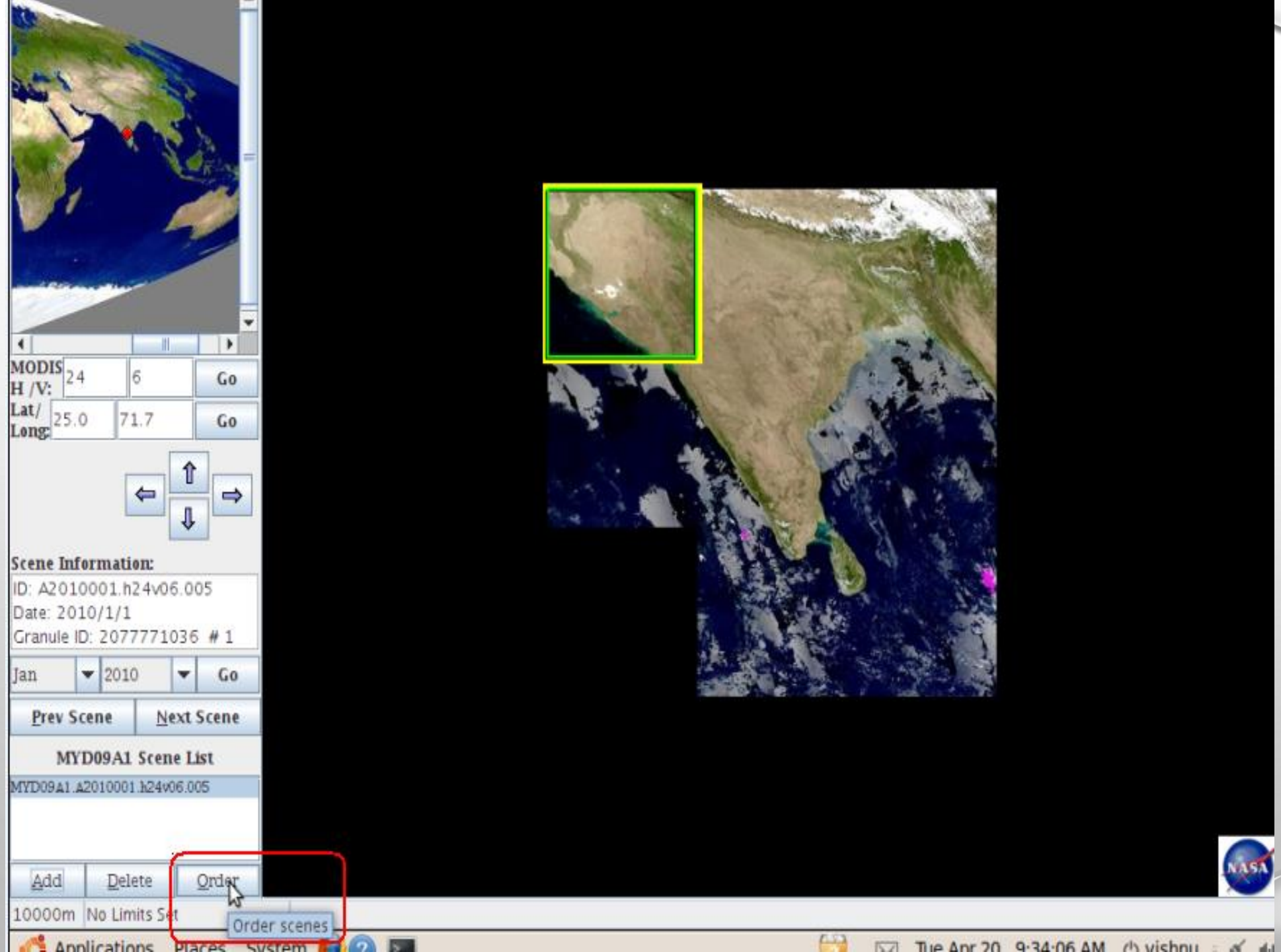
No Limits Set
Lat/Long: 4.999998, 63.324305 degrees


MODIS H /V:
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Lat/ Long:
25.0
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Go
Scene Information:
ID: A2010001.h24v06.005
Date: 2010/1/1
Granule ID: 2077771036 # 1
Jan
2010
Go
Prev Scene
Next Scene
MYD09A1 Scene List
MYD09A1.A2010001.h24v06.005
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No Limits Set
Order scenes
Applications
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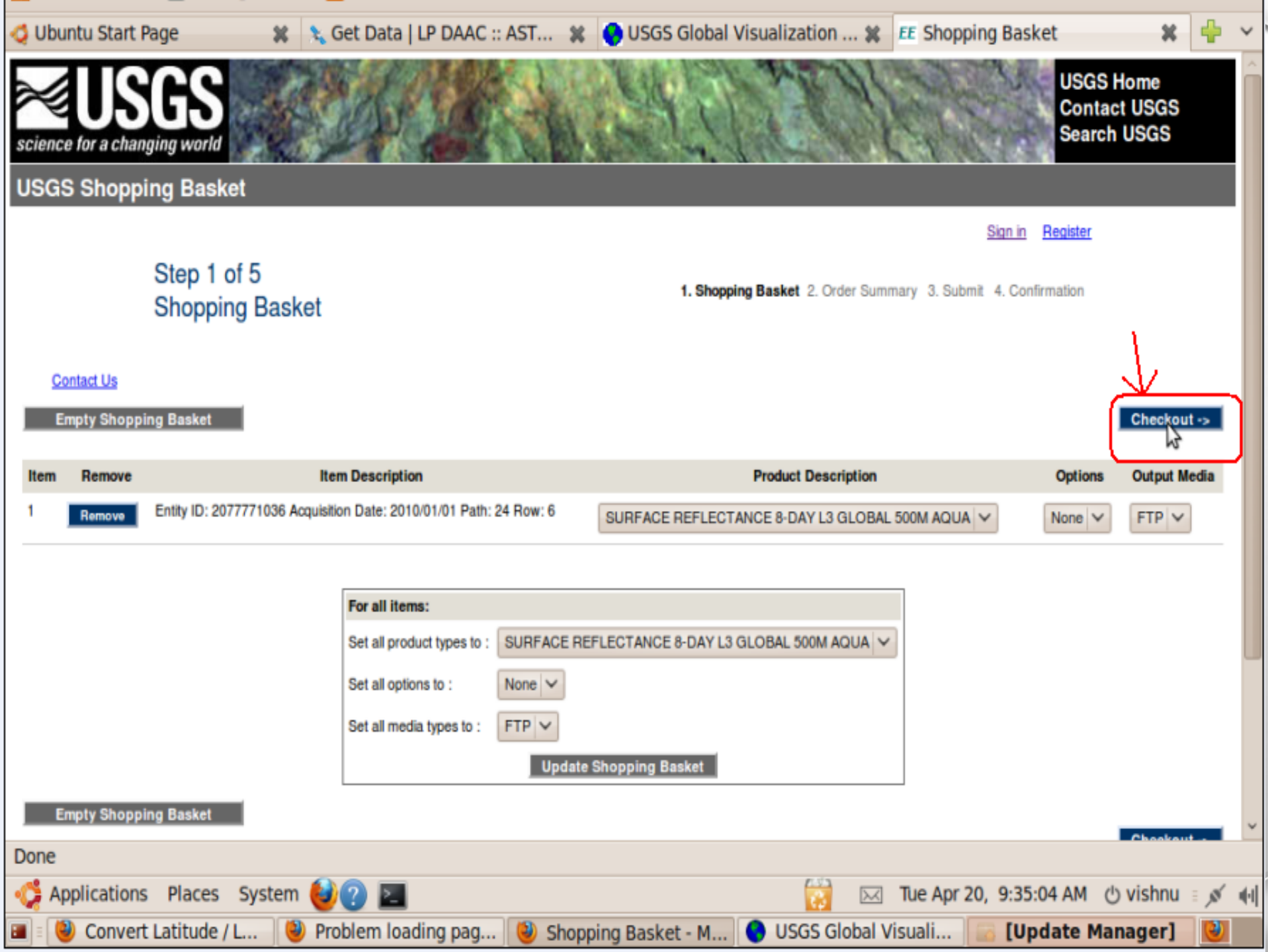
vishnu


Ubuntu Start Page
Get Data | LP DAAC :: AST...
USGS Global Visualization ...
Shopping Basket
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USGS Home
Contact USGS
Search USGS
USGS Shopping Basket
Sign in
Register
Step 1 of 5
Shopping Basket
1. Shopping Basket 2. Order Summary 3. Submit 4. Confirmation
Contact Us
Empty Shopping Basket
Checkout ->
Item
Remove
Item Description
Product Description
Options
Output Media
1
Remove
Entity ID: 2077771036 Acquisition Date: 2010/01/01 Path: 24 Row: 6
SURFACE REFLECTANCE 8-DAY L3 GLOBAL 500M AQUA
None
FTP
For all items:
Set all product types to :
SURFACE REFLECTANCE 8-DAY L3 GLOBAL 500M AQUA
Set all options to :
None
Set all media types to :
FTP
Update Shopping Basket
Empty Shopping Basket
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Convert Latitude / L...
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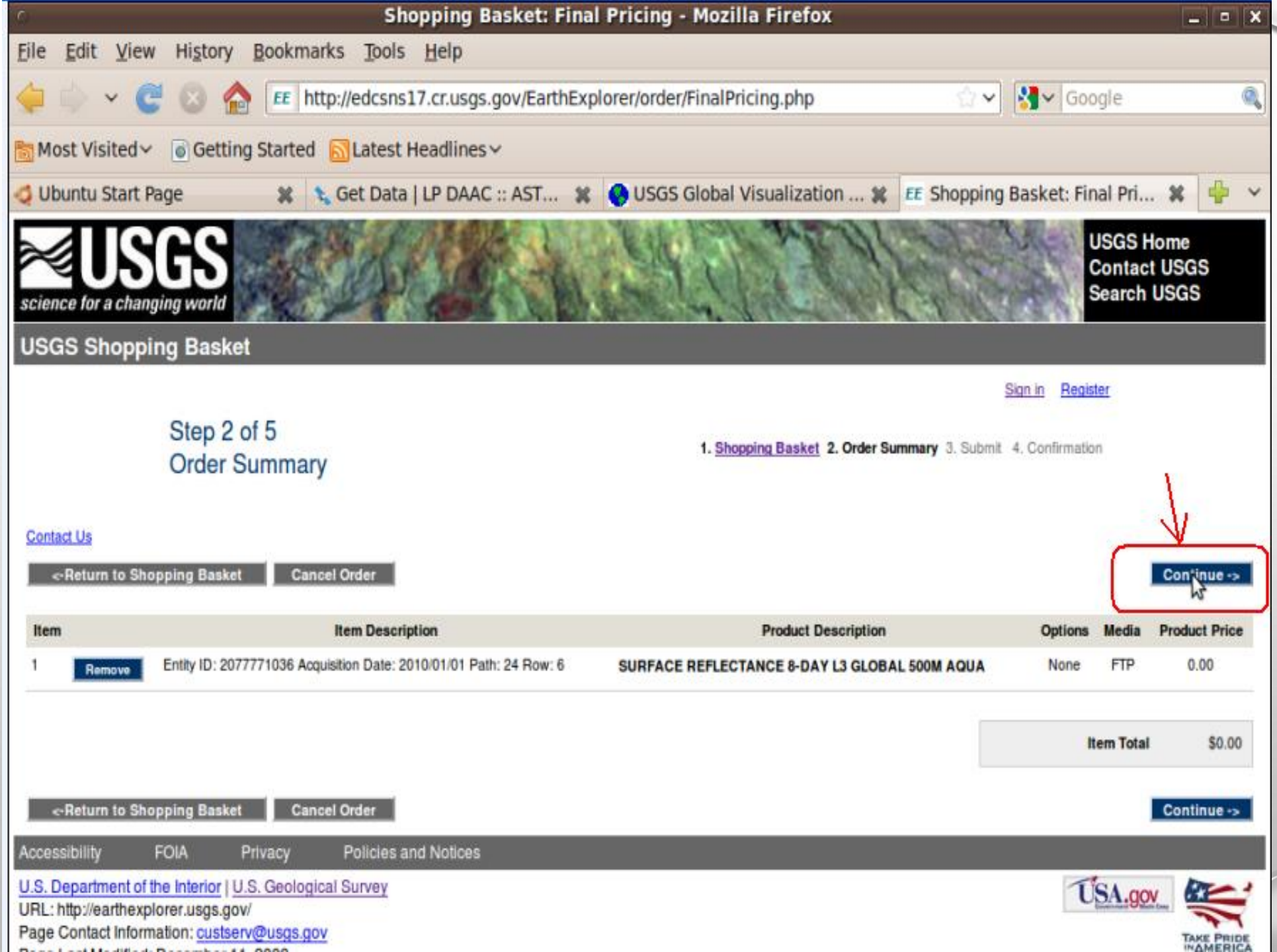
[Update Manager]


Shopping Basket: Final Pricing - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://edcsns17.cr.usgs.gov/EarthExplorer/order/FinalPricing.php
Google
Most Visited
Getting Started
Latest Headlines
Ubuntu Start Page
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Sign in
Register
Step 2 of 5
Order Summary
1. Shopping Basket 2. Order Summary 3. Submit 4. Confirmation
Contact Us
<-Return to Shopping Basket
Cancel Order
Continue ->
Item
Item Description
Product Description
Options
Media
Product Price
1
Remove
Entity ID: 2077771036 Acquisition Date: 2010/01/01 Path: 24 Row: 6
SURFACE REFLECTANCE 8-DAY L3 GLOBAL 500M AQUA
None
FTP
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Item Total
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<-Return to Shopping Basket
Cancel Order
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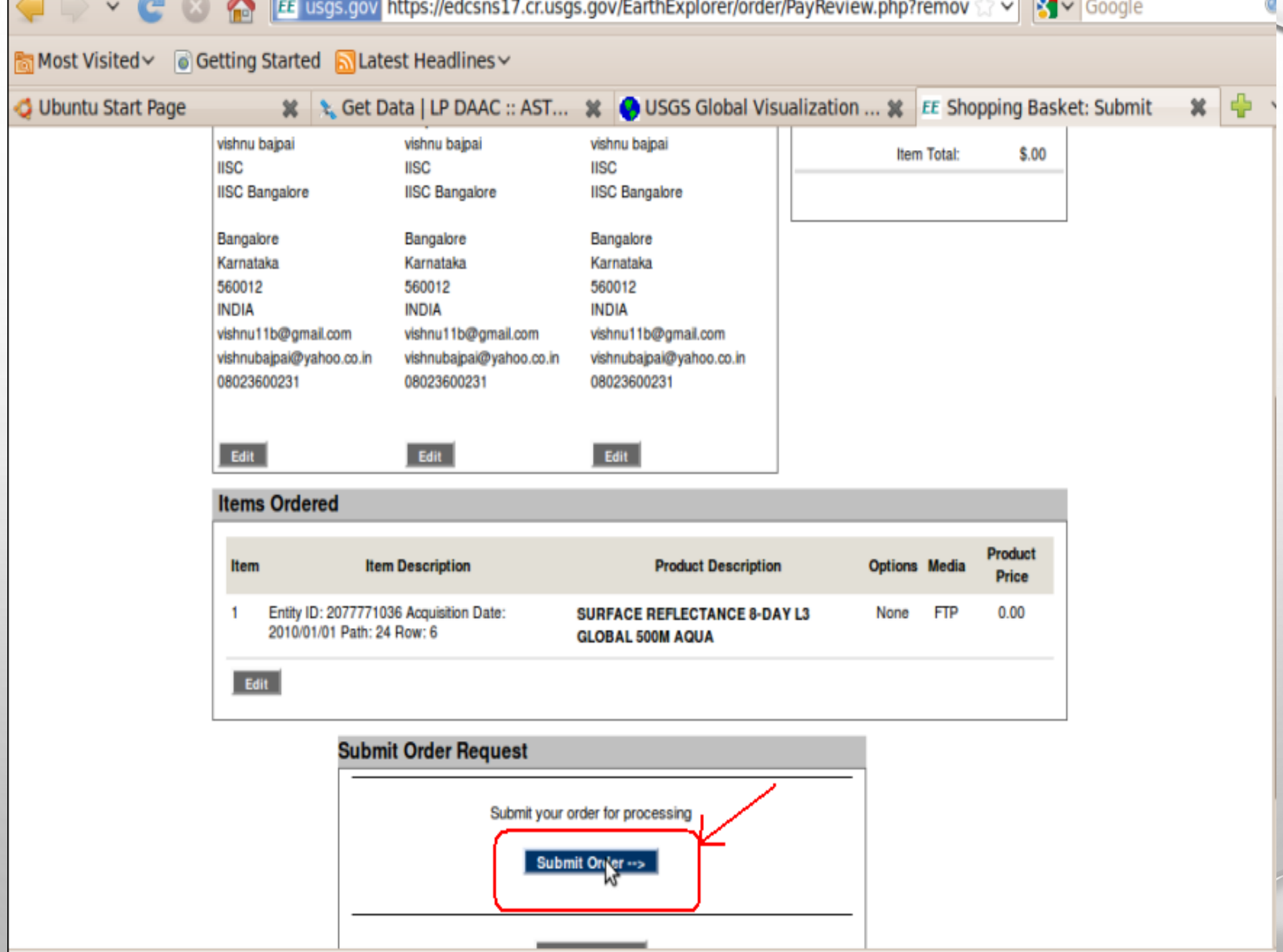
Policies and Notices
U.S. Department of the Interior | U.S. Geological Survey
URL: http://earthexplorer.usgs.gov/
Page Contact Information: custserv@usgs.gov
USA.gov
TAKE PRIDE IN AMERICA


usgs.gov https://edcsns17.cr.usgs.gov/EarthExplorer/order/PayReview.php?remov
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USGS Global Visualization ...
Shopping Basket: Submit
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vishnubajpai@yahoo.co.in
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Edit
Item Total: $.00
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Item
Item Description
Product Description
Options
Media
Product Price
1
Entity ID: 2077771036 Acquisition Date: 2010/01/01 Path: 24 Row: 6
SURFACE REFLECTANCE 8-DAY L3 GLOBAL 500M AQUA
None
FTP
0.00
Edit
Submit Order Request
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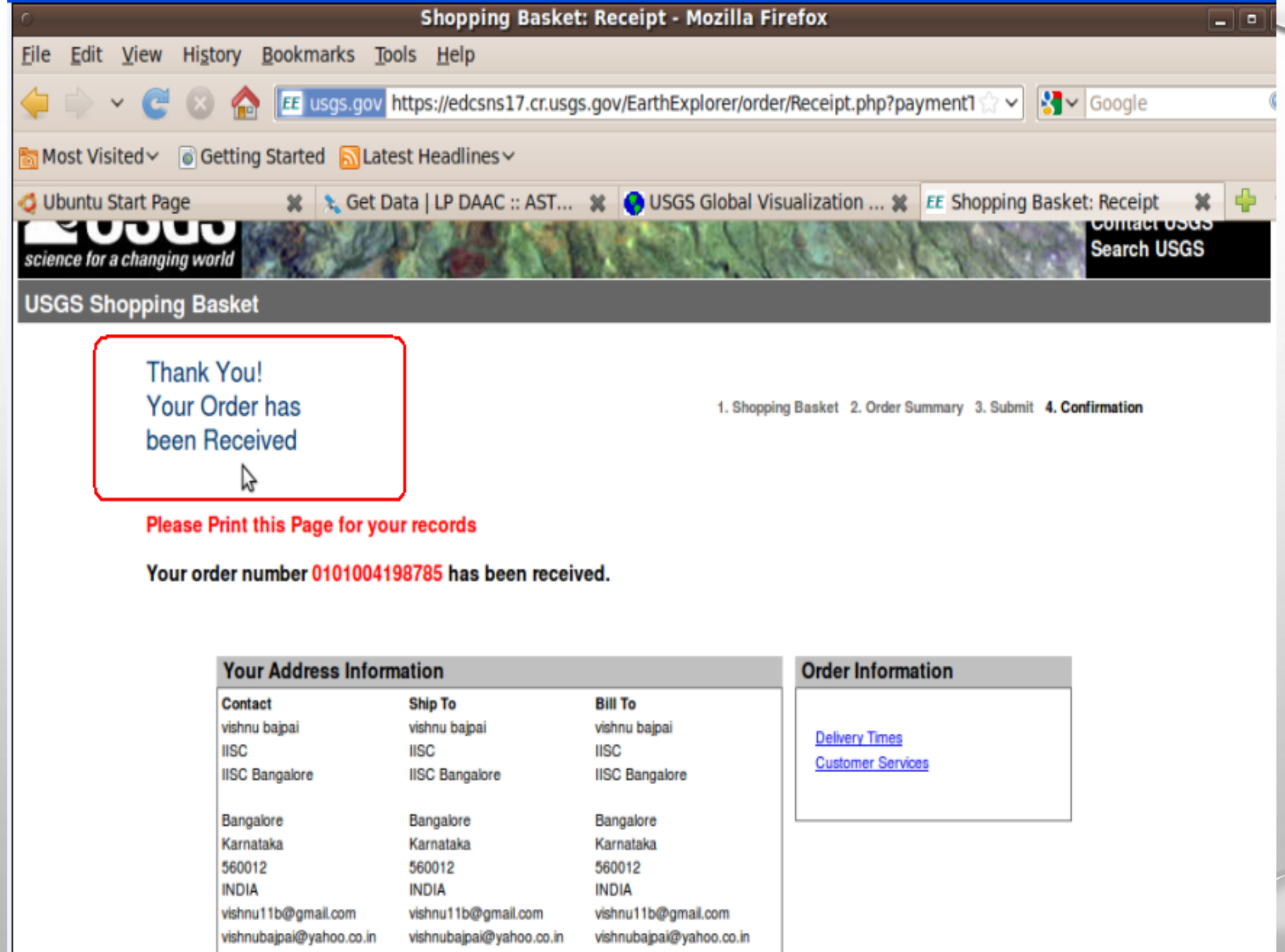
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Classification of images by taking signatures from google earth

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STEPS INVOLVED IN THE CLASSIFICATION OF IMAGES BY TAKING SIGNATURES FROM GOOGLE EARTH

- CREATING THE LOCATION AND THE MAPSET FOR THE DATA.
- IMPORTING THE DATA TO THE LOCATION AND MAPSET.
- CREATING FALSE COLOR COMPOSITE.
- OBTAINING SIGNATURES FROM GOOGLE EARTH.
- IMPORTING THOSE VECTOR FILES INTO ANOTHER VECTOR LOCATION.
- PROJECT THOSE VECTOR FILES INTO THE CURRENT LOCATION.
- BUILDING OF POLYLINES.
- DIGITIZING THE VECTOR MAP.
- CONVERTING THE VECTOR MAPS TO RASTER MAPS.
- PATCHING THE RASTER MAP TO OBTAIN THE TRAINING DATA.
- CREATING A GROUP.
- GENERATING THE SIGNATURE FILE.
- CLASSIFYING THE IMAGE USING THE SIGNATURE FILE.
- GENERATING ERROR MATRIX.

1)CREATING THE LOCATION AND THE MAPSET FOR THE DATA:

- VARIOUS GRASS COMMANDS ARE USED FOR CARRYING OUT VARIOUS OPERATIONS IN GRASS.
- INITIALLY A LOCATION AND MAPSET IS TO BE CREATED FOR HOLDING THE DATA IN GRASS.
- A LOCATION IS SOME GEOGRAPHIC EXTENT OF INTEREST THAT CONTAINS DATA SETS THAT MUST ALL BE IN THE SAME COORDINATE SYSTEM.
- EVERY LOCATION HAS A PERMANENT DIRECTORY WHICH STORES SOME BASIC INFORMATION ABOUT THE WHOLE LOCATION.
- A MAPSET IS A GEOGRAPHICAL SUBSET. EVERY GRASS SESSION RUNS UNDER A PARTICULAR MAPSET.
- THE REQUIRED LOCATION AND THE MAPSET IS CREATED BY RUNNING THE **GRASS –TEXT** COMMAND IN THE TERMINAL.

- ON ENTERING THE **GRASS –TEXT** COMMAND ,THE FOLLOWING DETAILS WILL BE ASKED FOR THE CREATION OF LOCATION AND MAPSET:

  - INITIALLY IT WILL ASK FOR THE LOCATION NAME.
  - LOCATION: ENTER THE NAME OF THE LOCATION.
  - COORDINATE SYSTEM:
    A. X,Y
    B. LAT-LONG
    C. UTM
    D. OTHER PROJECTION
  - >C (UTM SYSTEM)
  - ONE LINE DESCRIPTION FOR LOCATION: <ENTER ANYTHING>
  - GEODETIC DATUM: WGS84
  - ELLIPSOID NAME: WGS84
  - SOUTH HEMISPHERE? : N (NO)
  - ENTER ZONE: 43

- DEFINE DEFAULT REGION: IT IS TO SET DEFAULT REGION USING
  - NORTH_EDGE
  - SOUTH_EDGE
  - WEST_EDGE
  - EAST_EDGE.
  - GRID RESOLUTION
- MAPSET: NAME OF THE MAPSET
- DATABASE: /HOME/……(GIVE THE PATH WHERE THE LOCATION IS TO BE CREATED)

2) IMPORTING THE DATA TO THE LOCATION AND MAPSET:

- THE DATA IS IMPORTED TO THE CORRESPONDING LOCATION AND MAPSET BY USING THE **R.IN.GDAL** COMMAND.
- THE CORRESPONDING RASTER DATA WILL NOW RESIDE IN THAT LOCATION AND THE MAPSET.
- ALL THE 7 BANDS ARE TO BE IMPORTED INTO THE LOCATION AND THE MAPSET.
- IF ANY LINE ERRORS WAS FOUND, IT COULD BE CORRECTED USING THE SHELL SCRIPT IN THE **R.MAPCALCULATOR** COMMAND.

3) CREATION OF THE FCC IMAGE FROM THE DATA:

- **I.LANDSAT.RGB** HELPS IN THE AUTO BALANCING OF THE COLORS

  FOR LANDSAT IMAGES.
- THE BAND 4 IS SET TO RED CHANNEL AND BAND 3 TO GREEN AND BAND 2 TO BLUE CHANNEL.
- THE RED, GREEN AND THE BLUE MAP LAYERS ARE COMBINED INTO A SINGLE LAYER TO FORM A FALSE COLOR COMPOSITE IMAGE IMAGE BY THE COMMAND **R.COMPOSITE.**

4)OBTAINING SIGNATURES:

- THE SIGNATURES ARE OBTAINED FROM GOOGLE EARTH BY DRAWING THE POLYGONS IN THE REQUIRED AREAS.
- THESE SIGNATURES ARE THEN SAVED AS A VECTOR FILE WITH .KML EXTENSION.
- THE SIGNATURES OF EACH CATEGORY IS SAVED IN A SEPARATE VECTOR FILE.

5)IMPORTING VECTOR FILES:

- A NEW LOCATION AND MAPSET IS CREATED FOR THE VECTOR FILES APART FROM THE CURRENT WORKING LOCATION.

- THE CREATED VECTOR FILES ARE THEN IMPORTED TO THAT LOCATION USING THE COMMAND **V.IN.OGR**.

6)PROJECTING THE VECTOR FILES TO THE CURRENT LOCATION:

- THE VECTOR FILES IN THE NEWLY CREATED VECTOR LOCATIONS ARE PROJECTED TO THE CURRENTLY WORKING LOCATION BY USING THE COMMAND **V.PROJ.**
- **V.PROJ** HELPS IN THE PROJECTION CONVERSION OF THE VECTOR MAPS.
- **V.PROJ** ALLOWS A USER TO CONVERT A VECTOR MAP IN A SPECIFIED MAPSET OF A SPECIFIED LOCATION (DIFFERENT FROM CURRENT) WITH PROJECTION OF INPUT LOCATION TO THE VECTOR MAP IN A CURRENT MAPSET OF CURRENT LOCATION WITH PROJECTION OF CURRENT LOCATION.

7)BUILDING OF POLYLINES:

- THE POLYLINES ARE BUILT FROM THE LINES OR BOUNDARIES IN THE VECTOR MAP BY USING **V.BUILD.POLYLINES.**

8)DIGITIZING VECTOR MAP:

- BEFORE DIGITIZING THE REGION IS TO BE SET TO THE VECTOR MAP BY USING **G.REGION**
- THE VECTOR MAPS ARE DIGITIZED AFTER BUILDING THE POLYLINES BY USING THE COMMAND **V.DIGIT.**
- THE VECTOR MAPS OF EACH CATEGORY ARE DIGITIZED SEPARATELY BY MENTIONING THE CATEGORY AND THE LAYER NUMBER.

9)CONVERTING TO RASTER MAPS:

- THE DIGITIZED VECTOR MAPS ARE CONVERTED TO RASTER MAPS BY USING **V.TO.RAST**.
- THE VECTOR MAPS OF EACH CATEGORY ARE DIGITIZED SEPARATELY BY PROPERLY MENTIONING THE CATEGORY AND LAYER NUMBER.

10)PATCHING THE RASTER MAPS:

- THE RASTER MAPS OF ALL THE CATEGORY ARE PATCHED TOGETHER TO OBTAIN THE TRAINING DATA.
- THIS PATCHING PROCESS CAN BE DONE BY **R.PATCH**.

11)CREATING GROUP:

- **I.GROUP** IS USED TO CREATE ,EDIT ,LISTS THE GROUPS AND SUBGROUPS OF IMAGERY FILE.
- THE SELECTED BANDS ARE INCLUDED IN THE GROUP(ALL BANDS EXCEPT 6^{TH} BAND).
- ANY OPERATIONS LIKE I.MAXLIK, I.GENSIG ETC. ARE CARRIED OUT ON THOSE BANDS WHICH ARE INCLUDED IN THE GROUP.
- AFTER THE CREATION OF THE GROUP THE REGION IS SET TO THE FALSE COLOR COMPOSITE IMAGE BY USING **G.REGION.**

12)GENERATING SIGNATURE FILE:

- THE SIGNATURE FILE IS TO BE CREATED FOR DOING CLASSIFICATION.
- THE SIGNATURE FILE IS CREATED BY USING THE TRAINING DATA WHICH WAS CREATED BY PATCHING THE RASTER MAPS.(RASTER MAPS OBTAINED FROM THE DIGITIZED VECTOR MAPS.)
- THIS SIGNATURE FILE CAN BE GENERATED BY USING THE COMMAND **I.GENSIG.**
- FOR GENERATING THE SIGNATURE FILE THERE IS A NEED OF MENTIONING THE NAMES OF GROUP AND SUBGROUP.

13)CLASSIFICATION:

- THE GENERATED SIGNATURE FILE IS USED IN CLASSIFICATION OF THE DATA.
- THE SUPERVISED CLASSIFICATION IS DONE (MAXIMUM LIKELIHOOD).
- THE CLASSIFICATION IS DONE BY USING **I.MAXLIK.**
- THE CLASSIFIED IMAGE WILL HAVE THE DIFFERENT CATEGORIES AND THE EACH CATEGORY IS ASSIGNED A COLOR BY USING **D.COLORS.**
- FOR USING D.COLORS THE MONITOR IS TO BE SET FIRST AND IS DONE BY USING **D.MON** COMMAND.

REFERENCE MATERIAL

- LANDSAT.ORG
- TUTORIALS, CCRS, CANADA
- ITC, NETHERLANDS
- GRASS WIKI
- GRASS - OSGEO

THANK YOU

ACKNOWLEDGEMENT: DR. UTTAM KUMAR, NASA