



STAR Seminar

Title: Land-related data and products from USGS and the
Land Processes Distributed Active Archive Center (LP DAAC)

Speaker: Kevin Gallo, NOAA/NESDIS/STAR @ USGS EROS

Date & Time: Tuesday, August 4, 2009

10:00 a.m. – 11:00 a.m.

Room 707, World Weather Building



Title: Land-related data and products from USGS and the Land Processes Distributed Active Archive Center (LP DAAC)

Outline

A brief overview of USGS EROS

USGS/EROS (land-related) Data Products

LP DAAC Data Products

Examples of STAR applications of these products

Potential future sensors/products at EROS and LP DAAC

CEOS Land Surface Imaging Constellation activities update



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USGS Center For Earth Resources and Science (EROS)



An Overview

Pamela J. Van Zee, SAIC

Work performed under USGS contract 03CRCN0001



More than 30 years of Exploring Our Changing Planet!



USGS Center for EROS

Vision Statement

To be the world's leading source of land information for exploring our changing planet.



USGS Center for EROS

Mission Statement

- To promote new uses, new users, and new understanding of land information, so that others can better understand our planet
- To ensure scientists, researchers, businesses, decision makers, and the public have ready access to the land information they need
- To safeguard and expand the world's largest civilian archive of remotely sensed land data

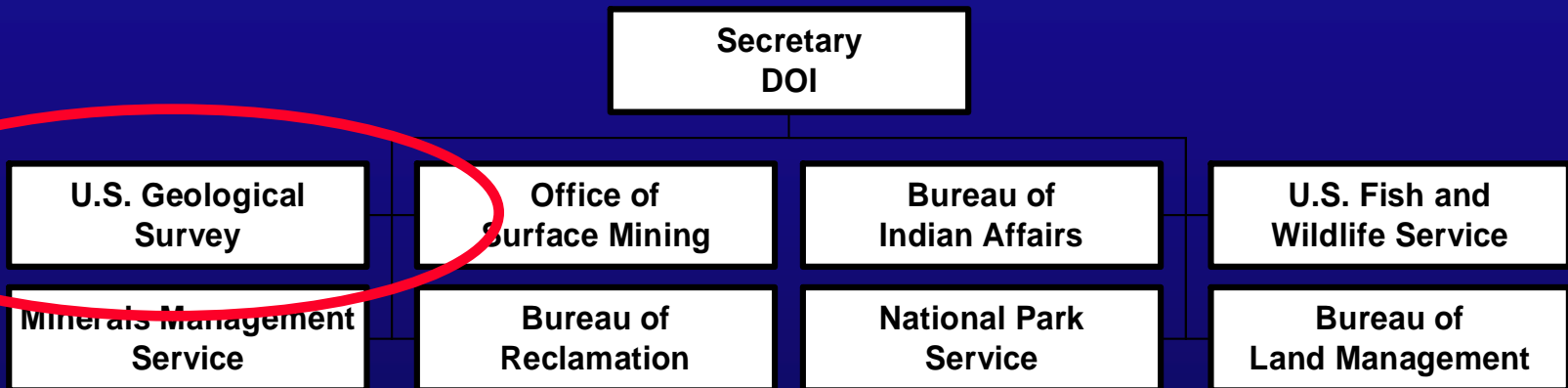


USGS EROS

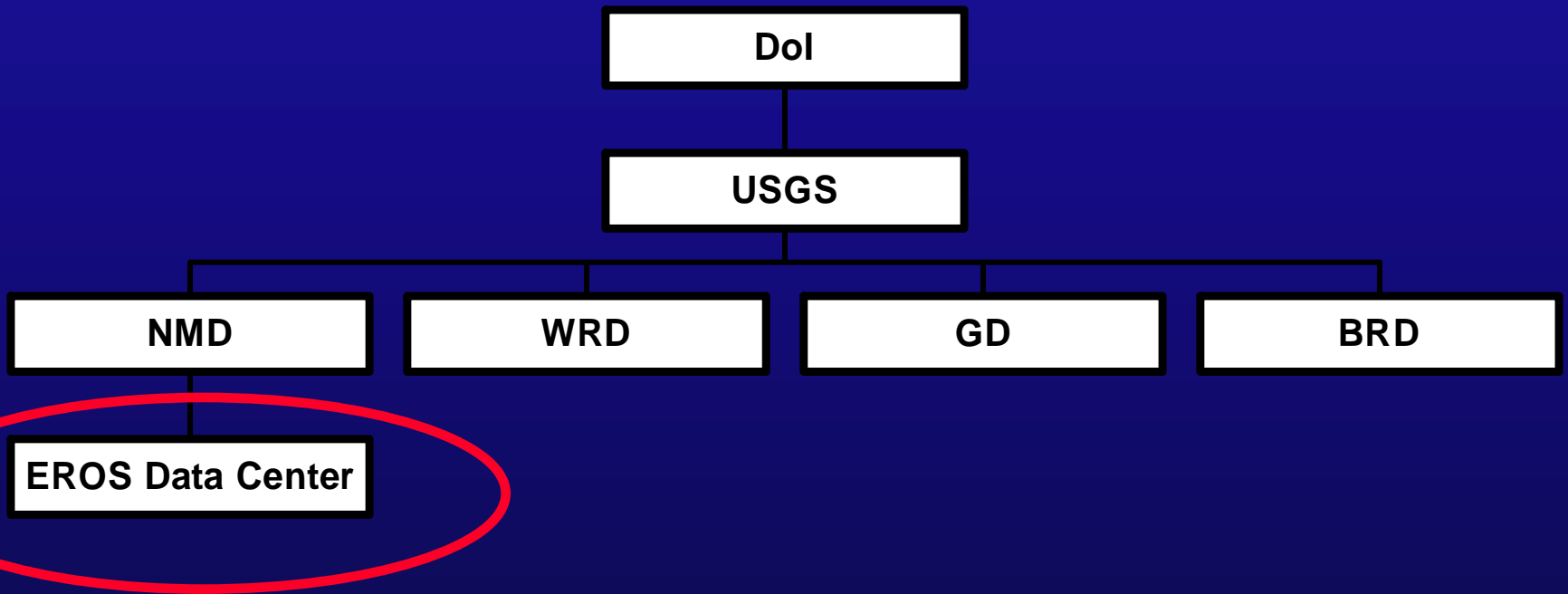
- Situated on 318 acres
- Fourth largest USGS facility
- 500 total staff (~ 120 civil servants)



Department of the Interior



Our Fit



EROS Organization

USGS EROS SIOUX FALLS 3/8/2009			Director's Office																	
			* vice ec, Director * J. Eidsenthink, Deputy Director (Acting Director) J. Thormodsgard, Chief Scientist R. Tornow S. Thorson vice dh, Comm & Outreach Lead J. Nelson, Communications & Outreach									Project Management Office vacant, Prog Analyst Project Management Department B. Foster C. Hamann Contracting Department J. Hood C. Johnson								
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Topographic Sci, Elevation, Lidar Branch * S. Greenlee, Branch Chief D. Gesch Y. Queija Seattle, WA J. Hutchinson						LANDSAT 5&7 Operations Office														



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J. Westegaard	
M. Dempsey	
N. Gregor	
vacant, Admin Asst	
R. Campbell, Faculty Appt	
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LDGC#5	R. Smith
LDGC#13	G. Senay
J. Long	C. Funk
	S. Maxwell
	K. Verdin
	D. Pedrerros, SCEP
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Earth Resources Observation and Science (EROS)

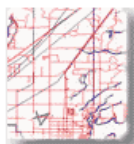
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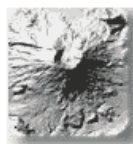


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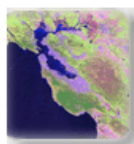
Primary source of land information for exploring our changing planet.



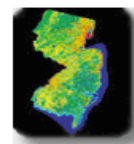
Map



Elevation



Satellite



Land Cover

What's New

- [As of June 15](#) [UNEP/GRID Operations Requests \(DAR\) process has been updated](#)
- [USGS Conversion](#) [National Data Distribution](#)
- [As of March 1](#) [Policy will be updated](#)
- [National Aerial](#) [\(APP\) medium resolution digitized images are available for download at no charge](#)
- [National High](#) [\(AP\) and Alaska High Altitude Photography \(AHAP\) medium resolution digitized images available for download at no charge](#)

[Purchase Order Policy Change](#)

[Landsat Satellite Imagery Used to Assess the Impact of Myanmar's Cyclone Nargis](#)

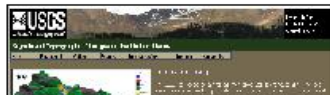
U.S. Releases A Plan For A National Land Imaging Program

[News Release \(PDF\)](#) — [Report \(PDF\)](#)
<http://www.ostp.gov/>

Featured Sites

Explore Significant Topographic Surface Changes in the United States

The U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center



Featured Products

USGS Opening Landsat Archive

Electronic access to the entire USGS Landsat 7 archive, enabling users to download standard-format scenes at no charge, has been an amazing success, with over 500,000 scenes downloaded since October 1st, 2008. Previously acquired imagery from Landsat 1 through Landsat 5, is also now available for download at no charge



USGS EROS Home of the:

- National Satellite Land Remote Sensing Data Archive (NSLRSDA)
- Land Processes Distributed Active Archive Center (DAAC)
- World Data Center-A for Remotely Sensed Land Data
- USGS Sales Data Base
- United Nations Environment Programme / Global Resource Information Data Base (UNEP/GRID)



EROS

- Archiving/Data Processing Center



Film Archive (28,725 sq.ft.)



EROS



Digital Archive (11,833 sq.ft.)



EROS



Computer Rooms (19,935 sq.ft.)





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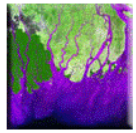
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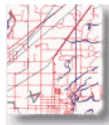
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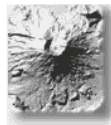
A leading source of land information for exploring our changing planet.



Aerial



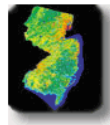
Map



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Satellite



Land Cover

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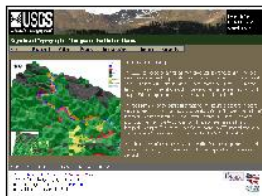
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U.S. Releases A Plan For A National Land Imaging Program
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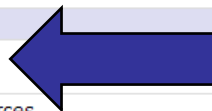
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Map Products

Map Products	Descriptions	Search & Order
Digital Raster Graphics (DRGs)	Scanned digital images of USGS topographic quadrangles.	EarthExplorer
Digital Line Graphs (DLGs)	Digital vector data derived from USGS maps and related sources.	EarthExplorer USGS Geographic Data Download
SRTM Water Body Dataset	SRTM Water Body Data files are a by-product of the data editing performed by the National Geospatial-Intelligence Agency (NGA) to produce the finished SRTM Digital Terrain Elevation Data Level 2 (DTED® 2).	EarthExplorer



Accessibility FOIA Privacy Policies and Notices

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URL: <http://eros.usgs.gov/>

Page Contact Information: custserv@usgs.gov

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Digital Raster Graphics (DRGs)

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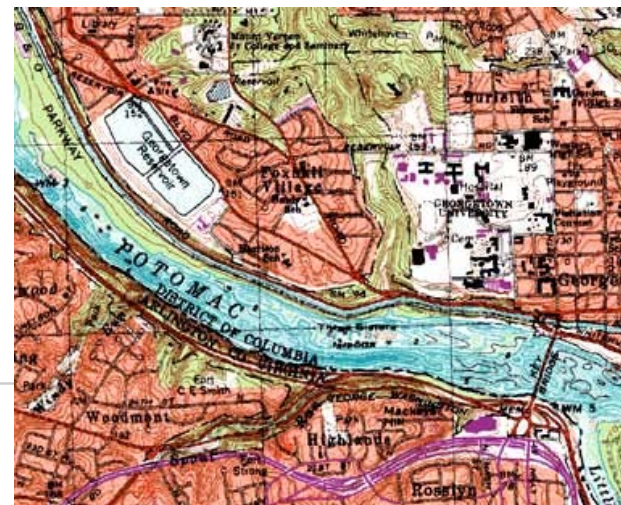
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- [Download](#)
- [Sample Data](#)



1:24,000 Scale DRG
(Eastford, CT)



1:250,000 Scale DRG
(Hartford, CT)



Product Description

A Digital Raster Graphic (DRG) is a scanned image of a USGS standard series topographic map, including all map collar information. The image inside the map neatline is georeferenced to the surface of the earth and fit to the Universal Transverse Mercator (UTM) projection. The horizontal positional accuracy and datum of the DRG matches the accuracy and datum of the source map. The map is scanned at a minimum resolution of 250 dots per inch.

DRGs have been made for all quadrangles in the USGS standard topographic map series for the United States, its territories and trusts. Source maps include:

- 7.5-minute maps of the conterminous United States, Hawaii, and limited areas of Alaska at 1:24,000 and 1:25,000 scale.
- 7.5 by 15-minute maps in limited areas of the conterminous United States at 1:25,000 scale.
- Pacific Island maps at 1:20,000, 1:24,000, and 1:25,000 scales.
- Puerto Rico and the Virgin Islands at 1:20,000 scale.
- Culebra, its adjacent islands, and the Island of Vieques at 1:30,000 scale.
- Alaska at 1:63,360 scale.
- 30 by 60-minute maps of the conterminous United States at 1:100,000 scale.
- 1 by 2-degree maps of the United States at 1:250,000 scale.

See the [DRG status graphic](#) for approximate areas of coverage. The technical specifications for DRGs from these sources differ slightly from USGS specifications.

DRGs are in TIFF 6.0 and use [GeoTIFF](#) 0.2 specifications to define a set of TIFF tags. These tags describe all cartographic information associated with the file. The average file size is 10 megabytes.

Current DRGs are available as a seamless product which can be downloaded at no cost from [Seamless](#). The DRGs are collarless and available for most of the conterminous United States.



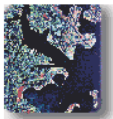
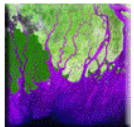
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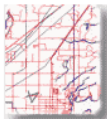
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- About EROS ▾

Image Gallery

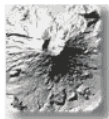
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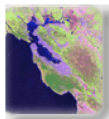
Aerial



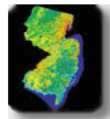
Map



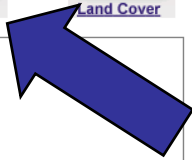
Elevation



Satellite



Land Cover



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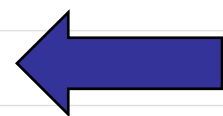
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Satellite Products

Satellite Products	Descriptions	Search & Download
ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer)	High-resolution (15- to 90-meter) multispectral data from the Terra satellite (2000 to present).	WIST Data Pool GloVis
AVHRR (Advanced Very High Resolution Radiometer)	1-km multispectral data from the NOAA satellite series (1979 to present).	NOAA Archive
Declassified Satellite Imagery - 1	Photographic imagery from the CORONA, ARGON and LANYARD satellites (1959 to 1972).	EarthExplorer
Declassified Satellite Imagery - 2	Photographic imagery from KH-7 Surveillance and KH-9 Mapping system (1963 to 1980).	EarthExplorer
Global Land Survey (GLS)	GLS 2000 (Tri-Decadal global Landsat Orthorectified ETM+ update), GLS 2005, GLS 1990, GLS 1975	EarthExplorer GloVIS
Hyperion and Advanced Land Imager (ALI)	10- to 30-meter multispectral and hyperspectral data from the Earth Observing-1 (EO-1) Extended Mission (2000 to present).	Data Acquisition Request (DAR) EarthExplorer GloVIS
Landsat ETM+ (Enhanced Thematic Mapper Plus)	High-resolution (15- to 60-meter) multispectral data from Landsat 7 (1999 to present).	EarthExplorer GloVis
Landsat MSS (Multispectral Scanner)	80-meter multispectral data from Landsats 1 to 5 (1972 to 1992).	EarthExplorer GloVis
Landsat TM (Thematic Mapper)	30- to 120-meter multispectral data from Landsat 4 and 5 (1982 to present).	EarthExplorer GloVis
LDCM (Landsat Data Continuity Mission)	Multispectral data from the proposed Landsat Data Continuity Mission.	<i>not yet available</i>
MODIS (Moderate Resolution Imaging Spectroradiometer)	Moderate-resolution (250- to 1000-meter) multispectral data from the Terra Satellite (2000 to present) and Aqua Satellite (2002 to present).	WIST GloVis Data Pool
MRLC2001 (Multi-Resolution Land Characteristics 2001)	Selected ETM+ and TM scenes (Landsats 7 and 5) from the National Land Cover Characterization 2001 project.	Land Cover Characterization Program (MRLC2001) EarthExplorer GloVis





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USGS > Geography > Earth Resources Observation and Science (EROS) Center

Products > Science > Hazards > NASA LP DAAC > Satellite Missions > NSLRSDA > About EROS >

Landsat Enhanced Thematic Mapper Plus (ETM+)

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- [Product Description](#)
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Product Description

The Landsat Enhanced Thematic Mapper Plus (ETM+), a sensor carried aboard the [Landsat 7](#) satellite, has acquired images of the Earth nearly continuously since July 1999 with a 16-day repeat cycle.

An instrument malfunction occurred on May 31, 2003; as a result, all Landsat 7 scenes acquired since **July 14, 2003** (20:32:40 GMT) are collected in [SLC-off mode](#). (Scenes acquired from 5/31/03 (21:42:35 GMT) to 7/14/03 (20:32:40 GMT) and from 9/3/03 (01:32:15 GMT) to 9/17/03 (06:22:27 GMT) are not available.)

On April 1, 2007, Landsat 7 began imaging in Bumper Mode, an alternate mirror-scanning control mode. This change was necessary due to a predictable physical wear of the mirror bumpers mounted within the ETM+ imaging system. Users should notice little or no change because of this transition, although it does differ from the original Scan Angle Monitor (SAM) process that was original since launch.

Landsat ETM+ image data consist of eight spectral bands ([band designations](#)). The resolution is 30 meters for Bands 1 – 5, and Band 7. Band 6 resolution (thermal infrared) is 60 meters, and Band 8 (panchromatic) has 15 meters resolution. The approximate scene size is 170 km north-south by 183 km east-west (106 mi by 114 mi).

Standard Processing Parameters

Product Type	L1T Terrain Corrected*
Pixel Size	30-meter reflective: Bands 1-5 and Band 7 60-meter thermal: Bands 6H and 6L 15-meter panchromatic: Band 8
Output Format	GeoTIFF
Resampling Method	Cubic Convolution (CC)
Map Projection	UTM – WGS 84 Polar Stereographic for the continent of Antarctica.
Image Orientation	Map (North Up)
Distribution	FTP Download Only
Delivery Time	Immediate for scenes already processed and ready for download. Landsat 7 ETM+ take 1 to 3 days for processing data.



* While most Landsat scenes are processed with the **Standard Terrain Correction (Level 1T)**, some scenes do not have the ground-control or elevation data necessary to perform



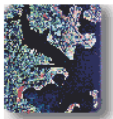
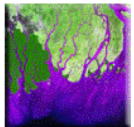
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Earth Resources Observation and Science (EROS)

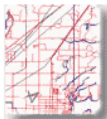
- Products ▾
- Science ▾
- Hazards ▾
- NASA LP DAAC ▾
- Satellite Missions ▾
- NSLRSDA ▾
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Image Gallery

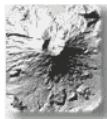
A leading source of land information for exploring our changing planet.



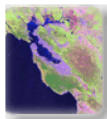
Aerial



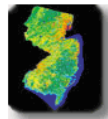
Map



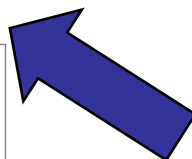
Elevation



Satellite



Land Cover



What's New

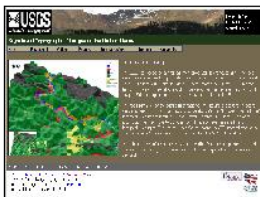
- [As of June 15, 2009, EO-1 Data Acquisitions Requests \(DAR\) process has been updated](#)
- [USGS Conversion to Electronic Geospatial Data Distribution](#)
- [As of March 1, USGS Product Return Policy will be updated](#)
- [National Aerial Photography Program \(NAPP\) medium resolution digitized images are available for download at no charge](#)
- [National High Altitude Photography \(NHAP\) and Alaska High Altitude Photography \(AHAP\) medium resolution digitized images available for download at no charge](#)
- [Purchase Order Policy Change](#)
- [Landsat Satellite Imagery Used to Assess the Impact of Myanmar's Cyclone Nargis](#)
- [U.S. Releases A Plan For A National Land Imaging Program](#)
[News Release \(PDF\)](#) — [Report \(PDF\)](#)
<http://www.ostp.gov/>

<http://eros.usgs.gov/index.html>

Featured Sites

Explore Significant Topographic Surface Changes in the United States

The U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center Topographic Science team has developed a Web site that provides a wealth of data about topographic change across the United States. The USGS National Inventory of Significant



Topographic Changes is available at <http://topochange.cr.usgs.gov>. The inventory is based on seamless multitemporal elevation data and land cover data. The need for more comprehensive information on the nature and extent of recent human geomorphic activity led to a spatial emphasis for the first ever accounting of topographic change across the United States.

Featured Products

USGS Opening Landsat Archive

Electronic access to the entire USGS Landsat 7 archive, enabling users to download standard-format scenes at no charge, has been an amazing success, with over 500,000 scenes downloaded since October 1st, 2008. Previously acquired imagery from Landsat 1 through Landsat 5, is also now available for download at no charge using the same standard processing format. Processing parameters and other details about the products can be found at http://landsat.usgs.gov/products_data_at_no_charge.php. Previously offered USGS Landsat products with customer-defined options, including media, are no longer available.

Newly acquired Landsat 7 ETM+ SLC-off and Landsat 5 TM images with less than 40 percent cloud cover are automatically processed and made available for immediate download. Imagery with greater than 40 percent cloud cover can be processed upon request. Once the requested scenes are processed, an email notification is sent to the customer with instructions for downloading. These scenes will then become accessible to all users. Landsat data can be

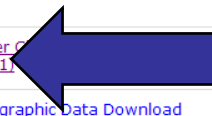


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Landcover Products

Landcover Products	Descriptions	Search & Order
National Land Cover Dataset 1992 (NLCD 92)	A U.S. land cover classification product based primarily on 1992 Landsat Thematic Mapper (TM) data.	Land Cover Characterization Program (NLCD 92) Seamless Data Distribution System Enhanced
MRLC2001 (Multi-Resolution Land Characteristics 2001)	Selected ETM+ and TM scenes (Landsats 7 and 5) from the National Land Cover Characterization 2001 project.	Land Cover Characterization Program (MRLC2001) 
Land Use and Land Cover Data (LULC)	Historical U.S. land use and land cover data derived from 1970`s and 1980`s aerial photography.	USGS Geographic Data Download
Global Land Cover Characterization (GLCC)	A global land cover database primarily derived from 1992 to 1993 1-km AVHRR data.	EROS (GLCC)
AVHRR NDVI Composites	Weekly and biweekly NDVI composites based on 1-km AVHRR data (1989 to present).	EarthExplorer

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[U.S. Department of the Interior](#) | [U.S. Geological Survey](#)

URL: <http://eros.usgs.gov/>

Page Contact Information: custserv@usgs.gov

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Multi-Resolution Land Characteristics Consortium (MRLC)

National Land Cover Database

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NLCD 2006 Update

NLCD 2006 Update Availability to be Determined

To continue monitoring the current land cover condition and updating land cover inventory, a prototype that uses spectrally normalized Landsat images and NLCD 2001 data layers is being developed. The method has been tested in five study areas-New England, Mississippi, South Dakota, Washington, and Southern California-to update NLCD to a nominal date of 2006. The images below are an example of the types of change this product will identify.

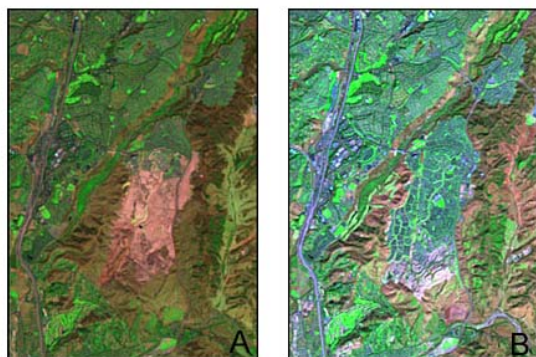


Figure 1a and 1b: Landsat subset scenes from 2001(a) and 2006 (b) in the San Diego California area. The 2001 subset image captures an area of land that has been cleared (pink). In 2006, the same area reveals urban development, new vegetation growth and road networks in the residential area.

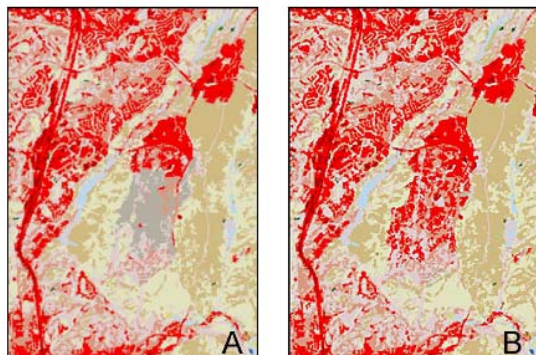


Figure 2a and 2b: Corresponding land cover in 2001 (2a) and 2006 (2b) derived from the Landsat subset scenes in Figure 1. The barren land (grey) in 2001 is now classified as developed (red) in the NLCD 2006 product update. This sequence of images captures the development of a new housing estate in the San Diego area.

All MRLC 2001 data are provided with the following standardized set of processing parameters:

Number of bands (Band designations)	8 (Landsat 7 ETM+) 7 (Landsat 5 TM)
Resolution	30 m (most bands) 15 m (Landsat 7 band 8)
Projection	Albers Equal-Area Conic
Datum	NAD83
Resampling	cubic convolution
Format	NDF (NLAPS Data format)
Media	Download



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- Products ▾
- Science ▾
- Hazards ▾
- NASA LP DAAC ▾
- Satellite Missions ▾
- NSLRSDA ▾
- About EROS ▾

Image Gallery



- Earthshots
- Fire Science
- Land Cover
- US Greenness
- International Activities
- Remote Sensing Phenology
- UNEP/GRID
- Information Science
- Geologic Applications ▶
- Carbon Cycle Research
- Topographic Science
- Conferences ▶

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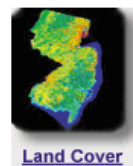
Map



Elevation



Satellite



Land Cover

What's New

- [As of June 15, 2008, the Data Access and Requests \(DAR\) process has been updated](#)
- [USGS Conversion of Digital Data Distribution](#)
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U.S. Releases A Plan For A National Land Imaging Program

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Featured Sites

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The U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center



Featured Products

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Greenness of the Conterminous U.S.

- What's New
- What is NDVI
- What is AVHRR
- Interactive Map Service
- Products/Services
- Links
- Contact Us

Overview of the Greenness of the Conterminous U.S.



Satellite derived vegetation information

The greenness indicator of 1 and diminish

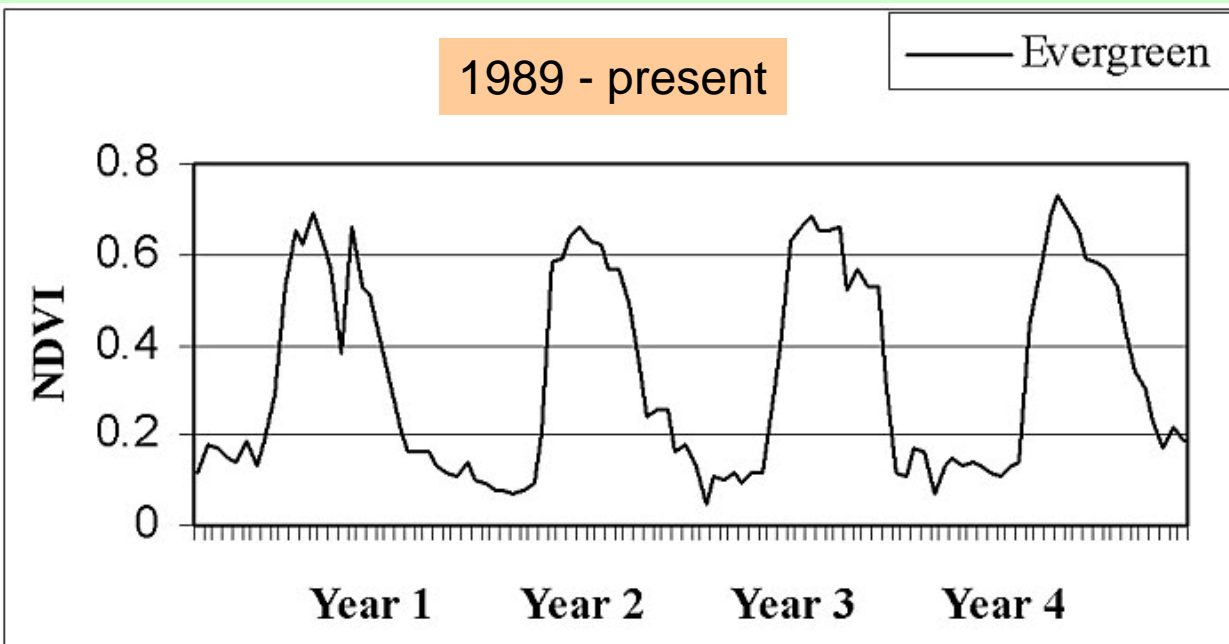
The greenness maps are produced with a regional evaluation of vegetation condition.

The greenness maps are used by government assessment, grazing land management, grass

One of the most important aspects of the US have come and gone, there have been years this information it is possible to determine the

As a result, it is possible to compare this week's vegetation condition with normal conditions. An above normal condition could indicate wetter or warmer than normal conditions while a below normal condition could indicate colder or dryer than normal conditions. The interpretation of departure from normal will depend on the season and geography of a region.

The greenness maps are digital images that can be used on any computer. The images are available in two basic forms. Most of the images you will see here are GIF formatted images that can viewed by a browser or most imagery viewing applications. The greenness images are also available in binary format that is more suitable for analytical image processing. Thus the greenness images can be used for visual assessment of conditions or for quantitative analysis of biophysical conditions.





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Earth Resources Observation and Science (EROS)

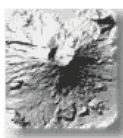
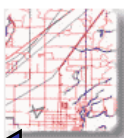
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- Science ▾
- Hazards ▾
- NASA LP DAAC ▾
- Satellite Missions ▾
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- About EROS ▾

Image Gallery

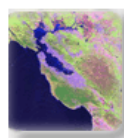


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- Fire Science
- Land Cover
- US Greenness
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- UNEP/GRID
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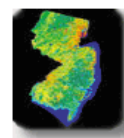
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Elevation



Satellite



Land Cover



What's New

- As of June 15 [UNEP/GRID Operations Requests \(DAR\) process has been updated](#)
- USGS Conversion [Information Science Data Distribution](#)
- As of March 1 [Geologic Applications Policy will be updated](#)
- National Aerial [Carbon Cycle Research \(APP\) medium resolution digitized images are available for download at no charge](#)
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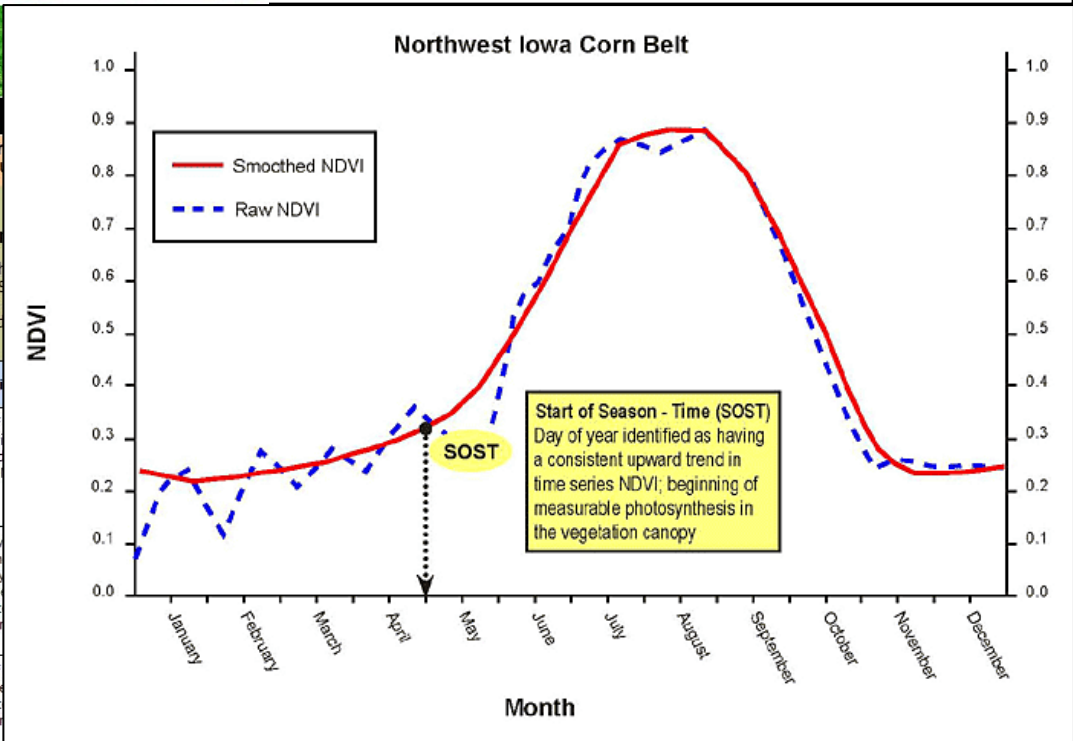
Remote Sensing Phenology

- Home
- Overview
- Vegetation Indices
- Methods
- Get Data
- Other Resources

Acquiring Remote Sensing Phenology Data from

Historical remote sensing phenology (RSP) image data and graph continuous U.S. are made freely available from the USGS/EROS through this table. Click on the drop down list to the right of the data (top) or graphics (bottom) and select the year for the RSP graphic. Metadata are bundled with the image data.

RSP Data Set	Acronym	Phenological Interpretation	Description
Start of Season - Time <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	SOST	Beginning of measurable photosynthesis in the vegetation canopy	Day of year as having upward series
Start of Season -NDVI <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	SOSN	Level of photosynthetic activity at the beginning of measurable photosynthesis	NDVI value baseline the day identified consistent trend in NDVI
End of Season -Time <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	EOST	End of measurable photosynthesis in the vegetation canopy	Day of year at the end of a consistent downward trend in NDVI
End of Season -NDVI <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	EOSN	Level of photosynthetic activity at the end of measurable photosynthesis	NDVI value corresponding with the day of year identified at the end of a consistent downward trend in time series NDVI
Time of Maximum <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	MAXT	Time of maximum photosynthesis in the canopy	Day of year corresponding to the maximum NDVI in an annual time series
Maximum NDVI <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	MAXN	Maximum level of photosynthetic activity in the canopy	Maximum NDVI in an annual time series
Duration <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	DUR	Length of photosynthetic activity (the growing season)	Number of days from the SOST to the EOST





Remote Sensing Phenology

Home Overview Vegetation Indices Methods Get Data

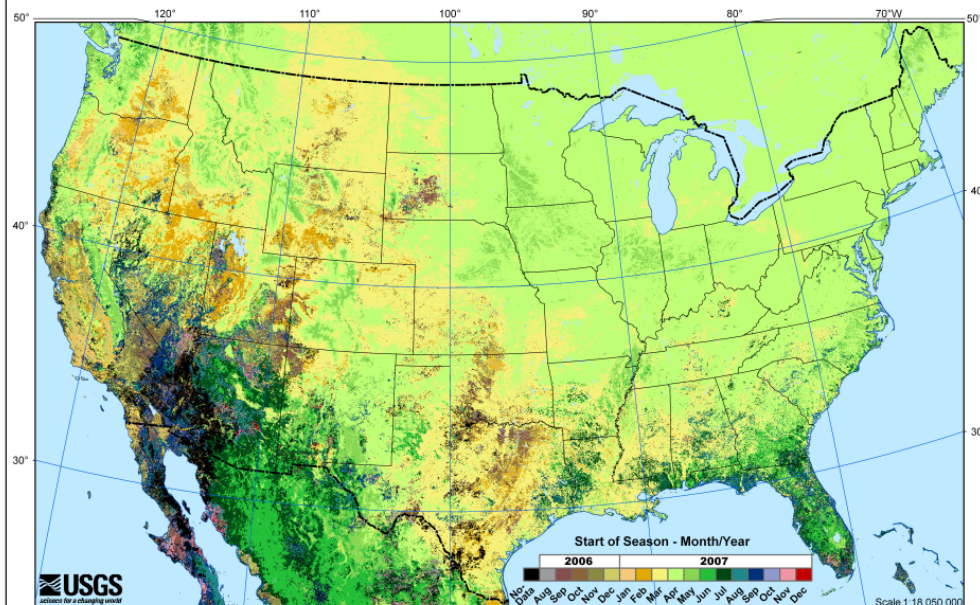
Acquiring Remote Sensing Phenology Data

Historical remote sensing phenology (RSP) image data for the conterminous U.S. are made freely available from the USGS through this table. Click on the drop down list to the right of the data (top) or graphics (bottom) and select the year for the data graphic. Metadata are bundled with the image data.

RSP Data Set	Acronym	Phenological Interpretation	
Start of Season - Time <input type="text" value="2007"/> <input type="text" value="2007"/>	SOST	Beginning of measurable photosynthesis in the vegetation canopy	
Start of Season -NDVI <input type="text" value="2007"/> <input type="text" value="2007"/>	SOSN	Level of photosynthetic activity at the beginning of measurable photosynthesis	
End of Season -Time <input type="text" value="2007"/> <input type="text" value="2007"/>	EOST	End of measurable photosynthesis in the vegetation canopy	
End of Season -NDVI <input type="text" value="2007"/> <input type="text" value="2007"/>	EOSN	Level of photosynthetic activity at the end of measurable photosynthesis	
Time of Maximum <input type="text" value="2007"/> <input type="text" value="2007"/>	MAXT	Time of maximum photosynthesis in the canopy	Day of year corresponding to the maximum NDVI in an annual time series
Maximum NDVI <input type="text" value="2007"/> <input type="text" value="2007"/>	MAXN	Maximum level of photosynthetic activity in the canopy	Maximum NDVI in an annual time series
Duration <input type="text" value="2007"/> <input type="text" value="2007"/>	DUR	Length of photosynthetic activity (the growing season)	Number of days from the SOST to the EOST

SOST_2007[1].png - Windows Picture and Fax Viewer

U.S. Remote Sensing Phenology - Start of Season Time (SOST) 2007



Start of Season Time (SOST)

The SOST estimates the day of the year at the beginning of a consistent upward trend in time series NDVI and is interpreted as the beginning of measurable photosynthesis in the vegetation canopy.

Remote Sensing Phenology

<http://phenology.cr.usgs.gov/>

Early Warning and Monitoring Program

<http://earlywarning.usgs.gov/>





Title: Land-related data and products from USGS and the Land Processes Distributed Active Archive Center (LP DAAC)

Outline

A brief overview of USGS EROS

USGS/EROS (land-related) Data Products

LP DAAC Data Products

Examples of STAR applications of these products

Potential future sensors/products at EROS and LP DAAC

CEOS Land Surface Imaging Constellation activities update



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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.



User Community

A place to share knowledge with others.



Customer Service

Need assistance? Our staff is happy to help.

News

07/06/2009

[continue ASTER Billable](#)

07/01/2009

[Change in Status Alert for the ASTER SWIR detector](#)

06/29/2009

[METI and NASA Release the ASTER Global DEM](#)

06/22/2009

[Problem Identified with MODIS Global Land Cover Type V005 Products](#)

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NASA and USGS Partnership

The Land Processes Distributed Active Archive Center (LP DAAC) is one of several discipline-specific data centers within the NASA Earth Observing System Data and Information System (EOSDIS). The LP DAAC is located at the USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, South Dakota.

Data in Action

Ash Eruptions from Sarychev Peak, Kuril Islands

06/16/2009



At the

northwestern end of Ostrov Matua (Matua Island), Sarychev Peak ranks among the most active volcanoes in the Kuril (or Kurile) Islands, which stretch between Hokkaido, Japan, and Russia's Kamchatka Peninsula. On June 12, 2009, Sarychev Peak began a series of eruptions that spread ash far and wide across the northwestern Pacific.

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- [TOOLS](#)
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- ▶ [MODIS Overview](#)
- ▶ [MODIS Products Table](#)
- ▶ [MODIS Policies](#)
- ▶ [ASTER Overview](#)
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- ▶ [ASTER Policies](#)
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Home > Products

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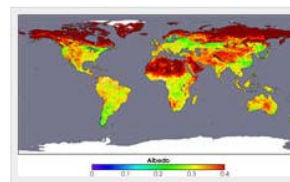
Products

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.



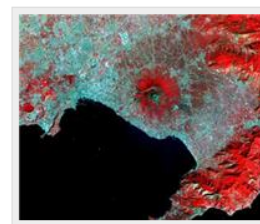
LP DAAC ASTER Data

[ASTER Overview](#) - What Makes ASTER Unique? Details about baseline, performance requirements and metadata.

[ASTER Products](#) - Sortable table of LP DAAC ASTER products with links to product-specific information.

[ASTER Policies](#) - ASTER pricing and payment details, data available at no cost and redistribution policies.

[ASTER Tasking](#) - Request data acquisition.



Other Data Links

[Other Data Links](#) - Related data sets not held or supported by the LP DAAC

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MODIS Products Table

These links will direct you to specific information and access points for each of the MODIS Land Products distributed from LP DAAC.

Shortname	Platform	MODIS Product	Raster Type	Res (m)	Temporal Granularity
MCD12Q1	Combined	Land Cover Type	Tile	500m	Yearly
MCD15A2	Combined	MODIS/Terra+Aqua Leaf Area Index/FPAR 8-Day L3 Global 1km SIN Grid V005	Tile	1000m	8 Day
MCD43A1	Combined	BRDF-Albedo Model Parameters	Tile	500m	16 Day
MCD43A2	Combined	BRDF-Albedo Quality	Tile	500m	16 Day
MCD43A3	Combined	Albedo	Tile	500m	16 Day
MCD43A4	Combined	Nadir BRDF-Adjusted Reflectance	Tile	500m	16 Day
MCD43B1	Combined	BRDF-Albedo Model Parameters	Tile	1000m	16 Day
MCD43B2	Combined	BRDF-Albedo Quality	Tile	1000m	16 Day
MCD43B3	Combined	Albedo	Tile	1000m	16 Day
MCD43B4	Combined	Nadir BRDF- Adjusted Reflectance	Tile	1000m	16 Day
MCD43C1	Combined	BRDF-Albedo Model Parameters	CMG	5600m	16 Day
MCD43C2	Combined	BRDF-Albedo Snow-free Quality	CMG	5600m	16 Day
MCD43C3	Combined	Albedo	CMG	5600m	16 Day
MCD43C4	Combined	Nadir BRDF- Adjusted Reflectance	CMG	5600m	16 Day
MCD45A1	Combined	Burned Area	Tile	500m	Monthly
MOD09A1	Terra	Surface Reflectance Bands 1-7	Tile	500m	8 Day
MOD09CMG	Terra	Surface Reflectance Bands 1-7	CMG	5600m	Daily
MOD09GA	Terra	Surface Reflectance Bands 1-7	Tile	500/1000m	Daily
MOD09GQ	Terra	Surface Reflectance Bands 1-2	Tile	250m	Daily
MOD09Q1	Terra	Surface Reflectance Bands 1-2	Tile	250m	8 Day
MOD11A1	Terra	Land Surface Temperature & Emissivity	Tile	1000m	Daily
MOD11A2	Terra	Land Surface Temperature & Emissivity	Tile	1000m	8 Day
MOD11B1	Terra	Land Surface Temperature & Emissivity	Tile	6000m	Daily
MOD11C1	Terra	Land Surface Temperature & Emissivity	CMG	5600m	Daily
MOD11C2	Terra	Land Surface Temperature & Emissivity	CMG	5600m	8 Day
MOD11C3	Terra	Land Surface Temperature & Emissivity	CMG	5600m	Monthly
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



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
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
MYD11A1	Aqua	Land Surface Temperature & Emissivity	Tile	1000m	Daily
MYD11A2	Aqua	Land Surface Temperature & Emissivity	Tile	1000m	8 Day
MYD11B1	Aqua	Land Surface Temperature & Emissivity	Tile	6000m	Daily
MYD11C1	Aqua	Land Surface Temperature & Emissivity	CMG	5600m	Daily
MYD11C2	Aqua	Land Surface Temperature & Emissivity	CMG	5600m	8 Day
MYD11C3	Aqua	Land Surface Temperature & Emissivity	CMG	5600m	Monthly
MYD13A1	Aqua	Vegetation Indices	Tile	500m	16 Day
MYD13A2	Aqua	Vegetation Indices	Tile	1000m	16 Day
MYD13A3	Aqua	Vegetation Indices	Tile	1000m	Monthly
MYD13C1	Aqua	Vegetation Indices	CMG	5600m	16 Day
MYD13C2	Aqua	Vegetation Indices	CMG	5600m	Monthly
MYD13Q1	Aqua	Vegetation Indices	Tile	250m	16 Day
MYD14	Aqua	Thermal Anomalies & Fire	Swath	1000m	5 Min
MYD14A1	Aqua	Thermal Anomalies & Fire	Tile	1000m	Daily
MYD14A2	Aqua	Thermal Anomalies & Fire	Tile	1000m	8 Day
MYD15A2	Aqua	Leaf Area Index - FPAR	Tile	1000m	8 Day
MYD17A2	Aqua	Gross Primary Productivity	Tile	1000m	8 Day



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Data Set Name:

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Vegetation Indices 16-Day L3 Global 1km

Short Name:
MOD13A2

Global MODIS vegetation indices are used to provide consistent spatial and temporal comparisons of vegetation conditions. Blue, red, and near-infrared reflectances, centered at 469-nanometers, 645-nanometers, and 858-nanometers, respectively, are used to determine the MODIS daily vegetation indices.

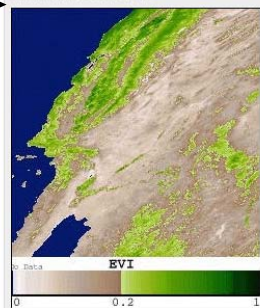
The MODIS Normalized Difference Vegetation Index (NDVI) complements NOAA's Advanced Very High Resolution Radiometer (AVHRR) NDVI products and provides continuity for time series historical applications. MODIS also includes a new Enhanced Vegetation Index (EVI) that minimizes canopy background variations and maintains sensitivity over dense vegetation conditions. The EVI also uses the blue band to remove residual atmosphere contamination caused by smoke and sub-pixel thin cloud clouds. The MODIS NDVI and EVI products are computed from atmospherically corrected bi-directional surface reflectances that have been masked for water, clouds, heavy aerosols, and cloud shadows.

Global MOD13A2 data are provided every 16 days at 1-kilometer spatial resolution as a gridded level-3 product in the Sinusoidal projection. Vegetation indices are used for global monitoring of vegetation conditions and are used in products displaying land cover and land cover changes. These data may be used as input for modeling global biogeochemical and hydrologic processes and global and regional climate. These data also may be used for characterizing land surface biophysical properties and processes, including primary production and land cover conversion.

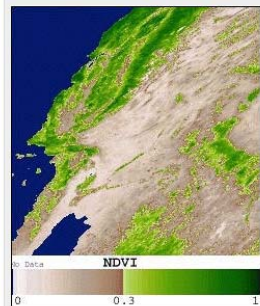
Version-5 MODIS/Terra Vegetation Indices products are Validated Stage 2, meaning that accuracy has been assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts. Although there may be later improved versions, these data are ready for use in scientific publications.

Change Points of Interest

Short Name: MOD13A2



The MOD13A2 images shown are samples of the MODIS/Terra Vegetation Indices 16-Day L3 Global 1km SIN Grid. The NDVI and EVI have been pseudo-colored to represent the biomass health of the western United States using tile h08v05 from June 25 July 10, 2000.



Due to their simplicity, ease of application, and widespread familiarity, vegetation indices have a wide range of usage within the user community. Some of the more common applications may include global biogeochemical and hydrologic modeling, agricultural monitoring and forecasting, land-use planning, land cover characterization, and land cover change detection.

Layer Specifications and QA/QC Descriptions

Science Data Sets for MODIS Terra Vegetation Indices 16-Day L3 Global 1km SIN Grid V005 (MOD13A2):

Science Data Sets (HDF Layers) (12)	UNITS	BIT TYPE	FILL	VALID RANGE	MULTIPLY BY SCALE FACTOR
1km 16 days NDVI	NDVI	16-bit signed integer	-3000	-2000, 10000	0.0001
1km 16 days EVI	EVI	16-bit signed integer	-3000	-2000, 10000	0.0001
1km 16 days VI Quality detailed QA	Bits	16-bit unsigned integer	65535	0, 65534	NA
1km 16 days red reflectance (Band 1)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
1km 16 days NIR reflectance (Band 2)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
1km 16 days blue reflectance (Band 3)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
1km 16 days MIR reflectance (Band 7)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
1km 16 days view zenith angle	Degree	16-bit signed integer	-	-9000, 9000	0.01
1km 16 days sun zenith angle	Degree	16-bit signed integer	-	-9000, 9000	0.01
1km 16 days relative azimuth angle	Degree	16-bit signed integer	-4000	-3600, 3600	0.1
1km 16 days composite day of the year	Julian day of year	16-bit signed integer	-1	1, 366	NA
1km 16 days pixel reliability summary QA	Rank	8-bit signed integer	-1	0, 4	NA

The QA information below is excerpted from the Quality Science Data Set within an HDF-EOS MOD13A2 file.

A summary Quality layer has been included in the MOD13A2: "pixel reliability." This layer contains ranked values describing overall pixel quality (Table 1 below).

Because evaluation of the past 6 years of V003 and V004 data collections revealed insignificant

MRTWeb – Create Regional Mosaic

Select
Product
Tiles / Date
Bands / Layers

Continue
to Process Tab

USGS Global Visualization Viewer

Product Zoom Map Layers Tools Help

Selection Process Download

Locator

Time Series

Start: Jan 2000 End: Jan 2000

May 2007

MOD13A1 Scene List

- 500m 16 days NDVI
- 500m 16 days EVI
- 500m 16 days VI Quality
- 500m 16 days red reflectance
- 500m 16 days NIR reflectance
- 500m 16 days blue reflectance
- 500m 16 days MIR reflectance
- 500m 16 days view zenith angle
- 500m 16 days sun zenith angle
- 500m 16 days relative azimuth angle
- 500m 16 days composite day of the year
- 500m 16 days pixel reliability

Set Point of Interest dialog: Latitude: 45.0, Longitude: -100.0





MRTWeb – Create Regional Mosaic

Monitor & Download

The screenshot shows the USGS Global Visualization Viewer interface with a job list on the left and an FTP directory listing in the main window. The job list includes:

- Job MRT1183473399420
- Job MRT118229425
- Job MRT118228303
- Job MRT118220476
- Job MRT118220430

The FTP directory listing shows a table of files with columns for date, time, size, and filename. The files are organized by date and time, showing a sequence of data files and processing logs.

Date/Time	Size	Filename
07/03/2007 03:00PM	15,069,520	1183473399168_A2007129_1_500m_16_days_MDWI.tif
07/03/2007 03:12PM	37,559,980	1183473399168_A2007129_1_500m_16_days_pixel_reliability.tif
07/03/2007 02:36PM	10,358,519	MOD13A1.A2007129.h08v04.005.2007154011833.hdf
07/03/2007 02:37PM	65,872,827	MOD13A1.A2007129.h08v05.005.2007154131819.hdf
07/03/2007 02:37PM	66,182,103	MOD13A1.A2007129.h08v06.005.2007155130234.hdf
07/03/2007 02:37PM	55,888,300	MOD13A1.A2007129.h09v04.005.2007155232421.hdf
07/03/2007 02:38PM	76,329,859	MOD13A1.A2007129.h09v05.005.2007152114635.hdf
07/03/2007 02:38PM	23,573,235	MOD13A1.A2007129.h09v06.005.2007151082007.hdf
07/03/2007 02:38PM	78,674,350	MOD13A1.A2007129.h10v04.005.2007152142521.hdf
07/03/2007 02:38PM	74,505,866	MOD13A1.A2007129.h10v05.005.2007155043121.hdf
07/03/2007 02:39PM	18,130,137	MOD13A1.A2007129.h10v06.005.2007155030201.hdf
07/03/2007 02:39PM	74,222,353	MOD13A1.A2007129.h11v04.005.2007151204533.hdf
07/03/2007 02:39PM	46,725,406	MOD13A1.A2007129.h11v05.005.2007150132506.hdf
07/03/2007 02:39PM	59,728,731	MOD13A1.A2007129.h12v04.005.2007153065339.hdf
07/03/2007 02:39PM	5,664,854	MOD13A1.A2007129.h12v05.005.2007151011921.hdf
07/03/2007 03:12PM	35	ProcessingComplete_MRT1183473399420_1.log
07/03/2007 02:41PM	2,677	TwoMosaicMRT1183473399420_1_094953.log
07/03/2007 02:39PM	1,118	TwoMosaicMRT1183473399420_1_094953.png
07/03/2007 03:12PM	3,040	TwoParamMRT1183473399420_1_094117.log
07/03/2007 02:41PM	530	TwoParamMRT1183473399420_1_094117.png





MRTWeb – Subset Area from Time Series

Select

Product

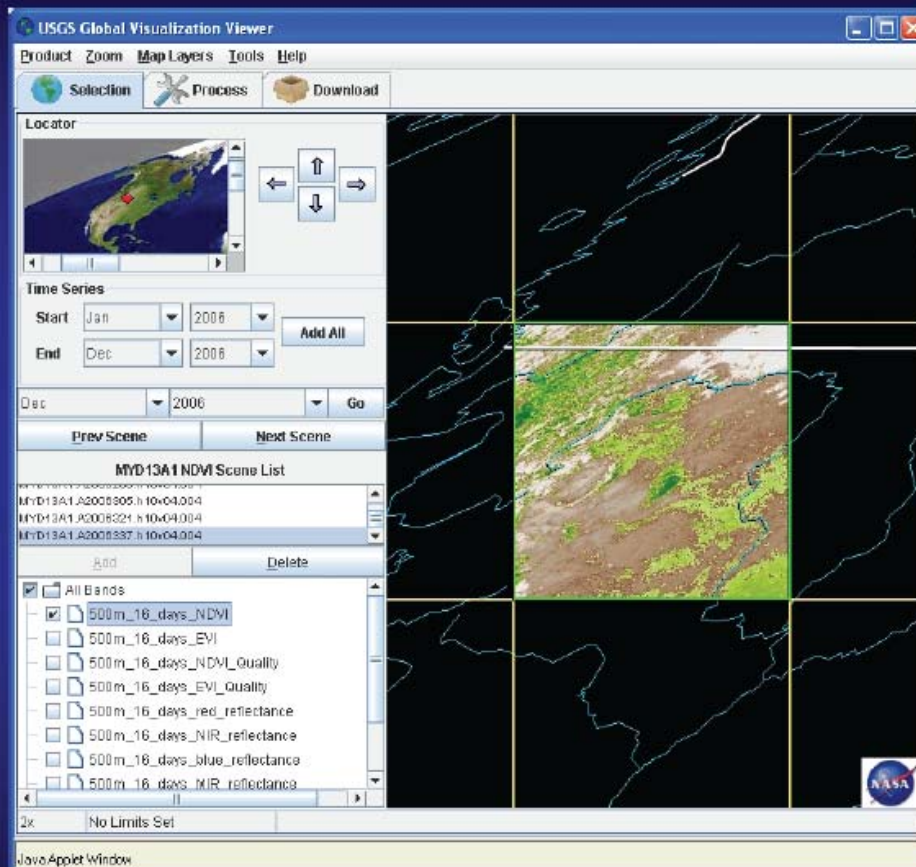
Tile(s)

Bands / Layers

Time Range

Continue

to Process Tab





MRTWeb – Subset Area from Time Series

Monitor & Download



Jan 1 Jan 17 Feb 2 Feb 18 Mar 5 Mar 21 Apr 6 Apr 22



May 8 May 24 Jun 9 Jun 25 Jul 11 Jul 27 Aug 12 Aug 28



Sep 13 Sep 29 Oct 15 Oct 31 Nov 16 Dec 2 Dec 18





eMODIS

- **MODIS is useful for Broad-scale monitoring:**
 - Better temporal resolution than Landsat, better spatial resolution than AVHRR
- **But, standard MODIS products have limitations for operational monitoring:**
 - **Timeliness:** standard products not available in near-real time
 - **Projection and format:** standard products in Sinusoidal tiles, HDF-EOS format
 - **Compositing period:** standard products are generated on a predetermined 16-day compositing interval
 - **Consistency:** Periodic reprocessing of entire data record causes discontinuities between collections



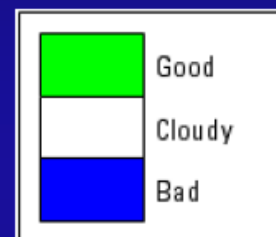
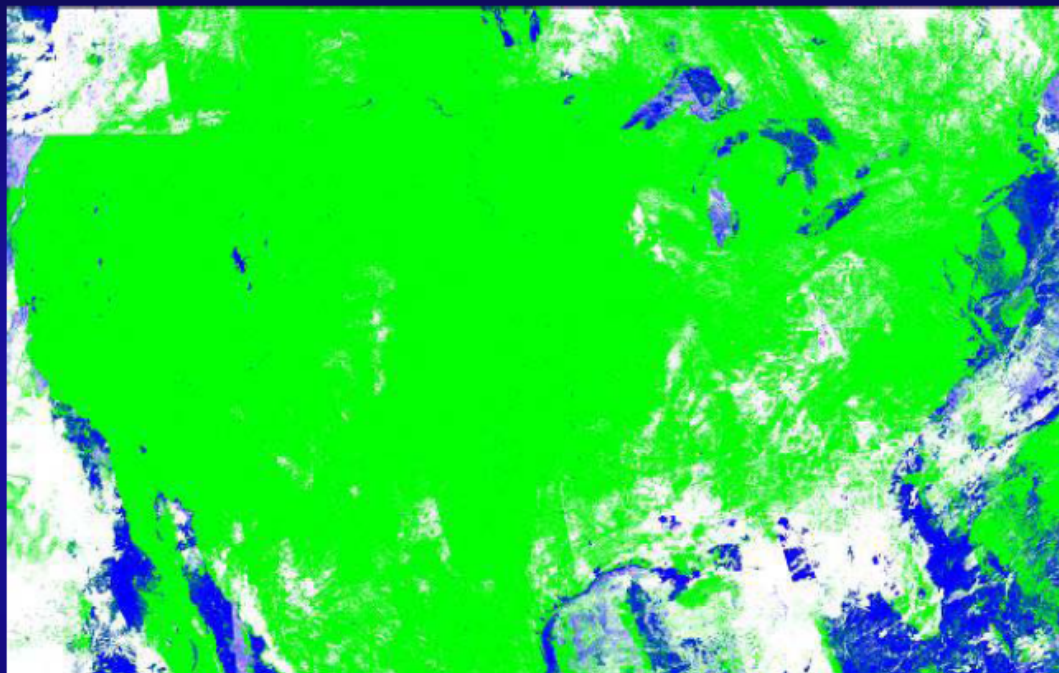


eMODIS

	Expedited	Historic
Timeliness Requirement	~ 1 day after last input	< 30 days after last input
Instruments	Aqua and Terra MODIS	
Geographic Extent	Continental U.S., Yukon River Basin	
Projection/Format	Lambert Equal Area Azimuthal / GeoTIFF	
Spatial Resolutions	250, 500, and 1,000 meters	
Layers	NDVI, Surface Refl. Bands, Quality, Date	
Composite Period	7-day, Rolling	7-day, Interval
Archive Persistence	30 days	Long Term



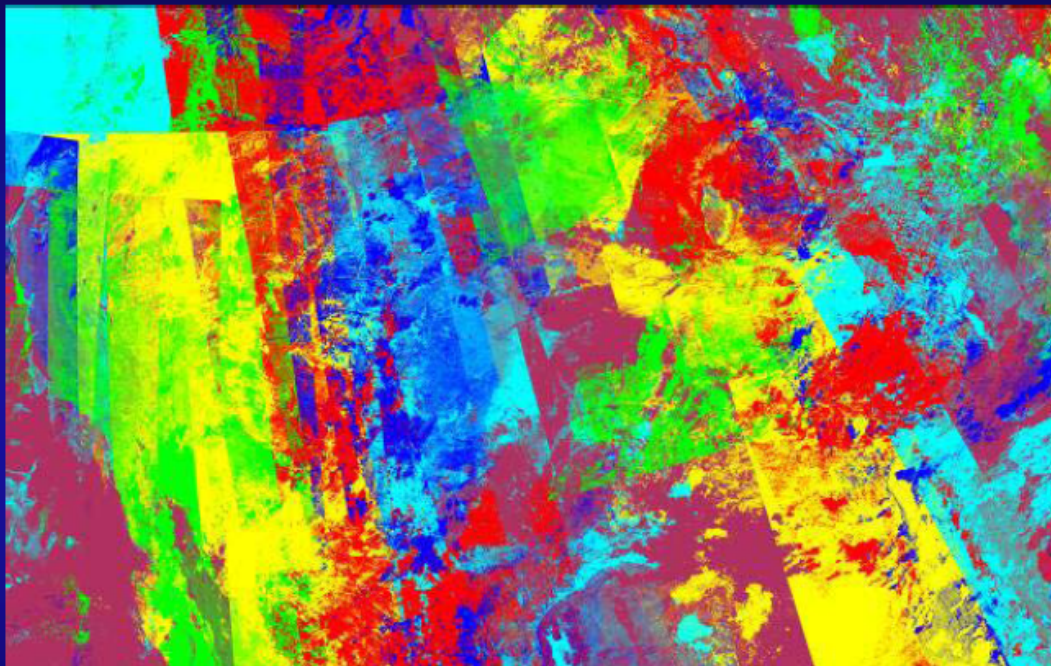
eMODIS



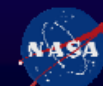
Expedited: July 28 - August 3, 2008 Aqua 250-m NDVI Quality



eMODIS

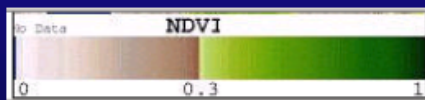


Expedited: July 28 - August 3, 2008 Aqua 250-m Source Acquisition Days





eMODIS



Expedited: July 28 - August 3, 2008 Aqua 250-m NDVI



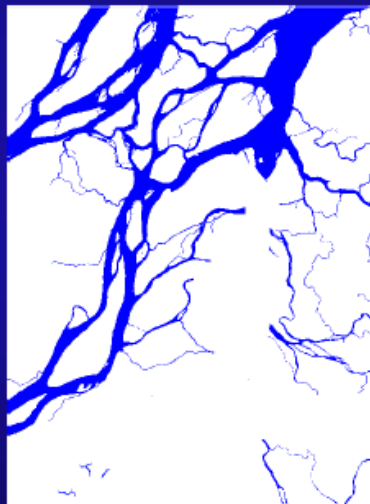
Land/Water Mask

- **Challenge:** MODIS Land collections use 1-km mask creating inaccuracies along major rivers and in higher resolution products
- **Solution:** Create a 250-m mask based on
 - SRTM Water Body Mask
 - MODIS 250-m data
 - Current 1-km mask

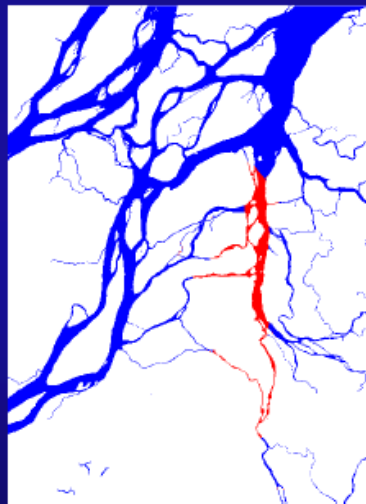
Land Water Mask

- SWBM shows major gaps along rivers

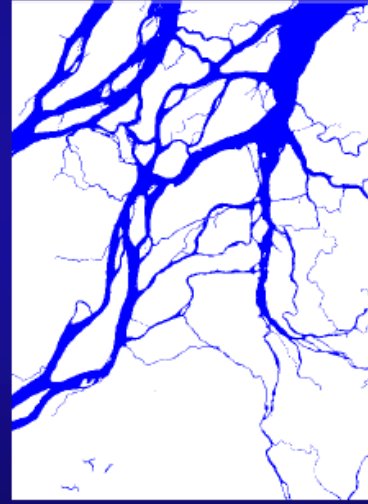
SRTM raster at 250m



Red shows MODIS



End product with
SRTM and MODIS



- Automated gap-filling with MODIS 250-m data

Land Water Mask

- **Resulting data product**
 - Companion to MODIS standard products
 - Global
 - Mostly 250-m
 - Sinusoidal tiles
 - Geotiff
 - 3 values: Land, Water and Shoreline
 - Anticipate completion end of 2009



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 - VNIR
 - SWIR
 - TIR
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- GALLERY
- DATA
- ABOUT US
- PRESENTATIONS & DOCUMENTS
- LINKS

Characteristic	VNIR	SWIR	TIR
Spectral Range	Band 1: 0.52 - 0.60 μm Nadir looking	Band 4: 1.600 - 1.700 μm	Band 10: 8.125 - 8.475 μm
	Band 2: 0.63 - 0.69 μm Nadir looking	Band 5: 2.145 - 2.185 μm	Band 11: 8.475 - 8.825 μm
	Band 3: 0.76 - 0.86 μm Nadir looking	Band 6: 2.185 - 2.225 μm	Band 12: 8.925 - 9.275 μm
	Band 3: 0.76 - 0.86 μm Backward looking	Band 7: 2.235 - 2.285 μm	Band 13: 10.25 - 10.95 μm
		Band 8: 2.295 - 2.365 μm	Band 14: 10.95 - 11.65 μm
		Band 9: 2.360 - 2.430 μm	
Ground Resolution	15 m	30m	90m
Data Rate (Mbits/sec)	62	23	4.2
Cross-track Pointing (deg.)	± 24	± 8.55	± 8.55
Cross-track Pointing (km)	± 318	± 116	± 116
Swath Width (km)	60	60	60
Detector Type	Si	PtSi-Si	HgCdTe
Quantization (bits)	8	8	12



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ASTER Products Table

These links will direct you to specific information and access points for each of the ASTER Land Products distributed from LP DAAC.

Shortname	Level	ASTER Product	Res (m)	Price US (FTP)	Price Non-US (FTP)
AST13POL	2	Polar Surface and Cloud Classification	30	\$85	\$85
AST14DEM	3	Digital Elevation Model	30	\$85	\$85
AST14DMO	3	Digital Elevation Model & Registered Radiance at the Sensor - Orthorectified	15, 30, 90	\$165	\$165
AST140TH	3	Registered Radiance at the Sensor - Orthorectified	15, 30, 90	\$85	\$85
AST_04	2	Brightness Temperature at the Sensor	90	\$85	\$85
AST_05	2	Surface Emissivity	90	\$85	\$85
AST_06SD	2	Decorrelation Stretch SWIR	30	\$85	\$85
AST_06TD	2	Decorrelation Stretch TIR	90	\$85	\$85
AST_06VD	2	Decorrelation Stretch VNIR	15	\$85	\$85
AST_07	2	Surface Reflectance - VNIR & SWIR	15, 30	\$85	\$85
AST_07XT	2	Surface Reflectance - VNIR & Crosstalk Corrected SWIR	15, 30	\$85	\$85
AST_08	2	Surface Kinetic Temperature	90	\$85	\$85
AST_09	2	Surface Radiance - VNIR & SWIR	15, 30	\$85	\$85
AST_09T	2	Surface Radiance TIR	90	\$85	\$85
AST_09XT	2	Surface Radiance - VNIR & Crosstalk Corrected SWIR	15, 30	\$85	\$85
AST_L1A	1A	Reconstructed Unprocessed Instrument Data	15, 30, 90	\$85	\$85
AST_L1AE	1A	Reconstructed Unprocessed Instrument Data - Expedited	15, 30, 90	\$0	\$0
AST_L1B	1B	Registered Radiance at the Sensor	15, 30,	\$85	\$85





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Data Set Name:

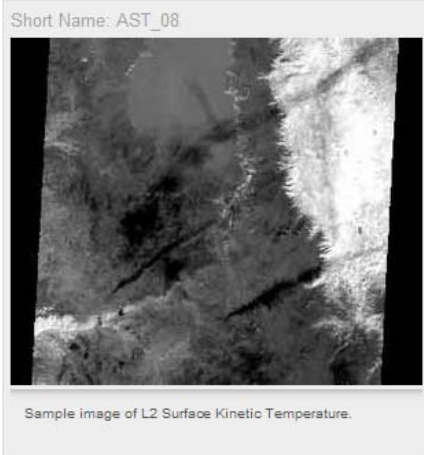
[Print Product Page](#)

On Demand Surface Kinetic Temperature

Short Name:
AST_08

The ASTER On-Demand L2 Surface Kinetic Temperature is an on-demand product generated using the five thermal infrared (TIR) bands (acquired either during the day or night time) between 8 and 12 μm spectral range. It contains surface temperatures at 90 m spatial resolution for the land areas only. Surface Kinetic Temperature provides a vital input to studies of volcanism, thermal inertia, surface energy, and high-resolution mapping of fires.

This product is derived using the same algorithm as the Surface Emissivity Product. Surface kinetic temperature is determined by applying Planck's Law using the emissivity values from the Temperature-Emissivity Separation (TES) algorithm, which uses atmospherically corrected ASTER Surface Radiance (TIR) data. The TES algorithm first estimates emissivities in the TIR channels using the Normalized Emissivity Method (NEM). These estimates are used along with Kirchoff's Law to account for the land-leaving TIR radiance that is due to sky irradiance. That figure is subtracted from TIR radiance iteratively to estimate the emitted radiance from which temperature is calculated using the NEM module.



Layer Specifications and QA/QC Descriptions

Science Data Sets for MODIS Terra Vegetation Indices 16-Day L3 Global 250m SIN Grid V005 (MOD13Q1):

Science Data Sets (HDF Layers) (12)	UNITS	BIT TYPE	FILL	VALID RANGE	MULTIPLY BY SCALE FACTOR
250m 16 days NDVI	NDVI	16-bit signed integer	-3000	-2000, 10000	0.0001
250m 16 days EVI	EVI	16-bit signed integer	-3000	-2000, 10000	0.0001
250m 16 days VI Quality detailed QA	Bits	16-bit unsigned integer	65535	0, 65534	NA
250m 16 days red reflectance (Band 1)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
250m 16 days NIR reflectance (Band 2)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
250m 16 days blue reflectance (Band 3)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
250m 16 days MIR reflectance (Band 7)	Reflectance	16-bit signed integer	-1000	0, 10000	0.0001
250m 16 days view zenith angle	Degree	16-bit signed integer	-10000	-9000, 9000	0.01
250m 16 days sun zenith angle	Degree	16-bit signed integer	-10000	-9000, 9000	0.01
250m 16 days relative azimuth angle	Degree	16-bit signed integer	-4000	-3600, 3600	0.1
250m 16 days composite day of the year	Julian day of year	16-bit signed integer	-1	1, 366	NA
250m 16 days pixel reliability summary QA	Rank	8-bit signed integer	-1	0, 3	NA

The QA information below is excerpted from the Quality Science Data Set within an HDF-EOS MOD13Q1 file.

A summary Quality layer has been included in the MOD13Q1: "pixel reliability." This layer contains ranked values describing overall pixel quality (Table 1 below).

Because evaluation of the past 6 years of V003 and V004 data collections revealed insignificant differences between the Quality assignments for NDVI versus EVI, the V005 MOD13 products include a single Quality layer pertinent to both indices (Table 2 below), rather than one layer for each. This reduces data volume as well as user confusion with multiple Quality layers.

TABLE 1: MOD13Q1 Pixel Reliability

Rank Key	Summary QA	Description
0	Pixel Data	Not Processed

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Data Set Characteristics



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Glaciers

Hydrology

Land Use

Natural Hazards

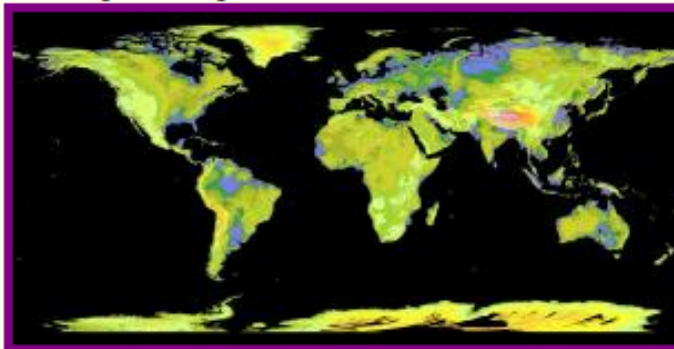
Volcanoes

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DATA

Global Digital Elevation Model

Click Image to Enlarge



(JPG) (1,153,192 bytes) (4,320 x 2,160)

NASA and Japan's Ministry of Economy, Trade and Industry (METI) announced the release of the ASTER Global Digital Elevation Model (GDEM) on June 29, 2009. The GDEM was created by stereo-correlating the 1.3 million scene ASTER VNIR archive, covering the Earth's land surface between 83N and 83S latitudes. The GDEM is produced with 30 meter postings, and is formatted in 23,000 1 x 1 degree tiles as GeoTIFF files. Each GDEM file is accompanied by a Quality Assessment file, either giving the number of ASTER scenes used to calculate a pixel's value, or indicating the source of external DEM data used to fill the ASTER voids. The GDEM is available for download from NASA's EOS data archive (<https://wist.echo.nasa.gov/~wist/api/imswelcome/>) and Japan's Ground Data System (<http://www.gdem.aster.ersdac.or.jp/index.jsp>). This ASTER product is available at no charge for any user pursuant to an agreement between METI and NASA.



Title: Land-related data and products from USGS and the Land Processes Distributed Active Archive Center (LP DAAC)

Outline

A brief overview of USGS EROS

USGS/EROS (land-related) Data Products

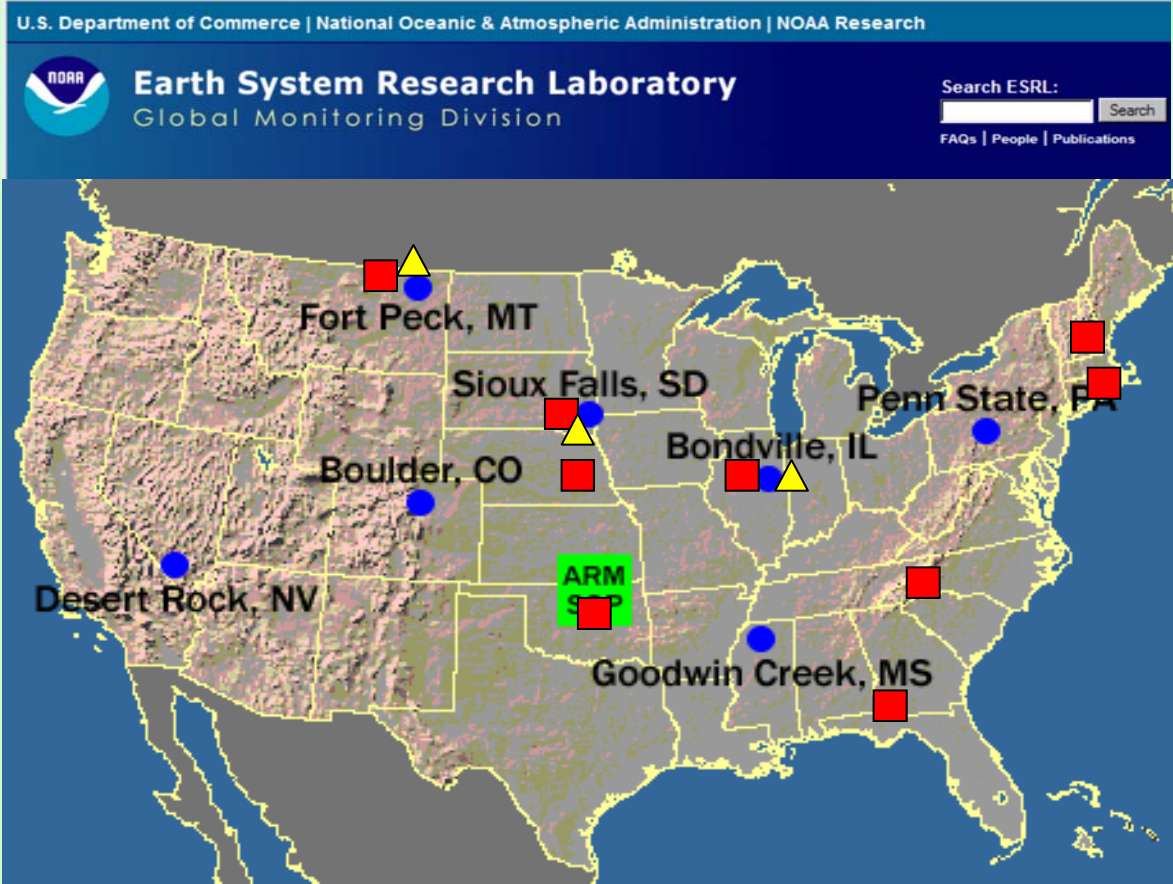
LP DAAC Data Products

Examples of STAR applications of these products

Potential future sensors/products at EROS and LP DAAC

CEOS Land Surface Imaging Constellation activities update

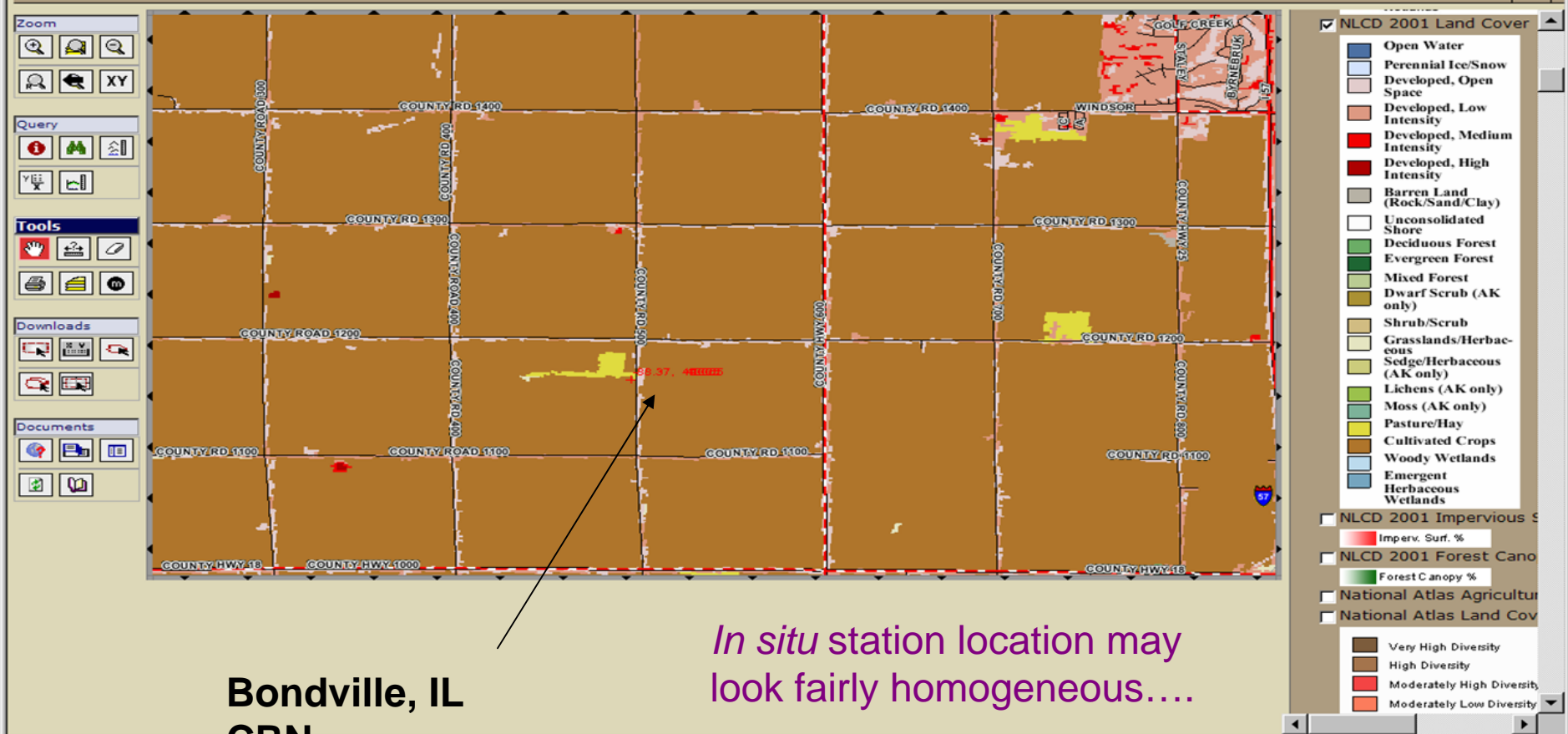
GOES-R cal/val – *in situ* station characterization



- CRN stations ■
- SURFRAD stations ●
- GEWEX stations ▲



2001 National Land Cover Database



Bondville, IL
CRN

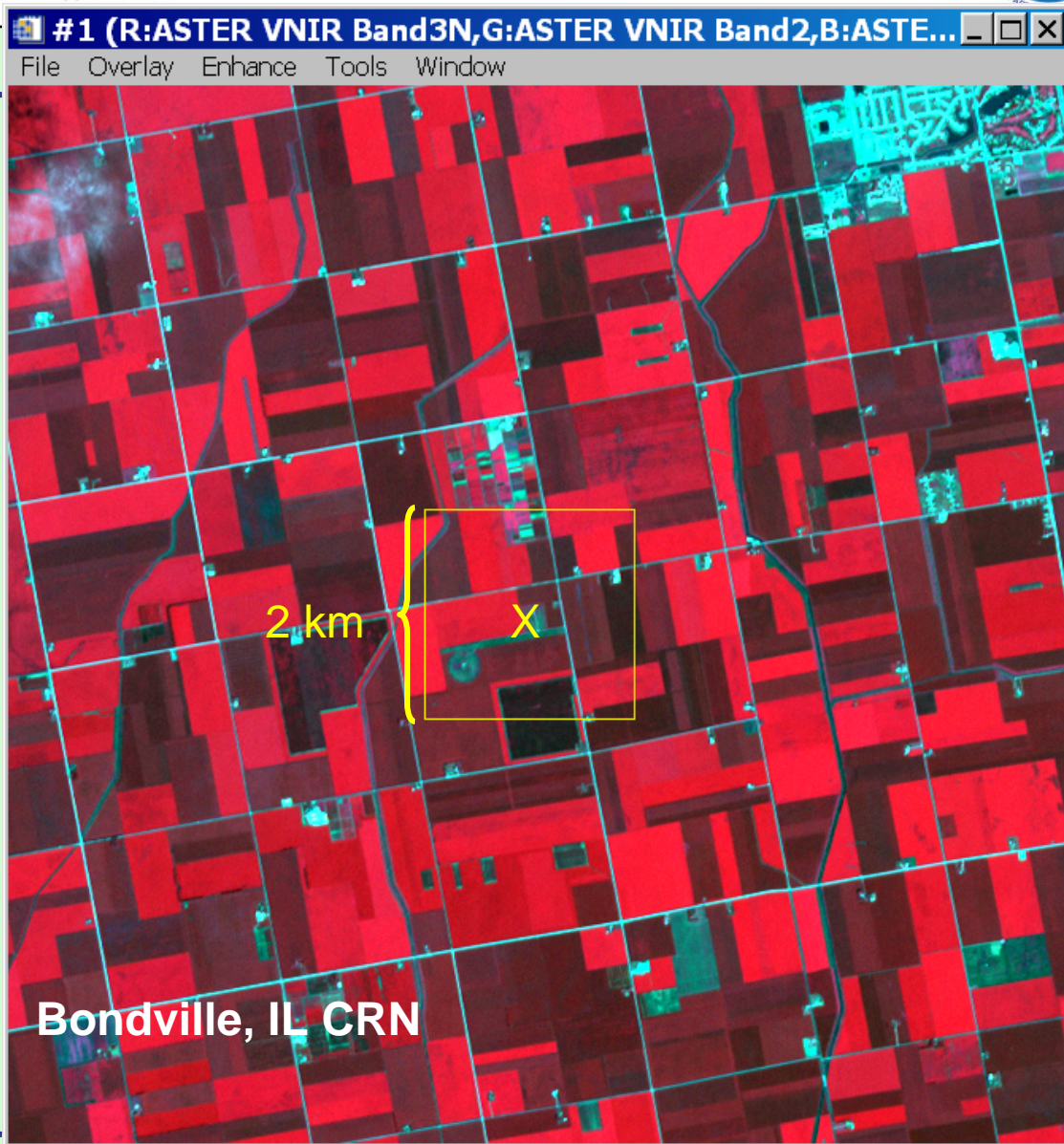
In situ station location may look fairly homogeneous....



Maybe not as homogeneous
as first appeared....

ASTER image

10 km



Bondville, IL CRN



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 - ▶ Science
 - ▼ Instrument
 - Characteristics
 - VNIR
 - SWIR
 - TIR
 - ▶ MASTER
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ASTER Instrument Characteristics

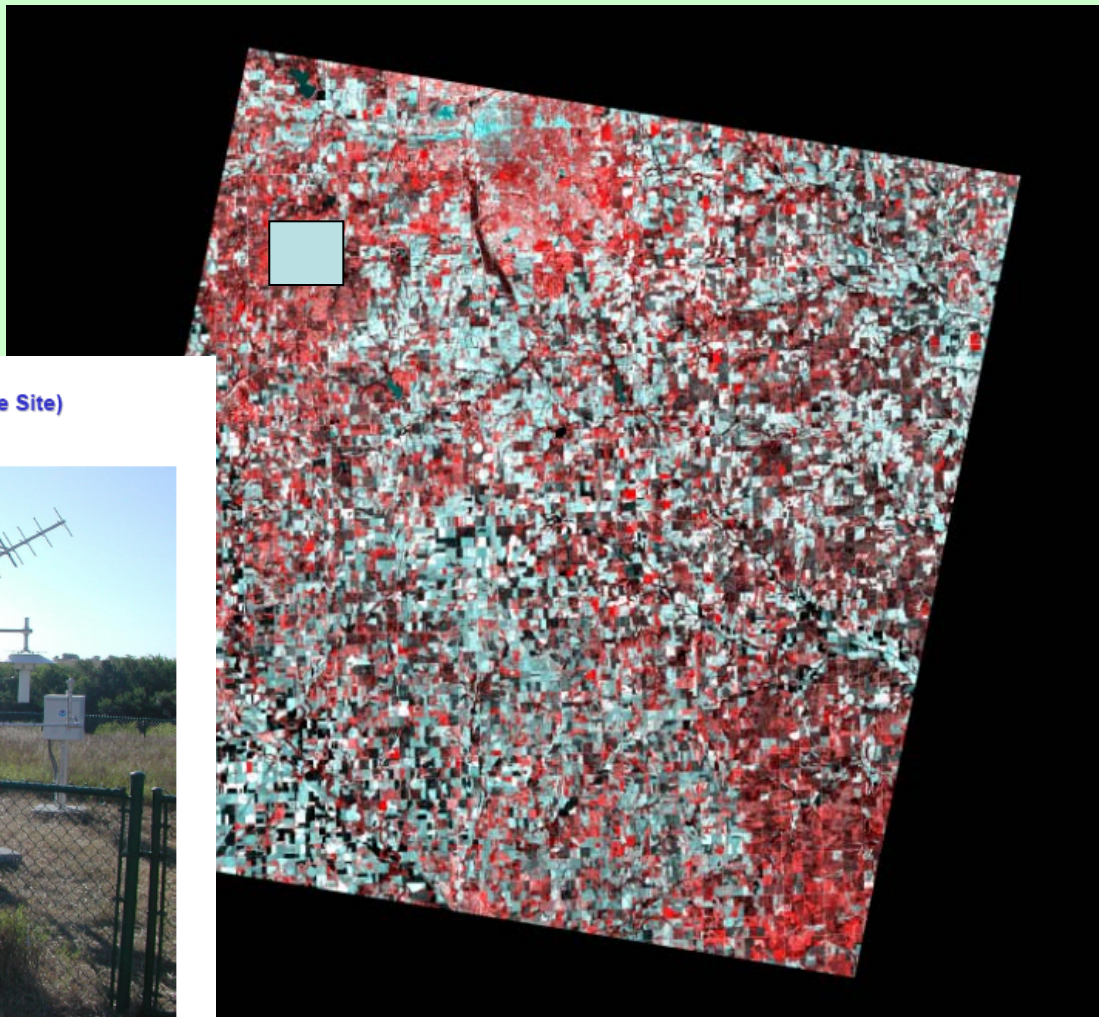
Characteristic	VNIR	SWIR	TIR
Spectral Range	Band 1: 0.52 - 0.60 μm Nadir looking	Band 4: 1.600 - 1.700 μm	Band 10: 8.125 - 8.475 μm
	Band 2: 0.63 - 0.69 μm Nadir looking	Band 5: 2.145 - 2.185 μm	Band 11: 8.475 - 8.825 μm
	Band 3: 0.76 - 0.86 μm Nadir looking	Band 6: 2.185 - 2.225 μm	Band 12: 8.925 - 9.275 μm
	Band 3: 0.76 - 0.86 μm Backward looking	Band 7: 2.235 - 2.285 μm	Band 13: 10.25 - 10.95 μm
		Band 8: 2.295 - 2.365 μm	Band 14: 10.95 - 11.65 μm
		Band 9: 2.360 - 2.430 μm	
Ground Resolution	15 m	30m	90m
Data Rate (Mbits/sec)	62	23	4.2
Cross-track Pointing (deg.)	± 24	± 8.55	± 8.55
Cross-track Pointing (km)	± 318	± 116	± 116
Swath Width (km)	60	60	60
Detector Type	Si	PtSi-Si	HgCdTe
Quantization (bits)	8	8	12

ASTER – *in situ* station characterization

ASTER – CRN comparisons

Lincoln, NE 11SW

CRN station



NE Lincoln 11 SW, Audubon Society (Spring Creek Prairie Site)

40.7 N 96.8 W 1364'

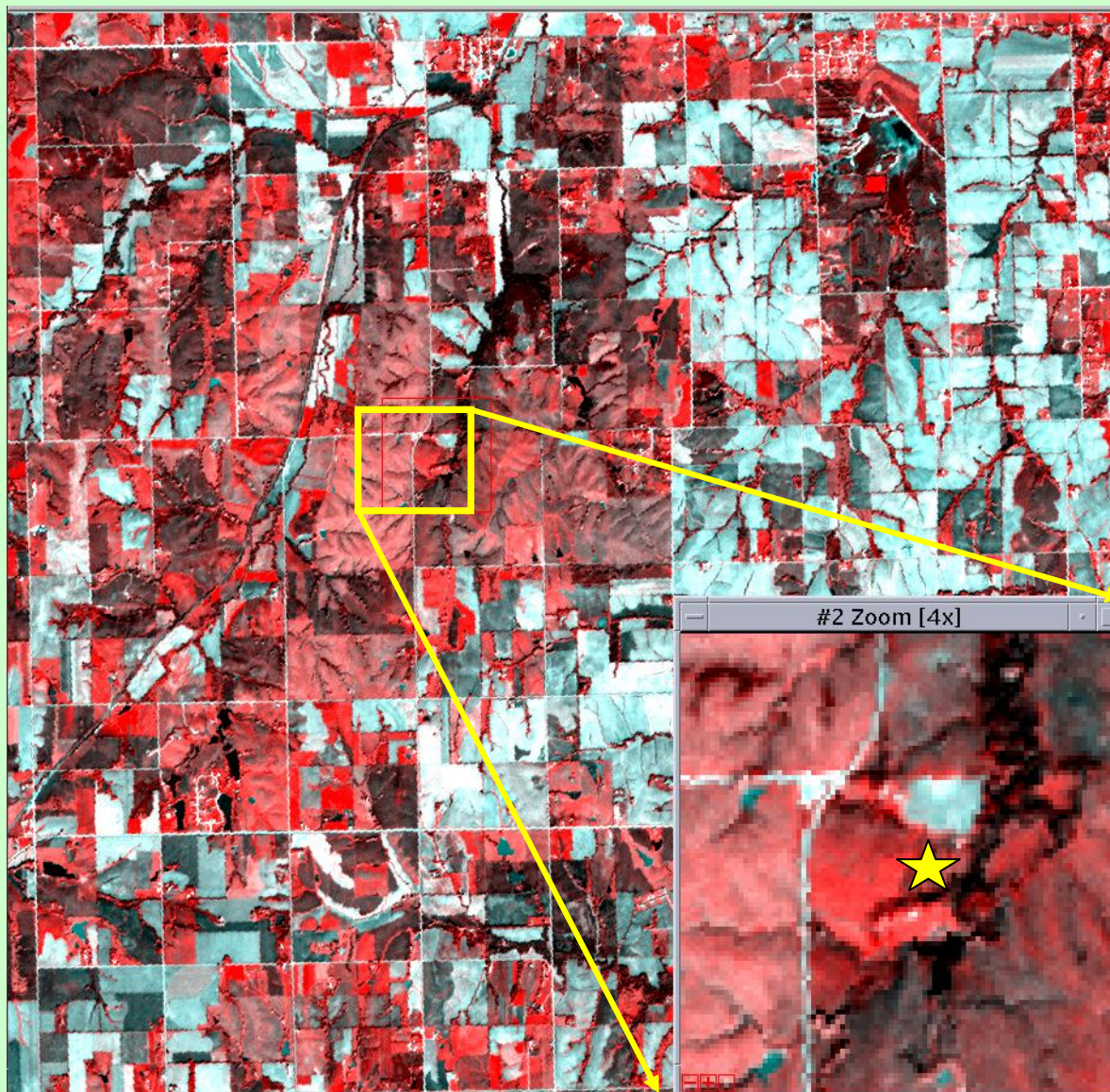
January 14, 2002





Lincoln, NE 11SW

CRN station

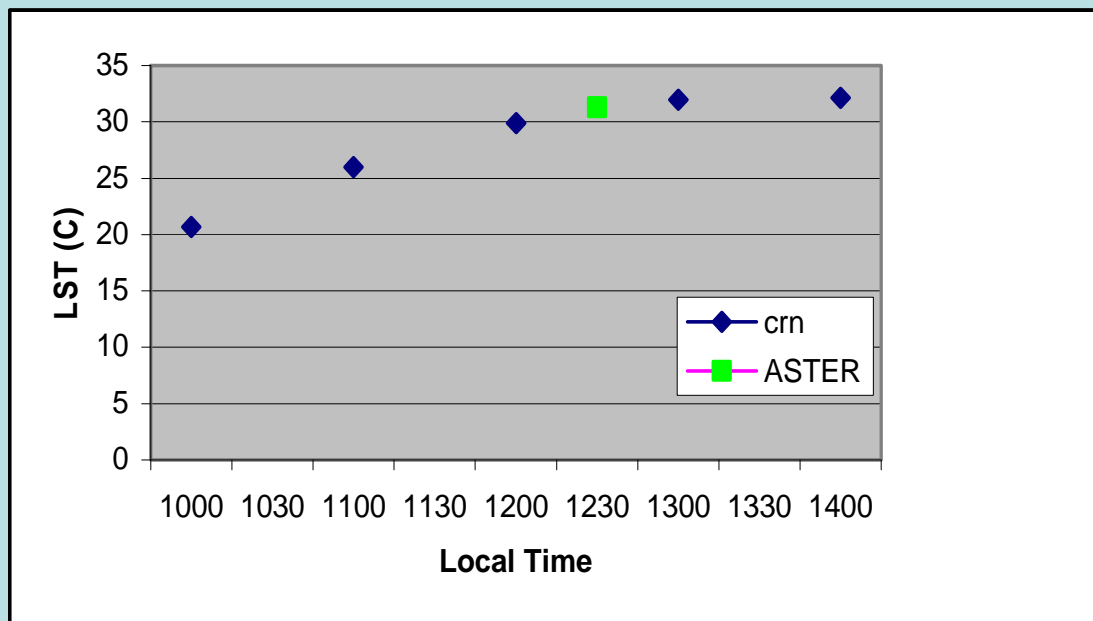




Satellite (ASTER) vs. in situ (CRN)

Lincoln, NE 11SW: 22 OCT 2003

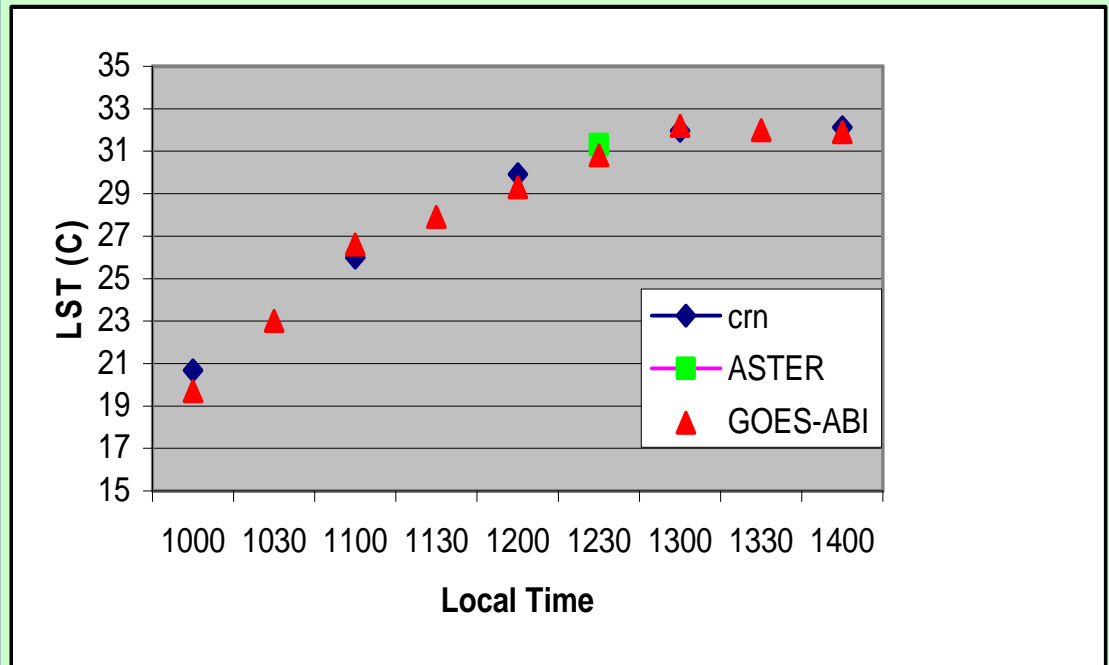
Time	CRN	ASTER
1000	20.67	
1030		
1100	26	
1130		
1200	29.91	
1230		31.3
1300	31.97	
1330		
1400	32.13	



Satellite (ASTER) vs. in situ (CRN)

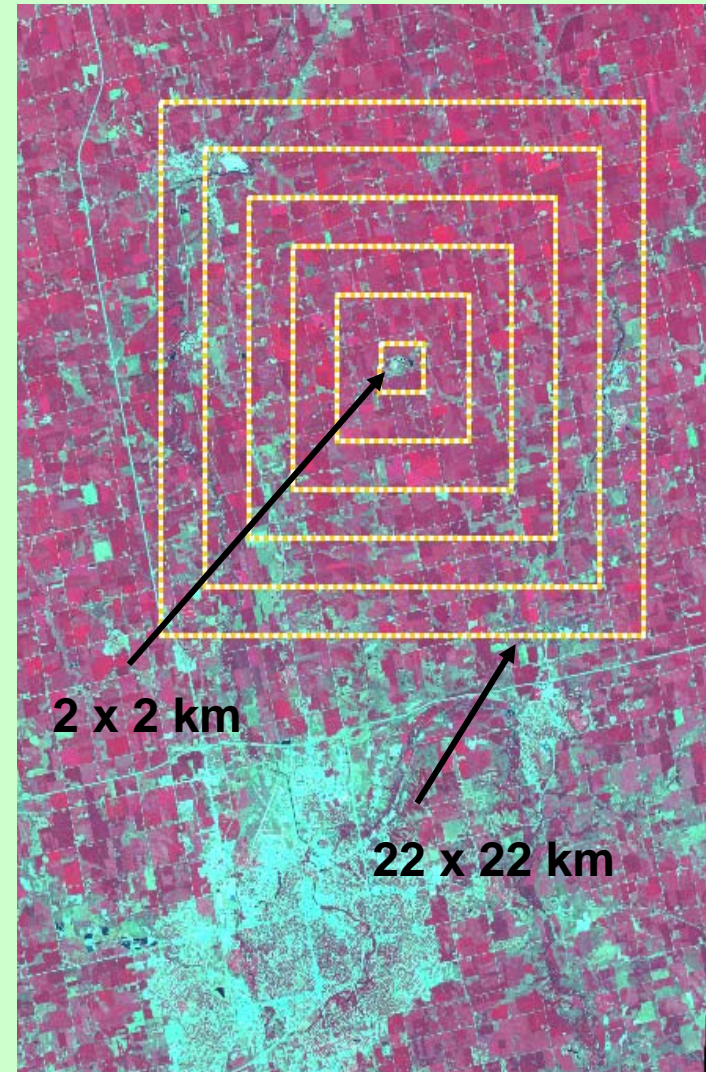
Lincoln, NE 11SW: 22 OCT 2003

Time	CRN	ASTER	Future GOES-ABI
1000	20.67		19.7
1030			23
1100	26		26.6
1130			27.9
1200	29.91		29.3
1230		31.3	30.8
1300	31.97		32.2
1330			32
1400	32.13		31.9



ASTER Spatial Analysis

Example of satellite data product sampling at several multiples of GOES-R resolutions (Sioux Falls/EROS, SD).

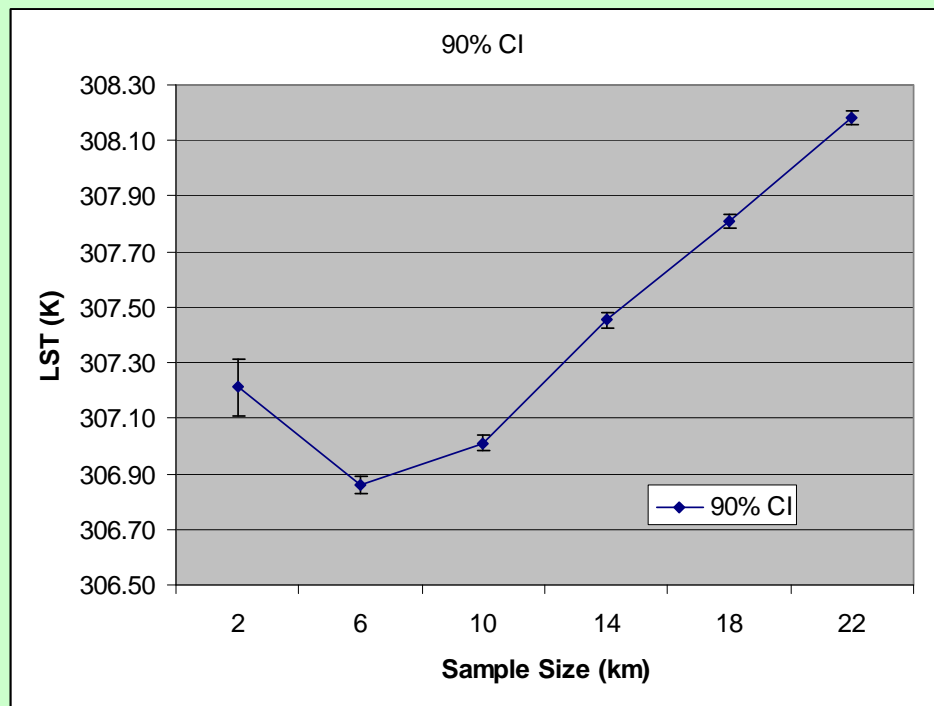
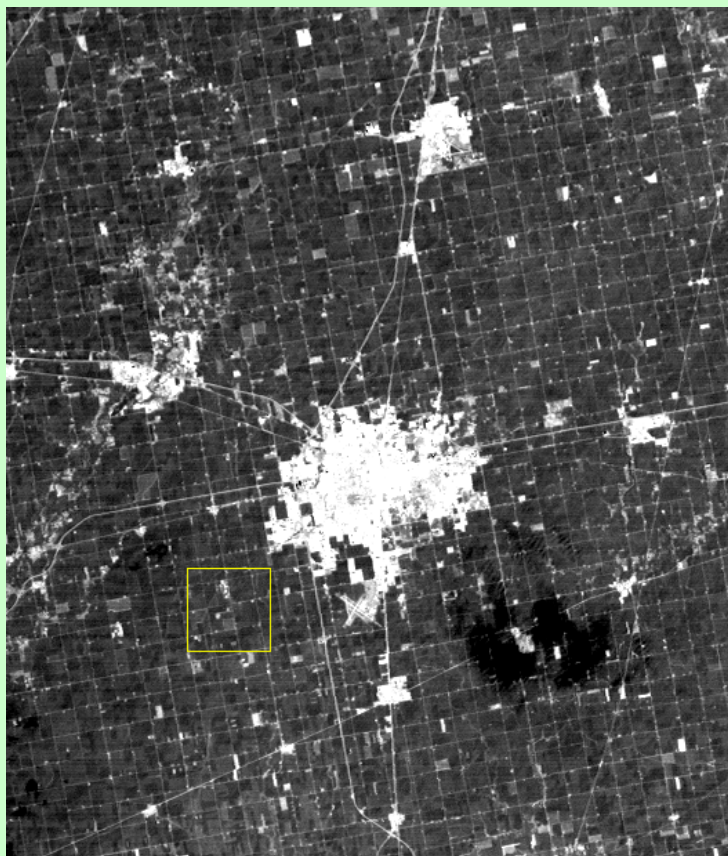
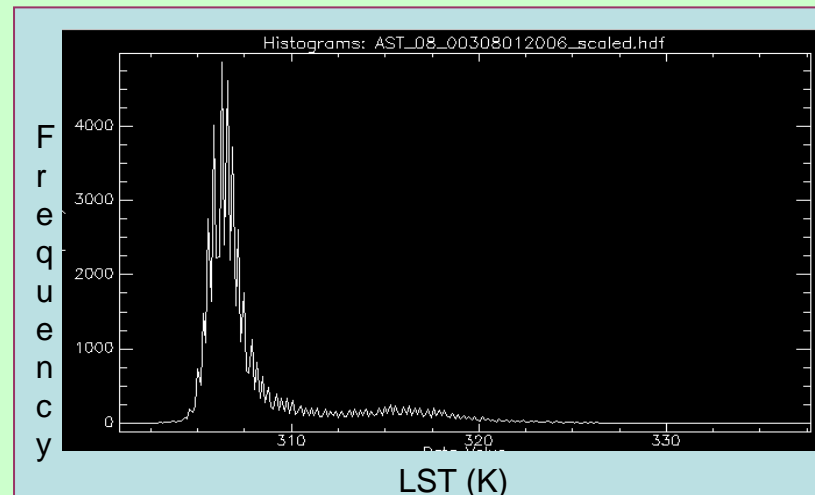


Bondville, IL SURFRAD/CRN

40.05 N 88.37 W

1 August 2006 16:46:36 UTC

ASTER LST Analysis





Jet Propulsion Laboratory
California Institute of Technology

[+ View the NASA Portal](#)

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EARTH

SOLAR SYSTEM

STARS & GALAXIES

TECHNOLOGY

North American Land Surface Emissivity Project

Home

Order

Pubs

Validation

Examples

USCRN

Log in

You are here: Home

Navigation

Home

Order

Pubs

Validation

Examples

USCRN

« July 2009 »

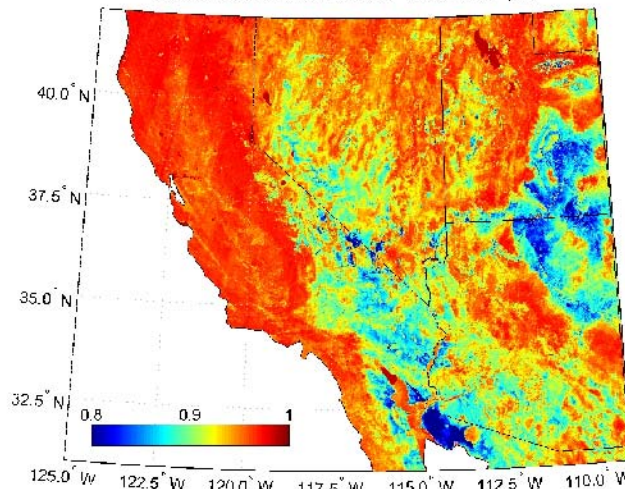
Mo	Tu	We	Th	Fr	Sa	Su
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

North American Land Surface Emissivity Project

Welcome to the website for the North American Land Surface Emissivity Project. The goal of the project is to create a seamless database of emissivity from standard ASTER emissivity products for use in climate research. The Earth emits energy at wavelengths we cannot normally see, that energy is a function of the temperature and the emissivity of the surface. The surface emissivity primarily depends on the composition of the surface. Thus as the surface composition changes through, for example, land cover land use change, so does the surface emissivity. The land surface emissivity is measured by several instruments mounted on satellites and aircraft. Some of the most well known satellite sensors are [AIRS](#), [ASTER](#) and [MODIS](#).

Of these three satellite sensors, ASTER provides the most detailed emissivity images with a pixel spatial resolution of 90m. The image below was created by merging together all the ASTER emissivity data ever acquired over California, Nevada, Arizona and Utah under clear skies from 2000-2008 for the months July, August and September.

ASTER Mean Summer Emissivity - Band 12 (9.1 μm)





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Home

Order

Pubs

Validation

Examples

USCRN

Log in

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Navigation

- Home
- Order
- Pubs
- Validation
- Examples
- USCRN

« July 2009 »

Mo	Tu	We	Th	Fr	Sa	Su
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

USCRN

The U.S Climate Reference Network (USCRN)

The U.S Climate Reference Network (USCRN) is being established to monitor present and future long-term climatic trends (50-100 yrs) and variability in temperature and precipitation to better define climatic change over the United States. The USCRN was officially commissioned in January 2004 and the network is scheduled to be completed in 2008 with a total of 114 stations in the Continental USA. It has the long-term commitment of the Department of Commerce (DOC) and the National Oceanic and Atmospheric Administration (NOAA) and is being implemented and managed by the National Climatic Data Center (NCDC) located in Asheville, NC.

The stations in the table below will link you to a 2x2 subplot of the corresponding ASTER images used to assess the homogeneity of each location. The images show 5x5 km cutouts with station at center, of the emissivity in ASTER bands 13 and 14, a decorrelation stretch and coefficient of variation in emissivity.

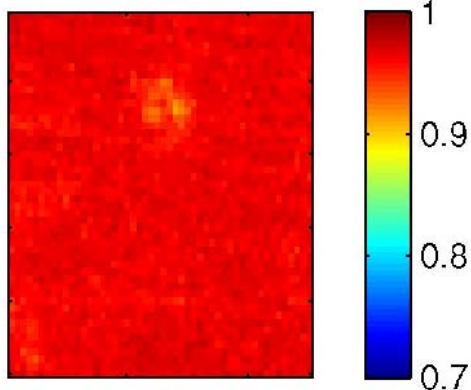
The decorrelation stretch will give an indication of surface composition around each site. In general, quartz rich rocks are displayed in red and magenta, quartz poor rocks are displayed in blues and purples and carbonates in green.

The CV will provide a good measure of the spatial homogeneity around each site and is defined as the ratio of standard deviation over the average for a given quantity (ie. emissivity). CV values less than 2% are generally considered to be low-variance.

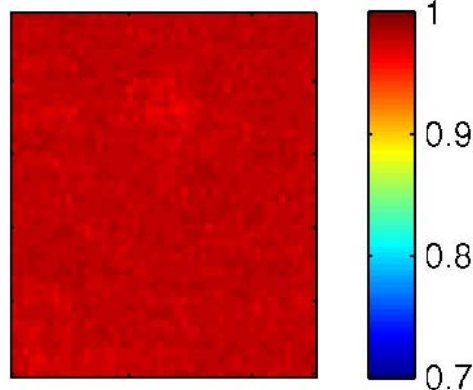
Name	Latitude [DD]	Longitude [DD]
ALFairhope3NE	30.5485	-87.8757
ALGadsden19N	34.2851	-85.9621
ALSelma13WNW	32.4567	-87.2422
ARBatesville8WNW	35.8201	-91.7812
AZEIqin5S	31.5907	-110.5087
AZTucson11W	32.2395	-111.1696
CABodeqa6WSW	38.3209	-123.0746

Champaign/Bondville, IL

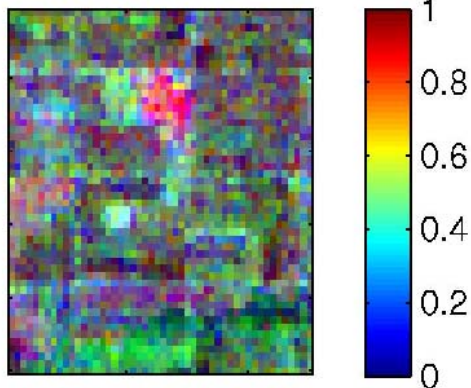
Mean Emissivity (9.1 μm)



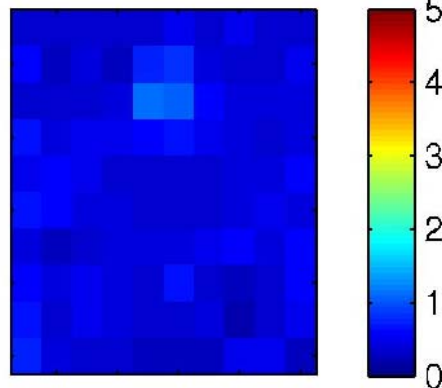
Mean Emissivity (11.3 μm)



D–Stretch

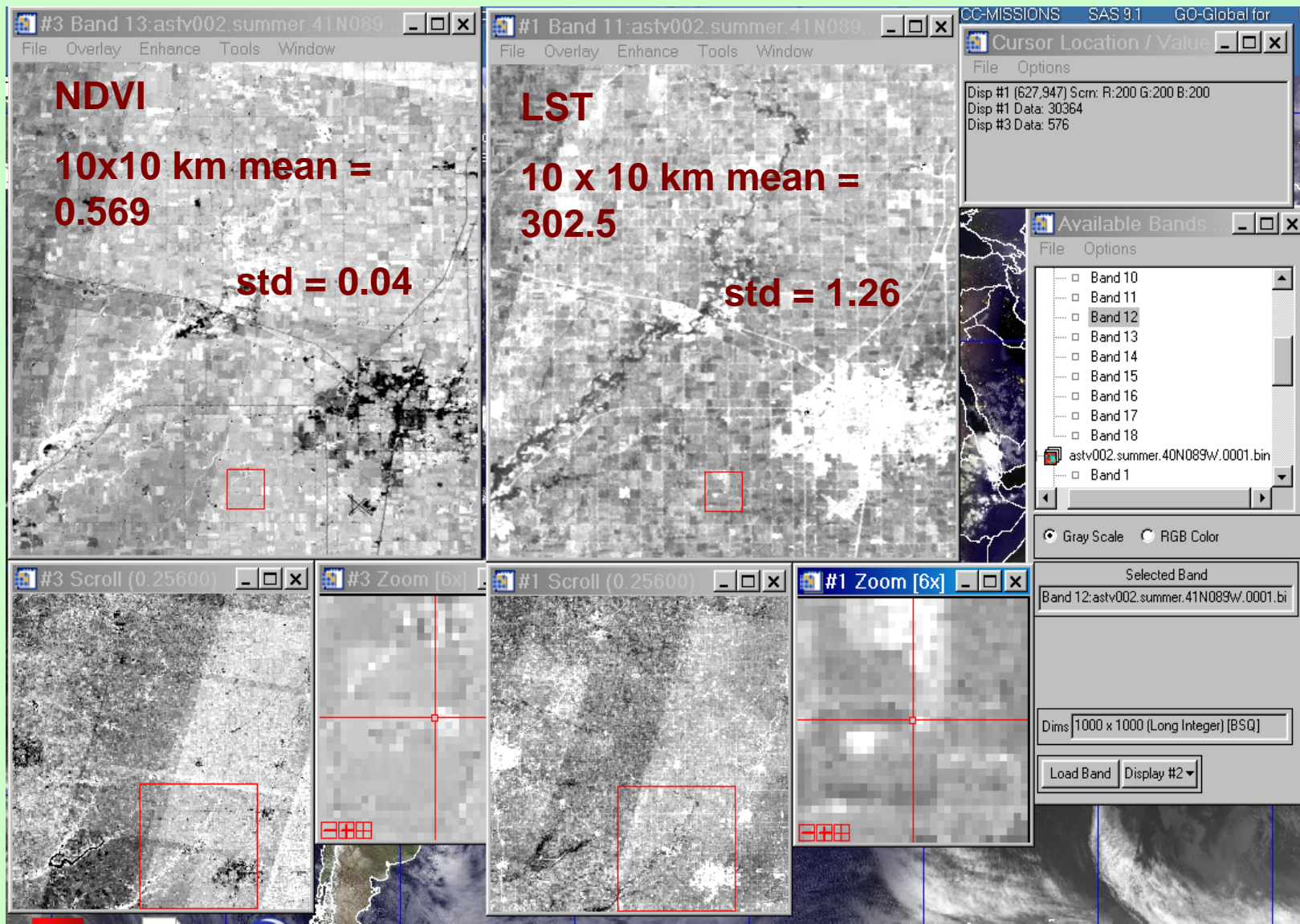


CV (%)



The stations in the table below will link you to a 2x2 subplot of the corresponding ASTER images used to assess the homogeneity of each location. The images show 5x5 km cutouts with station at center, of the emissivity in ASTER bands 13 and 14, a decorrelation stretch and coefficient of variation in emissivity.

ASTER Summer (JAS) mean LST and NDVI data: Bondville, IL CRN station



Data Set Name:

Vegetation Indices 16-Day L3 Global 1km

Short Name:
MOD13A2

Global MODIS vegetation indices are designed to provide consistent spatial and temporal comparisons of vegetation conditions. Blue, red, and near-infrared reflectances, centered at 469-nanometers, 645-nanometers, and 858-nanometers, respectively, are used to determine the MODIS daily vegetation indices.

The MODIS Normalized Difference Vegetation Index (NDVI) complements NOAA's Advanced Very High Resolution Radiometer (AVHRR) NDVI products and provides continuity for time series historical applications. MODIS also includes a new Enhanced Vegetation Index (EVI) that minimizes canopy background variations and maintains sensitivity over dense vegetation conditions. The EVI also uses the blue band to remove residual atmosphere contamination caused by smoke and sub-pixel thin cloud clouds. The MODIS NDVI and EVI products are computed from atmospherically corrected bi-directional surface reflectances that have been masked for water, clouds, heavy aerosols, and cloud shadows.

Global MOD13A2 data are provided every 16 days at 1-kilometer spatial resolution as a gridded level-3 product in the Sinusoidal projection. Vegetation indices are used for global monitoring of vegetation conditions and are used in products displaying land cover and land cover changes. These data may be used as input for modeling global biogeochemical and hydrologic processes and global and regional climate. These data also may be used for characterizing land surface biophysical properties and processes, including primary production and land cover conversion.

Version-5 MODIS/Terra Vegetation Indices products are Validated Stage 2, meaning that accuracy has been assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts. Although there may be later improved versions, these data are ready for use in scientific publications.

Change Points of Interest

[Print Product Page](#)

MODIS – *in situ* station characterization

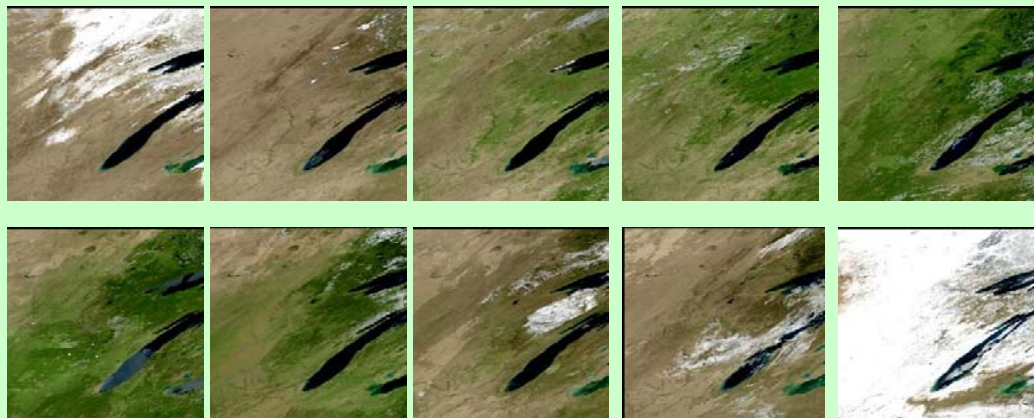
Short Name: MOD13A2



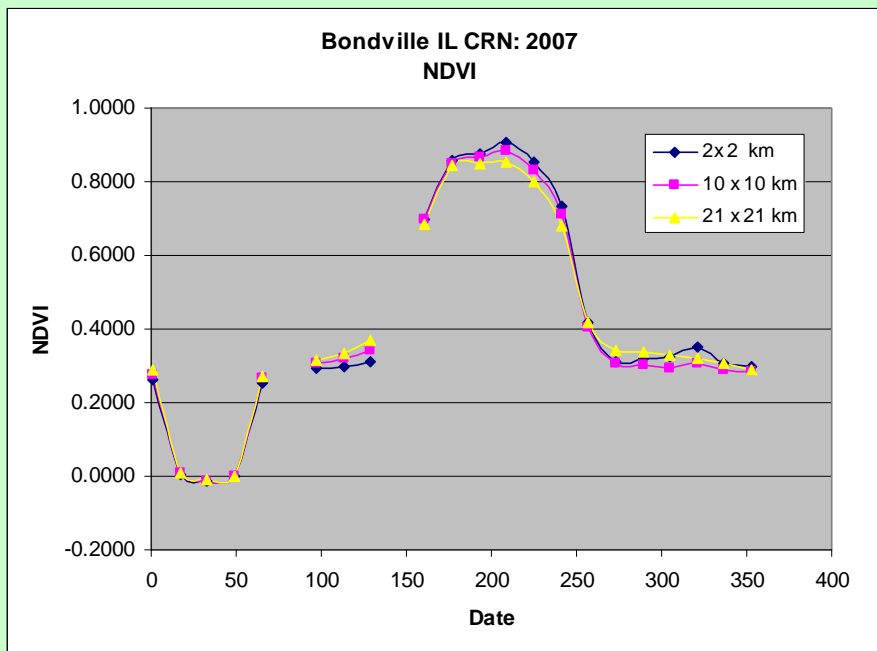
The MOD13A2 images shown are samples of the MODIS/Terra Vegetation Indices 16-Day L3 Global 1km SIN Grid. The NDVI and EVI have been pseudo-colored to represent the biomass health of the western United States using tile h08v05 from June 25 July 10, 2000.



Due to their simplicity, ease of application, and widespread familiarity, vegetation indices have a wide range of usage within the user community. Some of the more common applications may include global biogeochemical and hydrologic modeling, agricultural monitoring and forecasting, land-use planning, land cover characterization, and land cover change detection.



Example of MODIS time-series of images: March – December 2007





Landsat – *in situ* station characterization

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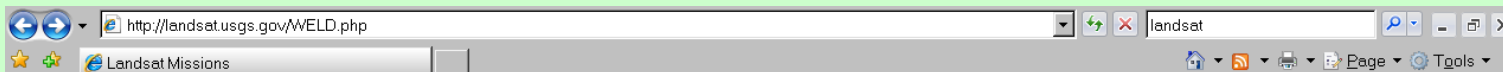
Conterminous United States Landsat ETM+ Annual Mosaic

Web-Enabled Landsat Data (WELD) Project

The Web-Enabled Landsat Data (WELD) project will improve the consistency and quality of [Landsat Enhanced Thematic Mapper Plus \(ETM+\)](#) data through a fusion with [MODIS land products](#) to systematically generate "seamless" consistent mosaicked ETM+ data sets with per-pixel quality assessment information and derived land cover characterization at monthly, seasonal, and annual time periods. The resulting high spatial resolution Landsat mosaic products will be generated for the conterminous USA and Alaska for a 7-year period and made freely available to the user community. The WELD project is funded by NASA's Making Earth System Data Records for Use in Research Environments (MEaSUREs) program.

A preliminary WELD data set is available here, specifically, a 12-month annual composite of the conterminous U.S. generated from ETM+ orthorectified and terrain-corrected data acquired December 2007 to November 2008. In the future, other annual, seasonal, and monthly, mosaic data sets will be made available for evaluation by the user community. The large image below shows the ETM+ red, green, and blue wavelength bands of the annual mosaic, please click on it to see a higher-resolution version.

Internet
100%



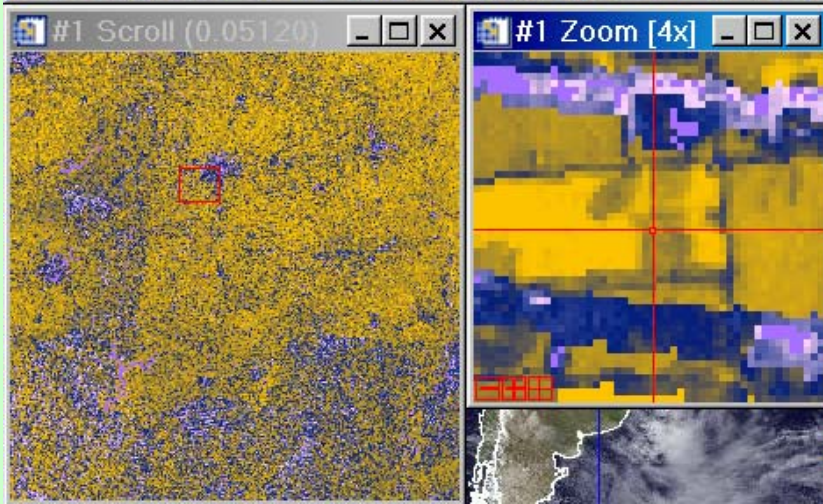
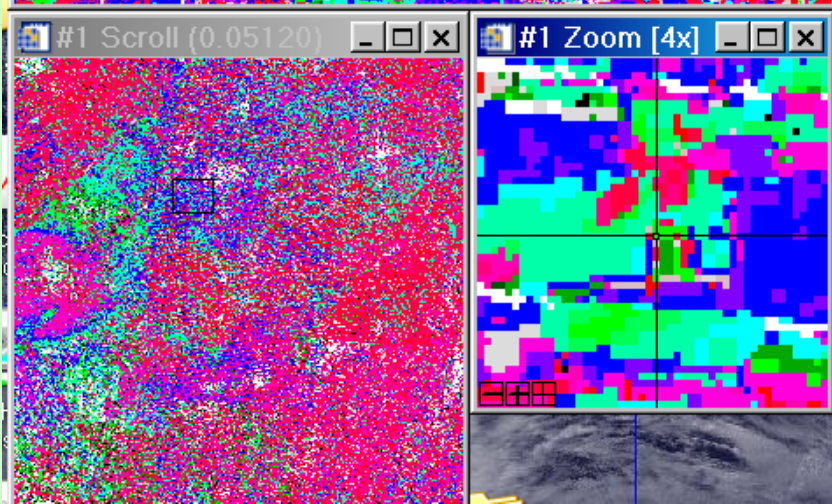
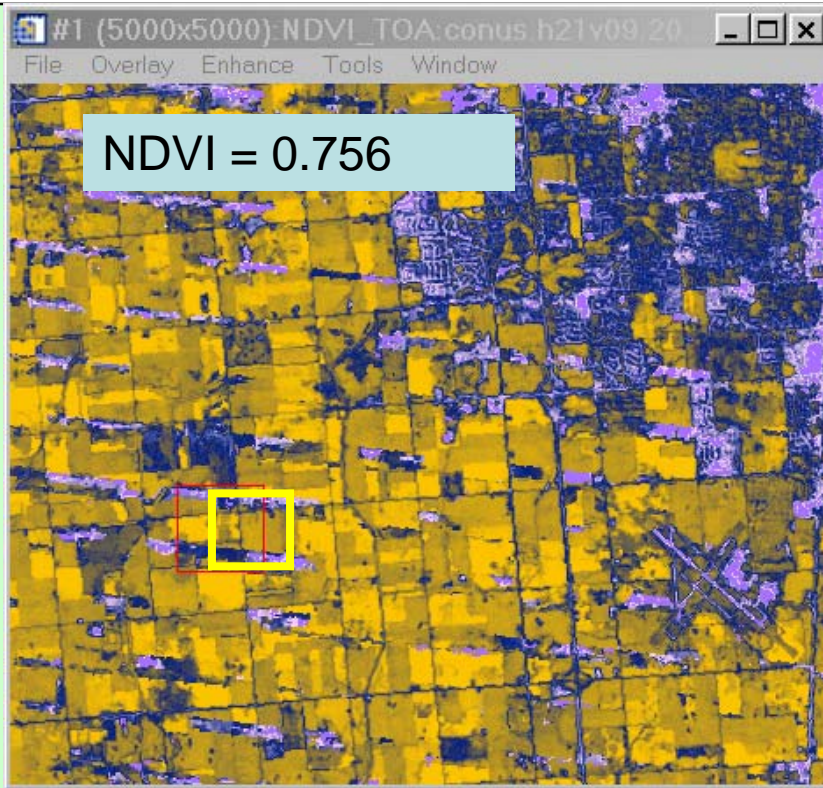
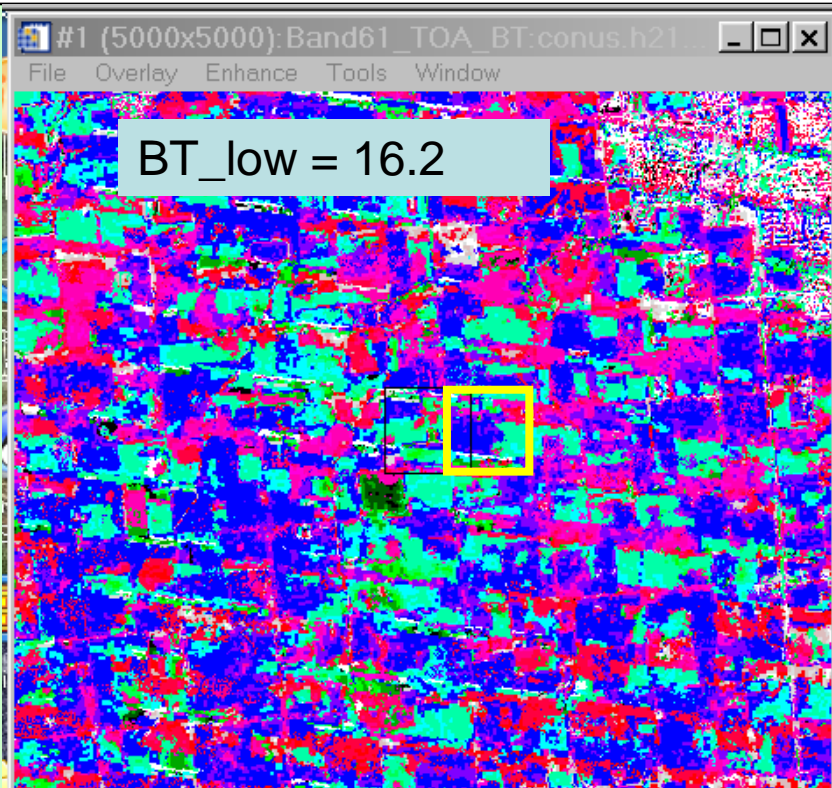
These data are defined with 30m pixels in the Albers Equal Area projection with standard parallels 29.5°N, 45.5°N, and central Meridian 96°W. The data are stored in Hierarchical Data Format (HDF) with HDF internal compression. HDF is a data file format designed by the National Center for Supercomputing Applications to assist users in the storage and manipulation of scientific data across diverse operating systems and machines. For example, it is used to store the standard MODIS products. In this version, each pixel has 14 bands (termed HDF science data sets) storing the information described in the Table. Future product versions will have refined processing and content, most notably atmospheric correction, radiometric/BRDF normalization, improved cloud and ETM+ SLC-off gap-filling, and land-cover characterization.

WELD Annual Mosaic Version 1.0 Product Format

Science Data Set Name	Data Type	Valid Range	Scale factor	Units	Fill Value	Notes
Band1_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	Top of atmosphere (TOA) reflectance and brightness temperature, computed using standard formulae and calibration coefficients associated with the sensed ETM+ granule.
Band2_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	
Band3_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	
Band4_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	
Band5_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	
Band61_TOA_REF	int16	-32767 -- 32767	100	Degrees Celsius	-32768	
Band62_TOA_REF	int16	-32767 -- 32767	100	Degrees Celsius	-32768	
Band7_TOA_REF	int16	-32767 -- 32767	10000	unitless	-32768	The conventional ETM+ band number scheme is used.
NDVI_TOA	int16	-10000 -- 10000	1	unitless	-32768	Band 6 brightness temperature data are resampled to 30m. Normalized Difference Vegetation Index value generated from Band3_TOA_REF and Band4_TOA_REF.
Day_Of_Year	int16	1 -- 366	1	Day	0	Day of year the selected ETM+ pixel was sensed on. Note days 1-335 were sensed in 2008 and days 336-365 were sensed in December 2007.
Saturation_Flag	uint8	0 -- 255	1	unitless	None	The least significant bit to the most significant bit corresponds to bands 1, 2, 3, 4, 5, 61, 62, 7 with a bit set to 1 signifying saturation in that band and 0 not saturated.
DT_Cloud_State	uint8	0, 1, 2, 200	1	unitless	255	Decision Tree Cloud Classification, 0 = not cloudy, 1 = cloudy, 2 = not cloudy but adjacent to a cloudy pixel, 200 = could not be classified reliably.
ACCA_State	uint8	0, 1	1	unitless	255	ACCA Cloud Classification, 0 = not cloudy, 1 = cloudy.
Num_Of_Obs	uint8	0 -- 255	1	unitless	None	Number of ETM+ observations considered over the 12 months.

The data are stored in tiles of 5000 x 5000 30m pixels. There are a total of 513 land tiles referenced using a two digit horizontal (HH) and vertical (VV) tile coordinate system reflected in the filename as conus.hHHVVV.2007dec-2008nov.v1.0.hdf. The image below illustrates the tile coordinate system, please click on it to see a higher-resolution version.





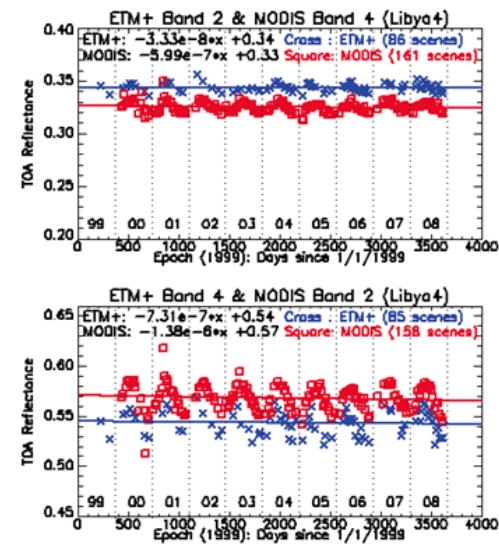
Landsat /AVHRR intercalibration

Initiated through meetings between Gyanesh Chander (EROS), Mitch Goldberg, Changyong Cao, and Fred Wu.

Discussed methodology with Gyanesh Chander on 7/28/09 for start of Landsat/AVHRR intercomparisons.

TOA Reflectance Trending (Libya 4)

- Linear equations are fitted
 - ◆ Slope values are very small: prove the long term stability of the two sensors
 - ◆ There are constant offsets: caused by a combination of the spectral signature of the ground target, atmospheric composition and the RSR characteristics of each sensor
- The annual oscillation were caused by BRDF effect
 - ◆ BRDF depends on wavelength and viewing geometry and does not need to be the same for both ETM+ and MODIS, considering the overpass time differences in addition to the differences caused due to the RSR
- The residue standard deviation values are within the radiometric specifications





Title: Land-related data and products from USGS and the
Land Processes Distributed Active Archive Center (LP DAAC)

Outline

A brief overview of USGS EROS

USGS/EROS (land-related) Data Products

LP DAAC Data Products

Examples of STAR applications of these products

Planned and potential sensors/data/products at EROS and
LP DAAC

CEOS Land Surface Imaging Constellation activities update



LDCM: Current launch date: Dec 2012

L A N D S A T

Data Continuity Mission



LDCM

Status of the Landsat Data Continuity Mission

presented by

Bill Ochs

Landsat Data Continuity Mission Project Manager

NASA Goddard Space Flight Center

at the

**Landsat Science Team Meeting
Rochester Institute of Technology**

Rochester, N.Y.

June 22, 2009



Operational Land Imager (OLI)

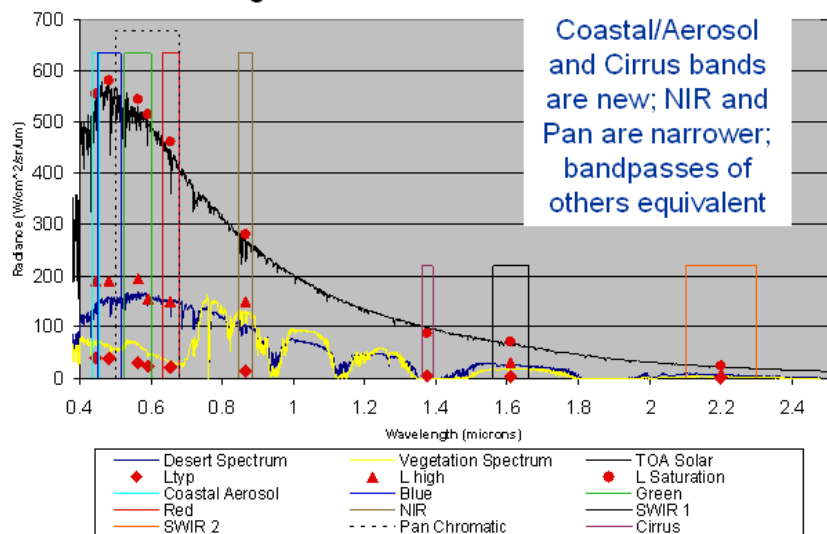


OLI Maintains Landsat Legacy



- Landsat Continuity Mission demands
 - Accurate spectral and spatial information
 - Frequent synoptic earth views
 - NIST calibrated over time
 - Precise geo-referenced data

- Key instrument parameters
 - Cross-track FOV 185 km
 - SIC altitude 705 km
 - Geodetic accuracy*
 - ❖ Absolute 65 m
 - ❖ Relative 25 m
 - Geometric accuracy**
 - ❖ Absolute 12 m



Band Name	CW (nm)	Bandwidth (nm)	GSD (m)	SNR
Coastal/Aerosol	443	20	30	130
Blue	482	65	30	130
Green	562	75	30	100
Red	655	50	30	90
NIR	865	40	30	90
SWIR 1	1610	100	30	100
SWIR 2	2200	200	30	100
PAN	590	180	15	80
Cirrus	1375	30	30	50

Visible/NIR SWIR

*No terrain compensation
**w/ terrain compensation

Note: Geometric reqts are tighter for OLI



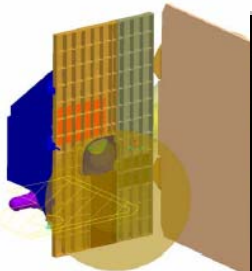
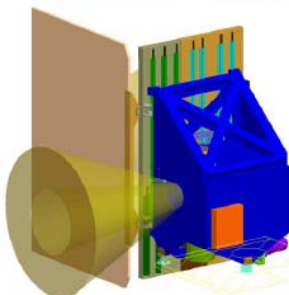
L A N D S A T

Data Continuity Mission

TIRS Overview

TIRS
LDCM

- 2 channel (10.8 and 12 um) thermal imaging instrument
- Quantum Well Infrared Photometer (QWIP) detector/FPA built in-house at Goddard
- <120 m Ground Sample Distance (100 m nominal)
- 185 km ground swath (15° field of view)
- Operating cadence: 70 frames per second
- Pushbroom design with a precision scene select mirror to select between calibration sources
 - “Cold OLI” (B. Markham)
- Two full aperture calibration sources: onboard variable temp black body and space view
- Passively cooled telescope assembly operating at 180K
- Actively cooled (cryocooler) FPA operating at 43K
- 3 Year Design Life, Class C Instrument



4

TIRS PDR
5/27-28/2009

Thermal Infrared Sensor (TIRS)

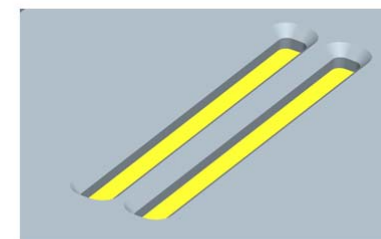
L A N D S A T

Data Continuity Mission

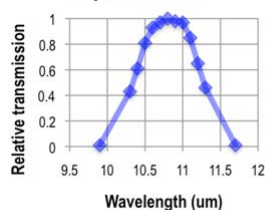
Filters

TIRS
LDCM

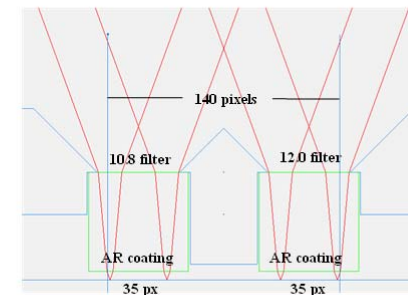
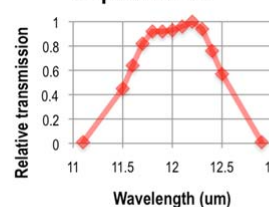
- 1 pair of filters over each SCA
 - 1.5 mm x 1.5 mm x 17 mm
 - Length spans long direction of QWIPs
- Bandpass filter on top side, AR coating on bottom side
- Filter shape defined by detector spectral response
- Within the 140 pixel readout region:
 - 30 pixel region under each filter where the incidence light path is unobstructed
 - 40 pixel central dark region, obscured by Invar filter holder structure



10.8 um band prelim. requirements



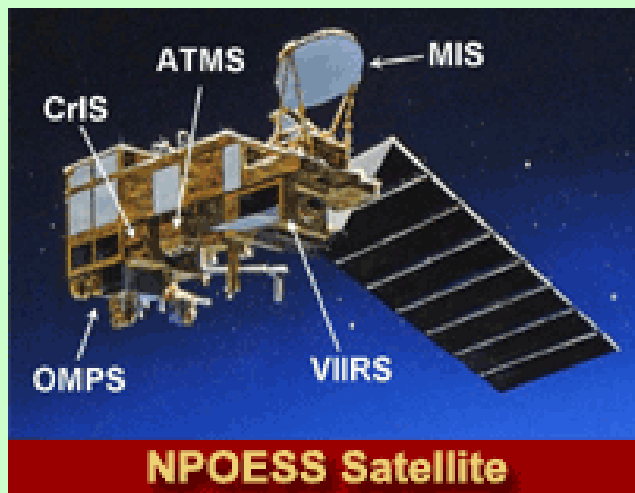
12.0 um band prelim. requirements



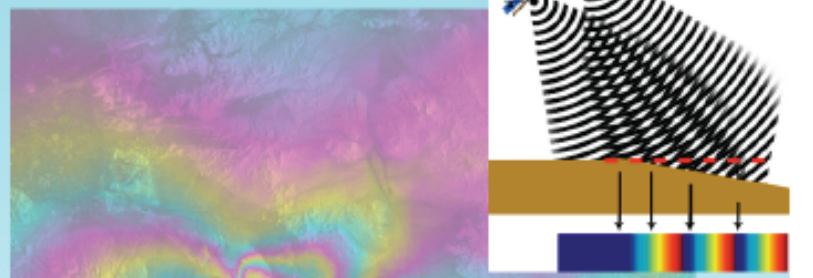
TIRS PDR
5/27-28/2009



Other potential data/products

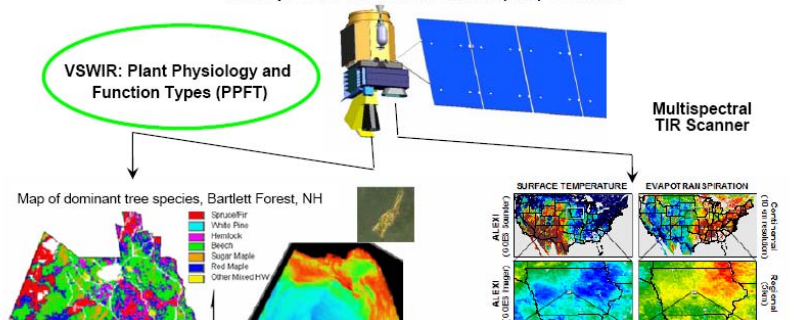


DESDynI Radar/Lidar Space Mission



NASA NRC Decadal Survey HypsIRI

Visible ShortWave InfraRed (VSWIR) Imaging Spectrometer
Multispectral Thermal InfraRed (TIR) Scanner





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LP DAAC

CEOS Land Surface Imaging Constellation activities update 79



The CEOS Land Surface Imaging Constellation contribution to GEO/GEOSS

Kevin Gallo, NOAA
G. Bryan Bailey, USGS
Lyn Oleson, USGS



*The 17th William T. Pecora Memorial Remote Sensing Symposium
November 16-20, 2008 • Denver, Colorado*





Presentation Overview

- CEOS, GEO, and GEOSS
- The CEOS Constellations Concept
- Mission and Goal of the LSI Constellation
- Potential Contributions of the LSI Constellation to GEO/GEOSS
- Recent LSI Accomplishments
- Summary and Conclusions



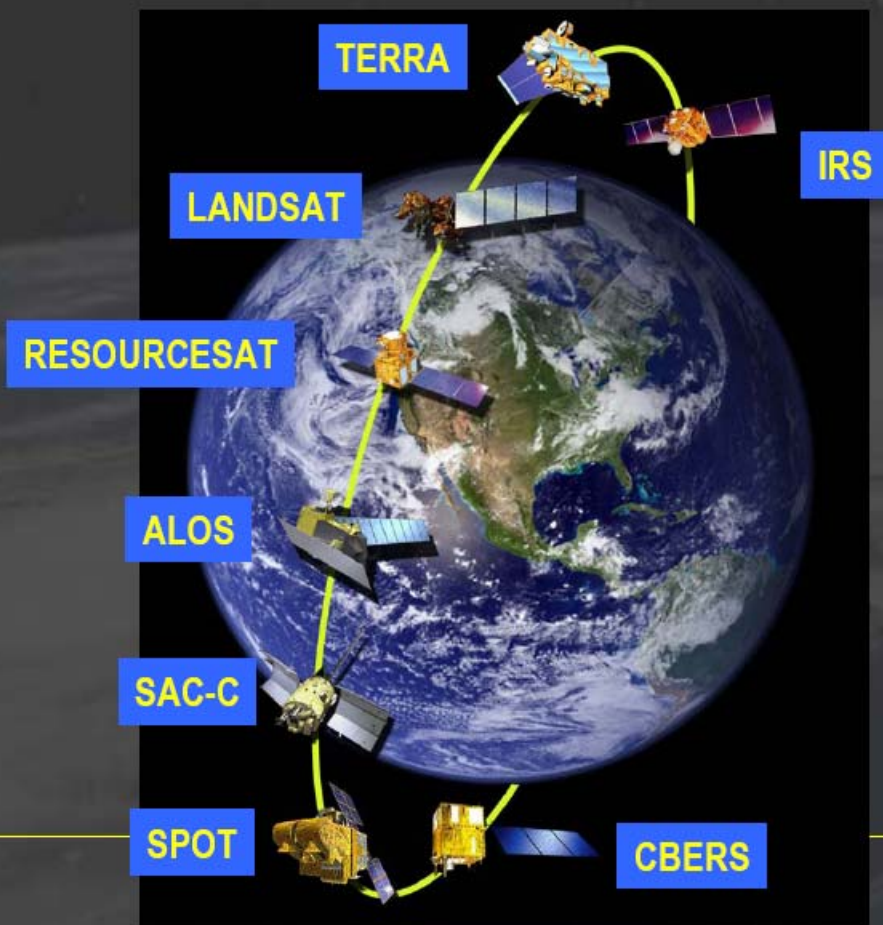


Mission and Goal of the LSI Constellation

“The **Land Surface Imaging** Constellation seeks to promote the efficient, effective, and comprehensive collection, distribution, and application of space-acquired image data of the global land surface, especially to meet societal needs of the global population, such as those addressed by the Group on Earth Observations (GEO) societal benefit areas.”



A Potential Real Prototype Land Surface Imaging Constellation



Others?

Recent LSI Constellation Accomplishments

- Standards for Mid-Resolution Optical Systems
 - Primary objective was to define a suite of initial standards (or guidelines) that describe optimal characteristics of a mid-resolution LSI Constellation.
 1. Space segments
 2. Ground systems
 3. Policies and operational considerations
 - Standards were developed based on the compilation of a representative cross-section of user information and technical requirements.

Recent LSI Constellation Accomplishments

- Standards for Mid-Resolution Optical Systems (cont.)
Preliminary Guidelines for Mid-Res. LSI Satellite Systems (example)

	Minimum	Recommended	
Space Segment	Spectral Band Coverage	3 VNIR, 1 SWIR	≥4 VNIR, ≥2 SWIR, ≥2 TIR 2 Atm correction
	Radiometric Accuracy	<15 %	<5%
	Spatial Resolution	10-100m	10 to 15m
	Geolocation Accuracy	500m	50 m
	Geographic Coverage (swath)	Not less than 60km	100 to 200 km
Ground Segment	Desired Global Repeat	4 Days (Constellation)	2 days (Constellation)
	Processing Level Provided	L1B	L1B-Ordnorectified, L0 with Metadata, and other derived information products TBD
	Plans to Archive Data	3 months at local direct downlink station	Permanently by each participating satellite provider
	Search/Order Method	On-Line (Internet)	Through GEO Web Portal
	Metadata/Formatting Stds.	KML and JPEG2000	KML, JPEG2000, GEOTIFF, HDF, NetCDF
Data & Ops Policies	Product Delivery Method	Internet	Internet, DVD
	Data Use Restrictions	Minimal, consistent with pricing policy	None, consistent with national law
	Distribution Policies (includes pricing)	Tiered, with some free for education and research	Free (or nearly so) to virtually all
	Acquisition Strategy	Bilateral agreements between satellite operators and local downlink station holders	Global, based on an international LTAP strategy with some opportunities for user data acquisition requests
	General	Standard product and metadata availability	Standard products, metadata, algorithms

Recent LSI Constellation Accomplishments

- Currently providing data to Global Forest Resources Assessment (FRA2010).
- LSI Constellation providing assistance in data acquisition within gaps in coverage identified by FRA2010.

<http://www.fao.org/forestry/media/14133/1/0/>



GLOBAL FOREST RESOURCES ASSESSMENT

2010

**Climate change, poverty,
water shortages,
species loss ...**

More than ever, the world needs forests.

Forests store carbon, contribute to food security, generate livelihoods, produce wood and non-wood products, supply clean water and provide habitat for half the species on the planet.

More than ever, we need reliable global information on forests.

How much forest is there? How well is it managed? How much is being lost?

FAO and its partners have been carrying out Global Forest Resources Assessments (FRAs) for over 60 years. Stronger support, advances in technology and expanding global communications will make the next assessment, FRA 2010, the most comprehensive and reliable yet.

The work is starting now – and your help is needed.

Recent LSI Constellation Accomplishments

- Regional Data Set Compilation.
 - Working Group formed and active.
 - Regional sites for data compilation have been defined.
 - Letter sent to CEOS Principals seeking data contributions to the regional data sets and to Global Land Survey of 2010.

South America Regional Area



Asia Regional Area

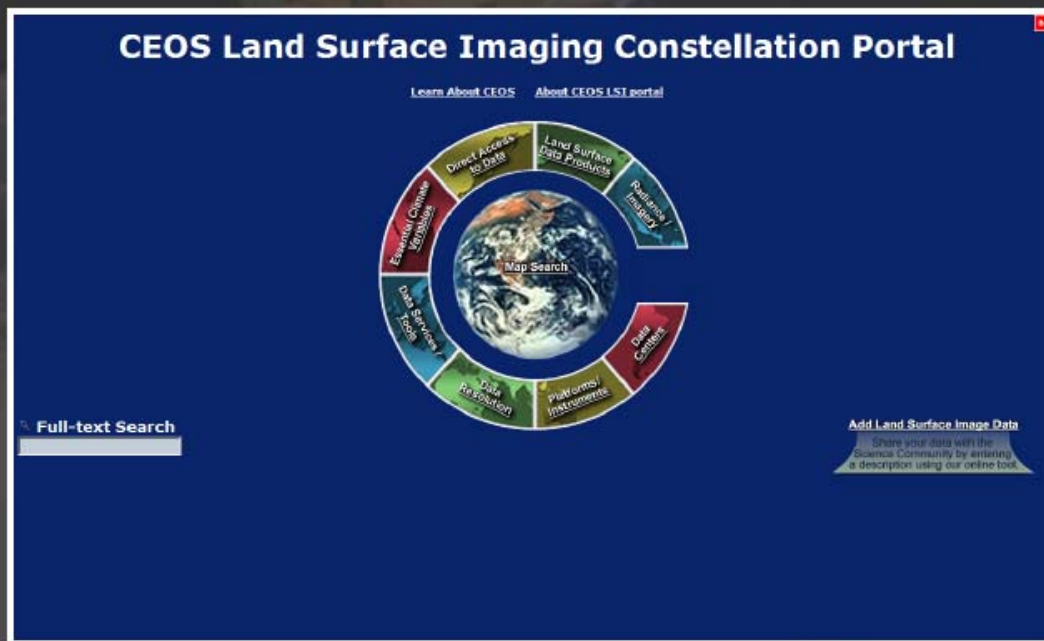


Africa Regional Area



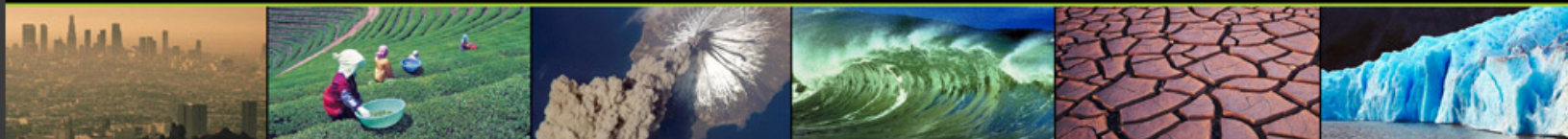
Recent LSI Constellation Accomplishments

- Developed prototype LSI Constellation Portal with the CEOS Working Group on Information Systems and Services (WGISS).





CEOS Committee on Earth Observation Satellites



[Calendar](#) | [Actions and Documentation](#) | [GEO](#) | [EO Handbook](#)

LSI Menu

- [CEOS Home](#)
- [LSI Home](#)
- [Members](#)
- [Meetings](#)
- [Documents](#)
- [LSI Portal](#)

LSI Members

CEOS Agency Members

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 Mónica Lopez Lopez (CDTI)

User WG Members

Stephen Ungar - WGCV (NASA)
 Greg Stensaas - WGCV (USGS)

User Community Members

Brad Reed (USGS)
 Alan Belward (JRC)
 Mike Abrams (JPL)
 Yasushi Yamaguchi (Nagoya University)
 Stuart Marsh (BGS)
 John Townshend (University of Maryland)
 Alex Held (CSIRO)

Tom Holm, USGS/EROS,
 new Co-Chair for B. Bailey
 (retired).



Questions?