

Land Product Characterization System: A tool for comparative analysis of satellite data and products

Kevin Gallo: NOAA/NESDIS/STAR
kevin.p.gallo@noaa.gov



19th Joint Agency Commercial Imagery Evaluation (JACIE) Workshop, 19 November 2020

LPCS Land Product Characterization System



	A	B	C	D	E	F	G
1	DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDEV	VALID
2	3/5/2015	64	197	3348	2233.75	254.36	yes
3	3/21/2015	80	86	3435	2290.46	283.83	yes
4	4/22/2015	112	301	4456	2662.25	360.74	yes
5	6/9/2015	160	536	4847	3641.67	373.78	yes
6	6/24/2015	175	3277	4386	3162.34	323.42	yes
7	7/12/2015	193	463	4415	3234.32	336.75	yes
8	7/24/2015	205	287	5333	3163.50	368.43	yes
9	8/12/2015	224	124	6987	3704.66	588.83	yes
10	8/13/2015	225	284	5263	3203.42	390.14	yes
11	8/26/2015	238	559	6009	4057.75	385.28	yes
12	10/14/2015	287	173	3287	2207.42	260.90	yes
13	10/15/2015	288	257	4663	2723.47	392.99	yes
14	10/18/2015	291	676	4266	3021.15	584.04	yes
15	10/19/2015	292	281	3474	2223.98	311.73	yes
16	10/25/2015	298	280	3102	2286.15	303.92	yes
17							



Disclaimer: The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author(s) and do not necessarily reflect those of NOAA or the Department of Commerce.



Collaborators

USGS/EROS: co-development team, data/products

NASA/USGS LP DAAC: data/products

NOAA/NESDIS: data/products

GOES-R AWG Program

NESDIS/STAR JPSS Program



Outline

- Background: motivation for LPCS
- Product Preview: system output products
- System Example: a tour of features and functionality
- Summary

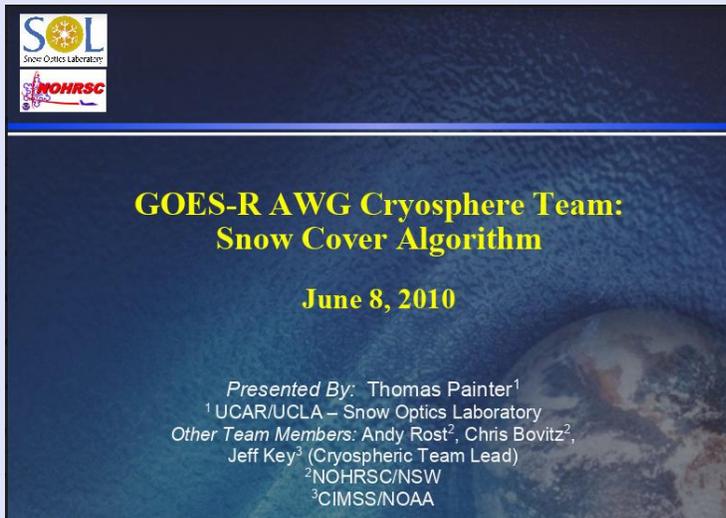




Background

2010

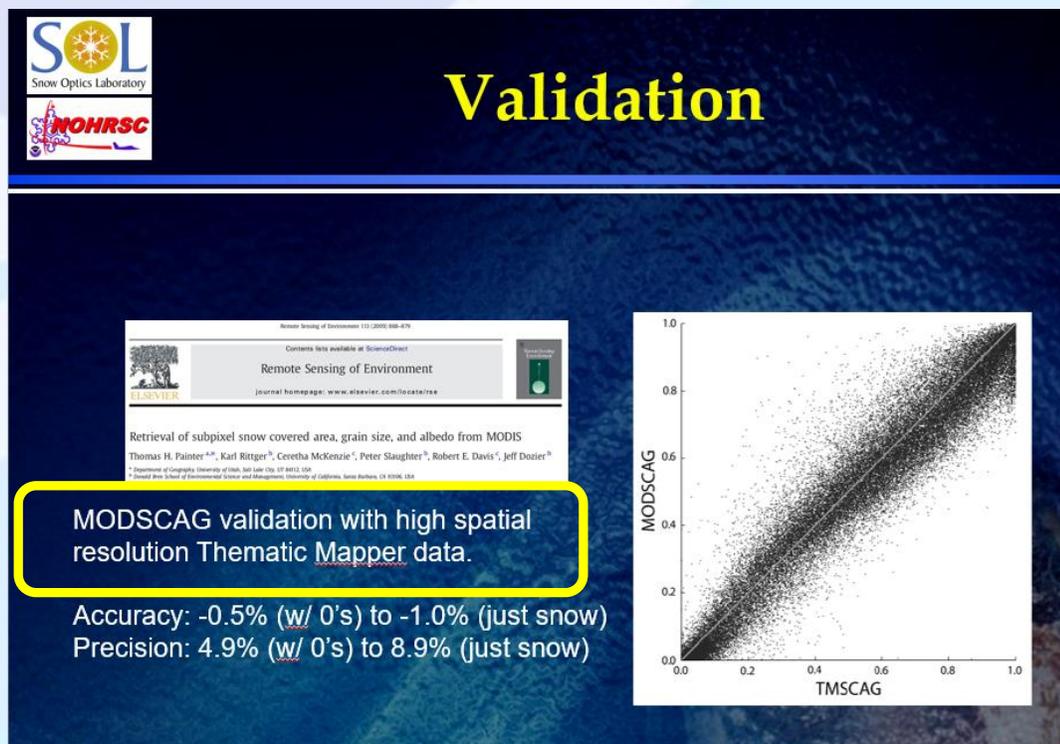
Landsat TM data was used to validate simulated GOES-R snow cover product.

**GOES-R RAWG Cryosphere Team:
Snow Cover Algorithm**

June 8, 2010

Presented By: Thomas Painter¹
¹UCAR/UCLA – Snow Optics Laboratory
Other Team Members: Andy Rost², Chris Bovitz²,
 Jeff Key³ (Cryospheric Team Lead)
²NOHRSC/NSW
³CIMSS/NOAA



Validation

Remote Sensing of Environment 151 (2010) 488–499
 Contents lists available at ScienceDirect
 Remote Sensing of Environment
 journal homepage: www.elsevier.com/locate/rse

Retrieval of subpixel snow covered area, grain size, and albedo from MODIS
 Thomas H. Painter^{a,*}, Karl Rittger^b, Ceretha McKenzie^c, Peter Slaughter^b, Robert E. Davis^c, Jeff Dozier^b

^aDepartment of Geography, University of Utah, Salt Lake City, UT 84112, USA
^bUnited States National Center for Environmental Prediction, University of Colorado, Boulder, CO 80508, USA

MODSCAG validation with high spatial resolution Thematic Mapper data.

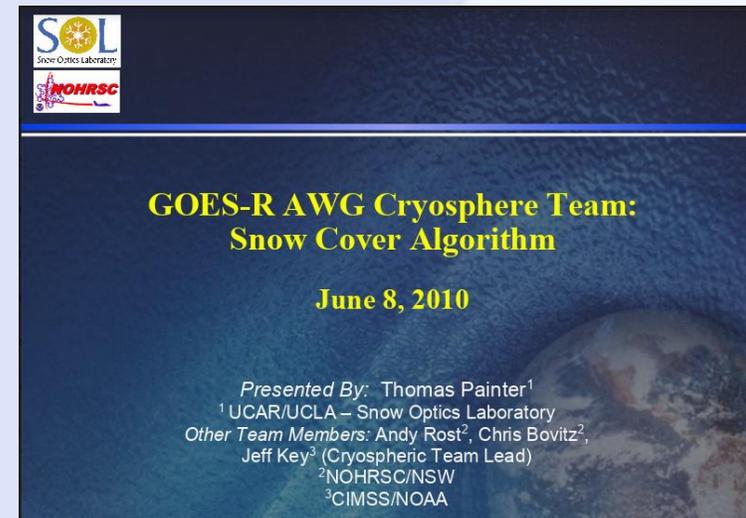
Accuracy: -0.5% (w/ 0's) to -1.0% (just snow)
 Precision: 4.9% (w/ 0's) to 8.9% (just snow)

Scatter plot showing MODSCAG vs TMSAG with a 1:1 diagonal line.

Background

Landsat TM data was used to validate simulated GOES-R snow cover product.

In a side discussion with Mitch Goldberg question raised about potential use of Landsat data to routinely validate GOES-R land products.



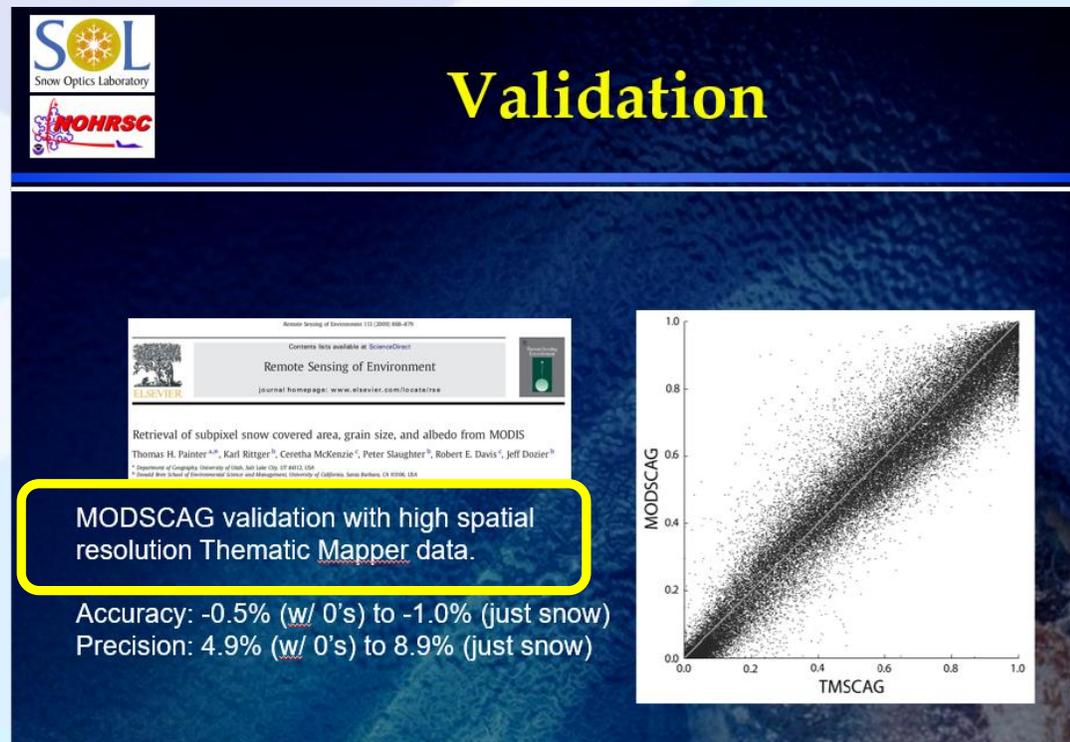
SOL
Snow Optics Laboratory

NOHRSC

GOES-R AWG Cryosphere Team: Snow Cover Algorithm

June 8, 2010

Presented By: Thomas Painter¹
¹UCAR/UCLA – Snow Optics Laboratory
Other Team Members: Andy Rost², Chris Bovitz²,
Jeff Key³ (Cryospheric Team Lead)
²NOHRSC/NSW
³CIMSS/NOAA



SOL
Snow Optics Laboratory

NOHRSC

Validation

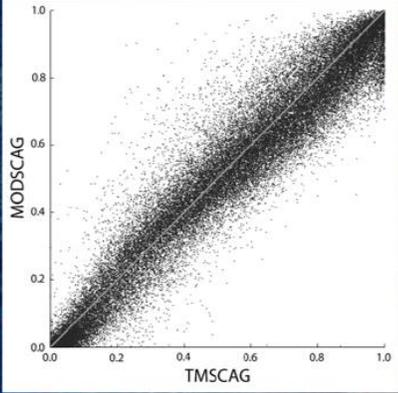
Remote Sensing of Environment 131 (2010) 468–479
Contents lists available at ScienceDirect
Remote Sensing of Environment
journal homepage: www.elsevier.com/locate/rse

Retrieval of subpixel snow covered area, grain size, and albedo from MODIS
Thomas H. Painter^{a,*}, Karl Rittger^b, Ceretha McKenzie^c, Peter Slaughter^b, Robert E. Davis^c, Jeff Dozier^b

^a Department of Geography, University of Utah, Salt Lake City, UT 84112, USA
^b Donald Rumsfeld School of Environmental Science and Management, University of California, Santa Barbara, CA 93106, USA

MODSCAG validation with high spatial resolution Thematic Mapper data.

Accuracy: -0.5% (w/ 0's) to -1.0% (just snow)
Precision: 4.9% (w/ 0's) to 8.9% (just snow)



MODSCAG

TMSAG

Landsat 8



Level-2

[Landsat Surface Reflectance](#)

[Landsat 8 Provisional Aquatic Reflectance](#)

[Landsat Surface Reflectance-Derived Spectral Indices](#)

[Landsat Surface Temperature](#)

Level-3

[Dynamic Surface Water Extent](#)

[Fractional Snow Covered Area](#)

[Burned Area](#)

[Provisional Actual Evapotranspiration](#)



Advanced Baseline Imager (ABI)

- Aerosol detection (including smoke and dust)
- Aerosol optical depth (AOD)
- Aerosol particle size
- Clear sky masks
- Cloud layers/heights
- Cloud and moisture imagery
- Cloud optical depth
- Cloud particle size distribution
- Cloud top height
- Cloud top phase
- Cloud top pressure
- Cloud top temperature
- Derived motion winds
- Derived stability indices
- Downward shortwave radiation: surface
- Fire/hot spot characterization
- Hurricane intensity estimation
- Land surface temperature (skin)
- Legacy vertical moisture profile
- Legacy vertical temperature profile
- Radiances
- Rainfall rate/QPE
- Reflected shortwave radiation: TOA
- Sea and lake ice: age
- Sea and lake ice: concentration
- Sea and lake ice: motion
- Sea surface temperature (skin)
- Snow cover
- Total precipitable water
- Volcanic ash: detection and height



NOAA-20 EDR Products

- Active Fires
- Aerosols
- Albedo
- ATMS L-C TDR
- Clouds
- Cryosphere - Ice
- Cryosphere - Snow
- Imagery - DNB
- Land Surface Temperature
- MiRS Soundings
- Ocean Color
- NUCAPS Soundings
- Ozone
- Sea Surface Temperature
- Snowfall Rate
- Surface Reflectance
- Vegetation Indices
- Vegetation Health

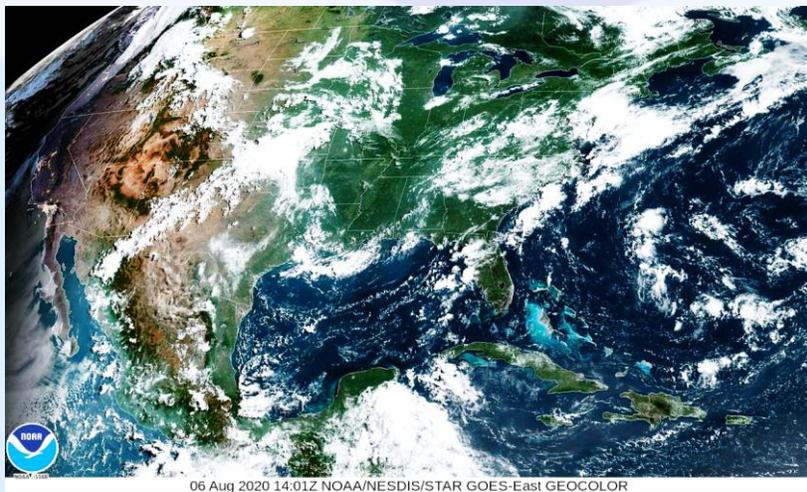




Background



Data archived at various facilities in various data formats (HDF, GeoTIFF, NetCDF) and map parameters (grid cell size, map projection, corner coordinates). **Comparative analysis of data/products not user friendly.**



Landsat 8

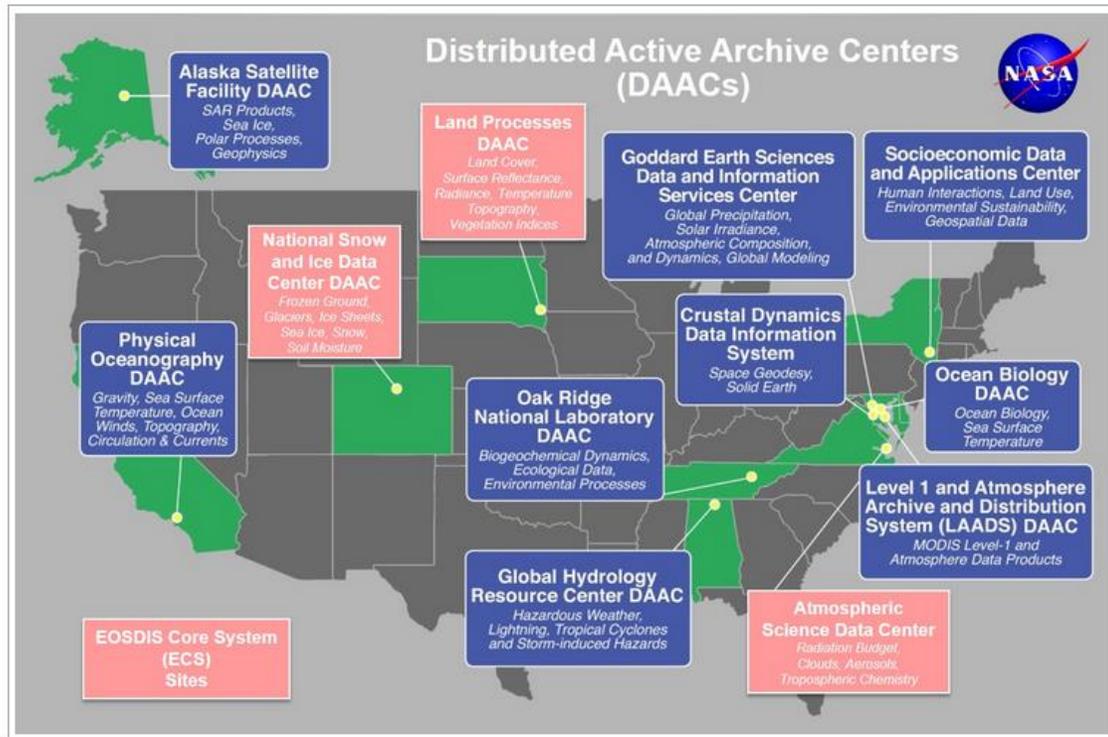


EOSDIS Distributed Active Archive Centers (DAACs)



NASA's Earth Observing System Data and Information System (EOSDIS) is designed as a distributed system, with major facilities at NASA's Distributed Active Archive Centers (DAACs) located throughout the United States. These institutions are custodians of EOS mission data and ensure that data will be easily accessible to users. EOSDIS DAACs process, archive, document, and distribute data from NASA's past and current Earth-observing satellites and field measurement programs. Acting in concert, the DAACs provide reliable, robust services to users whose needs may cross the traditional boundaries of a science discipline, while continuing to support the particular needs of users within the discipline communities. User services include:

- Assistance in selecting and obtaining data
- Access to data-handling and visualization tools
- Notification of data-related news
- Technical support and referrals



Land Processes DAAC User Working Group

UWG activities included:

“Mechanisms to enhance user access to data, including user interface attributes and modes of data distribution”

LP DAAC Charter



Background

Comparative Analysis Example

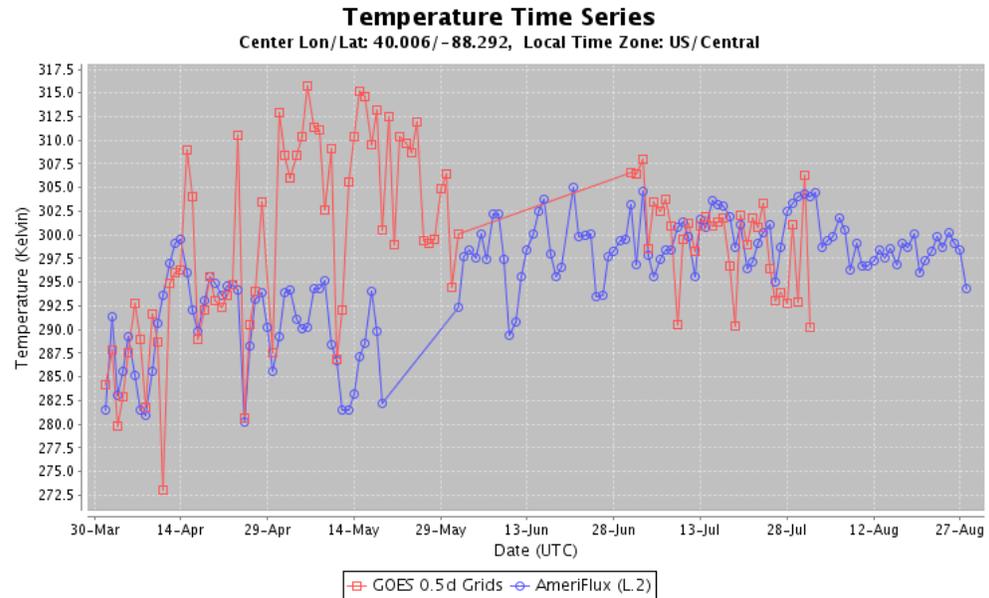
Prototype web page developed by Oak Ridge National Laboratory DAAC in collaboration with NOAA/NCDC.

Step 3: Select Process Option, Load Data

Operation Type: <input checked="" type="radio"/> Display Chart <input type="radio"/> Download ASCII	Parameters: Site: Bondville- Illinois Var: Temperature Time Range: start - 04-01-2006, end - 08-31-2006	Selected Data Sources: AmeriFlux (L.2) <input type="checkbox"/> GOES 0.5d Grids <input type="checkbox"/>
--	---	---

Submit  

Result:



Data Source	Statistics
[1] GOES 0.5d Grids	count=2185 mean=294.50 min=270.01 max=319.22 stdv=9.12
[2] AmeriFlux (L.2)	count=6342 mean=292.79 min=271.85 max=306.65 stdv=6.60



Background



Multi-date coincident satellite and in situ surface temp. data

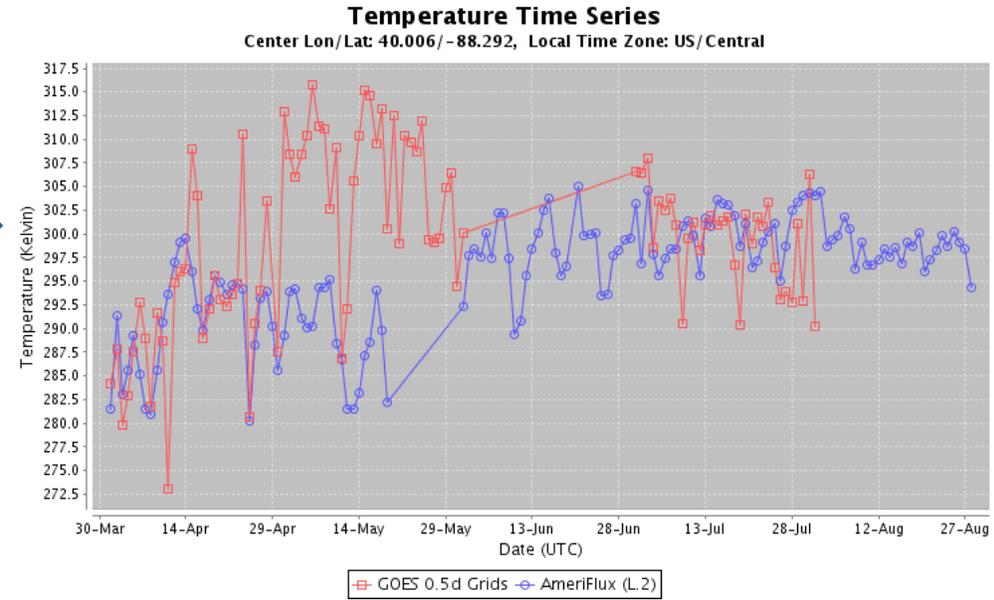


Step 3: Select Process Option, Load Data

Operation Type: <input checked="" type="radio"/> Display Chart <input type="radio"/> Download ASCII	Parameters: Site: Bondville- Illinois Var: Temperature Time Range: start - 04-01-2006, end - 08-31-2006	Selected Data Sources: AmeriFlux (L.2) GOES 0.5d Grids
--	---	---

Submit

Result:



Data Source	Statistics
[1] GOES 0.5d Grids	count=2185 mean=294.50 min=270.01 max=319.22 stdv=9.12
[2] AmeriFlux (L.2)	count=6342 mean=292.79 min=271.85 max=306.65 stdv=6.60

Background

Option for tabular data

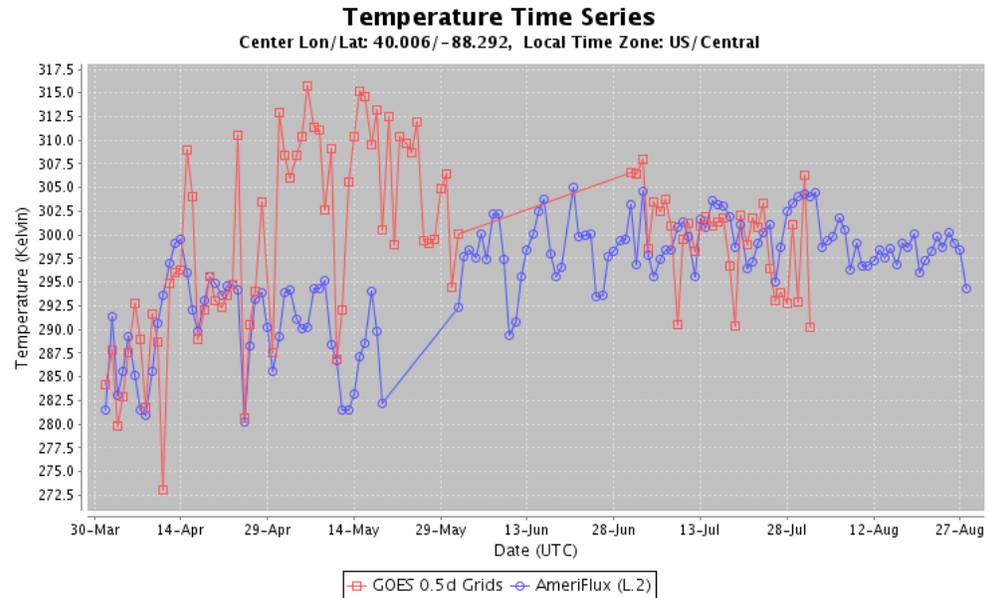
Multi-date coincident satellite and in situ surface temp. data

Step 3: Select Process Option, Load Data

Operation Type: <input checked="" type="radio"/> Display Chart <input type="radio"/> Download ASCII	Parameters: Site: Bondville- Illinois Var: Temperature Time Range: start - 04-01-2006, end - 08-31-2006	Selected Data Sources: AmeriFlux (L.2) GOES 0.5d Grids
--	---	---

Submit

Result:



Data Source	Statistics
[1] GOES 0.5d Grids	count=2185 mean=294.50 min=270.01 max=319.22 stdv=9.12
[2] AmeriFlux (L.2)	count=6342 mean=292.79 min=271.85 max=306.65 stdv=6.60

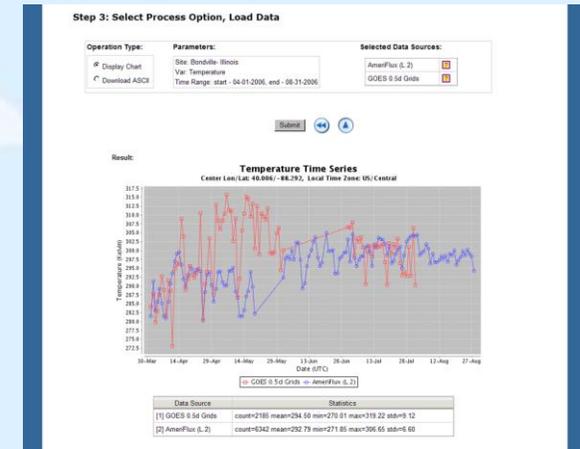


Background

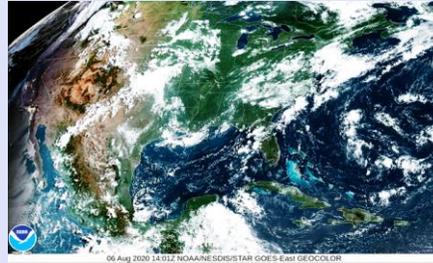


LPCS Foundational Goal

User Friendly System: Physical location of data/products, data format, and the geographic projection, etc., should be transparent to users' goal of comparative analysis of satellite data and products.



Background

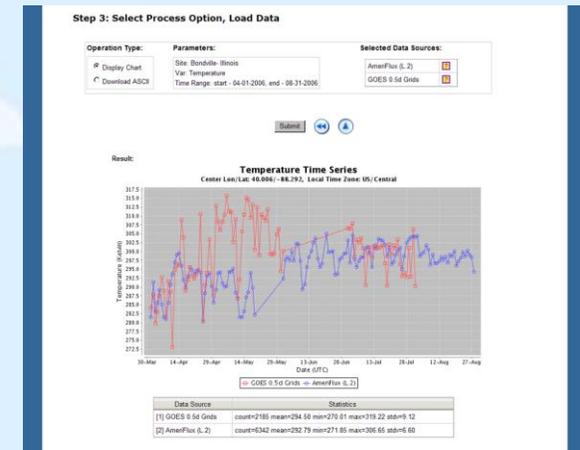


LPCS Foundational Goal

User Friendly System: Physical location of data/products, data format, and the geographic projection, etc., should be transparent to users' goal of comparative analysis of satellite data and products.

LPCS:

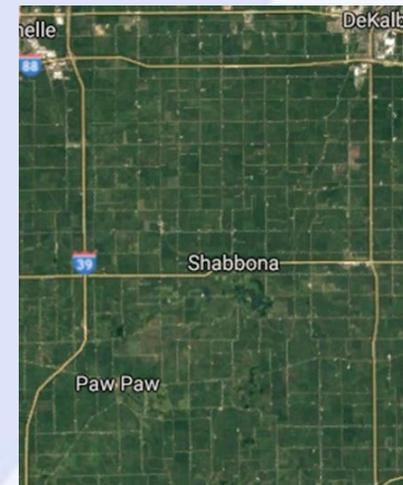
- A web-based system
- For comparative analysis of higher-level (level 2+) land products
- For Global analyses including pre-defined and user-defined locations
- Includes transparent data inventory, access, and retrieval
- User-defined output includes customized images, charts, and tabular products based on co-registered data



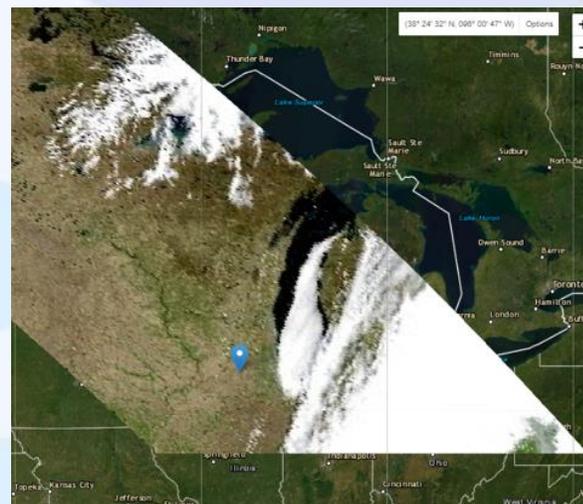
Product Preview

Input products: Surface Reflectance

- L 8 OLI, Terra and Aqua MODIS, and S-NPP VIIRS
- 4 to 11 dates, 1 May – 30 Sept. 2017
- 20 X 20 km spatial sample
- USCRN Station: Shabbona, IL



L 8 OLI



MODIS



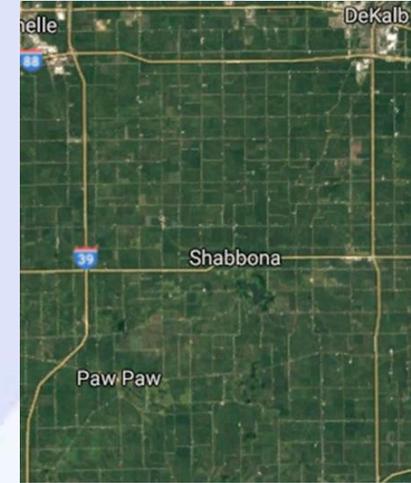
VIIRS



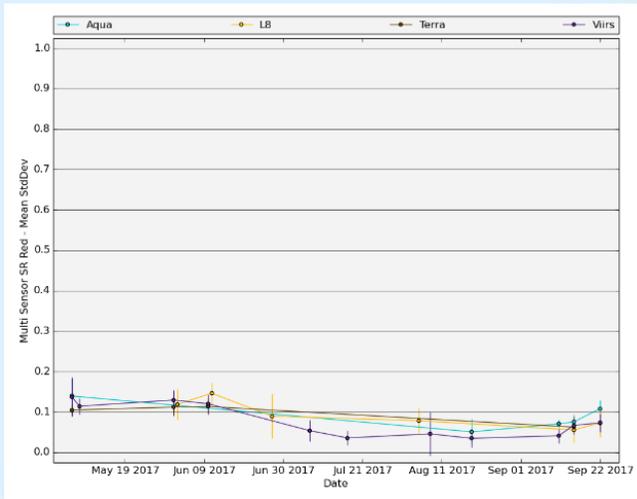
Product Preview

Input products: Surface Reflectance

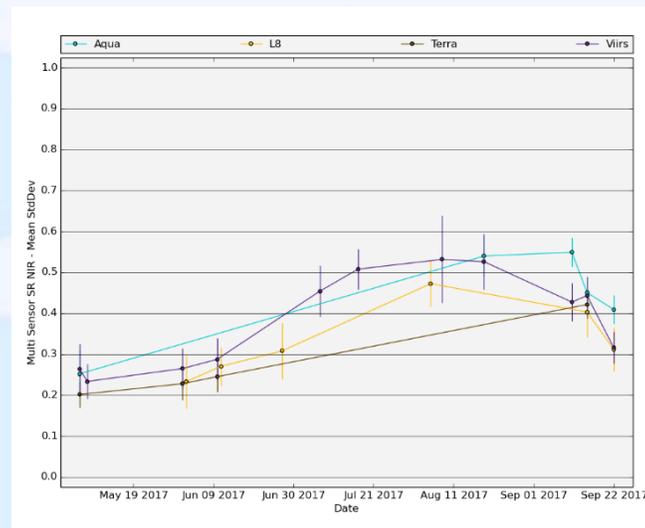
- L 8 OLI, Terra and Aqua MODIS, and S-NPP VIIRS
- 4 to 11 dates, 1 May – 30 Sept. 2017
- 20 X 20 km spatial sample
- USCRN Station: Shabbona, IL



Output products: graphical trending information



red channel



n-IR channel

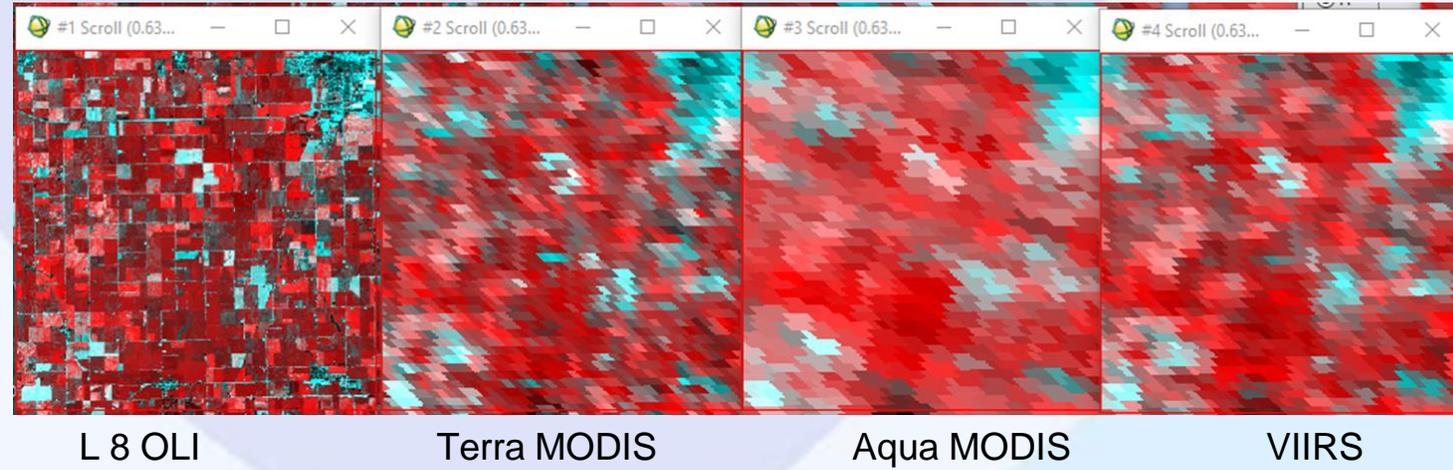


SWIR channel



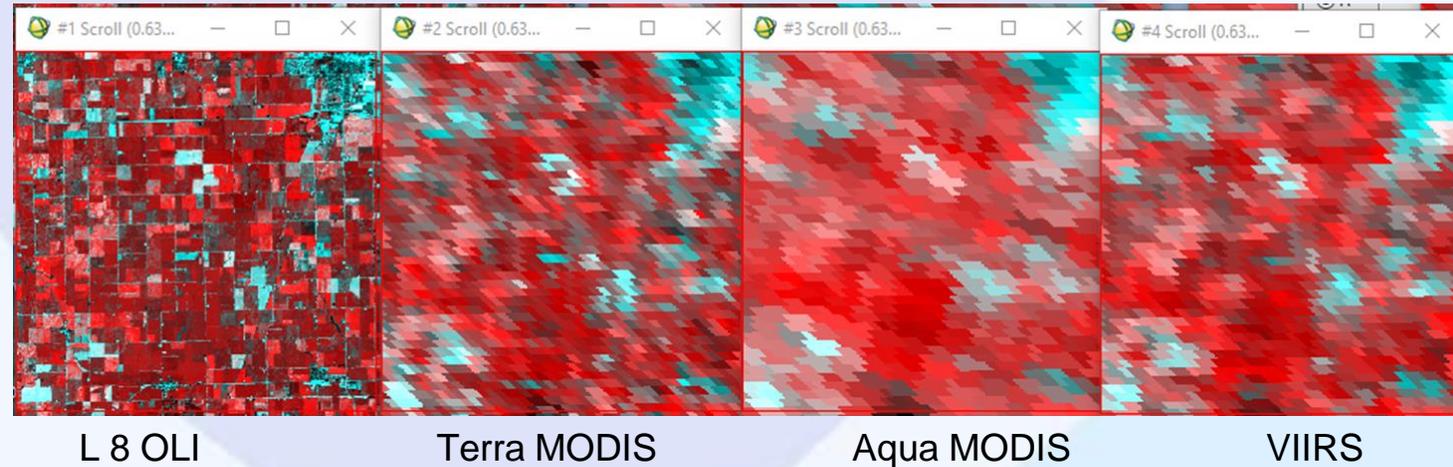
Additional output products: geographically registered images for each sensor

15 September 2017, 50 m spatial resolution (per pixel)



Additional output products: geographically registered images for each sensor

15 September 2017, 50 m spatial resolution (per pixel)



... and tabular information

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV	VALID
5/5/2017	125	348	7620	2634.208	622.8576	yes
5/7/2017	127	1343	5305	2334.916	430.253	yes
6/1/2017	152	1605	6215	2650.298	500.6584	yes
6/10/2017	161	1379	6366	2874.612	518.0361	yes
7/7/2017	188	1549	6086	4543.512	623.0945	yes
7/17/2017	198	2718	6248	5080.543	491.9401	yes
8/8/2017	220	755	8605	5317.396	1065.239	yes
8/19/2017	231	1794	6962	5262.045	680.1908	yes
9/11/2017	254	1765	5432	4274.348	459.1628	yes
9/15/2017	258	2372	5831	4432.018	457.8836	yes
9/22/2017	265	1519	4490	3156.984	384.2465	yes

VIIRS near-IR channel values for selected study area.





System Example



Data Inventory and Ordering

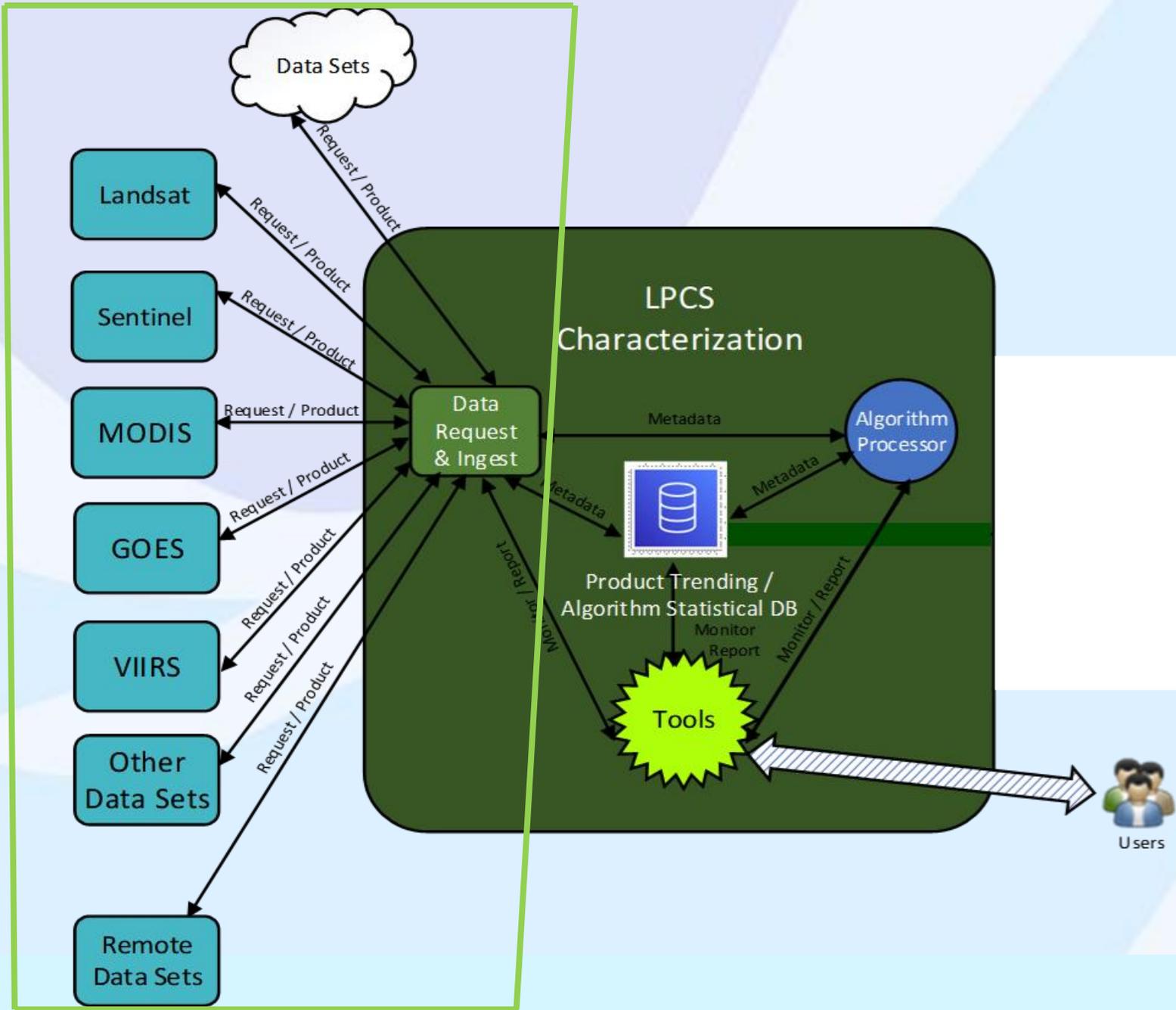
Inventory and ordering of data based on metadata stored within LPCS.



Data currently retrieved resides on variety of platforms including spinning disks and Cloud.



Data retrieval includes public views of existing databases and APIs or common services.



Locations can be manually selected, alternatively ...

USGS science for a changing world **NORA**

Land Product Characterization System (LPCS) - Home Page Expires In 1:54:51 C

Home 1 New System Message Login Register RSS Feedback Help

Search Criteria Data Sets Additional Criteria Results

1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or choose a date range.

Geocoder KML/Shapefile Upload **Cal/Val Site**

Type
Select One

Cal/Val Site

Show Site Clear Site

Polygon Circle Predefined Area

Degree/Minute/Second Decimal

1. Lat: 47° 03' 17" N, Lon: 001° 24' 09" E	🗑️ ❌
2. Lat: 47° 49' 39" N, Lon: 005° 26' 32" E	🗑️ ❌
3. Lat: 45° 43' 16" N, Lon: 005° 52' 53" E	🗑️ ❌
4. Lat: 44° 43' 51" N, Lon: 002° 01' 02" E	🗑️ ❌

Use Map Add Coordinate Clear Coordinates

Date Range Result Options

Search from: mm/dd/yyyy to: mm/dd/yyyy

Search months: (all)

Data Sets » Additional Criteria » Results »

Search Criteria Summary (Show) Clear Search Criteria

(51° 44' 47" N, 049° 26' 25" E) Options + -

The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only.



pre-defined locations are available for several cal/val networks

The screenshot shows the USGS LPCSE Explorer interface. The 'Search Criteria' tab is active, and the 'Cal/Val Site' dropdown menu is open, displaying a list of sites. A red box highlights the 'CEOS Reference Sites' dropdown and the 'Algeria 3' option. The map on the right shows the Mediterranean region with a blue location pin in Algeria.

USGS
science for a changing world

LPCSE Explorer

Search Criteria Summary (Show)

1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.

Geocoder KML/Shapefile Upload **Cal/Val Site**

CEOS Reference Sites

Algeria 3

Algeria 3

Algeria 5

Dome C, Antarctica

Dunhuang, China

Frenchman Flat, USA

Ivanpah Playa

La Crau, France

Libya 1

Libya 4

Mauritania 1

Mauritania 2

Negev, Southern Israel

Railroad Valley Playa

Tuz Golu

Search from: mm/dd/yyyy to: mm/dd/yyyy

Search months: (all)

Data Sets Additional Criteria Results

Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aer Community, ESRI

The provided maps are not for purchase or for download; it is to be used as a guide

The screenshot shows the CEOS Cal/Val Portal PICS Sites page. The page title is 'CEOS Cal/Val Portal PICS Sites'. Below the title is a search bar and a section titled 'PICS: Pseudo-Invariant Calibration Sites'. The text describes PICS sites and lists six CEOS endorsed sites. A map of North Africa shows the locations of these sites: MAURITANIA1, MAURITANIA2, ALGERIA5, ALGERIA3, LIBYA1, and LIBYA4.

CEOS Cal/Val Portal

PICS Sites

search...

PICS: Pseudo-Invariant Calibration Sites

Pseudo Invariant Calibration Sites (PICS) are terrestrial sites used to monitor the long term in-flight radiometric calibration of Earth Observation optical sensors. They are used intensively by spatial agencies since long time now because they are spatially very uniform, stable spectrally and invariant with time. A long site of these sites has been identified. They are mostly located in the Sahara desert and Peninsula Arabia. [USGS catalog](#) lists most of them.

Among these sites, six have been endorsed by CEOS as standard reference sites for the post-launch calibration of space-based optical imaging sensors in (CEOS IVOS-19 Meeting, Phoenix AZ).

MAURITANIA2

MAURITANIA1

ALGERIA5

ALGERIA3

LIBYA1

LIBYA4



pre-defined locations are available for cal/val networks and meteorological networks.

USGS science for a changing world

NOAA

Land Product Characterization System (LPCS) - Home

Home 1 New System Message

Search Criteria Data Sets Additional Criteria Results

1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or

Geocoder KML/Shapefile Upload **Cal/Val Site**

Type

- Select One
- Select One
- AERONET
- NEON Relocatable Terrestrial
- NEON Core Terrestrial
- USCRN**
- SURFRAD
- EOS Land Validation Core Sites
- CEOS Reference Sites
- CEOS Super Sites

No coordinates selected.

Use Map Add Coordinate Clear Coordinates

Date Range Result Options

Search from: mm/dd/yyyy to: mm/dd/yyyy

Search months: (all)

Data Sets » Additional Criteria » Results »

Search Criteria Summary (Show)



Selection of a USCRN station.

The screenshot displays the USGS Land Product Characterization System (LPCS) interface. At the top, the USGS logo and NOAA logo are visible, along with the text "science for a changing world". The page title is "Land Product Characterization System (LPCS) - Home". The navigation bar includes "Home", "1 New System Message", "Save Criteria", "Load Favorite", and "Manage Criteria". The user is logged in as "kgallo@usgs.gov".

The main content area is divided into two sections: "Search Criteria" and "Search Criteria Summary (Show)".

Search Criteria Section:

- 1. Enter Search Criteria**
- Instructions: "To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area" and "For advanced map tools, view the [help documentation](#), and/or choose a date range."
- Buttons: "Geocoder", "KML/Shapefile Upload", and "Cal/Val Site".
- Type:** A dropdown menu is open, showing "USCRN" selected and highlighted with a red box.
- Cal/Val Site:** A list of sites is displayed, with "IL Shabbona 5 NNE" highlighted in blue.

Search Criteria Summary (Show) Section:

- Coordinates: (42° 55' 47" N, 100° 48' 37" W)
- Map: A satellite map of the central United States with a blue location pin over Rockford, Illinois.
- Map controls: "Options", zoom in (+), and zoom out (-) buttons.

Selection of date(s) for search of data.

The screenshot displays the USGS LPCSE Explorer web application. The interface includes a header with the USGS logo and the tagline "science for a changing world", along with the NOAA logo. The main navigation bar shows "LPCSE Explorer" and "Manage Criteria". On the right, there is an "Item Basket (1)" icon.

The "Search Criteria" section is active, showing the following details:

- 1. Enter Search Criteria**
- To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.
- Buttons: Geocoder, KML/Shapefile Upload, Cal/Val Site
- Type: [Dropdown menu]
- Cal/Val Site: IL Shabbona 5 NNE
- Buttons: Show Site, Clear Site
- Buttons: Polygon, Circle, Predefined Area
- Buttons: Degree/Minute/Second, Decimal
- Coordinates: 1. Lat: 41.8430, Lon: -88.8513
- Buttons: Use Map, Add Coordinate, Clear Coordinates
- Buttons: Date Range, Cloud Cover, Result Options
- Date Range: Search from: 05/01/2017 to: 09/30/2017
- Date Range: Search months: (all)
- Buttons: Data Sets, Additional Criteria, Results

The "Search Criteria Summary" section shows a map of the United States with a blue location pin over Illinois, near the Chicago area. The map is titled "Search Criteria Summary (Show)".

At the bottom of the page, there is a disclaimer: "The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only."



Select sensors and products for analyses and output products.

The screenshot displays the USGS Land Product Characterization System (LPCS) homepage. The page title is "Land Product Characterization System (LPCS) - Home". The navigation bar includes "Home", "New System Messages", "Save Criteria", "Load Favorite", and "Manage Criteria". The user is logged in as "kgallo@usgs.gov".

The main content area is titled "2. Select Your Data Set(s)". It includes instructions: "Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the *Additional Criteria* or *Results* buttons below. Click the plus sign next to the category name to show a list of data sets." There is a checkbox for "Use Data Set Prefilter" and a search box labeled "Data Set Search:".

The data set selection list is as follows:

- Landsat Collection 1 Level-2 (On-Demand)
 - Landsat 8 OLI/TIRS C1 Level-2
 - Landsat 7 ETM+ C1 Level-2
 - Landsat 4-5 TM C1 Level-2
- NASA LPDAAC Collections (MODIS)
 - MODIS Vegetation Indices
 - MODIS Land Surface Reflectance
 - LPCS - MODIS MOD09A1
 - LPCS - MODIS MOD09GA
 - LPCS - MODIS MOD09GQ
 - LPCS - MODIS MOD09Q1
 - LPCS - MODIS MYD09A1
 - LPCS - MODIS MYD09GA
 - LPCS - MODIS MYD09GQ
 - LPCS - MODIS MYD09Q1
 - MODIS Land Cover
 - MODIS Land Surface Temp and Emiss
 - MODIS Albedo
- NASA LPDAAC Collections (VIIRS)
 - VIIRS Daily Surface Reflectance
 - LPCS VIIRS VNP09GA

At the bottom of the selection list are buttons for "Clear All Selected", "Additional Criteria", and "Results".

On the right side, there is a "Search Criteria Summary (Show)" section with a "Clear Search Criteria" button. Below this is a map of the Chicago area with a blue location pin. The map shows the city of Chicago, Lake Michigan, and surrounding areas in Illinois, Indiana, and Michigan. The map includes a coordinate display: (44° 29' 00" N, 089° 10' 08" W). At the bottom of the map, it says "Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community, ESRI". A disclaimer at the very bottom states: "The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only."



Results menu icons provide; *view of sensor browse images.*

USGS
science for a changing world

NOAA

Land Product Characterization System (LPCS) - Home Page Expires In 1:57:10

Home 1 New System Message Save Criteria Load Favorite Manage Criteria Item Basket (1) kgallo@usgs.gov RSS Feedback Help

Search Criteria Data Sets Additional Criteria **Results**

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set
Landsat 8 OLI/TIRS C1 Level-2

- 13 ID:LC08_L1TP_024031_20170618_20180125_01_T1
Acquisition Date:18-JUN-17
Path:24
Row:31
- 14 ID:LC08_L1TP_023031_20170611_20170628_01_T1
Acquisition Date:11-JUN-17
Path:23
Row:31
- 15 ID:LC08_L1TP_024031_20170602_20170615_01_T1
Acquisition Date:02-JUN-17
Path:24
Row:31
- 16 ID:LC08_L1TP_023031_20170526_20170615_01_T1
Acquisition Date:26-MAY-17
Path:23
Row:31
- ID:LC08_L1TP_024031_20170517_20170525_01_T1
Acquisition Date:17-MAY-17
Path:24

[View Item Basket >](#)

Search Criteria Summary (Show) Clear Search Criteria

(40° 18' 07" N, 091° 14' 31" W) Options

Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community, ESRI

The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only.



Results menu icons provide; *metadata associated with image.*

The screenshot displays the USGS Land Product Characterization System (LPCS) interface. At the top, the USGS logo and NOAA logo are visible. The page title is "Land Product Characterization System (LPCS) - Home". Below the title, there are navigation links: Home, 1 New System Message, Save Criteria, Load Favorite, and Manage Criteria. The main content area is divided into several sections:

- Search Criteria Summary (Shown):** A map view showing the search area over a satellite image of a region including Cedar Rapids and Iowa City.
- 4. Search Results:** A list of search results for "Landsat 8 OLI/TIRS C1 Level-2". Each result includes a thumbnail, ID, acquisition date, path, and row. A blue arrow points to the third result (ID: LC08_L1TP_024031_20170602_20170615_01_T1).
- Data Set Attribute Table:** A table showing metadata for the selected data set. The table has two columns: "Data Set Attribute" and "Attribute Value".
- Map View:** A satellite map showing the search area with various locations labeled, including Crystal Lake, Hoffman Estates, Evanston, Chicago, Aurora, Joliet, Tinley Park, and Kankakee.

The metadata table contains the following data:

Data Set Attribute	Attribute Value
Landsat Product Identifier	LC08_L1TP_024031_20170602_20170615_01_T1
Landsat Scene Identifier	LC80240312017153LGN00
Acquisition Date	2017/06/02
Collection Category	T1
Collection Number	1
WRS Path	024
WRS Row	031
Target WRS Path	24
Target WRS Row	031
Nadir/Off Nadir	NADIR
Roll Angle	-0.001
Date L-1 Generated	2017/06/15
Start Time	2017:153:16:40:37.7896270
Stop Time	2017:153:16:41:09.5596250
Station Identifier	LGN
Land Cloud Cover	0.59
Scene Cloud Cover	0.59
Ground Control Points Model	261
Ground Control Points Version	4
Geometric RMSE Model (meters)	8.015
Geometric RMSE Model X	5.386
Geometric RMSE Model Y	5.935
Image Quality	9
Processing Software Version	LPGS_2.7.0
Sun Elevation L1	64.75480437
Sun Azimuth L1	134.62234096
TIRS SSM Model	FINAL

At the bottom of the page, there are logos for the Department of Commerce, NOAA, and STAR (State Technical Assistance for Remote Sensing Applications).

Products are selected by clicking on shopping cart.

USGS
science for a changing world

NOAA

Land Product Characterization System (LPCS) - Home Page Expires In 1:57:10

Home 1 New System Message Save Criteria Load Favorite Manage Criteria Item Basket (1) kgallo@usgs.gov RSS Feedback Help

Search Criteria Data Sets Additional Criteria **Results**

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set

Landsat 8 OLI/TIRS C1 Level-2

13		ID:LC08_L1TP_024031_20170618_20180125_01_T1 Acquisition Date:18-JUN-17 Path:24 Row:31	
14		ID:LC08_L1TP_023031_20170611_20170628_01_T1 Acquisition Date:11-JUN-17 Path:23 Row:31	
15		ID:LC08_L1TP_024031_20170602_20170615_01_T1 Acquisition Date:02-JUN-17 Path:24 Row:31	
16		ID:LC08_L1TP_023031_20170526_20170615_01_T1 Acquisition Date:26-MAY-17 Path:23 Row:31	
		ID:LC08_L1TP_024031_20170517_20170525_01_T1 Acquisition Date:17-MAY-17 Path:24	

[View Item Basket >](#)

Search Criteria Summary (Show) Clear Search Criteria

(40° 18' 07" N, 091° 14' 31" W) Options

Map showing a satellite view of the Peoria, Illinois area with a large green and brown area overlaid. A blue location pin is placed on the Peoria area.

Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community, ESRI

The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only.

DOI Privacy Policy | Legal | Accessibility | Site Map | Contact USGS



Select other data sets to review

The screenshot displays the USGS LPCSExplorer web application. The top navigation bar includes the USGS logo, the text "Science for a changing world", and the NOAA logo. The page title is "LPCSExplorer" with a "Manage Criteria" link. On the right, there are links for "Item Basket (25)", "Help", "Feedback", and "Logout [kgallo@usgs.gov]".

The main content area is divided into several sections:

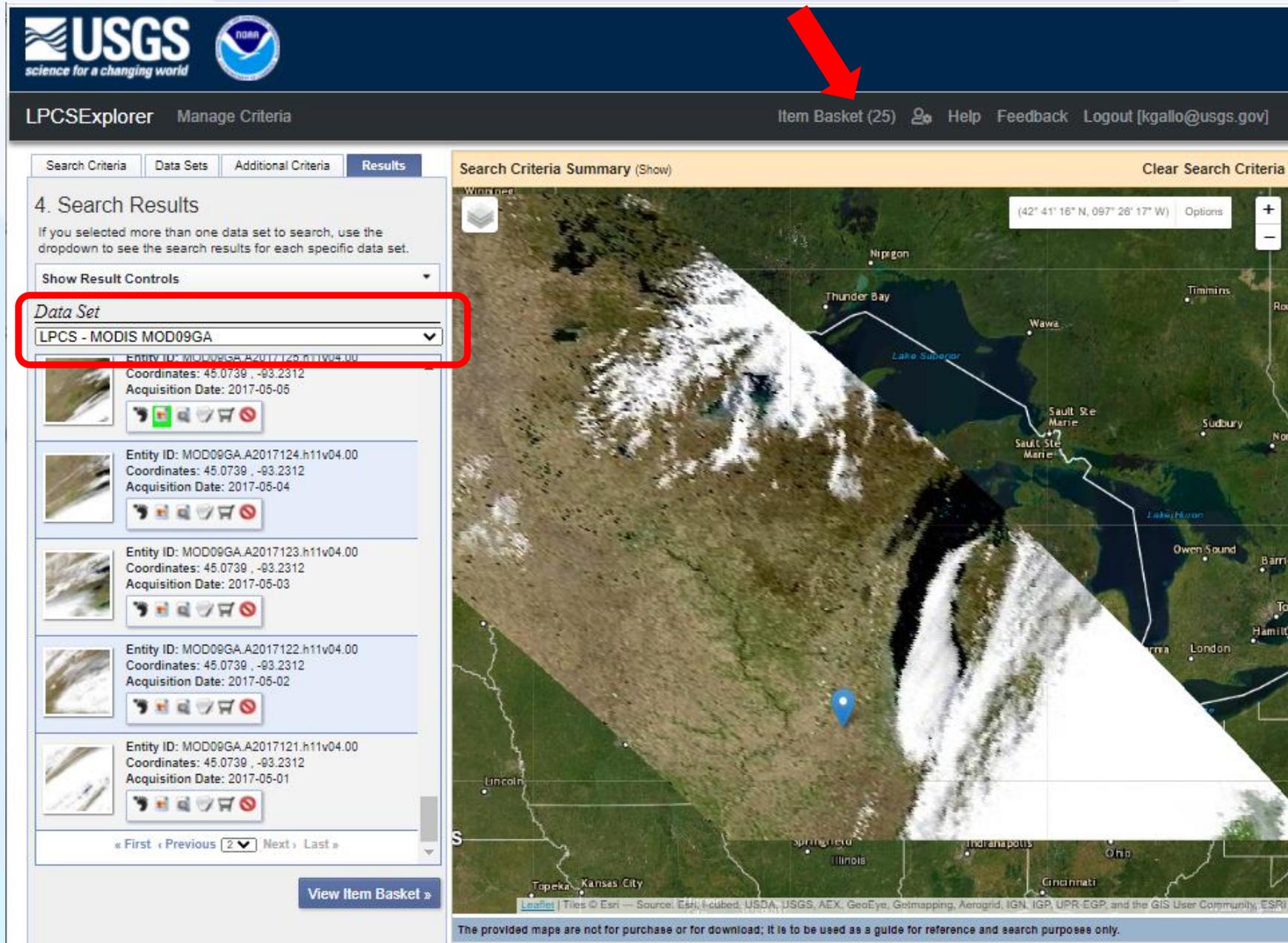
- Search Criteria Summary (Show)**: A yellow header bar with a "Clear Search Criteria" link on the right.
- 4. Search Results**: A section with a sub-header "4. Search Results" and a note: "If you selected more than one data set to search, use the dropdown to see the search results for each specific data set." Below this is a "Show Result Controls" dropdown menu.
- Data Set**: A dropdown menu with a red border, currently showing "LPCS - MODIS MOD09GA". The menu is open, listing the following options:
 - LPCS - MODIS MOD09GA (selected)
 - Landsat 8 OLI/TIRS C1 Level-2
 - LPCS - MODIS MOD09GA
 - LPCS - MODIS MYD09GA
 - LPCS - VIIRS VNP09GA
- Entity List**: A list of search results, each with a thumbnail image, an "Entity ID", "Coordinates", and "Acquisition Date".
 - Entity ID: MOD09GA.A2017124.h11v04.00, Coordinates: 45.0739, -93.2312, Acquisition Date: 2017-05-04
 - Entity ID: MOD09GA.A2017123.h11v04.00, Coordinates: 45.0739, -93.2312, Acquisition Date: 2017-05-03
 - Entity ID: MOD09GA.A2017122.h11v04.00, Coordinates: 45.0739, -93.2312, Acquisition Date: 2017-05-02
 - Entity ID: MOD09GA.A2017121.h11v04.00, Coordinates: 45.0739, -93.2312, Acquisition Date: 2017-05-01

At the bottom of the entity list, there are navigation controls: "« First", "Previous", a dropdown menu showing "2", "Next", and "Last »". A "View Item Basket »" button is located at the bottom right of the results section.

The right side of the interface features a satellite map of the Lake Superior region. The map shows the lake and surrounding land with a white overlay indicating the search area. A blue location pin is placed on the map. The map includes a coordinate display: "(48° 41' 04" N, 097° 23' 39" W)" and "Options" with zoom in (+) and zoom out (-) buttons.

At the bottom of the page, there is a footer with logos for the University of Wisconsin, NOAA, and STAR, along with a disclaimer: "The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only."

After all images selected, click on *Item Basket*.



USGS science for a changing world

LPCSExplorer Manage Criteria

Item Basket (25) Help Feedback Logout [kgallo@usgs.gov]

Search Criteria Data Sets Additional Criteria Results

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set

LPCS - MODIS MOD09GA

Entity ID: MOD09GA.A2017123.h11v04.00
Coordinates: 45.0739, -93.2312
Acquisition Date: 2017-05-05

Entity ID: MOD09GA.A2017124.h11v04.00
Coordinates: 45.0739, -93.2312
Acquisition Date: 2017-05-04

Entity ID: MOD09GA.A2017123.h11v04.00
Coordinates: 45.0739, -93.2312
Acquisition Date: 2017-05-03

Entity ID: MOD09GA.A2017122.h11v04.00
Coordinates: 45.0739, -93.2312
Acquisition Date: 2017-05-02

Entity ID: MOD09GA.A2017121.h11v04.00
Coordinates: 45.0739, -93.2312
Acquisition Date: 2017-05-01

« First Previous [2] Next Last »

View Item Basket »

Search Criteria Summary (Show) Clear Search Criteria

(42° 41' 16" N, 097° 28' 17" W) Options

The provided maps are not for purchase or for download; it is to be used as a guide for reference and search purposes only.

Data Inventory and Ordering

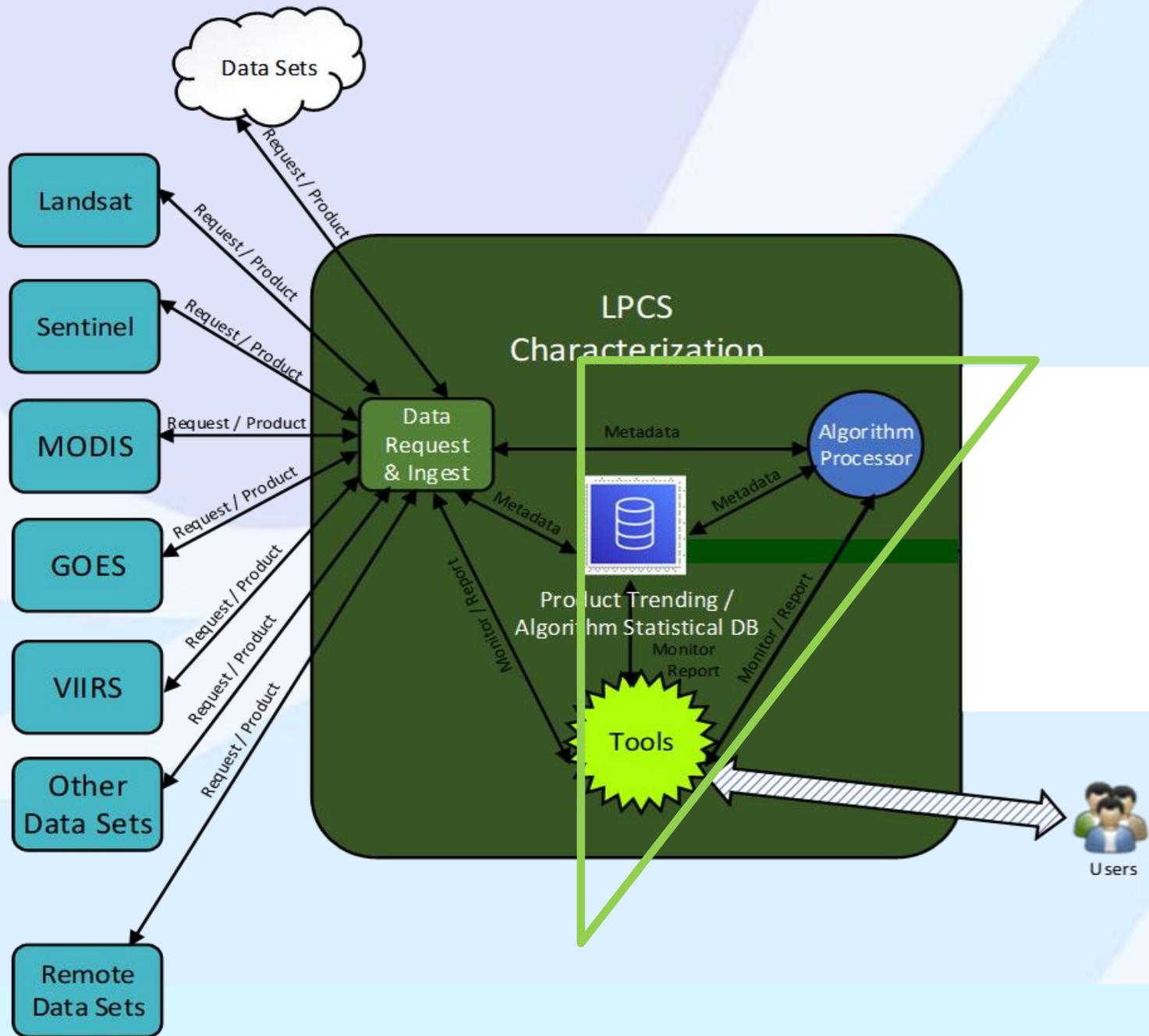
Inventory and ordering of data based on metadata stored within LPCS.

Data currently retrieved resides on variety of platforms including spinning disks and Cloud.

Data retrieval includes public views of existing databases and APIs or common services.

Data Product Definition and Customized Processing

Output products selected, associated parameters defined, and software tools engaged.





Order Details ☰ ☰

Scene List

LPCS - MODIS MOD09GA	
<input checked="" type="checkbox"/> MOD09GA.A2017127.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017153.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017244.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017198.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017265.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017258.h11v04.00	×
<input checked="" type="checkbox"/> MOD09GA.A2017220.h11v04.00	×

LPCS - MODIS MYD09GA	
<input checked="" type="checkbox"/> MYD09GA.A2017127.h11v04.00	×
<input checked="" type="checkbox"/> MYD09GA.A2017152.h11v04.00	×

Available Products

Select a scene to view available products

Available Products

Selected products will be applied to all scenes that can be processed to each product.

<p><u>Source Products</u></p> <p>Input Products <input checked="" type="checkbox"/></p> <p>Input Product Metadata <input type="checkbox"/></p>	<p><u>Level-2 Products</u></p> <p>Top of Atmosphere Reflectance <input type="checkbox"/></p> <p>Brightness Temperature <input type="checkbox"/></p> <p>Surface Reflectance <input checked="" type="checkbox"/></p> <p>Pixel QA <input type="checkbox"/></p> <p>Aquatic Reflectance <input type="checkbox"/></p>
<p><u>Spectral Indices</u></p> <p>MODIS Daily NDVI <input checked="" type="checkbox"/></p> <p>VIIRS Daily NDVI <input checked="" type="checkbox"/></p> <p>NDVI <input checked="" type="checkbox"/></p> <p>EVI <input type="checkbox"/></p> <p>SAVI <input type="checkbox"/></p> <p>MSAVI <input type="checkbox"/></p> <p>NDMI <input type="checkbox"/></p> <p>NBR <input type="checkbox"/></p> <p>NBR2 <input type="checkbox"/></p>	<p><u>Plotting & Statistics</u></p> <p>Summary Statistics <input checked="" type="checkbox"/></p>

Product Output Customization Options

Select specific output products.





Product Output Customization Options

Some customizations are only available for certain products

Output Format **gtiff** ▼

Resample Method **nn** ▼

Projection **Alber** ▼

- gtiff
- envi
- hdf-eos2
- netcdf

- nn
- bil
- cc

Latitude of Origin

Central Meridian

1st Standard Parallel

2nd Standard Parallel

False Easting (meters)

False Northing (meters)

Datum

Modify Image Extents

Define output image product details.



Product Output Customization Options

Some customizations are only available for certain products

Output Format

Resample Method

Projection

- (Do Not Reproject)
- Albers Equal Area**
- Universal Transverse Mercator
- Geographic
- Sinusoidal
- Polar Stereographic

Latitude of Origin

Central Meridian

1st Standard Parallel

2nd Standard Parallel

False Easting (meters)

False Northing (meters)

Datum

Modify Image Extents

Define output image product details.



Define output image product details...

Modify Image Extents

Extent Selection Interactive Selector ▾

Height Width Unit Show CalVal Sites Set Center



Coordinate Units ▾

Upper left X coordinate

Upper left Y coordinate

Lower right X coordinate

Lower right Y coordinate

Pixel Resizing

Coordinate Unit ▾

Pixel Size ▾

Order Description (optional)

Order Description Here

Clear Item Basket Submit Order





Define output image product details...

Modify Image Extents

Extent Selection Interactive Selector ▾

Height Width Unit Hide CalVal Sites Set Center



Coordinate Units

Upper left X coordinate

Upper left Y coordinate

Lower right X coordinate

Lower right Y coordinate

Pixel Resizing

Coordinate Unit

Pixel Size

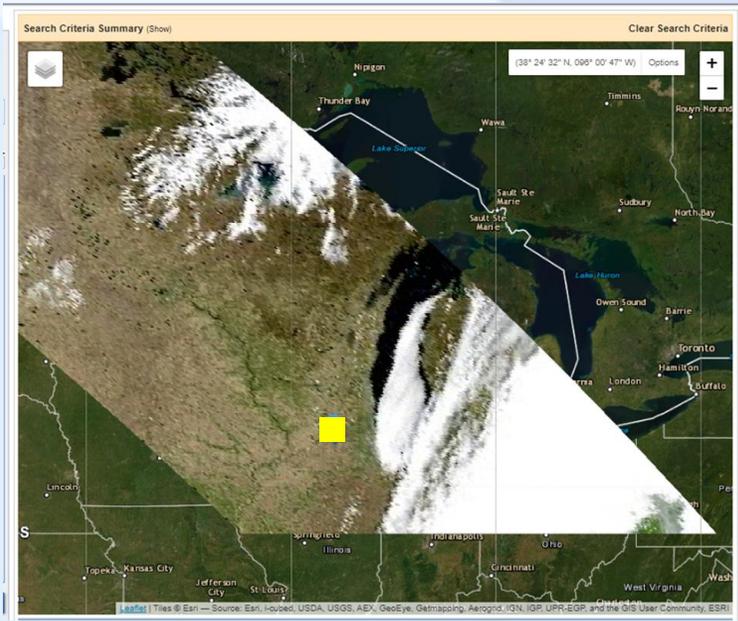
Order Description (optional)

Order Description Here





Define output image product details...



Modify Image Extents

Extent Selection Interactive Selector ▾

Height Width Unit km ▾ Show CalVal Sites Set Center

Coordinate Units dd ▾

Upper left X coordinate

Upper left Y coordinate

Lower right X coordinate

Lower right Y coordinate

Pixel Resizing

Coordinate Unit meters ▾

Pixel Size

Order Description (optional)

Order Description Here

..and Submit Order





Data Inventory and Ordering

Inventory and ordering of data based on metadata stored within LPCS.



Data currently retrieved resides on variety of platforms including spinning disks and Cloud.



Data retrieval includes public views of existing databases and APIs or common services.



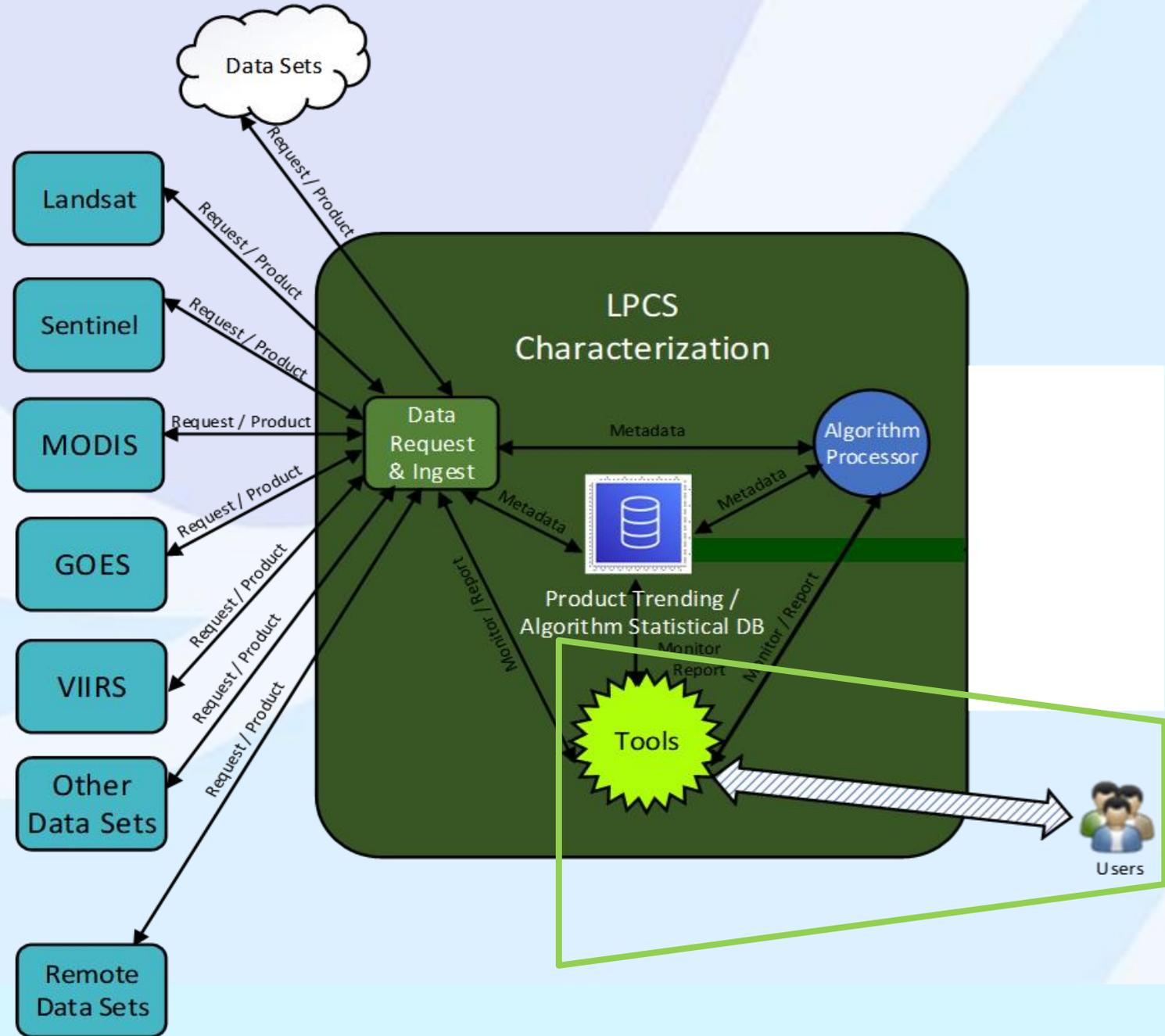
Data Product Definition and Processing

Output products selected, associated parameters defined and software tools engaged.



Output to Users

Users emailed notification of location of data for retrieval.





Notification by email when order received and when order completed.



USGS ESPA Processing for espa-kevin.p.gallo@noaa.gov-10302020-083304-442 complete  Inbox x 

espa@usgs.gov

Oct 30, 2020, 9:04 AM (6 days ago)  

to me ▾

espa-kevin.p.gallo@noaa.gov-10302020-083304-442 is now complete and can be downloaded from <http://espa.cr.usgs.gov/ordering/order-status/espa-kevin.p.gallo@noaa.gov-10302020-083304-442>

For large orders, the ESPA Bulk Downloader is available <https://code.usgs.gov/espa/bulk-downloader>

This order will remain available for 7 days. Any data not downloaded will need to be reordered after this time.



Notification by email when order received and when order completed.

USGS ESPA Processing for espa-kevin.p.gallo@noaa.gov-10302020-083304-442 complete Inbox x

espa@usgs.gov
to me ▾

Oct 30, 2020, 9:04 AM (6 days ago) ☆ ↶

espa-kevin.p.gallo@noaa.gov-10302020-083304-442 is now complete and can be downloaded from <http://espa.cr.usgs.gov/ordering/order-status/espa-kevin.p.gallo@noaa.gov-10302020-083304-442>

For large orders, the ESPA Bulk Downloader is available <https://code.usgs.gov/espa/bulk-downloader>

This order will remain available for 7 days. Any data not downloaded will need to be reordered after this time.

Products can be downloaded in bulk or individually.

Requested: 41
Completed: 41
Open: 0
Waiting on data: 0

Order: espa-kevin.p.gallo@noaa.gov-10302020-083304-442 **Date Ordered:** 2020-10-30 08:33:04.442459

Status: complete **Date Completed:** 2020-10-30 09:04:34.507977

Requested Processing: Reproject to albers equal area with latitude of origin:40 central meridian:-105 1st standard parallel:50 2nd standard parallel:30 false easting:0 false northing:0 datum:wgs84, resize pixels to 50 meters, image extents set to ulx:-88.97188318809307 uly:41.93283152841195 lrx:-88.73071681190692 lry:41.753168471588054, Output Format is geotiff

Products by sensor: mod09ga: modis_ndvi, plots and statistics , myd09ga: modis_ndvi, plots and statistics , olitirs8_collection: original input metadata, top of atmosphere, sr_ndvi, plots and statistics , vnp09ga: viirs_ndvi, plots and statistics ,

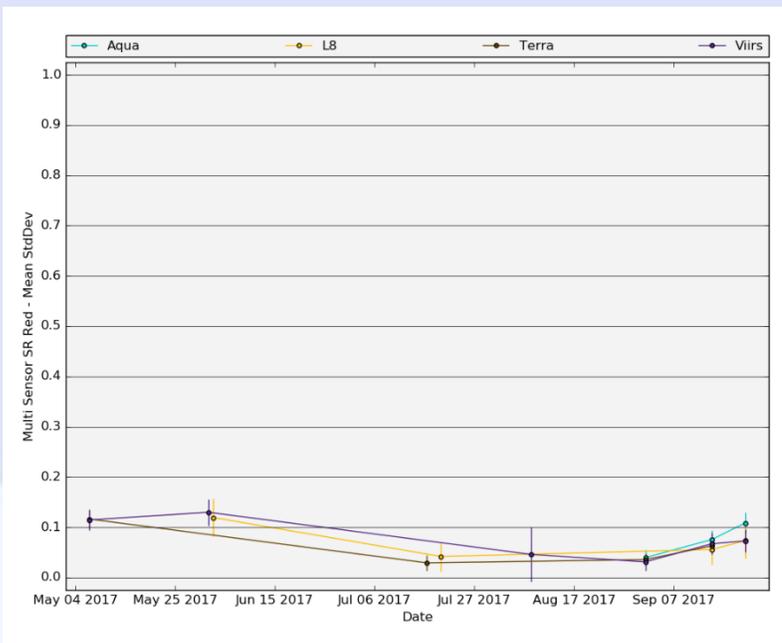
The ESPA Bulk Downloader is available [HERE](#)

Product	Status	Product URL	Chksum URL	Note
Plotting & Statistics	complete	Download	Checksum	
LC08_L1TP_024031_20170805_20170812_01_T1	complete	Download	Checksum	"
LC08_L1TP_023031_20170915_20170928_01_T1	complete	Download	Checksum	"
LC08_L1TP_024031_20170602_20170615_01_T1	complete	Download	Checksum	"
LC08_L1TP_024031_20170922_20171012_01_T1	complete	Download	Checksum	"
LC08_L1TP_029030_20200613_20200625_01_T1	unavailable			No valid pixels found for reprojection
LC08_L1TP_024031_20170720_20170728_01_T1	complete	Download	Checksum	"
MOD09GA.A2017258.h11v04.006.2017260031205	complete	Download	Checksum	"
MOD09GA.A2017153.h11v04.006.2017155030551	complete	Download	Checksum	"
MOD09GA.A2017152.h11v04.006.2017154025552	complete	Download	Checksum	"

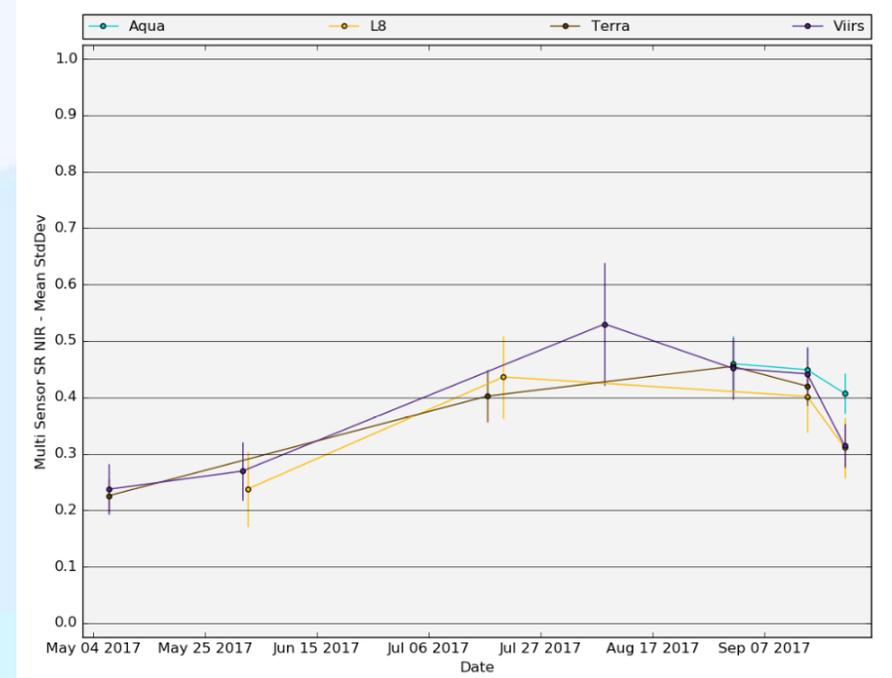


Standard output includes mean and standard deviation of individual channels

Red



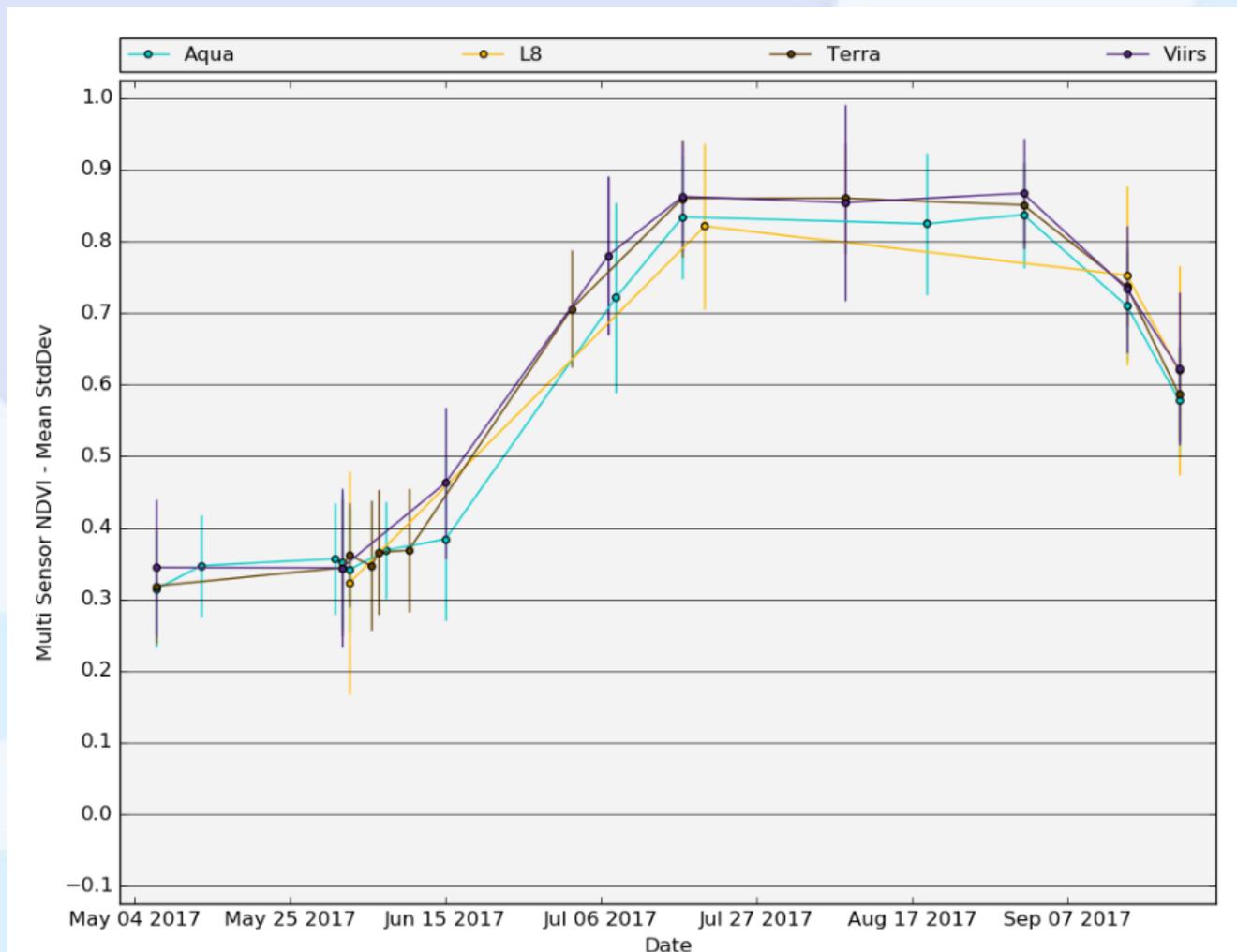
Near IR





Standard output available includes mean and standard deviation of individual channels and available indices.

NDVI

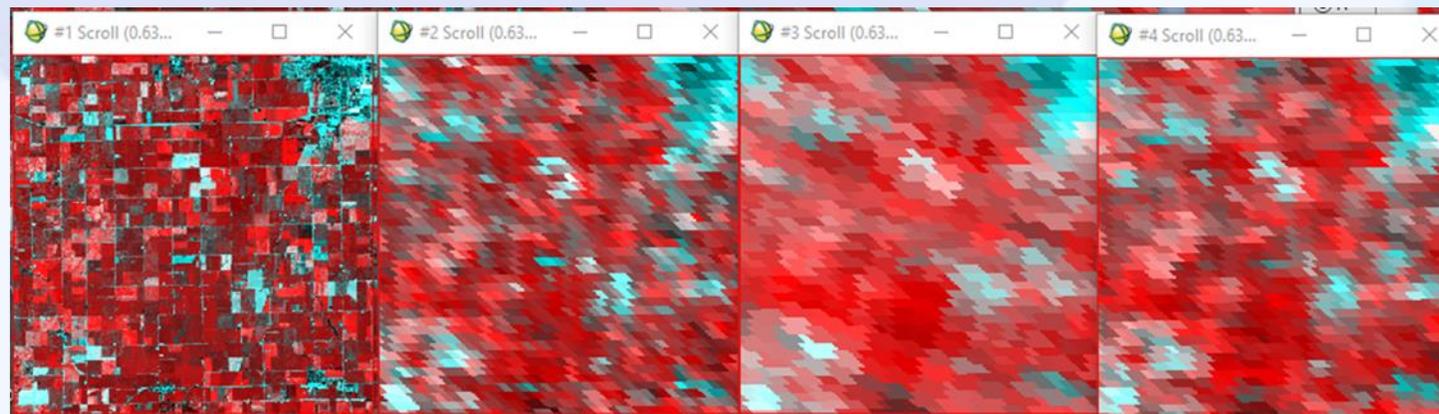


Summary

LPCS output products for comparative analysis

Images

15 September 2017, 50 m spatial resolution (per pixel)



L 8 OLI

Terra MODIS

Aqua MODIS

VIIRS

Charts



Tables

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV
6/2/2017	153	-990	9520	3229.074	1555.898
7/20/2017	201	101	10000	8214.904	1145.177
9/15/2017	258	-476	9871	7540.721	1240.008
9/22/2017	265	-963	9585	6211.303	1462.924



Tabular data provided allows comparisons with other datasets not yet included in LPCS (e.g., GOES-R ABI).

L-8

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV
6/2/2017	153	-990	9520	3229.074	1555.898
7/20/2017	201	101	10000	8214.904	1145.177
9/15/2017	258	-476	9871	7540.721	1240.008
9/22/2017	265	-963	9585	6211.303	1462.924

Terra

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV
5/7/2017	127	1765	7636	3189.299	807.0195
6/1/2017	152	1251	8463	3442.144	962.1462
6/2/2017	153	2545	7249	3619.127	726.6305
6/5/2017	156	2001	8290	3469.201	904.9535
6/6/2017	157	2189	7947	3659.676	866.1145
6/10/2017	161	1334	8610	3683.096	860.873
7/2/2017	183	3084	8849	7060.255	817.3158
7/17/2017	198	3001	9464	8600.771	823.0952
8/8/2017	220	2041	9397	8603.319	765.1748
9/1/2017	244	4094	9082	8509.106	589.9479
9/15/2017	258	4362	8269	7370.223	551.6571
9/22/2017	265	3660	7464	5871.323	661.9657

Aqua

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV
5/7/2017	127	1111	8006	3149.162	812.6877
5/13/2017	133	1078	6539	3470.15	711.8361
5/31/2017	151	1838	7940	3566.228	779.6774
6/1/2017	152	1694	8468	3522.106	953.6859
6/2/2017	153	2168	7931	3414.671	851.115
6/7/2017	158	2632	7342	3687.02	675.7367
6/15/2017	166	-642	10000	3842.52	1138.974
7/8/2017	189	631	10000	7214.763	1334.422
7/17/2017	198	2787	9316	8339.846	857.3913
8/19/2017	231	3165	9247	8245.959	994.2688
9/1/2017	244	2584	9238	8372.111	751.5663
9/15/2017	258	3330	8388	7098.519	749.1307
9/22/2017	265	2565	7711	5787.97	795.1172

VIIRS

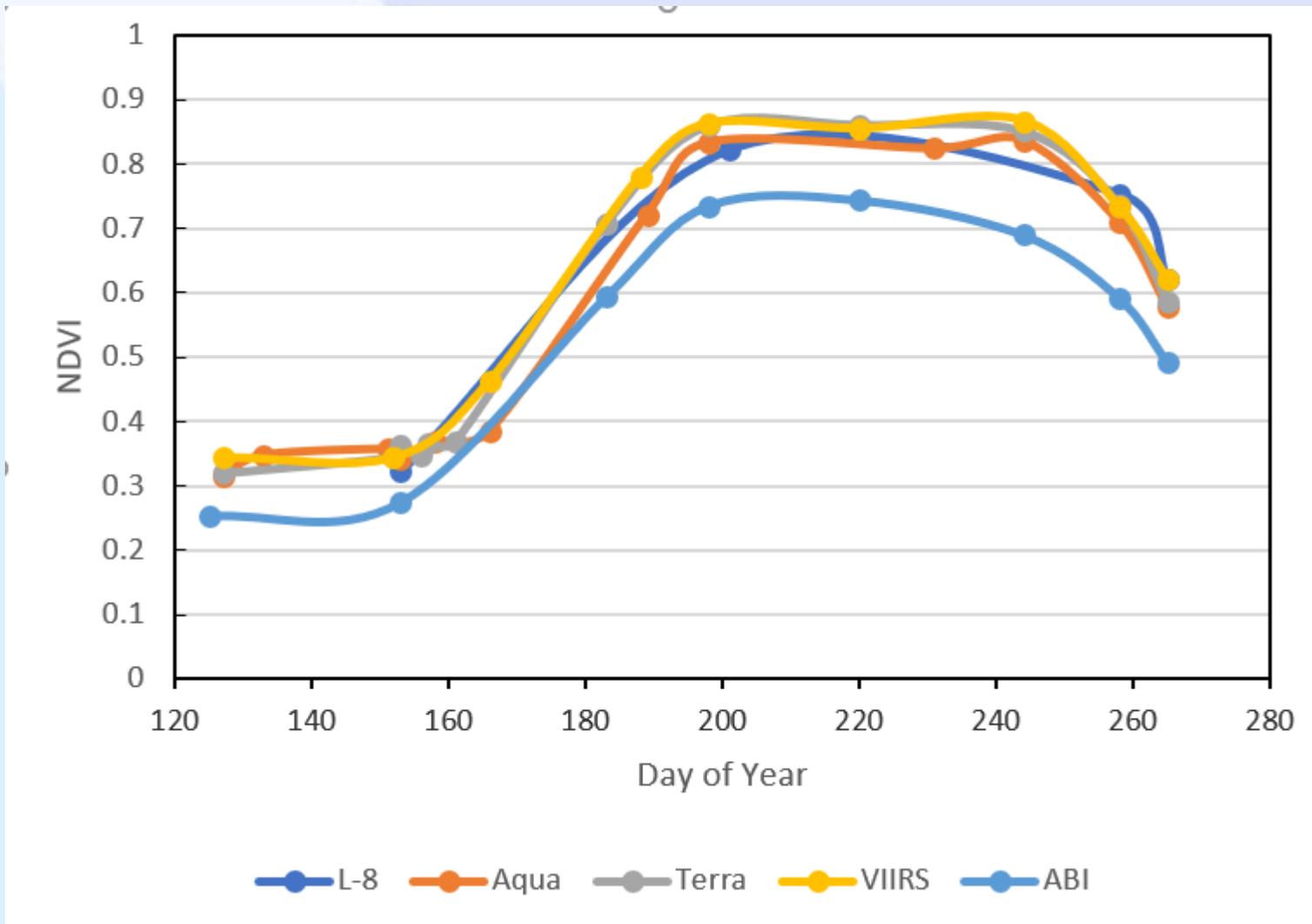
DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV
5/7/2017	127	233	8474	3446.17	954.8507
6/1/2017	152	1476	9044	3441.588	1113.316
6/15/2017	166	1048	9090	4628.96	1053.724
7/7/2017	188	1279	10000	7806.221	1111.188
7/17/2017	198	3231	9505	8625.095	759.8318
8/8/2017	220	1352	10000	8544.837	1371.329
9/1/2017	244	1470	9416	8670.06	764.6199
9/15/2017	258	1804	8843	7334.46	884.0544
9/22/2017	265	214	8589	6222.955	1061.24

ABI

DOY	Mean
125	0.253
153	0.274
183	0.593
198	0.735
220	0.744
244	0.693
258	0.592
265	0.493



Example of additional analysis possible with provided tabular data.



LPCS provides a comparison of the products **as produced** by the various agency/organizational providers.

There are no additional adjustments to the data for any spectral band pass, atmospheric correction differences, or any other inherent differences in the products.



Summary

Available and planned sensors and output products.

Product \ Sensor	Landsat ETM+ OLI	Terra & Aqua MODIS	S NPP VIIRS	GOES ABI*	Sentinel-2 MSI	In situ
Surface Reflectance	Available	Available	Available	In development	Planned	Planned
NDVI	Available	Available	Available	In development	Planned	Planned
Land Surface Temp	Planned	Planned	Planned	Planned	N/A	Planned
Albedo	Planned	Planned	Planned	Planned	Planned	Planned

*GOES ABI products initially derived from TOA reflectance.

Available	Available
In development	In development
Planned	Planned

Summary

Additional documentation on LPCS.

Remote Sens. 2018, 10, 48; doi:10.3390/rs10010048



Article

A Land Product Characterization System for Comparative Analysis of Satellite Data and Products

Kevin Gallo ^{1,2,*}, Greg Stensaas ², John Dwyer ² and Ryan Longhenry ²

¹ NOAA/NESDIS, College Park, MD 20740, USA

² USGS-EROS, Sioux Falls, SD 57198, USA; stensaas@usgs.gov (G.S.); dwyer@usgs.gov (J.D.); rlonghenry@usgs.gov (R.L.)

* Correspondence: kevin.p.gallo@noaa.gov; Tel: +1-605-594-2748

Received: 21 November 2017; Accepted: 21 December 2017; Published: 29 December 2017

Abstract: A Land Product Characterization System (LPCS) has been developed to provide land data and products to the community of individuals interested in validating space-based land products by comparing them with similar products available from other sensors or surface-based observations. The LPCS facilitates the application of global multi-satellite and in situ data for characterization and validation of higher-level, satellite-derived, land surface products (e.g., surface reflectance, normalized difference vegetation index, and land surface temperature). The LPCS includes data search, inventory, access, and analysis functions that will permit data to be easily identified, retrieved, co-registered, and compared statistically through a single interface. The system currently includes data and products available from Landsat 4 through 8, Moderate Resolution Imaging Spectroradiometer (MODIS) Terra and Aqua, Suomi National Polar-Orbiting Partnership (S-NPP)/Joint Polar Satellite System (JPSS) Visible Infrared Imaging Radiometer Suite (VIIRS), and simulated data for the Geostationary Operational Environmental Satellite (GOES)-16 Advanced Baseline Imager (ABI). In addition to the future inclusion of in situ data, higher-level land products from the European Space Agency (ESA) Sentinel-2 and -3 series of satellites, and other high and medium resolution spatial sensors, will be included as available. When fully implemented, any of the sensor data or products included in the LPCS would be available for comparative analysis.

Keywords: remote sensing; characterization; calibration; validation; Landsat; MODIS; VIIRS; Sentinel; GOES

1. Introduction

The intercomparison of space-based observations has been recognized as an important effort in the pursuit of the use of these data for detection, quantification, and long-term monitoring of the Earth's environment, land processes, and changes in land cover or features [1]. As stated within their conclusions [1], "the most crucial aspect of monitoring activities using EO (Earth Observation) satellites is the continuity and consistency of measurements through time". Recommendations related to assuring the consistency of measurements through time include various levels of detail and dependencies when comparing observations from multiple sensors, including (i) traceability of measurements; (ii) sampling differences between sensor spectral, spatial, or radiometric resolutions; and (iii) scene variability [1].

Several international efforts are underway related to the intercomparison of sensors, including those within the Global Space-Based Inter-Calibration System [2] and the Committee on Earth Observation Satellites (CEOS) Working Group on Calibration and Validation (WGCV) [3]. The CEOS WGCV includes a land product validation (LPV) subgroup that specifically focuses on the assessment of land products, including bidirectional reflectance/albedo, vegetation index, and land surface temperature [4].

Remote Sens. 2018, 10, 48; doi:10.3390/rs10010048

www.mdpi.com/journal/remotesensing





Thank you

Website: <https://lpcsexplorer.cr.usgs.gov/>

Contact: Kevin Gallo: NOAA/NESDIS/STAR
kevin.p.gallo@noaa.gov

