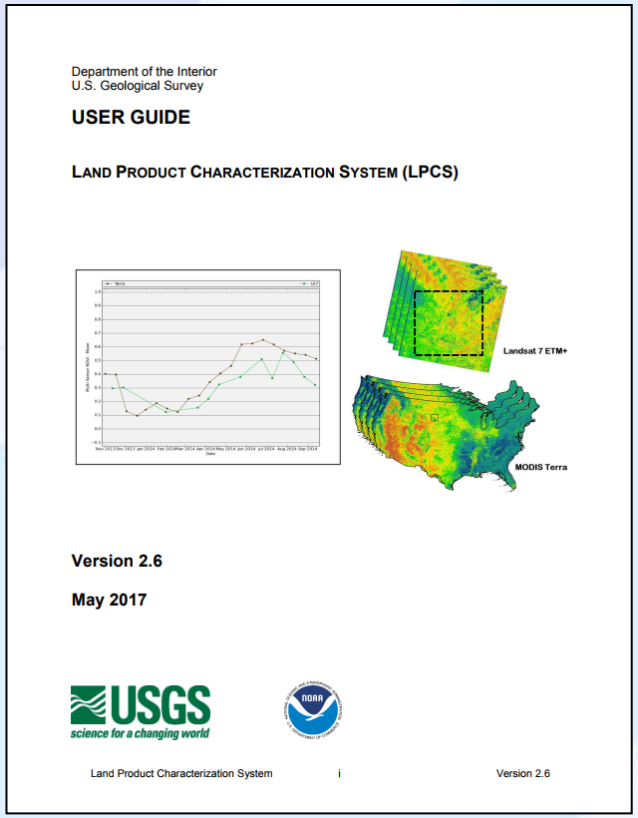
Land Product Characterization System

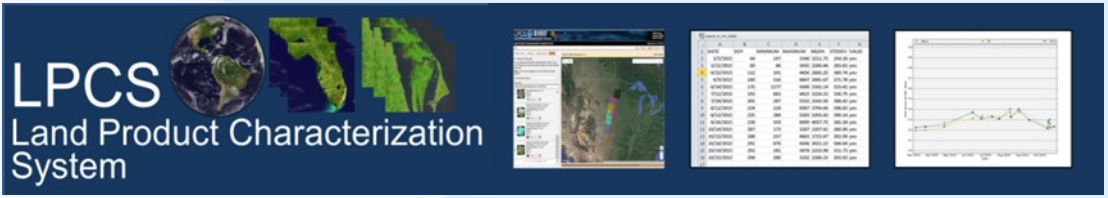
STAR JPSS Science Team Meeting
17 August 2017

Kevin Gallo: NOAA/NESDIS/STAR

collaborators

Greg Stensaas: USGS/EROS
John Dwyer: USGS/EROS
Ryan Longhenry: USGS/EROS





Land Product Characterization System (LPCS)

What is LPCS

Highlights of LPCS

1. Search, Inventory & Ordering
2. Analysis Tools

Path Forward

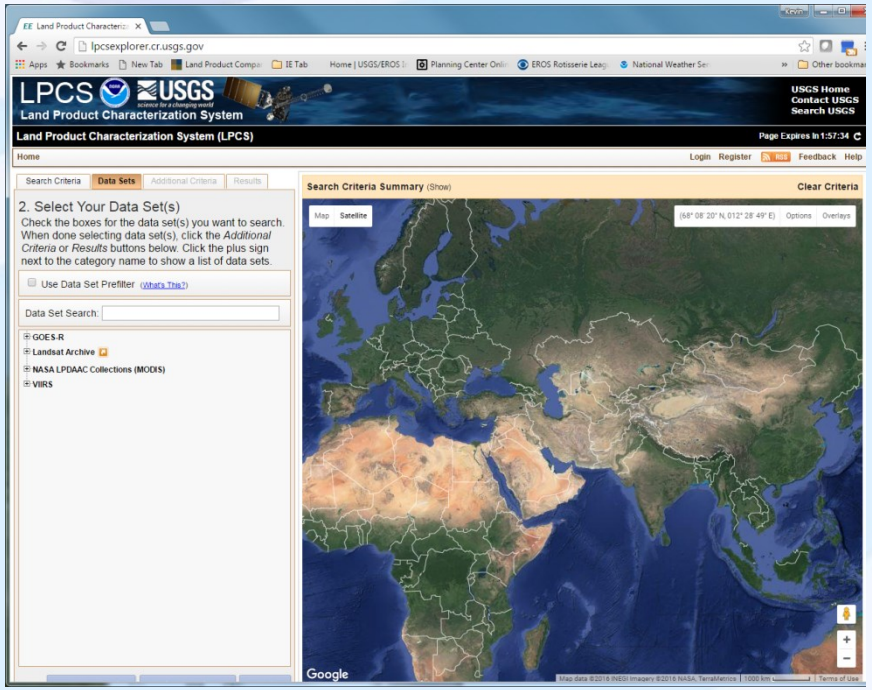
1. Status and Readiness
2. CEOS LPV collaboration

Summary

What is LPCS

A web-based system designed for comparative analysis of **global** satellite higher-level land products.

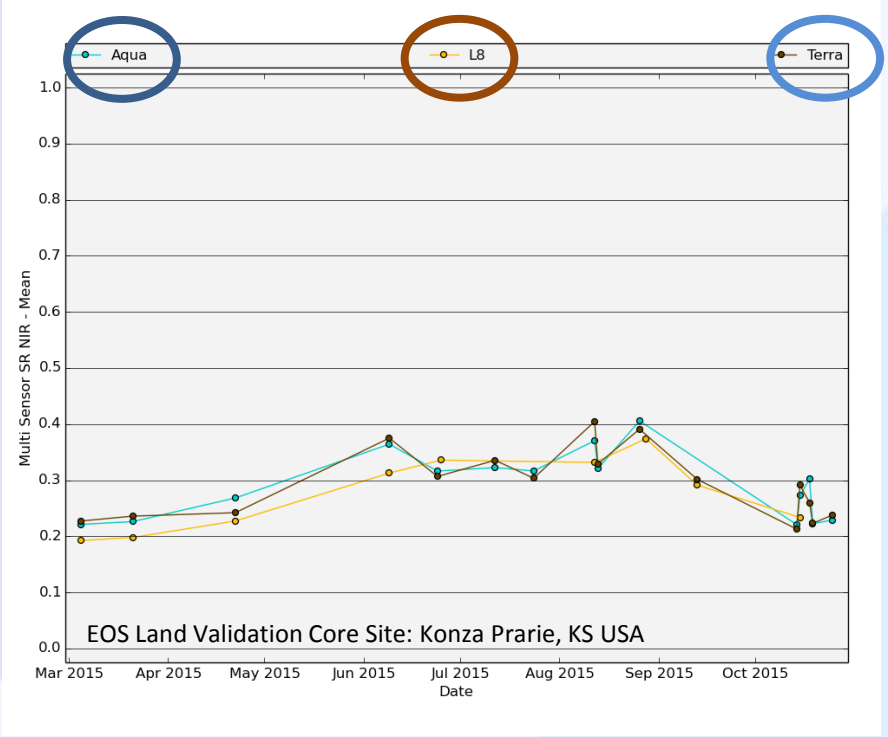




What is LPCS:
Output example

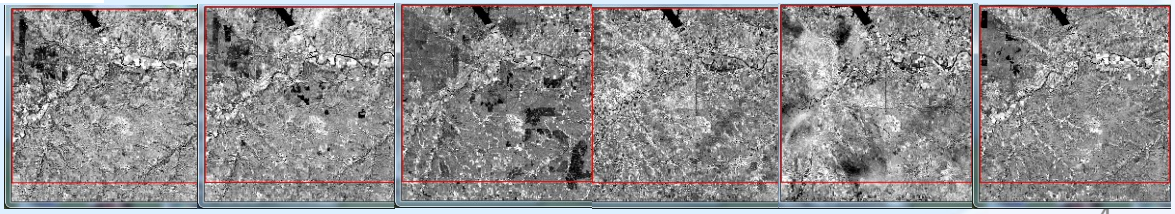
Trending of similar bands of data from multiple sensors.

Near-IR Surface Reflectance



DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV	VALID
3/5/2015	64	197	3348	2211.75	254.2622	yes
3/21/2015	80	86	3435	2260.46	283.6276	yes
4/22/2015	112	101	4456	2682.246	360.7378	yes
6/9/2015	160	516	4847	3641.673	371.7797	yes
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10/18/2015	291	676	4266	3021.147	584.0373	yes
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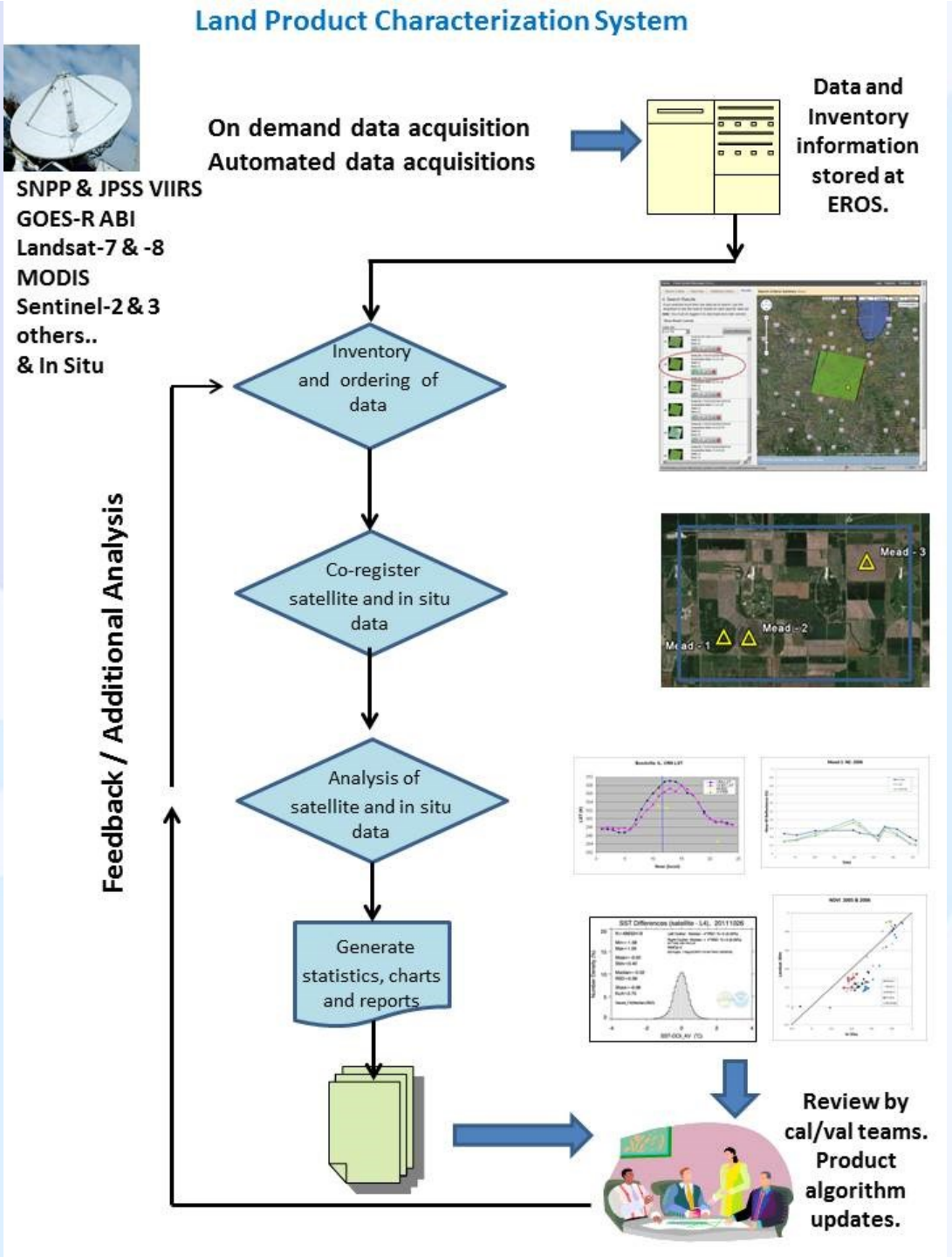
Tables and images provided for more intensive analyses.



What is LPCS

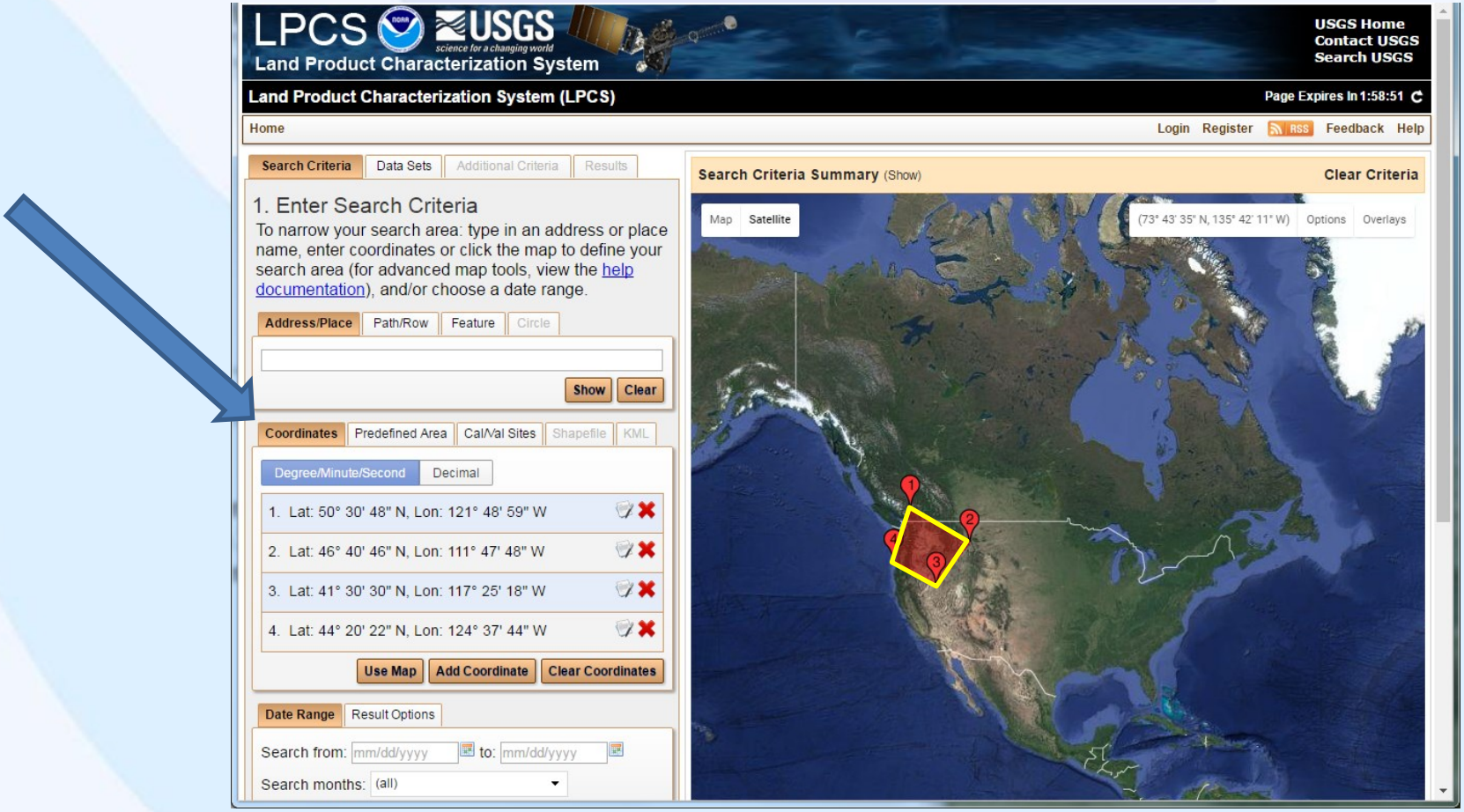
A web-based system designed for comparative analysis of global satellite higher-level land products.

- Search, inventory & order data
- Advanced processing
- Basic analysis options
- Output charts, images, & tables



Search, Inventory and Ordering

Several options to search and order data. Can search by entering latitude and longitude information or interactively drawing area of interest .



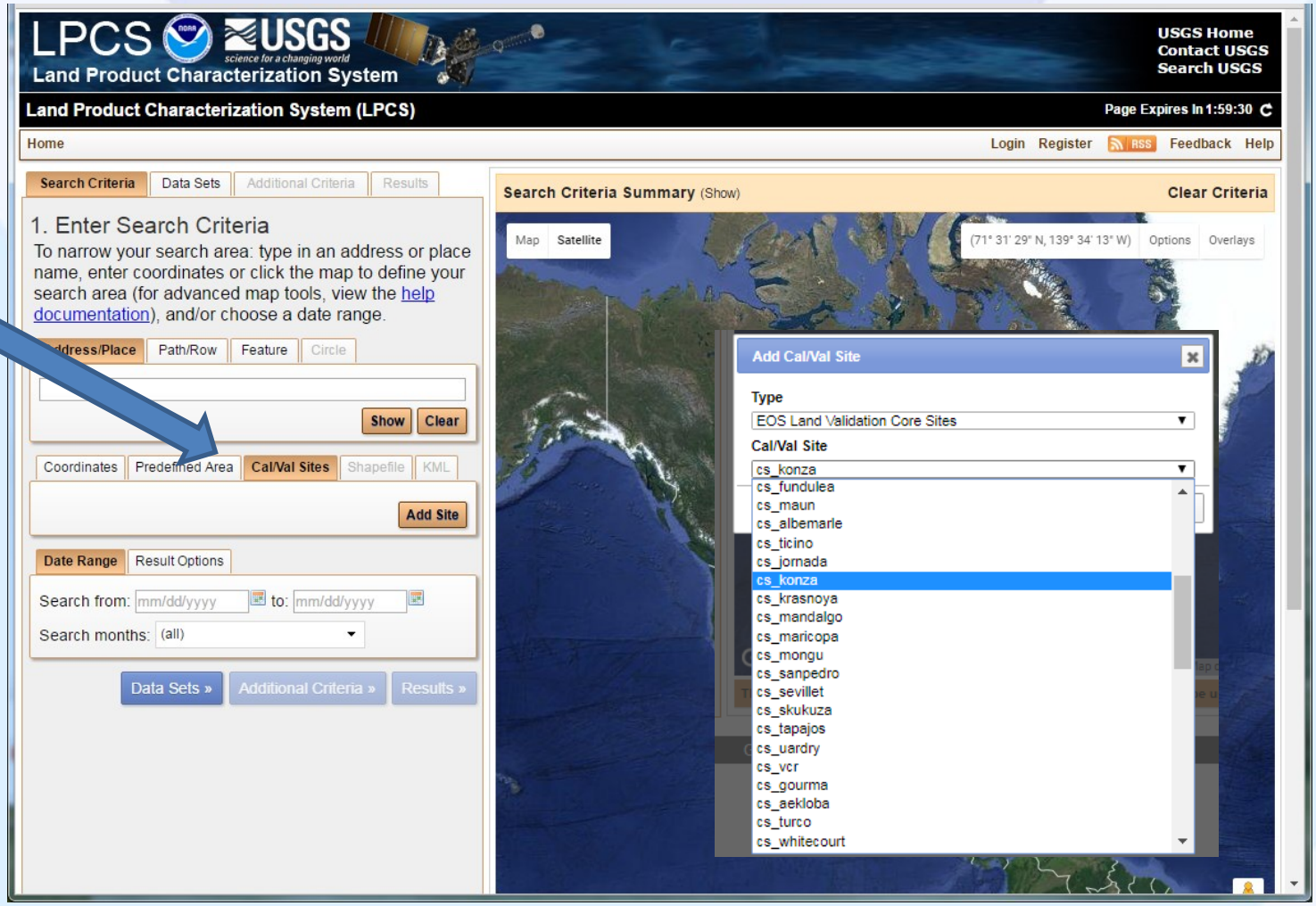
Search, Inventory and Ordering

NEW: Can search by location of several in situ networks.



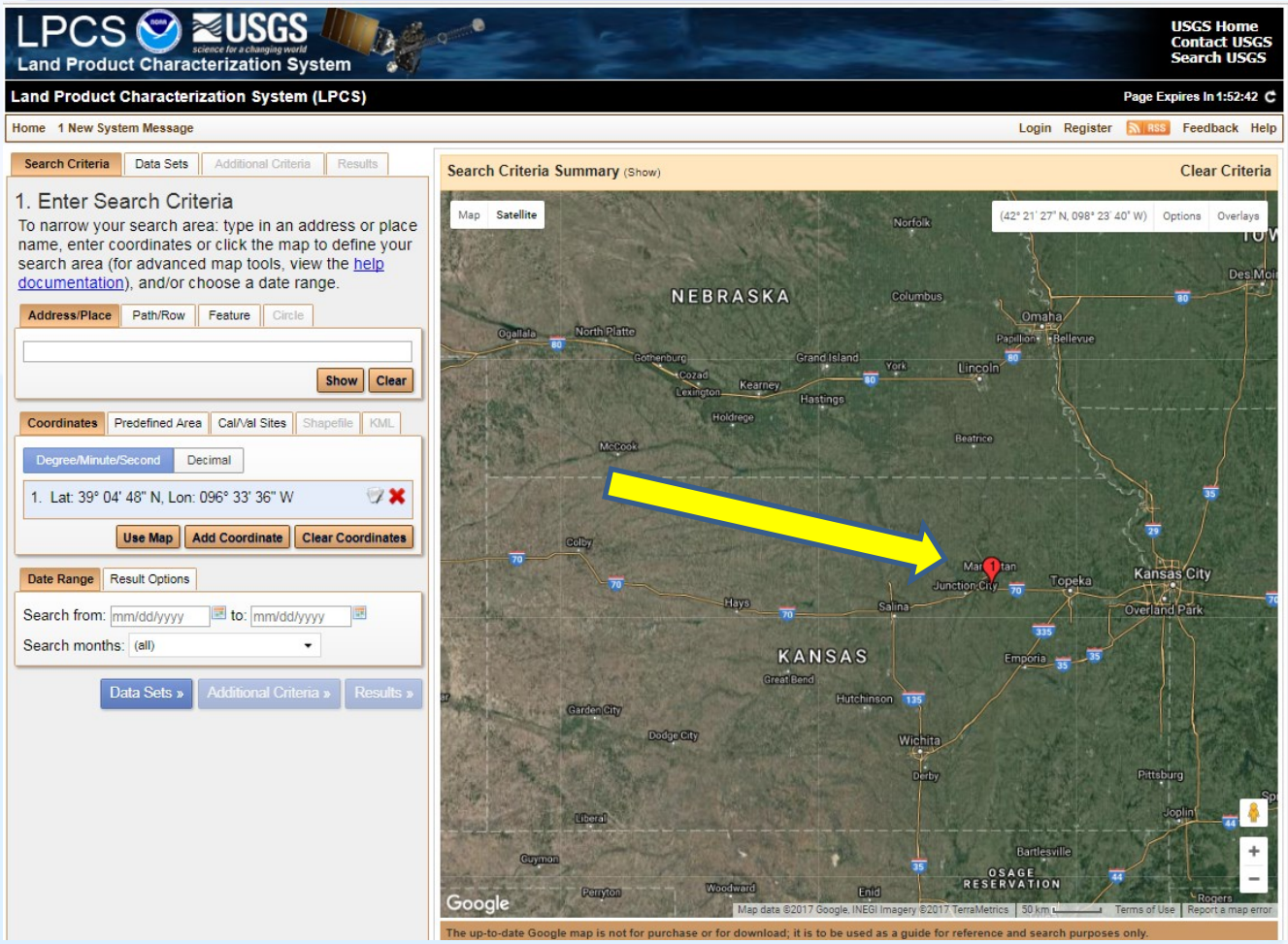
Search, Inventory and Ordering

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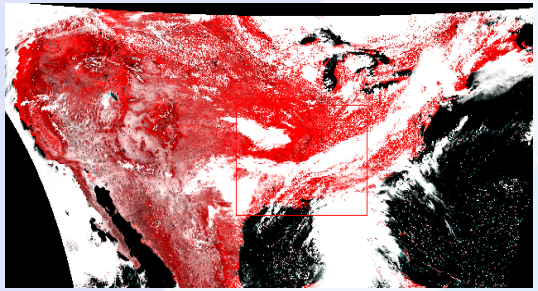
Search, Inventory and Ordering

NEW: Can search by location of several in situ networks (e.g., Konza Prairie, KS) .

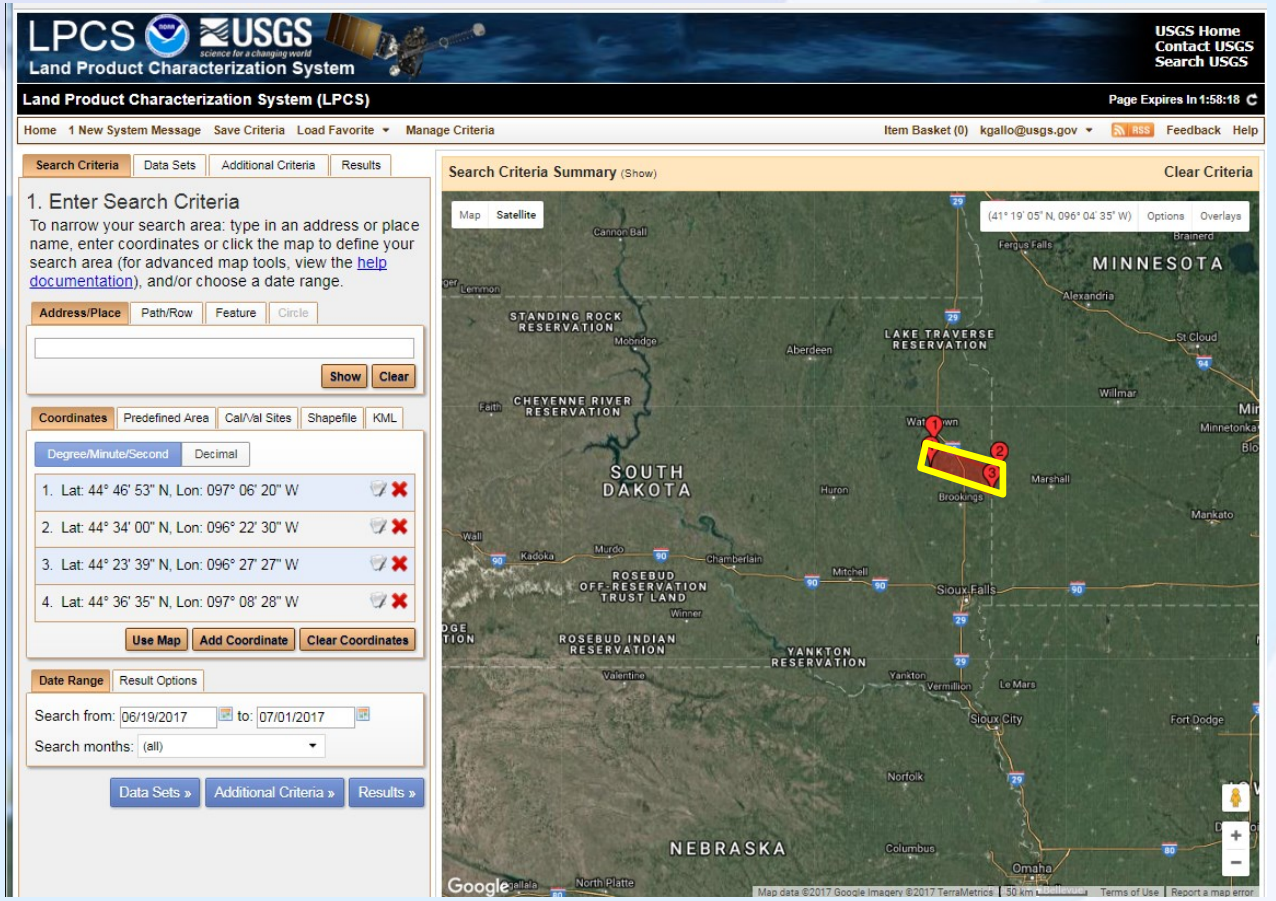


Search, Inventory and Ordering

Search for Landsat 8 data for comparison with GOES-16 ABI data for severe hail event in S. Dakota (June 2017).

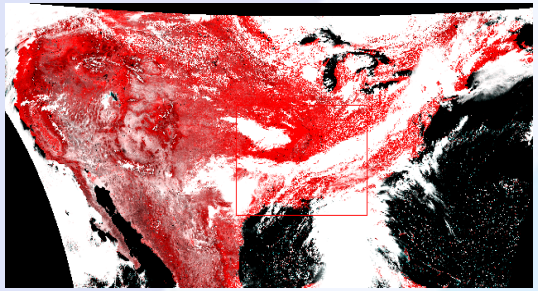


Users can search for data from multiple sensors over selected range of dates.

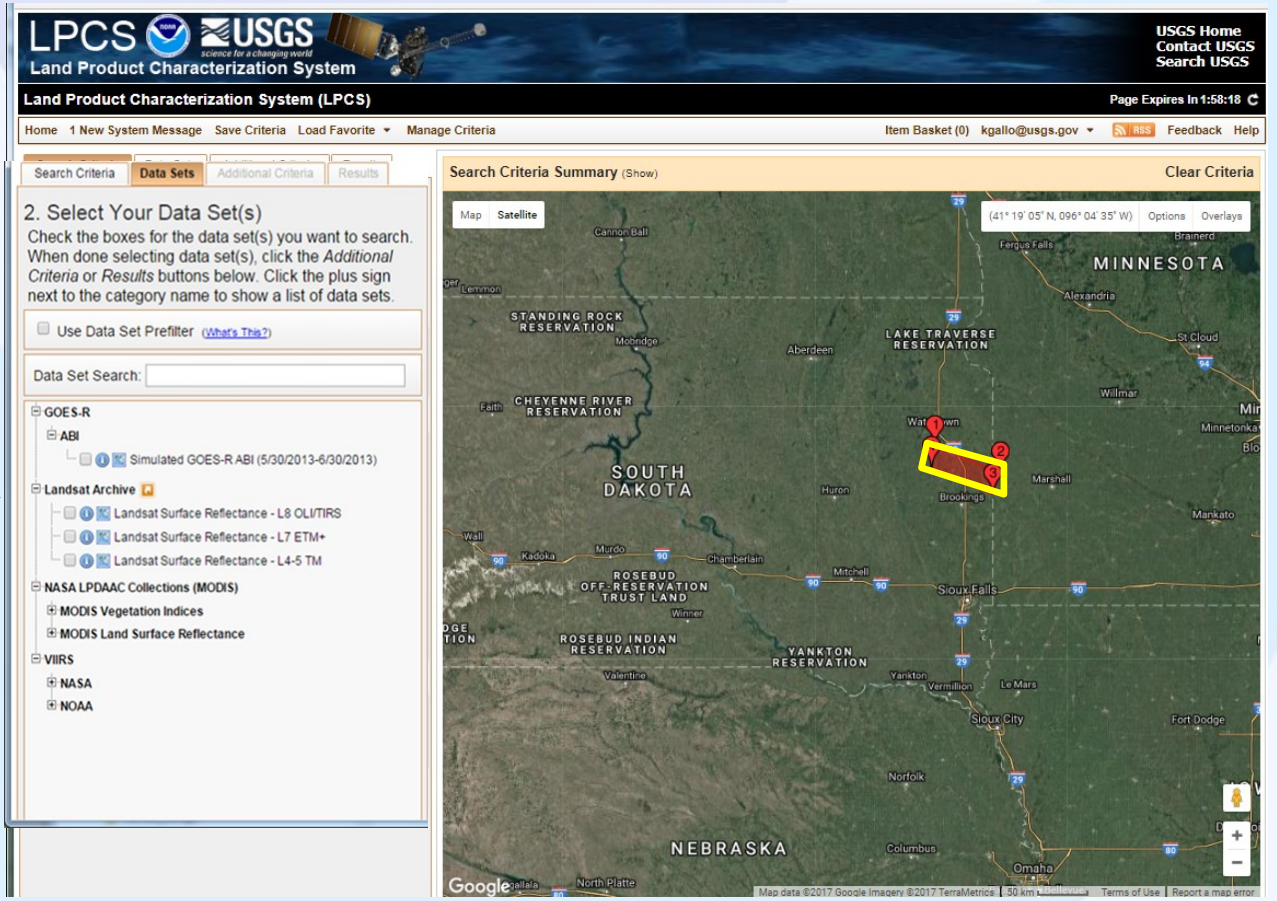


Search, Inventory and Ordering

Search for Landsat 8 data for comparison with GOES-16 ABI data for severe hail event in S. Dakota (June 2017).



Selected Landsat 8 data (other data options available and planned)



Search, Inventory and Ordering

Current

- 3 Landsat SR products
- 16 MODIS SR and NDVI
- Sample VIIRS
- Simulated GOES-R ABI

Future

- VIIRS
- GOES-R ABI
- Sentinel 2
- Sentinel 3
- in situ

Included data sets not arbitrary.

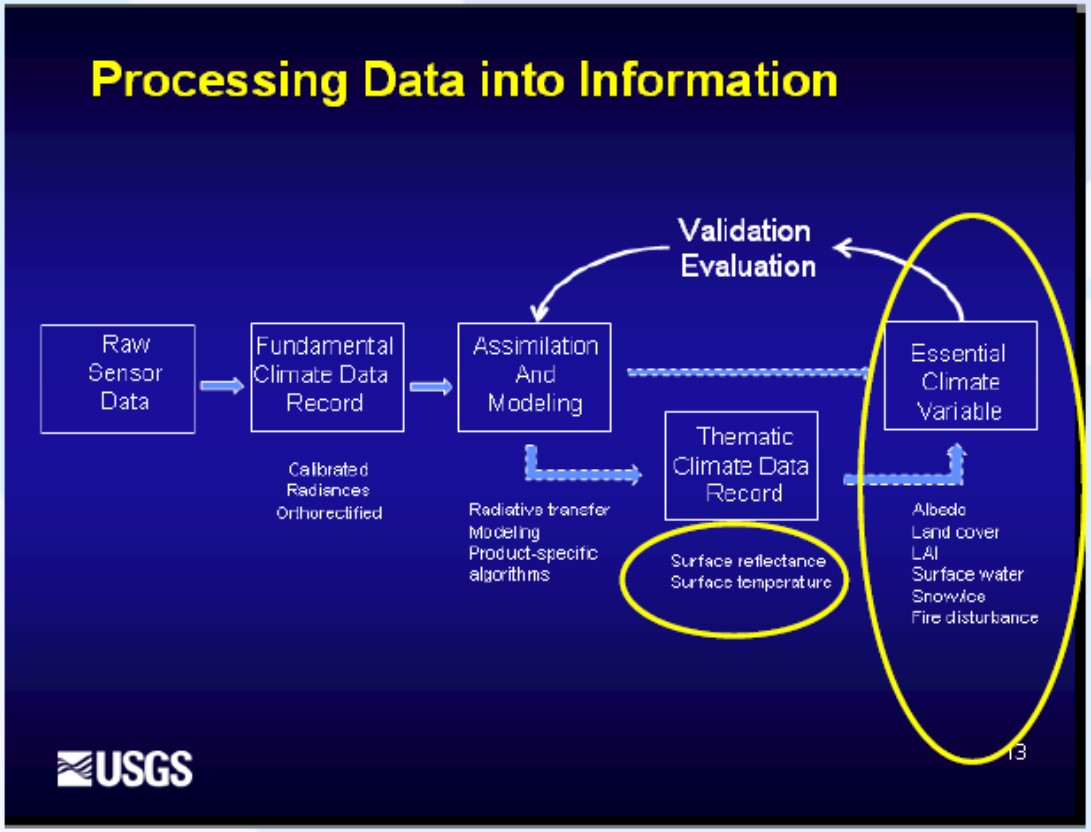
LPCS User Requirements Database

Organization	Mission	Instrument	Variable	Product Name	Spatial Coverage	Spatial Scale	Temporal Coverage	Temporal Scale	Validation Sites List
USGS/NASA	Landsat	Landsat 4-5	SR	Landsat Surface Reflectance L4-5 TM	Global	30 m		Daily (AM local time)	
USGS/NASA	Landsat	Landsat 7	SR	Landsat Surface Reflectance L7 ETM+	Global	30 m		Daily (AM local time)	
USGS/NASA	Landsat	Landsat 8	SR	Landsat Surface Reflectance L8 OLI/TIRS	Global	30 m		Daily (AM local time)	
NASA	EOS	MODIS	NDVI/EVI	MOD13A1 Vegetation Indices 16-Day L3 Global 500m	Global	500 m		Daily (AM local time)	
NASA	EOS	MODIS	NDVI/EVI	MOD13A2 Vegetation Indices 16-Day L3 Global 1km	Global	1000 m		Daily (AM local time)	
NASA	EOS	MODIS	NDVI/EVI	MOD13A3 Vegetation Indices Monthly L3 Global 1km	Global	1000 m		Daily (AM local time)	
NASA	EOS	MODIS	NDVI/EVI	MOD13Q1 Vegetation Indices 16-Day L3 Global 250m	Global	250 m		Daily (AM local time)	
NASA	EOS	MODIS	NDVI/EVI	MYD13A1 Vegetation Indices 16-Day L3 Global 500m	Global	500 m		Daily (PM local time)	
NASA	EOS	MODIS	NDVI/EVI	MYD13A2 Vegetation Indices 16-Day L3 Global 1km	Global	1000 m		Daily (PM local time)	
NASA	EOS	MODIS	NDVI/EVI	MYD13A3 Vegetation Indices Monthly L3 Global 1km	Global	1000 m		Daily (PM local time)	
NASA	EOS	MODIS	NDVI/EVI	MYD13Q1 Vegetation Indices 16-Day L3 Global 250m	Global	250 m		Daily (PM local time)	
NASA	EOS	MODIS	SR	MOD09A1 Surface Reflectance 8-Day L3 Global 500m	Global	500 m		Daily (AM local time)	
NASA	EOS	MODIS	SR	MOD09GA Surface Reflectance Daily L2G Global 1km and 500m	Global	500 m		Daily (AM local time)	
NASA	EOS	MODIS	SR	MOD09GQ Surface Reflectance Daily L2G Global 250m	Global	250 m		Daily (AM local time)	
NASA	EOS	MODIS	SR	MOD09Q1 Surface Reflectance 8-Day L3 Global 250m	Global	250 m		Daily (AM local time)	
NASA	EOS	MODIS	SR	MYD09A1 Surface Reflectance 8-Day L3 Global 500m	Global	500 m		Daily (PM local time)	
NASA	EOS	MODIS	SR	MYD09GA Surface Reflectance Daily L2G Global 1km and 500m	Global	500 m		Daily (PM local time)	
NASA	EOS	MODIS	SR	MYD09GQ Surface Reflectance Daily L2G Global 250m	Global	250 m		Daily (PM local time)	
NASA	EOS	MODIS	SR	MYD09Q1 Surface Reflectance 8-Day L3 Global 250m	Global	250 m		Daily (PM local time)	
NOAA	GOES-R	ABI	NDVI	Simulated TOA NDVI	CONUS	2222 m	31 May, 3 June, 26 Jun	1800, 1900, 2000 UTC	
NOAA	S-NPP	VIIRS	NDVI	Sample VIIRS Vegetation Index	SW CONUS	500 m	30 May - 29 June 2013	Daily (PM local time)	
NASA	S-NPP	VIIRS	NDVI	Sample VIIRS Vegetation Index	SW CONUS	488 m	31 May, 3 June, 26 Jun	Daily (PM local time)	
NASA	EOS	MODIS	land cover	MCD12Q1 Land Cover Type Yearly L3 Global 500 m SIN Grid	Global	500 m		Annual	
NASA	EOS	MODIS	LST	MOD11A1 LST and Emissivity Daily L3 Global 1 km Grid SIN	Global	1000 m		Daily (AM local time)	
NASA	EOS	MODIS	LST	MYD11A1 LST and Emissivity Daily L3 Global 1 km Grid SIN	Global	1000 m		Daily (PM local time)	
USGS/NASA	Landsat	Landsat 8	Albedo	TBD					
USGS/NASA	Landsat	Landsat 8	LST	TBD					
NOAA	GOES-R	ABI	TBD	TBD					
NOAA	GOES-R	ABI	TBD	TBD					
NOAA	GOES-R	ABI	TBD	TBD					
NOAA	GOES-R	ABI	TBD	TBD					
NOAA	S-NPP	VIIRS	TBD	TBD					
NOAA	S-NPP	VIIRS	TBD	TBD					
NOAA	S-NPP	VIIRS	TBD	TBD					
NOAA	S-NPP	VIIRS	TBD	TBD					
NASA	S-NPP	VIIRS	TBD	TBD					
NASA	S-NPP	VIIRS	TBD	TBD					
NASA	S-NPP	VIIRS	TBD	TBD					
NASA	S-NPP	VIIRS	TBD	TBD					
ESA	Sentinel-2	MSI	TBD	TBD					
	CRN	in situ	TBD	TBD					
	SURFRAD	in situ	TBD	TBD					
	AERONET	in situ	TBD	TBD					
	EOS Land Core	in situ	TBD	TBD					
				Currently available in LPCS					
				Soon to be avialble					
				Planned to be available					

USGS-NOAA validation synergy

USGS Requirements

- Landsat ECVs



USGS ECVs

- Albedo
- Land Cover
- LAI
- Surface Water
- Snow/Ice
- Fire disturbance
- LST

USGS-NOAA validation synergy

Several products of mutual interest (**e.g. GOES-R ABI**)

KEY

ABI	SUVI	EXIS
GLM	SEISS	MAG

ABI: Advanced Baseline Imager

SUVI: Solar Ultraviolet Imager

EXIS: Extreme Ultraviolet and X-ray Irradiance Suite

GLM: Geostationary Lightning Mapper

SEISS: Space Environment In-Situ Suite

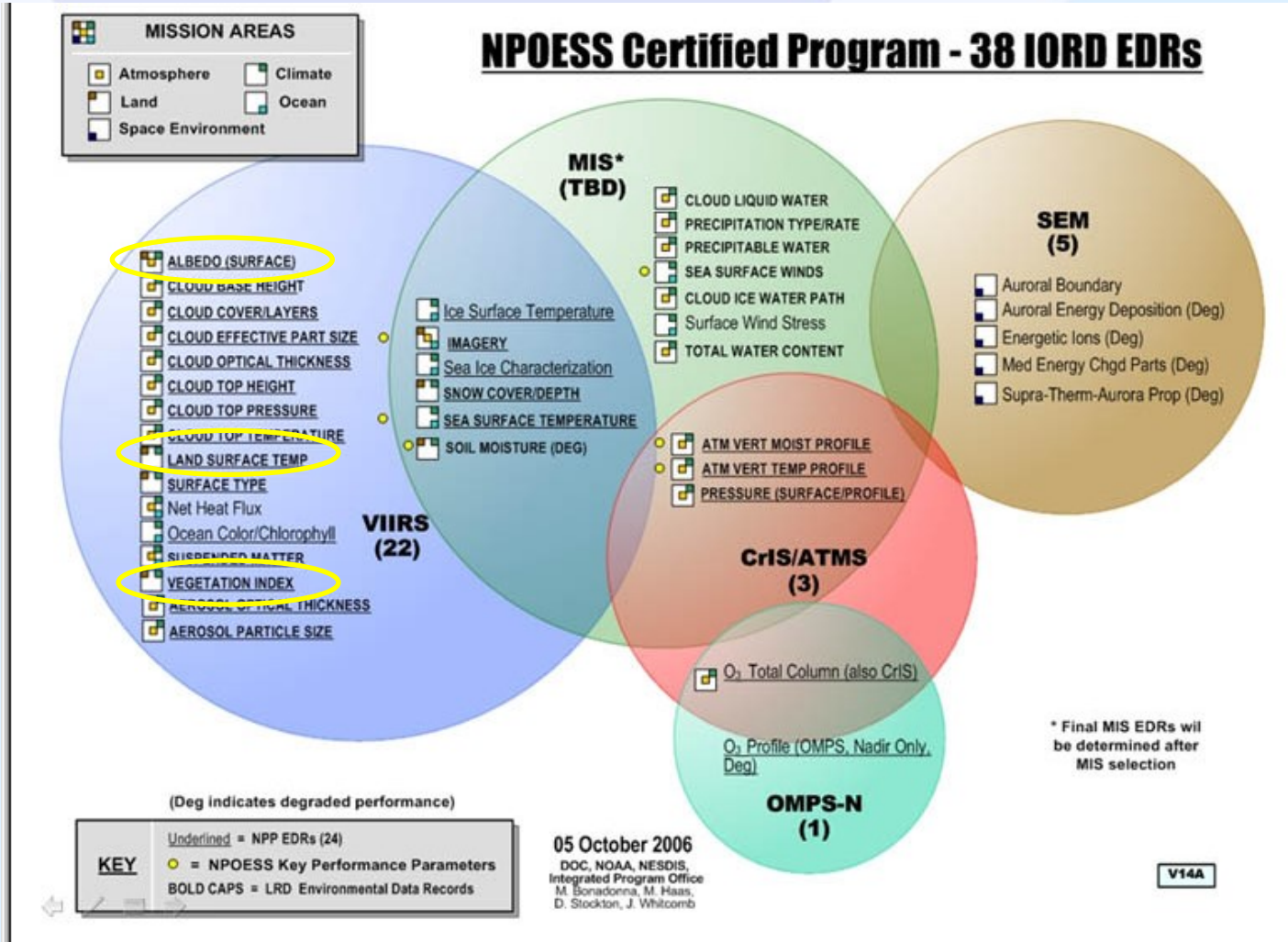
MAG: Magnetometer

BASELINE PRODUCTS
Aerosol Detection (Including Smoke and Dust)
Aerosol Optical Depth (AOD)
Volcanic Ash: Detection and Height
Cloud and Moisture Imagery
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Phase
Cloud Top Height
Cloud Top Pressure
Cloud Top Temperature
Hurricane Intensity
Lightning Detection: Events, Groups & Flashes
Rainfall Rate / QPE
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Derived Stability Indices
Total Precipitable Water
Clear Sky Masks
Radiances
Downward Shortwave Radiation: Surface
Reflected Shortwave Radiation: TOA
Derived Motion Winds
Fire/Hot Spot Characterization
Land Surface Temperature (Skin)
Snow Cover
Sea Surface Temperature (Skin)
Energetic Heavy Ions
Mag. Electrons & Protons: Low Energy
Mag. Electrons & Protons: Med & High Energy
Solar & Galactic Protons
Geomagnetic Field
Solar Flux: EUV
Solar Flux: X-Ray
Solar Imagery: X-Ray

OPTION 2 PRODUCTS
Aerosol Partical Size
Aircraft Icing Threat
Cloud Ice Water Path
Cloud Layers/Heights
Cloud Liquid Water
Cloud Type
Convective Initiation
Enhanced "V" / Overshooting Top Detection
Low Cloud and Fog
Tropopause Folding Turbulence Prediction
Visibility
Probability of Rainfall
Rainfall Potential
Absorbed Shortwave Radiation: Surface
Downward Longwave Radiation: Surface
Upward Longwave Radiation: Surface
Upward Longwave Radiation: TOA
Ozone Total
SO2 Detection
Flood/Standing Water
Ice Cover
Snow Depth (Over Plains)
Surface Albedo
Surface Emissivity
Vegetation Fraction: Green
Vegetation Index
Currents
Currents: Offshore
Sea and Lake Ice: Age
Sea and Lake Ice: Concentration
Sea and Lake Ice: Motion

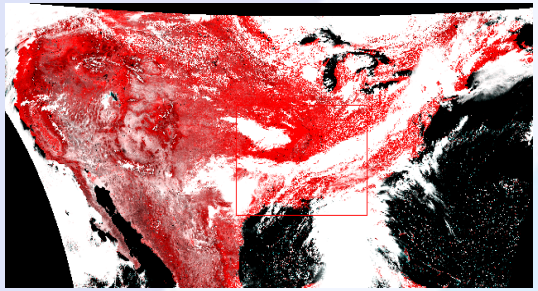
USGS-NOAA validation synergy

Several products of mutual interest (**e.g. VIIRS**)

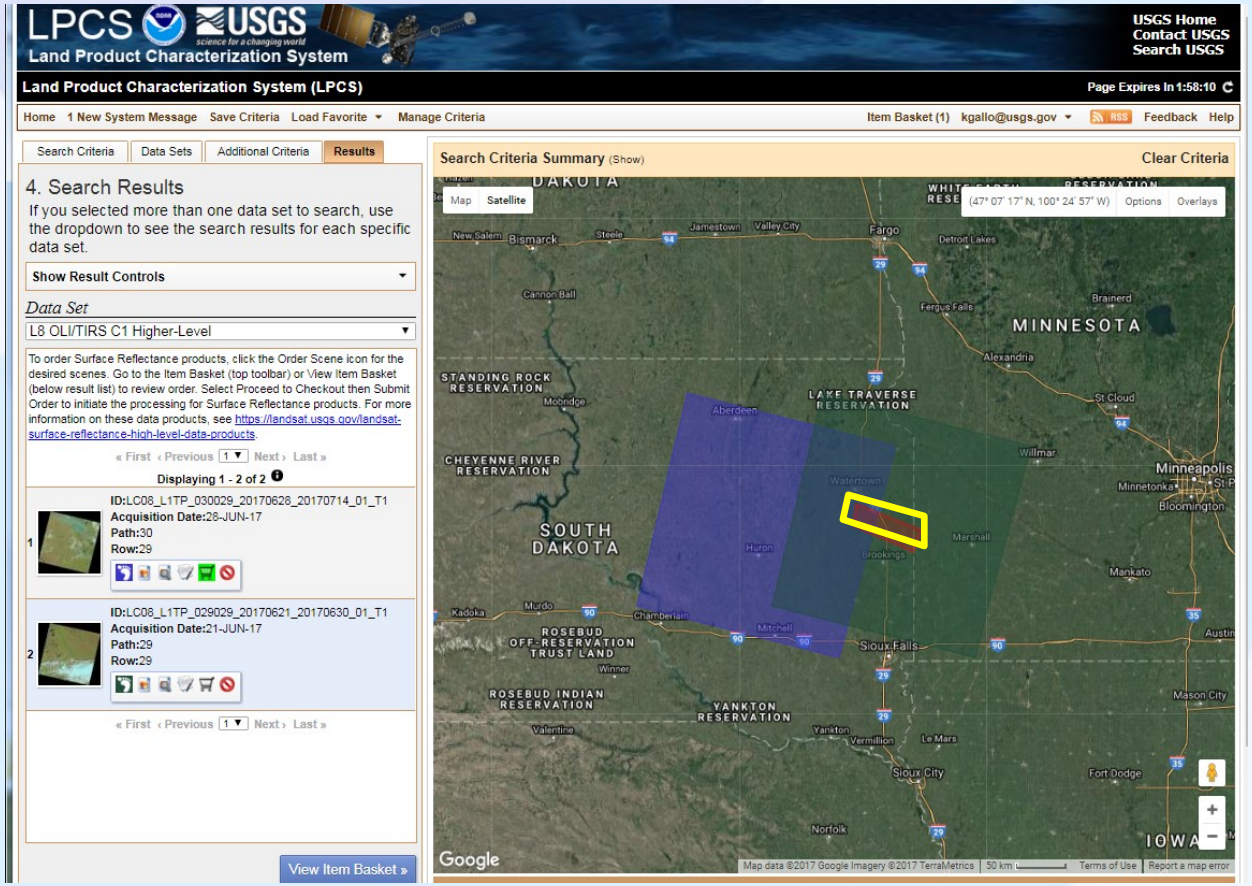


Search, Inventory and Ordering

Search for Landsat 8 data for comparison with GOES-16 ABI data for severe hail event in S. Dakota (June 2017).

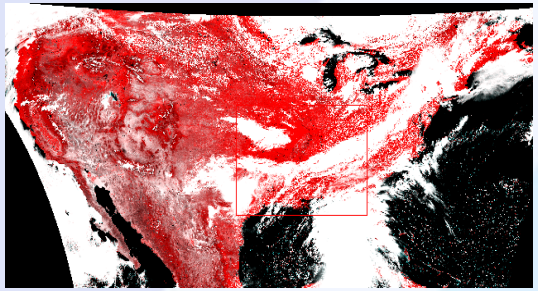


Once inventory of images provided, users can view browse images and…

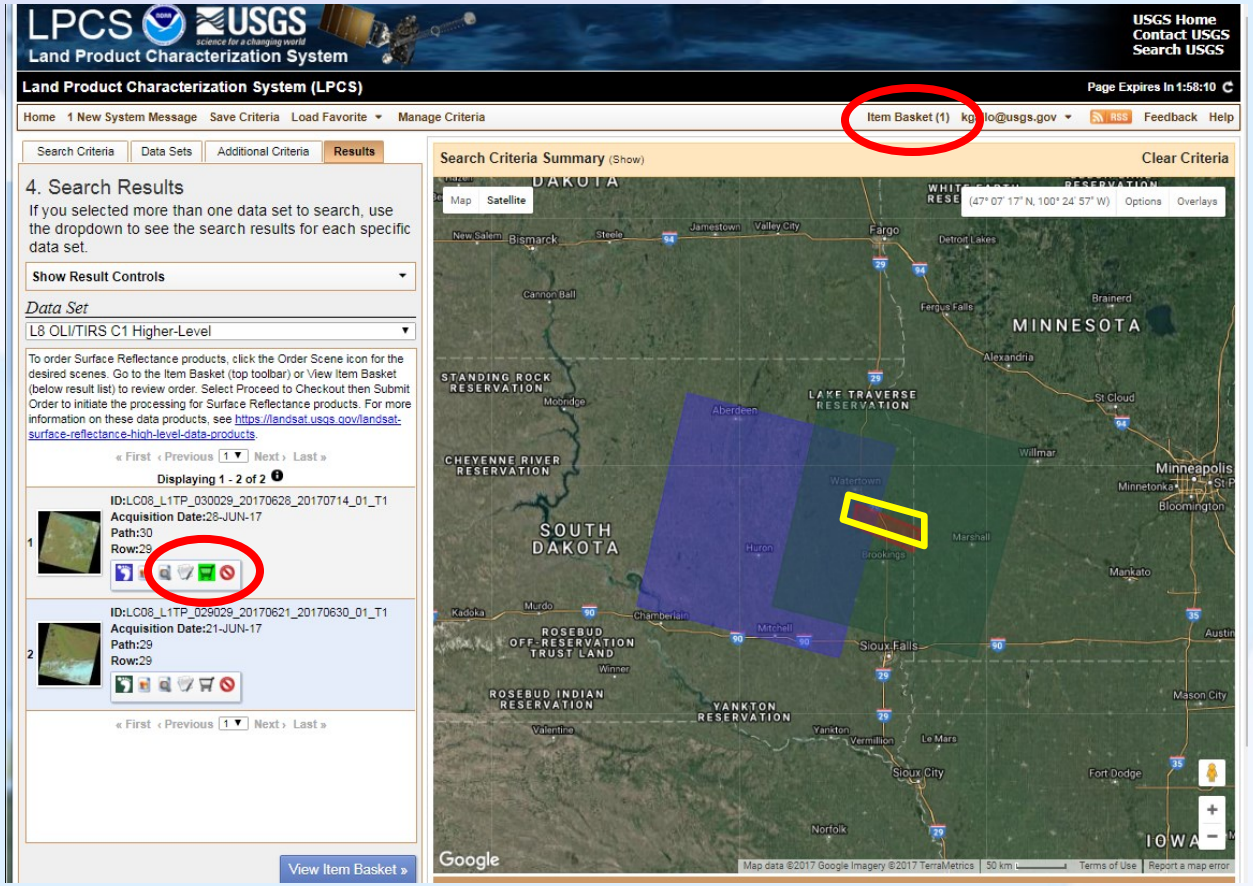


Search, Inventory and Ordering

Search for Landsat 8 data for comparison with GOES-16 ABI data for severe hail event in S. Dakota (June 2017).

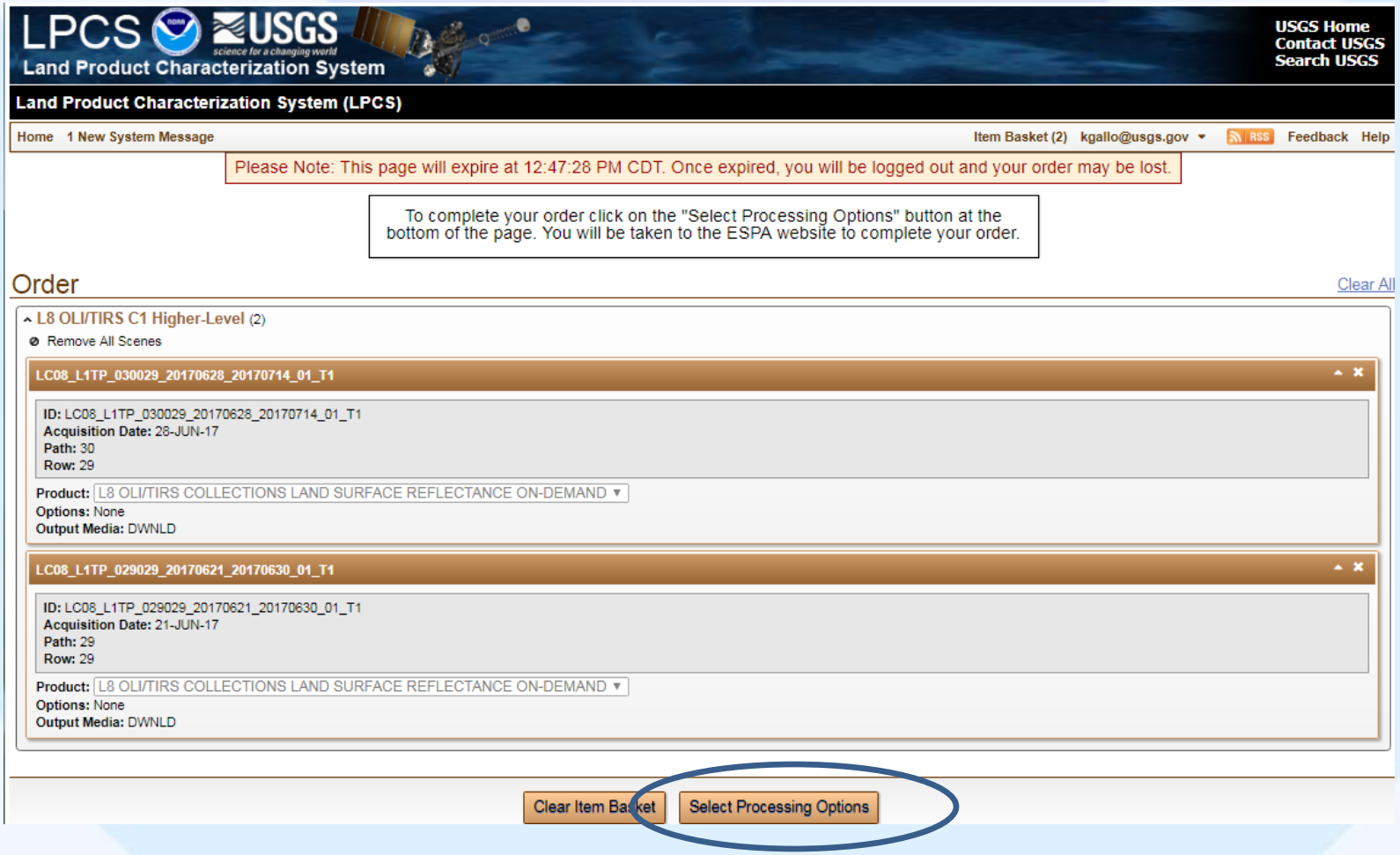


…. select scenes for further processing.



Search, Inventory and Ordering

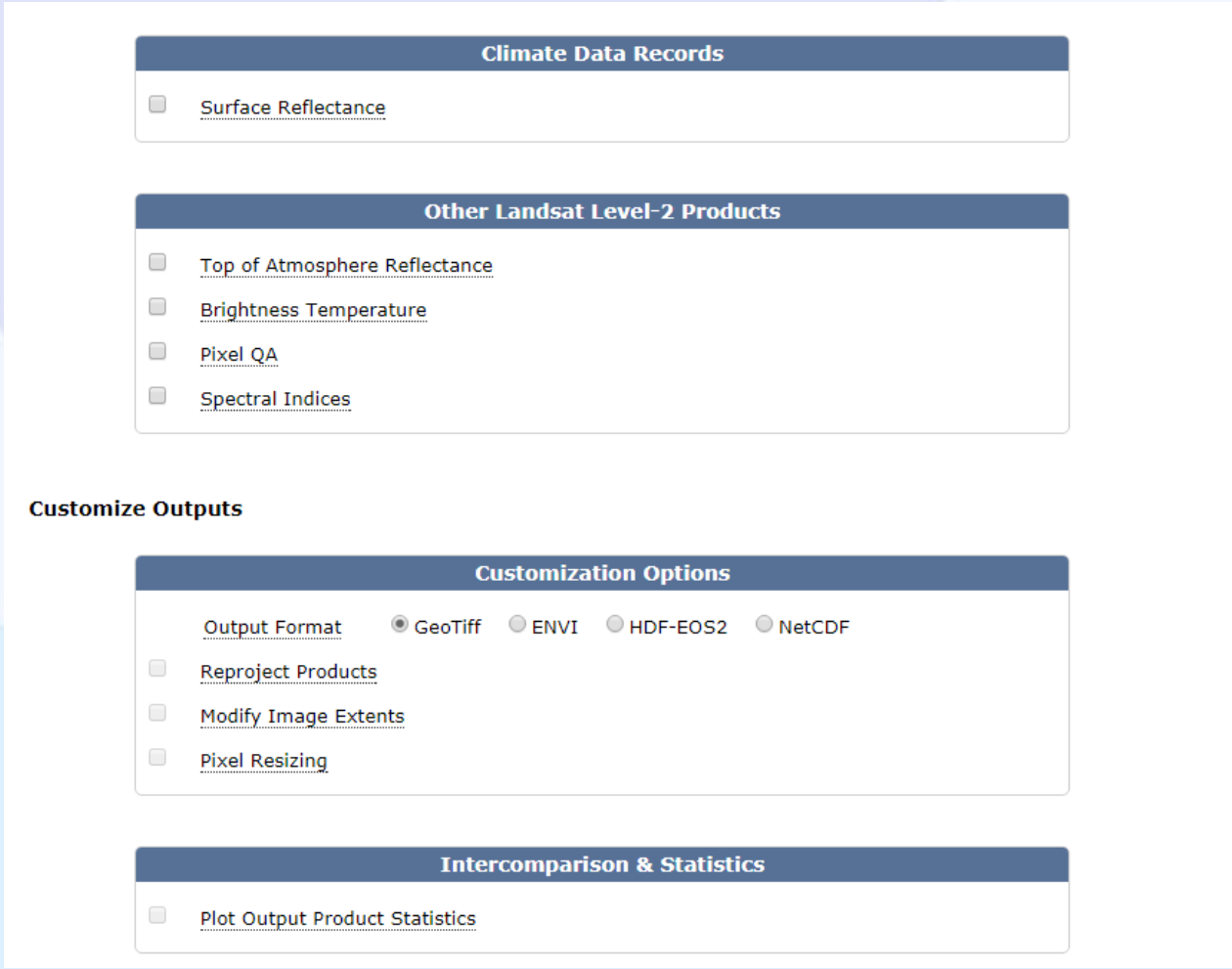
2017 Highlight…. seamless handoff of data from inventory/ordering to processing system.



Custom Processing

Higher Level Products

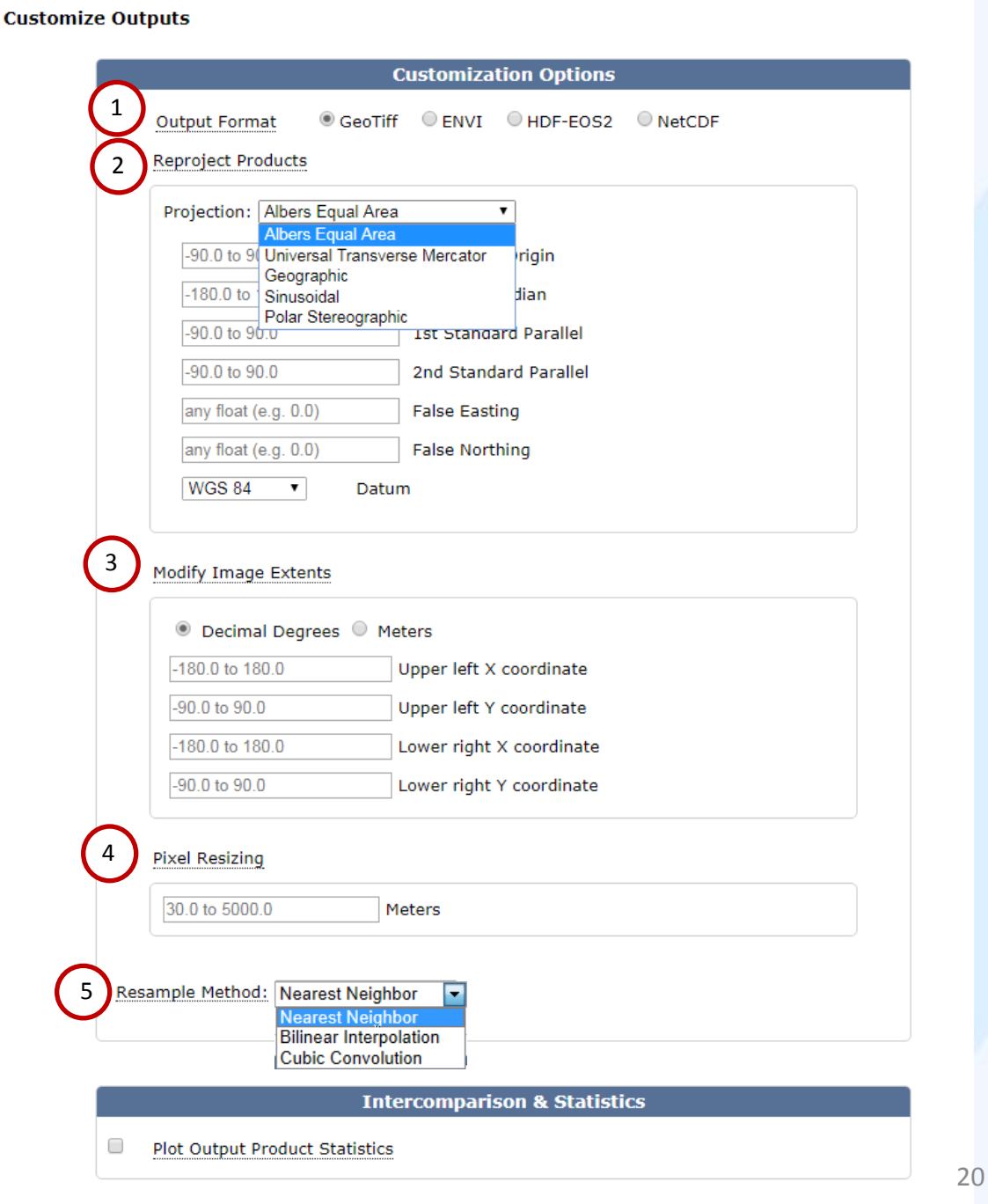
Choose higher level products from selected data. *Additional ECVs and CDRs will be added to menu as available.*



Custom Processing

Define Output Products
Product Customization

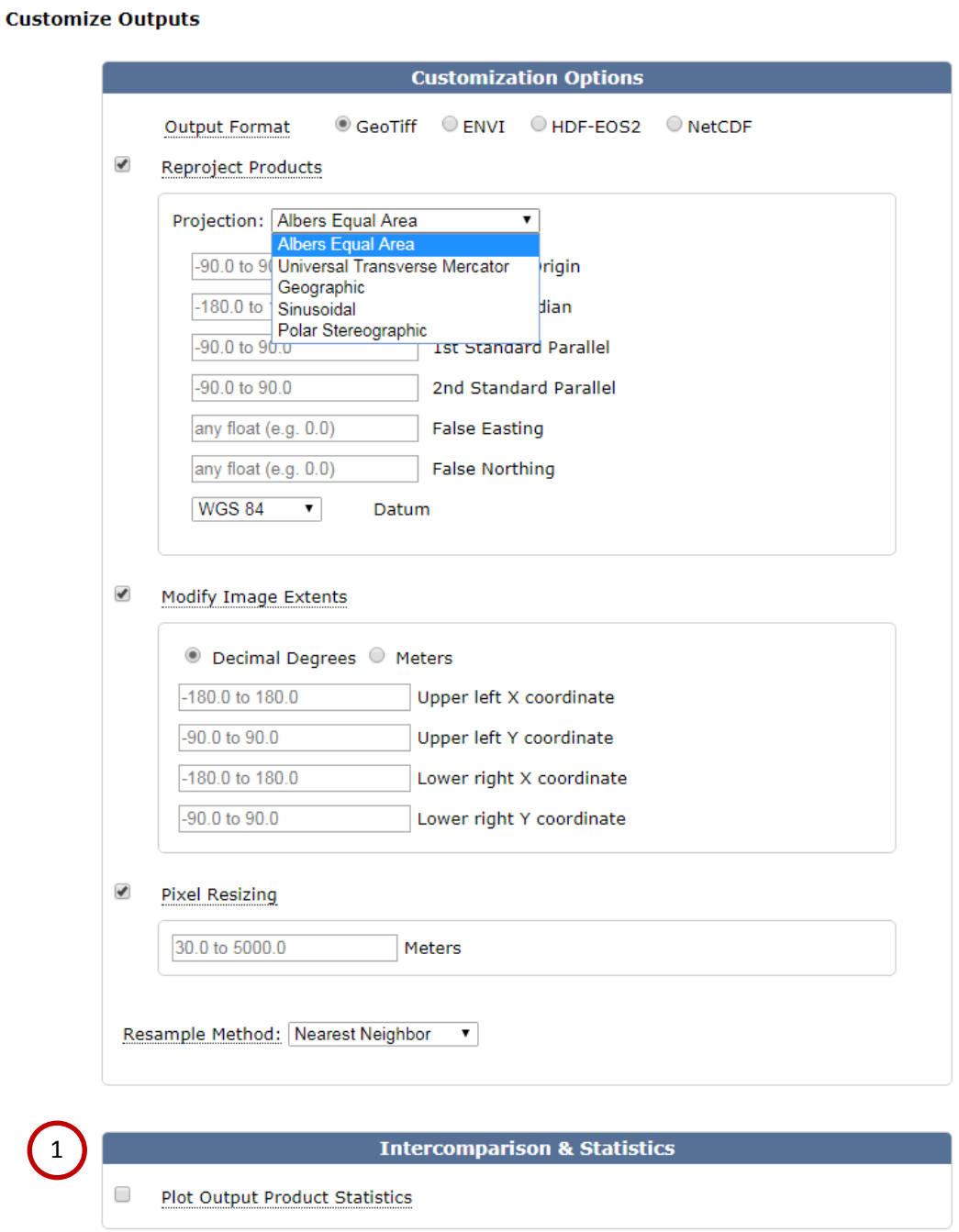
1. Several Output formats
2. Auto-registration of data to map projections
3. User defined area of interest
4. Defined pixel size for all images (30 – 5000 m)
5. Several resampling options



Custom Processing

Basic Analysis Tools

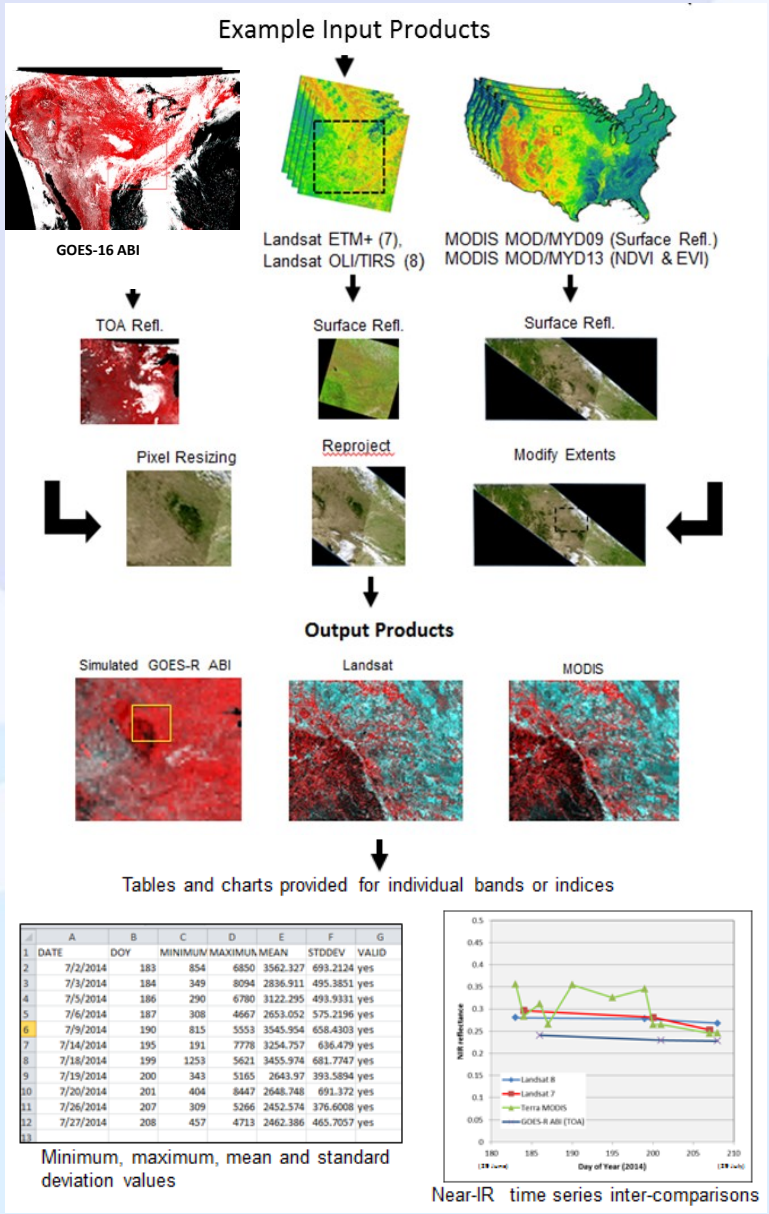
1. Product charts and tables



Custom Processing (summary)

Input products: *resized, remapped.*

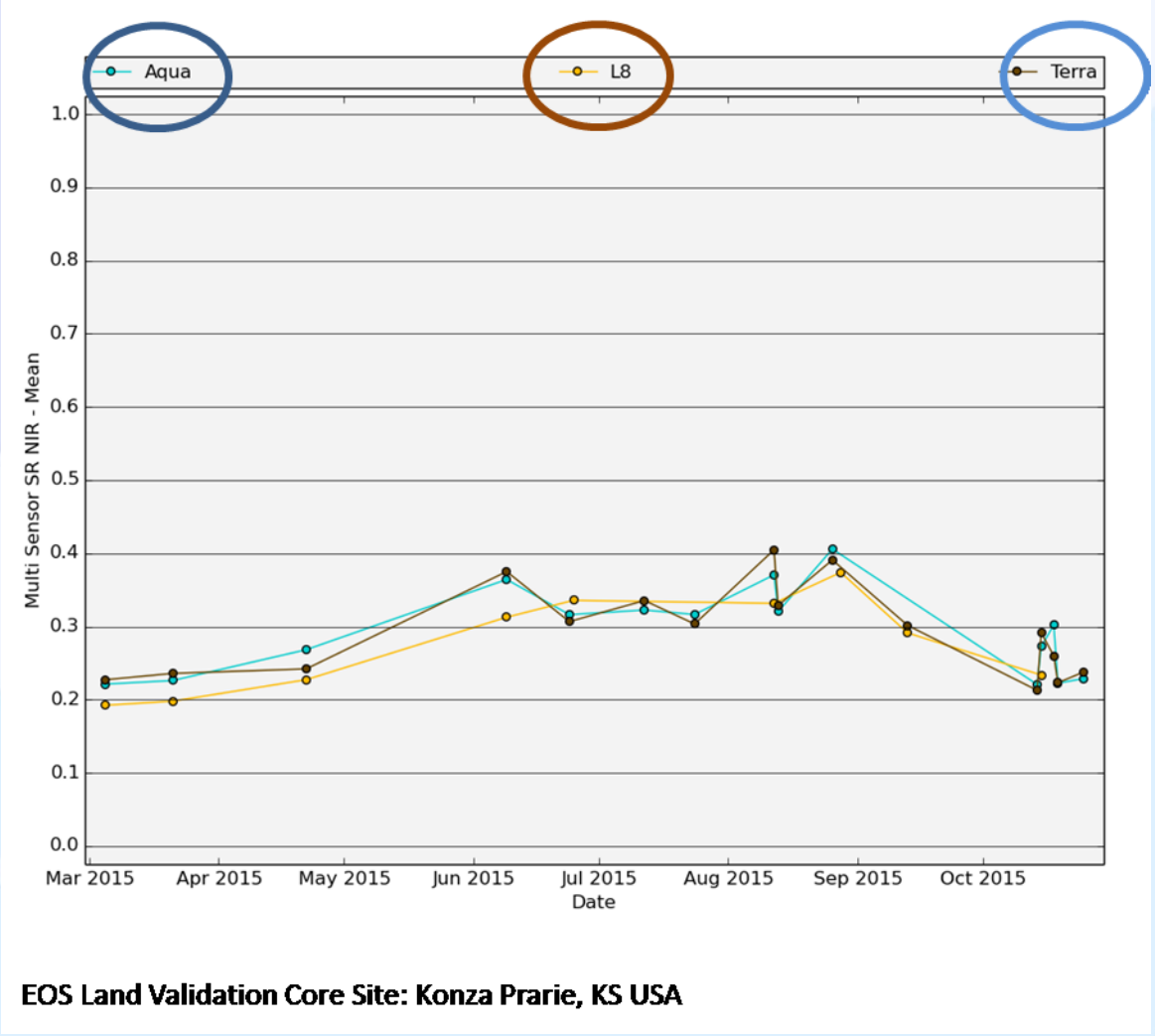
Output products*: images, charts, and tables.*



	A	B	C	D	E	F	G
1	DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV	VALID
2	7/2/2014	183	854	6850	3562.327	693.2124	yes
3	7/3/2014	184	349	8094	2836.911	495.3851	yes
4	7/5/2014	186	290	6780	3122.295	493.9331	yes
5	7/6/2014	187	308	4667	2653.052	575.2196	yes
6	7/9/2014	190	815	5553	3545.954	658.4303	yes
7	7/14/2014	195	191	7778	3254.757	636.479	yes
8	7/18/2014	199	1253	5621	3455.974	681.7747	yes
9	7/19/2014	200	343	5165	2643.97	393.5894	yes
10	7/20/2014	201	404	8447	2648.748	691.372	yes
11	7/26/2014	207	309	5266	2452.574	376.6008	yes
12	7/27/2014	208	457	4713	2462.386	465.7057	yes
13							

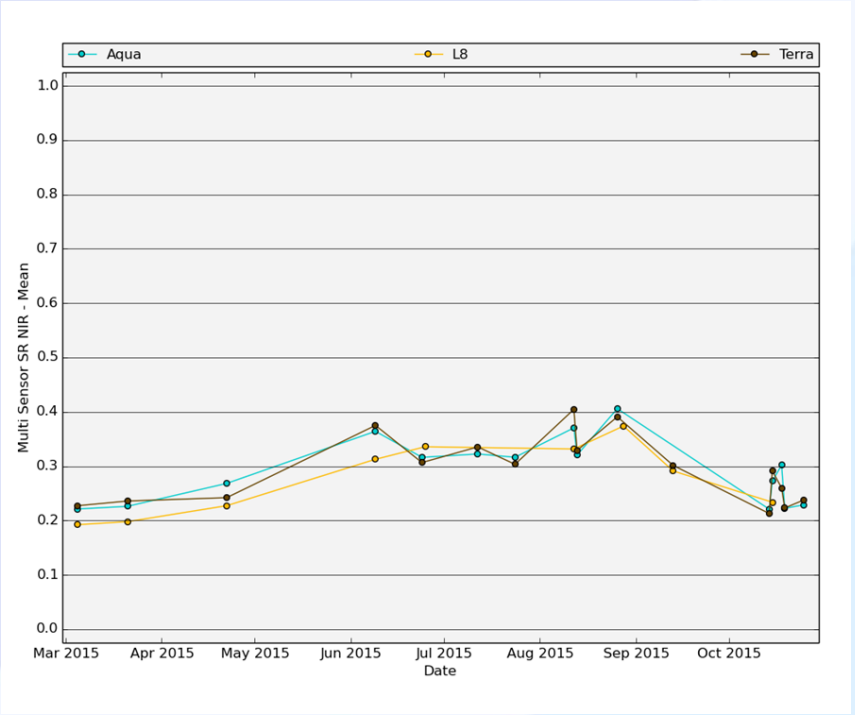
Analysis Tools

Output products include several charts, e.g., sensor values vs. time.



Near-IR Surface Reflectance (Aqua/MODIS, L8, and Terra/MODIS.

Analysis Tools



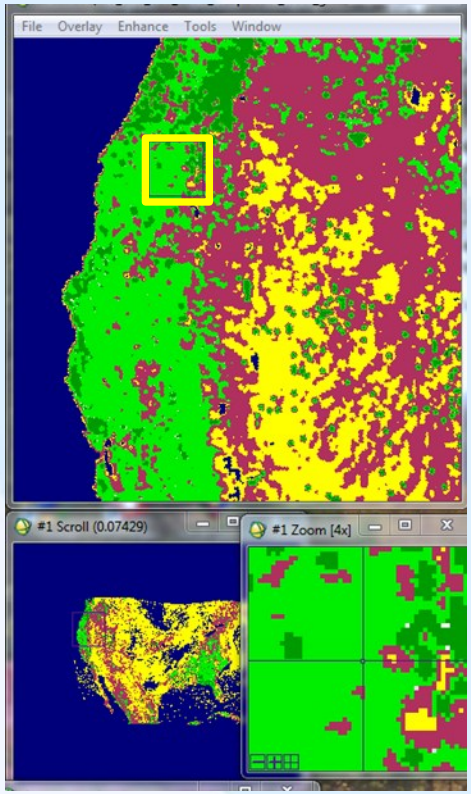
Tables provided with additional data for more intensive analyses.

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3/21/2015	80	86	3435	2260.46	283.6276	yes
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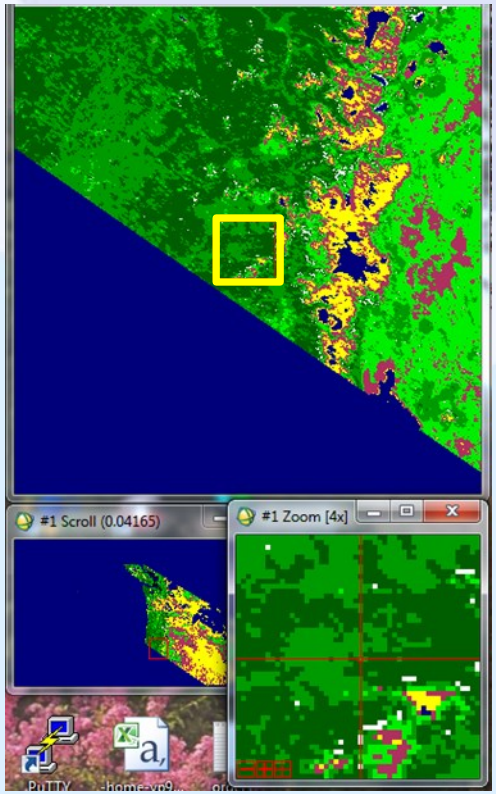
Analysis Tools

*LPCS also provides as output products **georegistered images** of input images for additional analysis (same map projection, cell size, etc., as defined within product customization).*

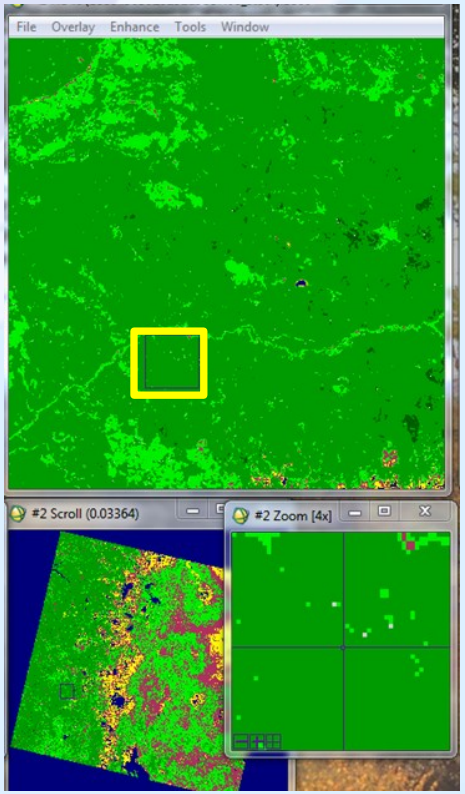
Simulated GOES-R ABI



VIIRS



Landsat 8



Land Product Characterization System (LPCS)

What is LPCS

Why LPCS developed/hosted at EROS

Highlights of LPCS

1. Inventory & Ordering
2. Analysis Tools

Path Forward

1. Status and Readiness
2. CEOS LPV collaboration

Summary

LPCS Status and Readiness

https://landsat.usgs.gov/lpcs

Public Release: February 2017

Includes a Landing Page and Tutorial



LPCS Status and Readiness

Introduction of future *data sets* and *analysis tools* within LPCS are planned, however, timing dependent on additional resources.

Current

MODIS

GSFC SBRC

Landsat 8



Under Development

Joint Polar Satellite System (JPSS) Visible Infrared Imaging Radiometer Suite (VIIRS)

NOAA-NASA Geostationary Operational Environmental Satellites - R Series (GOES-R)

Future

SENTINEL 2

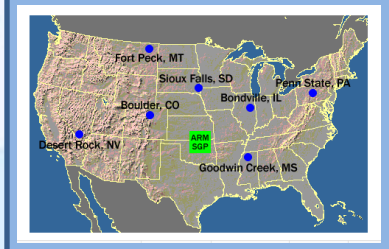
European Space Agency (ESA) Sentinel-2



sentinel-3

→ GMES MEDIUM RESOLUTION LAND AND OCEAN MISSION





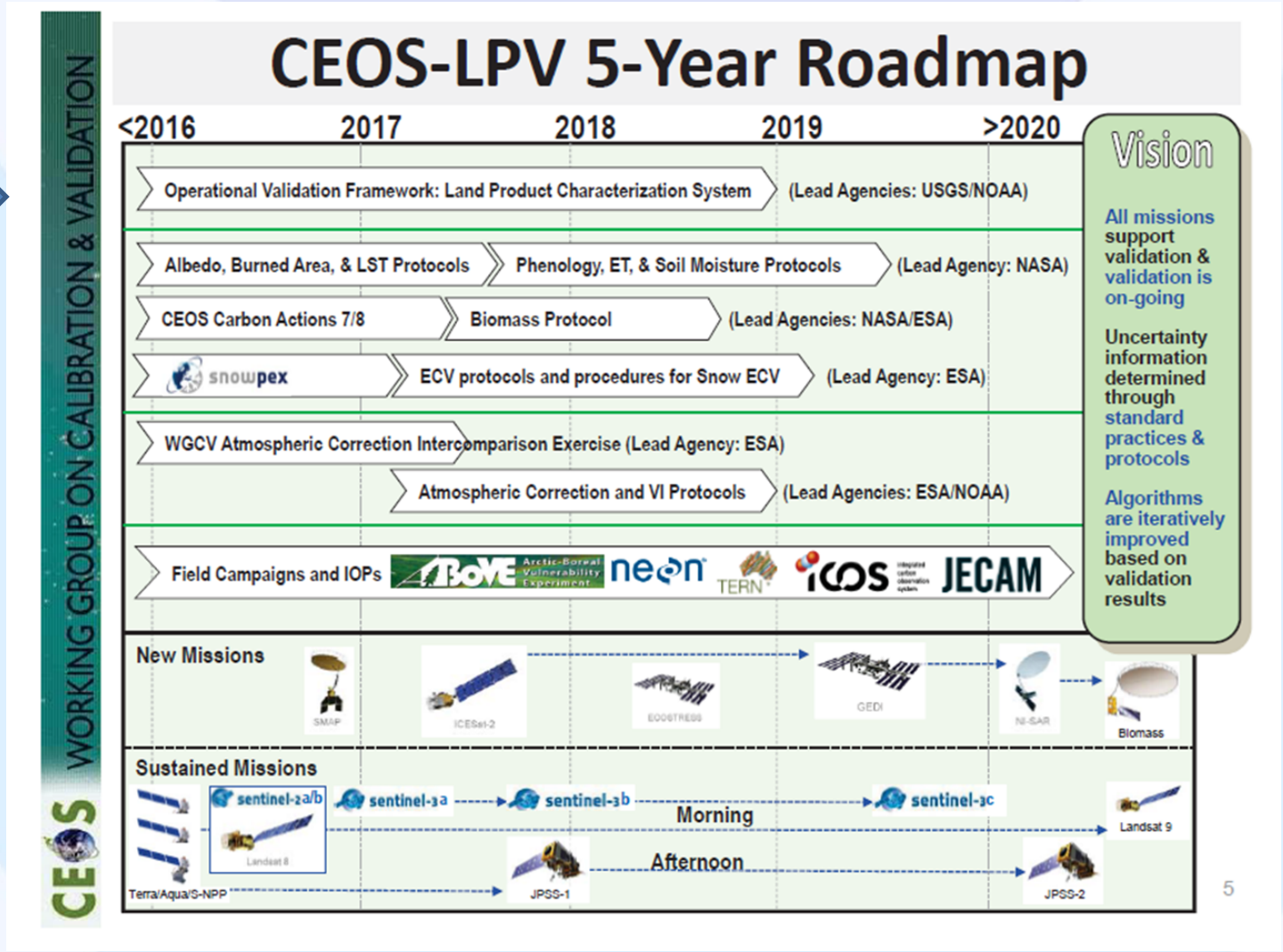
Surface Radiation Budget (SURFRAD) Network

The EOS Land Validation Core Sites



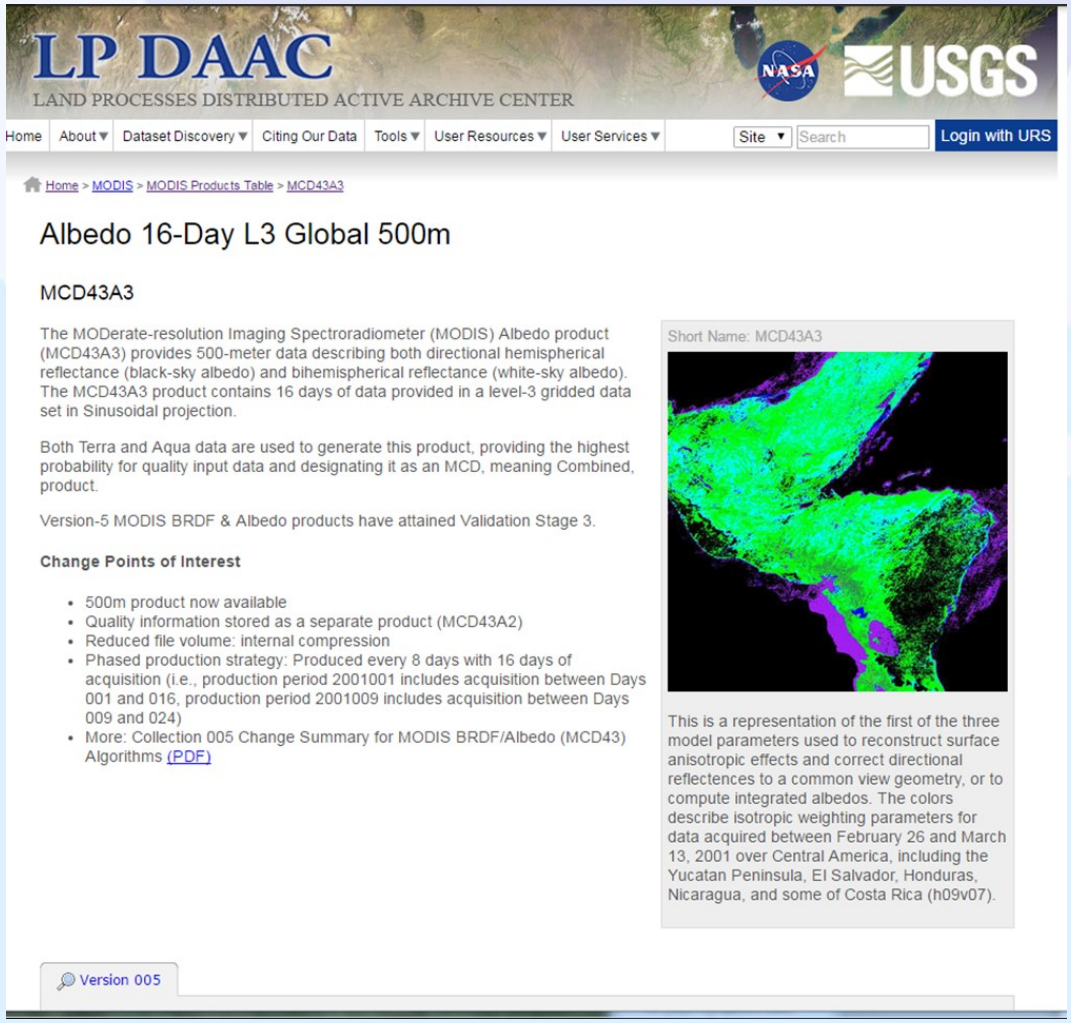
CEOS LPV collaboration

LPCS proposed/accepted as CEOS-LPV Online Validation Tool.



CEOS LPV collaboration

Albedo (MODIS MCD43A3) added to LPCS (limited capabilities) as requested by CEOS-LPV.



CEOS LPV collaboration

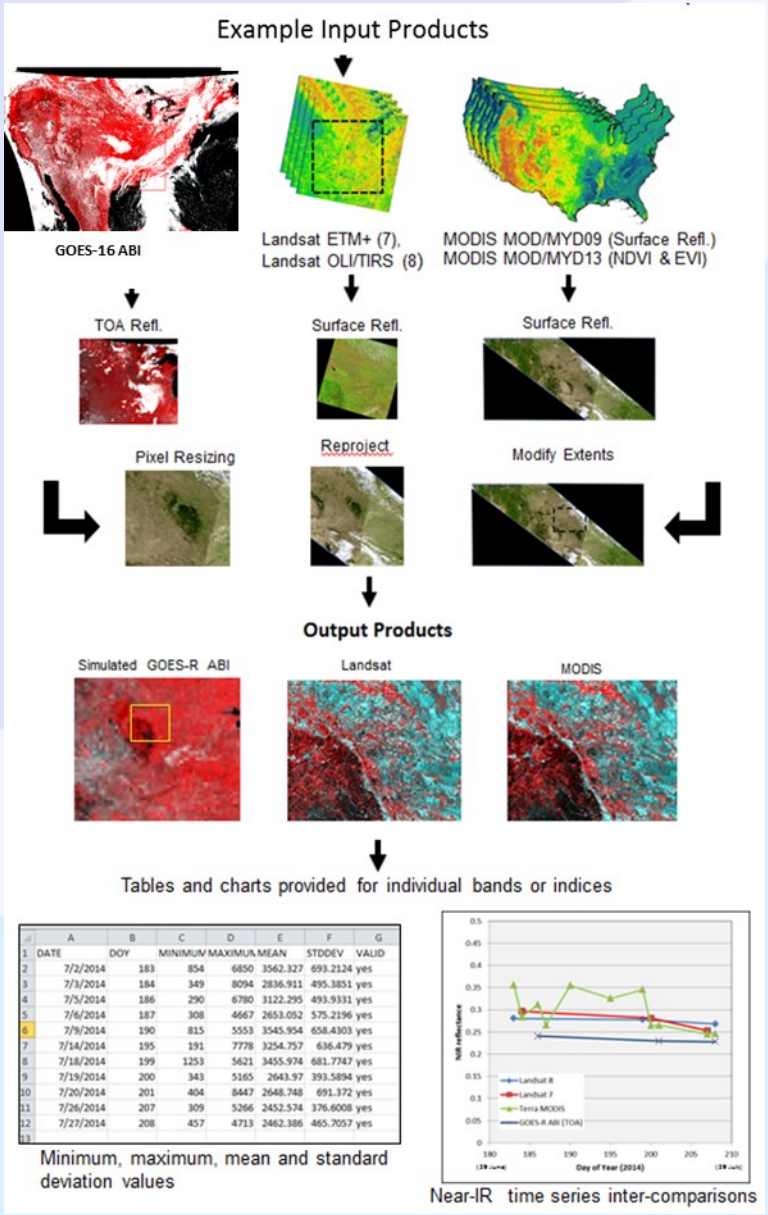
Additional analysis tools recommended by CEOS-LPV are under review for addition to LPCS.



Summary

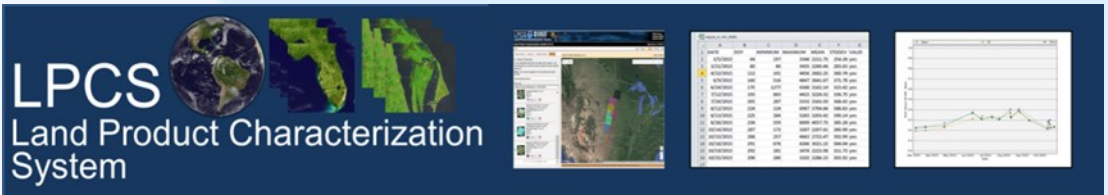
A web-based system designed for comparative analysis of global satellite higher-level land products.

- Search, Inventory & order data
- Advanced processing
- Basic analysis
- Output charts , images, & tables



LPCS Land Product Characterization System

Questions?



https://landsat.usgs.gov/lpcs