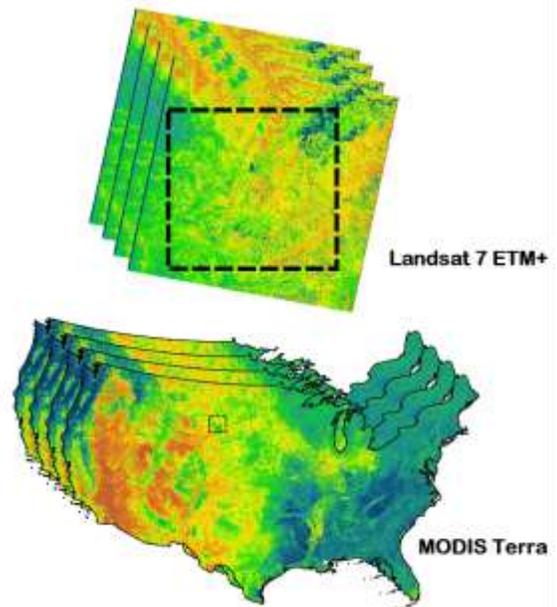
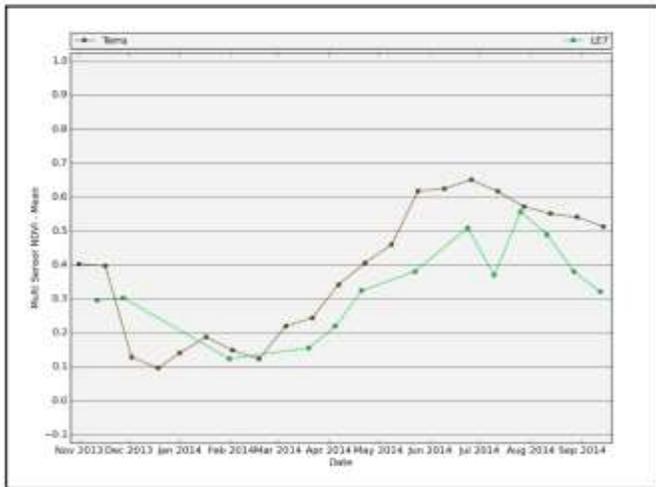


Department of the Interior  
U.S. Geological Survey

## USER GUIDE

### LAND PRODUCT CHARACTERIZATION SYSTEM (LPCS)



Version 2.7

December 2017



## Executive Summary

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This document describes the processes involved in generating per-scene and overlapping scene statistics for the Land Product Characterization System (LPCS), developed in collaboration between the U.S. Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA).

Please note that this document describes statistics generated from subsets of brightness values (BVs) extracted from Landsat 4, 5, 7, and 8 Collection 1 scenes, as well as select\* Moderate Resolution Imaging Spectroradiometer (MODIS) MOD/MYD09 and MOD/MYD13 scenes. Instructions for ordering these products are found in the [ESPA On Demand Interface User Guide](#).

\* Select data products include MODIS Aqua (MYD) and Terra (MOD) 09A1, 09GA, 09GQ, 09Q1, 13Q1, 13A1, 13A2, and 13A3. More information about MODIS products is found at [https://lpdaac.usgs.gov/dataset\\_discovery/modis/modis\\_products\\_table](https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table).

## Document History

Document Version	Publication Date	Change Description
Version 1.0	09/16/2014	Initial Draft
Version 1.1	10/14/2014	Addition of "valid" flag in per-band CSV file.
Version 1.2	11/01/2014	Updated cover figure.
Version 1.3	12/23/2014	Added descriptions for Landsat 8 OLI/TIRS products. Updated cover figure. Added additional acronym descriptions.
Version 1.4	01/09/2015	Edits for typographical and figure reference errors.
Version 1.5	03/06/2015	Added section for user interface steps for LPCS interface. Added product limitations to "Caveats and Constraints" section. Updated product guide formatting.
Version 1.6	05/27/2015	Removed Landsat 8 TIRS processing caveat.
Version 1.7	9/29/2015	Corrected URL for MODIS data products and Spectral Indices
Version 1.8	12/01/2015	Corrected small typos. Added simulated GOES-R ABI, NOAA VIIRS, and NASA VIIRS datasets (none available for statistics generation at this time).
Version 1.9	12/16/2015	Added caveat for maximum pixel count per grid. Updated tables to indicate cloud mask (CFmask) ordering option for Landsat products. Updated "stats" output formatting changes (now CSV instead of text file).
Version 2.0	05/10/2016	Switched nomenclature from "Product Guide" to "User Guide" to better reflect guide's purpose. Added additional caveats and constrains related to Landsat Surface Reflectance and usability of sample products (GOES-R ABI, VIIRS) in LPCS. Changed references from "CDR" to "Surface Reflectance" (more specific).
Version 2.1	07/01/2016	Updated name and links to Landsat 8 Surface Reflectance Code (LaSRC) product and product guide.
Version 2.2	11/01/2016	Updated instructions on placing orders – now go from LPCS directly to ESPA. Fixed broken LP DAAC "Citing Our Data" link.

Version 2.3	11/28/2016	Update to "Caveats and Constraints" to indicate temporal gaps exist for some products.
Version 2.4	12/07/2016	Replaced links to Landsat Missions Website.
Version 2.5	01/30/2017	Replaced any instance of GOES-R with GOES-16.
Version 2.6	05/23/2017	Removed Landsat Pre-Collection information and replaced with Landsat Collection 1.
Version 2.7	12/04/2017	Added "top of atmosphere" before "brightness temperature" to clarify that BT products are not atmospherically corrected

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## Section 1 Introduction

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The long-term acquisition and subsequent archiving of remotely sensed imagery continuously provides an ever-growing record for land surface change. The Land Product Characterization System (LPCS) allows for the generation of statistics from one or more pixels from spatially overlapping Landsat 4-5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager/Thermal Infrared Sensor (OLI/TIRS) Collection 1 scenes, and select Moderate Resolution Imaging Spectroradiometer (MODIS) Terra and Aqua Surface Reflectance (MOD/MYD09) and Vegetation Indices (MOD/MYD13). The minimum, maximum, mean, and standard deviation are calculated from within a user-defined bounding box. Statistical results are provided in two different directories:

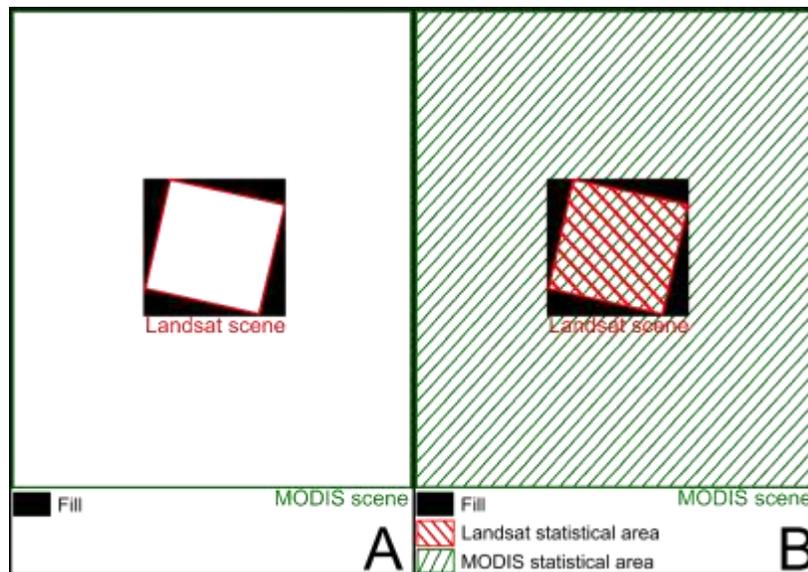
- 1) As a “stats” folder within each unique product identifier’s (Product ID) .tar.gz archive, containing text files for each band.
- 2) As a separate .tar.gz archive, named with the “-statistics” suffix. Within the archive, two file types exist:
  - a. Plots of individual bands and plots of each band across different sensors (if applicable).
  - b. Comma-Separated Value (.csv) files corresponding to each plot.

Each output type is explained in detail in **Section 5 Output Formats**.

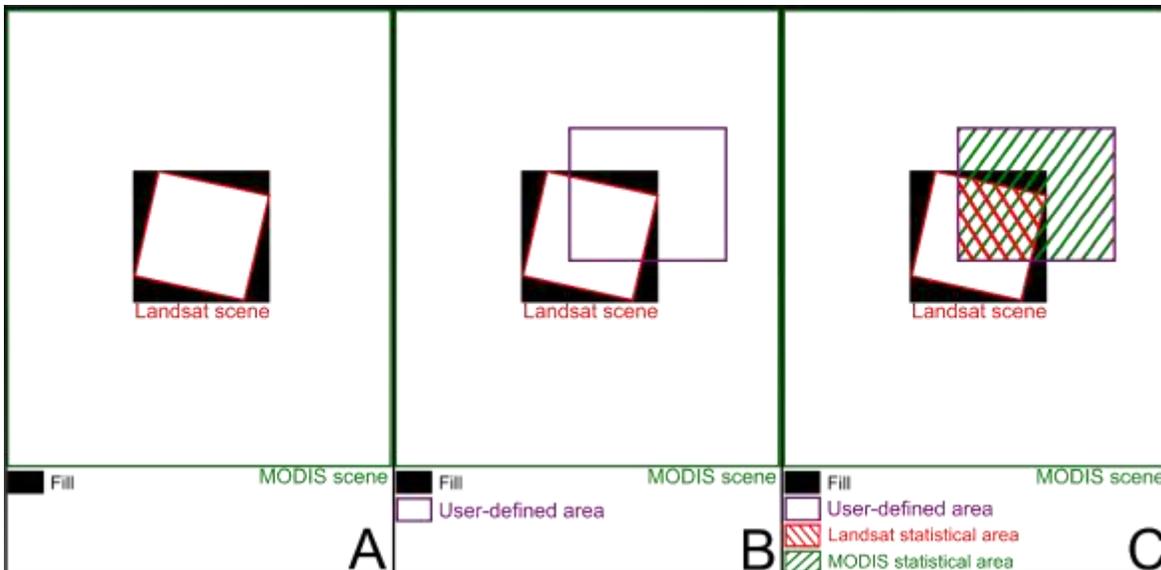
## Section 2 Caveats and Constraints

---

- 1) Only Landsat 4-8 Collection 1, MODIS MOD/MYD09 and MOD/MYD13 data products can be processed and have statistics generated through the ESPA system.
- 2) The sample datasets available through LPCS – Simulated GOES-16 ABI NDVI, NASA VIIRS NDVI, and NOAA VIIRS NDVI can be downloaded, but cannot be processed and/or have statistics generated via ESPA at this time.
- 3) Statistical analysis is performed only on areas occurring within the user-defined mask. Examples of how statistical areas are selected are shown in **Figure 2-1** and **Figure 2-2**.



**Figure 2-1 A) Base image comparison of a Landsat scene (red) within a Moderate Resolution Imaging Spectroradiometer (MODIS) scene (green). B) Statistical areas generated through Land Product Characterization System (LPCS) include overlap between the Landsat scene (red stripes) and the MODIS scene (green stripes).**



**Figure 2-2 A) Base image comparison of a Landsat scene (red) within a Moderate Resolution Imaging Spectroradiometer (MODIS) scene (green). B) User-defined area for statistical analysis added (purple). C) Statistical areas generated within user-defined boundary (purple) for the Landsat scene (red stripes) and the MODIS scene (green stripes).**

- 4) Alignment of statistical zones between MODIS (natively Sinusoidal) and Landsat (natively Universal Transverse Mercator (UTM)) requires that both products be projected to a common grid.
- 5) There are no constraints on generating statistics based upon ESPA's customization options. All output formats, projections, image extents, and pixel resizing are compatible with statistical generation.
- 6) Due to system limitations, image extents in ESPA cannot exceed 200 million pixels per band.
- 7) Specific pixel types will not be included in the statistical calculation:
  - a) Areas masked as NoData (e.g., scene edges, Scan Line Corrector (SLC)-off data gaps).
  - b) Areas of the scene not included within the study area mask (i.e., user-defined area), if specified.
  - c) Pixels beyond the valid range of data. Valid ranges are described in **Table 2-1**.
- 8) The Landsat 4-7 Surface Reflectance algorithm (LEDAPS) is different from the Landsat 8 Surface Reflectance Code (LaSRC) algorithm. Additional caveats and constraints for each dataset are described in the [Landsat 4-7 SR Product Guide](#) and the [Landsat 8 Surface Reflectance Code \(LaSRC\) Product Guide](#).

- 9) Some Landsat acquisitions cannot be processed to Surface Reflectance due to anomalies such as missing thermal or missing ancillary data. A full list of data gaps are listed under “Caveats and Constraints” at <https://landsat.usgs.gov/landsat-surface-reflectance-high-level-data-products>.

**Table 2-1 Valid ranges by date type.**

*SR Surface Reflectance, TOA Top of Atmosphere, SI Spectral Indices, BT Top of Atmosphere Brightness Temperature*

<b>Data Product</b>	<b>Valid Range</b>	<b>Scale Factor</b>	<b>Plot Display Range</b>
Surface Reflectance (SR)	0 – 10000	0.0001	0.0 – 1.0
Top of Atmosphere Reflectance (TOA)	0 – 10000	0.0001	0.0 – 1.0
Spectral Indices (SIs)	-10000 – 10000	0.0001	0.0 – 1.0
TOA Brightness Temperature (BT)	0 – 10000	0.1	0.0 – 1.0
Emissivity	1 – 255	1.0	0.0 – 1.0

More information about the Landsat data products and their valid ranges can be found in the [Landsat 4-7 Surface Reflectance Product Guide](#), the [Landsat 8 Surface Reflectance Code \(LaSRC\) Product Guide](#), and the [Surface Reflectance-Derived Spectral Indices \(SI\) Product Guide](#). MODIS data product information can be found in the [LP DAAC MODIS Data Products Table](#).

## Section 3 Product Options

Through the [ESPA On Demand Interface](#), statistics can be generated by selecting the “Plot Output Product Statistics” button under the “Intercomparison & Statistics” category. More information about the product ordering procedure is in **Section 4 LPCS Interface**.

The full list of available products is shown in **Table 3-1**. The possible output ranges, or valid ranges, are described in **Table 2-1**. The user-defined bounding box extent determines the area of statistical analysis. Data within the bounding box will have statistics calculated; if no bounding box is specified, statistics will be calculated for the entire scene, regardless of overlap. Please refer to **Section 2 Caveats and Constraints** regarding extent parameters.

**Table 3-1 Available products for statistics generation.**

*SR Surface Reflectance, TOA Top of Atmosphere, BT Top of Atmosphere Brightness Temperature, NDVI Normalized Difference Vegetation Index, NDMI Normalized Difference Moisture Index, NBR Normalized Burn Ratio, NBR2 Normalized Burn Ratio 2, SAVI Soil Adjusted Vegetation Index, MSAVI Modified Soil Adjusted Vegetation Index, EVI Enhanced Vegetation Index, TM Thematic Mapper, ETM+ Enhanced Thematic Mapper Plus, OLI Operational Land Imager, TIRS Thermal Infrared Sensor, MOD MODIS Terra, MYD MODIS Aqua, 09A1 Surface Reflectance 8-Day L3 Global 500m, 09GA Surface Reflectance Daily L2G Global 1 km and 500m, 09GQ Surface Reflectance Daily L2G Global 250m, 09Q1 Surface Reflectance 8-Day L3 Global 250m, 13Q1 Vegetation Indices 16-Day L3 Global 250m, 13A1 Vegetation Indices 16-Day L3 Global 500m, 13A2 Vegetation Indices 16-Day L3 Global 1km, 13A3 Vegetation Indices Monthly L3 Global 1km*

Product	Landsat Collection 1			MODIS Terra (MOD) and Aqua (MYD)							
	Landsat 4/5 TM	Landsat 7 ETM+	Landsat 8 OLI/TIRS	09A1	09GA	09GQ	09Q1	13Q1	13A1	13A2	13A3
Surface Reflectance (SR)	X	X	X	X*	X**	X**	X**				
Top of Atmosphere (TOA)	X	X	X								
TOA Brightness Temperature (BT)	X	X	X								
CFmask	X	X	X								
NDVI	X	X	X					X	X	X	X
NDMI	X	X	X								
NBR	X	X	X								
NBR2	X	X	X								
SAVI	X	X	X								
MSAVI	X	X	X								
EVI	X	X	X					X	X	X	X

\* MODIS surface reflectance bands 1 through 7.

\*\* MODIS surface reflectance bands 1 and 2.

## Section 4 LPCS Interface

The LPCS interface (<https://lpcsexplorer.cr.usgs.gov/>) allows users to query and generate Landsat and MODIS ProductIDs for statistical characterization. The LPCS interface is based upon the USGS EarthExplorer interface: <https://earthexplorer.usgs.gov/>.

An expanded explanation of the advanced EarthExplorer search features are found at: [https://lta.cr.usgs.gov/ee\\_tutorial\\_search\\_criteria](https://lta.cr.usgs.gov/ee_tutorial_search_criteria).

Below is an example of how to place a simple order through the LPCS interface.



The screenshot displays the LPCS (Land Product Characterization System) interface. The top navigation bar includes the USGS logo, the text "LPCS Land Product Characterization System", and links for "USGS Home", "Contact USGS", and "Search USGS". Below this, a secondary bar shows "Land Product Characterization System (LPCS)" and a "Page Expires In 1:58:03" indicator. The main content area is divided into a left sidebar and a right map area. The sidebar, titled "1. Enter Search Criteria", provides instructions and form fields for "Address/Place", "Coordinates", and "Date Range". The "Date Range" section shows a search from 01/01/1920 to 02/04/2015. The right map area, titled "Search Criteria Summary", shows a satellite view of North America with a search area highlighted. The bottom of the page contains a footer with accessibility links, FOIA, Privacy, Policies and Notices, Google Maps API Disclaimer, and USGS contact information.

**Figure 4-1** LPCS interface (<https://lpcsexplorer.cr.usgs.gov/>) home page. Select “Login” from the top-right corner, and use USGS Registration credentials to login.

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.

Address/Place   **Path/Row**   Feature   Circle

Point   Polygon

Type: WRS2 ▾ Path: 27 Row: 33

Show   Clear

Coordinates   Predefined Area   Shapefile   KML

Degree/Minute/Second   Decimal

*No coordinates selected.*

Use Map   Add Coordinate   Clear Coordinates

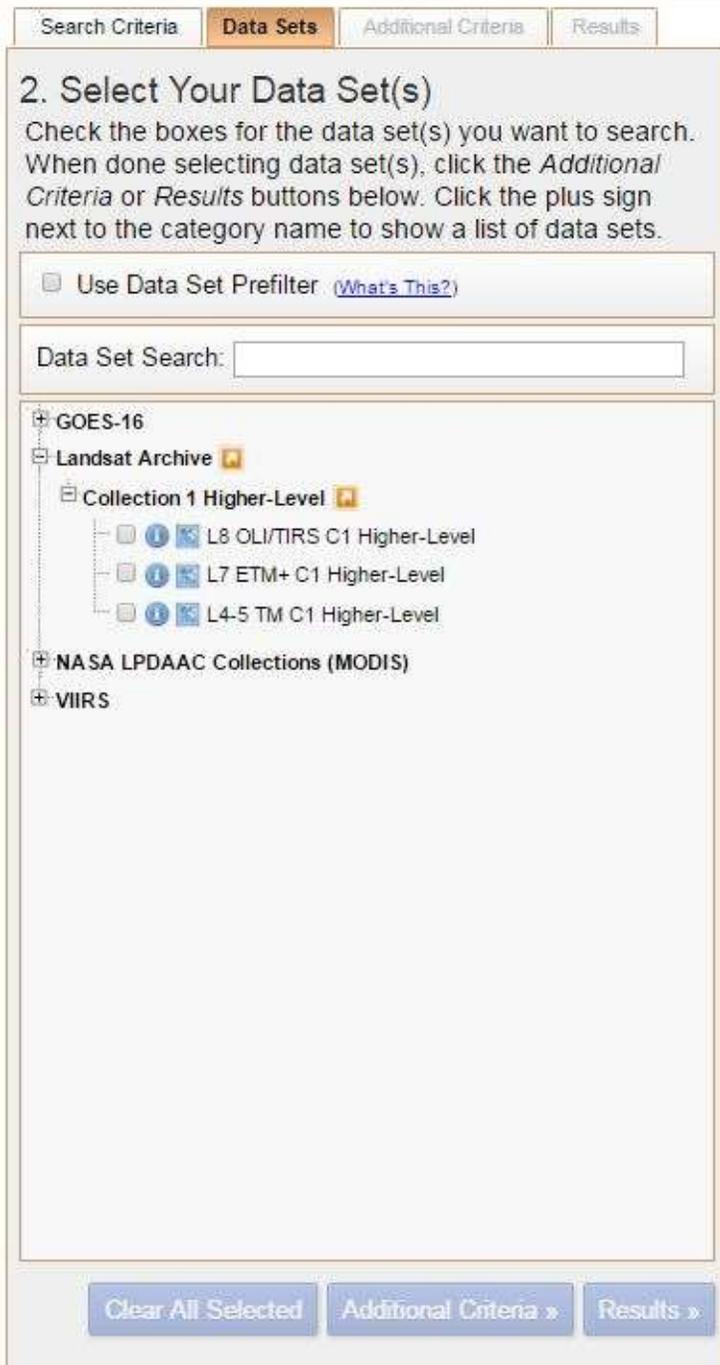
Date Range   Result Options

Search from: 01/01/1920 to: 02/04/2015

Search months: (all) ▾

Data Sets »   Additional Criteria »   Results »

**Figure 4-2** LPCS interface (<https://lpcsexplorer.cr.usgs.gov/>) Search Criteria tab. Regions of interest can be selected by address or place, WRS Path/Row, feature, circle, coordinates, or a predefined area. The date(s) of interest can be filtered from beginning (“from”) to the end (“to”).



**Figure 4-3** LPCS interface (<https://lpcsexplorer.cr.usgs.gov/>) Data Sets tab. Available products are Landsat 4-8 Collection 1 Surface Reflectance, MODIS Surface Reflectance/Vegetation Indices, Simulated GOES-16 ABI NDVI, NOAA VIIRS NDVI, and/or NASA VIIRS NDVI. Note that the latter three datasets can be downloaded, but not processed through the ESPA system at this time.

Search Criteria   Data Sets   **Additional Criteria**   Results

### 3. Additional Criteria (Optional)

If you have more than one data set selected, use the dropdown to select the additional criteria for each data sets.

Data Sets:  
 L8 OLI/TIRS C1 Higher-Level ▾

**L8 OLI/TIRS C1 Higher-Level**

Landsat Product Identifier

WRS Path  
 to

WRS Row  
 to

Land Cloud Cover

All ▾  
 Less than 10%  
 Less than 20%  
 Less than 30%  
 Less than 40% ▾

Scene Cloud Cover

All ▾  
 Less than 10%  
 Less than 20%  
 Less than 30%  
 Less than 40% ▾

Collection Category ▾

**Figure 4-4** LPCS interface (<https://ipcexplorer.cr.usgs.gov/>) **Additional Criteria** tab. Landsat products can be filtered by the following criteria: individual Landsat Product Identifier (Product ID), WRS Path range, WRS Row range, Sensor ID, Data Type Level 1, Data Type LORP, Cloud Cover, and Day/Night scenes. MODIS products can be filtered by the following criteria (not shown): Entity ID, Horizontal Tile range, Vertical Tile range, and Day/Night scenes.

Search Criteria   Data Sets   Additional Criteria   **Results**

### 4. Search Results

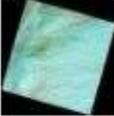
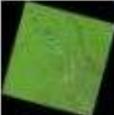
If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

**Note:** You must be logged in to download and order scenes

Show Result Controls ▾

Data Set

L8 OLI/TIRS C1 Higher-Level ▾

7	 <p>ID:LC08_L1GT_028030_20150828_20170225_01_T2            Acquisition Date:28-AUG-15            Path:28            Row:30</p> 
8	 <p>ID:LC08_L1TP_027030_20150821_20170225_01_T1            Acquisition Date:21-AUG-15            Path:27            Row:30</p> 
9	 <p>ID:LC08_L1TP_027031_20150821_20170225_01_T1            Acquisition Date:21-AUG-15            Path:27            Row:31</p> 
10	 <p>ID:LC08_L1TP_028030_20150812_20170226_01_T1            Acquisition Date:12-AUG-15            Path:28            Row:30</p> 

« First < Previous 1 ▾ Next > Last »

**Figure 4-5** LPCS interface (<https://ipcsexplorer.cr.usgs.gov/>) Results tab. Products can be added to the Item Basket by clicking on the Cart icon.

To complete your order click on the "Select Processing Options" button at the bottom of the page. You will be taken to the ESPA website to complete your order.

## Order

[Clear All](#)

▼ L8 OLI/TIRS C1 Higher-Level (3)

▼ L7 ETM+ C1 Higher-Level (1)

Clear Item Basket

Select Processing Options

**Figure 4-6 LPCS interface (<https://ipcexplorer.cr.usgs.gov/>) Item Basket. The "Select Processing Options" option passes selected Product IDs for both Landsat and MODIS products to the Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) Interface (<https://espa.cr.usgs.gov/>).**

### Add Input Products ([Show Available Products](#))

Scene List
LC08_L1GT_156021_20170207_20170216_01_T2,LE07_L1TP_105070_20160717_20161010_01_T1,LT05_L1TP_032028_20120425_20160830_01_T1

### Select Product Contents

Source Products
<input type="checkbox"/> Input Products
<input type="checkbox"/> Input Product Metadata

### Additional Processing (Landsat Only)

Climate Data Records
<input type="checkbox"/> Surface Reflectance

Other Landsat Level-2 Products
<input type="checkbox"/> Top of Atmosphere Reflectance
<input type="checkbox"/> Brightness Temperature
<input type="checkbox"/> CFMask
<input type="checkbox"/> Spectral Indices

**Figure 4-7 Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) Interface (<https://espa.cr.usgs.gov/>) LPCS Select Processing Options option. LPCS automatically passes the Product IDs from LPCSExplorer to ESPA**

for product customization. Detailed information on other ESPA products and processing options are found at:

[https://landsat.usgs.gov/sites/default/files/documents/espa\\_odi\\_userguide.pdf](https://landsat.usgs.gov/sites/default/files/documents/espa_odi_userguide.pdf).



**Figure 4-8 Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) Interface (<https://espa.cr.usgs.gov/>) Intercomparison & Statistics option. This option must be selected for statistics files to be generated from ESPA.**

Detailed information on other ESPA products and processing options are found at:

[https://landsat.usgs.gov/sites/default/files/documents/espa\\_odi\\_userguide.pdf](https://landsat.usgs.gov/sites/default/files/documents/espa_odi_userguide.pdf).

## Section 5 Output Formats

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### 5.1 “Stats” Folder

For each scene, statistics are output to a folder named “stats” containing raw data (CSV files) and plots (PNG files). An example of the folder contents is shown in **Appendix A Landsat “Stats” Directory File Characteristics**. Each data type and its related statistic are separated by an equal sign (=) without spaces. All data in the output text files are represented as their true value and not the scaled range. Data are displayed as floating-point values with six digits of precision. For example, the .stats file for band 1 surface reflectance of Landsat scene LE07\_L1TP\_105070\_20160717\_20161010\_01\_T1 is formatted as follows:

```
FILENAME=LE07_L1TP_105070_20160717_20161010_01_T1_sr_band1.img
MINIMUM=0.000000
MAXIMUM=3451.000000
MEAN=425.086616
STDDEV=103.320924
VALID=yes
```

### 5.2 Statistics Archive File

On the ESPA order status page, the statistics archive is downloadable under the ID named “Plotting and Statistics.” Each .tar.gz archive is named with the order ID as the prefix and “-statistics” as the suffix. Each statistic is separated by band but grouped together by sensor platform type. The groups of sensors are plotted by band and output as a separate statistics CSV file (

**Table 5-1**). In cases where a band may not have any values within the valid range, such as pixel saturation, the statistics will be reported as “-9999” and the VALID cell will be flagged with “no”. Each CSV file is written by row and contains a header in the first row. All bands are plotted together with the prefix “multi\_sensor\_” and are plotted against one another. An example of the archive contents is shown in **Appendix B Statistics Archive File Characteristics**.

**Table 5-1. Example of statistics CSV file generated by Land Product Characterization System (LPCS) for two example Landsat 7 Enhanced Thematic Mapper Plus (ETM+) shortwave infrared (SWIR) bands.**

*DOY Day of Year, STDDEV Standard deviation*

DATE	DOY	MINIMUM	MAXIMUM	MEAN	STDDEV	VALID
06/01/2010	152	19	5809	3857.950778	1653.534669	yes
07/01/2010	182	46	7948	3654.072626	824.665897	yes

## 5.4 Plots

Plots are displayed with the date on the X axis (in date format MMM DD YYYY) and individual bands scaled as 0.0 to 1.0 on the Y axis. Plots can represent the following statistics: minimum, maximum, mean, standard deviation, or a combination of minimum-maximum-mean. All data points are represented with a color-coded point, where the color represents a specific sensor platform (**Figure 5-1**). In the minimum-maximum-mean plot, the point represents the mean, the vertical line above the point represents the maximum value, and the vertical line below the point represents the minimum value (**Figure 5-2**). Multiple sensors across similar time scales are represented by different colors of lines and points, shown in **Figure 5-3**. Multi-sensor plots use the same statistics as the individual sensor plots discussed above.

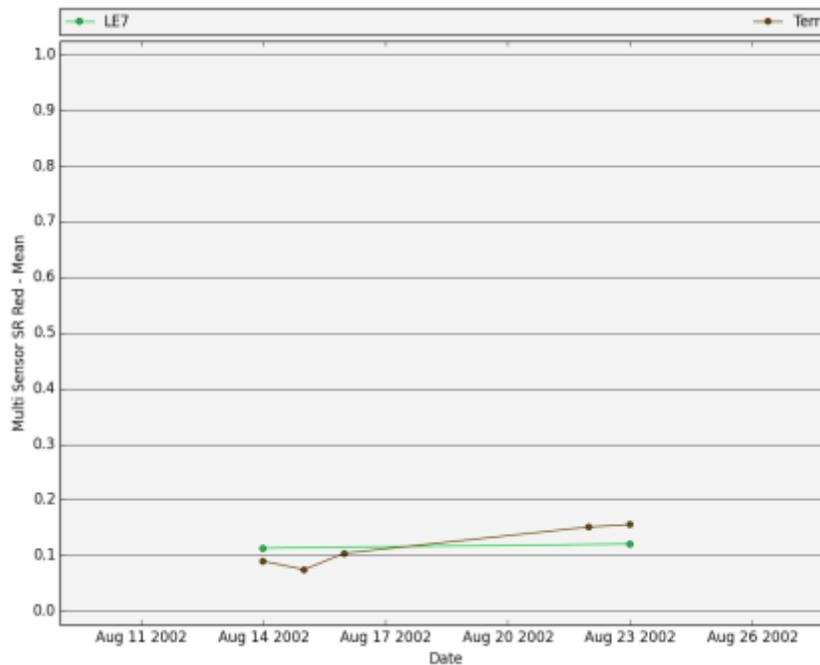
Note that plots are only generated for orders containing two or more scenes for each sensor. For example, an order of two Landsat ETM+ scenes and one MODIS MYD09 scene would generate plots for “landsat” and “multi\_sensor,” but not for “modis.”



**Figure 5-1. Example of mean plot generated by Land Product Characterization System (LPCS) for the Landsat 7 Enhanced Thematic Mapper Plus (ETM+) shortwave infrared (SWIR) band from two different scenes.**



**Figure 5-2. Example of minimum-maximum-mean plot generated by Land Product Characterization System (LPCS) for the Landsat 7 Enhanced Thematic Mapper Plus (ETM+) shortwave infrared (SWIR) band from two different scenes.**



**Figure 5-3 Example of multi-sensor mean plot generated by Land Product Characterization System (LPCS) for Landsat 7 Enhanced Thematic Mapper Plus (ETM+) and MODIS Terra (MOD) bands for two different scenes each.**

## Section 6 User Services

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LPCS and associated interfaces are supported by User Services staff at the USGS EROS Center. Any questions, comments, or interface problems are welcomed through the Landsat “Contact Us” online correspondence form. An email can also be sent to the customer service address included below, with the same indication of topic.

USGS User Services

<https://landsat.usgs.gov/contact>  
[custserv@usgs.gov](mailto:custserv@usgs.gov)

User support is available Monday through Friday from 8:00 a.m. to 4:00 p.m. central time. Inquiries received outside of these hours will be addressed during the next business day.

## Section 7 Citation Information

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There are no restrictions on the use of these high-level Landsat products. It is not a requirement of data use, but please include the following citation in publication or presentation materials based on these products to acknowledge the USGS as a data source, and to credit the original research.

*Landsat High-Level products courtesy of the U.S. Geological Survey Earth Resources Observation and Science Center.*

There are no restrictions on the use of MODIS products. It is not a requirement of data use, but please use one of the citations in the link below in publication or presentation materials based on these products to acknowledge Land Processes Distributed Active Archive Center (LP DAAC) as a data source, and to credit the original research. More information on LP DAAC citation formats can be found at [https://lpdaac.usgs.gov/citing\\_our\\_data](https://lpdaac.usgs.gov/citing_our_data).

## Appendix A Landsat “Stats” Directory File Characteristics

*ETM+ Enhanced Thematic Mapper Plus, TM Thematic Mapper, OLI Operational Land Imager, TIRS Thermal Infrared Sensor, MODIS Moderate Imaging Spectroradiometer, SR Surface Reflectance, TOA Top of Atmosphere, Stats Statistics*

NOTE: A Landsat 7 ETM+ Product ID is used only as an example. Landsat 4-5 TM, Landsat 8 OLI/TIRS, and MODIS files have similar characteristics.

NOTE: Each file contains the following fields:

- FILENAME
- MINIMUM
- MAXIMUM
- MEAN
- STANDARD DEVIATION (STDDEV)
- VALID

Description	Example File Size (bytes)	Example File Name
SR Band 1 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band1.stats
SR Band 2 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band2.stats
SR Band 3 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band3.stats
SR Band 4 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band4.stats
SR Band 5 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band5.stats
SR Band 7 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_sr_band7.stats
TOA Band 6 Statistics	144	LE07_L1TP_105070_20160717_20161010_01_T1_bt_band6.stats

*\* Band 6 Statistics are not included in a Surface Reflectance order. To acquire Band 6 stats, an order for top of atmosphere Brightness Temperature must be placed.*

## Appendix B Statistics Archive File Characteristics

*ETM+ Enhanced Thematic Mapper Plus, TM Thematic Mapper, OLI Operational Land Imager, TIRS Thermal Infrared Sensor, MODIS Moderate Imaging Spectroradiometer, SR Surface Reflectance, TOA Top of Atmosphere, Stats Statistics, CSV Comma-separated values, PNG portable network graphics, NIR near infrared, swir1 shortwave infrared band 1, swir2 shortwave infrared band 2, Stddev standard deviation, MOD09GQ MODIS Terra Surface Reflectance Daily L2G Global 250m*

NOTE: Two Landsat 7 ETM+ and three MODIS MOD09GQ product IDs are used only as an example. Landsat 4 TM, Landsat 5 TM, Landsat 8 OLI/TIRS, and other MODIS files have similar characteristics.

Description (File count)	Example File Size (bytes)	Example File Name	Possible Bands
Landsat 7 ETM+ C1 surface reflectance raw statistics (6)	105	landsat_7_sr_*_stats.csv	blue, green, red, nir, swir1, swir2
MODIS MOD09GQ surface reflectance raw statistics (2)	4,051	terra_sr_*_stats.csv	nir, red
Landsat 7 ETM+ surface reflectance statistical plots (24)	27,436	landsat_7_sr_*_*_plot.png	blue, green, red, nir, swir1, swir2; minimum, maximum, mean, stddev, minimum_maximum_mean
MODIS MOD09GQ surface reflectance statistical plots (8)	33,938	terra_sr_*_*_plot.png	Nir, red; minimum, maximum, mean, stddev, minimum_maximum_mean
Multi-sensor surface reflectance statistical plots (9)	32,768	multi_sensor_sr_*_*_plot.png	blue, green, red, nir, swir1, swir2; minimum, maximum, mean, stddev, minimum_maximum_mean
Landsat 7 ETM+ C1 TOA Brightness Temperature raw statistics (1)	107	landsat_7_bt_thermal_stats.csv	thermal
Landsat 7 ETM+ C1 TOA Brightness Temperature statistical plot (1)	33,392	landsat_7_bt_thermal_plot.png	thermal

## Appendix C Acronyms

Acronym	Description
09A1	MODIS Surface Reflectance 8-Day L3 Global 500m
09GA	MODIS Surface Reflectance Daily L2G Global 1 km and 500m
09GQ	MODIS Surface Reflectance Daily L2G Global 250m
09Q1	MODIS Surface Reflectance 8-Day L3 Global 250m
13Q1	MODIS Vegetation Indices 16-Day L3 Global 250m
13A1	MODIS Vegetation Indices 16-Day L3 Global 500m
13A2	MODIS Vegetation Indices 16-Day L3 Global 1km
13A3	MODIS Vegetation Indices Monthly L3 Global 1km
ABI	Advanced Baseline Imager (aboard GOES-16 satellite)
BT	Top of Atmosphere Brightness Temperature
BV	Brightness Value
CDR	Climate Data Record
CFmask	C version of Function of Mask
CSV	Comma-Separated Values
EE	EarthExplorer
EROS	Earth Resources Observation and Science
ESPA	EROS Science Processing Architecture
ETM+	Enhanced Thematic Mapper Plus
EVI	Enhanced Vegetation Index
GOES-16	Geostationary Operational Environmental Satellite-16
LaSRC	Landsat 8 Surface Reflectance Code
LEDAPS	Landsat Ecosystem Disturbance Adaptive Processing System algorithm
LPCS	Landsat Product Characterization System
LP DAAC	Land Processes Distributed Active Archive Center
MOD	MODIS Terra
MODIS	Moderate Resolution Imaging Spectroradiometer
MSAVI	Modified Soil Adjusted Vegetation Index
MYD	MODIS Aqua
NASA	National Aeronautics and Space Administration
NBR	Normalized Burn Ratio
NBR2	Normalized Burn Ratio 2
NDMI	Normalized Difference Moisture Index
NDVI	Normalized Difference Vegetation Index
NIR	Near Infrared
NOAA	National Oceanic and Atmospheric Administration
OLI	Operational Land Imager
PNG	Portable Network Graphics
ProductID	Product Identifier
SLC	Scan Line Corrector
SR	Surface Reflectance
Stats	Statistics
Stddev	Standard deviation
SWIR	Shortwave Infrared
TIRS	Thermal Infrared Sensor
TM	Thematic Mapper
TOA	Top of Atmosphere
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VIIRS	Visible Infrared Imaging Radiometer Suite