



Landsat Collection 2 Now Available!

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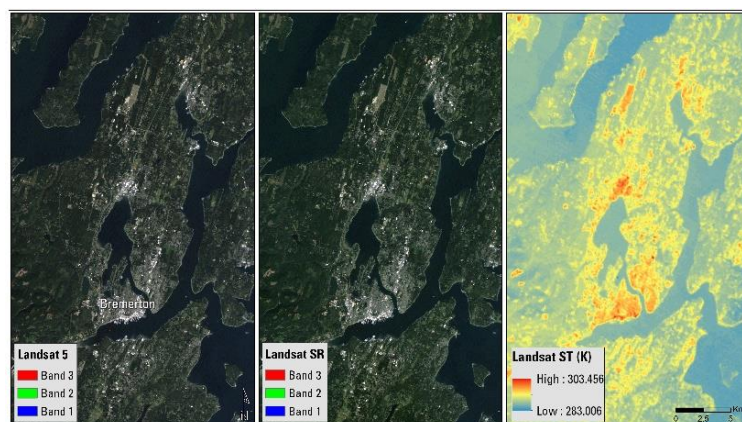
Landsat Collection 2 Now Available!

Landsat Collection 2 includes Landsat Level-1 data for all sensors since 1972, as well as global Level-2 surface reflectance and surface temperature scene-based products from 1982 to present.

Collection 2 marks the second major reprocessing of the Landsat archive by the USGS. The effort harnessed recent advancements in data processing, algorithm development, and data access and distribution capabilities to substantially enhance Landsat data products.

Collection 2 Improvements include:

- Substantial improvement in the absolute geolocation accuracy of the global ground reference dataset which improves interoperability with Europe's Copernicus Sentinel-2 mission
- Updated global digital elevation modeling sources
- Calibration and validation updates
- Accessible from a commercial cloud-based environment



Example of Landsat 5 Collection 2 data over Bremerton, WA. Left: Level 1 data, middle: Level-2 surface reflectance, right: Level-2 surface temperature.

As with Collection 1, Collection 2 uses Tiers as the inventory structure for the Level-1 data product. The purpose of the tier definition is to support easier identification of suitable scenes for time-series pixel-level analysis and are based on data quality and level of processing.

Newly acquired Landsat data are processed upon downlink but use predicted ephemeris, initial bumper mode parameters, or initial Thermal Infrared Sensor (TIRS) line of sight model parameters. These data are placed in the Real-Time tier and made available for immediate download. Once the Real-Time data have been reprocessed with definitive ephemeris, updated bumper mode parameters and refined TIRS parameters, the products are transitioned to either Tier 1 or Tier 2 and removed from the Real-Time tier. The transition latency from Real-Time to Tier 1 or Tier 2 is between 14 and

26 days. Landsat scenes with the highest available data quality are placed into Tier 1 and are considered suitable for time-series processing analysis and serve as input to the U.S. Analysis Ready Data product.

The USGS are delighted to be the first-ever recipient of the [Committee on Earth Observation Satellites \(CEOS\)](#) endorsement [CEOS Analysis Ready Data for Land \(CARD4L\)](#)-compliant products for the Landsat Collection 2 surface reflectance and surface temperature products. This internationally recognized certification ensures that these Landsat Collection 2 products will be more interoperable with other Earth observing platforms, such as Europe’s Sentinel-2 satellite, as they too work towards CARD4L-compliant products.

Collection 2 is accessible from a commercial cloud-based environment via the EarthExplorer data portal. The USGS Landsat no-cost open data policy remains intact since its inception in 2008.

Please visit the [Landsat Collection 2](#) web page to review detailed characteristics and documentation of Collection 2 data products, and view a summary of the typical Collection 2 product generation timeline.

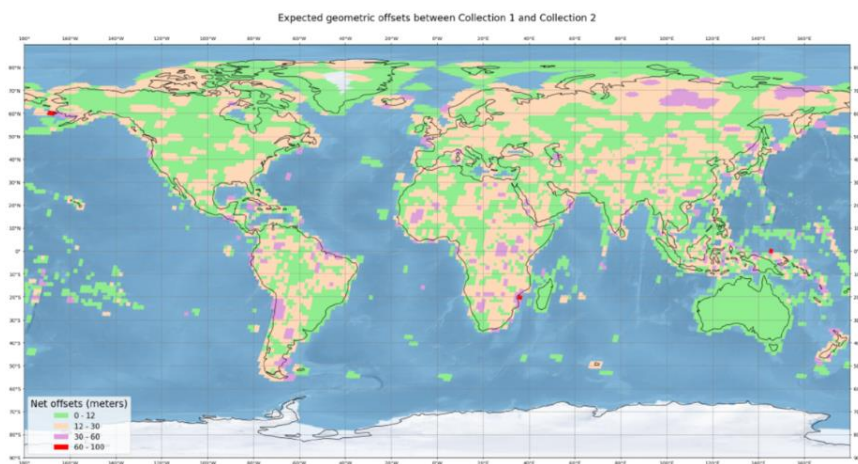
Collection 2 Improvement Highlights

The main improvements for Collection 2 are listed below. For a more detailed description of Collection 2 processing, geometric, and radiometric improvements please visit the [Collection 2](#) webpage or review the accompanying documentation.

- **Improved Geometric Accuracy**

Re-baselining the Landsat 8 OLI Ground Control Points (GCPs) to the European Space Agency (ESA) Copernicus Sentinel-2 Global Reference Image (GRI) improves the per pixel geodetic accuracy and interoperability of the global Landsat archive spatially and temporally.

The image to the right shows the estimated net offsets (in meters) between Ground Control Points for each WRS-2 path/row for Landsat Collection 1 and 2. Areas shown in green will have minimal pixel shifting, whereas areas in purple and red could see shifts up to 4 pixels.

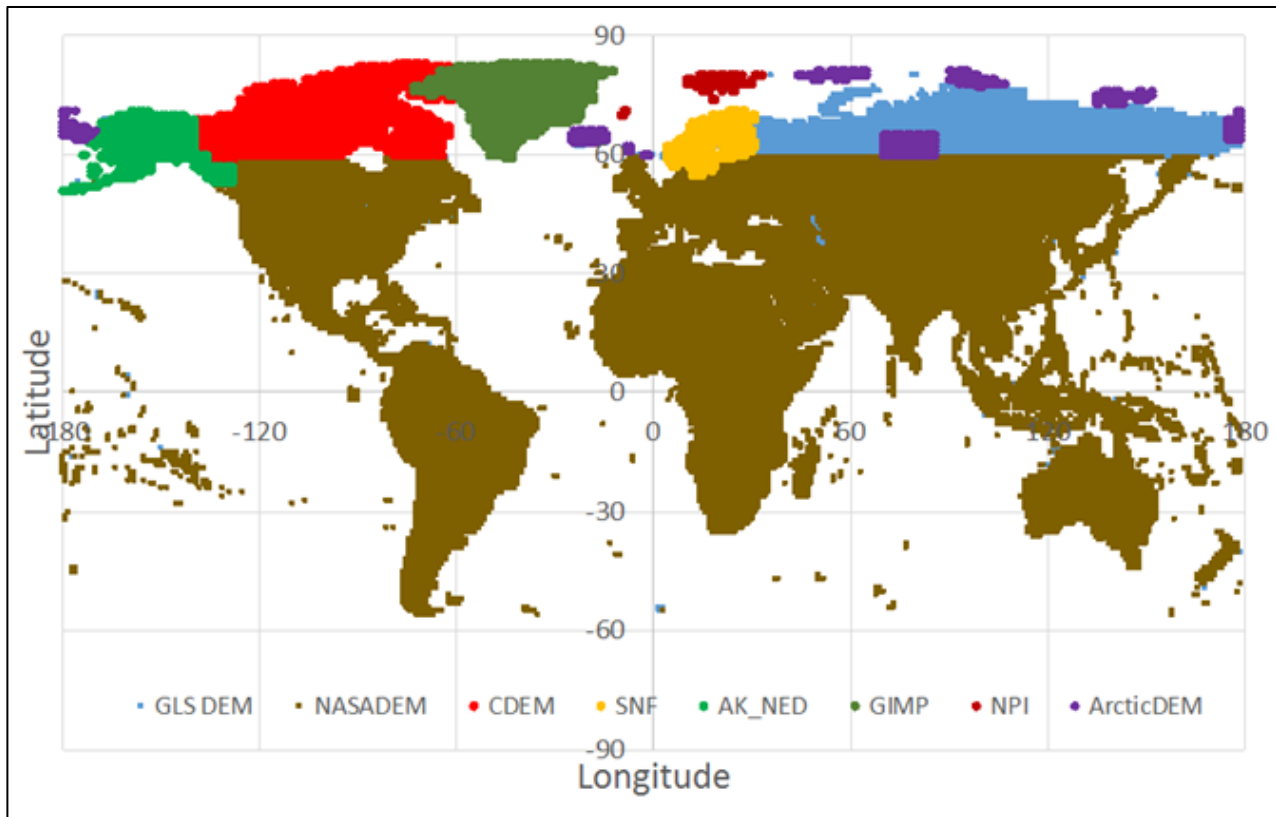


Visit the *January 2020: Phase 4 - Collection 2* section on the [Landsat Ground Control Points](#) webpage for more information.

- **Improved Digital Elevation Modeling**

Collection 2 uses the 3-arc-second digital elevation modeling (DEM) sources listed and shown on the map below. Users can refer to the “*DATA_SOURCE_ELEVATION*” field in the Level-1 metadata file to determine the DEM source used in processing.

- Global Land Survey Digital Elevation Model (GLS DEM)
- NASA Shuttle Radar Topography Mission (NASADEM) (*Reprocessed*)
- Canadian Digital Elevation Model (CDEM) (*Updated*)
- Sweden, Norway, and Finland (SNF) National Elevation Data
- National Elevation Dataset for Alaska (AK_NED) (*New*)
- Greenland Mapping Project (GIMP) Digital Elevation Model
- Norwegian Polar Institute (NPI) Elevation Data
- WorldView-derived ArcticDEM



- **Improved Radiometric Calibration**

Collection 2 includes several radiometric calibration improvements for Landsat 5 Thematic Mapper (TM) and Landsat 8 Operational Land Imager (OLI) data, including a correction for the [Thermal Infrared Sensor \(TIRS\) striping effect](#)

- **Global Level-2 Science and Atmospheric Auxiliary Products – Coming soon***

*NOTE: Atmospheric Auxiliary products will become available after final data verification is complete.

New for Collection 2 is the processing and distribution of Level-2 surface reflectance and surface temperature science products for Landsat 4-5 TM, Landsat 7 ETM+ and Landsat 8 OLI/TIRS.

[Landsat Collection 2 Atmospheric Auxiliary Data](#) used in the processing of Collection 2 Level-2 products are available to download for users wanting to generate custom Level-2 products using the Collection 2 surface reflectance and surface temperature algorithms.

- **Consistent Quality Assessment Bands**

Collection 2 Level-1 calibrated data are delivered with a Quality Assessment Band (QA_Pixel) and a Radiometric Saturation and Quality Assessment Band (QA_RADSAT). Collection 2 Level-2 products include the Level-1 QA Bands as well as a surface reflectance aerosol QA Band (SR_QA_AEROSOL) for Landsat 8, surface reflectance cloud QA band (SR_QA_CLOUD) for Landsat 4-7, and a surface temperature QA Band (ST_QA) to provide consistent QA information between products.

- **Updated and Consistent Metadata Files**

There are several enhancements and changes between Collection 1 and Collection 2 Level-1 metadata. New to Collection 2 data is the addition of an extensible markup language (XML) to the already offered Material Library File (MTL) (Object Description Language-based) format file. The metadata files facilitate consistency, machine-to-machine scripting and rapid querying of the USGS Landsat archive. There are also changes to the metadata fields visible on EarthExplorer and its associated applications. The [Landsat Collection 2 Metadata](#) web page describes changes to each and provides files displaying the changes.

- **Cloud Optimized File Format**

Collection 2 products are delivered in a Cloud Optimized Georeferenced (COG) Tagged Image File Format (TIFF). COGs are an extension of the current GeoTIFF file format that improves access to Geospatial datasets in a cloud-based environment by allowing users to request only the bands they need. For additional information on the COG file format please review the [Landsat Cloud Optimized GeoTIFF \(COG\) Data Format Control Book \(DFCB\)](#).

For more information and documentation about Collection 2, please visit the following web pages:

- [Landsat Collection 2](#)
- [Landsat Collection 2 Level-1 data](#)
- [Landsat Collection 2 Level-2 data](#)
- [Landsat Collection 2 Surface Reflectance](#)
- [Landsat Collection 2 Surface Temperature](#)
- [Quick Reference Guide for changes from Collection 1 to Collection 2](#) (truncated version below)

	Collection 1			Collection 2			
	Level-1 Landsat 1-8		Level-2 (U.S. ARD) Landsat 4-8 (L9)	Level-1 Landsat 1-8 (L9)		Level-2 Landsat 4-8 (L9)	Level-2 (U.S. ARD) Landsat 4-8 (L9)
Supporting Software							
Processing Software	Landsat Product Generation		L2PGS BRIDGE R0.8.x	Landsat Product Generation System (LPGS) R15.x			
Geometry							
Coverage	Global		U.S.	Global		Global *	U.S.
Geometric	Global Land Survey (GLS) 2000			Landsat 8 OLI Harmonized w/			
Digital Elevation	GLS DEM			GLSDEM / NASADEM / Alaska NED /			
Precision	Baseline			Improved usage of Ground Control Points (GCPs) to produce more			
Radiometry							
Solar / Sensor Viewing Angle Information	Angle Coefficient File		None (Per-Pixel Correction Already Applied)	Angle Coefficient File + Band 4 Solar / Sensor Angle Bands		None (Per-Pixel Correction Already Applied)	
TIRS Post-Stray Light Correction Adjustment (L8 Only)	None			Post-Stray Light Residual Bias Applied		Post-Stray Light Residual Bias Applied	
Atmospheric Correction / Level-2							
Surface Reflectance Algorithm Version	N/A		LEDAPS v3.2.1 (TM / ETM+) LaSRC v1.3.0 (OLI / TIRS)	N/A		LEDAPS v3.4.0 (TM / ETM+) LaSRC v1.4.1 (OLI / TIRS)	
Surface	N/A		-9999	N/A		0	
Surface	N/A		-9999	N/A		0	
Data Type / Scaling Factor (Surface Reflectance)	N/A		Signed 16-bit integer 0.0001 (no offset)	N/A		Unsigned 16-bit integer 0.0000275 + -0.2	
Data Type / Scaling Factor (Surface Temperature)	N/A		Signed 16-bit integer 0.1 (no offset)	N/A		Unsigned 16-bit integer 0.00341802 + 149.0	
L7 ETM+	N/A		Band 6L Only	N/A		Bands 6L and 6H Combined	

A summary of some of the enhancements and improvements between Collection 1 and Collection 2. Changes in Collection 2 are highlighted in green.

Data Availability

Collection 2 is available globally for the following sensors/date ranges:

- Level-1 data:
 - Landsat 1- 8 (1972- present)
- Level-2 surface reflectance and surface temperature:
 - Landsat 4 - 8 (1982-present) within defined constraints noted on the [Level-2 webpage](#). Surface Temperature may not be available for all scenes, due to missing auxiliary data. This primarily affects scenes acquired over small island areas.

(Please note that Level-2 Multispectral Scanner (MSS) surface reflectance products will only become available upon the maturity of an operational atmospheric compensation algorithm which satisfies the USGS Landsat program requirements.)

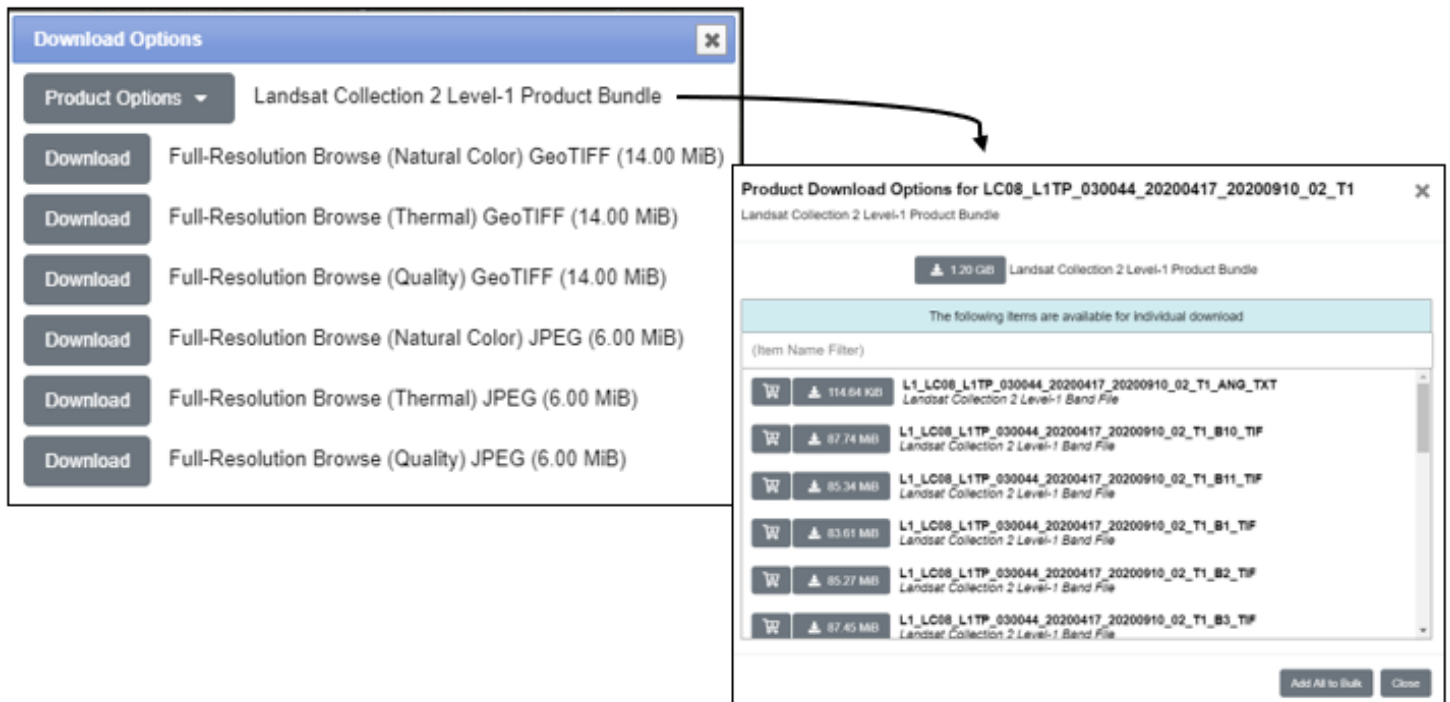
Data Access

The USGS Landsat no-cost open access data policy has been in place since 2008. Landsat Collection 2 Level-1 and Level-2 data are available to download from USGS [EarthExplorer](#). With Collection 2, users can select individual bands for download rather than having to download all the bands within a scene. The image below is an example of the Full Resolution Browse and Level-1 band download options that is available in [EarthExplorer](#).

EarthExplorer maintains a bulk download option, which allows individual band selection, using the [Bulk Download Application \(BDA\)](#). Full Resolution Browse downloads remain available.

Collection 2 data are also available through direct commercial cloud access. Please note that users who employ direct cloud access may incur fees associated with setting up their environment.

Visit the [Landsat Data Access](#) webpage for additional data access and download options.



Popular Collection 2 Social Media Posts

USGS Landsat
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Did you know that Landsat Collection 2 will include global Level-2 surface reflectance AND surface temperature science products? This graphic shows an example of the Landsat Level-2 products over Lake Gairdner in Australia (acquired August 18, 2020).

Surface reflectance improves comparison between multiple images over the same region by accounting for atmospheric effects such as aerosol scattering and thin clouds, which can help in the detection and characterization of Earth... See More

Oct 2, 2020
[Facebook.com/USGSLandsatProgram](https://www.facebook.com/USGSLandsatProgram)

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@USGSLandsat

For #LandsatCollection2 the method of calculating the Landsat 8 bias was modified. The improved bias estimates will reduce along-track noise, improve image uniformity & signal-to-noise ratio. Learn more at ow.ly/PLrO50AOJoP

Landsat 8 OLI images (P165 R198) over the Pacific Ocean (Band 3, acquired October 10, 2019) compare the striping in Collection-1 (left) and the reduction in striping in the Collection 2 image (right).

August 6, 2020
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