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Department of the Interior
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Landsat 8-9
Operational Land Imager (OLI) - Thermal Infrared Sensor (TIRS) Collection 2 Level 1 (L1) Data Format Control Book (DFCB)

Version 6.0

September 2020

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Executive Summary

This Data Format Control Book (DFCB) presents detailed data formats of the Landsat 8 and Landsat 9 Collection 2 (C2) Level 1 (L1) products that the Landsat Product Generation System (LPGS) generates. This processing system produces L1 output files from Level 0 Reformatted (L0R) images. Images are produced in Cloud Optimized Geographic Tagged Image File Format (GeoTIFF) (COG).

The Landsat Data Processing and Archive System (DPAS) Configuration Control Board (CCB) maintains and controls this DFCB. Staff may update or revise this document only upon Landsat DPAS CCB approval. Please direct comments and questions regarding this DFCB to the following:

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Section 1 Introduction

The Landsat mission is a joint mission formulated, implemented, and operated by the National Aeronautics and Space Administration (NASA) and the Department of the Interior (DOI) U.S. Geological Survey (USGS). Landsat is a remote sensing satellite mission providing coverage of the Earth's land surfaces. The Landsat series of satellites continue the 40+ years of global data collection and distribution.

1.1 Background

The goal of Landsat is to continue the collection, archival, and distribution of multispectral imagery affording global, synoptic, and repetitive coverage of the Earth's land surfaces at a scale where natural and human-induced changes can be detected, differentiated, characterized, and monitored over time. The Landsat programmatic goals are stated in the United States Code, Title 15 Chapter 82 "Land Remote Sensing Policy" (derived from the Land Remote Sensing Policy Act of 1992). This policy requires that the Landsat Project provide data into the future that are sufficiently consistent with previous Landsat data to allow the detection and quantitative characterization of changes in or on the surface of the Earth. The highly successful Landsat series of missions have provided satellite coverage of the Earth's continental surfaces since 1972. The data from these missions constitute the longest continuous record of Earth's surface as seen from space.

1.2 Purpose and Scope

This Data Format Control Book (DFCB) provides a high-level description of the Landsat 8 and Landsat 9 C2 L1 distribution product. It is intended for C2 L1 product recipients.

This DFCB describes the formats and data contents of the C2 L1 output files. The output format generated by the LPGS for distribution is COG.

The file formats contained in this DFCB are applicable to the C2 L1 products that LPGS generates at the USGS Earth Resources Observation and Science (EROS) Center.

1.3 Document Organization

This document contains the following sections:

- Section 1 provides an introduction
- Section 2 provides an overview of C2 L1 output files
- Section 3 provides the storage format for the data
- Appendix A provides a list of acronyms
- The References section provides a list of reference documents

1.4 Terminology

Level 1 Systematic Terrain (Corrected) (L1GT) product — Includes radiometric and geometric corrections, and uses a Digital Elevation Model (DEM) to correct parallax

error due to local topographic relief; the accuracy of the terrain-corrected product depends on the resolution of the best available DEM.

Level 1 Precision Terrain (Corrected) (L1TP) product — Includes radiometric, geometric, and precision correction, and uses a DEM to correct parallax errors due to local topographic relief; the accuracy of the precision/terrain-corrected product depends on the availability of Ground Control Points (GCPs), as well as the resolution of the best available DEM.

Section 2 Overview of C2 L1 Output Files

This section provides an overview of the C2 L1 output files.

2.1 L1GT/L1TP Output Files Overview

Standard L1TP products, which are Digital Number (DN) products in an unsigned 16-bit integer format, can be converted to Top of Atmosphere (TOA) reflectance (Bands 1–9) or radiance (Bands 1–11) using scaling factors provided in the product metadata. Refer to LSDS-1747 Landsat 8-9 Calibration and Validation (Cal/Val) Algorithm Description Document (ADD) for a description of the radiance calculations, reflectance calculations, and rescaling procedures used during processing. Refer to LSDS-1834 Landsat 8-9 Operational Land Imager (OLI) – Thermal Infrared Sensor (TIRS) Calibration Parameter File (CPF) Data Format Control Book (DFCB) for definitions of the reflectance conversion and the rescaling values used to process the L1 products. The CPF used to process a specific scene can be accessed through the USGS Landsat website (https://landsat.usgs.gov).

The L1GT/L1TP image data are radiometrically and geometrically corrected and are available as COG files.

Table 2-1 shows the band identification, Table 2-2 lists the specifications for the OLI bands, Table 2-3 lists the specifications for the TIRS bands, Table 2-4 lists the specifications for the Quality Assessment (QA) bands, and Table 2-5 lists the L1GT/L1TP product components.

Band Number	Band Description	Band Range (nm)
1	Coastal Aerosol (Operational Land Imager (OLI))	435-451
2	Blue (OLI)	452-512
3	Green (OLI)	533-590
4	Red (OLI)	636-673
5	Near-Infrared (NIR) (OLI)	851-879
6	Short Wavelength Infrared (SWIR) 1 (OLI)	1566-1651
7	SWIR 2 (OLI)	2107-2294
8	Panchromatic (OLI)	503-676
9	Cirrus (OLI)	1363-1384
10	Thermal Infrared Sensor (TIRS) 1	10600-11190
11	TIRS 2	11500-12510

Table 2-1. Band Reference Table

Band Number	Identifier FT	Data Type	Units	Fill	Range
1	B1	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
2	B2	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
3	B3	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
4	B4	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535

Band Number	Identifier FT	Data Type	Units	Fill	Range
5	B5	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
6	B6	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
7	B7	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
8	B8	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
9	B9	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535

Table 2-2. OLI Bands Specifications

Band Number	Identifier FT	Data Type	Units	Fill	Range
10	B10	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535
11	B11	UINT16	W/(m^2 sr um)	0 (No Data)	1 through 65535

Table 2-3. TIRS Bands Specifications

Identifier FT	Band Name	Data Type	Units	Range
QA_PIXEL	QA Band	UINT16	Bit Index	0 through 65535
QA_RADSAT	Radiometric Saturation and Terrain Occlusion QA Band	UINT16	Bit Index	0 through 65535

Table 2-4. OLI/TIRS Quality Assessment Bands Specifications

L1 Product Components
L1GT/L1TP image file (COG) (one for each band)
QA_PIXEL file (COG)
QA_RADSAT file (COG)
L1GT/L1TP ODL metadata file
L1GT/L1TP XML metadata file
Sun Azimuth Angle file (COG)
Sun Zenith Angle file (COG)
View (sensor) Azimuth Angle file (COG)
View (sensor) Zenith Angle file (COG)
Angle coefficient file

Table 2-5. L1 Product Components

2.1.1 Product Files

The product consists of individual files listed in Table 2-5. The files are unbundled and can be downloaded individually.

2.1.2 Naming Convention

Table 2-6 describes the Landsat Product Identifier: LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX. The Landsat Product

identifier is part of the file name associated with L1 product. Table 2-6 and Table 2-7 contain the file types and extensions for file names associated with the L1 products.

Identifier	Description
L	Landsat
X	Sensor of: O = OLI, T = TIRS, C = Combined TIRS and OLI Indicates which sensor collected data for this product
SS	Landsat satellite (08 for Landsat 8, 09 for Landsat 9)
LLLL	Processing level (L1TP, L1GT)
PPP	Satellite orbit location in reference to the Worldwide Reference System-2 (WRS-2) path of the product
RRR	Satellite orbit location in reference to the WRS-2 row of the product
YYYY	Acquisition year of the image
MM	Acquisition month of the image
DD	Acquisition day of the image
yyyy	Processing year of the image
mm	Processing month of the image
dd	Processing day of the image
CC	Collection number (e.g., 02)
TX	Collection category: "RT" for Real-Time, "T1" for Tier 1 (highest quality), "T2" for Tier 2

Table 2-6. Landsat 8-9 Product ID

The Landsat Product ID described in Table 2-6 is the first part of the file name, the file type and extension components of the file name are described in Table 2-7. The Landsat Product ID, file type, and extension make the file name:
LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_FT.ext

Identifier	Description
FT	File type, where FT equals one of the following: image band file number (B1–B11), VAA (Band 4 View (sensor) Azimuth Angle), VZA (Band 4 View (sensor) Zenith Angle), SAA (Band 4 Solar Azimuth Angle), SZA (Band 4 Solar Zenith Angle), MTL (metadata file), QA_PIXEL (QA Band file), QA_RADSAT (Radiometric saturation and Terrain Occlusion pixel QA Band), MD5 (checksum file), ANG (angle coefficient file)
ext	File extension, where .TIF equals COG file extension, .xml equals XML extension (metadata), and .txt equals text extension

Table 2-7. File Naming Convention

2.1.3 Example File Names

2.1.3.1 Image Files

LC08_L1TP_222005_20140922_20140923_02_T1_B1.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B2.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B3.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B4.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B5.TIF

LC08_L1TP_222005_20140922_20140923_02_T1_B6.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B7.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B8.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B9.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B10.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_B11.TIF

2.1.3.2 Band 4 Angle Files

LC08_L1TP_222005_20140922_20140923_02_T1_VAA.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_VZA.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_SAA.TIF
LC08_L1TP_222005_20140922_20140923_02_T1_SZA.TIF

2.1.3.3 QA Band

LC08_L1TP_222005_20140922_20140923_02_T1_QA_PIXEL.TIF

2.1.3.4 Radiometric Saturation and Terrain Occlusion QA Band

LC08_L1TP_222005_20140922_20140923_02_T1_QA_RADSAT.TIF

2.1.3.5 Metadata

LC08_L1TP_222005_20140922_20140923_02_T1_MTL.txt
LC08_L1TP_222005_20140922_20140923_02_T1_MTL.xml

2.1.3.6 Angle Coefficient File

LC08_L1TP_222005_20140922_20140923_02_T1_ANG.txt

2.1.3.7 Checksum

LC08_L1TP_222005_20140922_20140923_02_T1_MD5.txt

Section 3 Data Format Definition

This section describes the storage format for the data. Refer to LSDS-1388 Landsat Cloud Optimized GeoTIFF (COG) Data Format Control Book (DFCB) for a more detailed description of COG. The Geospatial Data Abstraction Library (GDAL) NODATA tag is used to indicate, in conjunction with the value for the pixel, which pixel(s) have no data for applicable bands. If GDAL's NODATA tag is included for the band, it is mentioned in this section.

3.1 L1GT / L1TP Image Files

Each image band in the L1GT/L1TP product is in a separate file. Each band is a grayscale COG file, which contains unsigned 16-bit integers. The GDAL_NODATA tag defines the value of 0 to be the no data value for these bands. The image files contain the tags and keys defined by the Geographic Tagged Image File Format (GeoTIFF) specification, which allows GeoTIFF readers to read the images. The following section gives more detail about the GeoTIFF format.

3.1.1 GeoTIFF

GeoTIFF defines a set of Tagged Image File Format (TIFF) tags, which describe cartographic and geodetic information associated with geographic TIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data. However, the TIFF file structure allows both the metadata and the image data to encode into the same file.

3.1.1.1 GeoTIFF Tags

GeoTIFF tags convey information about the image. The tags describe the image using information the GeoTIFF reader needs in order to control the appearance of the image on the user's screen. The GeoTIFF tags provide information on the image projection and corner points, which define the geographic location and extent of the image.

A complete description of the raster data requires geo-referencing of the data, which is accomplished using tags. The L1 production system uses the transformation raster, model space tiepoints, and scaling parameters. ModelTiepointTag and ModelPixelScaleTag are used for this purpose.

3.1.1.1.1 GeoTIFF ModelTiepointTag

The GeoTIFF ModelTiepointTag stores the raster-to-model tiepoint pairs.

3.1.1.1.1.1 Description

The raster-to-model tiepoint pairs are stored in the following order: ModelTiepointTag = (..., I, J, K, X, Y, Z...), where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space. The ModelTiepointTag requires that K and Z are set to zero. See the GeoTIFF Specification document (see the References section) for more information.

The raster image is geo-referenced by specifying its location, size, and orientation in the model coordinate space. Because the relationship between the raster space and the model space is often exact, the affine transformation relationship can be defined using one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

3.1.1.1.1.2 Parameters

Tag = 33922
Type = DOUBLE
N = 6*K, K = number of tiepoints

3.1.1.1.2 GeoTIFF ModelPixelScaleTag

The GeoTIFF ModelPixelScaleTag specifies the size of the raster pixel spacing in the model space units when the raster space is embedded in the model space coordinate system without rotation.

3.1.1.1.2.1 Description

The size of raster pixel spacing in the model space units consists of three values. These values are ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ), where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels, and ScaleZ maps the pixel value of a DEM into the correct Z-scale.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, determines the relationship between raster and model space.

3.1.1.1.2.2 Parameters

Tag = 33550
Type = DOUBLE
N = 3

3.1.1.2 GeoTIFF Keys

In addition to tags, the description of a projection in GeoTIFF requires the use of keys. Table 3-1 lists the keys necessary to define the Universal Transverse Mercator (UTM) projection supported by the L1 production systems, along with their possible values. Table 3-2 lists the keys necessary to define the Polar Stereographic (PS) projection supported by the L1 production systems, along with their possible values.

Valid Keys	Possible Values	Meaning
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	2	RasterPixelIsPoint (the coordinate is at the center of the pixel)
GTCitationGeoKey	(ASCII, 17)	American Standard Code for Information Interchange (ASCII) reference to public documentation
GeogLinearUnitsGeoKey	9001	Linear_Meter
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	32601-32660	European Petroleum Survey Group (EPSG) Projection System Codes

Table 3-1. GeoTIFF Keys Used to Define UTM Projection

Valid Keys	Possible Values	Meaning
ProjCoordTransGeoKey	15	CT_PolarStereographic
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	2	RasterPixelIsPoint (the coordinate is at the center of the pixel)
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	32767	User-defined
ProjectionGeoKey	32767	User-defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
ProjStraightVertPoleLongGeoKey	0.0000000	Value in units of GeogAngularUnits
ProjNatOriginLatGeoKey	-71.0000000, 71.0000000	Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey	0.0000000	Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey	0.0000000	Value entered in units of ProjLinearUnits

Table 3-2. GeoTIFF Keys Used to Define Polar Stereographic Projection

3.1.2 TIFF

TIFF is a tag-based file format for storing raster images.

3.1.2.1 TIFF Tags

TIFF tags are embedded in the same file as the TIFF image. TIFF tags are found in the header and in Image File Directories (IFDs) in a file.

3.1.2.1.1 TIFF PrivateTag

This TIFF private tag is used to indicate that a GDAL's NODATA value is specified. This tag is only supported by the GDAL library.

3.1.2.1.1.1 Description

The, unofficial, TIFF private tag used for GDAL's NODATA tag. The TIFF field has the pixel value which represents no information is available for a pixel.

3.1.2.1.1.2 Parameters

Tag = 42113
Type = ASCII
N = variable

3.2 QA Band File

The output from the CFMask algorithm is used as an input for the QA Application, which calculates values for all fields in the QA Band file. The QA Band file contains quality statistics gathered from the cloud mask and statistics information for the scene. The QA Band file is an unsigned 16-bit COG image with the same dimensions as the L1GT or L1TP scene. See Section 3.1.1 for details on the GeoTIFF. See LSDS-1388 for more details on COG. For some artifacts bits that are distinguishable at the L1G stage of processing are allocated. Bit 0 is the least significant. As several pixel quality classification types exist, a range of confidence levels is provided for each classification type. Table 3-3 shows the bits being set to artifact mapping.

A 3x3 pixel window is used for setting cloud dilation.

Bit	Flag Description	Values
0	Fill	0 for image data 1 for fill data
1	Dilated Cloud	0 for cloud is not dilated or no cloud 1 for cloud dilation
2	Cirrus	0 for Cirrus Confidence: no confidence level set or Low Confidence 1 for high confidence cirrus
3	Cloud	0 for cloud confidence is not high 1 for high confidence cloud
4	Cloud Shadow	0 for Cloud Shadow Confidence is not high 1 for high confidence cloud shadow
5	Snow	0 for Snow/Ice Confidence is not high 1 for high confidence snow cover
6	Clear	0 if Cloud or Dilated Cloud bits are set 1 if Cloud and Dilated Cloud bits are not set
7	Water	0 for land or cloud 1 for water
8-9	Cloud Confidence	00 for no confidence level set 01 Low confidence 10 Medium confidence 11 High confidence
10-11	Cloud Shadow Confidence	00 for no confidence level set 01 Low confidence 10 Reserved 11 High confidence
12-13	Snow/Ice Confidence	00 for no confidence level set 01 Low confidence

Bit	Flag Description	Values
		10 Reserved 11 High confidence
14-15	Cirrus Confidence	00 for no confidence level set 01 Low confidence 10 Reserved 11 High confidence

Table 3-3. QA Band Bit Description

3.3 Radiometric Saturation and Terrain Occlusion QA Band File

The radiometric saturation QA Band indicates which sensor band(s) are saturated. Table 3-4 shows which bits are for band data saturation and which bit is for terrain occlusion. Radiometric saturation is not common for OLI; it typically happens because of clouds and bright targets. Radiometric saturation can occur under two situations:

1. When processed L1 product's saturated pixels have the maximum unsigned 16-bit value of 65535
2. When a sensor is saturated during data capture

The TIRS sensor is not affected by radiometric saturation.

The terrain occlusion bit is set when the desired terrain is not visible from the sensor due to intervening terrain.

Bit	Flag Description	Values
0	Band 1 Data Saturation	0 no saturation 1 saturated data
1	Band 2 Data Saturation	0 no saturation 1 saturated data
2	Band 3 Data Saturation	0 no saturation 1 saturated data
3	Band 4 Data Saturation	0 no saturation 1 saturated data
4	Band 5 Data Saturation	0 no saturation 1 saturated data
5	Band 6 Data Saturation	0 no saturation 1 saturated data
6	Band 7 Data Saturation	0 no saturation 1 saturated data
7	Unused	0 not checked
8	Band 9 Data Saturation	0 no saturation 1 saturated data
9	Unused	0
10	Unused	0
11	Terrain occlusion	0 no terrain occlusion 1 terrain occlusion
12	Unused	0
13	Unused	0
14	Unused	0
15	Unused	0

Table 3-4. Radiometric Saturation and Terrain Occlusion QA Band Bit Description

3.4 Band 4 Angle Bands

The angles are calculated per pixel for the scene. All of the angle band files have units of hundredths of degrees. Zenith and azimuth angles for solar illumination are calculated, and each is output to a separate band file. Zenith and azimuth angles for sensor viewing are also calculated, each is output to a separate band file. There are four Band 4 angle bands in total. All four files are for the Band 4 image file.

3.5 L1 Metadata Files

The L1 metadata files are created during product generation and contain information specific to the product ordered. One of the metadata files is text in the Object Description Language (ODL) format. All of the parameters contained in the metadata file using ODL format are also in a separate metadata file using Extensible Markup Language (XML) format.

Table 3-5 lists the full contents of the L1 ODL metadata file. Table 3-6 shows the structure of the L1 XML metadata file, it does not show every possible value associated with each parameter name like Table 3-5 does.

The PRODUCT_CONTENTS group contains information about files in the product (e.g., it includes file names and the data type for the GeoTIFF files). Most of the parameters and parameter values in PRODUCT_CONTENTS are duplicates of the same parameter and parameter values in LEVEL1_PROCESSING_RECORD.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= LANDSAT_METADATA_FILE	The beginning of the first-level ODL group. It indicates the start of the Landsat metadata file group.
GROUP	= PRODUCT_CONTENTS	The beginning of the product contents group.
ORIGIN	= “Image courtesy of the U.S. Geological Survey”	Origin of the product.
DIGITAL_OBJECT_IDENTIFIER	= “https://doi.org/10.5066/P975CC9B”	Digital Object Identifier for Level 1 OLI-TIRS. For more information on Digital Object Identifiers, visit https://www.doi.org.
LANDSAT_PRODUCT_ID	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX”	Landsat uses the “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX” format, where: L = Landsat X = Sensor SS = Satellite (08 or 09) LLLL = Processing correction Level PPP = WRS path RRR = WRS row YYYYMMDD = Acquisition year (YYYY) Month (MM) Day (DD) yyyymmdd = Processing year (yyyy) month (mm) day (dd) CC = Collection number TX = Collection category
PROCESSING_LEVEL	= “L1GT” = “L1TP”	The identifier to inform the user of the processing level of the product.
COLLECTION_NUMBER	= NN	The product collection number.
COLLECTION_CATEGORY	= “T1” = “T2” = “RT”	The scene collection category, “RT” for real-time, “T1” for Tier 1 quality collection, and “T2” for Tier 2 quality collection.
OUTPUT_FORMAT	= “GEOTIFF”	Output file format for image files.
FILE_NAME_BAND_1	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B1.TIF”	The file name for L1 Band 1. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_2	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B2.TIF”	The file name for L1 Band 2. This parameter is only present if the band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_BAND_3	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B3.TIF”	The file name for L1 Band 3. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B4.TIF”	The file name for L1 Band 4. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_5	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B5.TIF”	The file name for L1 Band 5. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_6	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6.TIF”	The file name for L1 Band 6. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_7	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B7.TIF”	The file name for L1 Band 7. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_8	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B8.TIF”	The file name for L1 Band 8. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_9	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B9.TIF”	The file name for L1 Band 9. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_10	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B10.TIF”	The file name for L1 Band 10. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_11	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B11.TIF”	The file name for L1 Band 11. This parameter is only present if the band is included in the product.
FILE_NAME_QUALITY_L1_PIXEL	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_PIXEL.TIF”	The file name for the L1 Quality Assessment (QA) Band.
FILE_NAME_QUALITY_L1_RADIOMETRIC_SATURATION	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_RADSAT.TIF”	The file name for the Radiometric Saturation Quality Assessment (QA) Band.
FILE_NAME_ANGLE_COEFFICIENT	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ANG.txt”	The file name for the angle coefficient file. This parameter is only present if the angle coefficient file is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_ANGLE_SENSOR_AZIMUTH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VAA.TIF”	The file name for the Band 4 View (sensor) Azimuth Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SENSOR_ZENITH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VZA.TIF”	The file name for the Band 4 View (sensor) Zenith Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SOLAR_AZIMUTH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SAA.TIF”	The file name for the Band 4 Solar Azimuth Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SOLAR_ZENITH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SZA.TIF”	The file name for the Band 4 Solar Zenith Angle. This parameter is only present if the band is included in the product.
FILE_NAME_METADATA_ODL	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.txt”	The file name for L1 ODL metadata.
FILE_NAME_METADATA_XML	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.xml”	The file name for L1 XML metadata.
DATA_TYPE_BAND_1	= “UINT16”	The GeoTIFF file for band 1 uses unsigned 16-bit integers.
DATA_TYPE_BAND_2	= “UINT16”	The GeoTIFF file for band 2 uses unsigned 16-bit integers.
DATA_TYPE_BAND_3	= “UINT16”	The GeoTIFF file for band 3 uses unsigned 16-bit integers.
DATA_TYPE_BAND_4	= “UINT16”	The GeoTIFF file for band 4 uses unsigned 16-bit integers.
DATA_TYPE_BAND_5	= “UINT16”	The GeoTIFF file for band 5 uses unsigned 16-bit integers.
DATA_TYPE_BAND_6	= “UINT16”	The GeoTIFF file for band 6 uses unsigned 16-bit integers.
DATA_TYPE_BAND_7	= “UINT16”	The GeoTIFF file for band 7 uses unsigned 16-bit integers.
DATA_TYPE_BAND_8	= “UINT16”	The GeoTIFF file for band 8 uses unsigned 16-bit integers.
DATA_TYPE_BAND_9	= “UINT16”	The GeoTIFF file for band 9 uses unsigned 16-bit integers.
DATA_TYPE_BAND_10	= “UINT16”	The GeoTIFF file for band 10 uses unsigned 16-bit integers.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
DATA_TYPE_BAND_11	= “UINT16”	The GeoTIFF file for band 11 uses unsigned 16-bit integers.
DATA_TYPE_QUALITY_L1_PIXEL	= “UINT16”	The L1 QA Band uses unsigned 16-bit integers.
DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION	= “UINT16”	The L1 radiometric saturation QA Band uses unsigned 16-bit integers.
DATA_TYPE_ANGLE_SENSOR_AZIMUTH_BAND_4	= “INT16”	The sensor azimuth angle band uses signed 16-bit integers.
DATA_TYPE_ANGLE_SENSOR_ZENITH_BAND_4	= “INT16”	The sensor zenith angle band uses signed 16-bit integers.
DATA_TYPE_ANGLE_SOLAR_AZIMUTH_BAND_4	= “INT16”	The solar azimuth angle band uses signed 16-bit integers.
DATA_TYPE_ANGLE_SOLAR_ZENITH_BAND_4	= “INT16”	The solar zenith angle band uses signed 16-bit integers.
END_GROUP	= PRODUCT_CONTENTS	
GROUP	= IMAGE_ATTRIBUTES	
SPACECRAFT_ID	= “LANDSAT_8” = “LANDSAT_9”	Spacecraft from which the data were captured.
SENSOR_ID	= “OLI_TIRS” = “OLI” = “TIRS”	Sensor(s) used to capture this scene.
WRS_TYPE	= 2	World Reference System (WRS) type used for the collection of this scene.
WRS_PATH	= 1-233	Orbital WRS-2 defined nominal Landsat satellite track (path).
WRS_ROW	= 1-248	Orbital WRS-2 defined nominal Landsat row number for this scene.
NADIR_OFFNADIR	= “NADIR” = “OFFNADIR”	Nadir or Off-Nadir condition of the scene.
TARGET_WRS_PATH	= 1-233	Nearest WRS-2 path to the Line-of-Sight (LOS) scene center of the image.
TARGET_WRS_ROW	= 1-248, 880-889, 990-999	Nearest WRS-2 row to the LOS scene center of the image. Rows 880–889 are reserved for the north pole and 990–999 are reserved for the south pole, where WRS-2 is not defined.
DATE_ACQUIRED	= YYYY-MM-DD	The date the image was acquired.
SCENE_CENTER_TIME	= “HH:MI:SS.SSSSSSSZ”	Scene center time and date for when the image was acquired. HH = Hour (00-23), MI =

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
		Minute, SS.SSSSSSS = Fractional seconds, Z = constant (indicates “Zulu” time (same as GMT)).
STATION_ID	= “XXX”	The Ground Station that received the data. See LSDS-547 Landsat Ground Station (GS) Identifiers for all possible station IDs (e.g., “LGN” = Landsat Ground Network).
CLOUD_COVER	= 0.00–100.00, -1	The overall cloud coverage (percent) of the WRS-2 scene. -1 indicates that the score was not calculated.
CLOUD_COVER_LAND	= 0.00–100.00, -1	The overall cloud coverage over land (percent) in the WRS-2 scene. -1 indicates that the score was not calculated.
IMAGE_QUALITY_OLI	= 0–9	The composite image quality for the OLI bands. Values: 9 = Best. 1 = Worst. 0 = Image quality not calculated. This parameter is only present if OLI bands are present in the product. For Landsat 8, this parameter is adjusted downward for scenes collected using the lower 12 bits from the OLI sensor (TRUNCATION_OLI = “LOWER”).
IMAGE_QUALITY_TIRS	= 0–9	The composite image quality for the TIRS bands. Values: 9 = Best. 1 = Worst. 0 = Image quality not calculated. This parameter is only present if TIRS bands are present in the product. For Landsat 8, this parameter is adjusted downward for scenes processed using “PRELIMINARY” Scene Select Mirror (SSM) position values as determined by the TIRS_SSM_MODEL parameter. It is also adjusted downward for scenes processed with “SWITCHED” for the TIRS_SSM_POSITION_STATUS value.
SATURATION_BAND_1	= “Y” = “N”	Indicates Band 1 includes saturated pixels identified by the Radiometric Saturation Quality Assessment (QA) Band. This parameter is only present if the band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SATURATION_BAND_2	= “Y” = “N”	Indicates Band 2 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_3	= “Y” = “N”	Indicates Band 3 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_4	= “Y” = “N”	Indicates Band 4 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_5	= “Y” = “N”	Indicates Band 5 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_6	= “Y” = “N”	Indicates Band 6 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_7	= “Y” = “N”	Indicates Band 7 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
SATURATION_BAND_8	= “N”	Band 8 is not checked for saturation.
SATURATION_BAND_9	= “Y” = “N”	Indicates Band 9 includes saturated pixels identified by the Radiometric Saturation QA Band. This parameter is only present if the band is included in the product.
ROLL_ANGLE	= -15.00 through +15.00	The amount of spacecraft roll angle at the scene center. The roll value is given in the Yaw Steering Frame (YSF) reference, whose x-axis is aligned with the instantaneous ground track velocity vector. Rolls about this x-axis go by the right-hand rule: a positive roll results in the instruments pointing to the left of the ground track, while a negative roll results in the instrument pointing to the right.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SUN_AZIMUTH	= -180.00000000 through 180.00000000	The Sun azimuth angle in degrees for the image center location at the image center acquisition time. A positive value indicates angles to the east or clockwise from the north. A negative value (-) indicates angles to the west or counterclockwise from the north.
SUN_ELEVATION	= -90.00000000 through 90.00000000	The Sun elevation angle in degrees for the image center location at the image center acquisition time. A positive value indicates a daytime scene. A negative value (-) indicates a nighttime scene. Note: For reflectance calculation, the sun zenith angle is needed, which is 90 - sun elevation angle.
EARTH_SUN_DISTANCE	= N.NNNNNNN	Measurement of the earth to sun distance at the particular day and time of imagery acquisition. Astronomical Unit (AU) of measurement.
TRUNCATION_OLI	= “UPPER” = “LOWER”	The OLI truncation mode. “LOWER” indicates that the lower 12 bits were used and “UPPER” indicates the upper 12 bits were used. The normal truncation mode is “UPPER”. If the truncation mode is “LOWER”, the image likely includes artifacts and have the IMAGE_QUALITY_OLI parameter reduced. Only included if OLI is present in the product. This field is not included for Landsat 9.
TIRS_SSM_MODEL	= “PRELIMINARY” = “FINAL” = “ACTUAL”	Indicates how the Landsat 8 TIRS Scene Select Mirror (SSM) position was determined. The “PRELIMINARY” status indicates preliminary or estimated encoder values generated before or during the switch event and directly impacts the IMAGE_QUALITY_TIRS value. The “FINAL” status indicates final estimated encoder values generated after the switch event. The “ACTUAL” status indicates actual encoder values. This field is not included for Landsat 9.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
TIRS_SSM_POSITION_STATUS	= “NOMINAL” = “ESTIMATED” = “SWITCHED”	The Landsat 8 TIRS SSM position status. The “NOMINAL” status indicates the SSM was functioning normally for this scene. The “SWITCHED” status indicates the SSM switched operating modes in the scene and may have TIRS image quality issues, which directly impact the IMAGE_QUALITY_TIRS value. The “ESTIMATED” status indicates the SSM position was estimated, which may not be as accurate as the “NOMINAL” status. This field is not included for Landsat 9.
END_GROUP	= IMAGE_ATTRIBUTES	
GROUP	= PROJECTION_ATTRIBUTES	
MAP_PROJECTION	= “UTM” = “PS”	The map projection used in creating the image. Universal Transverse Mercator (UTM) or Polar Stereographic (PS).
DATUM	= “WGS84”	The datum used in creating the image.
ELLIPSOID	= “WGS84”	The ellipsoid used in creating the image.
UTM_ZONE	= 1 through 60	The value used to indicate the zone number. This parameter is only included for the UTM projection.
VERTICAL_LON_FROM_POLE	= 0	Vertical longitude (decimal degrees) from the pole. Only present when MAP_PROJECTION is PS.
TRUE_SCALE_LAT	= -71.00000 = 71.00000	Latitude of true scale in a map projection. Only present when MAP_PROJECTION is PS.
FALSE_EASTING	= 0	Value added to all "x" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in the ProjLinearUnitsGeoKey. Only present when MAP_PROJECTION is PS.
FALSE_NORTHING	= 0	Value added to all "y" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
		identified in the ProjLinearUnitsGeoKey. Only present when MAP_PROJECTION is PS.
GRID_CELL_SIZE_PANCHROMATIC	= 15.00	The grid cell size in meters used in creating the image for the panchromatic band. This parameter is only included if the panchromatic band is included in the product.
GRID_CELL_SIZE_REFLECTIVE	= 30.00	The grid cell size in meters used in creating the image for Visible and Near Infrared (VNIR) / Short-Wave Infrared (SWIR) bands, if part of the product. This parameter is only included if the reflective bands are included in the product.
GRID_CELL_SIZE_THERMAL	= 30.00	The grid cell size in meters used in creating the image for the thermal bands, if part of the product. This parameter is only included if the thermal bands are included in the product.
PANCHROMATIC_LINES	= 0–99999	The number of product lines for the panchromatic band (Band 8). This parameter is only present if the panchromatic band is present in the product.
PANCHROMATIC_SAMPLES	= 0–99999	The number of product samples for the panchromatic band (Band 8). This parameter is only present if the panchromatic band is in the product.
REFLECTIVE_LINES	= 0–99999	The number of product lines for the reflective bands (Bands 1–7 and Band 9). This parameter is only present if reflective bands are in the product.
REFLECTIVE_SAMPLES	= 0–99999	The number of product samples for the reflective bands (Bands 1–7 and Band 9). This parameter is only present if reflective bands are in the product.
THERMAL_LINES	= 0–99999	The number of product lines for the thermal bands (Bands 10–11). This parameter is only present if thermal bands are in the product.
THERMAL_SAMPLES	= 0–99999	The number of product samples for the thermal bands (Bands 10–11). This parameter

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
		is only present if thermal bands are in the product.
ORIENTATION	= “NORTH_UP”	The orientation used in creating the image.
CORNER_UL_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the upper-left corner of the product, measured at the center of the pixel. A positive (+) value indicates north latitude; a negative (-) value indicates south latitude. Units are in degrees.
CORNER_UL_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the upper-left corner of the product, measured at the center of the pixel. Positive (+) value indicates east longitude; negative (-) value indicates west longitude. Units are in degrees.
CORNER_UR_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the upper-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_UR_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the upper-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LL_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the lower-left corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LL_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the lower-left corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LR_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the lower-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LR_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the lower-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_UL_PROJECTION_X_PRODUCT	= -132000000.000 through 132000000.000	The upper-left corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_UL_PROJECTION_Y_PRODUCT	= -132000000.000 through 132000000.000	The upper-left corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
CORNER_UR_PROJECTION_X_PRODUCT	= -132000000.000 through 132000000.000	The upper-right corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_UR_PROJECTION_Y_PRODUCT	= -132000000.000 through 132000000.000	The upper-right corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LL_PROJECTION_X_PRODUCT	= -132000000.000 through 132000000.000	The lower-left corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LL_PROJECTION_Y_PRODUCT	= -132000000.000 through 132000000.000	The lower-left corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LR_PROJECTION_X_PRODUCT	= -132000000.000 through 132000000.000	The lower-right corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LR_PROJECTION_Y_PRODUCT	= -132000000.000 through 132000000.000	The lower-right corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
END_GROUP	= PROJECTION_ATTRIBUTES	
GROUP	= LEVEL1_PROCESSING_RECORD	
ORIGIN	= “Image courtesy of the U.S. Geological Survey”	Origin of the product.
DIGITAL_OBJECT_IDENTIFIER	= “https://doi.org/10.5066/P975CC9B”	Digital Object Identifier for Level 1 OLI-TIRS. For more information on Digital Object Identifiers, visit https://www.doi.org.
REQUEST_ID	= “NNNNNNNNNNNN_UUUUU”	USGS products use the “NNNYYMMDDSSSS_UUUUU” format, where: NNNYYMMDDSSSS = 13-digit Tracking, Recording, and Metrics (TRAM) order number NNN = Node indicator YY = Year MM = Month DD = Day SSSS = Sequence number for the day UUUUU = Five-digit TRAM unit number
LANDSAT_SCENE_ID	= “LsSppprrrYYYYDDDGGGVV”	The unique Landsat scene identifier.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
LANDSAT_PRODUCT_ID	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX”	Landsat uses the “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX” format, where: L = Landsat X = Sensor SS = Satellite (08 or 09) LLLL = Processing correction Level PPP = WRS path RRR = WRS row YYYYMMDD = Acquisition year (YYYY) Month (MM) Day (DD) yyyymmdd = Processing year (yyyy) month (mm) day (dd) CC = Collection number TX = Collection category
PROCESSING_LEVEL	= “L1GT” = “L1TP”	The identifier to inform the user of the processing level of the product.
COLLECTION_CATEGORY	= “T1” = “T2” = “RT”	The scene collection category, “RT” for real-time, “T1” for Tier 1 quality collection, and “T2” for Tier 2 quality collection.
OUTPUT_FORMAT	= “GEOTIFF”	Output file format for image files.
DATE_PRODUCT_GENERATED	= YYYY-MM-DDTHH:MI:SSZ	The date when the metadata file for the product was created: YYYY-MM-DDTHH:MI:SSZ Where: YYYY = Four-digit Julian year MM = Month of the Julian year (01-12) DD = Day of the Julian month (01-31) T = Start of time information in ODL American Standard Code for Information Interchange (ASCII) time code format HH = Hours (00-23) MI = Minutes (00-59) SS = Seconds (00-59) Z = Zulu time (same as Greenwich Mean Time (GMT))

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
PROCESSING_SOFTWARE_VERSION	= “LPGS_X.Y.Z”	The processing software version that created the product. The version consists of a system name followed by an underscore and then the software version, where X is the major release number, Y is the minor release number, and Z is the patch (or engineering) release number. X, Y, and Z are all numeric values.
FILE_NAME_BAND_1	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B1.TIF”	The file name for L1 Band 1. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_2	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B2.TIF”	The file name for L1 Band 2. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_3	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B3.TIF”	The file name for L1 Band 3. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B4.TIF”	The file name for L1 Band 4. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_5	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B5.TIF”	The file name for L1 Band 5. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_6	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6.TIF”	The file name for L1 Band 6. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_7	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B7.TIF”	The file name for L1 Band 7. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_8	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B8.TIF”	The file name for L1 Band 8. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_9	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B9.TIF”	The file name for L1 Band 9. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_10	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B10.TIF”	The file name for L1 Band 10. This parameter is only present if the band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_BAND_11	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B11.TIF”	The file name for L1 Band 11. This parameter is only present if the band is included in the product.
FILE_NAME_QUALITY_L1_PIXEL	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_PIXEL.TIF”	The file name for the L1 Quality Assessment (QA) Band.
FILE_NAME_QUALITY_L1_RADIOMETRIC_SATURATION	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_RADSAT.TIF”	The file name for the Radiometric Saturation Quality Assessment (QA) Band.
FILE_NAME_ANGLE_COEFFICIENT	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ANG.txt”	The file name for the angle coefficient file. This parameter is only present if the angle coefficient file is included in the product.
FILE_NAME_ANGLE_SENSOR_AZIMUTH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VAA.TIF”	The file name for the Band 4 View (sensor) Azimuth Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SENSOR_ZENITH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VZA.TIF”	The file name for the Band 4 View (sensor) Zenith Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SOLAR_AZIMUTH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SAA.TIF”	The file name for the Band 4 Solar Azimuth Angle. This parameter is only present if the band is included in the product.
FILE_NAME_ANGLE_SOLAR_ZENITH_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SZA.TIF”	The file name for the Band 4 Solar Zenith Angle. This parameter is only present if the band is included in the product.
FILE_NAME_METADATA_ODL	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.txt”	The file name for L1 ODL metadata.
FILE_NAME_METADATA_XML	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.xml”	The file name for L1 XML metadata.
FILE_NAME_CPF	= “LXSSCPF_YYYYMMDD_yyyymmdd_CC.NN”	The file name for the CPF used to generate the product.
FILE_NAME_BPF_OLI	= “LOSBPFYYYYMMDDhhmmss_YYYYMMDDhhmmss.nn”	The file name for the Bias Parameter File (BPF) used to generate the product, if applicable. This only applies to products that contain OLI bands.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_BPF_TIRS	= “LTSBPFYYYYMMDDhhmmss_YYYYMMDDhhmmss.nn”	The file name for the BPF used to generate the product, if applicable. This only applies to products that contain TIRS bands.
FILE_NAME_RLUT	= “LXSSRLUT_YYYYMMDD_yyyymmdd_CC_NN.h5”	The file name for the Response Linearization Lookup Table (RLUT) used to generate the product, if applicable.
DATA_SOURCE_TIRS_STRAY_LIGHT_CORRECTION	= “TIRS”	The correction source used in creating the Landsat 8 TIRS stray light correction image. This field is not included for Landsat 9.
DATA_SOURCE_ELEVATION	= “GLS2000” = “RAMP” = “GTOPO30”	Indicates the source of the DEM used in the correction process.
GROUND_CONTROL_POINTS_VERSION	= 0-999	GCP dataset version used in the precision correction process. This parameter is only present if the PROCESSING_LEVEL is L1TP.
GROUND_CONTROL_POINTS_MODEL	= 0-9999	Number of GCPs used in the precision correction process. This parameter is only present if the PROCESSING_LEVEL is L1TP.
GEOMETRIC_RMSE_MODEL	= N.NNN	Combined Root Mean Square Error (RMSE) of the geometric residuals (meters) in both across-track and along-track directions measured on the GCPs used in geometric precision correction. This parameter is only present if the PROCESSING_LEVEL is L1TP.
GEOMETRIC_RMSE_MODEL_Y	= N.NNN	The post-fit RMSE for the along-track direction. Units are in meters equal to or greater than zero, with no upper limit, and three decimal places. This parameter is only present if the PROCESSING_LEVEL is L1TP.
GEOMETRIC_RMSE_MODEL_X	= N.NNN	The post-fit RMSE for the along-track direction. Units are in meters equal to or greater than zero, with no upper limit, and three decimal places. This parameter is only present if the PROCESSING_LEVEL is L1TP.
GROUND_CONTROL_POINTS_VERIFY	= 1-9999	Number of GCPs used in the verification of the terrain corrected product. This parameter is only present for L1TP images with enough

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
		successfully correlating validation GCPs to calculate geometric accuracy.
GEOMETRIC_RMSE_VERIFY	= 0.000-9999.999	RMSE of the geometric residuals (meters) measured on the terrain-corrected product independently using GLS2000. This parameter is only present for L1TP images with enough successfully correlating validation GCPs to calculate geometric accuracy.
END_GROUP	= LEVEL1_PROCESSING_RECORD	
GROUP	= LEVEL1_MIN_MAX_RADIANCE	
RADIANCE_MAXIMUM_BAND_1	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 1. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_1	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 1. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_2	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 2. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_2	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 2. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_3	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 3. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_3	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 3. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_4	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 4. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_4	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 4. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_5	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 5. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MINIMUM_BAND_5	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 5. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_6	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 6. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_6	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 6. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_7	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 7. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_7	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 7. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_8	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 8. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_8	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 8. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_9	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 9. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_9	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 9. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_10	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 10. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_10	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 10. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_11	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 11. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MINIMUM_BAND_11	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 11. This parameter is only present if this band is included in the product.
END_GROUP	= LEVEL1_MIN_MAX_RADIANCE	
GROUP	= LEVEL1_MIN_MAX_REFLECTANCE	
REFLECTANCE_MAXIMUM_BAND_1	= N.NNNNNN	Maximum achievable reflectance value for Band 1. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_1	= N.NNNNNN	Minimum achievable reflectance value for Band 1. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_2	= N.NNNNNN	Maximum achievable reflectance value for Band 2. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_2	= N.NNNNNN	Minimum achievable reflectance value for Band 2. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_3	= N.NNNNNN	Maximum achievable reflectance value for Band 3. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_3	= N.NNNNNN	Minimum achievable reflectance value for Band 3. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_4	= N.NNNNNN	Maximum achievable reflectance value for Band 4. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_4	= N.NNNNNN	Minimum achievable reflectance value for Band 4. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_5	= N.NNNNNN	Maximum achievable reflectance value for Band 5. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_5	= N.NNNNNN	Minimum achievable reflectance value for Band 5. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_6	= N.NNNNNN	Maximum achievable reflectance value for Band 6. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
REFLECTANCE_MINIMUM_BAND_6	= N.NNNNNN	Minimum achievable reflectance value for Band 6. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_7	= N.NNNNNN	Maximum achievable reflectance value for Band 7. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_7	= N.NNNNNN	Minimum achievable reflectance value for Band 7. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_8	= N.NNNNNN	Maximum achievable reflectance value for Band 8. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_8	= N.NNNNNN	Minimum achievable reflectance value for Band 8. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_9	= N.NNNNNN	Maximum achievable reflectance value for Band 9. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_9	= N.NNNNNN	Minimum achievable reflectance value for Band 9. This parameter is only present if this band is included in the product.
END_GROUP	= LEVEL1_MIN_MAX_REFLECTANCE	
GROUP	= LEVEL1_MIN_MAX_PIXEL_VALUE	
QUANTIZE_CAL_MAX_BAND_1	= 1-65535	Maximum possible pixel value for Band 1. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_1	= 0-1	Minimum possible pixel value for Band 1. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_2	= 1-65535	Maximum possible pixel value for Band 2. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_2	= 0-1	Minimum possible pixel value for Band 2. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_3	= 1-65535	Maximum possible pixel value for Band 3. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MIN_BAND_3	= 0-1	Minimum possible pixel value for Band 3. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_4	= 1-65535	Maximum possible pixel value for Band 4. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_4	= 0-1	Minimum possible pixel value for Band 4. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_5	= 1-65535	Maximum possible pixel value for Band 5. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_5	= 0-1	Minimum possible pixel value for Band 5. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_6	= 1-65535	Maximum possible pixel value for Band 6. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_6	= 0-1	Minimum possible pixel value for Band 6. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_7	= 1-65535	Maximum possible pixel value for Band 7. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_7	= 0-1	Minimum possible pixel value for Band 7. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_8	= 1-65535	Maximum possible pixel value for Band 8. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_8	= 0-1	Minimum possible pixel value for Band 8. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_9	= 1-65535	Maximum possible pixel value for Band 9. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MIN_BAND_9	= 0-1	Minimum possible pixel value for Band 9. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_10	= 1-65535	Maximum possible pixel value for Band 10. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_10	= 0-1	Minimum possible pixel value for Band 10. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_11	= 1-65535	Maximum possible pixel value for Band 11. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_11	= 0-1	Minimum possible pixel value for Band 11. This parameter is only present if this band is included in the product.
END_GROUP	= LEVEL1_MIN_MAX_PIXEL_VALUE	
GROUP	= LEVEL1_RADIOMETRIC_RESCALING	
RADIANCE_MULT_BAND_1	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 1 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_2	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 2 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_3	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 3 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_4	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 4 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_5	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 5 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_6	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 6 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_7	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 7 (W/(m^2 sr um)/DN).

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MULT_BAND_8	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 8 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_9	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 9 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_10	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 10 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_11	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 11 (W/(m^2 sr um)/DN).
RADIANCE_ADD_BAND_1	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 1 (W/(m^2 sr um)).
RADIANCE_ADD_BAND_2	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 2 (W/(m^2 sr um).
RADIANCE_ADD_BAND_3	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 3 (W/(m^2 sr um).
RADIANCE_ADD_BAND_4	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 4 (W/(m^2 sr um).
RADIANCE_ADD_BAND_5	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 5 (W/(m^2 sr um).
RADIANCE_ADD_BAND_6	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 6 (W/(m^2 sr um).
RADIANCE_ADD_BAND_7	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 7 (W/(m^2 sr um).
RADIANCE_ADD_BAND_8	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 8 (W/(m^2 sr um).

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_ADD_BAND_9	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 9 (W/(m^2 sr um).
RADIANCE_ADD_BAND_10	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 10 (W/(m^2 sr um).
RADIANCE_ADD_BAND_11	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 11 (W/(m^2 sr um).
REFLECTANCE_MULT_BAND_1	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 1 (DN^-1).
REFLECTANCE_MULT_BAND_2	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 2 (DN^-1).
REFLECTANCE_MULT_BAND_3	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 3 (DN^-1).
REFLECTANCE_MULT_BAND_4	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 4 (DN^-1).
REFLECTANCE_MULT_BAND_5	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 5 (DN^-1).
REFLECTANCE_MULT_BAND_6	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 6 (DN^-1).
REFLECTANCE_MULT_BAND_7	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 7 (DN^-1).
REFLECTANCE_MULT_BAND_8	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 8 (DN^-1).
REFLECTANCE_MULT_BAND_9	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 9 (DN^-1).
REFLECTANCE_ADD_BAND_1	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 1.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
REFLECTANCE_ADD_BAND_2	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 2.
REFLECTANCE_ADD_BAND_3	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 3.
REFLECTANCE_ADD_BAND_4	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 4.
REFLECTANCE_ADD_BAND_5	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 5.
REFLECTANCE_ADD_BAND_6	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 6.
REFLECTANCE_ADD_BAND_7	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 7.
REFLECTANCE_ADD_BAND_8	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 8.
REFLECTANCE_ADD_BAND_9	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 9.
END_GROUP	= LEVEL1_RADIOMETRIC_RESCALING	
GROUP	= LEVEL1_THERMAL_CONSTANTS	
K1_CONSTANT_BAND_10	= NNN.NNNN	K1 coefficient for Band 10 radiance to temperature conversion. This parameter is only included if Band 10 is included in the product.
K2_CONSTANT_BAND_10	= NNNN.NNNN	K2 coefficient for Band 10 radiance to temperature conversion. This parameter is only included if Band 10 is included in the product.
K1_CONSTANT_BAND_11	= NNN.NNNN	K1 coefficient for Band 11 radiance to temperature conversion. This parameter is only included if Band 11 is included in the product.
K2_CONSTANT_BAND_11	= NNNN.NNNN	K2 coefficient for Band 11 radiance to temperature conversion. This parameter is only included if Band 11 is included in the product.
END_GROUP	= LEVEL1_THERMAL_CONSTANTS	
GROUP	= LEVEL1_PROJECTION_PARAMETERS	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
MAP_PROJECTION	= “UTM” = “PS”	The map projection used in creating the image. Universal Transverse Mercator (UTM) or Polar Stereographic (PS).
DATUM	= “WGS84”	The datum used in creating the image.
ELLIPSOID	= “WGS84”	The ellipsoid used in creating the image.
UTM_ZONE	= 1 through 60	The value used to indicate the zone number. This parameter is only included for the UTM projection.
VERTICAL_LON_FROM_POLE	= 0	Vertical longitude (decimal degrees) from the pole. Only present when MAP_PROJECTION is PS.
TRUE_SCALE_LAT	= -71.00000 = 71.00000	Latitude of true scale in a map projection. Only present when MAP_PROJECTION is PS.
FALSE_EASTING	= 0	Value added to all "x" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in the ProjLinearUnitsGeoKey. Only present when MAP_PROJECTION is PS.
FALSE_NORTHING	= 0	Value added to all "y" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in the ProjLinearUnitsGeoKey. Only present when MAP_PROJECTION is PS.
GRID_CELL_SIZE_PANCHROMATIC	= 15.00	The grid cell size in meters used in creating the image for the panchromatic band. This parameter is only included if the panchromatic band is included in the product.
GRID_CELL_SIZE_REFLECTIVE	= 30.00	The grid cell size in meters used in creating the image for Visible and Near Infrared (VNIR) / Short-Wave Infrared (SWIR) bands. This parameter is only included if the reflective bands are included in the product.
GRID_CELL_SIZE_THERMAL	= 30.00	The grid cell size in meters used in creating the image for the thermal bands. This

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
		parameter is only included if the thermal bands are included in the product.
ORIENTATION	= “NORTH_UP”	The orientation used in creating the image.
RESAMPLING_OPTION	= “CUBIC_CONVOLUTION”	The resampling option used in creating the image. Cubic Convolution (CC).
END_GROUP	= LEVEL1_PROJECTION_PARAMETERS	
END_GROUP	= LANDSAT_METADATA_FILE	
END		

Table 3-5. L1 Metadata ODL File

The XML metadata file and ODL metadata file have comparable fields. The LANDSAT_METADATA_FILE group for ODL is synonymous to the root element LANDSAT_METADATA_FILE for XML. The LANDSAT_METADATA_FILE group for ODL contains nested groups, synonymously, the LANDSAT_METADATA_FILE root element for XML has children elements. In the XML metadata file, the ODL parameter name is used in the start-tag and end-tag for elements. All parameters listed in the metadata file using ODL format are also in a separate metadata file using the XML format.

The XML metadata file and ODL metadata file have some contrasts. The ODL file distinguishes between strings and numerical values through the presence or absence of quotes around a value. The XML file does not make that distinction. The ODL file has an END statement signifying the end of the file. The XML file does not have a comparable entity.

XML Elements
<?xml version="1.0" encoding="UTF-8"?>
<LANDSAT_METADATA_FILE>
<PRODUCT_CONTENTS>
<ORIGIN>Image courtesy of the U.S. Geological Survey</ORIGIN>
<DIGITAL_OBJECT_IDENTIFIER>https://doi.org/10.5066/P975CC9B</DIGITAL_OBJECT_IDENTIFIER>
<LANDSAT_PRODUCT_ID>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX</LANDSAT_PRODUCT_ID>
<PROCESSING_LEVEL>L1GT</PROCESSING_LEVEL>
<COLLECTION_NUMBER>NN</COLLECTION_NUMBER>
<COLLECTION_CATEGORY>T1</COLLECTION_CATEGORY>
<OUTPUT_FORMAT>GEOTIFF</OUTPUT_FORMAT>
<FILE_NAME_BAND_1>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B1.TIF</FILE_NAME_BAND_1>
<FILE_NAME_BAND_2>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B2.TIF</FILE_NAME_BAND_2>
<FILE_NAME_BAND_3>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B3.TIF</FILE_NAME_BAND_3>
<FILE_NAME_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B4.TIF</FILE_NAME_BAND_4>
<FILE_NAME_BAND_5>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B5.TIF</FILE_NAME_BAND_5>
<FILE_NAME_BAND_6>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6.TIF</FILE_NAME_BAND_6>
<FILE_NAME_BAND_7>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B7.TIF</FILE_NAME_BAND_7>
<FILE_NAME_BAND_8>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B8.TIF</FILE_NAME_BAND_8>
<FILE_NAME_BAND_9>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B9.TIF</FILE_NAME_BAND_9>
<FILE_NAME_BAND_10>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B10.TIF</FILE_NAME_BAND_10>
<FILE_NAME_BAND_11>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B11.TIF</FILE_NAME_BAND_11>
<FILE_NAME_QUALITY_L1_PIXEL>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_PIXEL.TIF</FILE_NAME_QUALITY_L1_PIXEL>
<FILE_NAME_QUALITY_L1_RADIOMETRIC_SATURATION>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_QA_RADSAT.TIF</FILE_NAME_QUALITY_L1_RADIOMETRIC_SATURATION>
<FILE_NAME_ANGLE_COEFFICIENT>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ANG.txt</FILE_NAME_ANGLE_COEFFICIENT>
<FILE_NAME_ANGLE_SENSOR_AZIMUTH_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VAA.TIF</FILE_NAME_ANGLE_SENSOR_AZIMUTH_BAND_4>

XML Elements
<FILE_NAME_ANGLE_SENSOR_ZENITH_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_VZA.TIF</FILE_NAME_ANGLE_SENSOR_ZENITH_BAND_4>
<FILE_NAME_ANGLE_SOLAR_AZIMUTH_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SAA.TIF</FILE_NAME_ANGLE_SOLAR_AZIMUTH_BAND_4>
<FILE_NAME_ANGLE_SOLAR_ZENITH_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SZA.TIF</FILE_NAME_ANGLE_SOLAR_ZENITH_BAND_4>
<FILE_NAME_METADATA_ODL>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.txt</FILE_NAME_METADATA_ODL>
<FILE_NAME_METADATA_XML>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.xml</FILE_NAME_METADATA_XML>
<DATA_TYPE_BAND_1>UINT16</DATA_TYPE_BAND_1>
<DATA_TYPE_BAND_2>UINT16</DATA_TYPE_BAND_2>
<DATA_TYPE_BAND_3>UINT16</DATA_TYPE_BAND_3>
<DATA_TYPE_BAND_4>UINT16</DATA_TYPE_BAND_4>
<DATA_TYPE_BAND_5>UINT16</DATA_TYPE_BAND_5>
<DATA_TYPE_BAND_6>UINT16</DATA_TYPE_BAND_6>
<DATA_TYPE_BAND_7>UINT16</DATA_TYPE_BAND_7>
<DATA_TYPE_BAND_8>UINT16</DATA_TYPE_BAND_8>
<DATA_TYPE_BAND_9>UINT16</DATA_TYPE_BAND_9>
<DATA_TYPE_BAND_10>UINT16</DATA_TYPE_BAND_10>
<DATA_TYPE_BAND_11>UINT16</DATA_TYPE_BAND_11>
<DATA_TYPE_QUALITY_L1_PIXEL>UINT16</DATA_TYPE_QUALITY_L1_PIXEL>
<DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION>UINT16</DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION>
<DATA_TYPE_ANGLE_SENSOR_AZIMUTH_BAND_4>INT16</DATA_TYPE_ANGLE_SENSOR_AZIMUTH_BAND_4>
<DATA_TYPE_ANGLE_SENSOR_ZENITH_BAND_4>INT16</DATA_TYPE_ANGLE_SENSOR_ZENITH_BAND_4>
<DATA_TYPE_ANGLE_SOLAR_AZIMUTH_BAND_4>INT16</DATA_TYPE_ANGLE_SOLAR_AZIMUTH_BAND_4>
<DATA_TYPE_ANGLE_SOLAR_ZENITH_BAND_4>INT16</DATA_TYPE_ANGLE_SOLAR_ZENITH_BAND_4>
</PRODUCT_CONTENTS>
<IMAGE_ATTRIBUTES>

XML Elements
<SPACECRAFT_ID>LANDSAT_8</SPACECRAFT_ID>
<SENSOR_ID>OLI_TIRS</SENSOR_ID>
<WRS_TYPE>2</WRS_TYPE>
<WRS_PATH>1-233</WRS_PATH>
<WRS_ROW>1-248</WRS_ROW>
<NADIR_OFFNADIR>NADIR</NADIR_OFFNADIR>
<TARGET_WRS_PATH>1-233</TARGET_WRS_PATH>
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Table 3-6. L1 Metadata XML File

3.6 L1 Angle Coefficients File

The L1 angle coefficients file contains metadata and coefficients that allow solar and satellite viewing angles, for all bands, to be calculated. Table 3-7 lists the full contents of the L1 angle coefficients file. In Table 3-7, L1T refers to either L1GT or L1TP as applicable. The angle coefficients file is presented as text in the ODL format. Refer to https://landsat.usgs.gov for information on using the L1 angle coefficient file.

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
GROUP	= FILE_HEADER	The beginning of the file header ODL group.
LANDSAT_SCENE_ID	= "LsSppprrrYYYY DDDGGGVV"	The unique Landsat scene identifier.
SPACECRAFT_ID	= "LANDSAT_8" = "LANDSAT_9"	Spacecraft from which the data were captured.
NUMBER_OF_BANDS	= 1 – 11	Number of bands contained in the angle coefficient file.
BAND_LIST	= (1,2,3,4,5,6,7,8,9 ,10,11)	List of spectral bands contained in the angle coefficient file. The number of bands listed is specified by the NUMBER_OF_BANDS parameter.
END_GROUP	= FILE_HEADER	The end of the file header ODL group.
GROUP	= PROJECTION	The beginning of the projection ODL group.
ELLIPSOID_AXES	= (Semi-major, Semi-minor)	WGS84 ellipsoid semi-major and semi-minor axes, in meters.
MAP_PROJECTION	= "UTM" = "PS"	The map projection used in creating the image. UTM or PS.
PROJECTION_UNITS	= "METERS"	Map projection units, which are always METERS.
DATUM	= "WGS84"	The datum used in creating the image.
ELLIPSOID	= "WGS84"	The ellipsoid used in creating the image.
UTM_ZONE	= 1 – 60	UTM zone number (1 – 60). Field is absent for non-UTM projections.
PROJECTION_PARAMETERS	= (P_1 … P_{15})	General Cartographic Transformation Package (GCTP) map projection parameters array with 15 double precision floating point parameters. This is all zeros for UTM. PS includes ellipsoid axis, false easting and northing (both 0), latitude of true scale (+/- 71), and the vertical axis longitude (also 0).

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
UL_CORNER	= (X, Y)	L1T upper-left corner map projection coordinates in meters (doubles).
UR_CORNER	= (X, Y)	L1T upper-right corner map projection coordinates in meters (doubles).
LL_CORNER	= (X, Y)	L1T lower-left corner map projection coordinates in meters (doubles).
LR_CORNER	= (X, Y)	L1T lower-right corner map projection coordinates in meters (doubles).
END_GROUP	= PROJECTION	The end of the projection ODL group.
GROUP	= EPHEMERIS	The beginning of the ephemeris ODL group.
EPHEMERIS_EPOCH_YEAR	= YYYY	Year of ephemeris starting time epoch (integer).
EPHEMERIS_EPOCH_DAY	= DDD	Day of year of ephemeris epoch (integer).
EPHEMERIS_EPOCH_SECONDS	= Seconds	Seconds of day of ephemeris epoch (double).
NUMBER_OF_POINTS	= 1 – 99999	Number of ephemeris points contained in the next four parameter fields.
EPHEMERIS_TIME	= ($time_1$ … $time_N$)	Array of double precision ephemeris sample time offsets (from epoch) in seconds.
EPHEMERIS_ECEF_X	= (X_1 … X_N)	Array of double precision ephemeris samples Earth Centered Earth Fixed (ECEF) X coordinates in meters.
EPHEMERIS_ECEF_Y	= (Y_1 … Y_N)	Array of double precision ephemeris samples ECEF Y coordinates in meters.
EPHEMERIS_ECEF_Z	= (Z_1 … Z_N)	Array of double precision ephemeris samples ECEF Z coordinates in meters.
END_GROUP	= EPHEMERIS	The end of the ephemeris ODL group.
GROUP	= SOLAR_VECTOR	The beginning of the solar vector ODL group.
SOLAR_EPOCH_YEAR	= YYYY	Year of solar start time (integer).
SOLAR_EPOCH_DAY	= DDD	Day of year of solar start time (integer).
SOLAR_EPOCH_SECONDS	= Seconds	Seconds of day of solar start time (double).

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
EARTH_SUN_DISTANCE	= Distance	Measurement of the earth to sun distance at the particular day and time of imagery acquisition. AU of measurement.
NUMBER_OF_POINTS	= 1 – 99999	Number of solar vector points contained in the next four parameter fields.
SAMPLE_TIME	= ($time_1$ … $time_N$)	Array of double precision solar vector sample time offsets (from epoch) in seconds.
SOLAR_ECEF_X	= (X_1 … X_N)	Array of double precision solar vector samples ECEF X direction.
SOLAR_ECEF_Y	= (Y_1 … Y_N)	Array of double precision solar vector samples ECEF Y direction.
SOLAR_ECEF_Z	= (Z_1 … Z_N)	Array of double precision solar vector samples ECEF Z direction.
END_GROUP	= SOLAR_VECTOR	The end of the solar vector ODL group.
GROUP	= RPC_BAND##	The beginning of the Rational Polynomial Coefficients (RPC) Band ## ODL group. The "##" corresponds to the band number (1 – 11). This group is repeated for every band that is present.
BAND##_NUMBER_OF_SCAS	= 1 – 14	Number of Sensor Chip Assemblies (SCAs) present in the coefficient file.
BAND##_NUM_L1T_LINES	= 1 – 99999	Number of lines in the L1T product.
BAND##_NUM_L1T_SAMPS	= 1 – 99999	Number of samples in the L1T product.
BAND##_L1T_IMAGE_CORNER_LINES	= (Upper Left, Upper Right, Lower Right, Lower Left)	Defines the image corner line coordinates in the L1T image (as doubles).
BAND##_L1T_IMAGE_CORNER_SAMPS	= (Upper Left, Upper Right, Lower Right, Lower Left)	Defines the image corner sample coordinates in the L1T image (as doubles).
BAND##_NUM_L1R_LINES	= 1 – 99999	Number of lines in the Level 1 Reformatted (L1R) product.
BAND##_NUM_L1R_SAMPS	= 1 – 99999	Number of samples in the L1R product.
BAND##_PIXEL_SIZE	= L1T pixel size	L1T pixel size in meters.
BAND##_START_TIME	= Start Time	L1R image start time in seconds from the ephemeris epoch.

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
BAND##_LINE_TIME	= Seconds per line	L1R image line time increment in seconds.
BAND##_MEAN_HEIGHT	= Mean Height	Mean height offset over the scene for the RPC angle model (double).
BAND##_MEAN_L1R_LINE_SAMP	= (Line, Sample)	Mean L1R line and sample offsets for the RPC angle model (doubles).
BAND##_MEAN_L1T_LINE_SAMP	= (Line, Sample)	Mean L1T line and sample offsets for the RPC angle model (doubles).
BAND##_MEAN_SAT_VECTOR	= (X, Y, Z)	Mean satellite view vector for the RPC angle model (doubles).
BAND##_SAT_X_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector X coordinate.
BAND##_SAT_X_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector X coordinate.
BAND##_SAT_Y_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector Y coordinates.
BAND##_SAT_Y_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector Y coordinate.
BAND##_SAT_Z_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector Z coordinates.
BAND##_SAT_Z_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector Z coordinate.
BAND##_MEAN_SUN_VECTOR	= (X, Y, Z)	Mean sun vector for the RPC angle model (doubles).
BAND##_SUN_X_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector X coordinate.
BAND##_SUN_X_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of denominator polynomial coefficients for the sun vector X coordinate.

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
BAND##_SUN_Y_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector Y coordinates.
BAND##_SUN_Y_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the sun vector Y coordinates.
BAND##_SUN_Z_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector Z coordinates.
BAND##_SUN_Z_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the sun vector Z coordinates.
BAND##_SCA_LIST	= (1,2,3,4,5,6,7,8,9 ,10,11,12,13,14)	List of SCAs in this band. OLI normally has 14 and TIRS normally has 3.
BAND##_SCA##_MEAN_HEIGHT	= Mean Height	Mean height offset for the SCA## L1T to L1R RPC model. The "##" behind the SCA denotes the SCA number. This field and the following six fields are repeated for each SCA present in the SCA list for the current band and for each following band.
BAND##_SCA##_MEAN_L1R_LINE_SAMP	= (Line, Sample)	Mean L1R line and sample offsets for the SCA## L1T to L1R RPC model (doubles).
BAND##_SCA##_MEAN_L1T_LINE_SAMP	= (Line, Sample)	Mean L1T line and sample offsets for the SCA## L1T to L1R RPC model (doubles).
BAND##_SCA##_LINE_NUM_COEF	= (a_0 … a_4)	Array (five elements) of numerator polynomial coefficients for the SCA## L1R line RPC model (doubles).
BAND##_SCA##_LINE_DEN_COEF	= (b_1 … b_4)	Array (four elements) of denominator polynomial coefficients for the SCA## L1R line RPC model (doubles).
BAND##_SCA##_SAMP_NUM_COEF	= (c_0 … c_4)	Array (five elements) of numerator polynomial coefficients for the SCA## L1R sample RPC model (doubles).
BAND##_SCA##_SAMP_DEN_COEF	= (d_1 … d_4)	Array (four elements) of denominator polynomial coefficients for the SCA## L1R sample RPC model (doubles).

Parameter Name	Value, Format, and Range	Parameter Description/ Remarks
END_GROUP	= RPC_BAND##	The end of the RPC BAND ## ODL group. This group is followed by the next RPC_BAND## ODL group (if present).

Table 3-7. Angle Coefficients File

3.7 Checksum File

A single checksum file is created for all the files in the product. The checksum file contains a Message-Digest Algorithm 5 (MD5) checksum for every file. The file is in plain text format and contains the output from md5sum for each file. The checksum file is not distributed with the final product.

Appendix A Acronyms

ADD	Algorithm Description Document
ANG	Angle Coefficient File
ASCII	American Standard Code for Information Interchange
AU	Astronomical Unit
BPF	Bias Parameter File
C2	Collection 2
Cal/Val	Calibration/Validation
CC	Cubic Convolution
CCB	Configuration Control Board
CFMask	C version of FMask
COG	Cloud Optimized GeoTIFF
CPF	Calibration Parameter File
CR	Change Request
DEM	Digital Elevation Model
DFCB	Data Format Control Book
DN	Digital Number
DOI	Department of the Interior
DPAS	Data Processing and Archive System
ECEF	Earth Centered Earth Fixed
EPSG	European Petroleum Survey Group
EROS	Earth Resources Observation Science
FT	File Type
GCP	Ground Control Point
GCTP	General Cartographic Transformation Package
GDAL	Geospatial Data Abstraction Library
GeoTIFF	Geographic Tagged Image File Format
GMT	Greenwich Mean Time
L0R	Level 0 Reformatted
L1	Level 1 Data Product
L1GT	Level 1 Systematic Terrain (Corrected)
L1R	Level 1 Reformatted
L1T	Level 1 Terrain (Corrected)
L1TP	Level 1 Precision Terrain (Corrected)
LGN	Landsat Ground Network
LOS	Line-of-Sight
LPGS	Landsat Product Generation System
LSDS	Land Satellites Data System
MD5	Message-Digest Algorithm 5
MTL	Metadata file
NASA	National Aeronautics and Space Administration
NIR	Near-Infrared

nm	Nanometer
ODL	Object Description Language
OLI	Operational Land Imager
PS	Polar Stereographic
QA	Quality Assessment
RADSAT	Radiometric Saturation
RLUT	Response Linear Lookup Table
RMSE	Root Mean Square Error
RPC	Rational Polynomial Coefficient
RT	Real Time
SAA	Solar Azimuth Angle
SCA	Sensor Chip Assembly
SSM	Scene Select Mirror
SWIR	Short Wavelength Infrared
SZA	Solar Zenith Angle
T1	Tier 1
T2	Tier 2
TIFF	Tagged Image File Format
TIRS	Thermal Infrared Sensor
TOA	Top of Atmosphere
TRAM	Tracking, Routing, and Metrics
USGS	U.S. Geological Survey
UTC	Universal Time Coordinate
UTM	Universal Transverse Mercator
VAA	View Azimuth Angle
VZA	View Zenith Angle
VNIR	Visible and Near Infrared
WGS84	World Geodetic System 1984
WRS	Worldwide Reference System
WRS-2	Worldwide Reference System 2
XML	Extensible Markup Language
YSF	Yaw Steering Frame

References

Please see https://www.usgs.gov/land-resources/nli/landsat/glossary-and-acronyms for a complete list of acronyms.

USGS/EROS. LSDS-293. Landsat Data Management Policy.

USGS/EROS. LSDS-547. Landsat Ground Station (GS) Identifiers.

USGS/EROS. LSDS-1388. Landsat Cloud Optimized GeoTIFF (COG) Data Format Control Book (DFCB).

USGS/EROS. LSDS-1747. Landsat 8-9 Calibration and Validation (Cal/Val) Algorithm Description Document (ADD).

USGS/EROS. LSDS-1834. Landsat 8-9 Operational Land Imager (OLI) – Thermal Infrared Sensor (TIRS) Calibration Parameter File (CPF) Data Format Control Book (DFCB).

USGS/EROS. LSDS-1835. Landsat 8-9 Operational Land Imager (OLI) – Thermal Infrared Sensor (TIRS) Bias Parameter File (BPF) Data Format Control Book (DFCB).

EPSG Geodetic Parameter Registry
http://www.epsg-registry.org/

GeoTIFF Specification
http://geotiff.maptools.org/spec/geotiffhome.html