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Department of the Interior
U.S. Geological Survey

Landsat
Enhanced Thematic Mapper Plus (ETM+)
Collection 2 (C2) Level 2 (L2)
Data Format Control Book (DFCB)

Version 5.0

September 2020

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Approved By:

CHRISTOPHER ENGEBRETSON

Digitally signed by CHRISTOPHER ENGEBRETSON
Date: 2020.09.22 09:25:17 -05'00'

Chris Engebretson Date
Landsat DPAS CCB Chair
U.S. Geological Survey

EROS
Sioux Falls, South Dakota

Executive Summary

This Data Format Control Book (DFCB) presents detailed data formats of the Landsat 7 Collection 2 (C2) Level 2 (L2) products that the Landsat Product Generation System (LPGS) generates. This processing system produces L2 output files from Level 1 (L1) input files. 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:

Landsat Mission Management Officer
U.S. Geological Survey (USGS)
Earth Resources Observation and Science (EROS) Center
47914 252nd Street
Sioux Falls, SD 57198

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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 Enhanced Thematic Mapper Plus (ETM+) L2 product distribution.

This document describes the formats and data contents of the C2 L2 output files. The output format generated by the LPGS for distribution is COG.

1.3 Document Organization

This document contains the following sections:

- Section 1 provides an introduction
- Section 2 provides an overview of C2 L2 product files
- Section 3 provides data format definitions of the L2 product files
- Appendix A provides a list of acronyms
- The References section provides a list of reference documents

1.4 Terminology

Level 2 Science Product (L2SP) — The L2SP includes Surface Reflectance (SR), Surface Temperature (ST), ST intermediate bands, an angle coefficients file, and Quality Assessment (QA) Bands. It is created by correcting a Level 1 Geometric Systematic (L1GS), Level 1 Systematic Terrain (Corrected) (L1GT), or Level 1 Precision Terrain (Corrected) (L1TP) product for atmospheric effects.

Level 2 Surface Reflectance (L2SR) — The L2SR includes Surface Reflectance (SR), an angle coefficients file, and Quality Assessment (QA) Bands. It is created by correcting a Level 1 Systematic Terrain (Corrected) (L1GT) or Level 1 Precision Terrain (Corrected) (L1TP) product for atmospheric effects.

Section 2 Overview of L2 Product Files

This section provides an overview of the L2 product files.

2.1 Level 2 Output Files Overview

The standard L2SP is a Digital Number (DN) product stored in a 16-bit unsigned integer format.

SR bands approximate what a field spectroradiometer sensor held just above the Earth's surface would measure. Goddard Space Flight Center (GSFC)'s Total Ozone Mapping Spectrometer (TOMS) data and National Centers for Environmental Prediction (NCEP)'s surface pressure, water vapor, and air temperature are used by Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS). SR bands require Top of Atmosphere (TOA) reflectance bands corrected for per-pixel sun angles. SR bands are generated only for scenes with the Solar Zenith Angle (SZA) less than 76°. The SZA is 90° minus the sun elevation angle. Most L2 products are from scenes between 65 degrees north and 65 degrees south latitude. Table 2-2 lists specifications for the SR bands.

The ST band provides the temperature of the Earth's surface in Kelvin (K). The Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Emissivity Dataset (ASTER GED) by Land Processes Distributed Active Archive Center (LP DAAC) is used in the ST algorithm for ETM+. Goddard Earth Observing System Model, Version 5 (GEOS-5) Forward Process for Instrument Teams (FP-IT) data are used in the Single Channel algorithm for atmospheric correction. If GEOS data are unavailable NASA's Modern-Era Retrospective analysis for Research and Application, Version 2 (MERRA-2) data are used in its place. The algorithm that generates the ST band requires L1's Band 6 Virtual Channel Identifier (VCID) 1 and VCID 2 as inputs. Band 6 VCID 1 contains the low-gain (6L) data, while Band 6 VCID 2 contains the high-gain (6H) data. Band 6 VCID 2 is the default input to generate the ST band. If Band 6 VCID 2 has saturation for a pixel, then data from Band 6 VCID 1 is used in generating the ST band for that pixel instead. Table 2-3 lists specifications for the ST band. The ST band is scaled to Kelvin by multiplying the DN times the value for TEMPERATURE_MULT_BAND_ST_B6 and adding the value for TEMPERATURE_ADD_BAND_ST_B6. All values can be found in Table 3-4.

The L2SP image data are atmospherically corrected and available as COG files. Table 2-1 shows the band identification, while Table 2-6 lists the L2SP components. If ST cannot be produced, an SR-only product is attempted. Atmospheric auxiliary data used in processing a L1 product into the L2 product are described in LSDS-1329 Landsat Atmospheric Auxiliary Data Data Format Control Book (DFCB).

Seven ST intermediate bands are included in the L2SP when the Single Channel algorithm is used to generate ST. These ST intermediate bands consist of a thermal band converted to radiance, upwelled radiance, downwelled radiance, atmospheric

transmittance, emissivity estimated from ASTER GED, emissivity standard deviation, and pixel distance to cloud. Table 2-4 provides specifications for these bands.

Five QA Bands are included in the L2 product. These QA Bands consist of the L1 pixel, L1 radiometric saturation, SR atmospheric opacity, SR cloud, and ST. Table 2-5 lists specifications for these bands.

Band Number	Band Description	Band Range (nm)
1	Blue	441-514
2	Green	519-601
3	Red	631-692
4	Near-Infrared (NIR)	772-898
5	Short Wavelength Infrared (SWIR) 1	1547-1749
6	Thermal Infrared	10310-12360
7	SWIR 2	2064-2345

Table 2-1. Band Reference Table

Band Number	Identifier FT	Units	Valid Range	Fill Value	Saturate Value
1	SR_B1	Unitless	1 through 65455	0 (No Data)	65535
2	SR_B2	Unitless	1 through 65455	0 (No Data)	65535
3	SR_B3	Unitless	1 through 65455	0 (No Data)	65535
4	SR_B4	Unitless	1 through 65455	0 (No Data)	65535
5	SR_B5	Unitless	1 through 65455	0 (No Data)	65535
7	SR_B7	Unitless	1 through 65455	0 (No Data)	65535

Table 2-2. ETM+ SR Band Specifications

Band Number	Identifier FT	Units	Range	Fill Value
6	ST_B6	Scaled Kelvin	1 through 65535	0 (No Data)

Table 2-3. ETM+ ST Band Specifications

Band Name	Identifier FT	Data Type	Units	Valid Range	Fill Value	Scale Factor
Thermal band converted to radiance	ST_TRAD	INT16	W/(m^2 sr µm)/DN	0 through 22000	-9999 (No Data)	0.001
Upwelled Radiance	ST_URAD	INT16	W/(m^2 sr µm)/DN	0 through 28000	-9999 (No Data)	0.001
Downwelled Radiance	ST_DRAD	INT16	W/(m^2 sr µm)/DN	0 through 28000	-9999 (No Data)	0.001
Atmospheric Transmittance	ST_ATRAN	INT16	Unitless	0 through 10000	-9999 (No Data)	0.0001
Emissivity estimated from ASTER GED	ST_EMIS	INT16	Emissivity coefficient	0 through 10000	-9999 (No Data)	0.0001
Emissivity standard deviation	ST_EMSD	INT16	Emissivity coefficient	1 through 10000	-9999 (No Data)	0.0001
Pixel distance to cloud	ST_CDIST	INT16	Kilometers	0 through 24000	-9999 (No Data)	0.01

Table 2-4. ST Intermediate Band Specifications

Band Name	Identifier FT	Data Type	Units	Range	Fill Value	Scale Factor
Level-1 QA Band	QA_PIXEL	UINT16	Bit Index	0 through 65535	1 (bit 0)	NA
Level-1 Radiometric Saturation QA	QA_RADSAT	UINT16	Bit Index	0 through 65535	NA	NA
Internal SR Atmospheric Opacity	SR_ATMOS_OPACITY	INT16	NA	0 through 32767	-9999 (No Data)	NA
Cloud QA	SR_CLOUD_QA	UINT8	Bit Index	0 through 255	NA	NA
Surface Temperature QA	ST_QA	INT16	Kelvin	0 through 32767	-9999 (No Data)	0.01

Table 2-5. ETM+ Quality Assessment Band Specifications

L2 Product Components
L2SP/L2SR image files
ST Intermediate Band files
QA_PIXEL file
QA_RADSAT file
SR_ATMOS_OPACITY file
SR_CLOUD_QA file
ST_QA file
Angle Coefficient file
L2SP/L2SR metadata files

Table 2-6. L2 Product Components

2.1.1 Product Files

The product consists of individual files that are listed in Table 2-6. The files are unbundled and can be downloaded individually.

2.1.2 Naming Convention

Table 2-7 describes the Landsat Product Identifier: LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX. Table 2-7 and Table 2-8 contain the file types and extensions for file names associated with the L2 products.

Identifier	Description
L	Landsat
X	Sensor of: E = ETM+ Indicates which sensor collected data for this product
SS	Landsat satellite (07 for Landsat 7)
LLLL	Processing level (L2SP, L2SR)
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: "T1" for Tier 1 (highest quality), "T2" for Tier 2

Table 2-7. Landsat ETM+ Product ID

The Landsat Product ID described in Table 2-7 is the first part of the file name, the file type and extension components of the file name are described in Table 2-8.
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: MTL (metadata file), MD5 (checksum file), SR_(B1-5,7) (Surface Reflectance Bands), ST_B6 (Surface Temperature Band), QA_RADSAT (Radiometric saturation per pixel), QA_PIXEL (Level-1 QA Band), SR_CLOUD_QA (SR Cloud QA), SR_ATMOS_OPACITY (SR Atmospheric Opacity), ST_QA (Surface Temperature QA), ST_TRAD (Thermal band converted to radiance for 6L and 6H), ST_URAD (Upwelled Radiance), ST_DRAD (Downwelled Radiance), ST_ATRAN (Atmospheric Transmittance), ST_EMIS (Emissivity estimated from ASTER GED), ST_EMSD (Emissivity standard deviation), ST_CDIST (Pixel distance to cloud), ANG (angle coefficient file)
.ext	File extension, where .TIF equals COG file extension, .xml equals XML extension (metadata), and .txt equals text extension

Table 2-8. File Naming Convention

2.1.3 Example File Names

2.1.3.1 SR Image Files

LE07_L2SP_222005_20140922_20140923_02_T1_SR_B1.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_SR_B2.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_SR_B3.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_SR_B4.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_SR_B5.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_SR_B7.TIF

2.1.3.2 ST Image File

LE07_L2SP_222005_20140922_20140923_02_T1_ST_B6.TIF

2.1.3.3 Radiometric Saturation and Dropped Pixel QA Band

LE07_L2SP_222005_20140922_20140923_02_T1_QA_RADSAT.TIF

2.1.3.4 QA Band

LE07_L2SP_222005_20140922_20140923_02_T1_QA_PIXEL.TIF

2.1.3.5 ST QA

LE07_L2SP_222005_20140922_20140923_02_T1_ST_QA.TIF

2.1.3.6 SR Atmosphere Opacity

LE07_L2SP_222005_20140922_20140923_02_T1_SR_ATMOS_OPACITY.TIF

2.1.3.7 SR Cloud QA

LE07_L2SP_222005_20140922_20140923_02_T1_SR_CLOUD_QA.TIF

2.1.3.8 Metadata

LE07_L2SP_222005_20140922_20140923_02_T1_MTL.txt
LE07_L2SP_222005_20140922_20140923_02_T1_MTL.xml

2.1.3.9 Angle Coefficient File

LE07_L2SP_222005_20140922_20140923_02_T1_ANG.txt

2.1.3.10 ST Intermediate Band Files

LE07_L2SP_222005_20140922_20140923_02_T1_ST_TRAD.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_URAD.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_DRAD.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_ATRAN.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_EMIS.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_EMSD.TIF
LE07_L2SP_222005_20140922_20140923_02_T1_ST_CDIST.TIF

2.1.3.11 Checksum

LE07_L2SP_222005_20140922_20140923_02_T1_MD5.txt

Section 3 Data Format Definition

This section describes the storage format for the data. Refer to LSDS-1414 Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) Collection 2 (C2) Level 1 (L1) Data Format Control Book (DFCB) for a more detailed description of the GeoTIFF format. Refer to LSDS-1414 for a more detailed description of TIFF. 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 L2 Image Files

Each image band in the L2SP is in a separate file. Each band is a grayscale COG file, which contains unsigned 16-bit integers. The image files contain the tags and keys defined by the GeoTIFF specification, which allows GeoTIFF readers to read the images. The GDAL_NODATA tag defines the value of 0 to be the no data value for these bands.

3.2 QA Band File

The output from the CFMask algorithm is used as an input for the Quality Band Application, which calculates values for all fields in the QA Band file. The QA Band file contains quality statistics gathered from the image data and cloud mask information for the scene. The QA Band file is an unsigned 16-bit COG image with the same dimensions as the L1 scene. Bit 0 is the least significant. Bits are allocated for data artifacts and several land surface classification types. A range of confidence levels are provided for each classification type. Table 3-1 shows the bits being set to artifact mapping. A value of 1 for fill indicates that the associated L1 image bands have fill data for the corresponding pixel.

The bit confidence levels are as follows:

00	No confidence level set (used for fill or for a class not reported)
01	Low confidence
10	Mid confidence
11	High confidence
0	Criteria not likely to exist, or not checked
1	Criteria likely to exist

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	Unused	Unused
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 10 Reserved 11 High confidence
14-15	Unused	Unused

Table 3-1. QA Band Bit Description

3.3 Radiometric Saturation and Dropped Pixel QA Band File

The radiometric saturation QA Band indicates which sensor band(s) are saturated. Table 3-2 shows which bits are for band data saturation and which bit is for dropped pixel. Radiometric saturation can occur under two situations:

1. When the processed L1TP / L1GT product's saturated pixels have the maximum unsigned 8-bit value of 255.
2. When a sensor is saturated during data capture. This happens when the N bit ETM+ sensor reaches a value of (2^N-1) DN. N = 8 bits for ETM+.

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 6L 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 6H Data Saturation	0 no saturation 1 saturated data
9	Dropped Pixel	0 Pixel present 1 detector doesn't have a value – no data
10	Unused	0
11	Unused	0
12	Unused	0
13	Unused	0
14	Unused	0
15	Unused	0

Table 3-2. Radiometric Saturation and Dropped Pixel QA Band Bit Description

3.4 SR Atmospheric Opacity Band File

SR atmospheric opacity less than 0.1 can be interpreted as clear. SR atmospheric opacity between 0.1 and 0.3 can be considered average. SR atmospheric opacity values greater than 0.3 can be considered hazy. The estimate of atmospheric opacity is produced while generating the SR bands for the L2 product. Multiplying the DN times 0.001 gives the atmospheric opacity value.

3.5 SR Cloud QA File

The SR Cloud QA Band file shares some of the data artifacts and land surface classification indications as the QA Band file. The SR Cloud QA file is generated using Level 2 LEDAPS, unlike the QA Band file generated at Level 1.

Bit	Flag Description	Values
0	Dark Dense Vegetation (DDV)	0 Pixel has no DDV 1 Pixel has DDV
1	Cloud	0 Pixel has no cloud 1 Pixel has cloud
2	Cloud Shadow	0 Pixel doesn't have cloud shadow 1 Pixel has cloud shadow
3	Adjacent to Cloud	0 Pixel is not adjacent to cloud 1 Pixel is adjacent to cloud
4	Snow	0 Pixel is not snow 1 Pixel is snow
5	Water	0 Pixel is not water 1 Pixel is water
6	Unused	
7	Unused	
0 is Least Significant Bit, 7 is Most Significant Bit		

Table 3-3. SR Cloud QA File

3.6 Surface Temperature QA File

The ST QA file indicates uncertainty about the temperatures given in the ST band file. The ST QA file is generated using uncertainty values and distance to cloud values. Higher numbers indicate greater uncertainty. This file is not included in the product when an SR-only product is generated. The GDAL_NODATA tag defines the value of -9999 to be the no data value for this band.

3.7 ST Intermediate Bands

The ST intermediate bands are related to generating Surface Temperature. These bands are not included in the product when an SR-only product is generated. The GDAL_NODATA tag defines the value of -9999 to be the no data value for these bands.

3.7.1 Atmospheric Transmittance layer (ATRAN)

This indicates the ratio of the transmitted radiation to the total radiation incident upon the medium (atmosphere).

3.7.2 Distance to Cloud (CDIST)

This indicates the distance, in kilometers, that a pixel is from the nearest cloud pixel. Infrequently, the pixel distance to cloud will be greater than the maximum allowed value. This layer is used with emissivity standard deviation to create surface temperature QA.

3.7.3 Downwelled Radiance layer (DRAD)

This indicates the thermal energy emitted by the atmosphere that reaches the Earth's surface and is then reflected toward the sensor.

3.7.4 Emissivity layer (EMIS)

This indicates the ratio of the energy radiated from a material's surface to the energy radiated from a blackbody. Landsat emissivity values that are greater than the water

emissivity constant are adjusted to be the water constant (0.988). Negative values for emissivity are replaced with the fill value instead.

3.7.5 Emissivity Standard Deviation (EMSD)

This indicates the deviation for the emissivity product. This layer is used with CDIST to create ST_QA.

3.7.6 Thermal Radiance layer (TRAD)

This displays the values produced when L1's combined 6H and 6L are converted to radiance. 6L is used where 6H has saturation. The maximum value for thermal radiance, 22000 $Wm^{-2}sr^{-1}\mu m^{-1}$, may be exceeded (e.g., over volcanoes and fires). TRAD is generated so all the radiance layers share the same units.

3.7.7 Upwelled Radiance layer (URAD)

This indicates the amount of energy emitted from the atmosphere and scattered toward the sensor.

3.8 L2 Metadata Files

The L2 metadata files are created during product generation and contain information specific to the product ordered. The L1 metadata is encapsulated in the L2 metadata. Some files listed in the L1 metadata are not contained in the L2 product; these files are highlighted in red in Table 3-4. Some of the fields listed in the L1 metadata do not apply to the files in the L2 product. These fields are for provenance and are highlighted in red in Table 3-4. Files and fields included for provenance also have an asterism symbol: ⁂ at the end of each row.

Table 3-4 lists the L2 metadata using Object Description Language (ODL). Table 3-5 shows the structure of the Extensible Markup Language (XML) metadata file. The XML file contains only parent elements and children elements. Table 3-5 does not show every possible value associated with each parameter name like Table 3-4 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 LEVEL2_PROCESSING_RECORD.

Important fields from the L1 metadata apply to the L2 product. The number of lines in the file referenced by the FILE_NAME_QUALITY_L1_PIXEL are the same as the number of lines given by REFLECTIVE_LINES, found in the L1 metadata, in the metadata file.

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/P9C7I13B”	Digital Object Identifier for Level 2 ETM+. 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 (07) 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	= “L2SP” = “L2SR”	Level 2 Science Product Level 2 Surface Reflectance
COLLECTION_NUMBER	= NN	The product collection number.
COLLECTION_CATEGORY	= “T1” = “T2”	The scene collection category, “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_SR_B1.TIF”	The file name for Surface Reflectance from Band 1.
FILE_NAME_BAND_2	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B2.TIF”	The file name for Surface Reflectance from Band 2.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_BAND_3	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B3.TIF”	The file name for Surface Reflectance from Band 3.
FILE_NAME_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B4.TIF”	The file name for Surface Reflectance from Band 4.
FILE_NAME_BAND_5	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B5.TIF”	The file name for Surface Reflectance from Band 5.
FILE_NAME_BAND_ST_B6	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_B6.TIF”	The file name for Surface Temperature from the combined Band 6: 6H and 6L. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_BAND_7	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B7.TIF”	The file name for Surface Reflectance from Band 7.
FILE_NAME_THERMAL_RADIANCE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_TRAD.TIF”	The file name for the thermal band converted to radiance for 6H and 6L. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_UPWELL_RADIANCE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_URAD.TIF”	The file name for the upwelled radiance. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_DOWNWELL_RADIANCE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_DRAD.TIF”	The file name for the downwelled radiance. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_ATMOSPHERIC_TRANSMITTANCE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_ATRAN.TIF”	The file name for the atmospheric transmittance. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_EMISSIVITY	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_EMIS.TIF”	The file name for the atmospheric emissivity. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_EMISSIVITY_STDEV	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_EMSD.TIF”	The file name for the emissivity standard deviation. This field is not present if the PROCESSING_LEVEL is L2SR.
FILE_NAME_CLOUD_DISTANCE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_CDIST.TIF”	The file name for Surface Temperature cloud distance band which gives the pixel distance to the cloud in Kilometers. This field is not present if the PROCESSING_LEVEL is L2SR.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FILE_NAME_ATMOSPHERIC_OPACITY	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_ATMOS_OPACITY.TIF”	The file name for the Surface Reflectance Atmospheric Opacity Band.
FILE_NAME_QUALITY_L2_SURFACE_REFLECTANCE_CLOUD	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_QA_CLOUD.TIF”	The file name for the Surface Reflectance Cloud QA Band.
FILE_NAME_QUALITY_L2_SURFACE_TEMPERATURE	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_QA.TIF”	The file name for the Surface Temperature QA Band. This field is not present if the PROCESSING_LEVEL is L2SR.
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.
FILE_NAME_METADATA_ODL	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.txt”	The file name for L2 ODL metadata.
FILE_NAME_METADATA_XML	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_MTL.xml”	The file name for L2 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_ST_B6	= “UINT16”	The GeoTIFF file for band 6 uses unsigned 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
DATA_TYPE_BAND_7	= “UINT16”	The GeoTIFF file for band 7 uses unsigned 16-bit integers.
DATA_TYPE_THERMAL_RADIANCE	= “INT16”	The thermal band converted to radiance uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_UPWELL_RADIANCE	= “INT16”	The upwelled radiance band uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_DOWNWELL_RADIANCE	= “INT16”	The downwelled radiance band uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_ATMOSPHERIC_TRANSMITTANCE	= “INT16”	The atmospheric transmittance band uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_EMISSIVITY	= “INT16”	The emissivity estimated from ASTER GED uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_EMISSIVITY_STDEV	= “INT16”	The emissivity standard deviation uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_CLOUD_DISTANCE	= “INT16”	The Surface Temperature cloud distance band uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_ATMOSPHERIC_OPACITY	= “INT16”	The Surface Reflectance Atmospheric Opacity Band file uses signed 16-bit integers.
DATA_TYPE_QUALITY_L2_SURFACE_REFLECTANCE_CLOUD	= “UINT8”	The Surface Reflectance cloud QA file uses unsigned 8-bit integers.
DATA_TYPE_QUALITY_L2_SURFACE_TEMPERATURE	= “INT16”	The Surface Temperature QA file uses signed 16-bit integers. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_TYPE_QUALITY_L1_PIXEL	= “UINT16”	The L1 Quality Assessment Band, which is included in the L2 product, uses unsigned 16-bit integers.
DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION	= “UINT16”	The L1 radiometric saturation band, which is included in the L2 product, uses unsigned 16-bit integers.
END_GROUP	= PRODUCT_CONTENTS	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= IMAGE_ATTRIBUTES	
SPACECRAFT_ID	= “LANDSAT_7”	Spacecraft from which the data were captured.
SENSOR_ID	= “ETM”	Sensor 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.
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 = 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	= 0-9, -1	Composite image quality for the bands. Values: 9 = Best. 0 = Worst. -1 = Image quality not calculated or assessed.
SATURATION_BAND_1	= “Y” = “N”	Indicates Band 1 includes saturated pixels identified by the Radiometric Saturation Quality Assessment (QA) Band.
SATURATION_BAND_2	= “Y” = “N”	Indicates Band 2 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_3	= “Y” = “N”	Indicates Band 3 includes saturated pixels identified by the Radiometric Saturation QA Band.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SATURATION_BAND_4	= “Y” = “N”	Indicates Band 4 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_5	= “Y” = “N”	Indicates Band 5 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_6_VCID_1	= “Y” = “N”	Indicates Band 6 VCID 1 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_6_VCID_2	= “Y” = “N”	Indicates Band 6 VCID 2 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_7	= “Y” = “N”	Indicates Band 7 includes saturated pixels identified by the Radiometric Saturation QA Band.
SATURATION_BAND_8	= “N”	Band 8 is not checked for saturation.
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.
SENSOR_MODE	= “SAM” = “BUMPER”	Scan Angle Monitor (SAM) Mode and Bumper (BUMPER) Mode.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SENSOR_MODE_SLC	= “ON” = “OFF”	Indicates whether the Scan Line Corrector (SLC) was ON, as during the first part of the mission. Or whether the SLC was OFF, as during the rest of the mission. When SLC is OFF the line of sight traces a zig-zag pattern across the ground path.
SENSOR_ANOMALIES	= “SHUTTER_INTRUSION” = “NONE”	Indicates if shutter intrusion is found within scene.
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	= -180.00000 through +180.00000	Vertical longitude (decimal degrees) from the pole. Only present when MAP_PROJECTION is PS.
TRUE_SCALE_LAT	= -90.00000 through +90.00000	Latitude of true scale in a map projection. Only present when MAP_PROJECTION is PS.
FALSE_EASTING	= -100000000 through +100000000	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	= -100000000 through +100000000	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.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
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.
GRID_CELL_SIZE_THERMAL	= 30.00	The grid cell size in meters used in creating the image for the thermal bands. This field is not present if the PROCESSING_LEVEL is L2SR.
REFLECTIVE_LINES	= 0–99999	Product lines for the reflective bands.
REFLECTIVE_SAMPLES	= 0–99999	Product samples for the reflective bands.
THERMAL_LINES	= 0–99999	Product lines for the thermal bands. This field is not present if the PROCESSING_LEVEL is L2SR.
THERMAL_SAMPLES	= 0–99999	Product samples for the thermal bands. This field is not present if the PROCESSING_LEVEL is L2SR.
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.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
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.
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	= LEVEL2_PROCESSING_RECORD	
ORIGIN	= “Image courtesy of the U.S. Geological Survey”	Origin of the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
DIGITAL_OBJECT_IDENTIFIER	= “https://doi.org/10.5066/P9C7I13B”	Digital Object Identifier for Level 2 ETM+. For more information on Digital Object Identifiers, visit https://www.doi.org.
REQUEST_ID	= “NNNNNNNNNNNNN_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_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 (07) 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	= “L2SP” = “L2SR”	Level 2 Science Product Level 2 Surface Reflectance
OUTPUT_FORMAT	= “GEOTIFF”	Output file format for image files.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
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))
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.
ALGORITHM_SOURCE_SURFACE_REFLECTANCE	= “LEDAPS_X.Y.Z”	The version of the Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS) used to process Surface Reflectance bands.
DATA_SOURCE_OZONE	= “TOMS”	Data source for the Surface Reflectance algorithm.
DATA_SOURCE_PRESSURE	= “NCEP”	Data source for the Surface Temperature algorithm.
DATA_SOURCE_WATER_VAPOR	= “NCEP”	Data source for the Surface Reflectance algorithm.
DATA_SOURCE_AIR_TEMPERATURE	= “NCEP”	Data source for the Surface Reflectance algorithm.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
ALGORITHM_SOURCE_SURFACE_TEMPERATURE	= “st_X.Y.Z”	The version of the Landsat Surface Temperature code used to process Surface Temperature band. This field is not present if the PROCESSING_LEVEL is L2SR.
DATA_SOURCE_REANALYSIS	= “GEOS-5 FP-IT” = “MERRA-2”	Data source for the Surface Temperature algorithm. This field is not present if the PROCESSING_LEVEL is L2SR.
END_GROUP	= LEVEL2_PROCESSING_RECORD	
GROUP	= LEVEL2_SURFACE_REFLECTANCE_PARAMETERS	
REFLECTANCE_MAXIMUM_BAND_1	= N.NNNNNN	Maximum achievable reflectance value for Band 1.
REFLECTANCE_MINIMUM_BAND_1	= N.NNNNNN	Minimum achievable reflectance value for Band 1.
REFLECTANCE_MAXIMUM_BAND_2	= N.NNNNNN	Maximum achievable reflectance value for Band 2.
REFLECTANCE_MINIMUM_BAND_2	= N.NNNNNN	Minimum achievable reflectance value for Band 2.
REFLECTANCE_MAXIMUM_BAND_3	= N.NNNNNN	Maximum achievable reflectance value for Band 3.
REFLECTANCE_MINIMUM_BAND_3	= N.NNNNNN	Minimum achievable reflectance value for Band 3.
REFLECTANCE_MAXIMUM_BAND_4	= N.NNNNNN	Maximum achievable reflectance value for Band 4.
REFLECTANCE_MINIMUM_BAND_4	= N.NNNNNN	Minimum achievable reflectance value for Band 4.
REFLECTANCE_MAXIMUM_BAND_5	= N.NNNNNN	Maximum achievable reflectance value for Band 5.
REFLECTANCE_MINIMUM_BAND_5	= N.NNNNNN	Minimum achievable reflectance value for Band 5.
REFLECTANCE_MAXIMUM_BAND_7	= N.NNNNNN	Maximum achievable reflectance value for Band 7.
REFLECTANCE_MINIMUM_BAND_7	= N.NNNNNN	Minimum achievable reflectance value for Band 7.
QUANTIZE_CAL_MAX_BAND_1	= 1-65535	Maximum possible pixel value for Band 1.
QUANTIZE_CAL_MIN_BAND_1	= 1	Minimum possible pixel value for Band 1.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MAX_BAND_2	= 1-65535	Maximum possible pixel value for Band 2.
QUANTIZE_CAL_MIN_BAND_2	= 1	Minimum possible pixel value for Band 2.
QUANTIZE_CAL_MAX_BAND_3	= 1-65535	Maximum possible pixel value for Band 3.
QUANTIZE_CAL_MIN_BAND_3	= 1	Minimum possible pixel value for Band 3.
QUANTIZE_CAL_MAX_BAND_4	= 1-65535	Maximum possible pixel value for Band 4.
QUANTIZE_CAL_MIN_BAND_4	= 1	Minimum possible pixel value for Band 4.
QUANTIZE_CAL_MAX_BAND_5	= 1-65535	Maximum possible pixel value for Band 5.
QUANTIZE_CAL_MIN_BAND_5	= 1	Minimum possible pixel value for Band 5.
QUANTIZE_CAL_MAX_BAND_7	= 1-65535	Maximum possible pixel value for Band 7.
QUANTIZE_CAL_MIN_BAND_7	= 1	Minimum possible pixel value for Band 7.
REFLECTANCE_MULT_BAND_1	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_MULT_BAND_2	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_MULT_BAND_3	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_MULT_BAND_4	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_MULT_BAND_5	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_MULT_BAND_7	= 2.75e-05	Multiplicative radiometric rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_1	= -0.2	Additive rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_2	= -0.2	Additive rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_3	= -0.2	Additive rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_4	= -0.2	Additive rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_5	= -0.2	Additive rescaling factor applied to the L2 band.
REFLECTANCE_ADD_BAND_7	= -0.2	Additive rescaling factor applied to the L2 band.
END_GROUP	= LEVEL2_SURFACE_REFLECTANCE_PARAMETERS	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= LEVEL2_SURFACE_TEMPERATURE_PARAMETERS	This group is not present if the PROCESSING_LEVEL is L2SR.
TEMPERATURE_MAXIMUM_BAND_ST_B6	= NNN.NNNNNN	Maximum achievable temperature value for Band 6.
TEMPERATURE_MINIMUM_BAND_ST_B6	= NNN.NNNNNN	Minimum achievable temperature value for Band 6.
QUANTIZE_CAL_MAXIMUM_BAND_ST_B6	= 1-65535	Maximum possible pixel value for Band 6.
QUANTIZE_CAL_MINIMUM_BAND_ST_B6	= 1	Minimum possible pixel value for Band 6.
TEMPERATURE_MULT_BAND_ST_B6	= 0.00341802	Multiplicative temperature rescaling factor to convert DN to temperature.
TEMPERATURE_ADD_BAND_ST_B6	= 149.0	Additive temperature rescaling factor to convert DN to temperature.
END_GROUP	= LEVEL2_SURFACE_TEMPERATURE_PARAMETERS	
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/P9TU80IG”	Digital Object Identifier for Level 1 ETM+. For more information on Digital Object Identifiers, visit https://www.doi.org.⁂
REQUEST_ID	= “NNNNNNNNNNNNN_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 (07) 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	= “L1GS” = “L1GT” = “L1TP”	The identifier to inform the user of the processing level of the product.⁂
COLLECTION_CATEGORY	= “T1” = “T2”	The scene collection category, “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.⁂
FILE_NAME_BAND_2	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B2.TIF”	The file name for L1 Band 2.⁂
FILE_NAME_BAND_3	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B3.TIF”	The file name for L1 Band 3.⁂
FILE_NAME_BAND_4	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B4.TIF”	The file name for L1 Band 4.⁂
FILE_NAME_BAND_5	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B5.TIF”	The file name for L1 Band 5.⁂
FILE_NAME_BAND_6_VCID_1	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6_VCID_1.TIF”	The file name for L1 Band 6 VCID 1.⁂
FILE_NAME_BAND_6_VCID_2	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6_VCID_2.TIF”	The file name for L1 Band 6 VCID 2.⁂
FILE_NAME_BAND_7	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B7.TIF”	The file name for L1 Band 7.⁂
FILE_NAME_BAND_8	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B8.TIF”	The file name for L1 Band 8.⁂
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.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
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_GROUND_CONTROL_POINT	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_GCP.txt”	L1-generated external element file name for the GCP.⁂
FILE_NAME_ANGLE_COEFFICIENT	= “LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ANG.txt”	The file name for the angle coefficient file.
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.⁂
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.⁂
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.⁂
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.⁂
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.⁂
DATA_SOURCE_ELEVATION	= “NED” = “RAMP” = “SRTM1” = “SRTM3” = “GTOPO30” = “GLS2000”	Indicates the source of the DEM used in the correction process.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
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.⁂
EPHEMERIS_TYPE	= “DEFINITIVE” = “PREDICTIVE”	Identifier to inform the user of the orbital ephemeris type used. If the field is not present, the user should assume PREDICTIVE in all cases.⁂
DATE_ACQUIRED_GAP_FILL	= (YYYY-MM-DD,YYYY-MM-DD,YYYY-MM-DD,YYYY-MM-DD,YYYY-MM-DD)	Acquisition date of the input scenes used for the scan gap fill (up to five input scenes); included only for gap-filled products.⁂
GAP_FILL	= NN.N	Percentage of image pixels present after gap-filling. **Included only for gap-filled products.⁂
END_GROUP	= LEVEL1_PROCESSING_RECORD	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= LEVEL1_MIN_MAX_RADIANCE	⁂
RADIANCE_MAXIMUM_BAND_1	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 1.⁂
RADIANCE_MINIMUM_BAND_1	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 1.⁂
RADIANCE_MAXIMUM_BAND_2	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 2.⁂
RADIANCE_MINIMUM_BAND_2	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 2.⁂
RADIANCE_MAXIMUM_BAND_3	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 3.⁂
RADIANCE_MINIMUM_BAND_3	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 3.⁂
RADIANCE_MAXIMUM_BAND_4	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 4.⁂
RADIANCE_MINIMUM_BAND_4	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 4.⁂
RADIANCE_MAXIMUM_BAND_5	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 5.⁂
RADIANCE_MINIMUM_BAND_5	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 5.⁂
RADIANCE_MAXIMUM_BAND_6_VCID_1	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 6 VCID 1.⁂
RADIANCE_MINIMUM_BAND_6_VCID_1	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 6 VCID 1.⁂
RADIANCE_MAXIMUM_BAND_6_VCID_2	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 6 VCID 2.⁂
RADIANCE_MINIMUM_BAND_6_VCID_2	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 6 VCID 2.⁂
RADIANCE_MAXIMUM_BAND_7	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 7.⁂
RADIANCE_MINIMUM_BAND_7	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 7.⁂
RADIANCE_MAXIMUM_BAND_8	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 8.⁂
RADIANCE_MINIMUM_BAND_8	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 8.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
END_GROUP	= LEVEL1_MIN_MAX_RADIANCE	⁂
GROUP	= LEVEL1_MIN_MAX_REFLECTANCE	⁂
REFLECTANCE_MAXIMUM_BAND_1	= N.NNNNNN	Maximum achievable reflectance value for Band 1.⁂
REFLECTANCE_MINIMUM_BAND_1	= N.NNNNNN	Minimum achievable reflectance value for Band 1.⁂
REFLECTANCE_MAXIMUM_BAND_2	= N.NNNNNN	Maximum achievable reflectance value for Band 2.⁂
REFLECTANCE_MINIMUM_BAND_2	= N.NNNNNN	Minimum achievable reflectance value for Band 2.⁂
REFLECTANCE_MAXIMUM_BAND_3	= N.NNNNNN	Maximum achievable reflectance value for Band 3.⁂
REFLECTANCE_MINIMUM_BAND_3	= N.NNNNNN	Minimum achievable reflectance value for Band 3.⁂
REFLECTANCE_MAXIMUM_BAND_4	= N.NNNNNN	Maximum achievable reflectance value for Band 4.⁂
REFLECTANCE_MINIMUM_BAND_4	= N.NNNNNN	Minimum achievable reflectance value for Band 4.⁂
REFLECTANCE_MAXIMUM_BAND_5	= N.NNNNNN	Maximum achievable reflectance value for Band 5.⁂
REFLECTANCE_MINIMUM_BAND_5	= N.NNNNNN	Minimum achievable reflectance value for Band 5.⁂
REFLECTANCE_MAXIMUM_BAND_7	= N.NNNNNN	Maximum achievable reflectance value for Band 7.⁂
REFLECTANCE_MINIMUM_BAND_7	= N.NNNNNN	Minimum achievable reflectance value for Band 7.⁂
REFLECTANCE_MAXIMUM_BAND_8	= N.NNNNNN	Maximum achievable reflectance value for Band 8.⁂
REFLECTANCE_MINIMUM_BAND_8	= N.NNNNNN	Minimum achievable reflectance value for Band 8.⁂
END_GROUP	= LEVEL1_MIN_MAX_REFLECTANCE	⁂
GROUP	= LEVEL1_MIN_MAX_PIXEL_VALUE	⁂
QUANTIZE_CAL_MAX_BAND_1	= 0 - 255	Maximum possible pixel value for Band 1.⁂
QUANTIZE_CAL_MIN_BAND_1	= 0 - 1	Minimum possible pixel value for Band 1.⁂
QUANTIZE_CAL_MAX_BAND_2	= 0 - 255	Maximum possible pixel value for Band 2.⁂
QUANTIZE_CAL_MIN_BAND_2	= 0 - 1	Minimum possible pixel value for Band 2.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MAX_BAND_3	= 0 - 255	Maximum possible pixel value for Band 3.⁂
QUANTIZE_CAL_MIN_BAND_3	= 0 - 1	Minimum possible pixel value for Band 3.⁂
QUANTIZE_CAL_MAX_BAND_4	= 0 - 255	Maximum possible pixel value for Band 4.⁂
QUANTIZE_CAL_MIN_BAND_4	= 0 - 1	Minimum possible pixel value for Band 4.⁂
QUANTIZE_CAL_MAX_BAND_5	= 0 - 255	Maximum possible pixel value for Band 5.⁂
QUANTIZE_CAL_MIN_BAND_5	= 0 - 1	Minimum possible pixel value for Band 5.⁂
QUANTIZE_CAL_MAX_BAND_6_VCID_1	= 0 - 255	Maximum possible pixel value for Band 6 VCID 1.⁂
QUANTIZE_CAL_MIN_BAND_6_VCID_1	= 0 - 1	Minimum possible pixel value for Band 6 VCID 1.⁂
QUANTIZE_CAL_MAX_BAND_6_VCID_2	= 0 - 255	Maximum possible pixel value for Band 6 VCID 2.⁂
QUANTIZE_CAL_MIN_BAND_6_VCID_2	= 0 - 1	Minimum possible pixel value for Band 6 VCID 2.⁂
QUANTIZE_CAL_MAX_BAND_7	= 0 - 255	Maximum possible pixel value for Band 7.⁂
QUANTIZE_CAL_MIN_BAND_7	= 0 - 1	Minimum possible pixel value for Band 7.⁂
QUANTIZE_CAL_MAX_BAND_8	= 0 - 255	Maximum possible pixel value for Band 8.⁂
QUANTIZE_CAL_MIN_BAND_8	= 0 - 1	Minimum possible pixel value for Band 8.⁂
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).⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MULT_BAND_6_VCID_1	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 6 VCID 1 (W/(m^2 sr um)/DN).⁂
RADIANCE_MULT_BAND_6_VCID_2	= N.NNNNE-NN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 6 VCID 2 (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).⁂
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_ADD_BAND_1	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 1 (W/(m^2 sr um)).⁂
RADIANCE_ADD_BAND_2	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 2 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_3	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 3 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_4	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 4 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_5	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 5 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_6_VCID_1	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 6 VCID 1 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_6_VCID_2	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 6 VCID 2 (W/(m^2 sr um).⁂
RADIANCE_ADD_BAND_7	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 7 (W/(m^2 sr um).⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_ADD_BAND_8	= -9999.99999 through +9999.99999	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 8 (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_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_ADD_BAND_1	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 1.⁂
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_7	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 7.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
REFLECTANCE_ADD_BAND_8	= N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 8.⁂
END_GROUP	= LEVEL1_RADIOMETRIC_RESCALING	⁂
GROUP	= LEVEL1_THERMAL_CONSTANTS	⁂
K1_CONSTANT_BAND_6_VCID_1	= NNN.NN	Calibration constant for Band 6 radiance to temperature conversion.⁂
K2_CONSTANT_BAND_6_VCID_1	= NNNN.NN	Calibration constant for Band 6 radiance to temperature conversion.⁂
K1_CONSTANT_BAND_6_VCID_2	= NNN.NN	Calibration constant for Band 6 radiance to temperature conversion.⁂
K2_CONSTANT_BAND_6_VCID_2	= NNNN.NN	Calibration constant for Band 6 radiance to temperature conversion.⁂
END_GROUP	= LEVEL1_THERMAL_CONSTANTS	⁂
GROUP	= LEVEL1_PROJECTION_PARAMETERS	
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	= -180.00000 through +180.00000	Vertical longitude (decimal degrees) from the pole. Only present when MAP_PROJECTION is PS.
TRUE_SCALE_LAT	= -90.00000 through +90.00000	Latitude of true scale in a map projection. Only present when MAP_PROJECTION is PS.
FALSE_EASTING	= -100000000 through +100000000	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.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
FALSE_NORTHING	= -100000000 through +100000000	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.
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.
GRID_CELL_SIZE_THERMAL	= 30.00	The grid cell size in meters used in creating the image for the thermal bands.
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).
SCAN_GAP_INTERPOLATION	= 00.0–15.0	Maximum scan gap width to fill by interpolation, in units of ETM+ 30 m detectors / pixels. Note: Included only with single SLC-off and gap-filled products.
END_GROUP	= LEVEL1_PROJECTION_PARAMETERS	
GROUP	= PRODUCT_PARAMETERS	Beginning of the product parameters group (both 1R and 1G products).⁂
CORRECTION_GAIN_BAND_1	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 1.⁂
CORRECTION_GAIN_BAND_2	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 2.⁂
CORRECTION_GAIN_BAND_3	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 3.⁂
CORRECTION_GAIN_BAND_4	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 4.⁂
CORRECTION_GAIN_BAND_5	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 5.⁂
CORRECTION_GAIN_BAND_6_VCID_1	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 6 VCID 1.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
CORRECTION_GAIN_BAND_6_VCID_2	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 6 VCID 2.⁂
CORRECTION_GAIN_BAND_7	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 7.⁂
CORRECTION_GAIN_BAND_8	= “CPF” = “INTERNAL_CALIBRATION”	Correction method used by L1 in creating the image for Band 8.⁂
CORRECTION_BIAS_BAND_1	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 1.⁂
CORRECTION_BIAS_BAND_2	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 2.⁂
CORRECTION_BIAS_BAND_3	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 3.⁂
CORRECTION_BIAS_BAND_4	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 4.⁂
CORRECTION_BIAS_BAND_5	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 5.⁂
CORRECTION_BIAS_BAND_6_VCID_1	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 6 VCID 1.⁂
CORRECTION_BIAS_BAND_6_VCID_2	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 6 VCID 2.⁂
CORRECTION_BIAS_BAND_7	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 7.⁂
CORRECTION_BIAS_BAND_8	= “CPF” = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating the image for Band 8.⁂
GAIN_BAND_1	= “L” = “H”	Gain state for Band 1’s first data line.⁂
GAIN_BAND_2	= “L” = “H”	Gain state for Band 2’s first data line.⁂
GAIN_BAND_3	= “L” = “H”	Gain state for Band 3’s first data line.⁂
GAIN_BAND_4	= “L” = “H”	Gain state for Band 4’s first data line.⁂
GAIN_BAND_5	= “L” = “H”	Gain state for Band 5’s first data line.⁂
GAIN_BAND_6_VCID_1	= “L” = “H”	Gain state for Band 6-Format 1’s first data line.⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GAIN_BAND_6_VCID_2	= “L” = “H”	Gain state for Band 6-Format 2’s first data line.⁂
GAIN_BAND_7	= “L” = “H”	Gain state for Band 7’s first data line.⁂
GAIN_BAND_8	= “L” = “H”	Gain state for Band 8’s first data line.⁂
GAIN_CHANGE_BAND_1	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 1. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_2	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 2. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_3	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 3. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_4	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 4. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GAIN_CHANGE_BAND_5	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 5. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_6_VCID_1	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 6 Format 1. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_6_VCID_2	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 6 Format 2. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_BAND_7	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 7. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GAIN_CHANGE_BAND_8	= “HH” = “LL” = “LH” = “HL” = “U”	Presence and direction of gain change for Band 8. HH = no gain change LL = no gain change LH = low to high HL = high to low U = Unknown⁂
GAIN_CHANGE_SCAN_BAND_1	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_2	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_3	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_4	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_5	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN _BAND_6_VCID_1	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN _BAND_6_VCID_2	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_7	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
GAIN_CHANGE_SCAN_BAND_8	= 0 (for no gain change) = 1-13,875 (for the scan line number)	Scan line number where the first change in band gain was detected; the physical change occurred in the previous scan.⁂
END_GROUP	= PRODUCT_PARAMETERS	⁂
END_GROUP	= LANDSAT_METADATA_FILE	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
END		

Table 3-4. L2 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/P9C7I13B</DIGITAL_OBJECT_IDENTIFIER>
<LANDSAT_PRODUCT_ID>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX</LANDSAT_PRODUCT_ID>
<PROCESSING_LEVEL>L2SP</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_SR_B1.TIF</FILE_NAME_BAND_1>
<FILE_NAME_BAND_2>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B2.TIF</FILE_NAME_BAND_2>
<FILE_NAME_BAND_3>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B3.TIF</FILE_NAME_BAND_3>
<FILE_NAME_BAND_4>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B4.TIF</FILE_NAME_BAND_4>
<FILE_NAME_BAND_5>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B5.TIF</FILE_NAME_BAND_5>
<FILE_NAME_BAND_ST_B6>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_B6.TIF</FILE_NAME_BAND_ST_B6>
<FILE_NAME_BAND_7>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_B7.TIF</FILE_NAME_BAND_7>
<FILE_NAME_THERMAL_RADIANCE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_TRAD.TIF</FILE_NAME_THERMAL_RADIANCE>
<FILE_NAME_UPWELL_RADIANCE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_URAD.TIF</FILE_NAME_UPWELL_RADIANCE>
<FILE_NAME_DOWNWELL_RADIANCE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_DRAD.TIF</FILE_NAME_DOWNWELL_RADIANCE>
<FILE_NAME_ATMOSPHERIC_TRANSMITTANCE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_ATRAN.TIF</FILE_NAME_ATMOSPHERIC_TRANSMITTANCE>
<FILE_NAME_EMISSIVITY>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_EMIS.TIF</FILE_NAME_EMISSIVITY>
<FILE_NAME_EMISSIVITY_STDEV>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_EMSD.TIF</FILE_NAME_EMISSIVITY_STDEV>
<FILE_NAME_CLOUD_DISTANCE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_CDIST.TIF</FILE_NAME_CLOUD_DISTANCE>

XML Elements
<FILE_NAME_ATMOSPHERIC_OPACITY>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_ATMOS_OPACITY.TIF</FILE_NAME_ATMOSPHERIC_OPACITY>
<FILE_NAME_QUALITY_L2_SURFACE_REFLECTANCE_CLOUD>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_SR_QA_CLOUD.TIF</FILE_NAME_QUALITY_L2_SURFACE_REFLECTANCE_CLOUD>
<FILE_NAME_QUALITY_L2_SURFACE_TEMPERATURE>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_ST_QA.TIF</FILE_NAME_QUALITY_L2_SURFACE_TEMPERATURE>
<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_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>
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<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_ST_B6>UINT16</DATA_TYPE_BAND_ST_B6>
<DATA_TYPE_BAND_7>UINT16</DATA_TYPE_BAND_7>
<DATA_TYPE_THERMAL_RADIANCE>INT16</DATA_TYPE_THERMAL_RADIANCE>
<DATA_TYPE_UPWELL_RADIANCE>INT16</DATA_TYPE_UPWELL_RADIANCE>
<DATA_TYPE_DOWNWELL_RADIANCE>INT16</DATA_TYPE_DOWNWELL_RADIANCE>
<DATA_TYPE_ATMOSPHERIC_TRANSMITTANCE>INT16</DATA_TYPE_ATMOSPHERIC_TRANSMITTANCE>
<DATA_TYPE_EMISSIVITY>INT16</DATA_TYPE_EMISSIVITY>
<DATA_TYPE_EMISSIVITY_STDEV>INT16</DATA_TYPE_EMISSIVITY_STDEV>
<DATA_TYPE_CLOUD_DISTANCE>INT16</DATA_TYPE_CLOUD_DISTANCE>

XML Elements
<DATA_TYPE_ATMOSPHERIC_OPACITY>INT16</DATA_TYPE_ATMOSPHERIC_OPACITY>
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<DATA_TYPE_QUALITY_L2_SURFACE_TEMPERATURE>INT16</DATA_TYPE_QUALITY_L2_SURFACE_TEMPERATURE>
<DATA_TYPE_QUALITY_L1_PIXEL>UINT16</DATA_TYPE_QUALITY_L1_PIXEL>
<DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION>UINT16</DATA_TYPE_QUALITY_L1_RADIOMETRIC_SATURATION>
</PRODUCT_CONTENTS>
<IMAGE_ATTRIBUTES>
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<WRS_PATH>1-233</WRS_PATH>
<WRS_ROW>1-248</WRS_ROW>
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<SCENE_CENTER_TIME>HH:MI:SS.SSSSSSSZ</SCENE_CENTER_TIME>
<STATION_ID>XXX</STATION_ID>
<CLOUD_COVER>0.00–100.00, -1</CLOUD_COVER>
<CLOUD_COVER_LAND>0.00–100.00, -1</CLOUD_COVER_LAND>
<IMAGE_QUALITY>0-9, -1</IMAGE_QUALITY>
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<SATURATION_BAND_2>Y</SATURATION_BAND_2>
<SATURATION_BAND_3>Y</SATURATION_BAND_3>
<SATURATION_BAND_4>Y</SATURATION_BAND_4>
<SATURATION_BAND_5>Y</SATURATION_BAND_5>
<SATURATION_BAND_6_VCID_1>Y</SATURATION_BAND_6_VCID_1>
<SATURATION_BAND_6_VCID_2>Y</SATURATION_BAND_6_VCID_2>
<SATURATION_BAND_7>Y</SATURATION_BAND_7>
<SATURATION_BAND_8>N</SATURATION_BAND_8>
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<SUN_ELEVATION>-90.00000000 through 90.00000000</SUN_ELEVATION>

XML Elements
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<SENSOR_ANOMALIES>SHUTTER_INTRUSION</SENSOR_ANOMALIES>
</IMAGE_ATTRIBUTES>
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<DATUM>WGS84</DATUM>
<ELLIPSOID>WGS84</ELLIPSOID>
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<FALSE_EASTING>-100000000 through +100000000</FALSE_EASTING>
<FALSE_NORTHING>-100000000 through +100000000</FALSE_NORTHING>
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<GRID_CELL_SIZE_THERMAL>30.00</GRID_CELL_SIZE_THERMAL>
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<REFLECTIVE_SAMPLES>0–99999</REFLECTIVE_SAMPLES>
<THERMAL_LINES>0–99999</THERMAL_LINES>
<THERMAL_SAMPLES>0–99999</THERMAL_SAMPLES>
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<CORNER_UL_LON_PRODUCT>-180.00000 through +180.00000</CORNER_UL_LON_PRODUCT>
<CORNER_UR_LAT_PRODUCT>-90.00000 through +90.00000</CORNER_UR_LAT_PRODUCT>
<CORNER_UR_LON_PRODUCT>-180.00000 through +180.00000</CORNER_UR_LON_PRODUCT>
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<CORNER_LL_LON_PRODUCT>-180.00000 through +180.00000</CORNER_LL_LON_PRODUCT>
<CORNER_LR_LAT_PRODUCT>-90.00000 through +90.00000</CORNER_LR_LAT_PRODUCT>
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XML Elements
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<CORNER_UR_PROJECTION_X_PRODUCT>-132000000.000 through 132000000.000</CORNER_UR_PROJECTION_X_PRODUCT>
<CORNER_UR_PROJECTION_Y_PRODUCT>-132000000.000 through 132000000.000</CORNER_UR_PROJECTION_Y_PRODUCT>
<CORNER_LL_PROJECTION_X_PRODUCT>-132000000.000 through 132000000.000</CORNER_LL_PROJECTION_X_PRODUCT>
<CORNER_LL_PROJECTION_Y_PRODUCT>-132000000.000 through 132000000.000</CORNER_LL_PROJECTION_Y_PRODUCT>
<CORNER_LR_PROJECTION_X_PRODUCT>-132000000.000 through 132000000.000</CORNER_LR_PROJECTION_X_PRODUCT>
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<ORIGIN>Image courtesy of the U.S. Geological Survey</ORIGIN>
<DIGITAL_OBJECT_IDENTIFIER>https://doi.org/10.5066/P9C7I13B</DIGITAL_OBJECT_IDENTIFIER>
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<DATA_SOURCE_PRESSURE>NCEP</DATA_SOURCE_PRESSURE>
<DATA_SOURCE_WATER_VAPOR>NCEP</DATA_SOURCE_WATER_VAPOR>
<DATA_SOURCE_AIR_TEMPERATURE>NCEP</DATA_SOURCE_AIR_TEMPERATURE>
<ALGORITHM_SOURCE_SURFACE_TEMPERATURE>st_X.Y.Z</ALGORITHM_SOURCE_SURFACE_TEMPERATURE>
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</LEVEL2_PROCESSING_RECORD>
<LEVEL2_SURFACE_REFLECTANCE_PARAMETERS>
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<REFLECTANCE_MINIMUM_BAND_1>N.NNNNNN</REFLECTANCE_MINIMUM_BAND_1>

XML Elements
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<REFLECTANCE_MAXIMUM_BAND_3>N.NNNNNN</REFLECTANCE_MAXIMUM_BAND_3>
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<REFLECTANCE_MAXIMUM_BAND_4>N.NNNNNN</REFLECTANCE_MAXIMUM_BAND_4>
<REFLECTANCE_MINIMUM_BAND_4>N.NNNNNN</REFLECTANCE_MINIMUM_BAND_4>
<REFLECTANCE_MAXIMUM_BAND_5>N.NNNNNN</REFLECTANCE_MAXIMUM_BAND_5>
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<REFLECTANCE_MAXIMUM_BAND_7>N.NNNNNN</REFLECTANCE_MAXIMUM_BAND_7>
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XML Elements
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<ORIGIN>Image courtesy of the U.S. Geological Survey</ORIGIN>⁂
<DIGITAL_OBJECT_IDENTIFIER>https://doi.org/10.5066/P9TU80IG</DIGITAL_OBJECT_IDENTIFIER>⁂
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<COLLECTION_CATEGORY>T1</COLLECTION_CATEGORY>⁂
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<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>⁂

XML Elements
<FILE_NAME_BAND_5>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B5.TIF</FILE_NAME_BAND_5>⁂
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<FILE_NAME_BAND_6_VCID_2>LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX_B6_VCID_2.TIF</FILE_NAME_BAND_6_VCID_2>⁂
<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_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>
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Table 3-5. L2 Metadata XML File

3.9 Angle Coefficients File

The angle coefficients file contains coefficients used for calculating solar and satellite viewing angles. The contents of the angle coefficients file are copied verbatim from the L1 angle coefficients file. Only the file name is changed to indicate it is part of the Level 2 product. Refer to LSDS-1414 for a description of the L1 angle coefficient file.

3.10 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
ASTER GED	Advanced Spaceborne Thermal Emission and Reflection Global Emissivity Dataset
ATRAN	Atmospheric Transmittance Layer
AU	Astronomical Unit
C2	Collection 2
CC	Cubic Convolution
CCB	Configuration Control Board
CDIST	Distance to Cloud
CFMask	C version of FMask
COG	Cloud Optimized GeoTIFF
CPF	Calibration Parameter File
CR	Change Request
DDV	Dark Dense Vegetation
DEM	Digital Elevation Model
DFCB	Data Format Control Book
DN	Digital Number
DOI	Department of the Interior
DPAS	Data Processing and Archive System
DRAD	Downwelled Radiance layer
EMIS	Emissivity layer
EMSD	Emissivity Standard Deviation
EROS	Earth Resources Observation and Science
ETM	Enhanced Thematic Mapper
ETM+	Enhanced Thematic Mapper Plus
GCP	Ground Control Point
GDAL	Geospatial Data Abstraction Library
GEOS	Goddard Earth Observing System Model
GEOS-5 FP-IT	Goddard Earth Observing System Model, Version 5 Forward Process for Instrument Teams
GeoTIFF	Geographic Tagged Image File Format
GLS	Global Land Survey
GMT	Greenwich Mean Time
GS	Ground Station
GSFC	Goddard Space Flight Center
GTOPO30	Global 30 Arc-Second Elevation Data Set
IAS	Image Assessment System
ID	Identification
K	Kelvin

L1	Level 1 Data Product
L1GS	Level 1 Geometric Systematic
L1GT	Level 1 Systematic Terrain (Corrected)
L1TP	Level 1 Terrain Precision (Corrected)
L2	Level 2 Data Product
L2SP	Level 2 Science Product
L2SR	Level 2 Surface Reflectance
L7	Landsat 7
LAT	Latitude
LEDAPS	Landsat Ecosystem Disturbance Adaptive Processing System
LGN	Landsat Ground Network
LON	Longitude
LP DAAC	Land Processes Distributed Active Archive Center
LPGS	Landsat Product Generation System
LR	Lower Right
LSDS	Land Satellites Data System
MD5	Message-Digest Algorithm 5
MERRA-2	Modern-Era Retrospective Analysis for Research and Applications, Version 2
MTL	Landsat Metadata
NASA	National Aeronautics and Space Administration
NCEP	National Centers for Environmental Prediction
NED	Natural Elevation Data
NIR	Near-infrared
nm	Nanometer
ODL	Object Description Language
PS	Polar Stereographic
QA	Quality Assessment
QB	Quality Band
RADSAT	Radiometric Saturation
RMSE	Root Mean Square Error
SAA	Solar Azimuth Angle
SAM	Scan Angle Monitor
SLC	Scan Line Corrector
SR	Surface Reflectance
ST	Surface Temperature
STDEV	Standard Deviation
SWIR	Short Wavelength Infrared
SZA	Solar Zenith Angle
T1	Tier 1
T2	Tier 2
TOA	Top of Atmosphere

TOMS	Total Ozone Mapping Spectrometer
TRAD	Thermal Radiance layer
TRAM	Tracking, Routing, and Metrics
URAD	Upwelled Radiance
USGS	U.S. Geological Survey
UTF	Unicode Transformation Format
UTM	Universal Transverse Mercator
VAA	View Azimuth Angle
VCID	Virtual Channel Identifier
VNIR	Visible to Near Infrared
VZA	View Zenith Angle
WGS84	World Geodetic System 1984
WRS	Worldwide Reference System
WRS-2	Worldwide Reference System 2
XML	Extensible Markup Language

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-1329. Landsat Atmospheric Auxiliary Data Data Format Control Book (DFCB).

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

USGS/EROS. LSDS-1414. Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) Collection 2 (C2) Level 1 (L1) Data Format Control Book (DFCB).

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

GeoTIFF Specification
http://web.archive.org/web/20160403164508/http:/www.remotesensing.org/geotiff/spec/geotiffhome.html

Landsat LEDAPS Product Guide