Landsat Collection 1 Level-1 Data Processing Starting Soon

Public access to the Landsat 4-5 Thematic Mapper (TM) and Landsat 7 Enhanced Thematic Mapper Plus (ETM+) Collection 1 data will begin by the end of August 2016. Landsat 8 Operational Land Imager (OLI)/ Thermal Infrared Sensor (TIRS) processing will start in December 2016 (details below). Landsat 1-5 Multispectral Scanner (MSS) data will start after the TM, ETM+, and OLI/TIRS reprocessing and MSS Collection investigations are completed.

This issue contains reminders about changes to the Landsat Level-1 data product and EarthExplorer data-searching portal (http://earthexplorer.usgs.gov) for Collection 1 data.

The Landsat Collections Web page (http://landsat.usgs.gov/landsatcollections.php) contains information about the items described in this issue, as well as the background and definition of Collection 1, sample data products, and all details related to this effort. We encourage Landsat data users to review this page and contact Landsat User Services (custserv@usgs.gov) with questions.

Landsat Collection Category (Tiers)

All scenes in the Landsat archive are assigned to a Collection category. The purpose of Collection categories is to support rapid and easy identification of suitable scenes for time-series pixel level analysis. During Collection 1 reprocessing, all Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI/TIRS scenes in the USGS archive are assigned to a specific "Tier". These data have well-characterized radiometric quality and are cross-calibrated among the different Landsat sensors.

Tier 1 (T1): Contains the highest quality L1TP data considered suitable for time-series analysis. The georegistration is consistent and within prescribed tolerances [<12m root mean square error (RMSE)].

Tier 2 (T2): Contains L1TP scenes not meeting Tier 1 criteria and all L1GT and L1GS scenes. Users interested in Tier 2 scenes can evaluate the L1TP RMSE and other properties to determine suitability for use in their applications and studies.

Real-Time (Temporary designation) (RT): Contains newly acquired Landsat 7 and Landsat 8 scenes, which require a period of evaluation and calibration adjustment after acquisition but are processed immediately based on preliminary calibration coefficients, assigned to the temporary RT Tier, and made available for download. When definitive calibration information becomes available, these scenes are reprocessed, assigned to the appropriate Tier 1 or Tier 2 category, and removed from the RT Tier.

The Collection category designation is visible at the end of the Landsat Product Identifier, as shown in the examples below.

```
Tier 1:      LE07_L1TP_016039_20040918_20160211_01_T1
Tier 2:      LT04_L1GS_017036_19821115_20160315_01_T2
Real-Time:   LE07_L1GT_037035_20160314_20160314_01_RT
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Landsat Collection 1 Data Changes

The following changes are being applied to Landsat Level-1 data as scenes are reprocessed and placed into Collection 1:

Processing Level Designations: The table below displays the processing levels currently used for the existing data held in the Landsat Archive datasets (now known as Pre-Collection), compared to those being implemented for Collection 1 data products.

Landsat Archive – Pre-Collection	Landsat Collection 1
L1T (Precision terrain) systematically, radiometrically, geometrically, and topographically corrected; highest quality	**L1TP (Precision terrain)** systematically, radiometrically, geometrically, and topographically corrected using ground control points; highest quality; scenes suitable for time-series pixel level analysis
L1GT (Systematic terrain) systematically, radiometrically, geometrically and topographically corrected using digital elevation model (DEM) source data	**L1GT (Systematic terrain)** systematically, radiometrically, geometrically and topographically corrected using digital elevation model (DEM) source data
L1G (Systematic) systematically, radiometrically, geometrically corrected; no topographical correction applied	**L1GS (Systematic)** systematically, radiometrically, geometrically corrected; no topographical correction applied

New Landsat Product Identifiers: While the new Landsat Product Identifier contains information inherited from the Pre-Collection Scene ID, it also includes the new processing correction level designations, the most recent Level-1 processing date, the collection number, and collection category (Tier). The new items are noted in red in the graphic below.

Scene ID	Landsat Product Identifier
LXSPPPRRYYYYDDDGSIVV L = Landsat X = Sensor S = Satellite PPP = WRS path RRR = WRS row YYYY = Year DDD = Julian day of year GSI = Ground station identifier VV = Archive version number	**LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX** L = Landsat X = Sensor ("C" = OLI/TIRS Combined, "O"= OLI-only, "T" = TIRS-only, "E" = ETM+, "T" = TM, "M"= MSS) SS = Satellite ("07" = Landsat 7, "08" = Landsat 8) LLLL = Processing correction level ("L1TP": Precision Terrain, "L1GT": Systematic Terrain, "L1GS": Systematic) 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 ("01","02") TX = Collection category: ("RT" for Real-Time, "T1" for Tier 1 , or "T2" for Tier 2)
Examples: LC80290302015343LGN00 LE70160392004262EDC02 LT40170361982320XXX08 LM10170391976031AAA01	**Examples:** LC08_L1GT_029030_20151209_20160131_01_RT LE07_L1TP_016039_20040918_20160211_01_T1 LT04_L1GS_017036_19821115_20160315_01_T2 LM01_L1GS_017039_19760131_20160225_01_T2

New files and metadata fields: The files and metadata fields described below are included in Landsat Collection 1 Level-1 data products. Note: These files will increase the size of the Level-1 data product.
- Quality Assessment (QA) band (NEW to Landsat 4-5 TM and Landsat 7 ETM+; UPDATED for Landsat 8 OLI/TIRS) (http://landsat.usgs.gov/collectionqualityband.php)
- Angle Coefficient Files (Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI/TIRS) (http://landsat.usgs.gov/solar_illumination.php)
- Saturation bits parameter (Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI/TIRS) (http://landsat.usgs.gov/what-new-saturation-bits-parameter-metadata-file.php)

- Land-based cloud cover score (Landsat 4-7) (http://landsat.usgs.gov//what-difference-between-scene-cloud-cover-and-land-cloud-cover-scores.php)
- Collection 1 Calibration Parameter File (CPF) file names include the Collection number to uniquely identify CPFs to specific Collection data. CPFs are maintained for both Pre-Collection and Collection 1 data, and will follow suit during transitions to new Collections in the future. (http://landsat.usgs.gov//landsatcollections.php)

New Cloud Cover Algorithm: The C Function of Mask (CFMask) algorithm (http://landsat.usgs.gov//what-cfmask.php) is used to populate fill, cloud, cloud confidence, cloud shadow, and snow/ice in Landsat 4-5, Landsat 7, and Landsat 8 scenes, and is populated in the Quality Assessment (QA) band.

Collection 1 Reprocessing Details

The reprocessing of Landsat 4-5 TM and Landsat 7 ETM+ scenes to start populating the Collection 1 datasets begins in August. Data over the conterminous United States, followed by international areas, and the most recently acquired data are reprocessed first, and then efforts will move backward into the archive.

During Collection 1 reprocessing, newly acquired Landsat 7 scenes are produced for both the Pre-Collection and Collection 1 datasets, using the parameters established for each.

Pre-Collection datasets will be retained for a sometime after each dataset is completely reprocessed into Collection 1 (specific timeframe is yet to be determined). Announcements will be made to alert users when each dataset has completed Collection 1 processing and when the Pre-Collection datasets will be removed.

Collection 1 Level-1 Data Access

Initially, Collection 1 Level-1 data products will only be available on EarthExplorer (EE) (http://earthexplorer.usgs.gov). Modifications to accommodate Collection 1 Level-1 Landsat data on GloVis (http:/glovis.usgs.gov) and the LandsatLook Viewer (http://landsatlook.usgs.gov) are being considered.

The graphic below displays the changes to the Earth Explorer Data Set tab. All existing datasets are being moved into the Pre-Collection section. Each Collection 1 Level-1 dataset will become visible as scenes are processed and made available to download. Collection 1 Higher Level datasets will appear on the Data Set tab when the submission process of Collection 1 Surface Reflectance orders becomes available.
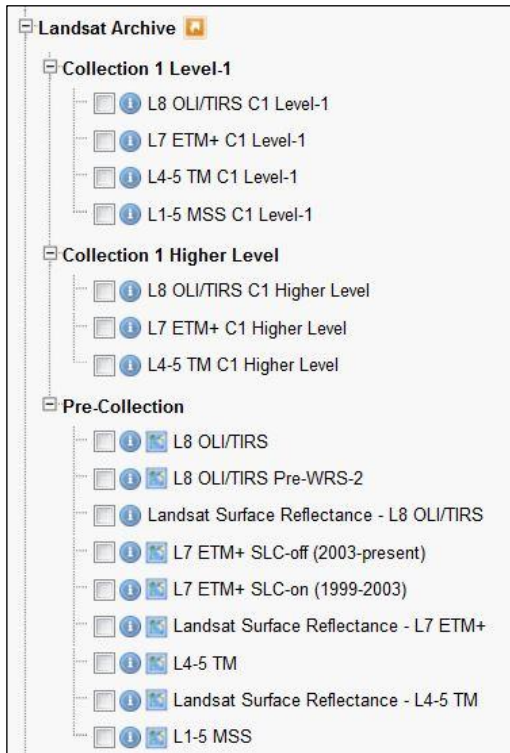
Please note the changes to the Landsat 8 and Landsat 7 datasets:

Pre-Collection	Collection 1
L8 OLI/TIRS and L8 OLI/TIRS Pre-WRS-2	**L8 OLI/TIRS**
L7 ETM+ SLC-off and L7 ETM+ SLC-on	**L7 ETM+**

The Earth Explorer Additional Criteria tab allows users to select the options for the data (i.e., Landsat 7 ETM+ SLC-on or SLC-off), in order to further restrict data searches.