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Landsat Collection 2 U.S. Analysis Ready Data

Landsat Collection 2 (C2) U.S. Analysis Ready Data (U.S. ARD) are bundles of tiled Landsat data that make the Landsat archive easier to analyze and reduce the amount of time users spend on data processing for time-series analysis.

Landsat C2 was released in 2020 and includes improvements over Landsat Collection 1 data, including better geometric accuracy, which increases the number of available C2 U.S. ARD tiles. Landsat C2 U.S. ARD are processed to the highest scientific standards.

Landsat C2 U.S. ARD are available for the conterminous United States (CONUS; 1982–present), Alaska (1984–present), and Hawaii (1989–93 and 1999–present) using Landsat C2 Level-1 data processed into Albers Equal-Area Conic-projected Level-2 surface reflectance and surface temperature products from the following Landsat sensors:

- Landsats 8 and 9 Operational Land Imager (OLI)/Thermal Infrared Sensor (TIRS): tier 1, tier 2[a]
- Landsat 7 Enhanced Thematic Mapper Plus (ETM+): tier 1
- Landsats 4 and 5 Thematic Mapper (TM): tier 1

[a]Newly acquired Landsat 8 scenes are processed to U.S. ARD 16–18 days after the initial Landsat Level-1 Real Time data are processed to tiered products. Landsat 9 immediately processes to a tier structure and to U.S. ARD when all ancillary data are collected (3–4 days).

Tile Grid System

The Landsat C2 U.S. ARD product is processed to a common tiling scheme, modified from the Web-Enabled Landsat Data system developed at South Dakota State University. The tiles are units of uniform dimension bounded by static corner points in a defined grid system (fig. 1). An ARD tile is defined as 5,000 x 5,000 30-meter pixels. For a given acquisition date, an ARD tile is created from one to three scenes acquired over the same World Reference System-2 (WRS–2) path (fig. 2).

Although the ARD Product identifier follows the naming convention of its collection-based data source, the ARD Product identifier replaces WRS–2 path and row designations with tile identifiers (that is, HHH for horizontal and VVV for vertical) because an ARD tile may include data from several WRS–2 rows. Note: The Alaska tile grid was modified for C2 U.S. ARD to include the Aleutian Islands. The CONUS and Hawaii tile grids remain the same in C2 as they are in Collection 1.

Product Content

The following products are included in the Landsat C2 U.S. ARD product:

- Top of Atmosphere (TOA) Reflectance.
- TOA Brightness Temperature (BT)[b]: TOA Reflectance and TOA BT are generated using the calibration parameters from the metadata.
- Surface Reflectance (SR): Generated using the specified algorithm that applies the atmospheric correction routines on the TOA Reflectance. Note: 15-meter panchromatic bands (OLI/ETM+ Band 8) are not processed to TOA or SR.
    - For OLI/TIRS, U.S. Geological Survey (USGS) Land SR Code (LaSRC) version 1.5.0 (derived from the National Aeronautics and Space Administration [NASA] LaSRC version 3.5.5) was used.
    - For TM and ETM+, USGS Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS) SR algorithm version 3.4.0 (derived from the February 2011 version of NASA LEDAPS code) was used.

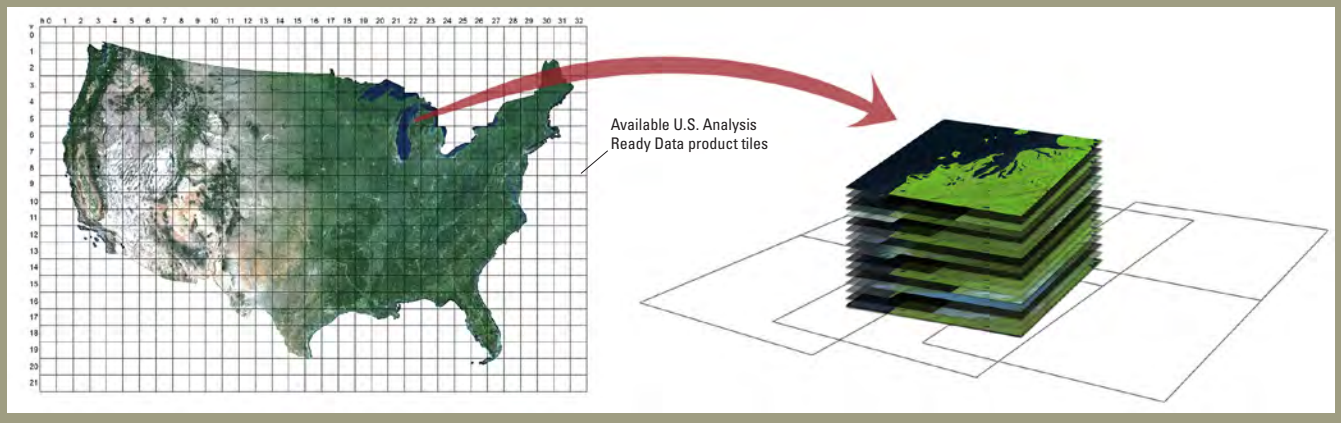

Figure 1. This graphic shows the Landsat Collection 2 U.S. Analysis Ready Data tile grid for the conterminous United States and an example of the stacked images for various dates from that specific tile. [h, horizontal; v, vertical]

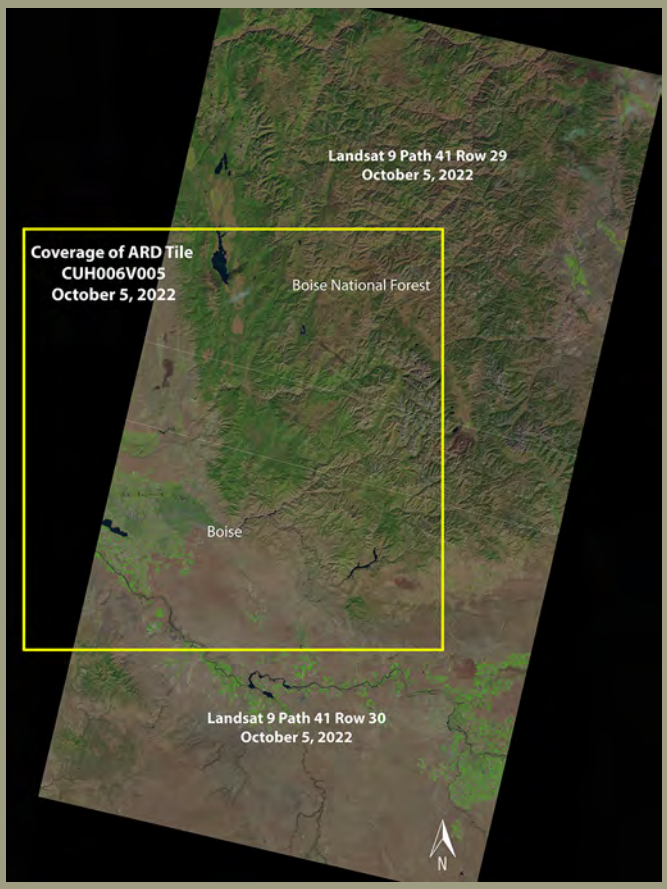

Figure 2. Graphic showing the coverage of typical U.S. Analysis Ready Data tiles, relating to two Landsat 9 scenes. U.S. Analysis Ready Data tiles have varying data fill because of how the tiles intersect with the Landsat scenes of a certain date.

- Surface Temperature (ST)[b]: Calculated by applying the Single Channel algorithm on TIRS Band 10 and TM/ETM+ Band 6. (Note: ST is available only when the Level-2 science product exists; generated using Landsat Level-2 ST algorithm version 1.3.0 [derived from the June 2017 version of Rochester Institute of Technology ST code]).
- Quality Assessment (QA) bands: Pixel QA is derived from Fmask version 3.3.1, Aerosol and Cloud QA are derived from atmospheric compensation algorithms, and radiometric saturation QA is derived from the detector's input signal level.
- Extensible Markup Language metadata: Contains associated metadata for the tile. See https://www.usgs.gov/media/files/landsat-collection-2-us-ard-tile-xml-metadata-schema.
- JavaScript Object Notation (JSON) metadata: Contains associated metadata written in JSON for the tile. See https://landsat.usgs.gov/stac/ard_json_metadata_schema.json.

[b]For Landsat 7 ETM+ products, Band 6 TOA BT and ST data are generated from merging ETM+ Band 6 High (6H) and Band 6 Low (6L). The merged band contains unsaturated pixels from Band 6. If Band 6H pixels have a BT outside of the 6H dynamic range (240–322 kelvins), then Band 6L pixels are used. Pixels that are saturated in Band 6L remain saturated in the merged Band 6 product. The merged thermal radiance is then used in the creation of the TOA BT and ST data.

Data Access

Visit the "Landsat Data Access" web page (https://www.usgs.gov/landsat-missions/landsat-data-access) to discover how to search and download all Landsat products from USGS data portals. The USGS Landsat no-cost open access data policy remains intact since its inception in 2008.

Documentation

Basic information about the Landsat C2 U.S. ARD product is available at https://www.usgs.gov/landsat-missions/landsat-collection-2-us-analysis-ready-data. For further information, the product guide and algorithm description document are accessible from this web page.

Citation Information

The use of the Landsat C2 U.S. ARD product is not restricted. Although not a requirement of data use, the following citations may be used in publication or presentation materials to acknowledge the USGS as a data source and to credit the original research.

Landsat Collection 2 U.S. Analysis Ready Data product courtesy of the U.S. Geological Survey.

Dwyer, J.L., Roy, D.P., Sauer, B., Jenkerson, C.B., Zhang, H.K., and Lymburner, L., 2018, Analysis Ready Data—Enabling analysis of the Landsat archive: Remote Sensing, v. 10, no. 9, art. 1363, 19 p. [Also available at https://doi.org/10.3390/rs10091363.]

Visit https://www.usgs.gov for more information about the USGS and https://www.usgs.gov/programs/national-land-imaging-program for specifics about the National Land Imaging Program.

For more information and to ask questions about Landsat operations, products, and data access, please contact:

Customer Services
U.S. Geological Survey
Earth Resources Observation and Science Center
47914 252nd Street
Sioux Falls, SD 57198
Phone: 605–594–6151 or 1–800–252–4547

Email: custserv@usgs.gov

Twitter: @USGSLandsat; https://www.twitter.com/USGSLandsat

Instagram: @usgslandsat; https://www.instagram.com/USGSLandsat

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