Landsat Collection 2 Level-3 Dynamic Surface Water Extent Science Product
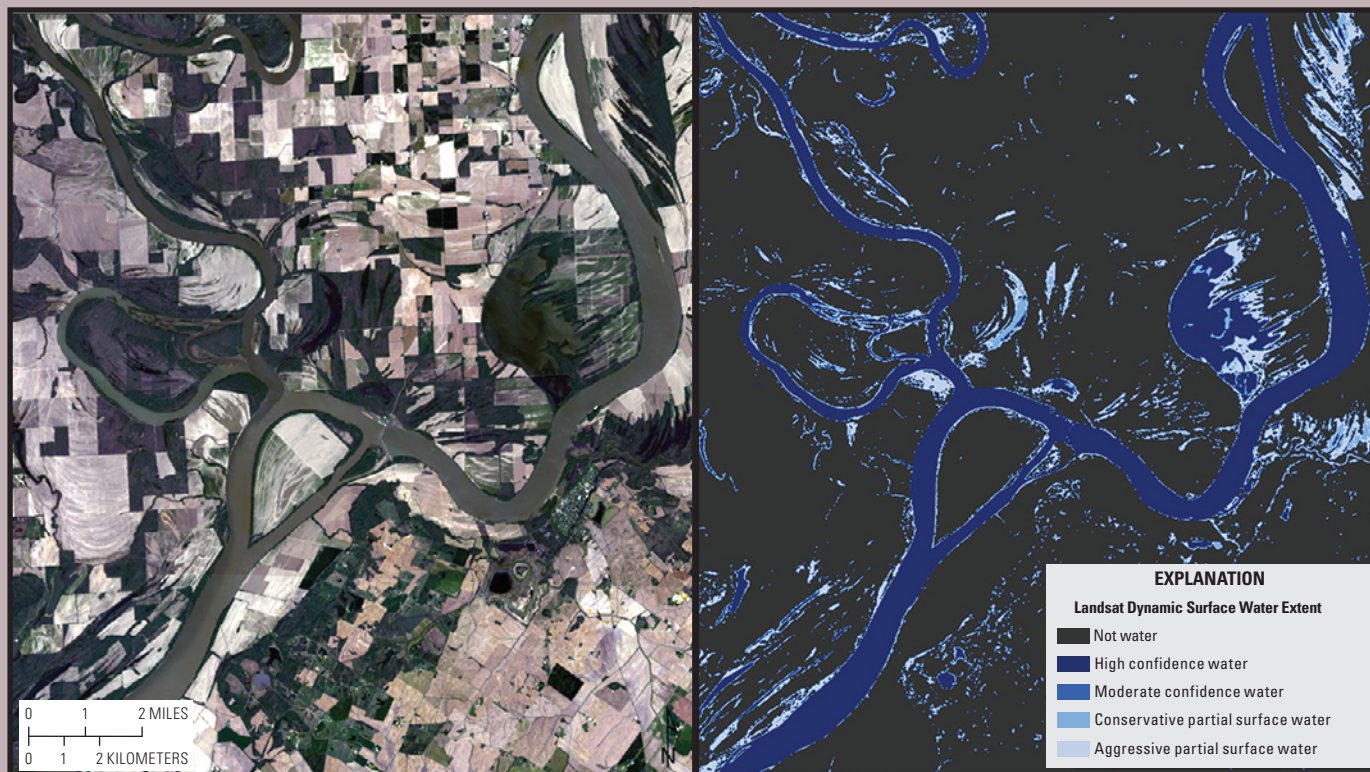
The Landsat Collection 2 (C2) Level-3 Dynamic Surface Water Extent (DSWE) science product provides raster data that represent surface water inundation per pixel in Landsat 4–9 imagery. The C2 DSWE science product contains six acquisition-based raster products relating to surface water. Surface water extent is modulated by weather and climate, stream network hydrology, and geological processes such as isostatic rebound. Land use, ecosystem and service management, and overall water management also are affected by changes in surface water extent.

The C2 DSWE science product (fig. 1) is generated from Landsat C2 U.S. Analysis Ready Data Surface Reflectance products using the cloud, cloud shadow, and snow information provided in the "QA_PIXEL" Level-2 Quality Assessment band. These products are available for Landsat 4–5 Thematic Mapper, Landsat 7 Enhanced Thematic Mapper Plus, and Landsat 8–9 Operational Land Imager data.

The Landsat C2 DSWE science product is processed to a 30-meter spatial resolution in the Albers Equal-Area Conic projection using the World Geodetic System of 1984 (known as WGS 84) datum and gridded to fixed 5,000-square meter nonoverlapping tiles.

The C2 DSWE science product is available for the conterminous United States, Alaska, and Hawaii for the following date ranges:

- Landsat 9 Operational Land Imager: October 2021 to present

- Landsat 8 Operational Land Imager: April 2013 to present

- Landsat 7 Enhanced Thematic Mapper Plus: July 1999 to April 2022

- Landsat 5 Thematic Mapper: March 1984 to May 2012

- Landsat 4 Thematic Mapper: November 1982 to December 1992

EXPLANATION

Landsat Dynamic Surface Water Extent

- Not water
- High confidence water
- Moderate confidence water
- Conservative partial surface water
- Aggressive partial surface water

Figure 1. Example of the Landsat Collection 2 Dynamic Surface Water Extent science product showing the confluence of the Wabash and Ohio Rivers on April 12, 2021. From left to right, Landsat Collection 2 U.S. Analysis Ready Data Surface Reflectance image and Dynamic Surface Water Extent (Interpreted Layer) image. Images by the U.S. Geological Survey.

Product Improvements

Several improvements were made to the C2 DSWE science product. Overall, agreement between Collection 1 and C2 in the High Confidence Water Class is excellent. The changes made in C2 DSWE are as follows:

- Landsat C2 DSWE uses the C2 Digital Elevation Model.

- The Land Cover Mask was added to the Interpreted Layer masking.

- The Interpreted Layer with Mask Applied was split into two bands: Interpreted Layer with Some Masks Applied and Interpreted Layer with All Masks Applied.

- The static Hillshade threshold was replaced with a dynamic threshold for commission masking.

- The Percent Slope thresholds in Interpreted Layer masking were removed, so the Percent Slope band is not included in the C2 DSWE package.

The Landsat C2 DSWE science product includes six raster layers and a metadata file (Extensible Markup Language [or XML] file format) relating to the existence and condition of surface water. The files included in the C2 DSWE science product are as follows:

- Diagnostic Layer (raster layer): Provides the results of the five diagnostic tests used to determine the probability of water presence in each pixel.
  Delivered file name: tileID_DIAG.TIF

- Interpreted Layer (raster layer): Provides the recoded results of the five diagnostic tests to identify specific surface water conditions.
  Delivered file name: tileID_INTR.TIF

- Interpreted Layer with Some Masks Applied (raster layer): Although like the Interpreted Layer, the Interpreted Layer with Some Masks Applied is screened for terrain, snow, and land cover conditions.
  Delivered file name: tileID_INTSM.TIF

- Interpreted Layer with All Masks Applied (raster layer): Although like the Interpreted Layer with Some Masks Applied, the Interpreted Layer with All Masks Applied includes cloud and cloud shadow information from the Level-2 Quality Assessment layer.
  Delivered file name: tileID_INWAM.TIF

- Mask (raster layer): Indicates where cloud, cloud shadow, and (or) snow is true; where the threshold indicates shade; or where the land cover map specifies that the location is not water.
  Delivered file name: tileID_MASK.TIF

- Hillshade (raster layer): Represents the extent of terrain-produced shadow for each pixel.
  Delivered file name: tileID_SHADE.TIF

- Metadata (Extensible Markup Language file): Metadata file.
  Delivered file name: tileID_DSWE.XML

Data Access

The Landsat C2 DSWE science product and Landsat C2 Analysis Read Data are available for download from EarthExplorer (https://earthexplorer.usgs.gov/) and through the commercial cloud.

In EarthExplorer, the data are available under the "Landsat" category and the "Landsat Collection 2 Level-3 Science Products" or "Landsat C2 U.S. Analysis Ready Data (ARD)" subcategory and are listed as "Landsat 4-9 C2 Dynamic Surface Water Extent."

Visit the "Landsat Data Access" web page (https://www.usgs.gov/landsat-missions/landsat-data-access) for additional information about cloud access and bulk download options.

Documentation

Information about the Landsat C2 DSWE science product package is available at https://www.usgs.gov/landsat-missions/landsat-collection-2-level-3-dynamic-surface-water-extent-science-product. Additional technical details about the C2 DSWE science product are available in the product guide and algorithm description document on this web page.

Citation Information

The use of Landsat C2 Level-3 science products is not restricted. Although not a requirement of data use, the following citations may be used in publication or presentation materials to acknowledge the U.S. Geological Survey as a data source and to credit the original research:

Landsat Collection 2 Level-3 Dynamic Surface Water Extent science product courtesy of the U.S. Geological Survey.

Jones, J.W., 2019, Improved automated detection of subpixel-scale inundation—Revised Dynamic Surface Water Extent (DSWE) partial surface water tests: Remote Sensing, v. 11, no. 4, art. 374, 26 p., https://doi.org/10.3390/rs11040374.

Visit https://www.usgs.gov for more information about the U.S. Geological Survey 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: