Landsat Science Products Now Available

The USGS has developed research-quality, applications-ready, Level-2 and Level-3 science products derived from Landsat Collection 1 Level-1 data. These products can be used to monitor and assess how changes in land use, land cover, and land condition affect people and the environment.

<table>
<thead>
<tr>
<th><strong>Landsat Level-2 Products</strong></th>
<th><strong>Landsat Level-3 Products</strong></th>
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<td><strong>Surface Reflectance</strong></td>
<td><strong>Provisional Surface Temperature</strong></td>
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<tr>
<td>Measures the fraction of incoming solar radiation that is reflected from Earth’s surface to the Landsat sensor</td>
<td>Represents the temperature of the Earth’s surface in Kelvin (K)</td>
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<tr>
<th><strong>Dynamic Surface Water Extent</strong></th>
<th><strong>Fractional Snow Covered Area</strong></th>
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<tr>
<td>Describes the existence and condition of surface water</td>
<td>Indicates the percentage of a pixel covered by snow</td>
<td>Represents per pixel burn classification and burn probability</td>
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<tr>
<td>Landsat 4-5 Thematic Mapper (TM)</td>
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<td>Landsat 7 Enhanced Thematic Mapper Plus (ETM+)</td>
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<td>Landsat 8 Operational Land Imager (OLI)</td>
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These images representative Landsat Science Products from Landsat ARD Tile H004V002, acquired July 23, 2017.
Landsat Level-2 Surface Reflectance

Surface reflectance (SR) improves comparability between images by removing atmospheric artifacts such as aerosol scattering and thin clouds and is instrumental in identifying and quantifying environmental change. SR is a measure of reflectance on the surface of the ground, as compared to reflectance measurement at the sensor. Landsat Level-2 SR data are the base for all of the other products described below. SR data are produced using algorithms that apply atmospheric correction routines to most descending mode (daytime) Landsat 4-5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), and Landsat 8 Operational Land Imager (OLI) Collection 1 Level-1 data. Newly-collected Landsat 8 and Landsat 7 Real-Time data become suitable for processing within 2-3 days of acquisition and receipt into the USGS Landsat Level-1 archive.

SR data can be delivered as a World Reference System 2 (WRS-2) scene-based product with selectable data formats, or, like the other science products described below, as a U.S. Landsat Analysis Ready Data (ARD) tile-based product in GeoTIFF format. The Data Access section of the Landsat Surface Reflectance web page (https://www.usgs.gov/land-resources/nli/landsat/landsat-surface-reflectance) provides specific details on obtaining SR data products. Product documentation and other useful information are also available on this page.

Landsat Level-2 Provisional Surface Temperature

Surface Temperature (ST) measures the temperature of the surface of the Earth and is an important input to net radiation budget and hydrologic models. ST data are also useful for monitoring crops and vegetation, studying drought effects during normal and extreme heat events, natural disasters (volcano eruptions, fires), as well as in urban area/heat island studies.

Landsat Level-2 Provisional* ST data are available as a U.S. Landsat ARD tile-based product for descending node (daytime) Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI acquisitions from August 1982 to present for the conterminous United States, Alaska, and Hawaii.

ST data are generated using U.S. Landsat Analysis Ready Data (ARD) top of atmosphere (TOA) reflectance and top of atmosphere Brightness Temperature (TOA BT) bands, as well as Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Emissivity Database (GED) and ASTER Normalized Difference Vegetation Index (NDVI) data.

The ST file package contains two primary raster products and several intermediate bands used by the ST algorithm to represent the temperature of the Earth’s land surface in Kelvin (K), as well as quality assessment information.
ST data are delivered in GeoTIFF format and are included in the U.S. Landsat ARD tile package bundles, that are available to download from the U.S. Landsat ARD dataset on EarthExplorer (https://earthexplorer.usgs.gov).

The Landsat Provisional Surface Temperature web page (https://www.usgs.gov/land-resources/nli/landsat/landsat-provisional-surface-temperature) contains more information about the data, including package contents, important caveats and constraints, and product documentation.

*The Landsat Surface Temperature Science Product has reached a provisional level of maturity for the United States, meaning that its uncertainties are understood in multiple locations and assessments of its results have demonstrated positive science value. Algorithm artifacts have been identified under certain observational conditions and are currently being analyzed to develop and test solutions to enhance algorithmic implementation, reduce uncertainty, and improve future surface temperature products. Current algorithm performance is documented in the peer-reviewed literature listed in the Provisional Surface Temperature documentation.*

**Landsat Level-3 Dynamic Surface Water Extent**

Aquatic scientists and water resource managers require information on the dynamics of surface water extent. Surface water extent is modulated by weather and climate, stream network hydrology, and geological processes such as isostatic rebound. Land use, ecosystem and services, and water management are also impacted by changes in surface water extent.

Landsat Level-3 Dynamic Surface Water Extent (DSWE) data are U.S. Landsat ARD tile-based products and are available for Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI acquisitions from August 1982 to present, for the conterminous United States, Alaska, and Hawaii.

DSWE data represent surface water inundation per-pixel observables in Landsat data. The DSWE package contains six acquisition-based raster data products in GeoTIFF format relating to the existence and condition of surface water. All intermediate bands used to produce DSWE product are also provided in the download package.

DSWE are available to download from the Landsat Collection 1 Level-3 dataset section on EarthExplorer (https://earthexplorer.usgs.gov).

The Landsat Dynamic Surface Water Extent web page (https://www.usgs.gov/land-resources/nli/landsat/landsat-dynamic-surface-water-extent) contains more information about the data, including package contents, important caveats and constraints, user community information, and product documentation.
Landsat Level-3 Fractional Snow Covered Area

Snow cover is spatially and temporally variable and is often concentrated in remote or inaccessible land regions making spaceborne remote sensing the most feasible approach to measure and monitor snow cover change. Landsat’s spatial resolution offers the capability to resolve snow cover patterns across topographically complex mountainous regions.

Landsat Fractional Snow Covered Area (fSCA) data are U.S. Landsat ARD tile-based products and are available for Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI data from March 1984 to December 2017, for the western United States and Alaska.

fSCA data provide per-pixel fractional snow cover maps that indicate the percentage of a pixel covered by snow for Landsat data. The fSCA package contains two GeoTIFF raster layers to indicate the percentage of a pixel covered by snow, and a cloud mask that is used to produce the DSWE product.

fSCA are available to download from the Landsat Collection 1 Level-3 dataset section on EarthExplorer (https://earthexplorer.usgs.gov).

The Landsat Fractional Snow Covered Area web page (https://www.usgs.gov/land-resources/nli/landsat/landsat-fractional-snow-covered-area) contains more information about the data, including package contents, important caveats and constraints, user community information, and product documentation.

Landsat Level-3 Burned Area

Accurate and complete data on fire locations and burned areas (e.g. fire occurrence) are needed to quantify trends and patterns of fire occurrence, characterize drivers of fire occurrence, projections of future fire pattern behavior, and help with assessments of fire impacts on both natural and social systems.

Landsat Burned Area (BA) data are U.S. Landsat ARD tile-based products and are available for Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8 OLI data from March 1984 to December 2017, for the conterminous United States.

BA data help identify burned areas across all ecosystems (e.g. forests, shrublands, and grasslands) for Landsat data. The BA package contains two acquisition-based raster data products in GeoTIFF format that represent burn classification and burn probability.

BA are available to download from the Landsat Collection 1 Level-3 dataset section on EarthExplorer (https://earthexplorer.usgs.gov).

The Landsat Burned Area web page (https://www.usgs.gov/land-resources/nli/landsat/landsat-burned-area) contains more information about the data, including package contents, important caveats and constraints, user community information, and product documentation.
Useful Landsat Science Product Resources

**Landsat Level-2 Surface Reflectance**
https://www.usgs.gov/land-resources/nli/landsat/landsat-surface-reflectance

**Landsat Level-2 Provisional Surface Temperature**
https://www.usgs.gov/land-resources/nli/landsat/landsat-provisional-surface-temperature

**U.S. Landsat Analysis Ready Data (ARD)**

**Landsat Level-3 Dynamic Surface Water Extent**
https://www.usgs.gov/land-resources/nli/landsat/landsat-dynamic-surface-water-extent

**Landsat Level-3 Fractional Snow Covered Area**
https://www.usgs.gov/land-resources/nli/landsat/landsat-fractional-snow-covered-area

**Landsat Level-3 Burned Area**
https://www.usgs.gov/land-resources/nli/landsat/landsat-burned-area

Contact USGS Customer Services with any questions about Landsat Level-2 and Level 3 Science Products:
custserv@usgs.gov
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1-605-594-6151

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