

Landsat 9 and Landsat Collection 2 Archive

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Landsat 9 OLI-2 image over Lake Erie on February 6, 2022; source: USGS

Outline

- NASA/USGS Landsat Mission and Partnership
- Landsat 9 is Operational!
- Landsat Collection 2
- Landsat Collection 2 Data Products
- Provisional Landsat 8 and Landsat 9 Aquatic Reflectance Products
- Landsat Collection 2 Data Processing and Latency
- Landsat Collection 2 Data Access

Landsat Mission

- Mission goal since 1972: to provide Earth looking measurements to enable detection and attribution of natural versus anthropogenic causes of land surface change
- For 2/3rds of Landsat's lifetime there have been two active satellites providing 8-day temporal revisit

Landsat Missions: Imaging the Earth Since 1972



source: <https://www.usgs.gov/land-resources/nli/landsat/>

NASA and USGS Landsat Mission Partnership

NASA is largely responsible for:

Technology investments, **mission requirements**, space segment (i.e., **development**, launch, checkout, commissioning), instruments, pre-launch **calibration**, **science and applications**, and **communications and outreach**

USGS is largely responsible for:

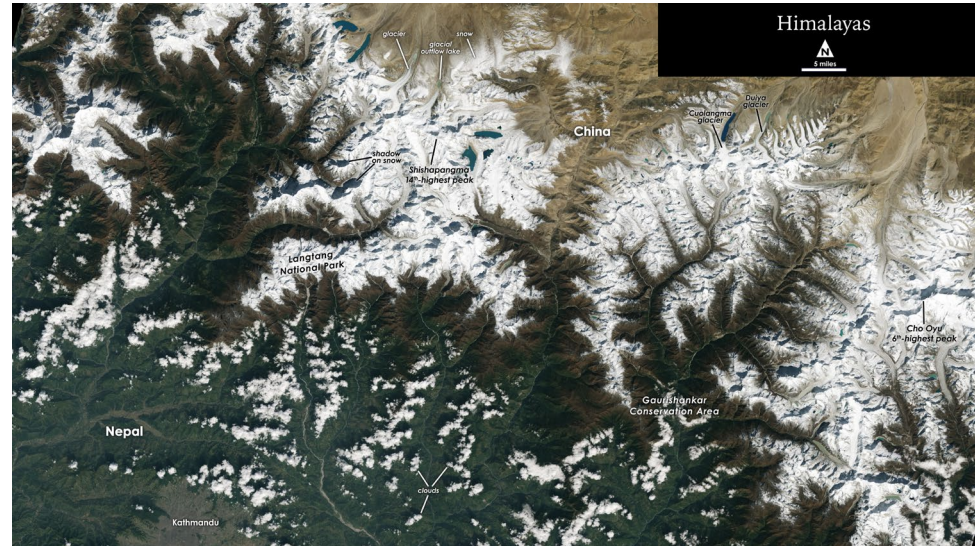
User needs, **mission requirements**, ground segment (i.e., **development**, downlinking, processing, archiving, management, and distribution), on-orbit operations and data acquisition, post-launch **calibration/validation**, science data products, **science and applications**, and **communications and outreach**



Landsat 8 OLI image over Lake Superior Apostle Islands, WI; source: USGS

Landsat 9 is Operational!

- Landsat 9 launched from Vandenberg Space Force Base, California on September 27, 2021
- The observatory carries multispectral visible-to-shortwave infrared (VSWIR) Operational Land Imager 2 (OLI-2) and dual channel Thermal Infrared Sensor 2 (TIRS-2) instruments
- Commissioning was completed and operations started in late January 2022
- Collection 2 Landsat 9 science data was released on February 10, 2022
- Landsat 9 has been radiometrically cross-calibrated to Landsat 8 to within 1%



Landsat 9 OLI-2 first light image over the Himalayas on October 31, 2021; source: NASA/USGS



Landsat 9 OLI-2 first light image over the western Lake Erie on October 31, 2021; source: NASA/USGS

Landsat Collection 2 Overview

- The USGS started planning and defining specifications for Landsat Collection 2 data products in 2018 and reprocessing was completed in September 2020 using the USGS's commercial cloud architecture
- Landsat Collection 2 was released publicly in December 2020
- Landsat Collection 2 data products include several enhancements that harness more recent advancements in processing, algorithm developments, and access and distribution services

Key Advancements include:

- Improved per-pixel geodetic accuracy by incorporating Landsat 8 ground control points harmonized with the ESA Sentinel-2 Ground Reference Image (GRI)
- A global inventory of scene-based Level-2 surface reflectance (SR) and surface temperature (ST) data products that meet the solar elevation angle criteria



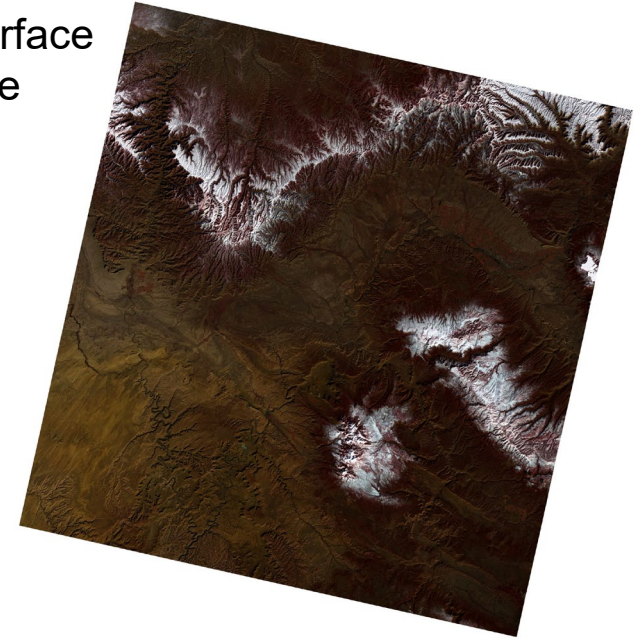
Landsat Collection 2 Data Products

- Real-Time (RT) Digital Numbers (DNs) for Landsat 8
- Level-1 TP corrected (Tier 1) DNs for Landsat 1-9
- Level-1 GT and Level-1 GS corrected (Tier 2) DNs for Landsat 1-9
- Level-2 Surface Reflectance (SR) for Landsat 4-9
- Level-2 Surface Temperature (ST) for Landsat 4-9

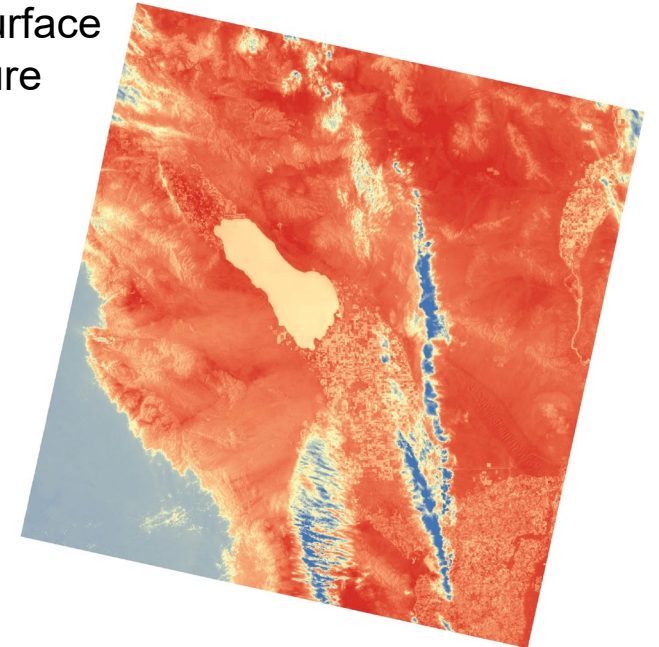
Note: Product package includes product metadata, Level-1 per-pixel quality QA, per-pixel solar and view angle image arrays, Level-2 SR per-pixel aerosol QA, and Level-2 ST per-pixel intermediate QA bands

More information: [Landsat Collection 2 | U.S. Geological Survey \(usgs.gov\)](https://www.usgs.gov/landsat-collection-2)

Level-2 Surface Reflectance



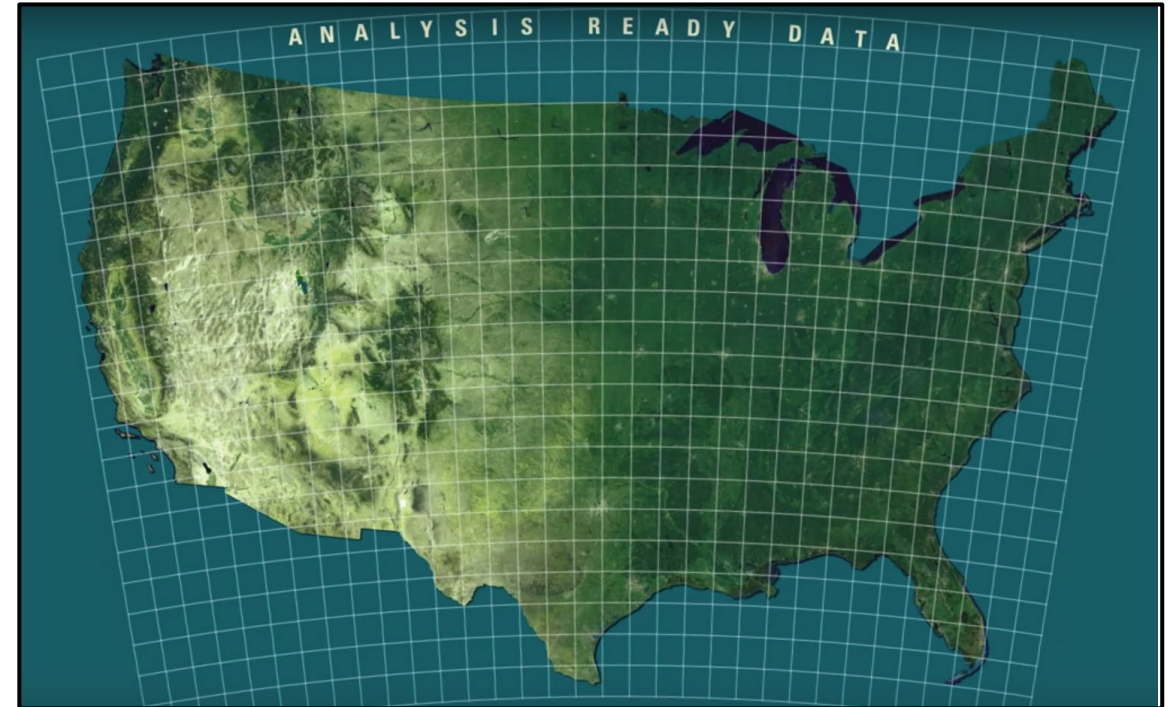
Level-2 Surface Temperature



Landsat Collection 2 U.S. Analysis Ready Data (ARD) Products (CONUS, Alaska, Hawaii)

- Level-1 Top-of-Atmosphere (TOA) reflectance for Landsat 4-9
- Level-1 TOA Brightness Temperature (BT) for Landsat 4-9
- Level-2 Surface Reflectance (SR) for Landsat 4-9
- Level-2 Surface Temperature (ST) for Landsat 4-9

Note: Product package includes product metadata, Level-1 per pixel quality QA, per-pixel solar and view angle image arrays, Level-2 SR per-pixel aerosol QA, and Level-2 ST per-pixel intermediate QA bands

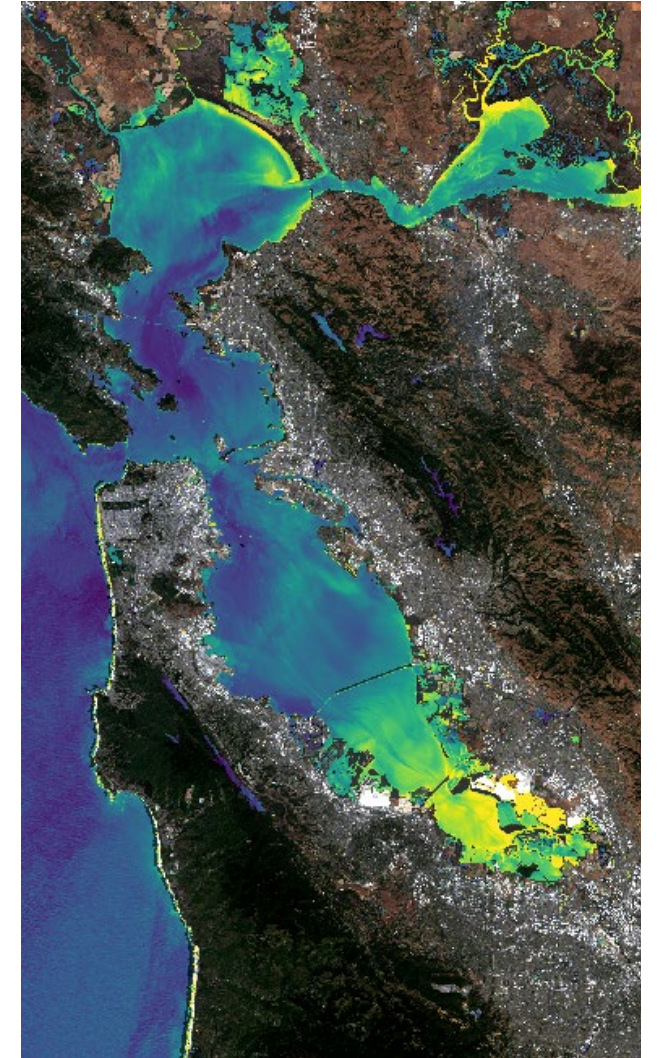
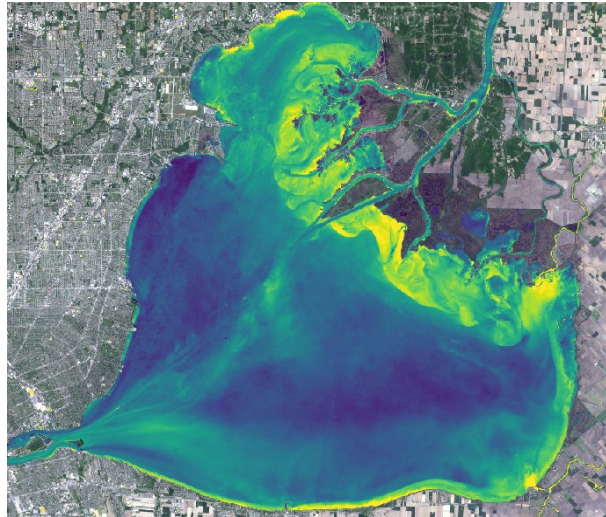
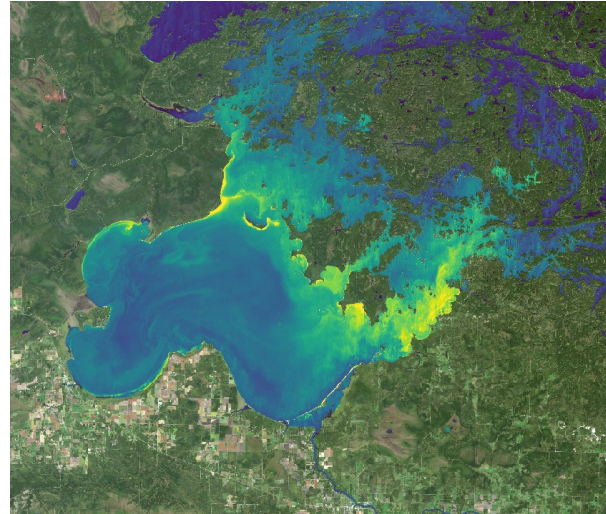


Example Landsat U.S. ARD product tiles over CONUS

More information: [Landsat Collection 2 U.S. Analysis Ready Data | U.S. Geological Survey \(usgs.gov\)](https://www.usgs.gov/landsat-collection-2-us-analysis-ready-data)

Provisional Landsat 8 / Landsat 9 Aquatic Reflectance Products

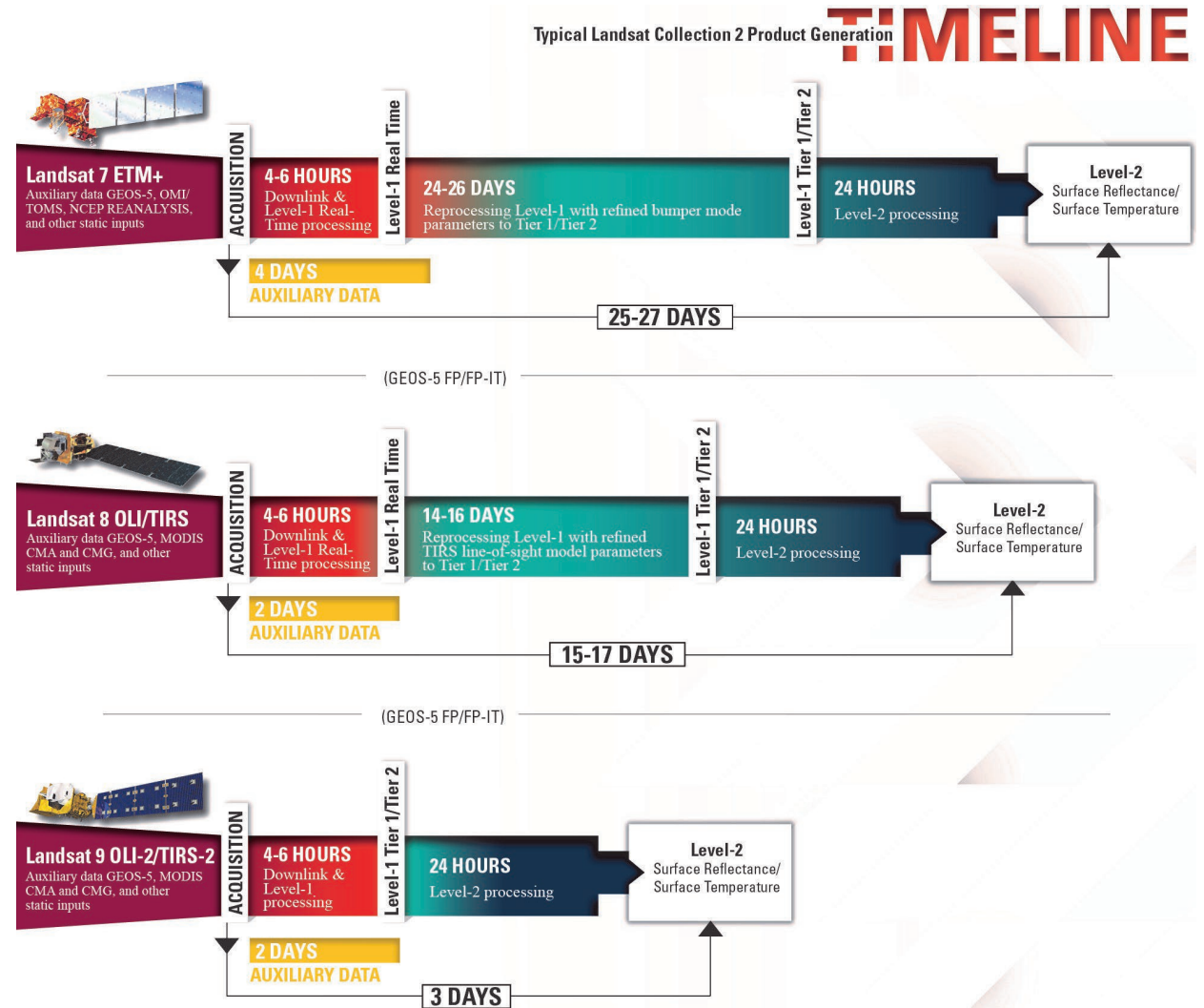
- USGS's goal is to produce high-quality, standard Landsat 8/9 Aquatic Reflectance products to support the aquatic community needs
- Landsat Collection 1 provisional Landsat 8 Aquatic Reflectance products have been available since early 2020
- Landsat Collection 2 provisional Landsat 8/9 Aquatic Reflectance products are coming this year
- Collection 2 improvements include QA processing adjustments, land-water masking, and the addition of Rayleigh-corrected reflectance
- More information and data access: [Landsat Provisional Aquatic Reflectance | U.S. Geological Survey \(usgs.gov\)](https://www.usgs.gov/land-resources/earth-observation-data/landsat-8/landsat-8-aquatic-reflectance)



Example Landsat 8 Aquatic Reflectance products; source: USGS

Landsat Collection 2 Data Processing and Latency

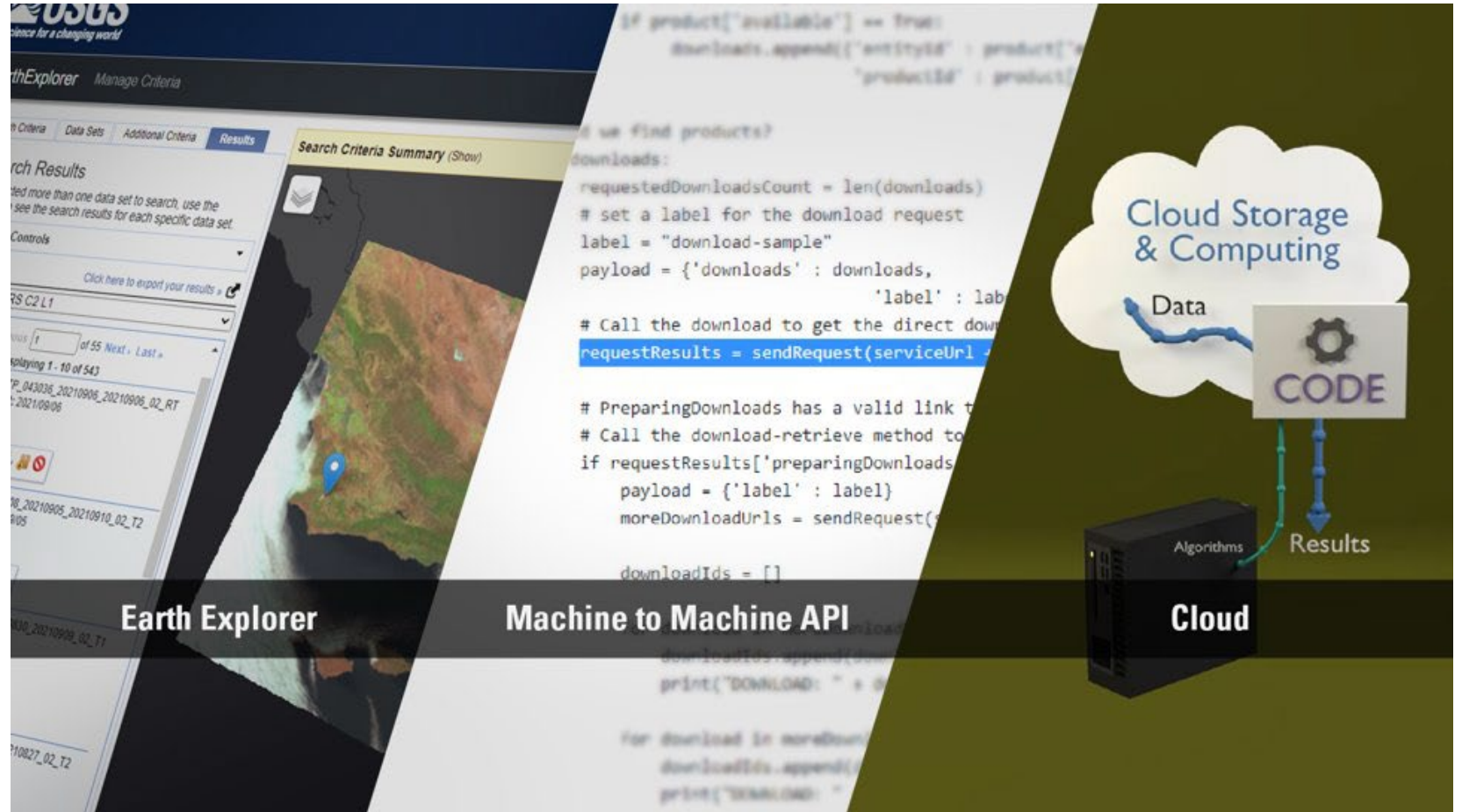
- Collection 2 image data is processed at EROS and then synced to the USGS Landsat cloud
- Data product latency varies with satellite
- On-orbit auxiliary and calibration dependencies drive product latency
- Ingest of atmospheric auxiliary data for Level-2 processing drive short-term latency
- Level-3 products are generated within 24 hours of Level-2 processing



Landsat Collection 2 Data Access

Data Access Pathways

- USGS Earth Explorer including the bulk download option
- EROS Machine-to-Machine Application Programming Interface (API) – automated scripting
- Direct commercial cloud access through the USGS US-West Amazon Web Services (AWS) S3 bucket



source: USGS

Thank you!

All Landsat questions can be directed to custserv@usgs.gov