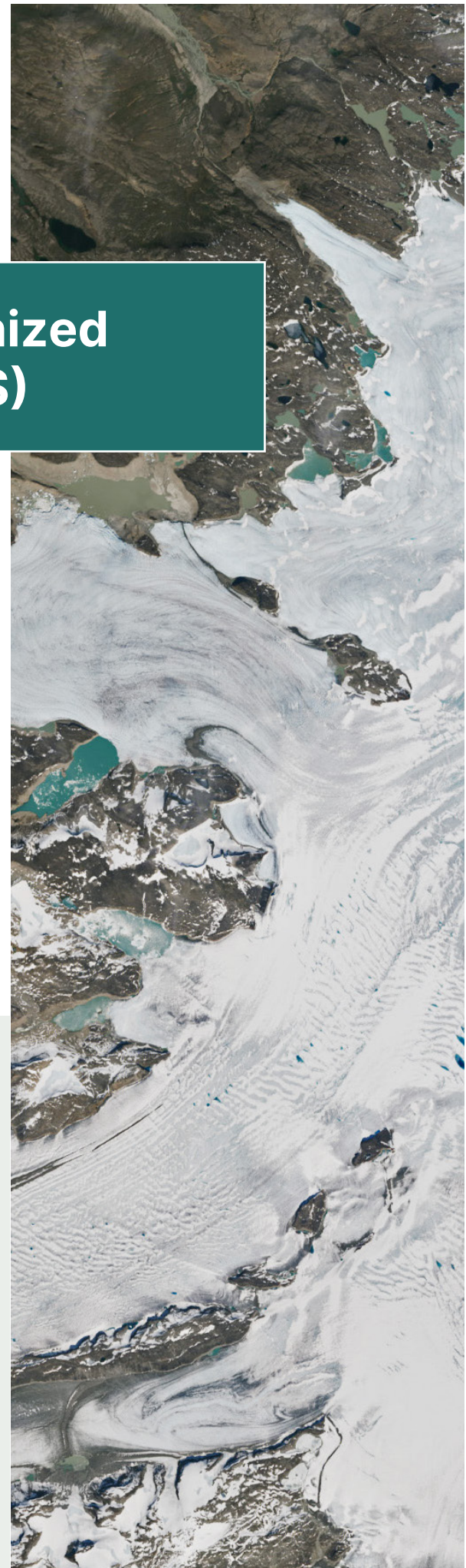


National Aeronautics and
Space Administration



Training Resources: Harmonized Landsat and Sentinel-2 (HLS)

Summary

Harmonized Landsat and Sentinel-2 (HLS) is a Satellite Needs Working Group (SNWG) solution that generates two surface reflectance products by re-projecting top-of-atmosphere reflectance from Landsat 8/9 and Sentinel-2A/B/C onto a common grid.

A number of training resources relevant to this solution are aggregated into five categories (specified below). For more information about this solution, visit the [HLS Solutions webpage](#).

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Fundamentals of Remote Sensing

This category's resources provide an introduction to remote sensing techniques used to develop this solution.

<u>Fundamentals of Remote Sensing</u>	<p>Training on the fundamentals of remote sensing provided by NASA's Applied Remote Sensing Training (ARSET) program, which includes a section on obtaining and using Landsat data.</p>
<u>From Pixels to Products: An Overview of Satellite Remote Sensing</u>	<p>Presentation by Dr. Sundar Christopher at NASA's Office of Data Science and Informatics providing an overview of satellite remote sensing, including a section detailing Landsat 8.</p>
<u>Earth Observation Data Basics</u>	<p>Webpage providing an overview of remote sensing capabilities and components, including orbits, sensors, and spatial resolutions. It provides data users insight into how remotely sensed data is collected.</p>

Missions and Instruments

This category's resources describe the missions and instruments used to develop this solution.

<u>Landsat</u>	<p>Landsat homepage that describes the mission and links to various resources. Note that Landsat 8 and 9 missions are used in the development of HLS.</p>
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<u>Sentinel-2 Missions</u>	<p>Sentinel-2 applications homepage providing an overview of the Sentinel-2 mission that is used in the development of HLS, with links to global case studies.</p>
<u>Landsat with Sentinel: Global Coverage</u>	<p>Webpage describing the benefits of a combined Landsat Sentinel product with helpful visualizations showing how the use of two different satellite missions results in a reduction of the time it takes to obtain global observations.</p>
<u>HLS Overview</u>	<p>HLS project page providing an overview of HLS that links to additional resources including data access, information about HLS vegetation indices and low-latency products, and the HLS Earthdata Forum where users can ask questions and view feedback.</p>
<u>Harmonized Landsat and Sentinel-2</u>	<p>HLS homepage with information on HLS algorithms, product descriptions, data access, and documentation.</p>

Data Products and Descriptions

This category's resources describe the solution's resulting data products and provide other descriptive materials.

<u>HLS: SNWG Solution Fact Sheet</u>	<p>SNWG solution fact sheet for the HLS product that includes an overview of the solution, its scientific and societal benefit, and data specifications such as temporal coverage and spatial resolution.</p>
<u>HLSL30 v002</u>	<p>Dataset landing page for the HLS Operational Land Imager Surface Reflectance and Top of Atmosphere (TOA) Brightness Daily Global 30m (HLSL30) product.</p>

<u>HLSS30 v002</u>	Dataset landing page for the HLS Sentinel-2 Multi-spectral Instrument Surface Reflectance Daily Global 30m (HLSS30) product.
<u>HLS User Guide</u>	User guide for HLS, with information on products and product formats, algorithms, and spatial coverage.
<u>HLS Algorithm Theoretical Basis Document</u>	Document describing the algorithm used to develop the Harmonized Landsat/Sentinel-2 Reflectance dataset.
<u>The Harmonized Landsat and Sentinel-2 version 2.0 surface reflectance dataset</u>	Scientific paper detailing characteristics of the HLS version 2.0 surface reflectance dataset, including information on spatial and temporal coverage, and atmospheric correction and cloud masking.

Data Access and Code Examples

This category's resources provide links to access the solution's data as well as open source code for using the data.

<u>Earthdata HLS Data Access</u>	Access HLS data products (HLSL30, HLSS30) through Earthdata Search. Note that HLS-VI products may also appear in the search results.
<u>Data Prep Scripts</u>	Webpage with links to Python and R scripts available for downloading HLS data and performing basic data processing functions.

<u>HLS Data Resources</u>	<p>GitHub repository providing Jupyter Notebooks, guides, and tutorials to help users access and work with HLS data.</p>
<u>SpatioTemporal Asset Catalog (STAC) Application Programming Interface (API)</u>	<p>GitHub repository and readme for the STAC API which can be used to query and subset HLS products.</p>
<u>Getting Started with Cloud-Native HLS Data in Python</u>	<p>Python tutorial for working with HLS data products that shows how to use the CMR-STAC API to investigate the HLS collection, how to search for and load data into a Jupyter Notebook, and how to utilize and export that data.</p>

Use Case and Application Examples

This category's resources provide examples of the solution in-use as well as other potential scientific applications of the data.

<u>Normalized Difference Vegetation Index (NDVI) Visualizations using HLS Data</u>	<p>Time series visualizations of HLS NDVI for different regions across the country. In each visualization, healthy vegetation is represented by the color green, and red is indicative of bare soil.</p>
<u>Common Landsat Band Red Green Blue (RGB) Composites</u>	<p>Diagram showing commonly used Landsat band RGB composites for true-color and false-color imagery which enhance the visibility of different surface characteristics and features. These techniques can also be applied to the HLS dataset.</p>

<p><u>Advancing Science Capabilities with Data Harmonization - NASA's HLS Products</u></p>	<p>Webinar providing an introduction to HLS data including how to find, access, and visualize the data. The webinar includes specific use case examples and a demonstration of HLS data being used in the Fire Information for Resource Management System (FIRMS) tool for fire and flood monitoring.</p>
<p><u>Spectral Indices for Land and Aquatic Applications</u></p>	<p>Tutorial provided by NASA ARSET for calculating spectral indices from the Landsat 9 Operational Land Imager (OLI)-2, Sentinel-2 Multi-spectral Instrument (MSI), and HLS data.</p>

Contact Information

Need additional help using this solution? Let us know what gaps or questions still exist, what tools interest you, and/or how you want to apply this solution. We are happy to connect you with more information and ongoing efforts to fill those gaps. Contact us at info@snwg-impact.net.