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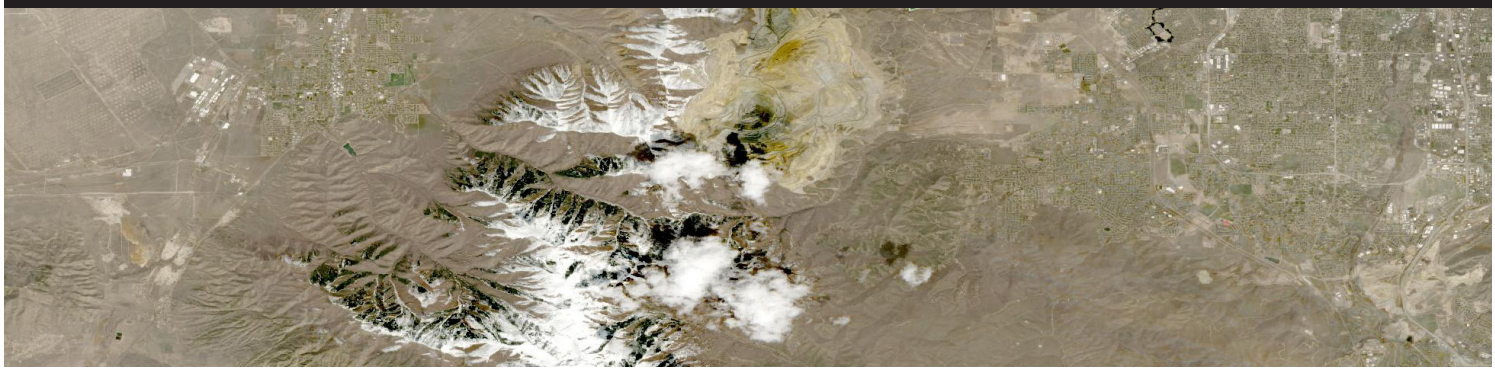

FEATURE ARTICLES

New, Gridded Level 3 Data Product Facilitates the Use of GEDI Mission Data

ORNL DAAC has released a new Level 3 data product from the Global Ecosystem Dynamics Investigation (GEDI) mission offering gridded estimates of canopy height and ground elevation.

From estimates of afforestation and deforestation to assessments of greenness and land cover type, the images we get from NASA's polar-orbiting and geostationary satellites can tell us a lot about what's happening on the Earth's terrestrial surfaces. Unfortunately, this two-dimensional imagery does not provide much information about the structure of the plants growing on those terrestrial surfaces. Until now, data offering that richer, three-dimensional assessment of the Earth's terrestrial biomes have been scattered and in short supply. Thanks to the Global Ecosystem Dynamics Investigation (GEDI) mission, which produces high resolution laser-ranging observations of the 3D structure of the Earth, this is beginning to change.

GEDI DATA PRODUCTS

	Data Level Product	Description	DAAC Location
Level 1: Waveforms/Geolocated Waveforms Raw GEDI waveforms collected by the GEDI system and waveforms geolocated by the GEDI science team. **Format: HDF5**	Level 1B	Geolocated waveforms	LP DAAC
Level 2: Footprint level canopy height and profile metrics The waveforms are processed to provide canopy height and profile metrics, which provide easy-to-use and interpret information about the vertical distribution of the canopy material. **Format: HDF5**	Level 2A	Ground elevation, canopy top height, and Relative Height (RH) metrics	LP DAAC
	Level 2B	Canopy Cover Fraction (CCF), CCF profile, Leaf Area Index (LAI), and LAI profile	LP DAAC
Level 3: Gridded canopy height metrics and variability Gridded by spatially interpolating Level 2 footprint estimates of canopy cover, canopy height, LAI, vertical foliage profile and their uncertainties. **Format: GeoTIFF**	Level 3	Gridded canopy cover, canopy height, LAI, and uncertainty	ORNL DAAC
Level 4: Footprint and Gridded Above Ground Carbon Estimates Level 4 data are model output. Footprint metrics derived from Level 2 data products are converted to footprint estimates of aboveground biomass density using calibration equations. These footprints are used to produce mean biomass and its uncertainty in cells of 1 km using statistical theory. **Format: GeoTIFF**	Level 4A	Footprint level aboveground biomass	ORNL DAAC
	Level 4B	Gridded aboveground biomass density [AGBD]	ORNL DAAC

Image by Felix Mittermeier from Pixabay

This table shows the available and planned GEDI data products, their NASA EOSDIS DAAC location, and format. Graphic based on a table created by the GEDI science team. Level 4 data are expected later in 2021.

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Unless otherwise noted, all articles written by Joseph M. Smith, NASA EOSDIS Science Writer

Launched on December 5, 2018 and installed on the International Space Station (ISS)'s Japanese Experiment Module (JEM)-Exposed Facility, GEDI is a full waveform lidar (i.e., laser version of radar) instrument offering the highest resolution and densest sampling of any lidar ever put in orbit. Led by scientists at the University of Maryland, the mission is supported by NASA's Goddard Space Flight Center, located in Greenbelt, Maryland. Its data are transferred to the GEDI Mission Operations Center and then processed through the Science Operations Center, both of which are located at Goddard, and then sent to two of NASA's Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs) where they are archived, managed, and distributed to a diverse worldwide user community.

The first, lower-level datasets released from the GEDI mission — Level 1 and Level 2 data — were made available in January 2020 through NASA's Land Processes DAAC (LP DAAC), a partnership between NASA and the US Geological Survey that manages, archives, and distributes EOSDIS land processes data, services, and tools for discovering and analyzing data. Now, the GEDI Level 3 data product — GEDI L3 Gridded Land Surface Metrics, Version 1 — is available from NASA's Oak Ridge National Laboratory DAAC (ORNL DAAC), a partnership between NASA and the U.S. Department of Energy that is responsible for EOSDIS data related to biogeochemical dynamics, ecological data, and environmental processes.

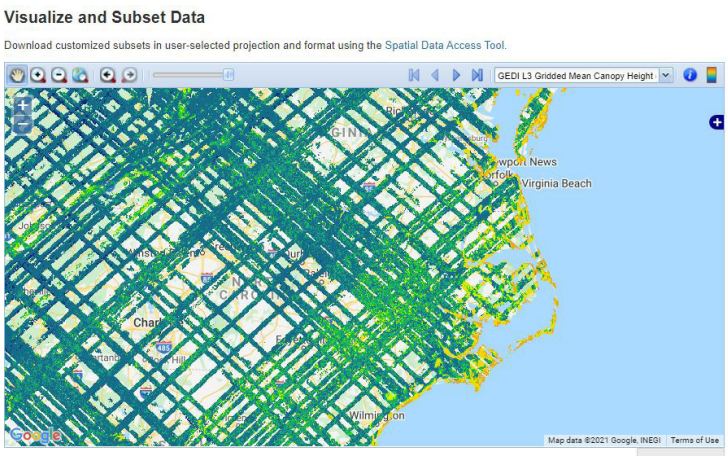
All EOSDIS data products are processed at levels ranging from 0 to 4. Level 0 products are raw data at full instrument resolution. Level 1 data are reconstructed, unprocessed instrument data at full resolution and time-referenced and annotated with ancillary information, such as georeferencing parameters. Level 2 data provide derived geophysical variables at the same resolution and location as Level 1 source data. Level 3 data contain variables mapped on uniform space-time grid scales, usually with some completeness and consistency, and Level 4 data are model outputs or results from analyses of lower-level data (e.g., variables derived from multiple measurements). All Earth Observing System (EOS) instruments must have Level 1 products. Most have products at Levels 2 and 3, and many have products at Level 4, including GEDI.

To obtain its measurements of the Earth's terrestrial ecosystems, GEDI relies on a lidar (short for "light detection and ranging") system that emits laser beam pulses and records the reflected energy from plant stems, branches, and leaves, as well as the terrain. This reflected energy, known as a waveform, is the sole observable from the GEDI mission and the source of all GEDI data products. The waveforms quantify the vertical distribution of vegetation and, when paired with data from its Global Positioning System (GPS) and Inertial Measurement Unit (IMU) receiver, are used to create very accurate, geolocated 3D measurements of the planet's terrestrial landscapes.

Left: This graphic shows the GEDI instrument's three lasers, which are split into eight tracks. Each laser fires 242 times per second and illuminates a 25-meter footprint on the surface within which four surface parameters — surface topography, canopy height metrics, canopy cover metrics, and vertical structure metrics—are calculated. Right: This graphic shows the eight tracks sampling the Earth's surface with between-track spacing of about 600 meters (1,969 feet) and a total width of 4.2 kilometers (about 2.6 miles) across all eight tracks. (Credit: NASA's Goddard Space Flight Center)

As shown in the graphic above, the GEDI instrument obtains 3D measurements of the Earth's surface using three lasers that produce 8 parallel tracks of observations. Each laser fires 242 times per second and illuminates a 25-meter footprint on the surface within which four surface parameters — surface topography, canopy height metrics, canopy cover metrics, and vertical structure metrics—are calculated. Each footprint is separated by 60 meters along the track, with between-track spacing of about 600 meters (1,969 feet) and a total width of 4.2 kilometers (about 2.6 miles) across all eight tracks.

GEDI measurements are made over the Earth's surface between 51.6° North and 51.6° South latitudes in a crisscross pattern, similar to that seen on a ball of yarn (see image of GEDI tracks along the East Coast at right). The GEDI instrument can also be rotated on the JEM by up to six degrees, allowing the lasers to be pointed up to 40 km on either side of the ISS ground track. This capability helps GEDI sample the Earth's land surface as completely as possible, filling in coverage gaps due to clouds.



This screen capture from the ORNL DAAC's Spatial Data Access Tool shows the crisscross pattern of GEDI's laser tracks on the Earth's terrestrial surface.

As GEDI moves over the Earth, it makes systematic and detailed 3D measurements of forest canopy height, forest structure, and surface elevation of the planet's most diverse terrestrial biomes — measurements that can be used to further the ecological research community's understanding of Earth's habitats. Version 1 of this Level 3 dataset provides measurements of global gridded mean canopy height and ground elevation and standard deviation of canopy height and ground elevation. In addition, one of its layers provides the count of good quality laser footprints within each 1 kilometer (km) by 1 km grid cell.

"This initial release of the Level 3 product aggregates data for a period of about one year from April 2019 to April 2020." said Dr. Rupesh Shrestha, a research staff member at ORNL DAAC. "The number of footprints included in each grid varies depending on available GEDI tracks in that particular grid. Higher counts occur where the ISS orbit tracks overlap, but there are also gaps in between these tracks. In future releases, these gaps will decrease as GEDI records more footprints, and we will have much better coverage of the Earth between the 51.6 North and South latitudes."

This Level 3 gridded data can be used in studies of carbon and water cycling processes, biodiversity, and habitats, and may be of immense value to climate modeling, forest management, snow and glacier monitoring, and generating digital elevation models. According to Shrestha, future versions of the GEDI Level 3 products will use footprints with improved geolocation accuracy and calibration as well as advanced gridding algorithms to produce the best estimate of the mean and its error for each grid cell.

Beyond managing, archiving and distributing a variety of regional and global biogeochemical and environmental satellite, in situ, model and land validation datasets, ORNL DAAC also provides a variety of data subsetting and visualization tools and services, such as the Spatial Data Access Tool (SDAT) Web-based tool that enables users to browse, visualize, and download geospatial data in various user-selected spatial/temporal extents, formats, and projections.

"Our role is to make the data accessible to researchers by providing a range of standards-based interoperable tools and services such as SDAT," said Shrestha. "SDAT provides Open Geospatial Consortium (OGC) services that will help users visualize and bring GEDI data into GIS applications for further analysis."

The GEDI Level 3 data is also available in ORNL DAAC's Fixed Sites Subset Tool and Global Subsets Tool for locations within the GEDI spatial coverage. The Fixed Sites Subset Tool provides pre-computed 8 km x 8 km subsets and time series visualizations for 29 different NASA earth data products at over 3100 different research sites around the world. The Global Subsets Tool allows users to select a location and get subsets and time series visualizations covering up to 200 km x 200 km for the selected NASA data products. The Global Subsets Tool also has Web Service interface that provides access to this capability from within scripts and other computer programs.

Level 4 GEDI data products, the highest-level data products from the GEDI mission, will offer model outputs, and be available later this calendar year. These products will provide footprint metrics derived from the Level 1 and 2 data products (i.e., ground and vegetation metrics to produce footprint estimates of aboveground biomass density).

"The Level 3 product is a gridded version of Level 2 footprints. The Level 4 products will be based on models that estimate biomass," Shrestha said. "Level 4A products will use the waveform height metrics from the Level 2 footprints and field-based information to estimate above ground biomass density for each footprint-print. Level 4B will provide gridded estimates of those above-ground biomass estimates. This is the first time this kind of information will be available at this level of detail for

tropical and temperate forests across the world."

Traditionally, studies of Earth's terrestrial ecosystems have relied on limited field studies and sampling from airborne lidar. Now, with its global gridded measurements of mean canopy height and ground elevation and standard deviation of canopy height and ground elevation, the Level 3 GEDI data available from the ORNL DAAC will fill significant data gaps about the planet's terrestrial biomes and inform ecological research for decades to come.

To learn more about the GEDI mission and GEDI data products, see the following online resources:

GEDI mission website

GEDI data can be searched for and discovered using the EOSDIS Earthdata Search application.

LP DAAC GEDI Landing Pages:

- Level 1B (doi.org/10.5067/GEDI/GEDI01_B.002)
- Level 2A (doi.org/10.5067/GEDI/GEDI02_A.002)
- Level 2B (doi.org/10.5067/GEDI/GEDI02_B.002)

ORNL DAAC GEDI Landing Page:

- Level 3 (doi.org/10.3334/ORNLDAAC/1865)
- Level 4 data (expected in calendar year 2021) ■

Published April 20, 2021

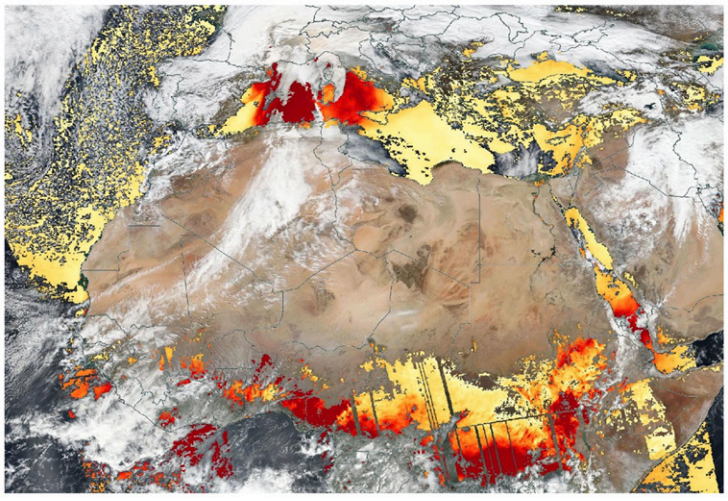
Near Real-Time VIIRS Dark Target Aerosol Product Now Available from NASA's LANCE

Based on the same MODIS algorithm, the new VIIRS Dark Target Aerosol product provides global satellite-derived measurements of Aerosol Optical Depth and aerosol properties over land and ocean.

What do fog, wildfire smoke, air pollution, and dust have in common? They're all examples of aerosols – solid particles or liquid droplets suspended in the atmosphere. Aerosols can originate from both natural (e.g., dust, volcanoes, and wildfires) and anthropogenic (e.g., automobile and power plant emissions) sources and, although they're small, often less than 1 micron (or one-millionth of a meter), they remain a significant source of uncertainty in climatology and public health.

To keep tabs on the amount and location of aerosols in the atmosphere, climatologists, meteorologists, and other scientists rely on measurements of Aerosol Optical Depth (AOD), which indicates the level at which aerosols absorb or scatter light traveling through the atmosphere. An AOD of less than 0.1 is referred to as "clean" and characteristic of a clear blue sky on bright and sunny day with maximum visibility. An AOD of 2.5 to 3.0, aerosol concentrations are so dense that sun is obscured.

Given that radiometers, such as the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Aqua and Terra satellites, and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the joint NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) and NOAA-20 satellites, can measure the light aerosols dispersed within a column of air, their data are a key source of information used in the data products that provide measurements of AOD.



This NASA Worldview image shows the new VIIRS Near real-time Dark Target Aerosol Optical Depth imagery layer. Note the high aerosol concentration over the Mediterranean, observed during a Saharan dust event on Feb. 6th, 2021.

Now, a new VIIRS Level-2 Dark Target Aerosol Optical Depth Near Real-Time (NRT) product (AERDT_L2_VIIRS_SNPP_NRT) has been made available from NASA's Land, Atmosphere Near real-time Capability for

EOS (LANCE). This product provides satellite-derived measurements of AOD and aerosol properties over land and ocean and is generally available within three hours of observation. It also includes measurements of AOD at other visible and near-IR wavelengths and derived parameters such as the Ångström exponent, which provides additional information related to the aerosol particle size over the ocean. With this parameter, the larger the exponent, the smaller the particle size. Therefore, values greater than 1 suggest optical dominance of coarse particles (e.g., dust), whereas values less than 1 suggest optical dominance of fine particles (e.g., smoke). The VIIRS Dark Target aerosol product is based on the same Dark Target algorithm developed for similar AOD products from MODIS and will ensure the long-term continuation of the climate data records.

The words "dark target" in the product's title refer to the Dark Target algorithm that helps satellite data analysts detect bright aerosols over dark surfaces. In fact, there are two Dark Target algorithms in use, one of which is used over land and the other over the ocean. This dual approach results from the inherent difficulty of separating atmospheric aerosol and surface signals. The surfaces of dark-colored landscapes vary, due to vegetation, soil type, and topography and this can make it challenging to distinguish aerosols from the land beneath them. Over the ocean, where the surface is less diverse, this separation is much easier, allowing analysts to derive more information about aerosol properties.

The VIIRS Level-2 Dark Target Aerosol Optical Depth Near Real-Time (NRT) product is distinct from the VIIRS Deep Blue aerosol product, which uses the Deep Blue (DB) algorithm over land and the Satellite Ocean Aerosol Retrieval (SOAR) algorithm over water to determine aerosol loading for daytime cloud-free snow-free scenes. In addition, the new NRT Dark Target VIIRS product also differs slightly from the standard Dark Target VIIRS product in that it uses different sources of supplemental weather data. The near real-time version of the product uses ancillary data from the 12-hour Global Forecast System numerical weather model for surface windspeed, which is used to estimate the reflectance over the ocean surface, and for ozone and water vapor, which is used to isolate the aerosol signal from that of gases in the atmosphere. In the standard product these weather parameters come from the Global Ocean Data Assimilation System reanalysis.

The new Dark Target Aerosol Optical Depth product was developed by the Dark Target team at NASA's Goddard Space Flight Center in association with NASA's VIIRS Atmosphere Science Investigator-led Processing System (Atmosphere SIPS), located at the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison. The VIIRS Atmosphere SIPS is responsible for processing, reprocessing, and general assessments of Suomi NPP VIIRS Atmosphere products.

LANCE is part of NASA's Earth Observing System Data and Information System (EOSDIS), and distributes NRT data products from almost a dozen satellite-borne instruments. EOSDIS provides end-to-end capabilities for managing NASA's Earth science data. These data represent some of the most complex and diverse Earth science data sets on the planet from satellites, aircraft, field measurements, and numerous other EOSDIS programs. The primary services provided by EOSDIS are data archive, management, and distribution; information management; product generation; and user support services. These services are managed by NASA's Earth Science Data and Information System (ESDIS) Project.

For More Information:

To download the VIIRS Level-2 Dark Target Aerosol Optical Depth Near Real-Time (NRT) data, or to discover and access other NASA NRT data, visit the EOSDIS LANCE website.

View the VIIRS Level-2 Dark Target Aerosol Optical Depth NRT product and the VIIRS Dark Target Aerosol Angstrom Exponent as layers in Worldview.

Learn more about VIIRS Deep Blue Aerosol and Dark Target Aerosol products at NASA's Level-1 and Atmosphere Archive and Distribution System Distributed Active Archive Center (LAADS DAAC).

Additional Reading:

Sawyer V, Levy RC, Mattoo S, Cureton G, Shi Y, Remer LA. Continuing the MODIS Dark Target Aerosol Time Series with VIIRS. *Remote Sensing*. 2020; 12(2):308. doi:10.3390/rs12020308 ■

Published February 18, 2021

EOSDIS Worldview Version 3.9.0 Makes Finding, Viewing, and Downloading NASA Earth Data Easier than Ever

New Location Search Feature and Better Integration with Earthdata Search Improve Worldview User Experience

NASA's Earth Observing System Data and Information System (EOSDIS) released a new version of Worldview, its imagery and data visualization application offering the interactive browsing of nearly 1,000 global, full-resolution satellite imagery and data layers. The new version — Version 3.9.0 — debuted on March 2 and it aims to enhance the user experience with new features designed to improve the application's search, data layer, and data download capabilities.

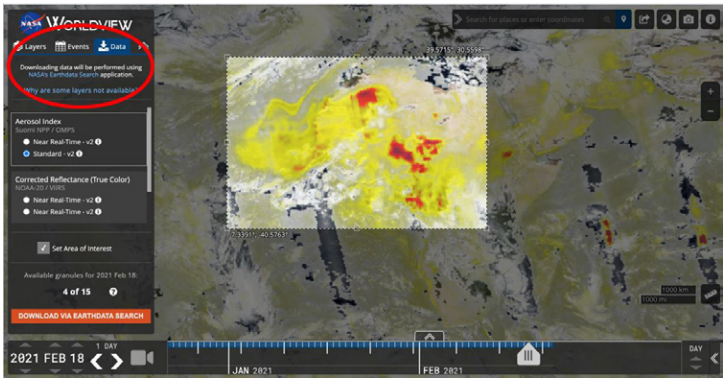
Among the most noteworthy is the new "Location Search" feature that lets users go directly to a specific location simply by entering a place name or geographical coordinates in the search bar at the top right of the application. Users can also add a marker on the Worldview map by clicking the "Add Marker" button to the right of the search bar. When a marker is placed on the map, Worldview will provide the name and coordinates of that location.

Worldview's new "Location Search" feature allows users to go directly to a specific location simply by entering a place name or geographical coordinates in the search bar at the top right of the application.

"These new features work like Google maps, where users can enter the name of a location in the search bar and then zoom to the area," said Minnie Wong, an Earth Science Data and Information System (ESDIS) Systems Engineer at NASA's Goddard Space Flight Center. "We didn't have this feature in earlier versions. This will work well with the new Harmonized Landsat Sentinel-2 (HLS), 30-meter resolution layers."

HLS imagery is available through the EOSDIS Global Imagery Browse Services (GIBS) for interactive exploration in Worldview. The application's new HLS data layers provide atmospherically corrected surface reflectance products with high spatial resolution, which allows users to get a closer look at the surface of the earth and the natural and anthropological forces that shape it. HLS data is available for download through Earthdata Search and NASA's Land Processes Distributed Active Archive Center (LP DAAC). There is also a Worldview HLS Tour Story that provides an introduction to the HLS project and its imagery and highlights specific examples for working with the imagery in Worldview.

Another significant addition to Worldview 3.9.0 is its seamless connection with data to Earthdata Search, NASA's web-based application for discovering and downloading Earth science data from EOSDIS.



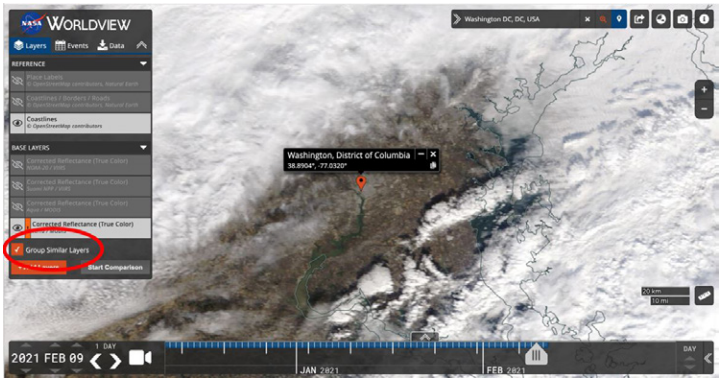
When users want to download data, Worldview will bring them into Earthdata Search which will provide a list of all the available granules. The new version also offers a "Set Area of Interest" feature (shown here) that allows users to select a specific geographic area to see how many granules are available in that region and appropriately narrow the results in Earthdata Search.

"In the past, when users wanted to download the data products associated with the layer they were viewing on the map, they sometimes came up empty-handed, as only about one-third of the Worldview's layers had data download products associated with them," said Wong. "The new version of Worldview is much more comprehensive in terms of the products users can download."

For example, if users are viewing the Aerosol Optical Depth layer and want to download the data, they would click on the "Data Download" button in the Layer List. Then Worldview will inform them that the download is

taking place in Earthdata Search and provide them with information on what dataset they have downloaded, what imagery layer it relates to, and the selected date of the data. Then, users will be brought into Earthdata Search and shown a list of all the available granules. In addition, there is a "Set Area of Interest" feature that allows users to select a specific geographic area, see how many granules are available for it, and then download those specific granules.

Other features of Worldview 3.9.0 include a new "Group Similar Layers" option, which is on by default in the Layer List. In the past, if users had several related layers (from measurements such as Aerosol Optical Depth, Carbon Monoxide, and Population Density) open, they would have to manipulate (i.e., turn on/off, move, collapse, and so on) each one separately. Now, by checking this box, related data layers are grouped together making it easier to view related layers in the Layer List.



By clicking Worldview's "Group Similar Layers" feature, users can manipulate related data layers as a group.

In addition, Worldview 3.9.0 also includes a new "Filter Events by Type" feature that allows users to sort a catalog of recent meteorological and terrestrial events by event type (e.g., severe storms, sea and lake ice, volcanic eruptions, and wildfires) pulled from NASA's Earth Observatory Natural Event Tracker application. Once sorted, users can then click on a specific event to see where it took place and access links to supplemental information.

Taken together, these new features make Worldview an even more robust tool for users to view the Earth as it looks "right now." Most of Worldview's imagery layers are updated daily, with new imagery typically available within three hours of satellite observation. Best of all, it'll keep getting better. Even though this new version was just released, engineers and developers are already planning more updates and new features. Among them are overhauled OpenStreetMap-based layers (e.g., labels and borders) with enhanced zoom levels to match the detail of the recently added HLS products, additional improvements to the Layer Selector, and a new capability to visualize individual granules for certain layers, which will be particularly useful at higher latitudes where satellite passes overlap. Stay tuned!

For more information:

Explore global near real-time data imagery using NASA's Worldview.

To learn more about the significance of the new Harmonized Landsat Sentinel-2 (HLS) data and the HLS layers available in Worldview, see "A Harmonious New Data Set" on the Earthdata website. ■

Published March 2, 2021

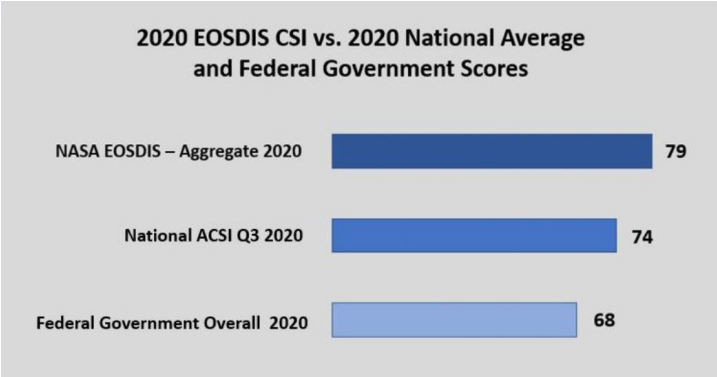
EOSDIS Products and Services Receive High Marks in 2020 ACSI Survey

Once again, EOSDIS products and services and EOSDIS DAACs earn high rates of customer satisfaction in annual survey

NASA's Earth Observing System Data and Information System (EOSDIS) has been a central component of the NASA Earth observation program since the 1990s, providing end-to-end capabilities for managing NASA Earth science data from various sources—satellites, aircraft, field measurements, and various other programs. And although the system has changed substantially over the past 27 years, the global user community's satisfaction with EOSDIS products and services has remained consistent.

According to the 2020 American Customer Satisfaction Index (ACSI) survey of EOSDIS data, products, and services, EOSDIS received a Customer Satisfaction Index

(CSI) score of 79 out of 100, tying the record-high score received on the 2018 survey. This indicates a high level of satisfaction with EOSDIS products and services and, given that the CSI score is an aggregate of several scores (calculated using the proprietary ACSI methodology), scores in the upper-70s represent a "strong" performance, especially when maintained over several years.



In fact, NASA's EOSDIS has never received a CSI score lower than 74 since the first EOSDIS ACSI survey was conducted in 2004. As with all previous surveys spanning more than 15 years, NASA's EOSDIS outscored the federal government, which received an aggregate 2020 CSI score of 68. In addition, CSI scores for EOSDIS Distributed Active Archive Centers (DAACs) ranged from 71 to 83, with an average aggregate CSI of 78.

The results from the annual ACSI survey provide something of a blueprint that the DAACs and NASA's Earth Science Data and Information System (ESDIS) Project (which manages EOSDIS science operations, including data archival and distribution) can use to tailor their products and services so they better align with and serve user needs.

The ACSI survey is administered by the CFI Group, an independent organization contracted by the federal government to assess user satisfaction with products and services at numerous federal entities. Along with conducting the annual NASA EOSDIS survey, the CFI Group also conducts surveys for the National Weather Service, the General Services Administration, and the U.S. Department of Education, among others.

The ACSI model used by the CFI Group to conduct the annual survey is a set of causal equations linking customer expectations, perceived quality, and perceived value to customer satisfaction, which is reflected numerically in the CSI score. Satisfaction, in turn, is further linked to a customer's likelihood to recommend products and services and their willingness to use products and services in the future.

One expected result of high customer satisfaction with services is user trust and loyalty. This is accounted for in the ACSI algorithm and reflected by a number indicating the likelihood of a respondent to recommend the evaluated products and services to others coupled with the likelihood of a respondent to use the services in the future.

Scores pertaining to respondents' "likelihood to recommend EOSDIS products and services" (87 out of 100) and "likelihood to use EOSDIS services in the future" (88 out of 100) were one point higher than in the 2019 survey (although one point lower than in the 2018 survey). These consistent rankings suggest that, over the years, EOSDIS has consistently provided products and services its users value.

ESDIS, which coordinates and facilitates the annual ACSI survey, opted to use a "long-form" version of survey questionnaire in 2020. One benefit of this longer survey are the more detailed and in-depth questions allowing for a more complete survey of EOSDIS products and services. In all, 9,178 completed surveys were returned in the 2020 vs. 6,337 completed surveys in 2019. This higher response rates lends further credence that the 2020 survey more accurately reflects user satisfaction. Starting with its 2019 survey, the ESDIS Project began alternating short-form surveys with more detailed longer surveys as a way to maintain continuity with questions from longer surveys (e.g., the 2020 survey was a long-form survey; the 2021 survey will use the short-form, and so on.).

The 2020 survey was conducted online between September 21 and October 23. The CFI Group sent email invitations to individuals who used EOSDIS data and/or products. They received 9,178 completed surveys, a significant increase from last year's 6,337, representing a 1.2% response rate and, according to the CFI Group, a large enough sample size for calculating a statistically valid CSI score.

Outside of three survey questions required by the CFI Group asking respondents to rate their overall expectations, perceived quality, and perceived value of EOSDIS services and products on a 1 to 10 scale (which are used to calculate the CSI score), the remaining questions on the EOSDIS survey asked respondents to evaluate their

experience with the specific DAAC or DAACs from which they receive data and products (respondents were allowed to skip questions pertaining to DAACs they did not consult with or contact). The survey also allowed respondents to provide open-ended comments, providing EOSDIS with direct and valuable insights regarding respondents' likes, dislikes, and thoughts on suggested improvements.

In the following summary tables, total percentages may not equal 100% due to survey questions allowing for multiple responses; all non-percentage values are out of 100.

CSI and Frequency by Type of User

Type of User	2019 %	2019 CSI	2020 %	2020 CSI
General Public	18%	78	19%	78
Elementary Teacher (Middle, High school)	2%	77	2%	77
University Professor	15%	82	18%	82
University Undergraduate Student	11%	75	11%	77
University Graduate Student	29%	77	25%	77
Other Education and Outreach	8%	78	8%	78
Earth Science Researcher	34%	80	33%	80
Earth Science Modeler	11%	78	10%	78
NASA-affiliated Scientist	2%	80	1%	76
Non-NASA-affiliated Scientist	5%	78	5%	79
NASA Science Team Member	1%	77	1%	78
Data/Tool Provider or Developer/ Decision Support Systems Analyst	10%	78	9%	77
Other User Type	9%	78	9%	77

As in past surveys, respondents self-identifying as Earth Science Researchers make up the majority of EOSDIS data users (34%), followed by University Graduate Students (25%) and members of the public (19%). These percentages are similar to those of the 2019 survey, except for in the case of University Graduate Students who comprised 29% of users in 2019, a 4% decrease as compared to 2020. On the contrary, in 2019, University Professors made up 15% of users. In 2020, that number rose to 18%.

Areas/Disciplines Need/Use Earth Data Science

General areas need or use Earth science data and services	2019%	2019 CSI	2020%	2020 CSI
Atmosphere	34%	79	37%	78
Biosphere	19%	79	19%	79
Calibrated radiance	8%	80	8%	78
Cryosphere	7%	79	7%	79
Human dimensions	15%	78	16%	78
Land	71%	78	66%	79
Near-Real-Time applications	16%	77	18%	78
Ocean	16%	79	20%	79
Space geodesy	12%	78	13%	79
Other general area	10%	77	9%	78
Not applicable	1%	72	1%	74

In regard to user satisfaction, University Professors report the highest satisfaction with EOSDIS products and services, with a 2020 CSI of 82, the highest of any user type. Earth Science Researchers reported the second-highest level of user satisfaction, with a CSI of 80. NASA-affiliated Scientists reported the lowest satisfaction with EOSDIS products and services, with a CSI score of 76 (which is still considered a "strong" score, based on the survey methodology).

Two thirds of Survey respondents indicated that they used EOSDIS data and services for Land Processes (66%), Atmosphere (37%), Ocean (20%), Biosphere (19%), and Near-Real-Time applications (18%) comprised other popular uses of EOSDIS data and services.

CSI and Frequency by DAAC

DATA CENTER EVALUATED	2019 %	2019 CSI	2020 %	2020 CSI
ASDC DAAC	11%	76	13%	77
ASF DAAC	12%	82	13%	83
CDDIS	3%	79	3%	77
GESDISC	13%	78	12%	79
GHRC	7%	74	7%	71
LP DAAC	29%	79	23%	80
LAADS DAAC	12%	78	14%	78
NSIDC DAAC	3%	78	3%	79
OB.DAAC	1%	77	2%	81
ORNL DAAC	2%	83	1%	82
PO DAAC-JPL	3%	78	4%	76
SEDAC	5%	76	4%	75

Each year, ACSI survey respondents are asked to evaluate their experience and satisfaction with the specific DAAC or DAACs from which they receive data, products, and services, and CSI scores were computed for each DAAC based on individual DAAC survey responses. All DAACs achieved CSIs between 71 and 83, with a strong average aggregate DAAC CSI of 78. NASA's Alaska Satellite Facility DAAC (ASF DAAC) received the highest CSI score of the 2020 survey (83, based on evaluations from 1,239 respondents), with NASA's Oak Ridge National Laboratory DAAC (ORNL DAAC) and Ocean Biology DAAC (OB.DAAC) receiving the second- and third-highest scores, 82 (based on 125 responses) and 81 (based on 222 responses), respectively. OB.DAAC saw the largest positive change (+5 points) in CSI score between 2019 and 2020.

Would you like to participate in a future ACSI surveys? Anyone who downloads data from an EOSDIS DAAC during the year will automatically be added to the survey list. Users can also visit the DAAC or DAACs from which

they acquire data and request that their email address to be added to the list of survey recipients.

Thanks to user participation, the evaluations and comments from the 2020 EOSDIS ACSI survey will enhance existing products and services and spur the development of new ones. And based on the previous 15 years of survey results, users can be assured that the ESDIS Project and the DAACs will continue delivering products and services of the highest quality.

Read more

A summary of the 2020 EOSDIS ACSI report, along with summaries of all EOSDIS ACSI surveys dating back to the first survey in 2004, are available on the ACSI Reports page in the System Performance and Metrics section of the Earthdata website. Full reports are available upon request. ■

Published April 8, 2021

Data User Profiles

NASA Earth Science Data User Profiles highlight our diverse end-user community and show how NASA Earth data are used – from the plains of West Texas to the Sea of Oman and everywhere in-between – in cutting-edge applications and the latest, ground-breaking research.

https://earthdata.nasa.gov/profiles

Dr. Qing Liang

Research Physical Scientist, Atmospheric Chemistry and Dynamics Laboratory, NASA's Goddard Space Flight Center, Greenbelt, Maryland

NASA's atmospheric datasets help scientists like Dr. Qing Liang monitor and simulate concentrations of trace gasses that impact ozone in the atmosphere.

https://go.nasa.gov/3gkHQ9x

Dr. Melinda Webster

Research Assistant Professor, Geophysical Institute, University of Alaska Fairbanks

Data from NASA's NSIDC DAAC helps scientists like Dr. Melinda Webster study sea ice and overcome the challenges of working in the Arctic's inhospitable environments.

https://go.nasa.gov/3xyk55A

Dr. Anthony Walker

Senior Scientist and Leader of the Ecosystem Processes Group; Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

NASA's ecological and atmospheric datasets help scientists like Dr. Walker gain insight into how Earth's terrestrial ecosystems respond to global change

https://go.nasa.gov/3xbjOFn

Dr. Steve D. Bowman

Geologic Hazards Program Manager, Utah Geological Survey.

NASA's Synthetic Aperture Radar (SAR) data from NASA's ASF DAAC helps scientists like Dr. Steve Bowman provide Utah's citizens with timely scientific information about the state's geologic hazards.

https://go.nasa.gov/2RcEWuV

DATA CHATS

Dr. Jeffrey Masek

The Harmonized Landsat Sentinel-2 (HLS) project offers daily, 30-meter global land surface data products to facilitate a wide range of terrestrial Earth science research. Principal Investigator Dr. Jeff Masek discusses the origins of the HLS project, the significance of the recent release of provisional HLS data, and what the project has in store for the future.

https://go.nasa.gov/3pDq0CJ

Dr. Chelle Gentemann

Open science, open-source software, and cloud-based Big Data collections are changing how science is conducted and expanding the possibilities for what scientists can do with NASA data. Physical oceanographer and NASA Earth Science Data Systems (ESDS) Program open science lead Dr. Chelle Gentemann describes how open source science has been transformational in her work and research.

https://go.nasa.gov/35423uT

Kaylin Bugbee

NASA Earth Science Data Systems (ESDS) Program data manager Kaylin Bugbee observes that the combination of massive volumes of data and the technology to work with these data collaboratively is leading to new ways of pursuing scientific investigations.

https://go.nasa.gov/3xf6v6d

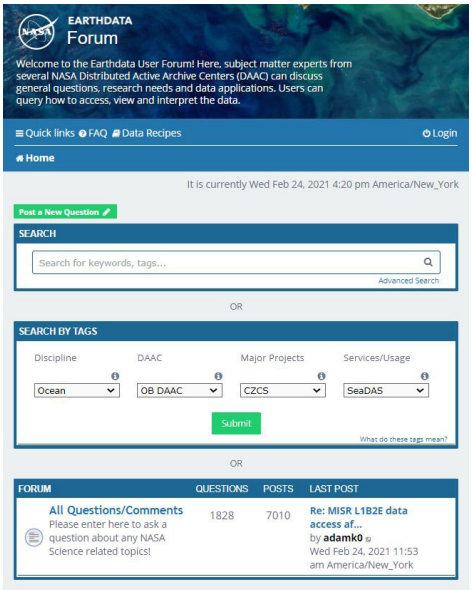
ANNOUNCEMENTS

OB.DAAC Joins NASA's EOSDIS Earthdata Forum

NASA's Ocean Biology Distributed Active Archive Center has joined the Earthdata Forum, NASA's interactive platform that gives data users the chance to communicate with and learn from experts.

NASA's Ocean Biology Distributed Active Archive Center (OB.DAAC) is pleased to announce its participation in NASA's Earthdata Forum.

Earthdata Forum provides a central, online location where data users can interact with subject matter experts from NASA's Distributed Active Archive Centers (DAACs) to discuss data applications and research needs, and get answers to specific questions about accessing, viewing, and manipulating NASA Earth observation data. Current Forum participants include NASA's Atmospheric Science Data Center (ASDC), Crustal Dynamics Data Information System (CDDIS), Global Hydrology Resource Center DAAC (GHRC DAAC), Goddard Earth Sciences Data and Information Services Center (GES DISC), Land Processes DAAC (LP DAAC), Level-1 and Atmosphere Archive and Distribution System DAAC (LAADS DAAC), and now OB.DAAC.



OB.DAAC data holdings include a mixture of historical and current ocean color missions, including the joint

NASA/NOAA missions: the Joint Polar Satellite System (JPSS-1 a.k.a. NOAA-20, 2017-present) and Suomi-National Polar orbiting Partnership (Suomi NPP, 2011–present); the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Terra (1999–present) and Aqua (2002–present) satellites; the SeaWiFS instrument aboard the SeaStar satellite (1997–2010), the Coastal Zone Color Scanner (CZCS) instrument aboard the Nimbus-7 satellite (1978–1987); the MEdium Resolution Imaging Spectrometer (MERIS) aboard the European Space Agency's Envisat satellite (2002–2012); and the Ocean Colour Monitor-2 (OCM) aboard the Indian Space Research Organisation's Oceansat-2 satellite (2009–present).

Data from these missions are available through OB.DAAC's Ocean Color website, which allows users to search the DAAC's ocean color data archive, filter by spatial and temporal parameters and time periods, and order data from single files to the entire mission. OB.DAAC also offers a full suite of services and tools, including sensor calibration and characterization and algorithm development; the SeaWiFS Data Analysis System (SeaDAS), a comprehensive software package for the processing, display, analysis, and quality control of remote-sensing Earth data; and the SeaWiFS Bio-optical Archive and Storage System (SeaBASS), a public repository of in situ oceanographic and atmospheric data, to support their routine algorithm development and satellite data product validation activities.

Established at NASA's Goddard Space Flight Center in Greenbelt, Maryland, in 2004, OB.DAAC is managed by NASA's Ocean Biology Processing Group (OBPG). OB.DAAC is responsible for archiving satellite ocean biology data produced or collected under NASA's Earth Observing System Data and Information System (EOSDIS). OB.DAAC's holdings include a mixture of historical- and current-mission data, as well as data from both NASA and partner space organizations.

To learn more about OB.DAAC and to explore its data, services, and tools, go to the OB.DAAC website. To interact with subject matter experts from participating DAACs and get answers to your data questions, visit the Earthdata Forum.

For an introduction to the Earthdata Forum and tips on how to use it, watch the Earthdata Forum webinar.

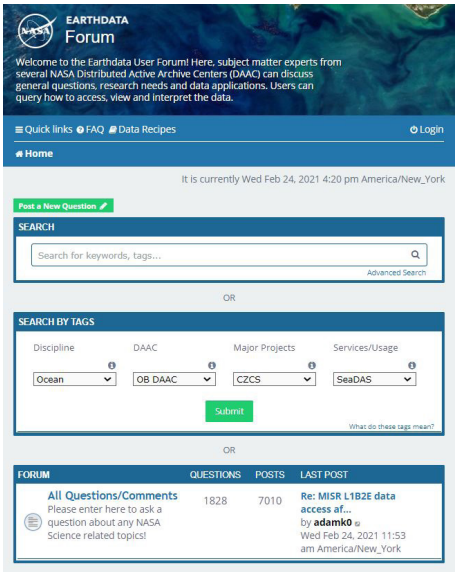
Published March 4, 2021

LAADS DAAC Joins NASA's EOSDIS Earthdata Forum

NASA's Level-1 and Atmosphere Archive and Distribution System Distributed Active Archive Center has joined the Earthdata Forum, NASA's interactive platform that gives data users the chance to communicate with and learn from experts.

NASA's Level-1 and Atmosphere Archive and Distribution System Distributed Active Archive Center (LAADS DAAC) is pleased to announce its participation in NASA's Earthdata Forum.

Earthdata Forum provides a central, online location where data users can interact with subject matter experts from DAACs to discuss data applications and research needs, and get answers to specific questions about accessing, viewing, and manipulating NASA Earth observation data. Current Forum participants include NASA's Atmospheric Science Data Center (ASDC), Crustal Dynamics Data Information System (CDDIS), Global Hydrology Resource Center DAAC (GHRC DAAC), Goddard Earth Sciences Data and Information Services Center (GES DISC), Land Processes DAAC (LP DAAC), and now LAADS DAAC.



Earthdata Forum users can search the Forum using keywords (top blue box), Tags (middle box, with dropdowns for Discipline, DAAC, Major Projects, or Services/Usage), or look at all Forum Questions/Comments (bottom blue box). Users can also post a question via the green button above the Search box. NASA EOSDIS image.

LAADS DAAC's expertise is in

atmospheric science and Moderate Resolution Imaging Spectroradiometer (MODIS)- and Visible Infrared Imaging Radiometer Suite (VIIRS)-derived Level 1 (L1) calibrated radiances and geolocation products. Its atmosphere products portfolio includes Aerosol, Atmospheric Profiles, Cloud Mask, Cloud Properties, and Water Vapor. LAADS DAAC serves a globally diverse MODIS and VIIRS science and applications user community through access to its full catalog of data products, related services, tools, and resources.

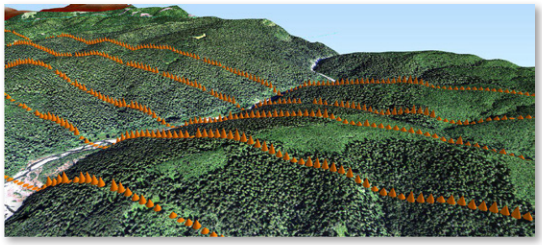
Established in 2007 at NASA's Goddard Space Flight Center in Greenbelt, Maryland, LAADS DAAC is collocated with two Science Investigator-led Processing Systems (SIPS) that each produce MODIS L1, atmosphere, and land products, and VIIRS L1, and land products. They help produce both NASA standard as well as near-real-time products. LAADS DAAC plays a central role in providing NASA standard L1 MODIS and VIIRS data inputs to generate higher-level products in all three discipline domains that include atmosphere, land, and ocean.To learn more about LAADS DAAC and to explore its data, services and tools, visit the LAADS DAAC website.

To interact with subject matter experts from participating DAACs and get answers to data application and research questions, visit the Earthdata Forum.

For an introduction to the Earthdata Forum and tips on how to use it, watch the Earthdata Forum webinar.

Published February 4, 2021

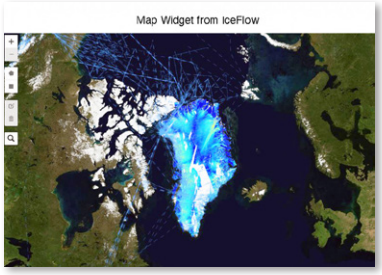
DAACs Participate in "Use of Solar Induced Fluorescence and LIDAR to Assess Vegetation Change and Vulnerability" Webinar



The NASA Land Processes Distributed Active Archive Center (LP DAAC) and the National Snow and Ice Data Center DAAC (NSIDC DAAC) presented during the NASA Applied Remote Sensing Training (ARSET) Program introductory webinar series. The presentation covered the fundamentals of Solar Induced Fluorescence (SIF) and LIDAR, their applications, and an overview of different satellite data sources that are openly available.

Learn more: https://go.nasa.gov/2SvPJAU

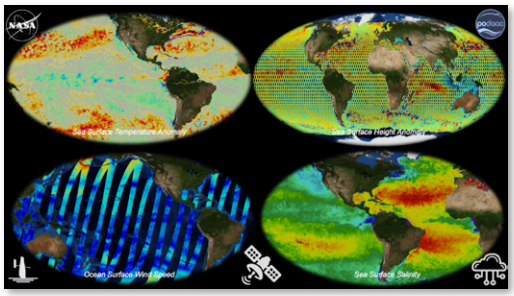
There and Back Again: The IceFlow Data Tool



IceFlow, a new data tool developed at NASA's NSIDC DAAC, harmonizes land and sea ice laser altimetry data products into similar formats and applies the necessary geophysical corrections for users to immediately access, compare, and visualize data using Python and Jupyter Notebook-based tools.

Learn more: https://bit.ly/2RbstqL

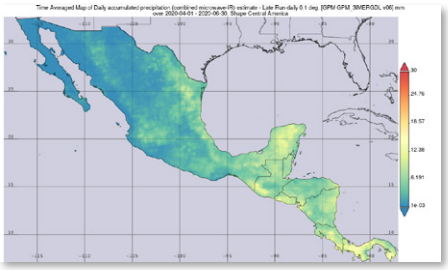
New Cloud Computing Resource for Physical Oceanography Data



The NASA Physical Oceanography DAAC (PO.DAAC) Portal features a new cloud data resources page that serves as a centralized location for information to guide data users in discovering, accessing, and using cloud data.

Explore cloud data resources: https://go.nasa.gov/3h7HzH6

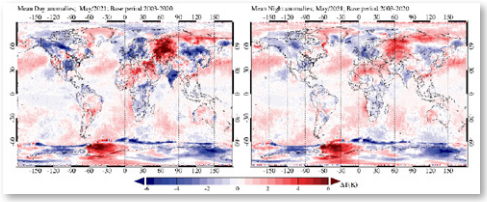
New and Improved Data Animation and Regional Shapefiles for Analysis with Giovanni 4.35



The latest release of the Goddard Earth Sciences Data and Information Services Center (GES DISC) Giovanni system (Version 4.35) provides an important update to the animation capability for data maps, and also offers shapefiles of world regions as a new visualization option.

Learn more:
https://go.nasa.gov/3xsIWaT

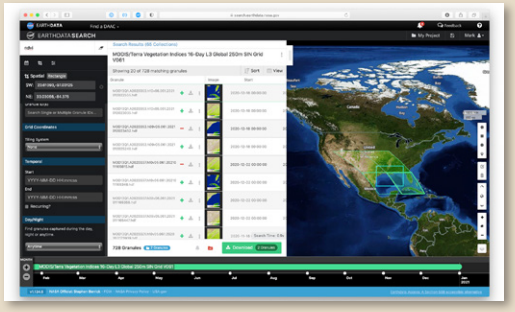
Monthly Global Surface Air Temperatures and Precipitation Analysis



The GES DISC provides a monthly assessment of anomalies and extremes in global surface air temperatures and precipitation using surface air temperature data from the Atmospheric Infrared Sounder aboard NASA's Aqua satellite and Integrated Multi-satellitE Retrievals for GPM (IMERG) precipitation data from the Global Precipitation Measurement Mission (GPM).

Access analysis:
https://go.nasa.gov/3qxWnTU

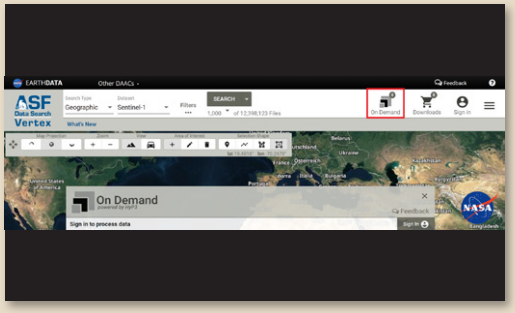
2/3/2021



Discover, Access, and Customize Multiple Datasets Using Earthdata Search

https://youtu.be/X97wSj_gzg4

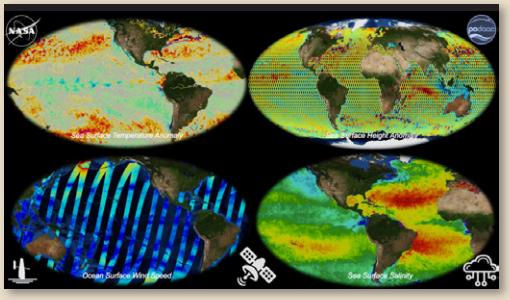
2/24/2021



Sentinel-1 On-Demand RTC Processing: Generating Analysis Ready SAR Data with ASF Vertex

https://youtu.be/t41JX2qnHJA

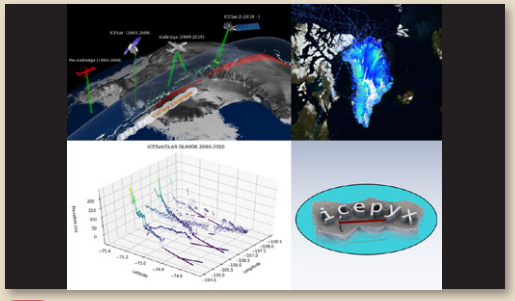
3/24/2021



The PO.DAAC: An Open Ocean of Remote Sensing and In Situ Data for Science in the Cloud

https://youtu.be/jy20oqtx1Fk

4/28/2021

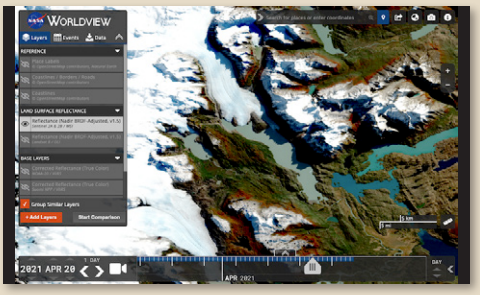


IceFlow and icepyx Python tools for Harmonizing Laser Altimetry Datasets

https://youtu.be/3GSSZRxuGYY

WEBINARS NASA EARTHDATA (CONTINUED)

5/18/2021

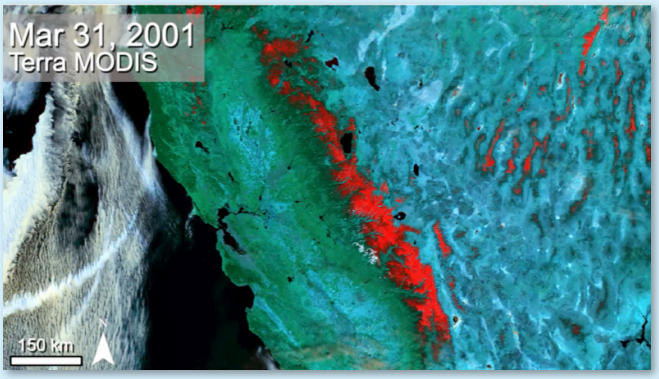


NASA Worldview—Explore the Earth from Past to Present with Global Satellite Observations

https://youtu.be/WqkX-b-jYGI

SPECIAL FEATURE VIDEO

Observing Over Two Decades of Snow Cover in the Sierra Nevada



https://youtu.be/5sBBVjey-sQ

DATA PATHFINDERS

SDG 11: Sustainable Cities and Communities

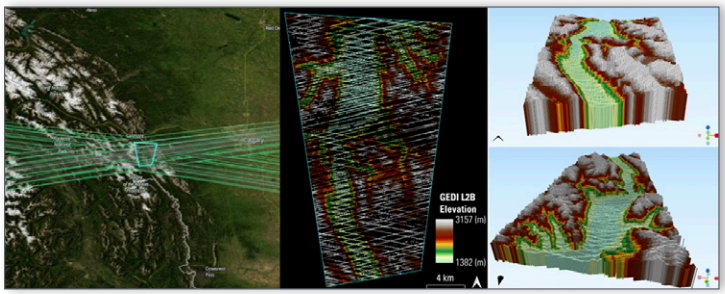
https://go.nasa.gov/3divzSf

Greenhouse Gases

https://go.nasa.gov/3qv1bcL

DATA Recipes & Tutorials

Getting Started with GEDI L1B, L2A, and L2B Version 2 Data in Python



The Global Ecosystem Dynamics Investigation (GEDI) is a full-waveform lidar instrument aboard the International Space Station that produces detailed observations of the 3-dimensional structure of the Earth's surface. Learn how to work with the various GEDI datasets in this tutorial series from the LP DAAC.

Access Tutorial: https://bit.ly/3A8Pi03

GEDI Spatial and Band/Layer Subsetting

The GEDI_Subsetter.py script converts GEDI data products, stored in Hierarchical Data Format version 5 (HDF5, .h5) into GeoJSON files that can be loaded into GIS and remote sensing software.

View Script: https://go.nasa.gov/3gfzfEi

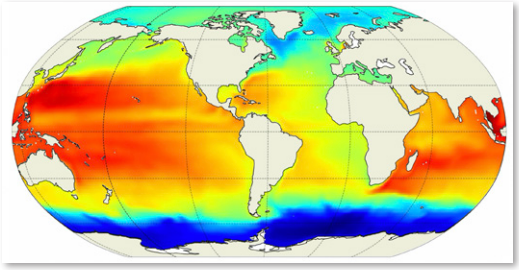
DATA Recipes & Tutorials (Continued)

HLS Subsetting, Processing and Exporting Reformatted (HLS SuPER)

NASA's LP DAAC archives and distributes Harmonized Landsat Sentinel-2 (HLS) version 1.5 products in the LP DAAC Cumulus cloud archive as Cloud Optimized GeoTIFFs (COG). The HLS_SuPER.py data prep script is a command line-executable Python script that allows users to submit inputs for their desired spatial (GeoJSON, Shapefile, bounding box) region of interest (ROI), time period of interest, and the specific desired product(s) and bands/layers within the HLS products.

View Script: https://go.nasa.gov/3w50oR1h

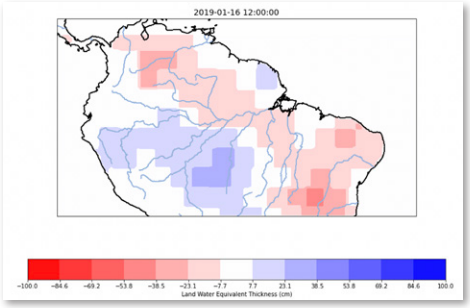
ECCO Data Access Notebooks



Learn how to work with Estimating the Circulation and Climate of the Ocean (ECCO) data archived in Amazon Web Services (AWS) by PO.DAAC.

Access Notebooks: https://github.com/podaac/ECCO

Explore Seasonal Impacts on the Amazon Estuary Environment



NASA's PO.DAAC developed this tutorial that uses multiple satellite products to explore the relationship between oceanography and hydrology data in the Amazon River estuary using a combination of on-premise archived and Earthdata Cloud data. Examine river height, land water equivalent thickness, sea surface salinity, and sea surface temperature in the Amazon River estuary coastal region over several years.

View tutorial: https://bit.ly/2U7NLr4

MODIS L2P SST Data Cube

This notebook, developed by NASA's PO.DAAC demonstrates how to create a gridded "Data Cube," essentially an Analysis Ready Dataset (ARD), from native Level 2P sea surface temperature (SST) data from the MODIS Aqua (https://doi.org/10.5067/GHMDA-2PJ19) collection or dataset. This tutorial can also be applied to Terra L2P SST and other similar L2 satellite collections.

Access tutorial: https://bit.ly/3hgaBEE

SWOT Early Adopters Hackweek Recipes

The command line based data recipes support Surface Water and Ocean Topography (SWOT) mission early adopters to learn how to co-locate satellite and in-situ data for cross-validation, and explore coastal processes with satellite data in the cloud.

Download Recipes: https://bit.ly/3doJVQQ

Vertex On-Demand SAR Processing

This video developed by the Alaska Satellite Facility Distributed Active Archive Center (ASF DAAC) provides an overview of the On-Demand synthetic aperture radar (SAR) processing system within Vertex, the ASF DAAC's data discovery and data access portal.

View Tutorial: https://youtu.be/AxhYMBzycuY

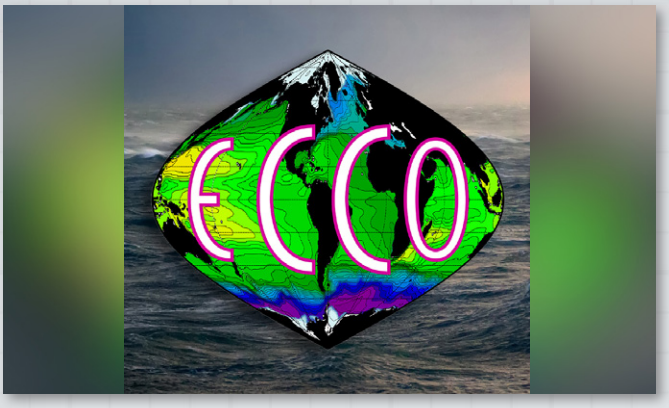
Download SAR Data Using Vertex

This video shows data users how to download SAR data available through the NASA ASF DAAC's Vertex data discovery and data access portal.

View Tutorial: https://youtu.be/AxhYMBzycuY

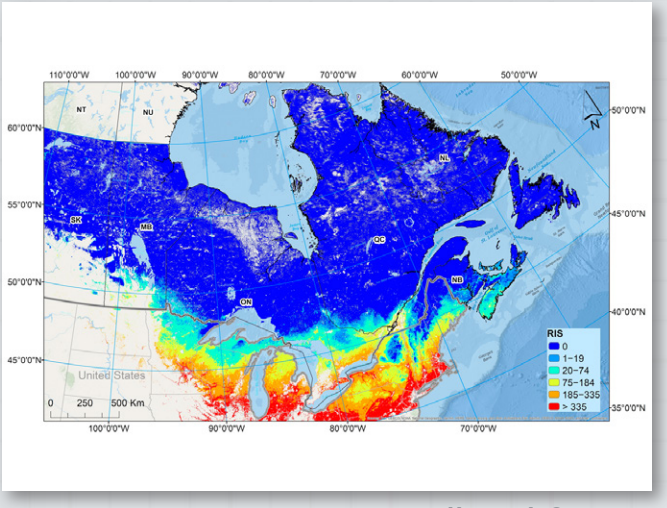
HIGHLIGHTS: DATA IN ACTION

ECCO Helps Validate New Field of Seismic Ocean Thermometry



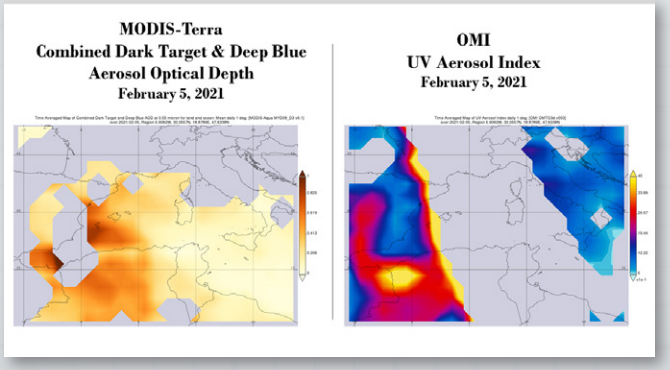
https://go.nasa.gov/3vukAvX

Highlights from the Literature: January to March 2021



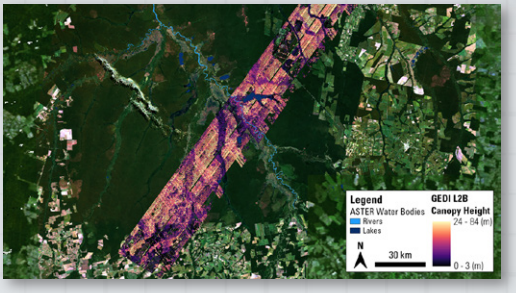
https://bit.ly/2QHFzw2

Let It Snow, Let It Snow, Let It Orange Snow



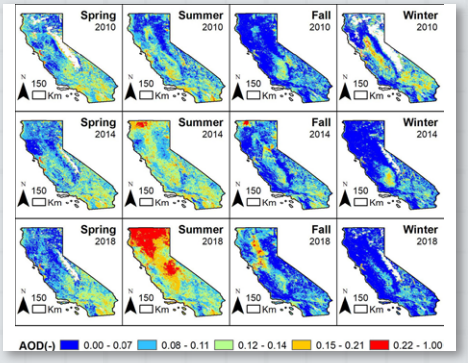
https://go.nasa.gov/3t3bIMM

May the Forest be With You: But How Tall is the Forest?



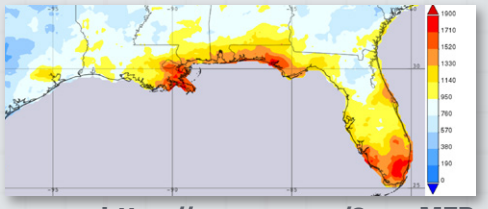
https://bit.ly/2Tp1cCF

Highlights from the Literature: October to December 2021



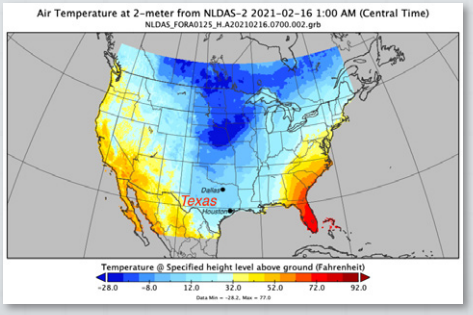
https://bit.ly/37qOilv

2020 Hurricane Season Precipitation Analysis along the U.S. Gulf Coast



https://go.nasa.gov/3uwyMED

Analyzing the Coldest February in Texas in Four Decades



https://go.nasa.gov/2Qp4S67

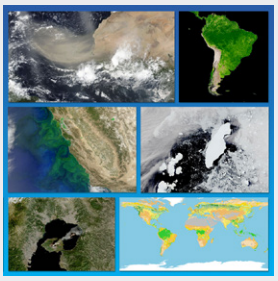
STORY MAP

How to Use the Sub-Orbital Order Tool (SOOT) Power User Interface

This ArcGIS StoryMap provides an overview and tutorial for how to use the new Sub-Orbital Order Tool (SOOT) Power User Interface (UI), a tool developed by the Atmospheric Science Data Center (ASDC) DAAC for handling data acquired from suborbital field campaigns that are assigned to and archived at the ASDC. SOOT supports data discovery and accessibility for users interested in airborne and field campaign data and promotes suborbital research and analysis.

View StoryMap: https://go.nasa.gov/3dmKMSp

Connected to Earth—Informed by Data



Whether it's the trees and plants that give us the oxygen we breathe, the snow-capped mountains that provide the water we drink, or the breathtaking geophysical forces that shape the land beneath our feet, we're all connected to and connected by Earth. In this ArcGIS StoryMap: ***Connected by Earth, Informed by Data*** we will both introduce you to researchers working in interesting environments around the globe and give you a chance to experience the power of NASA Earth data for yourself. Be sure to check out the Learning Resources section for links to Data Pathfinders, Data Toolkits, articles, webinars, and more!

View StoryMap: https://go.nasa.gov/2Temh2O

MICRO ARTICLES

Advancing Aerosol-Cloud-Meteorology Knowledge through ACTIVATE

Despite the crucial role of clouds in maintaining the Earth's energy balance and water cycle, their formation and evolution processes still have large uncertainties among the international scientific research community. Expanding knowledge on the relationships between aerosols and clouds is key to understanding different cloud properties and their resulting impact on climate and weather. The Aerosol Cloud meTeorology Interactions oVer the western ATlantic Experiment (ACTIVATE) aims to provide a unique dataset of aerosol-cloud-meteorology interactions for international model intercomparison and improvement, in addition to process-based studies.

Learn more: https://go.nasa.gov/3qmNX1D

Accessing Airborne and Field Campaign Data with the Sub-Orbital Order Tool

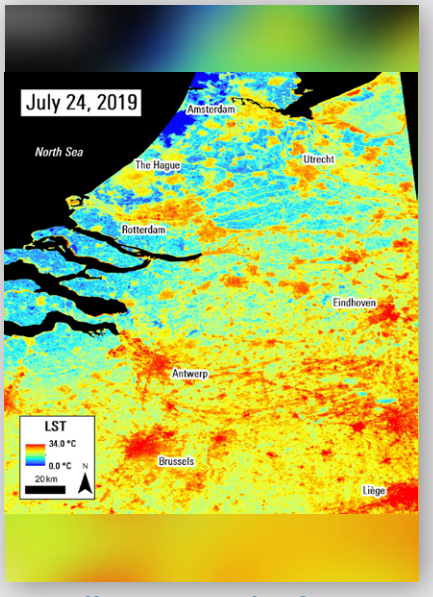
Suborbital campaigns serve as a key component of the integrated observing system of the atmosphere by linking satellite observations and surface measurements, as well as probing atmospheric phenomena critical to climate change and air quality issues. These suborbital campaigns often deploy many instruments on different platforms, including aircraft, ships, sondes, mobile, and ground sites, to collect necessary data to gain fundamental understanding of the atmosphere. Developed by the ASDC DAAC, the Sub-Orbital Order Tool (SOOT) address the attributes specific to suborbital data and to streamline data discovery and accessibility.

Learn more: https://go.nasa.gov/2U1vn2M

EARTHDATA TOOLKIT

Data Toolkits are designed as entry points to access NASA Earth science data resources organized by topic. They contain links to datasets, tutorials and how-tos, feature articles and Data User Profiles, as well as other useful information.

Extreme Heat



https://go.nasa.gov/3joOnDg

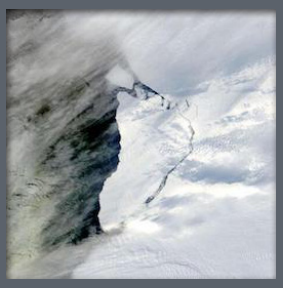
Spring 2021 NASA Earthdata Images

Steam Emanating from the Sakurajima Volcano, Japan

https://go.nasa.gov/3a2av16

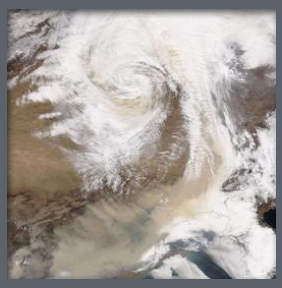
Power Outages in Houston, Texas

https://go.nasa.gov/3po6QPy



Iceberg Forms after Calving Event on Brunt Ice Shelf, Antarctica

https://go.nasa.gov/3xgzVkl

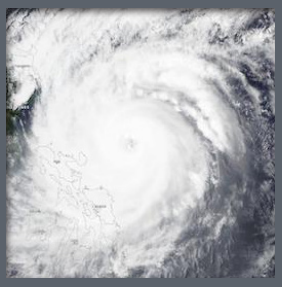


Dust Storm in Eastern China

https://go.nasa.gov/39rGXsR

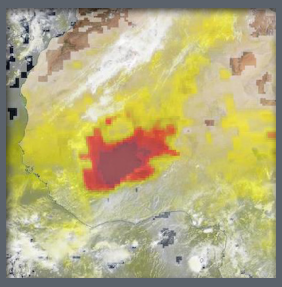
Etosha Pan, Namibia

https://go.nasa.gov/3wtlEQu



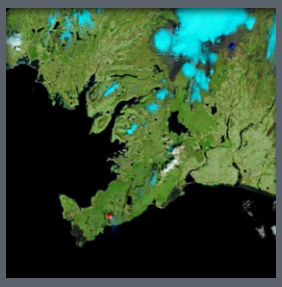
Typhoon Surigae near the Philippines

https://go.nasa.gov/2QJts16



Dust Storm in Burkina Faso

https://go.nasa.gov/3vNy0Dd

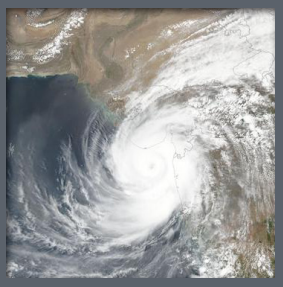


Eruption near Mount Fagradalsfjall, Iceland

https://go.nasa.gov/3eKktq7

Bingham Canyon Mine, USA

https://go.nasa.gov/3dWQevE



Tropical Cyclone Tauktae

https://go.nasa.gov/3haf78Z

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