



# EOSDIS Update

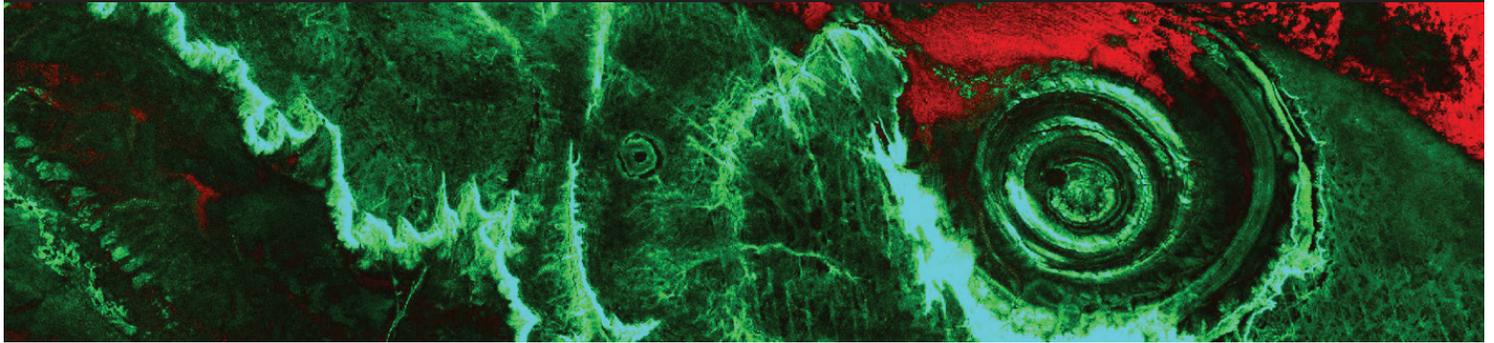
Earth Science Data and Information System (ESDIS) Project

National Aeronautics and Space Administration



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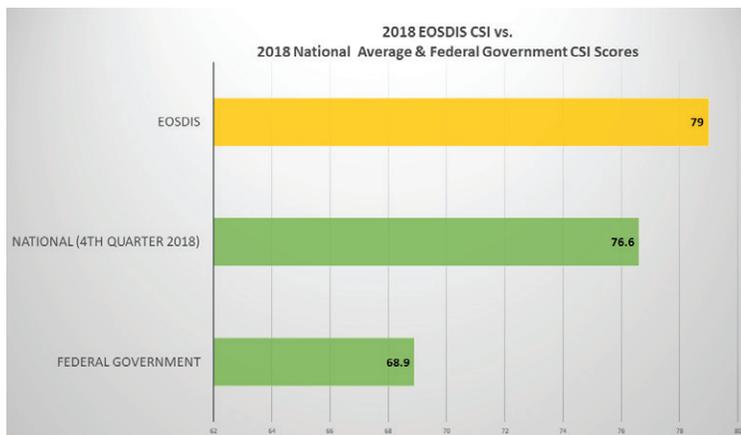
## TOP STORIES

### Record Setting Satisfaction

NASA's EOSDIS received an all-time high overall score on its 2018 American Customer Satisfaction Index (ACSI) survey.

For the 15<sup>th</sup> consecutive year, NASA's Earth Observing System Data and Information System (EOSDIS) received high scores for customer satisfaction in the annual American Customer Satisfaction Index (ACSI) survey. In addition, all EOSDIS Distributed Active Archive Centers (DAACs) received strong individual evaluations.

The EOSDIS received an aggregate Customer Satisfaction Index (CSI) of 79 out of 100, which is the highest CSI ever received by the EOSDIS and an indication of strong, consistent performance (and one point higher than last year's score). The EOSDIS CSI score is also more than 10 points higher than the aggregate [federal government 2018 CSI](#). In fact, the EOSDIS has maintained an average aggregate CSI of 77 over the past 12 years and has received a CSI at or above 74 every year the EOSDIS ACSI survey has been conducted.



These consistently strong scores represent overall satisfaction with EOSDIS and DAAC products and services by the global EOSDIS data user community. More importantly, the annual ACSI survey provides a roadmap for the Earth Science

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Unless otherwise noted, all articles written by Josh Blumenfeld, EOSDIS Science Writer.

Data and Information System (ESDIS) Project (which manages EOSDIS science operations, including data archiving and distribution) and the DAACs on ways these products and services can further be improved or enhanced along with insight into developing data user needs.

Before looking at some of the high-end results of the 2018 survey, let's first look at the survey background and how it is conducted.

The ACSI survey is administered by the CFI Group, an independent organization that is under contract to the federal government to assess user satisfaction with products and services at numerous federal entities, including the National Weather Service, the General Services Administration, and the Department of Education.

The ACSI model is a set of causal equations linking customer expectations, perceived quality, and perceived value to customer satisfaction, which is reflected mathematically 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. Because the CSI score is based on aggregate weighted scores in several factors that are calculated using the proprietary [ACSI methodology](#), a score in the upper-70s can be considered an indication of "strong" performance.

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. Respondents' likelihood to recommend EOSDIS products and services (88, one point higher than in 2017) and likelihood to use EOSDIS services in the future (89, the same record-high score as in 2017) remain very strong, and are consistent with previous EOSDIS ACSI surveys.

The 2018 survey was conducted online between October 1 and October 23. The CFI Group emailed roughly 285,698 survey invitations to individuals who used EOSDIS data and/or products in the past year and received 2,778 completed surveys—a response rate close to 1%. While this response rate is lower than previous surveys, it is still a large enough sample size for calculating a statistically valid CSI score, according to the CFI Group.

Outside of three survey questions 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 required by the CFI Group and used to calculate the CSI score), the remaining questions on the EOSDIS survey are developed collaboratively by the ESDIS Project, the DAACs, and the CFI Group. Respondents to the survey are asked to evaluate their experience with the specific DAAC or DAACs from which they receive data and products. In addition, the survey allows respondents to provide open-ended comments. These are some of the most valuable areas of the survey since they allow respondents to candidly express their specific likes, dislikes, satisfactions, and suggested improvements.

The CFI Group breaks EOSDIS services into six "Satisfaction Drivers" representing specific areas of performance affecting overall EOSDIS customer satisfaction. Each satisfaction driver is further evaluated by its weighted Impact on Satisfaction, which ranges from 0.0 to 1.5 and indicates the leverage an individual driver has on customer satisfaction and the area or areas in which improvements matter the most to survey respondents.



The driver with the greatest impact on EOSDIS customer satisfaction continues to be Product Quality, which has an impact value of 1.1. The Product Quality score of 85 (received in both 2018 and 2017) is the highest Product Quality score received since the EOSDIS survey was first conducted in 2004. As noted by the CFI Group, maintaining a high Product Quality score is essential to maintaining a high CSI score due to the high impact of Product Quality on overall satisfaction.

Product Documentation also has an impact value of 1.1, indicating this driver has a high impact on the overall CSI score. However, the combination of the high

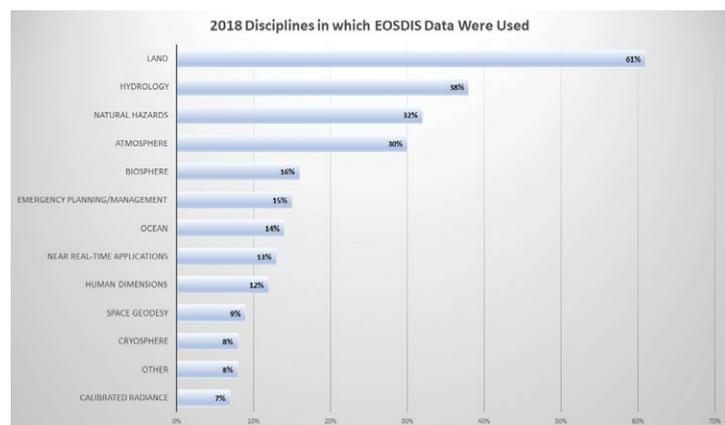
impact (1.1) and lower score (81) in this driver makes Product Documentation a priority area for improvement, according to the CFI Group. While 73% of survey respondents looked for or obtained documentation, they indicated difficulty finding documentation dealing with general data conversion as well as documents dealing with specific DAACs. Improvements in documentation clarity and in documentation to aid in data use are two recommendations by the CFI Group to help raise the score in this area.

Overall, EOSDIS Satisfaction Driver Scores remained remarkably consistent from 2017, with no change in the scores for Product Quality (85), Product Selection & Order (83), and Product Delivery (84). The Product Documentation score increased one point to 81, while Customer Support and Product Search both decreased one point from 2017.

Customer Support (86) remains the highest scoring satisfaction driver in the EOSDIS satisfaction model. Respondents noted that customer support personnel are professional, knowledgeable, quick, and helpful.

Now, let's dig a bit more deeply into some of the specific findings of the 2018 ACSI survey. 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.

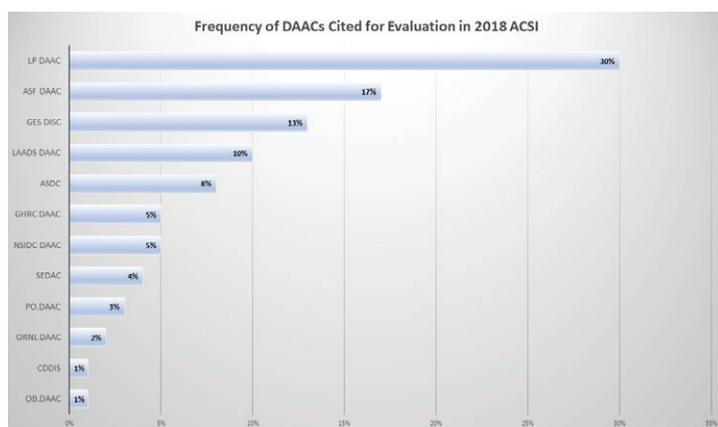
Survey respondents self-identifying themselves as university students (39%)—which includes both undergraduate (10%) and graduate (29%) students—and Earth science researchers (34%) were the most common EOSDIS data users, followed by university professors (16%) and the general public (13%). These percentages are consistent with previous surveys. The disciplines for which EOSDIS data are used also are consistent with previous years. While Land decreased from 67% in 2017



to 61%, the other disciplines noted by survey respondents remained either unchanged or within 1% of 2017 values. Note that the disciplines of Hydrology, Natural Hazards, and Emergency Planning/Management were broken out separately in the 2018 survey, but were not included in previous year's surveys.

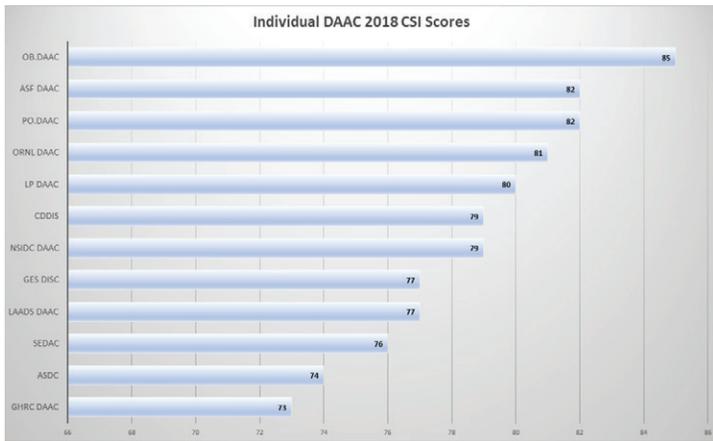
ACSI survey respondents are asked to evaluate their experience with the specific DAAC or DAACs from which they receive data and products. For links to the specific DAACs mentioned below, please see the [DAAC page on the Earthdata website](#).

The Land Processes DAAC (LP DAAC) continues to be the most frequent DAAC evaluated (30%). Since LP DAAC is the home for NASA Earth observing data related to land-oriented disciplines (including land cover, topography, and vegetation indices), the high frequency of LP DAAC evaluation is in line with the high level of use of EOSDIS data in land-oriented disciplines. The 2018 LP DAAC evaluation frequency, though, is 8% lower than in 2017.



CSI scores were computed for each DAAC based on individual DAAC survey responses. All DAACs achieved CSIs between 73 and 85, which is higher than the 2017 survey and considered strong scores by the CFI Group. Among DAACs with at least 50 evaluations in the 2018 survey, the Alaska Satellite Facility DAAC (ASF DAAC) and the Physical Oceanography DAAC (PO.DAAC) both saw two-point CSI increases. The Atmospheric Science Data Center DAAC (ASDC DAAC) saw the largest change in CSI, with a three-point drop from their 2017 score (77 to 74).

Note that while the Ocean Biology DAAC (OB.DAAC) saw the largest change in CSI score between 2017 and 2018 (+9 points), it also had the fewest evaluations in the 2018 survey (35). Two other DAACs also had fewer



than 50 evaluations in 2018: the Oak Ridge National Laboratory DAAC (ORNL DAAC), 45 evaluations; and

the Crustal Dynamics Data Information System (CDDIS), 37 evaluations.

Summaries of all EOSDIS ACSI reports are available on the [ACSI Reports](#) page in the Performance section of the Earthdata website, and full reports are available upon request. Thanks to your participation, the evaluations and comments from the 2018 EOSDIS ACSI survey are being incorporated into enhancements you will see throughout 2019 to further increase the usefulness and quality of EOSDIS data and services. Be sure to check your email this fall for an invitation to participate in the 2019 survey—your opinion matters and will help make NASA Earth observing data and services even better. ■

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## Coming Soon from a Space Station Near You

The ECOSTRESS, GEDI, and OCO-3 Earth observing missions aboard the International Space Station (ISS) will help scientists better understand Earth systems.

Two new innovative instruments aboard the International Space Station (ISS) are bringing a wealth of vital Earth observing data to NASA's Earth Observing System Data and Information System (EOSDIS) collection, and a third instrument will soon be on the way.

The [ECOsysteM Spaceborne Thermal Radiometer Experiment on Space Station](#) (ECOSTRESS) (installed in June 2018) globally monitors and measures evaporation and plant transpiration, collectively known as evapotranspiration. The [Global Ecosystem Dynamics Investigation](#) (GEDI) mission uses a Light Detection And Ranging (LIDAR) laser system (installed in December 2018) to create 3D images of forest and canopy structure. Finally, the [Orbiting Carbon Observatory-3](#) (OCO-3) instrument will continue the global data record of atmospheric carbon dioxide (CO<sub>2</sub>) measurements and provide a better understanding of the regional sources and sinks of CO<sub>2</sub>.

Mission	Launch Date	Planned Mission Length	ISS Location	Instrument Type	Data Location
ECOSTRESS	June 29, 2018	One Year	Japanese Experiment Module-Exposed Facility (JEM-EF)	Radiometer	LP DAAC
GEDI ECOSYSTEM LIDAR	December 5, 2018	Two Years	JEM-EF	LIDAR	LP DAAC (L1, L2) ORNL DAAC (L3, L4)
OCO-3	April 25, 2019 (scheduled)	Three Years	JEM-EF	Three high-resolution grating spectrometers	GES DISC

*ECOSTRESS, GEDI, and OCO-3 data will be fully and openly available through discipline-specific EOSDIS DAACs. ECOSTRESS data products will be available in four EOSDIS data processing levels from the Land Processes DAAC (LP DAAC). Lower level GEDI data products (Level 1 and Level 2) also will be available through LP DAAC; higher level products (Level 3 and Level 4) will be available through the Oak Ridge National Laboratory DAAC (ORNL DAAC). OCO-3 data products will be available through the Goddard Earth Sciences Data and Information Services Center (GES DISC).*

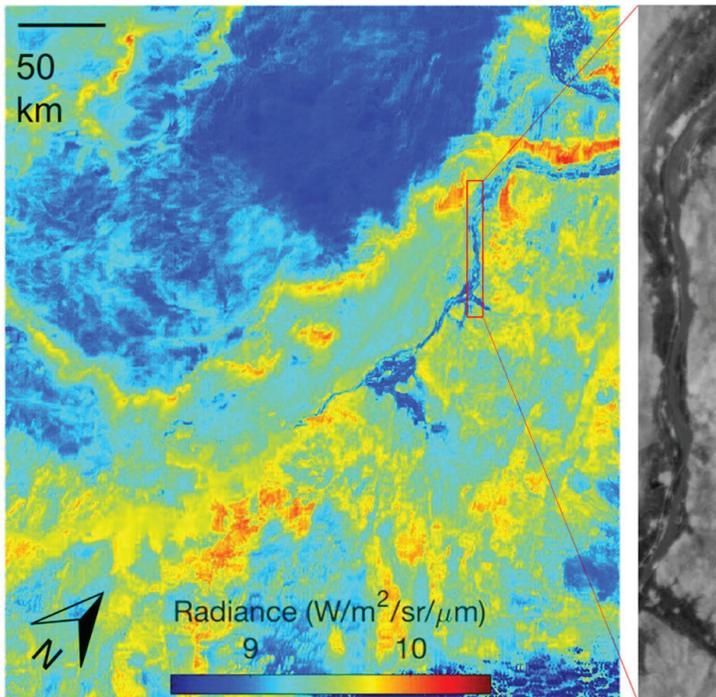
Along with being valuable individual datasets, data from these three missions complement each other. For example, OCO-3 CO<sub>2</sub> data can be combined with evapotranspiration and biomass measurements from ECOSTRESS and GEDI in studies of terrestrial ecosystem processes and carbon storage. The result is a data collection that will add to the global climate data record. As with all EOSDIS data, these data are (or, in the case of OCO-3, will be) fully and freely available through EOSDIS Distributed Active Archive Centers (DAACs) for use by a diverse worldwide user community.



Humans need to regulate their body

temperature to survive. When body temperature begins to increase beyond a certain threshold, a mixture of water, salt, and other minerals (what we know as sweat) is released through pores in the skin. As sweat evaporates, it exchanges heat with the atmosphere, which results in overall cooling that helps reduce body temperature.

Plants, like people, also need to regulate their temperature to survive, and accomplish this in a similar manner. Plants release water through tiny pores on their leaves called *stomata* in a process called *transpiration*. As this



*ECOSTRESS first data image showing Egypt and the Nile River. Yellow and red indicate generally higher temperatures. The Nile River is visible as a thin blue line on the main image. The black-and-white inset (vertical right image) shows the level of detail available from ECOSTRESS, with the relatively cool Nile River and surrounding vegetation appearing darker. Image and text: NASA JPL-Caltech.*

transpired water evaporates and exchanges heat with the atmosphere, it lowers the plant's temperature. When plants have sufficient water, they can maintain a steady temperature. If water resources are insufficient or if relative humidity gets too high, plant stomata close and the plant can heat up and become stressed. Orbiting sensors like radiometers, which sense radiated energy, can measure this vegetative temperature rise over large areas. These temperature data, in turn, can be used to calculate how much water plants use and can help pinpoint areas of potential drought or areas with developing drought.

Over the course of its one-year mission, ECOSTRESS is using a multispectral thermal infrared radiometer to sense and globally measure the temperature of plants, giving scientists a better understanding of how much water plants need and how plants respond to stress.

ECOSTRESS launched June 29, 2018, aboard a SpaceX cargo resupply mission that docked at the ISS on July 2. Ground controllers extracted ECOSTRESS on July 5, robotically transferred it to the station's Japanese Experiment Module - Exposed Facility (JEM-EF), and installed it. After a few days of testing and start-up activities, ECOSTRESS acquired its first data image of Egypt and the Nile River on July 9.

The ECOSTRESS radiometer is producing the most detailed global surface temperature images ever acquired from space, and is so sensitive it can even measure the temperature of individual fields. These plant-temperature data are addressing three primary science questions:

- How is the terrestrial biosphere responding to changes in water availability?
- How do changes in diurnal vegetation water-stress impact the global carbon cycle?
- Can agricultural vulnerability be reduced through advanced monitoring of water consumption in agriculture and improved drought estimation?

One of the core data products produced by the ECOSTRESS science team is the [Evaporative Stress Index \(ESI\)](#). ESI is a leading drought indicator, and can show when plants are stressed and areas where drought is likely to occur. These data enable decision-makers to know where and when resources (such as supplemental water) might need to be allocated to mitigate potential risks.

[ECOSTRESS data products](#) are available through NASA's [Land Processes DAAC](#) (LP DAAC). The LP DAAC is responsible for NASA land cover and land use data in the EOSDIS collection, and operates as a partnership between the U.S. Geological Survey (USGS) and NASA.



Our world exists in three dimensions, yet data depicting this 3D structure is a gap in Earth observations. This gap is being filled with GEDI (pronounced "jedi").

Launched on December 4, 2018, aboard a SpaceX Falcon-9 rocket, GEDI's primary mission is to produce high-resolution laser ranging observations of Earth in 3D. From its mounting on the ISS, GEDI can observe nearly all tropical and temperate forests. These data allow for precise measurements of forest canopy height, canopy vertical structure, and surface elevation. In addition, these data will greatly advance our ability to characterize carbon and water cycling processes, biodiversity, and habitat by quantifying the amount of carbon stored in Earth's vegetation and estimated carbon fluxes resulting from land use and climate change. GEDI's data on surface structure also will aid weather forecasting, forest management, glacier and snowpack monitoring, and help enable the generation of more accurate digital elevation models (DEMs).



Artist's rendering of how the GEDI LIDAR samples forest canopy height and structure. GEDI has the highest resolution and densest sampling of any LIDAR ever put in orbit. Screenshot from a video produced by NASA's Scientific Visualization Studio and available at <https://svs.gsfc.nasa.gov/13090>.

The GEDI instrument is a geodetic-class LIDAR laser system comprising three lasers producing eight parallel observation tracks. Each laser fires 242 times per second and illuminates a 25-meter spot on the surface over which 3D structure is measured. Each illuminated spot is separated by 60 meters along track, with an across-track distance of about 600 meters between each of the eight tracks. GEDI is led by the University of Maryland in collaboration with NASA's Goddard Space Flight Center in Greenbelt, Maryland, and is expected to produce about 10 billion cloud-free observations during its two-year mission.

The GEDI Science Operations Center (SOC) receives the Level 0B data from the GEDI Mission Operations Center (MOC) located at NASA's Goddard Space Flight Center. The Level 0B science data will be sent from the

GEDI SOC to the LP DAAC for archiving and will be processed by the SOC in four EOSDIS data processing levels. Lower level GEDI products—Level 1B, Geolocated Waveforms (which also contains Level 1A, Waveform Fitted Parameters); Level 2A, Footprint Elevation and Height Metrics; and Level 2B, Footprint Cover and Profile Metrics—are acquired from the SOC, and will be distributed through the LP DAAC. Higher level products—Level 3A, Gridded Land Surface Metrics; Level 4A, Footprint Aboveground Biomass; and Level 4B, Gridded Aboveground Biomass—come from the GEDI science team and Principal Investigators (PIs) and will be distributed through the [Oak Ridge National Laboratory DAAC](#) (ORNL DAAC), which is responsible for biogeochemical and ecological data and models. A [summary of GEDI data products](#) is available on the GEDI mission website.

GEDI data will complement several NASA missions, including the upcoming joint [NASA/Indian Space Research Organization \(ISRO\) Synthetic Aperture Radar \(NISAR\)](#) mission and NASA's recently-launched [Ice Cloud and Elevation Satellite-2 \(ICESat-2\)](#) mission. GEDI data also will be incorporated with Landsat maps of vegetation change to provide high spatial resolution estimates of vegetation height and change in aboveground carbon stocks at annual to five-year time scales. The result will be some of the most accurate estimates of carbon emissions from deforestation. Additionally, GEDI LIDAR data will be incorporated with data from the German Aerospace Center (DLR) [TanDEM-X SAR interferometry mission](#) to produce wall-to-wall maps of canopy heights and other structure metrics.



Precise measurements of atmospheric concentrations of CO<sub>2</sub>, methane (CH<sub>4</sub>), and other greenhouse gases have been collected from orbit since 2009 and the launch of the [Greenhouse gases](#)

[Observing SATellite](#) (GOSAT, nicknamed "IBUKI"). GOSAT was developed by the Japan Aerospace Exploration Agency and is still in operation. NASA's first mission to precisely measure atmospheric CO<sub>2</sub> from orbit, the 2009 Orbiting Carbon Observatory (OCO) mission, suffered a launch vehicle failure and never reached orbit.

NASA's [OCO-2](#) satellite, described as a "carbon-copy" of the original OCO satellite in the OCO-2 Data Product

User's Guide, successfully launched in 2014 to collect space-based measurements of atmospheric CO<sub>2</sub> with the precision, resolution, and global coverage necessary to characterize the sources and sinks of CO<sub>2</sub> and quantify CO<sub>2</sub> variability over seasonal cycles. Originally designed as a two-year mission, OCO-2 is still providing valuable data from orbit.

OCO-3, which is tentatively scheduled for launch in April 2019 on a SpaceX Falcon-9 rocket for a planned three-year mission, is a complete stand-alone payload built using the spare OCO-2 flight instrument with additional elements added to accommodate installation and operation on the ISS. Unlike OCO-2, a free-flying satellite in a 705 km sun-synchronous polar orbit that observes locations at nearly the same time every day, OCO-3 will monitor CO<sub>2</sub> concentrations throughout the day from approximately 400 km at an inclination of 51.6 degrees (which provides coverage of about 80 percent of Earth's surface north and south of the equator, but not the poles).

OCO-3 data will address four principal science questions:

- What is the magnitude, distribution, and variability of surface-atmosphere CO<sub>2</sub> fluxes and what are their uncertainties in time and space?
- What are the inter-annual, seasonal, and diurnal changes in uptake and release of CO<sub>2</sub> on sub-regional and regional scales in the terrestrial biosphere?
- How do the regional oceanic sources and sinks of atmospheric CO<sub>2</sub> change with sub-seasonal to inter-annual variability, such as from synoptic forcing or the El Niño/Southern Oscillation (ENSO)?
- How are urban population growth and changing patterns of fossil fuel combustion influencing atmospheric CO<sub>2</sub> distributions? Can regional trends of human-created CO<sub>2</sub> emissions be compared against the backdrop of natural variability?

Like OCO-2, OCO-3 will not measure CO<sub>2</sub> directly, but rather will measure the intensity of sunlight reflected from the presence of CO<sub>2</sub> in a column of air. The OCO-3 instrument uses a diffraction grating (like the back of a compact disk) to separate incoming sunlight into a spectrum of multiple component colors. CO<sub>2</sub> and molecular oxygen (O<sub>2</sub>) molecules in the atmosphere absorb light energy at very specific wavelengths. The intensity of these wavelength bands is analyzed, with



*Sunlight rays entering the OCO-3 instrument pass through the atmosphere twice: once as they travel from the Sun to Earth and then again as they bounce off Earth's surface to the instrument. NASA JPL/Caltech illustration.*

the absorption levels indicating the presence of specific gasses. By simultaneously measuring gases over the same location and over time, OCO-3 will be able to track surface changes.

The OCO-3 instrument will acquire data in three different measurement modes. In Nadir Mode, the instrument views the

ground directly below the space station. In Glint Mode, the instrument tracks near the location where sunlight is directly reflected on Earth's surface (which enhances the instrument's ability to acquire highly accurate measurements, particularly over the ocean). In Target Mode, the instrument views and tracks a specified surface target continuously as the ISS passes overhead. Target Mode provides the capability to collect a large number of measurements over sites where ground-based and airborne instruments also measure atmospheric CO<sub>2</sub>. The OCO-3 Science Team will compare Target Mode measurements with those acquired by ground-based and airborne instruments to validate OCO-3 mission data.

OCO-3 data will be available through NASA's [Goddard Earth Sciences Data and Information Services Center](#) (GES DISC). The GES DISC is the EOSDIS DAAC responsible for NASA Earth science satellite and modeling data products related to global precipitation, atmospheric composition, atmospheric dynamics, hydrology, and solar irradiance, and archives and distributes OCO-2 data.

Together, OCO-3, ECOSTRESS, and GEDI will provide further insight into Earth's complex systems, especially the cycling of carbon and CO<sub>2</sub>. Data from these new missions, coming from Earth's largest orbiting observing platform, will contribute significantly to the climate data record being compiled by space-based instruments—data that are fully and freely available to support interdisciplinary global investigations and research. ■

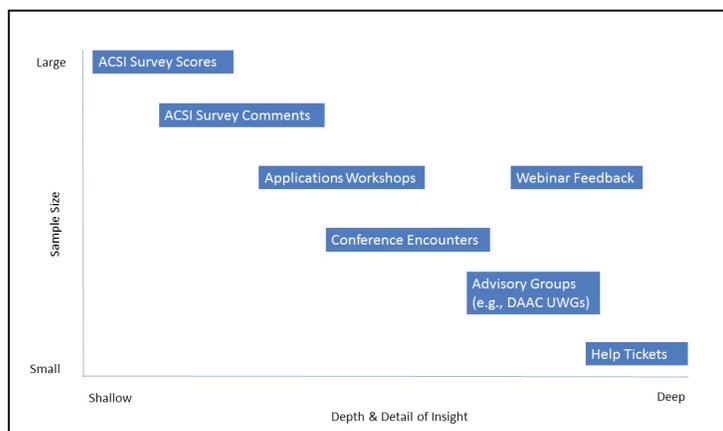
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# Meeting Data User Needs: A Look Behind the Curtain

The needs of global data users drive the many strategies used by the ESDIS Project to continually enhance its products and services.

What do data users need? When it comes to the data, products, and services provided by NASA's Earth Science Data and Information System (ESDIS) Project, basic needs include having data easily discoverable, processed to the required data product level (from raw and near real-time data to extensively-processed Level 4 products), and available—quickly and efficiently—in a variety of formats. [NASA's free and open data policy](#) means that the ESDIS Project faces the additional challenge of fulfilling these basic needs for a global community comprising millions of distinct data users.

The success of the ESDIS Project in facilitating use of the more than 27.5 petabytes (PB) of Earth observing data in NASA's Earth Observing System Data and Information System (EOSDIS) collection is due, in no small part, to its ability to continually adapt to serve its ever-growing and changing user community. A look “behind the curtain” shows the many internal and external strategies the ESDIS Project employs to assess user needs and some of the ways these needs are technically addressed.



The ESDIS Project utilizes a wide range of formal and informal strategies for assessing user needs. Input from these assessments is used as the basis for constant improvement and enhancement to ESDIS Project services, tools, and interfaces. Illustration based on a graphic originally created by Dr. Chris Lynnes, EOSDIS System Architect. NASA EOSDIS graphic.

A number of formal and informal external strategies are used for determining if existing products and services are meeting user needs. A key formal strategy is the annual

[American Customer Satisfaction Index](#) (ACSI) survey that is sent to hundreds of thousands of worldwide EOSDIS data users. The ACSI is used by the Federal Government (including by NASA and numerous other agencies) as well as corporations across a wide range of industries as an accepted national measure of customer satisfaction with products and services. Results from ACSI survey questions and, especially, from open-ended comments by respondents provide vital information that helps ensure that the ESDIS Project and the discipline-specific EOSDIS Distributed Active Archive Centers (DAACs) are providing the high-quality service and products users expect.

Another formal strategy for determining user needs is through scheduled meetings of DAAC User Working Groups (UWGs). A DAAC's UWG is a vital link between the DAAC and the Earth science discipline community served by the DAAC. The subject-matter experts who make up a DAAC's UWG provide not only guidance and direction for the DAAC, but also deep insight and specific recommendations for enhancements to existing data products and the creation of new products.

Along with the formal ACSI survey and DAAC UWGs, user input is also received through numerous informal strategies. One key informal mechanism is through comments or questions submitted using the “Feedback” button on the Earthdata and individual DAAC webpages. In addition, face-to-face interactions at conferences between ESDIS Project and DAAC staff and conference attendees along with the opportunity for live feedback during webinars and workshops (such as through polling questions or during question and answer periods) provide additional valuable information.

Supplementing these external assessments, the ESDIS Project occasionally establishes short-term internal focus groups to look more closely at specific issues. A User Needs Focus Group was chartered in 2016 to review cross-discipline and cross-DAAC user issues, identify best practices throughout the DAAC system, and develop unified strategies to address user needs.

The work of the User Needs Focus Group culminated in a User Needs Technical Interchange Meeting (UN-TIM) held in August 2016. The UN-TIM brought together DAAC managers and representatives along with ESDIS Project managers and systems engineers with the overall objectives of:

- Sorting and characterizing user needs;
- Providing an assessment, prioritization, and ranking of categorized needs;
- Enabling DAACs to easily see where collaboration in support of user needs can be done more effectively; and
- Prioritizing common cross-DAAC tools to address common issues or needs.

The outcome of the 2016 UN-TIM was a prioritized list of recommendations. While some recommendations were related to improving the user experience through enhancements to systems architecture and internal ESDIS Project and DAAC processes, many related to improving the direct user experience with data and services. These recommendations included the development of a Getting Started Guide for new data users, improved data set documentation and technical notes, and the development of a more robust bulk data download capability.

In July 2018, DAAC and ESDIS Project representatives met for a second UN-TIM to review the 2016 UN-TIM recommendations and discuss evolving user needs. Implemented 2016 UN-TIM recommendations include the initial release of a [Getting Started Guide](#) for new users of EOSDIS data, enhancements to various services to make them more user-friendly (such as the integration of [Open-source Project for a Network Data Access Protocol](#) [OPeNDAP] with other existing services to enable better networking and data access), and collaborative cross-DAAC development of [Earthdata Drive](#) as a way to provide users with a more efficient and secure bulk download capability.

Ongoing and new recommendations from the 2018 UN-TIM include continuing to improve the bulk download user experience; measuring social media efforts more effectively to better connect users with ESDIS Project and DAAC activities; going beyond the ACSI survey to gain better insight into how data users interact with specific DAACs, DAAC products, and DAAC tools; and exploring more cross-DAAC efforts for DAAC-wide services.

Of course, user needs also must be addressed as well as assessed. Some recommendations, such as the development of a Getting Started Guide, are relatively straightforward. Technical enhancements, such as adjustments to data download architecture or development of cross-DAAC services, are more complex and require the collaborative efforts of the entire ESDIS Project team, both at the ESDIS

Project Office at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and at individual DAACs. This is where ESDIS Project Systems Engineering Technical Interchange Meetings (SE-TIMs) come in.

SE-TIMs bring together systems engineers, developers, and management teams to discuss a wide range of topics related to the technical aspects of improving, enhancing, and developing ESDIS Project systems. UN-TIM recommendations, the ACSI survey, and other assessments provide much of the foundation for the SE-TIM agenda and discussions. Along with plenary sessions covering ESDIS Project-wide efforts, numerous break-out sessions over several days enable smaller teams to address specific engineering, system, and development challenges or to provide updates about on-going efforts. The three-day 2018 SE-TIM was attended by more than 150 participants.

The ESDIS Project SE-TIM meetings complement the work of NASA's [Earth Science Data System Working Groups](#) (ESDSWG). Established in 2004, the ESDSWG is a NASA organization comprising short-term working groups organized around key technology and information system issues. Each working group has a one-year charter that can be renewed for an additional year (if necessary) along with an action plan defining specific objectives, stakeholders, activities, and deliverables. A working group is retired once its objectives have been met. One responsibility of the ESDSWG is to improve ESDIS Project efficiency and user interaction through developing guidelines and best practices addressing the implementation of standards and technologies, enhancing data interoperability, and improving software development and software architecture. These actions further aid in addressing identified user needs and enhancing ESDIS Project products and services.

In the end, it is the global community of EOSDIS data users that drives the many proactive efforts by the ESDIS Project and the DAACs to continually enhance data, products, and services. This brief peek “behind the curtain” shows the many ways user needs are continually assessed and how these insights enable user needs to be addressed. The results of these collaborative efforts ensure that NASA Earth science data are easily discoverable and constantly available in the data processing levels and formats required to support interdisciplinary Earth science research. ■

*Published on Earthdata website: 2/14/19*

## USER PROFILES:

NASA Earth Science Data User Profiles highlight our diverse end-user community worldwide and show you not only how these data are being used for research and applications, but also where these data are being used – from the plains of West Texas to the Sea of Oman and everywhere in between. You'll also learn where you can download the data sets in each feature. <https://earth-data.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles>

### Dr. Paul Stackhouse

**Who uses NASA Earth science data?**  
**Dr. Paul Stackhouse, for developing new products for analyzing the global energy cycle and interfaces for using these data.**



**Senior Research Scientist, NASA's Langley Research Center, Science Directorate/Climate Sciences Branch, Hampton, VA**

**Research interests:** Using satellite observations of the Earth-atmosphere system from multiple sources to study Earth's global energy cycle, especially the processes that cause variability from global to regional scales. Dr. Stackhouse also develops new data products and data systems to help analyze these processes and more efficiently understand and use renewable energy sources.

<https://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles/user-profile-dr-paul-stackhouse>

### Dr. Ludovic Brucker

**Who uses NASA Earth science data?**  
**Dr. Ludovic Brucker, for investigating climate-related changes in the cryosphere.**



*An Arctic fox assesses Dr. Ludovic Brucker's snow measurements during a 2015 expedition to Cambridge Bay, Nunavut, Canada. Image by Dr. A. Roy, University of Sherbrooke, Canada.*

**Universities Space Research Association (USRA)/Goddard Earth Sciences Technology And Research (GESTAR) program; Manager and Senior Scientist, Cryospheric Sciences Laboratory, NASA's Goddard Space Flight Center, Greenbelt, MD**

**Research interests:** Investigating climate-related changes to ice sheets, snow, and sea ice using microwave instrument observations from Earth observing satellites and aircraft coupled with measurements collected during field expeditions.

<https://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles/user-profile-dr-ludovic-brucker>

## ANNOUNCEMENTS

### And the Global Winners Are...

Six apps are Global Winners in the 2018 NASA Space Apps Challenge.

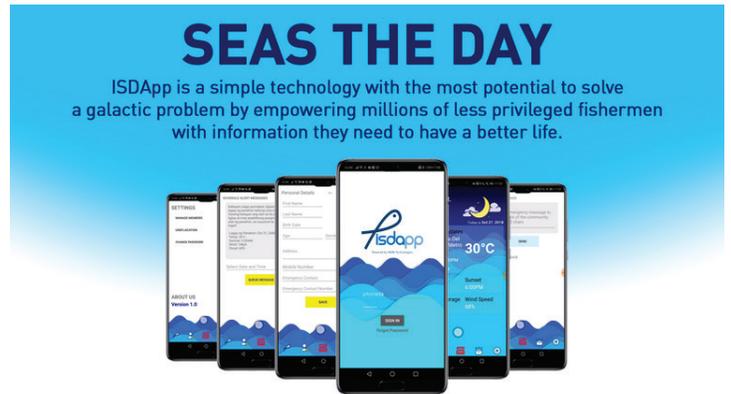


A virtual reality (VR) exploration of the Moon; an educational, problem solving, and collaborative VR game for kids using NASA and planetary data; and a tool to express the wonders of satellite imagery through audio are three of the six apps chosen as Global Winners in the [2018 NASA Space Apps Challenge](#). The six Global Winners were selected from 1,375 apps created during an intense 48-hour global hackathon last October.

[Global Winners](#) were selected in six categories:

- **Best Use of Data:** The solution that best made data accessible or leveraged data to a unique application.  
*Winner:* [Lunar VR](#). Team: Olik, Virtual Space Exploration (Sylhet, Bangladesh).
- **Best Use of Hardware:** The solution with the most plausible solution concept and design.  
*Winner:* [DeltaMesh](#). Team: DeltaProtocol (Rosario, Argentina).
- **Best Mission Concept:** The solution with the most plausible solution concept and design.  
*Winner:* [Wander Space](#). Team: that-VR-team (Sydney, Australia).
- **Galactic Impact:** The solution with the most potential to improve life on Earth or in the universe.  
*Winner:* [ISDApp: Bridging Fisherman to Information with Analog Phones](#). Team: iNON (Manila, Philippines).
- **Most Inspirational:** The solution that captured judge's hearts.  
*Winner:* [SongSAT](#). Team: Salinity (Waterloo, Ontario).
- **Best Use of Science:** The solution that made the best and most valid use of science and/or the scientific method.  
*Winner:* [Galaxy Quest](#). Team: Pillars of Creation (Madrid, Spain).

The 2018 NASA Space Apps Challenge took place at a record number of locations (200 venues, including



*Global Winner ISDApp was created by a team called iNON in the Philippines ("isda" is the Filipino word for "fish"). This community app is designed to empower fishermen with daily information useful for fishing and safety.*

virtual teams) and countries (75), and featured more teams and submitted projects than ever before. Almost 18,000 participants representing 2,729 teams created 1,375 projects in response to NASA challenges for solving problems on Earth and in space.

Many participating teams used data and services available through NASA's Earth Observing System Data and Information System (EOSDIS). The EOSDIS provides end-to-end capabilities for managing NASA's Earth science data collection. These data represent some of the most complex and diverse Earth science datasets on the planet, and are acquired from satellites, aircraft, field measurements, and numerous other programs.

Apps created during the hackathon were evaluated based on impact, creativity, validity, relevance, and presentation. Initial judging took place at each Challenge location (including virtual teams), and each local event could nominate up to two projects to advance to global judging. The result was 339 nominees for global awards. A panel of NASA experts narrowed the nominees to 25 finalists. In addition to global awards, many NASA Space Apps Challenge venues also provided local awards.

Along with being featured on the NASA Space Apps Challenge website, team members from each Global Winner receive an invitation to visit NASA's Kennedy Space Center in Cape Canaveral, Florida, with the Space Apps Global Organizing Team. Mark your calendars—the 2019 NASA Space Apps Challenge takes place October 18 through 20. Stay tuned! ■

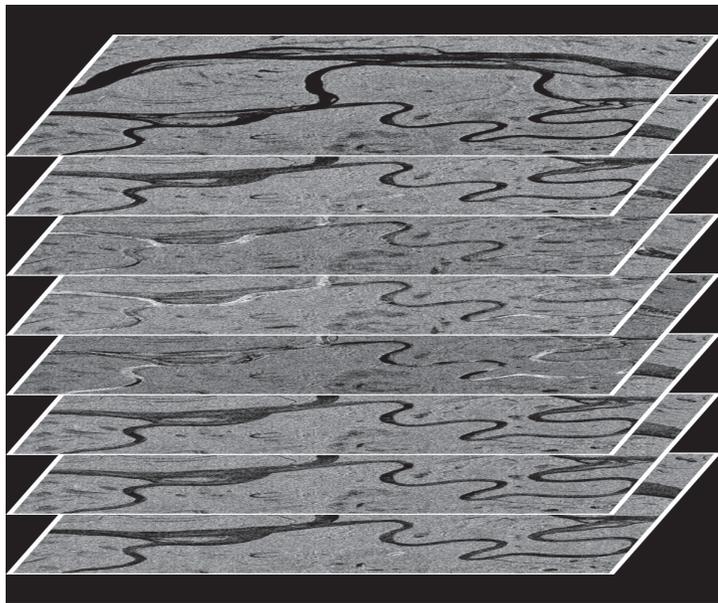
*Published on Earthdata website: 2/26/19*

# New Tool for Analyzing SAR Imagery

The ASF DAAC's RTC Stacking Tool helps facilitate time-series analysis.

A new open-source tool created by NASA's [Alaska Satellite Facility Distributed Active Archive Center](#) (ASF DAAC) facilitates time-series analysis of Synthetic Aperture Radar (SAR) imagery.

The Radiometrically Terrain Corrected (RTC) Stacking Tool uses the ASF DAAC's [Hybrid Pluggable Processing Pipeline](#) (HyP3, pronounced "hype") system to create a stack of images from a set of [Sentinel-1](#) RTC products. In fact, the tool can accept any Universal Transverse Mercator (UTM)-projected co-registered set of images, such as a co-registered set of RTC products from the Japan Aerospace Exploration Agency's [Phased Array type L-band SAR](#) (PALSAR) instrument, which also are archived and distributed by the ASF DAAC.



*Stack of processed GeoTIFF Sentinel-1 imagery of the Yukon River flats near Beaver, Alaska, created using the RTC Stacking Tool. Image: ASF DAAC 2019, contains modified Copernicus Sentinel data 2017-2018, processed by the European Space Agency.*

Once a stack of imagery products is created, the RTC Stacking Tool allows the user to perform sub-setting,

resampling, grouping, filtering, and culling on the stack. The final products are a stack of processed GeoTIFF images and an animated GIF of the stack.

SAR is an active radar technology that senses microwave signals reflected off Earth's surface, which means [SAR imagery](#) can be created day or night and in virtually any kind of weather. The result is cloud-free, high-contrast imagery. After the radar sends its microwave signal toward a target, the target reflects part of the signal back to the radar antenna. This reflection is called "backscatter." Various properties of the target (land, water, trees, etc.) affect how much the target backscatters the return signal.

Radiometric correction involves mitigating the influence of topography on backscatter values. In an ASF DAAC example, the correction eliminates bright backscatter from a steep slope, leaving only the backscatter that reveals surface characteristics such as vegetation and soil moisture. Terrain correction is the process of correcting geometric distortions that lead to geolocation errors. These distortions are caused by side-looking (rather than straight-down looking) imaging, and are compounded by rugged terrain. Terrain correction moves image pixels into the proper spatial relationship with each other. Collectively, the RTC process further enhances the sharpness and accuracy of SAR imagery and makes it easier to use SAR imagery with other types of imagery.

NASA's ASF DAAC archives and distributes SAR imagery in the NASA collection. Some of this imagery is produced by international space organizations and distributed by the ASF DAAC through intergovernmental agreements. This includes imagery from the European Space Agency's Sentinel-1A and -1B missions and from the PALSAR instrument aboard the Japan Aerospace Exploration Agency's Advanced Land Observing Satellite-1 (ALOS).

For more information about the RTC Stacking Tool and to download the code, visit the ASF DAAC GitHub repository at <https://github.com/asfadmin/hyp3-giant.git> and select "[RTC Time Series Generation Using HYP3 Products](#)." ■

*Published on Earthdata website: 2/4/19*

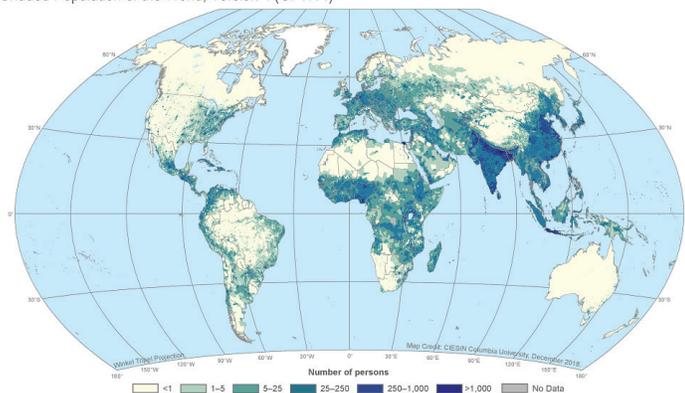
# New Update to SEDAC's Gridded Population of the World (GPW)

The most recent GPW update brings new maps and greater utility to SEDAC's flagship data collection.

NASA's [Socioeconomic Data and Applications Center](#) (SEDAC) recently released an update that

**Population Count, v4.11, 2020**

Gridded Population of the World, Version 4 (GPWv4)



*Population Count 2020 is one of nine GPWv4.11 Data Sets. The Population Count Data Set consists of estimates of human population consistent with national censuses and population registers for 2000, 2005, 2010, 2015, and 2020. Data source: CIESIN, Columbia University, 2018. GPWv4: Population Count, Revision 11. Palisades, NY: NASA SEDAC. DOI: 10.7927/H4JW8BX5.*

adds numerous enhancements to its flagship [Gridded Population of the World](#) (GPW) data collection.

[GPWv4.11](#) is the first GPW update in more than a year. Data collection enhancements include extending the final gridded data to a full global extent, adding two new classes (Total Land Pixels and Ocean Pixels) to the Water

Mask, and reprocessing the National Identifier Grid to remove artifacts from inland water. For detailed information, please visit SEDAC's [GPWv4 Documentation page](#).

The nine Data Sets comprising GPWv4.11 include 35 maps. In addition, Web Mapping Services (WMS) for 78 layers from the [Basic Demographic Characteristics](#) dataset have been published and the existing 26 WMS services in the GPWv4 collection have been updated with GPWv4.11 data.

SEDAC's Gridded Population of the World provides a spatially disaggregated population layer that is compatible with datasets from social, economic, and Earth science disciplines as well as with remote sensing. It provides globally consistent and spatially explicit data for use in research, policy-making, and communications. Initially released in 1995, version 4 (v4.0) of the collection was published in 2016.

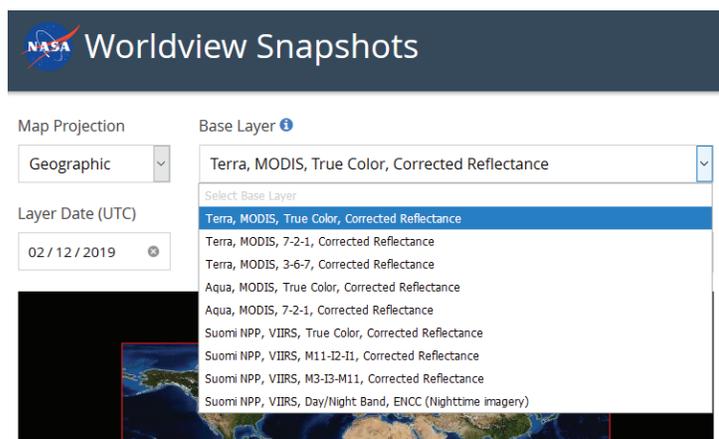
SEDAC is the Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Center (DAAC) responsible for archiving and distributing socioeconomic data in the EOSDIS collection, and is hosted at Columbia University's Center for International Earth Science Information Network (CIESIN). SEDAC synthesizes Earth science and socioeconomic data and information in ways useful to a wide range of decision makers and other applied users, and serves as an "Information Gateway" between the socioeconomic and Earth science data and information domains. ■

*Published on Earthdata website: 3/18/19*

# Introducing Worldview Snapshots

Worldview Snapshots is an easy-to-use application for rapidly producing images from daily MODIS and VIIRS global imagery.

After almost 20 years, the Rapid Response system that was created to display daily satellite images is being retired. The good news is that a new system with greater capability and flexibility for producing these images is taking its place—Worldview Snapshots.



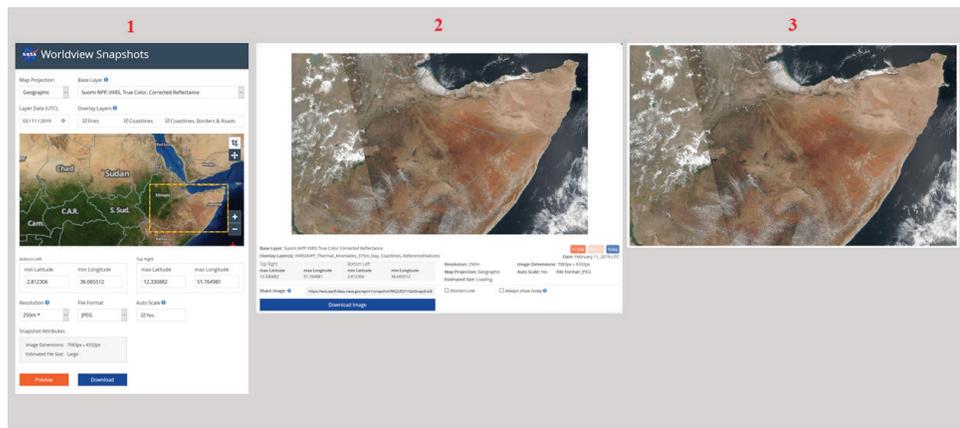
The nine available base layers include MODIS and VIIRS Corrected Reflectance along with several band combinations for highlighting features like snow, ice, and flooding. The VIIRS Day/Night Band enables studies of auroras, urban spread, and even the movement of fishing fleets. NASA EOSDIS/Worldview Snapshots image.

Worldview Snapshots is a lightweight application created by NASA's Earth Science Data and Information System (ESDIS) Project for quickly making satellite images for any location on Earth (including the poles). Users can even configure the application to produce daily images of a specific area of interest, and images can be previewed and adjusted before they are downloaded. Based on the

size of the geographic area selected, Worldview Snapshots even provides a suggested optimal image resolution from a drop-down menu.

Worldview Snapshots offers daily base layers from the [Moderate Resolution Imaging Spectroradiometer](#) (MODIS) instrument aboard NASA's Terra and Aqua Earth observing satellites as well as from the [Visible Infrared Imaging Radiometer Suite](#) (VIIRS) instrument aboard the joint NASA/National Oceanic and Atmospheric Administration (NOAA) Suomi National Polar-orbiting Partnership (Suomi-NPP) satellite. To keep Worldview Snapshots uncluttered and allow for rapid image creation, the application features only nine common MODIS and VIIRS base layers and only three overlays: fires (provided by the [Land, Atmosphere Near real-time Capability for EOS](#) [LANCE] system); coastlines; and coastlines, borders, and roads. If the fire overlay is selected, the fire overlay will be matched with the corresponding base layer. For example, if a Terra MODIS Corrected Reflectance base layer is chosen, the application will use the Terra MODIS Day Fires/Thermal Anomalies overlay.

The ESDIS Project created Worldview Snapshots using the same API that powers the [Worldview](#) data visualization application. In fact, imagery for both Worldview and Worldview Snapshots is provided through NASA's [Global Imagery Browse Services](#) (GIBS). However, while Worldview is designed for in-depth interactive exploration of satellite imagery using more than 800 layers (including the ability to compare imagery from different days and create animated GIFs of imagery covering several days), Worldview Snapshots is designed for the rapid creation of static images based on a limited menu of pre-defined settings. This makes Worldview Snapshots well-suited for users with limited internet bandwidth, such as users



Creating a snapshot is easy! 1. Select a base layer from the dropdown menu and click the box next to any desired overlay layers, then highlight the area to appear in the snapshot. Click the orange "Preview" button to check the image or the blue "Download" button to directly download the image. 2. The preview window provides basic information about the image, including resolution, dimensions in pixels, file format, and estimated size. There also is an opportunity to shorten the image link for sharing. If the image looks good, click the large blue "Download Image" bar. 3. Final image is displayed. At the click of a button, a user also can import their Worldview Snapshots parameters into NASA Worldview to browse full-resolution imagery and add more than 800 additional data layers. NASA EOSDIS/Worldview Snapshots image.

aboard research vessels or conducting research in remote areas. Want to explore a snapshot in more detail? A simple click of a button imports Worldview Snapshots settings into Worldview, where the image can be interactively explored in more detail.

Worldview Snapshots is a logical evolution of the Rapid Response system. When it was created in 2001, Rapid Response was designed to provide images created from Terra MODIS data shortly after a satellite overpass. These static images met the needs of the U.S. Forest Service, the National Interagency Fire Center, and other federal and state users. While lacking the processing and quality assessment required for scientific use, these near real-time images were perfect for monitoring and tracking ongoing events, such as wildfires or storms.

By 2007, Rapid Response had incorporated data and imagery from Aqua MODIS and was producing daily images of pre-defined areas. LANCE was developed in 2009 to deliver data and imagery from instruments aboard numerous Earth observing missions within three hours of a satellite overpass. The advent of global mapping

services like Google Maps created a desire for interactive imagery for any point on Earth, not just the pre-defined Rapid Response images. As a result, an effort to create daily global MODIS imagery was initiated in 2011 along with the development of an application to allow users to interactively explore this imagery. The result was Worldview, which was introduced in December 2011.

The combination of Worldview Snapshots' ability to quickly create images showing any location on Earth and Worldview's ability to enable in-depth interactive exploration of daily global imagery provides users with an unmatched, integrated flexibility to explore the planet using NASA Earth observing data. See for yourself and create some snapshots today! ■



Check out Worldview Snapshots: <https://wvs.earthdata.nasa.gov/>



Worldview Snapshots FAQ Page: <https://earthdata.nasa.gov/faq/worldview-snapshots-faq>

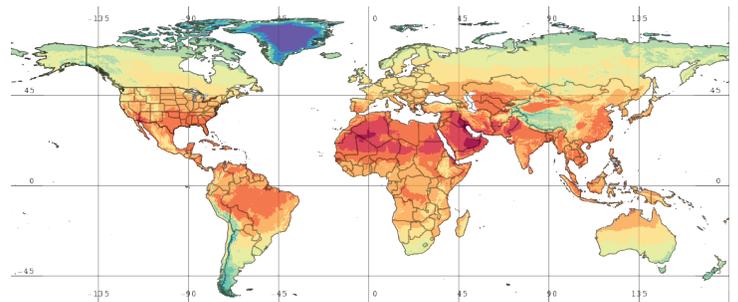
*Published on Earthdata website: 2/28/19*

## New Land Surface Global Data Products at GES DISC

Three new global datasets released by NASA's Land Information System (LIS) will aid in land surface analysis and support famine and drought assessment.

Three new global land surface data sets recently added to NASA's [Goddard Earth Sciences Data and Information Services Center](#) (GES DISC) collection will aid not only in hydrologic, land surface process, and climate analysis, but also provide support for detecting areas susceptible to famine and drought.

The release of the [Famine Early Warning Systems Network](#) (FEWS NET) Land Data Assimilation System (FLDAS) Version 001 global monthly data sets from the Noah Version 3.6.1 Land Surface Model (LSM) includes three new data sets: global monthly data, global monthly climatology data, and global monthly anomaly data. The time range for the global data set is January 1982 to



*Sample image from the monthly climatology dataset generated using Giovanni showing the monthly average of surface air temperature for August calculated as a 35-year monthly average from 1982 to 2016. Colors represent temperature in degrees Kelvin (K). GES DISC image.*

present; the monthly climatology and anomaly data sets are based on a 35-year average (1982 to 2016). All three data sets are available in NetCDF format.

[FLDAS](#) is a custom instance of NASA's [Land Information System](#) (LIS) that has been adapted to work with food security assessment in data-sparse, developing countries. The FLDAS objective is to more effectively use hydroclimatic observations in areas where these observations are limited to support FEWS NET decision-

making. NASA's LIS is a software framework for high performance terrestrial hydrology modeling and data assimilation, developed with the goal of integrating satellite and ground-based observational data products and advanced modeling techniques to produce optimal fields of land surface states and fluxes. LIS is developed and maintained by the [Hydrological Sciences Laboratory](#) at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

FLDAS datasets, including the new data sets, can be discovered and downloaded using the Earth Observing System Data and Information System's (EOSDIS) [Earthdata Search](#) application or the GES DISC's [Hydro HTTPS](#) download system, and can be interactively viewed and analyzed using the GES DISC's [Giovanni](#) application. ■

*Published on Earthdata website: 2/8/19*

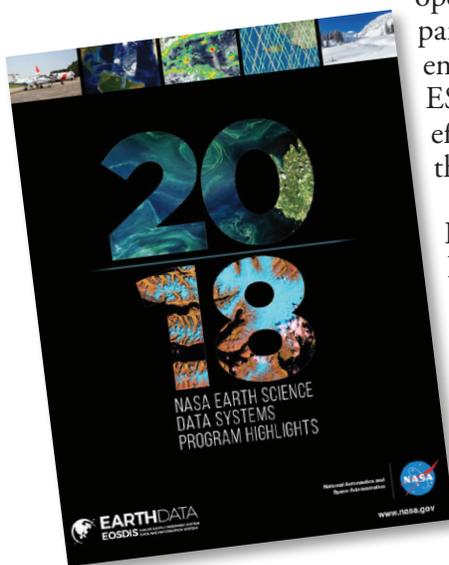
## NASA Earth Science Data System (ESDS) Program Highlights

Read about the many 2018 accomplishments of NASA's ESDS Program.

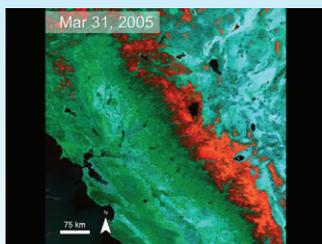
Over the past year, NASA's [Earth Science Data Systems \(ESDS\) Program](#) continued its cutting-edge work developing and enhancing the more than 27.5 PB of Earth observing data in NASA's Earth Observing System Data and Information System (EOSDIS)

collection and the systems that provide these data fully and openly to global data users. Through a combination of competitive awards and strategic investments in open data, international and interagency partnerships, and a set of standards that ensure consistency and interoperability, the ESDS Program is furthering its ongoing efforts to increase the worldwide use of these data.

Read about the many ESDS Program accomplishments over the past year—and about exciting new initiatives and partnerships that the Program is working on—in the [2018 ESDS Program Highlights](#). ■



## SPECIAL FEATURE VIDEOS



### Observing Snowpack in the Sierra Nevada (2000-2019)

The Moderate Resolution Imaging Spectroradiometer (MODIS) sensor is located aboard NASA's Terra and Aqua satellites. This video uses images produced from Terra MODIS

Surface Reflectance data over the Sierra Nevada Mountain Range to show changes in the snowpack from 2000 to 2019. These data are crucial for studying changes that have occurred on the surface of Earth, including during times of drought. [https://youtu.be/ro\\_qgXwPVzI](https://youtu.be/ro_qgXwPVzI)



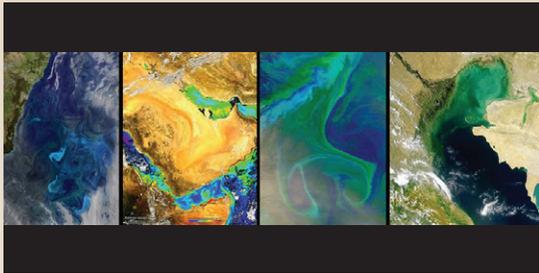
### The Disappearance of Lake Aculeo, Chile (2000-2019)

This video shows images produced from the NASA

Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Precision Terrain Corrected Radiance data over Lake Aculeo, a lake in Chile. Over the years this popular lake has decreased in size due to a lack of rain and now the area that was once occupied by water is composed of dried mud and vegetation. <https://youtu.be/aEi-itbg4bs>



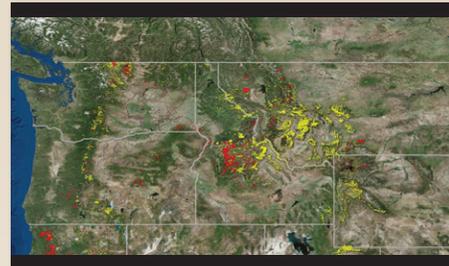
# WEBINARS NASA EARTHDATA



2/6/19

**Discover and Access NASA Ocean Color Data, Services, and Tools**

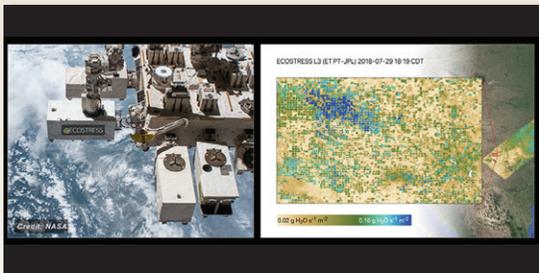
<https://youtu.be/YwDj-bdqZ78>



3/13/19

**Introduction to Geospatial Analysis in R**

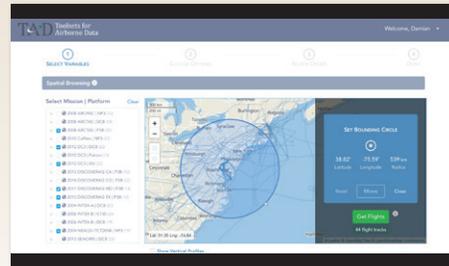
<https://youtu.be/UI5Ly0266fU>



3/28/19

**ECOSTRESS: NASA's Next-Generation Mission to Measure Evapotranspiration from the ISS**

<https://youtu.be/7d1beGfOHPs>



4/30/19

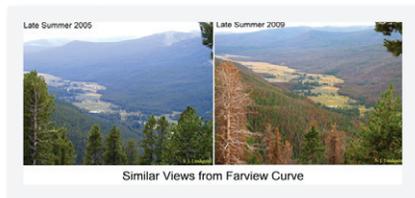
**Modern Website Engineering for STA3CD ("stacked"): Subsetting Tools for Advanced Analysis of Airborne Chemistry Data**

<https://youtube/087LNRRIV2wbe/3df76EZJQnw>



# DATA Recipes

## Learn how to Access ORNL DAAC Data through Web Services



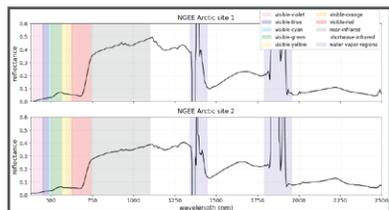
NASA's Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) offers many [tools and services](#) for visualizing and accessing data. The Web services used in this tutorial include:

- [MODIS Web Service](#), a [REST](#) Web service, to access [MODIS Land Products](#)
- [Daymet Single Pixel Tool](#), a REST Web service to access daily weather parameters offered in the [Daymet data product](#) at a single geographic point
- [Spatial Data Access Tools](#) (SDAT) offers [OGC](#)-based [REST](#) Web services to visualize and download spatial data in various user-selected spatial/temporal extents and formats. The SDAT is a general-purpose Web application. It contains 187 archived data products (as of April 2019) in many science disciplines, including agriculture, biosphere, climate, and land surface.
  - [Web Map Service \(WMS\)](#): Get maps (i.e., visualization) of geospatial data from a remote server
  - [Web Coverage Service \(WCS\)](#): Download geospatial data from a remote server

**View Recipe:** <http://bit.ly/2HvYOLL>

**Download additional ORNL DAAC recipes/tutorials:** <https://daac.ornl.gov/resources/learning/>

## How to Process AVIRIS-NG Hyperspectral Imagery from NASA ABoVE using Python



Hyperspectral imagery from the Airborne Visible InfraRed Imaging Spectrometer-Next Generation (AVIRIS-NG) was collected as part of the Arctic-Boreal Vulnerability Experiment (ABoVE) in 2017 and 2018 and archived at the ORNL DAAC. File sizes can be

prohibitively large due to the large number of raster bands. This tutorial shows users some ways to work with these data in Python.

**View recipe:** <http://bit.ly/2JPNbbT>

## ECOSTRESS Swath to Grid Conversion Script



The ECOSTRESS\_ swath2grid.py script converts ECOSTRESS swath data products, stored in Hierarchical Data Format version 5 (HDF5, .h5) into projected GeoTIFFs. When

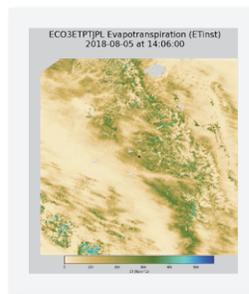
executing this script, a user will submit a desired output projection and input directory containing ECOSTRESS swath data products as command line arguments.

**View Recipe:** <https://go.nasa.gov/2JOUXWC>

This recipe was developed by NASA's Land Processes Distributed Active Archive Center (LP DAAC).

**Download additional LP DAAC recipes/tutorials:** <https://lpdaac.usgs.gov/resources/e-learning/>

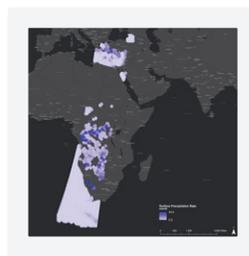
## Working with ECOSTRESS Evapotranspiration Data in Python Jupyter Notebook



The Land Processes Distributed Active Archive Center (LP DAAC) distributes the Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station ([ECOSTRESS](#)) data products. ECOSTRESS products are archived and distributed in the HDF5 file format as swath-based products. In this tutorial, you will use Python to perform a swath to grid conversion to project the swath data on to a grid with a defined coordinate reference system (CRS), compare ECOSTRESS data with ground-based AmeriFlux flux tower observations, and export science dataset (SDS) layers as GeoTIFF files that can be loaded into a GIS and/or Remote Sensing software program.

**View recipe:** <http://bit.ly/2LR3fv0>

## Create a Quickview for Near Real-Time AMSR2 Global Swath Rain Ocean Data using Python and GIS



The Land, Atmosphere Near real-time Capability for EOS (LANCE) Near Real-Time (NRT) AMSR2 Level 2B Global Swath Rain Ocean Data include surface precipitation, wind speed over ocean, water vapor over ocean, and cloud liquid water over ocean retrieved from measurements of the Advanced Microwave Scanning Radiometer 2 (AMSR2) instrument aboard the JAXA Global Change Observation Mission - Water 1 (GCOM-W1). This Python-based data recipe

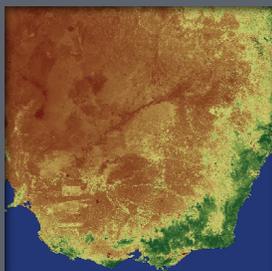
steps the user through code that compiles information from a series of NRT AMSR2 Swath data files and generates a CSV file containing surface precipitation rates with locations to enable use with other software. For this data recipe, the CSV file will be used to plot surface precipitation rates in ESRI ArcMap.

**View Recipe:** <https://go.nasa.gov/2HopTqf>

This recipe was developed by the NASA Global Hydrology Resource Center Distributed Active Archive Center (GHRC DAAC).

**Download additional GHRC DAAC recipes/tutorials:** <https://ghrc.nsstc.nasa.gov/home/data-recipes>

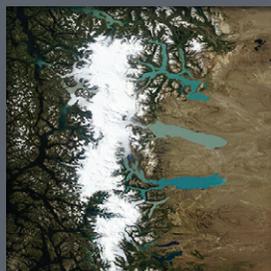
## Latest NASA Earthdata Images



### Monitoring Vegetative Health from Space

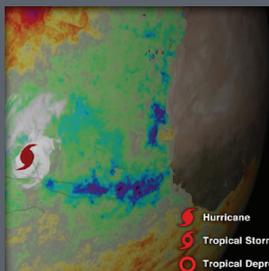
<https://earthdata.nasa.gov/mastheads>

(Published 2/11/19)



### Los Glaciares National Park, Argentina

<https://earthdata.nasa.gov/los-glaciares-national-park-argentina>



### Cold Wake Signatures from 2018 Atlantic Storms

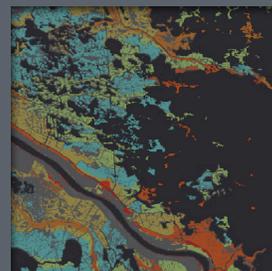
<https://earthdata.nasa.gov/mastheads>

(Published 2/19/19)



### Tropical Cyclone Idai in the Mozambique Channel

<https://earthdata.nasa.gov/tropical-cyclone-idai-in-the-mozambique-channel>



### Sensing Tidal Wetland Soil Carbon Stocks

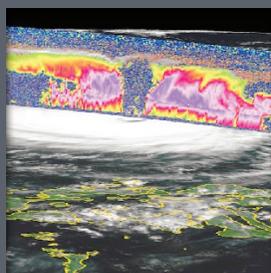
<https://earthdata.nasa.gov/mastheads>

(Published 3/18/19)



### Fires and Smoke in New South Wales, Australia

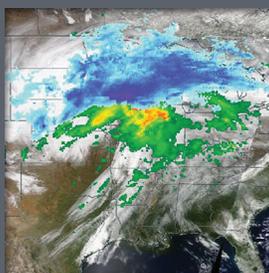
<https://earthdata.nasa.gov/fires-and-smoke-in-new-south-wales-australia>



### Super Typhoon Yutu as Observed by CALIPSO

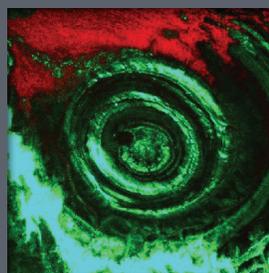
<https://earthdata.nasa.gov/mastheads>

(Published 2/25/19)



### Springtime Storm Moves Across the Central US

<https://earthdata.nasa.gov/springtime-storm-moves-across-the-central-us>



### Sensing the "Eye of the Sahara" with SAR

<https://earthdata.nasa.gov/mastheads>

(Published 4/8/19)



### White Sands National Monument, New Mexico

<https://earthdata.nasa.gov/white-sands-national-monument-new-mexico>

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