## FEATURE ARTICLES

Keeping NASA EOSDIS Data Flowing (Even When the World is Telecommuting)

EOSDIS strategies for processing, archiving, and distributing NASA Earth observing data ensure that data are constantly available to global data users – regardless of world events.

When you turn on a faucet, the expectation is that water will flow and that this flowing water will be in a form useful for activities such as cooking, cleaning, and drinking. The same is true for data. When you search for NASA Earth observing data and imagery using Earthdata Search or NASA Worldview, the expectation is that the data will be readily available and in the forms required for activities such as research, near real-time natural hazard monitoring, and model development.

The sudden shift in mid-March 2020 to telecommuting for almost everyone responsible for processing, archiving, and distributing data in NASA's Earth Observing System Data and Information System (EOSDIS) collection has not stopped the flow of data. In fact, metrics from NASA's Earth Science Data and Information System (ESDIS) Project, which manages Earth observing data in the EOSDIS

Monthly Total Data Distribution by EOSDIS DAACs from Jan 2020 to Jul 2020
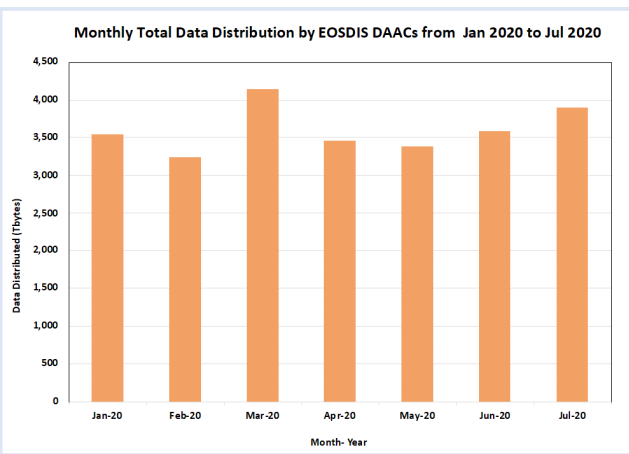
Distribution of data in NASA's EOSDIS collection (shown as terabytes of data distributed) has remained steady even as EOSDIS DAACs located at academic institutions and at NASA and other federal facilities shifted to mandatory telework. The increase in data distributed in March is likely the result of data being downloaded in advance of nationwide and global work restrictions. Table based on NASA ESDIS Project metrics.

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

collection as well as the systems that process, archive, and deliver these data, indicate overall consistency in the total amount of monthly data distributed by the discipline-specific EOSDIS Distributed Active Archive Centers (DAACs).

A look at the strategies used to ensure the steady flow of NASA Earth observing data shows how NASA's EOSDIS is able to meet the challenge of providing data to a data-hungry world (even when much of the world is working from home).

Let's start with the instruments aboard satellites orbiting hundreds of kilometers above Earth. Their function is to collect the raw data and observations about Earth processes that are the basic ingredients for the tens of thousands of EOSDIS data products. Regardless of what is going on at the planet's surface, these instruments continue their job of collecting data 24 hours a day, seven days a week. But an instrument has only limited storage for these data; the data must return to Earth.

Getting the raw data from orbiting sensors to a ground station is accomplished by NASA's Earth Science Mission Operations (ESMO) Project. These vital data transfers have not been impacted by remote work, and ESMO satellite platform operators are continually downlinking data from

Flag outside the building at NASA's Goddard Space Flight Center where the dedicated ESMO mission operations staff work every day downlinking raw satellite data.

satellites to ground stations. As mission-essential personnel, ESMO staff are hard at work at the operations center at NASA's Goddard Space Flight Center in Greenbelt, Maryland. After being downloaded from satellites, data are transferred to teams located at NASA facilities, universities, and other centers of excellence for processing.

Transforming raw sensor data into the multitude of data products required by EOSDIS data users is accomplished by instrument processing teams who continue to maintain a steady flow of data from their processing streams to the appropriate DAACs for distribution. This work is enabled through the use of encrypted virtual private networks (VPNs) that not only provide data security, but also safely enable interaction between processing teams and the DAACs receiving their processed data.

Along with ESDIS, ESMO, and data processing teams, DAACs, too, had to transition to remote operations in March. For DAACs located in large cities with robust internet connectivity, operations quickly shifted off-site, and DAAC staff are securely running programs and monitoring systems using VPNs, cloud services, and other means. For some DAACs, though, transitioning to remote activities was not as simple.

For NASA's Alaska Satellite Facility DAAC (ASF DAAC) located approximately 200 miles south of the Arctic Circle at the University of Alaska Fairbanks (UAF), providing the necessary internet connectivity in private homes was a challenge. "This was the biggest hurdle we had [in the shift to telecommuting]," observes Dr. Nettie La Belle-Hamer, ASF Director and ASF DAAC Manager, via email. "For a place that has very little cell coverage and fiber networks, having a lack of access to the internet is an issue."

NASA's ASF DAAC archives and distributes Synthetic Aperture Radar (SAR) data in the EOSDIS collection, some of which are distributed under international agreements with foreign space agencies. During the first two weeks after UAF closed to the public on March 26, the home work environments of ASF staff were augmented with necessary equipment via a check-out system to help compensate for internet bandwidth or connectivity issues. Currently, DAAC operations are continuing without any outages or slowdowns and data distribution remains consistent.

ASF operations staff, including information technology (IT) staff, still have access to systems located at UAF for

Monthly Total Data Distribution by ASF DAAC from Jan 2020 to Jul 2020
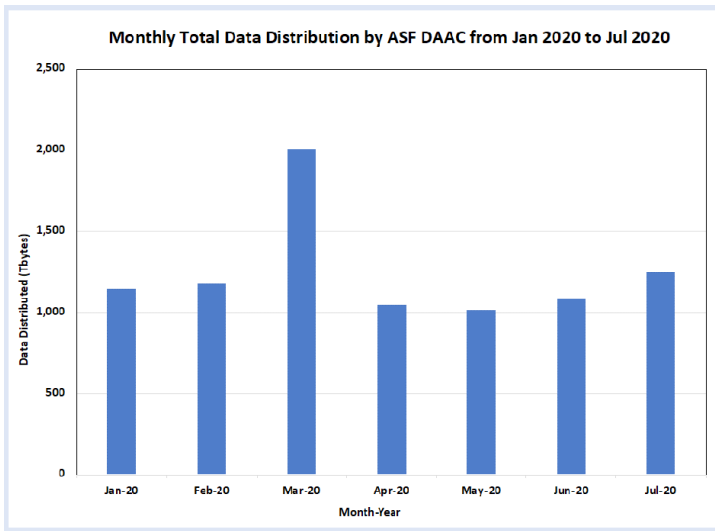
With the exception of a slight increase in March when UAF closed to the public and ASF staff shifted to telecommuting, NASA's ASF DAAC data distribution has remained consistent. Table based on NASA ESDIS Project metrics.

the DAAC and the ASF Ground Station, which is part of the NASA Near Earth Network (NEN). As Dr. La Belle-Hamer notes, for the Ground Station this means daily in-person operations at UAF.

Four-thousand miles east of Fairbanks, NASA's Socioeconomic Data and Applications Center (SEDAC) near New York City has maintained almost all of its operations since mandatory telecommuting began in mid-March. SEDAC is the EOSDIS 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) located in Palisades, NY, on the Hudson River. All online tools and services are operational, and new socioeconomic data are being added to the EOSDIS archive.

Through CIESIN, NASA's SEDAC has a robust IT infrastructure designed to support secure remote access for all staff and provide a flexible virtual environment for development, sustaining engineering, and operations. When staff members had to quickly adjust to remote work, IT staff immediately strengthened the DAAC's VPN capacity and deployed laptops and other devices to improve staff productivity.

One early proactive step, notes Dr. Robert Chen, CIESIN Director and SEDAC Manager, was to install remote environmental monitoring devices in the SEDAC computer and data archive rooms that send out warnings when temperature or humidity exceed specified limits

and enable campus facilities staff to respond to on-site problems rapidly. This system worked exactly as planed on August 8 when the temperature of the SEDAC media archive room increased above 80°F, triggering the remote alarm. Onsite personnel were notified, the air conditioning unit was restarted, and the temperature was brought back to safe operating levels.

Monthly Total Data Distribution by SEDAC from Jan 2020 to Jul 2020
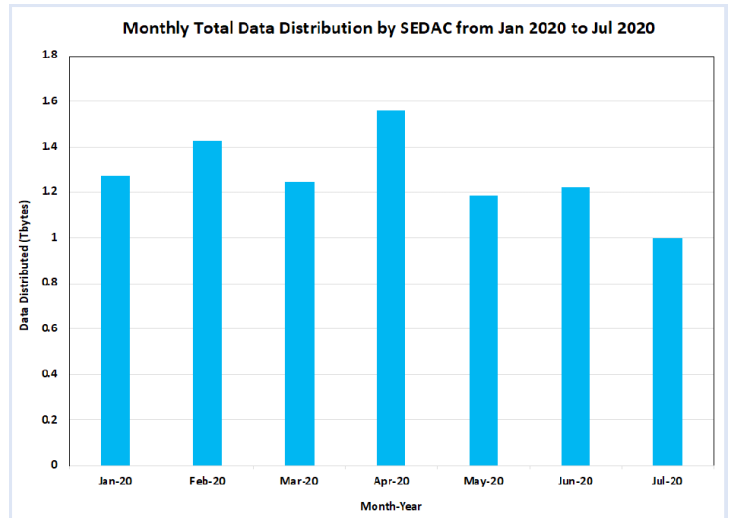
Distribution of EOSDIS data by NASA's SEDAC has remained consistent since the beginning of the year. Table based on NASA ESDIS Project metrics.

As Dr. Chen points out, this is not the first incidence when SEDAC operations were suddenly impacted. The attacks of September 11, 2001, and Superstorm Sandy (October to November 2012) both caused significant long-term disruptions to New York City and the surrounding region, and provided lessons-learned that SEDAC is applying to the current situation. "I think these events caused us to think more carefully about backup, vulnerability, and recovery issues, and the potential for extended periods of disruption," he writes in an email. "We have gradually virtualized most of our systems, which has given us greater flexibility in implementing remote operations and reducing the need for onsite work with physical servers, storage devices, and networks. Virtualizing also enables more seamless and secure access to all organizational resources from any remote location, more reliable back-ups, and faster response to problems."

While VPNs provide secure connections for working with EOSDIS data and moving processed data, there still is a need for real-time interaction between ESDIS Project staff, science teams, and the DAACs. A knock on a door or an inter-office phone call has been replaced with instant messaging tools that facilitate the real-time exchange of ideas or updates. For more involved issues or for team

gatherings, video meeting applications such as Teams and WebEx have proved to be valuable collaboration tools.

These tools, however, are not without their limitations. For example, video conferencing applications use a lot of bandwidth, and can slow down other systems. In addition, they can't compensate for existing issues such as distance – a meeting between teams at the ESDIS Project office in Greenbelt, MD, and ASF DAAC in Fairbanks will always mean coordinating schedules across four time zones.

DAAC help desks are still providing rapid response to user questions. However, the inability of ESDIS and DAAC staff to physically attend numerous science meetings and interact one-on-one with data users at events like the Ecological Society of America Annual Meeting or the American Geophysical Union Fall Meeting (both of which shifted to virtual meetings for 2020) removes a valuable link in the EOSDIS data use chain.

Remote work requirements also are leading to work-arounds for internal office activities. For example, to ensure that software development is not impacted and that requirements continue to be met, staff have mapped requirements to objectives during development sprint periods on quarterly increments. Technical meetings to discuss and evaluate these software and development efforts, such as quarterly Program Increment planning meetings (which are part of the Agile Framework), shifted to virtual meetings. These virtual meetings involve more than 200 programmers across the nation and utilize several virtual collaboration tools to ensure that development, integration, and operations remain on schedule.

This is not to say that these virtual meetings seamlessly take the place of in-person meetings. While in-person planning meetings at Goddard were accomplished in less than three all-day sessions, these virtual meetings require five partial days. Facilitating these large virtual meetings, which include plenary sessions along with numerous breakout sessions, necessitates a great deal of coordination. Out of respect for participating West Coast programmers,

meetings don't start until 11am Eastern Time, and the meeting schedule incorporates many breaks to allow staff time to meet personal needs ranging from managing child care to eating lunch. Even with the extra time needed for these strategies, EOSDIS software teams continue to meet data user needs and development evolution goals.

Overall, ESDIS and DAAC teams have adapted well to the new reality of distributed collaboration, and it's likely that some of these interactions will become more a part of normal operations. In addition, the ongoing trend towards cloud-based services should enable more flexible, distributed operational capabilities.

Both Dr. Chen at NASA's SEDAC and Dr. La Belle-Hamer at NASA's ASF DAAC observe that the responses by their teams to provide a steady, uninterrupted flow of NASA Earth observing data while conducting DAAC operations via telecommuting have strengthened relationships with their respective user communities. "I think users have been appreciative of the continued service provided by all of the EOSDIS DAACs despite the recent challenges," writes Dr. Chen. "In SEDAC's case, there has been a steady increase in the number of new Earthdata users accessing SEDAC, to more than 2,000 per month, on average."

Dr. La Belle-Hamer points out that with everyone working remotely, she and her team understand exactly what their data users are experiencing. "We have had to deal with low bandwidth, no cell overage, old laptops, and long hours with video conferencing," she writes. "Just like our data users – we are in this with them."

Even though those responsible for NASA Earth observing data are working from home offices scattered across thousands of miles, data users can be assured that the availability of NASA Earth observing data is unaffected. In addition, new data, services, and tools are still being developed. These may be challenging times, but NASA's EOSDIS is meeting the challenge. ■

Published August 24, 2020

# An Internship Like No Other

The experience may be different this summer, but almost a dozen interns are helping the ESDIS Project office and EOSDIS DAACs move vital work forward.

Every summer a small meeting room in NASA's Earth Science Data and Information System (ESDIS) Project office becomes a center of activity. The work done in the room represents the future of many ESDIS projects, and the individuals who spend 10 weeks in the room every summer are, in many respects, the future of the ESDIS Project. This room is the work center and home-away-from-home for a majority of the interns supporting the ESDIS Project. At least, this is how it works most summers.

But not this summer. This summer all ESDIS staff are telecommuting, and have been since mid-March. The same is true for staff at all NASA facilities and at universities and other centers of excellence that host or support NASA Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs). Even so, NASA Earth observing data are still being processed, archived, and distributed. And, thanks to interns working from home across the country this summer, vital ESDIS and DAAC projects are moving forward along with important enhancements to systems and software.

Of course, a virtual internship is not the same as an in-person experience, and this poses unique challenges for both interns and their mentors. For interns supporting the ESDIS Project office and the DAACs during the summer of 2020, this is an internship like no other.

"When I received the internship offer, they made clear that this would be a remote internship," says Margaret (Maggie) Zhu in a virtual interview. Maggie, a rising sophomore computer science major at the University of
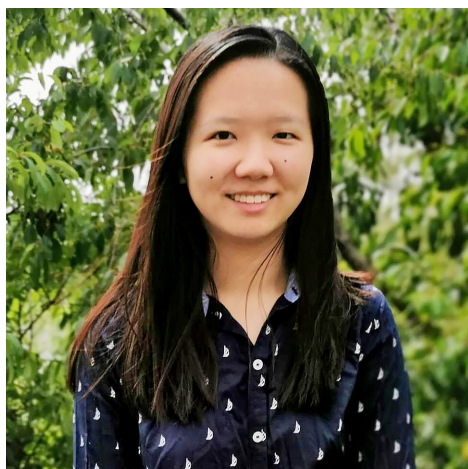
ESDIS Project office summer intern Maggie Zhu, University of Maryland.

Maryland, is supporting the ESDIS Project office this summer. "Not being able to be on the actual NASA campus and being able to physically meet people face-to-face is a bit disappointing. But I'm fine with this. Overall, I was just really excited that I was chosen for this opportunity."

Over her 10-week summer internship, Maggie worked with her mentor, EOSDIS system architect Dr. Christopher Lynnes, to develop a proof of concept for a user interface to make it easier for data users to quickly assess the applicability of datasets in the EOSDIS collection to specific applications, such as flood monitoring or air quality. "This is a good experience for me to put the skills that I've learned in class as a computer science major into practice," Maggie says. "With this internship I'm also exploring some new software-related tools, which is also a really great learning experience."

To help further refine her dataset discovery project, Dr. Lynnes asked Maggie to help design and run a data discovery hackfest at this summer's Earth Science Information Partners (ESIP) Summer Meeting. "The idea is to bring together a number of people within ESIP to work on a proof of concept of usage-based discovery, work on what the user experience should be like for this discovery, and then actually go out and find more of these relationships between applications and datasets," explains Dr. Lynnes. "This will help EOSDIS since a lot of our users are applications users and it can be difficult for them to precisely find the data they need for their particular application."

As Dr. Lynnes notes, the shift to a virtual internship had some unexpected benefits. "We originally had a completely different summer intern project in mind," he says. "When we realized we would not be able to do an in-person internship, we pivoted to this usage-based discovery project that Maggie is working on. This allowed us to open up the scope of Maggie's project to not just the ESDIS Project, but also ESIP."

NASA's highly-competitive Internship Program brings together college and graduate school students (along with recent graduates and qualified high school students) to work on projects at NASA centers and facilities across the nation. Internships are available throughout the year, with summer internships lasting a minimum of 10 weeks and fall and spring internships lasting a minimum of 16 weeks.

Detailed information and an electronic application can be found on the NASA Internships and Fellowships website: https://intern.nasa.gov/.

Another intern supporting the ESDIS Project office this summer, Sara Garcia-Beech, is part of the NASA Pathways Program. Unlike standard NASA internships, which are designed to be short-term opportunities to gain experience supporting NASA tasks, the Pathways Program offers the chance for permanent employment as a NASA civil servant after successful completion of an academic degree and other program requirements. More information about the program is available at https://www.nasa.gov/careers/pathways-program.

Sara, a rising senior computer science major at the University of Maryland, started the Pathways Program this past fall semester working part-time with Flight Software Systems before rotating to work on her ESDIS project this summer.

ESDIS Project office Pathways intern Sara Garcia-Beech, University of Maryland.

Prior to joining the Pathways Program, she did a regular internship in the summer of 2019 working on software for the Joint Polar Satellite System (JPSS). She will continue her work with the ESDIS Project through the end of the year, working part-time during the fall semester while attending classes at Maryland.

This summer Sara developed an application to monitor and provide better security for content on a messaging application called Slack. She also worked on a proof of concept for an Amazon Web Services (AWS) product called Workspaces to support cloud remote access on behalf of ESDIS systems. Both projects make extensive use of her background in cybersecurity. As noted by her mentor, ESDIS computer engineer and security manager

Chris Mishaga, this work is an important piece of enhancing security for ESDIS collaborators and partners. "Slack is the best tool for us to communicate with external partners, but we have to have security built into the tool to make sure we're not sharing files with viruses or distributing information that should not be out in the cloud," he says. "Her AWS Workspace work will help our external collaborators and partners access our environment in a very secure way."

Like Maggie, Sara has mixed feelings about having to work virtually this summer. "On the one hand, I would much rather be in an office interacting with everyone and in the office culture that you don't get when you're doing everything virtually," she says. "At the same time, I'm grateful that I can continue with my work at NASA. I know a lot of people whose work and internships were canceled at the last minute since companies or organizations just didn't have the capability to do things remotely."

As Maggie, Sara, and their mentors are quick to note, working virtually has challenges, especially with communication. For Maggie's daily tag-ups with Dr. Lynnes, they initially used the WebEx conferencing application, but switched to using Slack voice and occasionally pure phone to lower the burden that teleconferencing programs place on computers. They also exchange messages throughout the day via Slack. While this strategy has been effective, both note that this is not a substitute for face-to-face interaction. "I think as good as we've tried to make the virtual experience, there really is no substitute for being able to do this in-person," says Dr. Lynnes.

Sara's mentor Chris Mishaga agrees. "Time management and communications have been the two biggest challenges," he observes. "We've done [virtual meetings], but it's not the same; it's just not. Being able to have those office sidebar conversations, pulling other people in, has been non-existent."

Along with Maggie and Sara, ESDIS Project summer interns are remotely supporting a wide range of projects at EOSDIS DAACs.

2020 EOSDIS Summer Interns

DAAC	Intern	School	School Year	Project
Atmospheric Science Data Center (ASDC)	Meaghan Harrington	Thomas Nelson Community College, Hampton, VA	Completing Geographic Information System (GIS) Technician Certificate	Using data from the Multi-angle Imaging SpectroRadiometer (MISR), Measurements of Pollution in the Troposphere (MOPITT), Tropospheric Emission Spectrometer (TES), and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) instruments to investigate the impact of fires in Sub-Saharan Africa on regional air quality.
ASDC	Jenna Howard	Thomas Nelson Community College, Hampton, VA	Rising Junior	Using data from the MISR, MOPITT, TES, and CALIPSO instruments to investigate the impact of fires in Sub-Saharan Africa on regional air quality.
ASDC	Kathy LaMarsh	D'Youville College, Buffalo, NY	Master's Degree Candidate	Creating user guides for various campaigns along with helping in the creation of sub-orbital story maps.
ASDC	Grace Weaver	New River Community College, Dublin, VA	Rising Sophomore	Using data from the MISR, MOPITT, TES, and CALIPSO instruments to investigate the impact of fires in Sub-Saharan Africa on regional air quality.
ESDIS Project Office	Sara Garcia-Beech (Pathways intern)	University of Maryland, College Park	Rising Senior	Working on a Slack App to monitor and secure messaging content along with developing an Amazon Web Services (AWS) Workspaces Proof of Concept architecture to support cloud remote access on behalf of ESDIS systems.
ESDIS Project Office	Margaret (Maggie) Zhu	University of Maryland, College Park	Rising Sophomore	Developing a proof of concept for Usage-Based Discovery, in concert with the Earth Science Information Partners (ESIP) Discovery Cluster. This consists of finding relationships between data and usage for research or applications, storing them in a graph database, and providing a simple interface to obtain datasets that are used for a particular purpose.
Goddard Earth Sciences Data and Information Services Center (GES DISC)	Abhinav Kumar	Georgia Institute of Technology, Atlanta, GA	Rising Senior	Implementing a machine learning framework using natural language processing.
GES DISC	Lauryn Wu	Harvard University, Cambridge, MA	Rising Sophomore	Implementing a machine learning framework using natural language processing.
Physical Oceanography DAAC (PO.DAAC)	Cassandra Nickles	Northeastern University, Boston, MA	Ph.D. Candidate	Producing resource material for PO.DAAC's Surface Water and Ocean Topography (SWOT) mission page (https://podaac.jpl.nasa.gov/swot), including developing tutorials and data recipes based on cloud services and focused hydrology user needs.
Socioeconomic Data and Applications Center (SEDAC)	Alexandra Hays	Columbia University, New York City	Rising Senior	Working on the upcoming release of the third version of the Urban-Rural Population and Land Area Estimates, which is part of the Low Elevation Coastal Zone (LECZ) data collection. Also assisting in developing Web Map Services for this and other SEDAC data sets.
SEDAC	Serena Killion	Columbia University, New York City	Rising Senior	Analyzing nighttime lights data from the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument and assisting in developing Web Map Services for this and other SEDAC data.

For computer science majors Abhinav Kumar, a rising senior at the Georgia Institute of Technology in Atlanta, and Lauryn Wu, a rising sophomore at Harvard University in Cambridge, Massachusetts, their work this summer supporting NASA's Goddard Earth Sciences Data and Information Services Center (GES DISC) complements their studies and provides the opportunity to explore new applications of their work.

GES DISC is the EOSDIS DAAC that archives and distributes data related to atmospheric composition and dynamics, global precipitation, hydrology, and solar irradiance, and is located at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Abhinav and Lauryn are

working on two aspects of a project based on implementing a machine learning framework using natural language processing (NLP) to make it easier for GES DISC data users to find appropriate datasets.

NASA GES DISC intern Abhinav Kumar, Georgia Institute of Technology.

Abhinav's work focuses on taking various natural disasters, such as hurricanes, tornadoes, and earthquakes, and analyzing various text sources that mention these disasters. This is done by fine tuning a pre-trained NLP model with relevant scientific research papers and Wikipedia articles. The objective is to compile a list of variables or keywords that can help provide a semantic understanding of these disasters. "We can use these lists of words and phrases to connect disasters to the datasets that GES DISC has stored, and allow datasets to be more easily provided to scientists who might need them," he says.

Lauryn's work also is helping to improve results from the GES DISC search engine. After extracting geophysical variables related to user queries, with a specific focus on queries related to wildfires, she created related concept maps to serve as domain models (ontologies) and applied decision trees to provide a better correspondence among the map entities and related variables. "Once these variables are derived, people can use them to return relevant GES DISC datasets," she explains.

Abhinav is a returning GES DISC intern, and was working on the same project this past spring semester. When telecommuting was required starting in mid-March, he not only had to shift his work to a home office, he also had to drive back to his home in Atlanta. "I've definitely never had an experience like that before," he says. "Back in February or early-March, it wasn't mandatory to telework, but it was recommended. I felt, okay, we'll get through this in a couple of weeks. Then it just kept going for longer and longer. Eventually, I just realized that this is what it's going to be. I originally drove up from Atlanta, so I just drove back over a weekend."

Lauryn also was not surprised at the shift to a virtual internship. "I knew the internship was either going to be online or canceled," she recalls. "I was actually relieved to hear that the program was continuing virtually. Switching to a virtual internship made sense given the situation."

For both Lauryn and Abhinav the lack of social interaction is a missing component this summer. "It's not as bad as I thought it would be; most of the work can be done on our home computers," Lauryn

NASA GES DISC intern Lauryn Wu, Harvard University.

says. "Still, this summer lacks the social interaction that you would normally have, like being able to ask your mentors a question and having them be physically available nearby. Also, of course, being able to interact with other interns."

Abhinav agrees with the lack of intern interaction. "One challenge is connecting with other interns," he says. "When I was on-campus, we would have lunch together pretty much every day. There are still ways around this, I guess. We have remote talk sessions, but it's not really the same."

Lauryn and Abhinav's three mentors also are dealing with the challenges of a virtual internship. "One aspect that I really miss by doing this virtually is the chance to talk with them personally, face-to-face," says GES DISC computer engineer/systems engineer Long Pham. "I think the social aspect of the internship is important. Not being able to sit and discuss technical details with the interns or do something as simple as taking them to lunch is tough on everybody."

Dr. Bill Teng, a GES DISC principal scientist, agrees. "Technology helps mitigate this down-side, but it's the best we can do under the circumstances," he says. "We're pretty much restricted to the VPN [virtual private network]."

"I like to work on the whiteboard – face-to-face with the interns – discussing, for example, deep learning algorithms," says GES DISC data scientist Arif Albayrak, Lauryn and Abhinav's third mentor. "Sometimes it's difficult to do everything online. This sort of work and interaction, such as showing our interns our [Earth Observing System] mission centers, just isn't happening this summer."

All three mentors, though, are quick to note the contribution of Lauryn and Abhinav's work to the DAAC.

"Having these interns really helps us move forward," says Dr. Teng. "Ultimately one of our goals is to enable the GES DISC search engine to become a smarter one. Having interns like Abhinav and Lauryn has been really important in keeping the forward motion going."

Back at the ESDIS Project office, Maggie's mentor Dr. Lynnes points out another valuable aspect of work done by the interns. "I often design intern projects so that the interns will be blazing new territory that we have not gotten into – or had the time to get into – at the ESDIS Project," he says. "It's an opportunity to explore new technologies to see what they can offer us. What often happens is that I end up learning as much, sometimes more, than the intern learns from me."

As the ESDIS Project office and EOSDIS DAAC virtual summer internships come to an end, the interns know that their virtual experience likely will continue as they prepare to return to their respective schools. During this unique summer, both interns and their mentors gained valuable

lessons-learned about ways to foster effective communication, support a team whose only interaction is via computer, and maximize the limited resources of a home office.

What is perhaps more important, though, is what is being left behind after an intense summer of work. By coming together virtually, connected only by a computer and a VPN, interns and mentors were able to contribute to the future of NASA's ESDIS Project and make EOSDIS data more usable.

"You know, there's a lot of clout to being able to put on your resume that you worked for NASA," says Sara's mentor Chris Mishaga. "Whether you stay with NASA or not, I guarantee you employers are going to notice that and they're going to respect that. You probably did something there that was meaningful." ■

Published August 10, 2020

Data 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 datasets in each feature.

https://earthdata.nasa.gov/profiles

Dr. Navin Ramankutty

Professor in the School of Public Policy and Global Affairs and the Institute for Resources, Environment, and Sustainability, University of British Columbia, Vancouver, British Columbia, Canada

Approximately one-third of Earth's ice-free land surface is devoted to agriculture and livestock. Dr. Ramankutty uses Earth observing data to help find pathways to more sustainable agricultural practices.

https://go.nasa.gov/36TRBrq

Dr. Paul Siqueira

Professor of Electrical and Computer Engineering, and Co-Director of the Microwave Remote Sensing Laboratory; University of Massachusetts, Amherst, MA

The ability for Synthetic Aperture Radar (SAR) to create high-resolution imagery regardless of atmospheric conditions makes it a key technology for studies of change over time. Dr. Paul Siqueira's work improves these sensors and the Earth observing data they collect.

https://go.nasa.gov/31w3mSu

Dr. Brian Barnes

Research Associate, College of Marine Science, University of South Florida, St. Petersburg, FL

Ocean color data provide key information about ocean health. Dr. Barnes uses these data in his investigations into the health of optically shallow waters.

https://go.nasa.gov/3gfgrW0

ANNOUNCEMENTS

New Global Food Insecurity Dataset at NASA's SEDAC

The dataset provides a picture of food insecurity over a 10-year period, in five global regions.

A new dataset at NASA's Socioeconomic Data and Applications Center (SEDAC) uses food security data from the Famine Early Warning Systems Network (FEWS NET) to identify the level of intensity and frequency of global food insecurity between 2009 and 2019. The dataset also enables the identification of hotspot areas that have experienced consecutive food insecurity events during this period.

Food insecurity is defined by the Food and Agriculture Organization (FAO) of the United Nations as a lack of regular access to enough safe and nutritious food for normal growth and development and an active and healthy life. The Food Insecurity Hotspots Data Set (2009 to 2019)
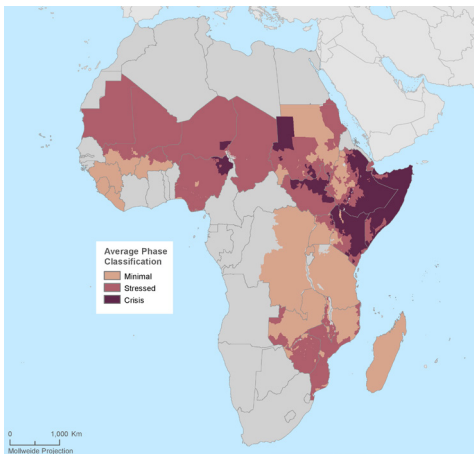
Map from SEDAC's Food Insecurity Hotspots (2009 to 2019) dataset showing the 10-year global average food insecurity phase classification for Africa. Darker colors indicate higher 10-year average phases of food insecurity. Data Source: Center for International Earth Science Information Network (CIESIN) Columbia University. 2020. Food Insecurity Hotspots Data Set. Palisades, NY: NASA SEDAC. https://doi.org/10.7927/cx02-2587. Map Credit: CIESIN Columbia University, June 2020.

(doi:10.7927/cx02-2587) provides gridded data based on subnational food security analysis provided by FEWS NET in five regions: Central America and the Caribbean, Central Asia, East Africa, Southern Africa, and West Africa.

FEWS NET was created in 1985 by the United States Agency for International Development (USAID), and is a leading provider of early warning and analysis on acute food insecurity around the world. NASA was part of the FEWS NET implementing team, and FEWS NET products can be accessed through NASA's Land Information System (LIS). In the SEDAC dataset, 10-year averaged phases of food insecurity are indicated by color, ranging in severity from Minimal and Stressed at the low end to Crisis, Emergency, and Famine at the high end. These phases are based on the Integrated Food Security Phase Classification (IPC), which is a global system for classifying the severity and magnitude of food insecurity and malnutrition, and for identifying its key drivers.

SEDAC is the NASA 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 August 17, 2020

New Saildrone Dataset at NASA's PO.DAAC

Data from the Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC) shed new light on ocean-atmosphere interactions.

Saildrone is a remotely-controlled platform that can be configured with a variety of instruments to collect data

over long distances and relay live data wirelessly to research teams. Between January 17 and March 2, 2020, a fleet of Saildrone unmanned surface vehicles (USVs) plied the Atlantic Ocean waters off the island of Barbados in a joint NASA/NOAA-funded research project. The data collected by these USVs are now available at NASA's Physical Oceanography Distributed Active Archive Center (PO.DAAC) as part of the Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC).

The Saildrone ATOMIC dataset ([doi:10.5067/SDRON-ATOM0](#)) comprises two data files for each of the three NASA-funded Saildrone USVs that were deployed (two additional Saildrones in the deployment were NOAA-funded). One data file contains near-surface observational data (air temperature, sea surface skin and bulk temperatures, salinity, oxygen and chlorophyll-a concentrations, barometric pressure, and wind speed and direction). The second data file has Acoustic Doppler Current Profiler (ADCP) data spanning the entire cruise for each Saildrone.
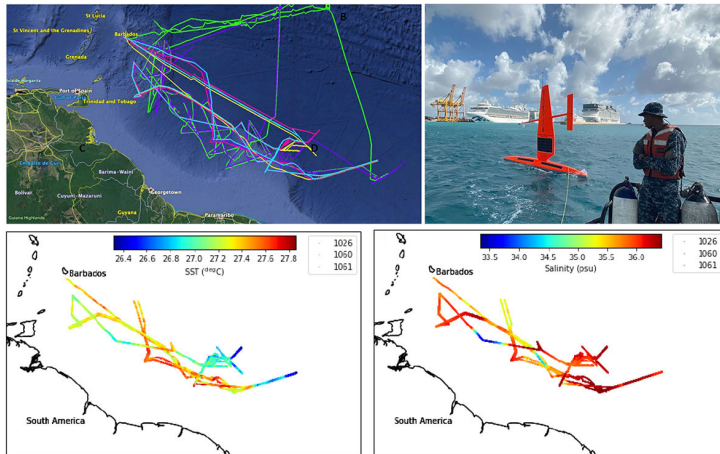
(Upper Left) Survey tracks of the five Saildrone USVs deployed during the ATOMIC field campaign. (Upper Right) Saildrone leaving Barbados. (Lower Left) Along track surface temperature maps for the three NASA Saildrone USVs. (Lower Right) Along track surface salinity maps for the three NASA Saildrone USVs. Image and text courtesy of NASA's PO.DAAC.

The objective of ATOMIC was to acquire data to better understand ocean-atmosphere interactions, particularly over mesoscale ocean eddies. As noted by NOAA's Geophysical Fluid Dynamics Laboratory, mesoscale ocean eddies are common ocean features that are dynamically analogous to atmospheric weather. Their swirling circulation, generally extending about 100 kilometers in diameter or less, is characterized by salinity and temperature differences that enable them to transport properties such as heat, salt, and carbon around the ocean.

Saildrone-acquired data are being used to support NASA satellite calibration/validation and ocean science studies, including the improvement of salinity and sea surface temperature (SST) retrievals at high latitudes and along coasts. Data from four Saildrone field campaigns are available through PO.DAAC, which is responsible for archiving and distributing physical oceanography data in NASA's Earth Observing System Data and Information System (EOSDIS) collection.

The Saildrone Field Campaign Surface and ADCP Measurements for the ATOMIC Project dataset is accessible via the [PO.DAAC data portal](#). Additional information is available on PO.DAAC's [Saildrone Mission page](#). ∎

Published August 19, 2020

Field Campaign Explorer Released at GHRC DAAC

The new Field Campaign Explorer (FCX) at NASA's Global Hydrology Resource Center ([GHRC](#)) Distributed Active Archive Center (DAAC) addresses the challenges of analyzing and visualizing three-dimensional datasets, particularly from airborne field campaigns.

These airborne campaign datasets require a dynamic display to enable the visualization of numerous variable fields available in both two- and three-dimensions. A key feature of the [FCX](#) system is the capability to display coincident data from multiple platforms (i.e., ground-, airborne-, and satellite-based data) on a single application interface.

Discover and access data using FCX:
https://ghrc.earthdata.nasa.gov/fcx/index.html

ORNL DAAC Tool Provides Updated SMAP NEE Data
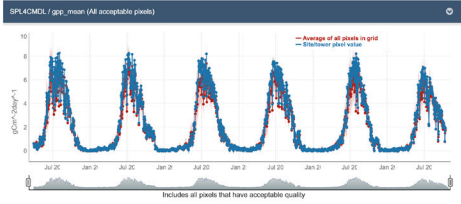
The Oak Ridge National Laboratory (ORNL) DAAC now provides Version 5 of the Soil Moisture Active Passive (SMAP) L4 Global Daily 9 km EASE-Grid Carbon Net Ecosystem Exchange (NEE) (SPL4CMDL) dataset from its Fixed Sites Subsets Tool. The National Snow and Ice Data Center (NSIDC) DAAC is the official archive for SMAP datasets.

Learn more: https://bit.ly/36Et3mu

ASF's ArcGIS Custom Toolbox Updated
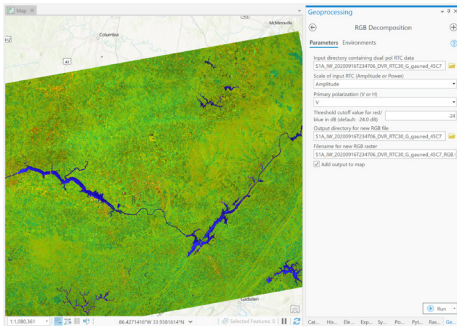
The Alaska Satellite Facility (ASF) DAAC offers a Custom ArcGIS Toolbox that contains tools for performing geoprocessing tasks with Synthetic Aperture Radar (SAR) datasets in either ArcMap or ArcGIS Pro. A new version of the toolbox, which was released in October, includes an RGB Decomposition tool. This new tool generates false-color images from dual-pol Sentinel-1 RTC data to provide an alternative visualization of SAR backscatter values.

Access Custom ArcGIS Toolbox: https://bit.ly/36E3HVK

HIGHLIGHTS: DATA IN ACTION

A Tale of Two Hurricanes in the Gulf of Mexico

https://go.nasa.gov/3IIJXV0
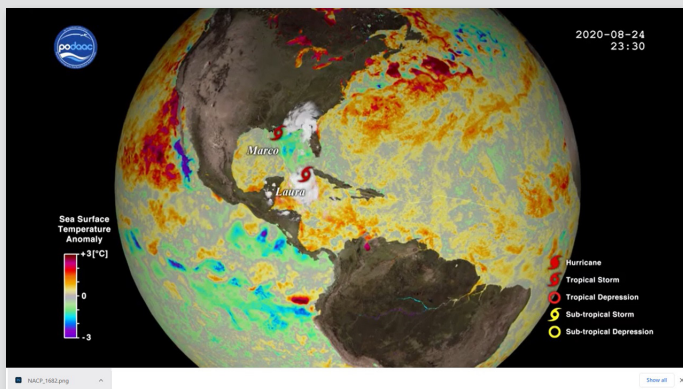
Highlights from the Literature: April to June 2020

https://bit.ly/2JyO7BS
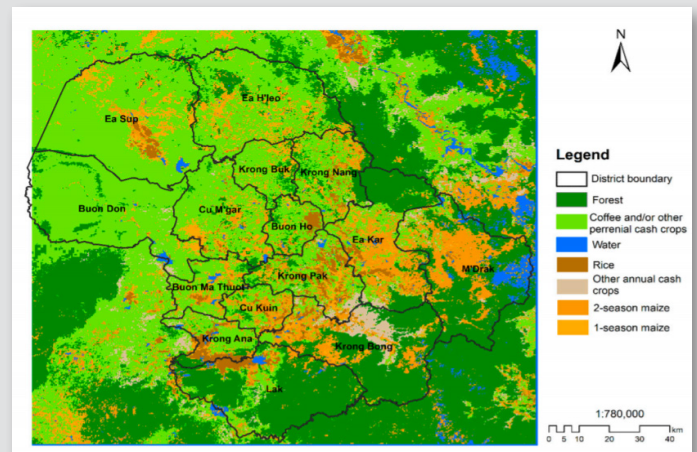
WEBINARS
NASA EARTHDATA

8/4/2020

Introduction to Synthetic Aperture Radar (SAR) Data

▶ https://youtu.be/R_-T0BddWQY

9/23/2020
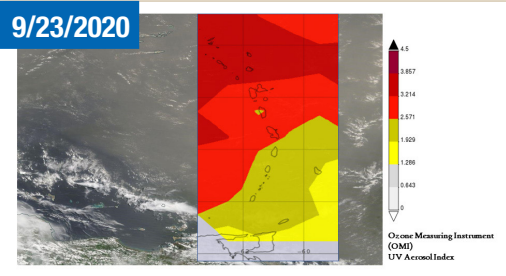
A Clearer View of the Haze – Using NASA GES DISC Data Tools to Examine the June 2020 Sahara Dust Event

▶ https://youtu.be/CwMOF4FzULE

8/6/2020
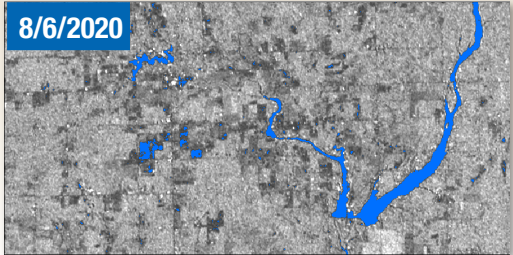
Applications of SAR Data in GIS Environments

▶ https://youtu.be/uNslcJ8wCWA

10/28/2020
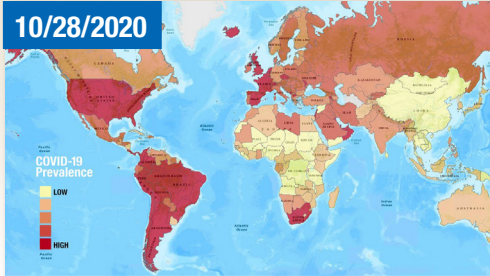
SEDAC's Global COVID-19 Viewer, A User-Friendly Tool for Assessing Trends in Coronavirus Spread

▶ https://youtu.be/ZdEe_uDrEmw

MICRO ARTICLE

Instrument: Water Isotope System for Precipitation and Entrainment Research (WISPER)

WISPER has been deployed to the NASA ORACLES (ObseRvations of Aerosols above CLouds and their intEractionS) and IMPACTS (Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms) field campaigns. Data from these field campaigns are available through the NASA Global Hydrology Resource Center Distributed Active Archive Center (GHRC DAAC)

Read Micro Article: https://go.nasa.gov/3qvT0ME

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.

Earthquakes and Volcanoes
https://go.nasa.gov/2LcXpE6

Floods
https://go.nasa.gov/3m4BEmY
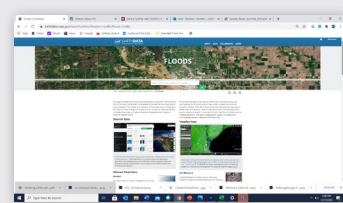
DATA Recipes & Tutorials

New GRACE File Format Conversion Script

A new Python script developed by NASA's Physical Oceanography Distributed Active Archive Center (PO.DAAC) can be used to convert the Jet Propulsion Laboratory (JPL) Gravity Recovery and Climate Experiment (GRACE) Mascon file format from netCDF4 to GeoTIFF file format, and decompose the multi-year monthly Mascon netCDF file into single GeoTIFF files for each month.

Download Recipe: https://github.com/podaac/GRACE

Navigating the New PO.DAAC Web Portal

The new NASA PO.DAAC web portal is content centered, data driven, and provides personalized user experiences that are supplemented with efficient search and discovery capabilities. This new video tutorial provides a tour of the newly revamped portal.

View Tutorial: https://youtu.be/NP4TQuDbDtg

Dataset Search and Discovery at PO.DAAC
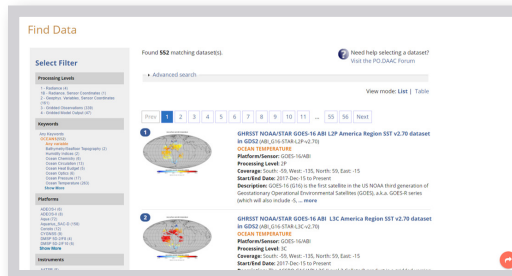
This new tutorial showcases the newly revamped PO.DAAC web portal's dataset search and discovery capabilities– including free text search, faceted search and filtering, and information contained on dataset landing pages.

View tutorial: https://youtu.be/4M5AAsUVV1Q

Identify SAR Image Pairs with ASF DAAC's Baseline Tool
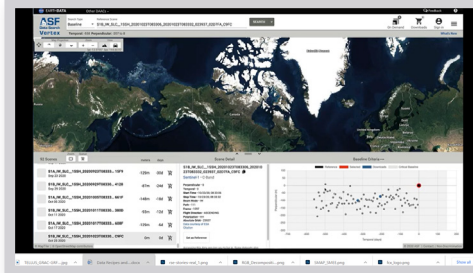
The Alaska Satellite Facility Distributed Active Archive Center (ASF DAAC) Baseline Tool is now integrated directly into the Vertex synthetic aperture radar (SAR) data discovery and data access application. The Baseline Tool helps users identify and select image pairs for generating SAR interferometry (InSAR) by visualizing spatial and temporal baseline information.

View tutorial: https://youtu.be/Xp5bgvi2pEM

Vertex Short Baseline Subset Search Capability
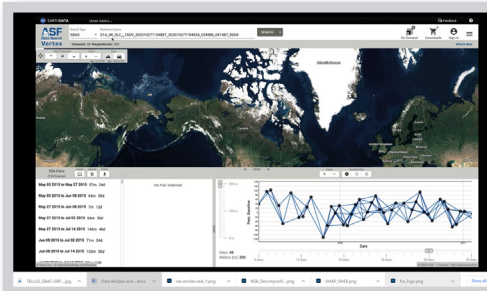
This ASF DAAC tutorial shows users how to perform Short Baseline Subset (SBAS) searches within ASF DAAC's Vertex data discovery and data access tool. The SBAS tool's graphical summary of the temporal and spatial baselines for SAR data helps users select data that can be used to create interferograms for deformation analysis.

View tutorial: https://youtu.be/bQPdtuobdcg

How to Convert GeoTIFFs into netCDF Files
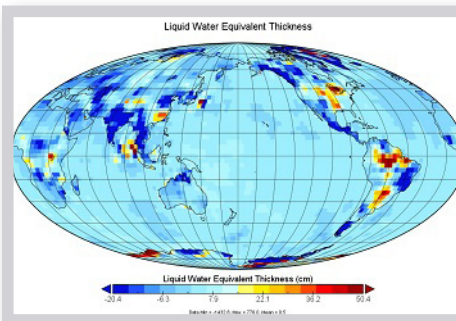
This National Snow and Ice Data Center (NSIDC) DAAC recipe provides step-by-step instructions for converting GeoTIFF files into the netCDF file format using R and Python command line utilities within the Geospatial Data Abstraction Library (GDAL) framework.

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

Decode MODIS and VIIRS Quality Science Datasets using the ArcGIS MODIS-VIIRS Python Toolbox
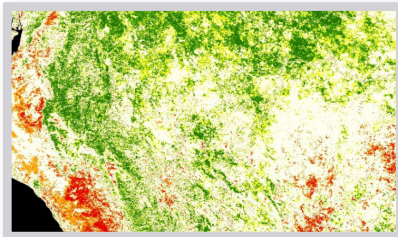
NASA Earth Observation mission data products and their science datasets (SDS) often require additional filtering of contaminated or invalid data values before performing an analysis. A Quality assurance (QA) SDS accompanies data products and provides the information for determining the usability and usefulness of the data. The purpose of the Python Toolbox for ArcGIS is to provide users with a simple and intuitive way to decode Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS) QA SDS' layers; extracting the content stored within the bit-encoded value and saving the information as individual GIS-ready data layers.

View recipe at LP DAAC: https://go.nasa.gov/37wggSa

Access, Process, and Analyze Earth Science Data with AppEEARS

In a set of two tutorials learn how to complete both a point-based, and area based data extraction, explore results and download the contents of these data

queries using the Application for Extracting and Exploring Analysis Ready Samples (AppEEARS) at the NASA LP DAAC.

Access tutorials: https://bit.ly/2JECoSv

## Understanding AVIRIS-NG Data in ENVI Format with Rotate Grid
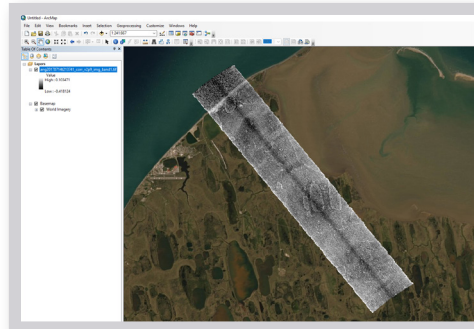
AVIRIS-NG imagery like those collected for the NASA Arctic-Boreal Vulnerability Experiment (ABoVE) field campaign are distributed in ENVI binary image format. ENVI image analysis software representation of a raster grid allows for a rotated grid such that the pixels are not "north-up". This tutorial will walk you through the procedure to transform a rotated grid (the pixel space) to north-up (the geodetic space) while minimizing distortion of the underlying data using GDAL binary utilities.

View recipe at ORNL DAAC: https://bit.ly/3lHL7jU

STORY MAP

Analysis-Ready SAR Data Products Now Available On-Demand at at NASA's ASF DAAC
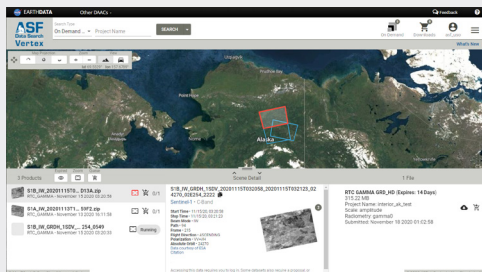
The Alaska Satellite Facility Distributed Active Archive Center (ASF DAAC) now provides a service for applying radiometric terrain correction (RTC) to Sentinel-1 synthetic aperture radar (SAR) imagery. This new service helps solve common SAR processing issues by allowing users to request custom, on-demand SAR processing through the ASF Vertex Data Search application.

Access on-demand service: https://bit.ly/3mCuzLq

DATA PATHFINDERS

Extreme Heat
https://earthdata.nasa.gov/heat

Wildfires
https://earthdata.nasa.gov/wildfires

Landslides
https://earthdata.nasa.gov/landslides

Cyclones
https://earthdata.nasa.gov/cyclones

Floods
https://earthdata.nasa.gov/flood

Fall 2020 NASA Earthdata Images

Arctic Cyclone

https://earthdata.nasa.gov/mastheads
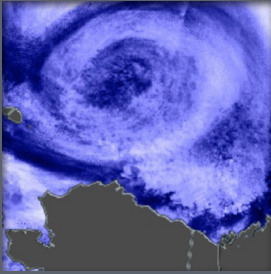
(Published 8/10/20)

Typhoon Maysak

https://go.nasa.gov/36DYhKg
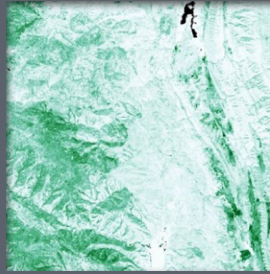
Surface Phenology in Mendocino National Forest

https://earthdata.nasa.gov/mastheads

(Published 8/24/20)
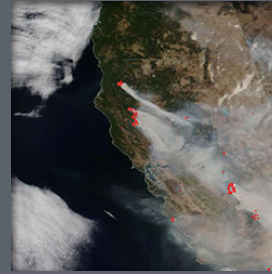
Fires Across the Western USA

https://go.nasa.gov/32brlXa

Iceberg A-68A

https://earthdata.nasa.gov/mastheads
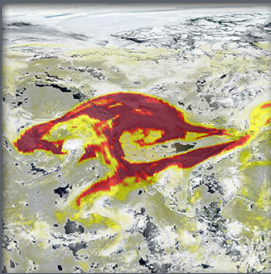
(Published 9/14/2020)

High Aerosol Index over the USA

https://go.nasa.gov/32rtxtO

Lena River Delta

https://earthdata.nasa.gov/mastheads
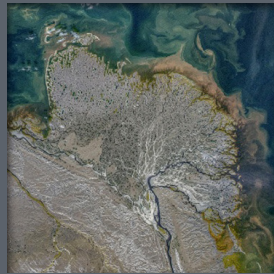
(Published 9/28/20)
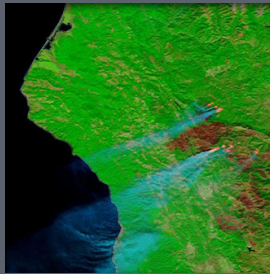
August Complex Fire, California

https://go.nasa.gov/30gcV6P

AirSWOT Water Masks: Yukon Flats Basin, Alaska

https://earthdata.nasa.gov/mastheads

(Published 10/19/2020)
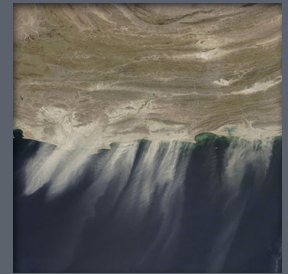
Dust Blowing off the Coast of Pakistan and Iran

https://go.nasa.gov/33GynE0

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