EOSDIS Update

National Aeronautics and Space Administration

SUMMER 2018

Earth Science Data and Information System (ESDIS) Project

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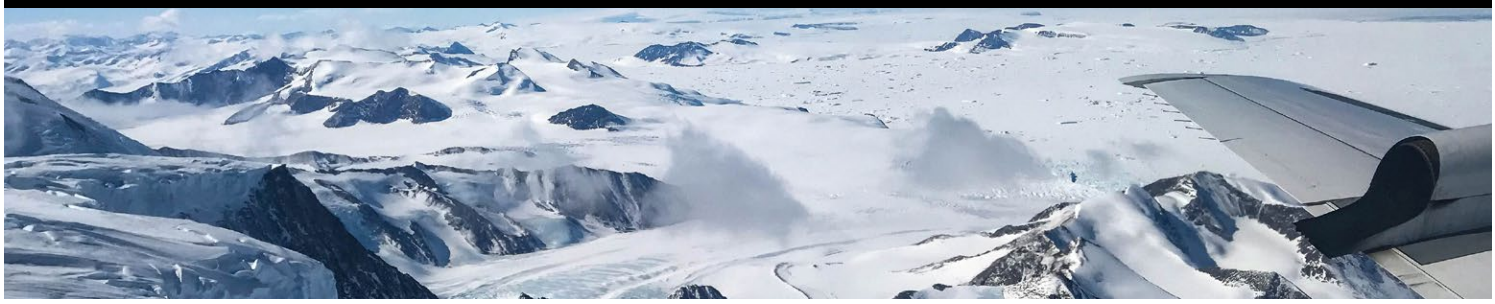
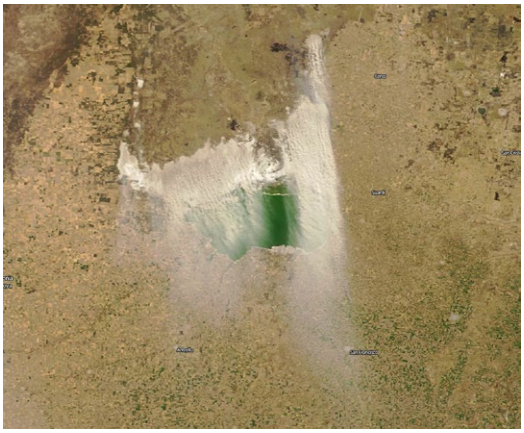


TOP STORIES

Nearly 20 Years of Change at Your Fingertips

Interactively explore your world your way with nearly 20 years of MODIS global imagery and the EOSDIS Worldview satellite imagery exploration tool.

Argentina's Mar Chiquita lake is one of the largest saline lakes in the world. Along with the tremendous variety of resident and migratory bird species in the lake's wetlands, one unique aspect of Mar Chiquita is that its water level is constantly changing. These extreme water level fluctuations affect not only its salinity, but also the amount of dust blowing off the lake as it periodically dries out. For Dr. Santiago Gassó, an Associate Research Scientist with NASA's Goddard Earth Sciences Technology And Research (GESTAR) program and Morgan State University, the lake is a living laboratory for his studies into dust transport—one that is best viewed and studied from great height and with years of observations. In other words, the types of imagery provided by NASA's constellation of Earth observing satellites.



Terra MODIS image of dust blowing off Mar Chiquita on September 10, 2013 (go.nasa.gov/2uGACrz). Image courtesy of NASA Worldview.

"I'm interested in dust coming out of South America," says Dr. Gassó. "For instance, Mar Chiquita shrank significantly in 2008, 2009, and 2010. [Using satellite imagery], I can go and check more than a decade of images and find what days were active, how much dust [was produced], and compare activity to El Niño and La Niña years."

IN THIS ISSUE:

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

Click on image to see 15 years of change at Mar Chiquita. Images courtesy of NASA Worldview.

A valuable resource for Dr. Gassó's studies of Mar Chiquita is imagery from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument aboard NASA's Terra and Aqua Earth observing satellites. Terra launched on December 18, 1999, and was followed by Aqua in 2002. Between them, the two satellites have spent more than 12,000 days in orbit and have amassed a tremendous archive of imagery and data.

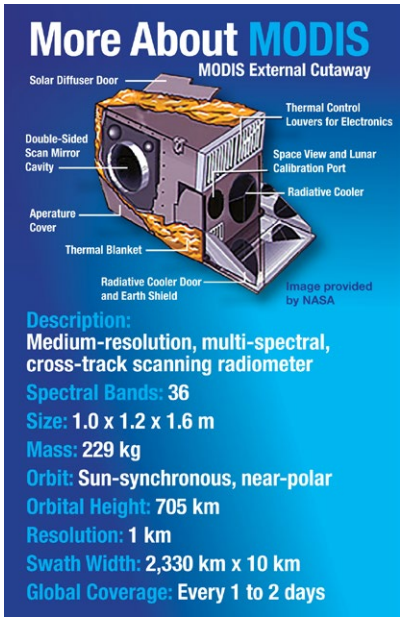
Now, all global MODIS imagery dating back to the operational start of MODIS data collection in 2000 is available through NASA's Global Imagery Browse Services (GIBS). The nearly 20 years of MODIS imagery is the longest continuous daily global satellite observation record of Earth ever compiled. This imagery can be viewed rapidly and interactively using the Earth Observing System Data and Information System's (EOSDIS) Worldview satellite imagery exploration tool.

The availability of all global MODIS imagery in GIBS is the result of more than a half-decade of work involving several NASA teams. "This is the culmination of the work of hundreds of people, scientists and support staff, keeping the satellites healthy to enable us to get these data from MODIS and create these images," says Ryan Boller, the EOSDIS Data Visualization Lead and Worldview Project Owner. "Having all the MODIS imagery available [in GIBS] has been a long-term goal of ours."

GIBS was established by the EOSDIS in 2011 and provides quick access to over 600 satellite imagery products covering every part of the world. Worldview, which was released in December 2011, pulls imagery from GIBS and allows users to interactively overlay these same 600+ Earth observing data products on top of a MODIS global base map from Terra or Aqua and easily create data animations (a daily global base map from data collected by the Visible Infrared Imaging Radiometer Suite [VIIRS] aboard the Suomi National Polar-orbiting Partnership [Suomi-NPP] satellite also is available dating back to November 24, 2015).

Two decades of planetary change are available to explore in NASA's Worldview. Detailed views of volcanoes fuming, hurricanes flooding, dams being built and wildfires sweeping across landscapes are just some of the data accessible. Credits: NASA's Goddard Space Flight Center/ LK Ward

https://svs.gsfc.nasa.gov/12819



The MODIS instrument has a number of attributes that make it popular with researchers. "MODIS is the right balance of coverage, both spatially and in time. It's also the right combination of spectral bands," says Dr. Gassó. "With the two sensors deployed—one on Aqua and the other on Terra—the whole planet is observed many times and at least once over the tropics every day, which is a great benefit. The spatial resolution is about right for detecting general features. If you see a dust plume or a smoke plume [in a MODIS image], you can then see about getting a higher resolution image from, say, Landsat to take a closer look. Worldview makes this easy since you can overlay the Landsat orbital tracks on the MODIS images."

Near real-time data and imagery from the Terra MODIS instrument have been available since 2001 through the EOSDIS Rapid Response system. The static Rapid Response imagery originally was developed to meet the needs of the U.S. Forest Service, the National Interagency Fire Center, and other federal and state users. By 2007, the Rapid Response system had incorporated data and imagery from the Aqua MODIS instrument. As Boller notes, the advent of global mapping services like Google Maps created a desire for interactive imagery for any point on Earth. 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 easily interact with this imagery. "We transitioned from the static imagery of Rapid Response to interactive imagery provided through GIBS for viewing in Worldview," he says.

The first daily global MODIS imagery base maps were available in GIBS for interactive viewing in Worldview in 2012, and daily MODIS base maps have been produced ever since. This effort is a collaboration between the GIBS and Worldview teams and NASA's MODIS Adaptive Processing System (MODAPS).

MODAPS is an operations group that was established prior to the launch of Terra for processing MODIS data. These processed data are sent for archiving and distribution to the EOSDIS Land Processes Distributed Active Archive Center (LP DAAC), National Snow and Ice Data Center DAAC (NSIDC DAAC), Ocean Biology DAAC (OB.DAAC), and Level 1 and Atmosphere Archive and Distribution System DAAC (LAADS DAAC).

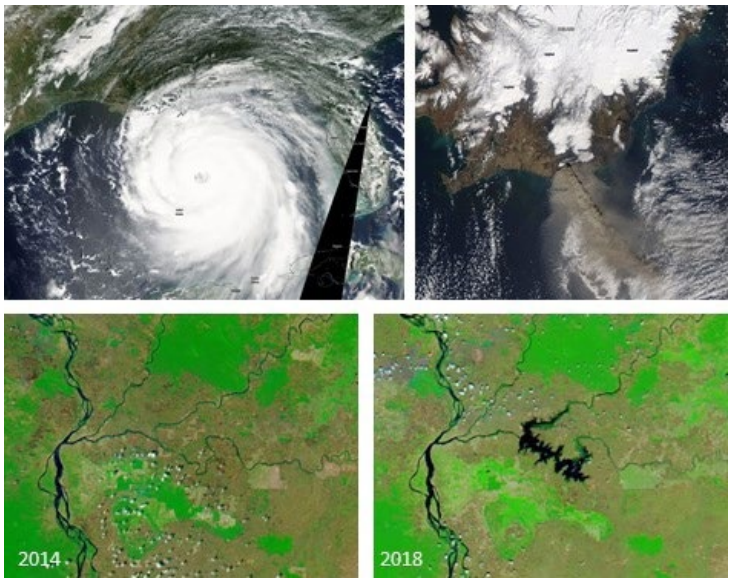
While continuous MODIS global imagery has been available in GIBS from 2012 to the present, there still was a gap in this imagery between the start of the MODIS data record in 2000 and the start of the daily global MODIS base maps in 2012. "Users said to us, 'We know you have the source data available, and we'd like to see it as imagery in Worldview,'" says Boller. The responsibility for processing the missing MODIS imagery for GIBS fell to MODAPS.

For the MODAPS team, filling in the MODIS imagery archive gap was a challenge, especially given the volume of data involved and the processing resources available. According to Kurt Hoffman, the MODIS Lead Operations Analyst at MODAPS, the volume of MODIS data from Terra and Aqua required to produce GIBS imagery for land alone was more than 3,850 terabytes (TB) (the data volume required for processing MODIS atmosphere imagery was much smaller: about 424 TB). After processing, MODAPS sent more than 565 TB of land imagery and about 14.41 TB of atmosphere imagery to GIBS.

From Terra to terabytes (TB)

A "byte" is the amount of storage space required for a single character of type. Moving upward in size is the kilobyte (KB), megabyte (MB), gigabyte (GB), and terabyte (TB). According to the My NASA Data website (https://mynasadata.larc.nasa.gov), 1 TB is equivalent to about 1,000 digital copies of Beethoven's 5th Symphony or all the x-rays in a large hospital. NASA's Hubble Space Telescope generates about 10 TB of new data per year; the total Hubble archive is currently over 150 TB in size.

"At first, we thought it would be about spring 2018 when we would get caught up in processing all the MODIS imagery," Hoffman says. "We got lucky during this processing when an extra machine was freed up. We were able to use this extra machine and double down on the processing. In fact, we were able to squeeze in a third machine in the last month. Using these three machines enabled us to [process more data and] meet the pie-in-the-sky goal of finishing this processing in early December [2017]."



Use MODIS imagery and Worldview to explore events like Hurricane Katrina (upper left; Terra/MODIS; August 28, 2005), the eruption of Iceland's Eyjafjallajökull Volcano (upper right; Aqua/MODIS; April 17, 2010), and the effects of human-caused change, such as the impact of the Lower Sesan 2 Dam in Cambodia (lower image; false color, Aqua/MODIS, 2014 and 2018). Images courtesy of NASA Worldview.

Even after MODAPS finished processing the imagery, the data still had to be added to the GIBS collection. "Just ingesting the MODIS data took [the GIBS team] an extra month, and then they had to do an analysis and assessment of the data," says Hoffman. "There are still a few small imagery gaps that we're working on, but it's just one image here, one image there."

As Dr. Gassó notes, the ability to have an easily accessible historical perspective dating back almost two decades greatly facilitates research. "[Back] in the 80s and 90s, if you wanted to look at, say, clouds off the coast of California, you would have to figure out the time of year when it was best to look at these clouds, then place a data request for a specific window of days when you thought the satellite overflew the area," he says. "You would get a physical tape with these images and have to put this into the processing system. Only then would you know if the image was usable. This process used to take from days to weeks. Now, you can look at images for days, weeks, and even years in a matter of minutes in Worldview, immediately find the images you need, and download them for use. It's fantastic!"

For the MODAPS, GIBS, and Worldview teams, the completion of this effort gives MODIS users access to a tremendous resource that enables studies into our changing planet reaching back almost 20 years, including the effects of urbanization, historic storms and natural events, and, of course, ongoing changes to Mar Chiquita. "This is really an impressive chunk of data considering the wide range of research scientists can use these data for," says Hoffman.

Boller agrees and acknowledges that finally having all daily global MODIS imagery in GIBS is the fulfillment of a long-standing desire—the MODIS past finally reaching the present. "It has been rewarding to see how excited our users are when we release new imagery or extend the imagery timeline back another few years," he says. "Now, to be able to go from the very start, the very first image, to the present and move forward provides a sense of completeness and the potential for new discoveries."

See for yourself, and use Worldview to see your world your way by interactively exploring almost 20 years of change as observed by MODIS. ■

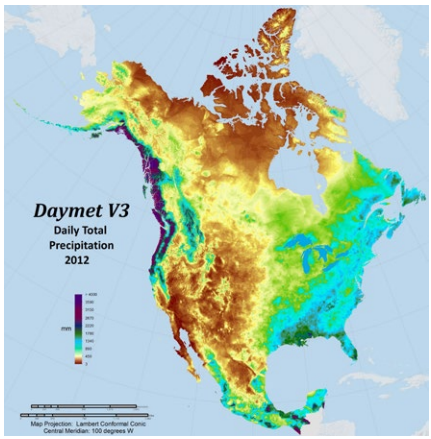
Daymet Data Take the Planet's Pulse

Daymet data from NASA's Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) provide almost 40 years of weather measurements for North America and are ORNL DAAC's most popular products.

Kim Askey, Oak Ridge National Laboratory (ORNL) Communications

As temperatures change, snow melts, and days grow longer across North America, a network of sensors captures these vital data, measuring key weather metrics that inform scientific endeavors from wildlife biology to crop studies to modeling future environmental change. Scientists at NASA's Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) translate these raw meteorological statistics into an easy-to-use dataset known as Daymet.

Daymet provides seven daily weather parameters for the continent, from Mexico to Canada and Hawaii to Puerto Rico. The data combine temperature and precipitation measurements from 20,000 National Oceanic and Atmospheric Administration (NOAA) stations with modeled values for snowmelt, vapor pressure, day length, and shortwave radiation. With detail available for every square kilometer of the continent, this makes for a dataset



Daymet data include daily precipitation totals for North America (including Hawaii and Puerto Rico). Other daily Daymet weather parameters include continuous surfaces of minimum and maximum temperature, humidity, shortwave radiation, snow water equivalent, and day length. Image courtesy of ORNL DAAC.

of approximately 500 million data points for each year in the series.

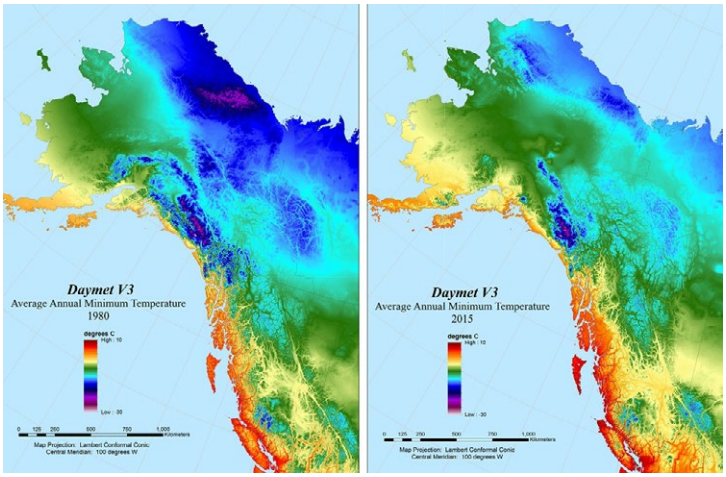
Data this big would be challenging to use if not for the efforts of the ORNL DAAC experts. ORNL DAAC is part of NASA's Earth Observing System Data and Information System (EOSDIS) and is responsible for archiving and distributing NASA Earth observing data related to biogeochemical dynamics, ecological data, and environmental processes.

ORNL DAAC recently extended the Daymet data through the year 2017 to create a 37-year time series of weather measurements for the North American continent. "These data fuel a lot of great science," says Michele Thornton, ORNL DAAC Daymet Project Lead. "With support from NASA, we've made this foundational information accessible in ways that save the research community significant processing time so scientists can focus efforts on discoveries in their field."

Daymet is supported by NASA through the Earth Science Data and Information System (ESDIS) Project, which manages EOSDIS science systems (including the DAACs), as well as through NASA's Terrestrial Ecology Program. The continued development of the Daymet algorithm and processing is also supported by the Office of Biological and Environmental Research within the Department of Energy's (DOE's) Office of Science.

At ORNL DAAC, Daymet Project Lead Thornton leverages several types of coding, algorithms developed by NASA, and her own background in Geographic Information System mapping to translate the raw Daymet binary data into standard data products that have the extensive processing, quality assurance, and validation necessary for use in scientific research. She led the charge in 2013 to make Daymet available on the web and continues to work with a team of ORNL DAAC developers to create new functionality for users. As ORNL DAAC Chief Scientist Dr. Alison Boyer notes, "Making scientific data accessible and transparent is the driving force behind our work."

With the heavy lifting taken care of by ORNL DAAC, Daymet users can select the information they need through a variety of tools, including the single pixel tool that allows users to pick locations of interest on a map and annual climatologies that provide yearly averages for



Daymet climatologies make it easy to compare metrics, such as this comparison of average annual minimum temperatures for 1980 (left image) and 2015 (right image) for Alaska and Western Canada. Image courtesy of ORNL DAAC.

each variable. A variety of data file formats are available to facilitate use in applications ranging from spreadsheets to modeling software to high-performance computing.

This ease of use, paired with the vital nature of the data, has made Daymet the most popular data collection in the ORNL DAAC archive. During Fiscal Year 2017, over 75.5 terabytes worth of Daymet products were distributed to worldwide data users, according to EOSDIS metrics.

With more than 200 scientific publications citing Daymet in the last five years, this rich data resource has become vital to many fields of study.

The United States Geological Survey (USGS) is one of the biggest users of Daymet. The USGS user community is focused on factors affecting water quality and availability, such as stream flows, groundwater levels, and reservoir stocks. To support the needs of this community, the USGS folds Daymet statistics in with other USGS datasets to create hydrologic summaries that are available through the USGS Geodata Portal. In addition, scientists studying the Alaskan tundra as part of the DOE's Next-Generation Ecosystem Experiments are using Daymet data to complement their extensive onsite observations as they gain insights about the permafrost landscape and improve models of environmental change.

Due to its ease of use and depth of detail, citizen scientists across the United States also are using Daymet data as part of an initiative called Nature's Notebook, which encourages participants to track the seasonal changes

in plants and animals in their own neighborhoods. A project of the National Phenology Network, Nature's Notebook offers a visualization tool that combines Daymet temperature and precipitation data with member phenology records to track and visualize patterns in seasonal changes.

The widespread scientific adoption of Daymet is further enabled by the availability of community-developed scientific software. These include the "daymetr" and "daymetpy" packages developed by Dr. Koen Hufkens at the Computational & Applied Vegetation Ecology Lab at Ghent University, Belgium. These tools provide a programmatic interface to Daymet directly from R or Python workspaces.

Like all NASA data, Daymet products are fully and openly available to worldwide data users, and ORNL DAAC provides a series of tutorials to help users get started using Daymet in research applications. User feedback also is important and is used to further develop Daymet products and algorithms. "We want to know how scientists are using Daymet data, and what additional features will benefit their work," says Daymet Project Lead Thornton.

Experience Daymet for yourself and begin exploring the pulse of the planet! ■

NASA's EOSDIS and the International Council for Science (ICSU) World Data System (WDS)

Through a shared objective of ensuring the free and open availability of Earth science data, NASA and the WDS are working together to improve international data stewardship, archiving, and use.

H. K. (Rama) Ramapriyan, Science Systems and Applications, Inc. & ESDIS Project, NASA Goddard Space Flight Center

NASA established its free and open Earth science data and information policy in the early 1990's, and the Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs) conform to this policy. EOSDIS data usage metrics illustrate the benefits of making NASA data openly available to the public and show a rapid growth in data distribution to a worldwide community of data users. In fact, each year since 2014 the EOSDIS has distributed over one billion data files of products from satellite, aircraft, and *in situ* observations.

Over the last two decades, many other organizations around the world also have adopted open data policies. NASA's Earth Science Data and Information System (ESDIS) Project, which manages the EOSDIS data systems, participates as a member in several national and international data systems communities, all of which promote openness in data sharing.

Notable among these data system communities is the International Council for Science (ICSU) World Data System (WDS). The ICSU, which was founded in 1931 and is headquartered in Paris, France, is devoted to international cooperation in the advancement of science. The ICSU established a set of World Data Centers to archive and distribute data collected from the observational programs of the 1957-1958 International Geophysical Year. All data held in the World Data Centers were available to users for the cost of reproduction and fulfilling their requests. Over time, the World Data Centers broadened their coverage of scientific disciplines and expanded to include 52 centers in 12 countries.

In 2009, the ICSU replaced the existing, stand-alone World Data Centers with the unified World Data System (WDS). The WDS is a common globally interoperable distributed data system incorporating emerging technologies and new scientific data activities. The objectives of the WDS are to:

- Enable universal and equitable access to quality-assured scientific data, data services, products, and information;
- Ensure long-term data stewardship;

- Foster compliance to agreed-upon data standards and conventions; and
- Provide mechanisms to facilitate and improve access to data and data products.

These objectives mirror those of the EOSDIS, and the NASA Advisory Committee recommended in 2012 that the ESDIS Project and the DAACs should become members of the WDS.

There are four types of WDS membership – Regular, Network, Partner, and Associate. Of these, Regular and Network memberships are most applicable to the ESDIS Project and the DAACs. *Regular Members* are organizations that are data stewards and/or data analysis services. These include data centers and services that support scientific research by holding and providing data or data products (such as the EOSDIS DAACs). *Network Members* are umbrella bodies representing groups of data stewardship organizations and/or data analysis services (such as the ESDIS Project). As of August 14, 2018, the WDS comprises 113 worldwide member organizations, with 73 Regular Members and 11 Network Members.

Organizations become WDS members by going through a formal application process that includes submission of a letter of intent and a formal application, a response to review questions posed by the WDS Scientific Committee, and the signing of a Letter of Agreement between the applicant organization and the WDS.

An updated application process for WDS Regular Members now entails a self-evaluation through a new international organization called CoreTrustSeal. Certification under CoreTrustSeal requires organizations petitioning for WDS Regular Membership to review their end-to-end data management processes in the context of relevant international standards and best practices, a review by the CoreTrustSeal board (which includes members of the WDS Scientific Committee), certification by CoreTrustSeal, and a Letter of Agreement between the applicant organization and the WDS.

The ESDIS Project became a WDS Network Member in 2012 and is actively involved in WDS activities. In addition, 10 of the 12 EOSDIS DAACs are WDS Regular Members (the exceptions being the Physical Oceanography DAAC [PO.DAAC] and the Level 1 and Atmosphere Archive and Distribution System [LAADS DAAC]). LAADS DAAC is in the process of becoming a WDS Regular Member.

The EOSDIS DAACs also are represented on the WDS Scientific Committee. The deputy manager of the EOSDIS Socioeconomic Data and Applications Center (SEDAC), Dr. Alex de Sherbinin, has served as an elected member of the WDS Scientific Committee since 2015, a term that has been renewed in 2018. As the WDS governing body, the Scientific Committee develops and prioritizes plans for the WDS, guides the implementation of these plans, and publicizes the results.

Membership in the WDS provides numerous benefits for member organizations, many of which complement EOSDIS goals and objectives. These general member benefits and their application to the EOSDIS and the DAACs include:

- ***Demonstrated commitment to open science*** – Since its establishment in 1958, NASA has been a pioneer in its commitment to open science. This commitment is clearly stated in the agency's free and open data and information policy for Earth science that has existed since the beginning of the Earth Observing System (EOS) Program in 1990. This is commensurate with the WDS Data Sharing Principles. Continuing to affirm this commitment through recognized international scientific organizations such as the WDS provides assurance to the worldwide scientific community that NASA remains fully committed to open data sharing, even when governments may place restrictions on direct bilateral scientific interactions. Further, this commitment affords the EOSDIS DAACs additional opportunities to engage with other science data systems and archives outside of their current discipline-oriented connections. This could be especially beneficial to an EOSDIS that must engage in more international interactions and data reciprocity than has been done in previous decades. For newer members of the WDS, signing up to these WDS principles demonstrates their commitment to open science and offers a greater short-term benefit than it does to the EOSDIS. The WDS website publicizes its members with brief introductions and pointers to their respective websites. Additionally, obtaining certification as a trusted data repository permits members to display the WDS (or CoreTrustSeal) logo on their websites.

- ***Certification as a trusted digital repository*** – Many data users, especially in the private sector, are increasingly interested in identifying "trusted" data sources that they can depend on under emergency conditions or when legal liability may be an issue. Additionally, certification as a trusted digital repository is potentially an important factor in a decision to use or not use a particular data source. In light of the rapid increase in the variety and volume of Earth observation data from both public and private sources, the peer review process provided by the WDS CoreTrustSeal certification (and the requirement for recertification every three years) may be valuable in further assuring EOSDIS data users of the long-term integrity, quality, reliability, accessibility, transparency, and usability of EOSDIS data.

- ***Increased performance and agility*** – For organizations without the strong infrastructure enjoyed by the EOSDIS, the ability to include their data holdings in the WDS catalog is a significant benefit. For the EOSDIS, if the metadata querying interfaces between the WDS catalog and the EOSDIS Common Metadata Repository (CMR) are fully implemented, an even broader community visibility could be realized. Collaborations and exchange of information about best practices at venues such as the annual WDS and Committee on Data (CODATA) of the International Council for Science (ICSU) SciDataCon meetings as well as regular webinars hosted by the WDS are an additional benefit. These interactions enable the EOSDIS, the ESDIS Project, and member DAACs to learn about new data science and data management approaches and improve interoperability with peer data networks, centers, and services around the world. For example, the WDS and other international scientific groups are promoting data citations and the use of Digital Object Identifiers (DOIs) for data and data sets, as is the EOSDIS. These efforts are expected to facilitate a broader and more consistent use of data citations in publications and applications across disciplines as well as internationally. The WDS CoreTrustSeal certification/recertification process itself may be valuable in requiring EOSDIS DAACs to periodically review their end-to-end data management processes in the context of relevant international standards and best practices. This, in turn, should lead to improved data quality and documentation, expanded capabilities and interoperability, and increased efficiency and usability. As with other peer-review processes in science, regular peer review of data center processes and management is likely to benefit both reviewees and reviewers.

- ***The WDS Data Stewardship Award*** – Each year, the WDS solicits nominations for the organization's Data Stewardship Award. This award highlights "exceptional contributions to the improvement of scientific data stewardship by early career researchers through their (1) engagement with the community, (2) academic achievements, and (3) innovations." The award provides early-career staff in WDS member organizations significant visibility in the international community, and award winners are invited to present at WDS conferences and are provided travel support to attend WDS international meetings. The 2015 award recipient, Dr. Yaxing Wei, is a geospatial information scientist at the EOSDIS Oak Ridge National Laboratory (ORNL) DAAC and made a presentation to the plenary session of the WDS SciDataCon 2016 meeting in Denver, CO, USA.

- ***Opportunities for interaction with WDS members through international meetings*** – The WDS Scientific Committee organizes biennial meetings of WDS members, generally in concert with ICSU CODATA scientific conferences. These meetings provide an opportunity to interact and exchange ideas with data managers from around the world and cover a wide variety of scientific disciplines. The ESDIS Project and EOSDIS DAACs have participated in these conferences since 2014. The next WDS members' meeting will be held in conjunction with International Data Week (November 5-8, 2018), and takes place in Gaborone, Botswana.

As an early adopter of a free and open data policy, NASA's Earth Science Data System (ESDS) Program, including the EOSDIS, the ESDIS Project, and the individual EOSDIS DAACs, shares a common set of objectives with the WDS. Through its active participation on the WDS Scientific Committee and in WDS initiatives, the EOSDIS and the DAACs are helping ensure not only the proper archiving of Earth science data, but also fostering sound data management strategies. The result is better Earth science data that are scientifically reliable and more easily available to an ever-growing worldwide data user community. ■

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://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles

Dr. Pinki Mondal

Who uses NASA Earth science data? Dr. Pinki Mondal, to study the effects of climate change on agricultural systems and communities.

Dr. Pinki Mondal, Senior Research Associate, Center for International Earth Science Information Network (CIESIN), Columbia University, Palisades, NY (Note: Starting in August 2018 Dr. Mondal will be an Assistant Professor, Department of Geography, University of Delaware, Newark, DE)

Research interests: Human-environment interactions with a specific focus on the sustainability of agricultural ecosystems, agricultural sensitivity to climate variability, adaptation strategies for smallholder farms, and the effects of national-level policies on forestry and conservation.

Dr. Pinki Mondal in her CIESIN office. On the computer screen is a map showing trends in MODIS Normalized Difference Vegetation Index (NDVI) for the 2000-2016 wet season/ monsoon in South Asia/India. Image by Dr. Chandranath Basak.

https://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles/user-profile-dr-pinki-mondal

Dr. Róisín Commane

Who uses NASA Earth science data? Dr. Róisín Commane, to study the effects of terrestrial pollution on the atmosphere's chemical composition.

Dr. Róisín Commane, Research Associate, Harvard School of Engineering and Applied Sciences, Cambridge, MA (Note: Starting in July 2018 Dr. Commane will be an Assistant Professor, Columbia University, New York, NY, and affiliated with Columbia University's Lamont-Doherty Earth Observatory)

Research interests: Using airborne gas concentration data, atmospheric transport models, and ecosystem models to understand surface processes affecting atmospheric chemistry. This includes measuring carbon dioxide (CO_2) and methane (CH_4) from Arctic ecosystems and measuring continental pollution (from, for example, fires and aerosols) over remote oceans.

https://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles/user-profile-dr-roisin-commane

Dr. Larry O'Neill

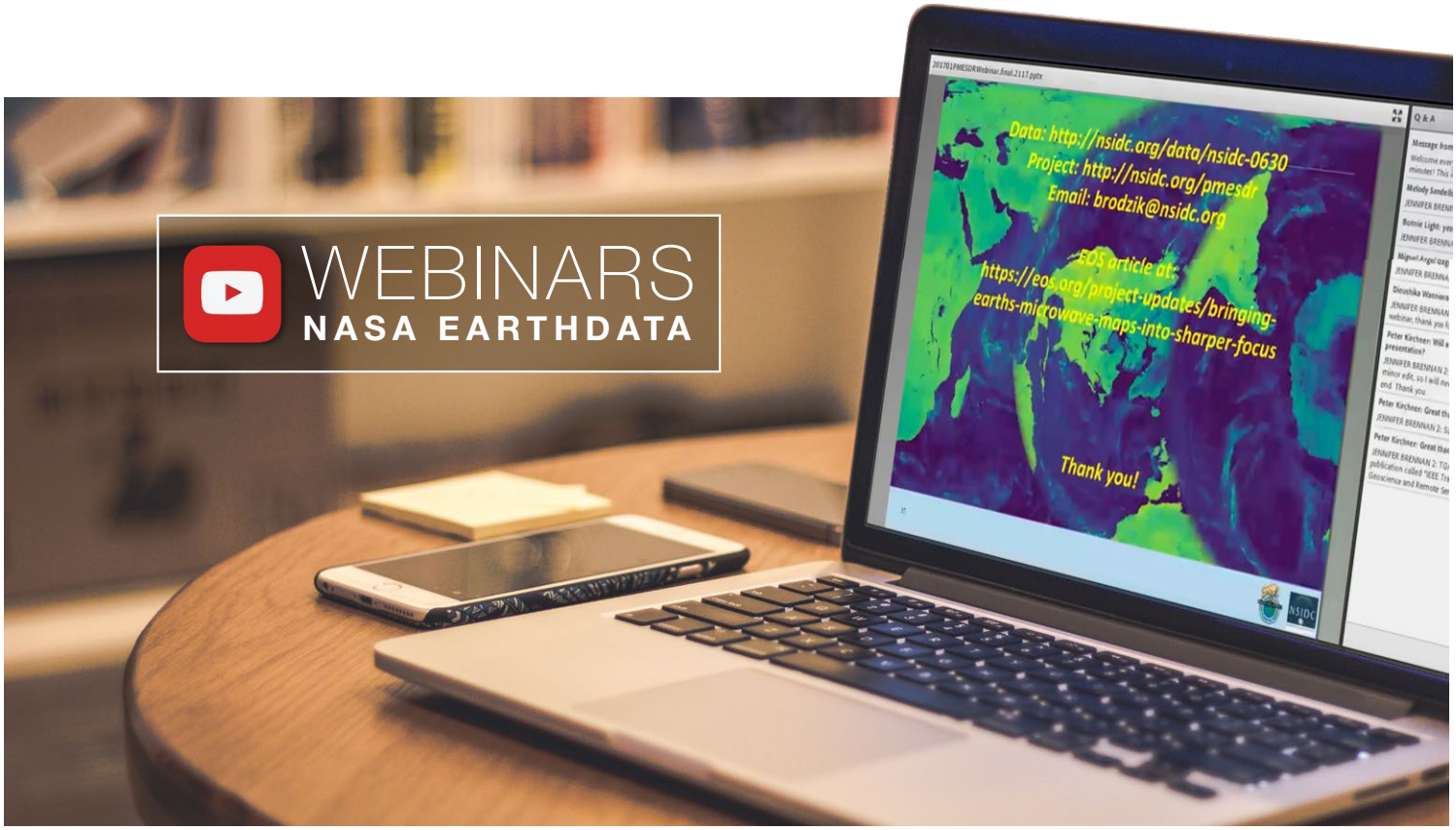
Who uses NASA Earth science data? Dr. Larry O'Neill, to explore the effects of air-sea interactions on weather, ocean, and climate.

Dr. Larry O'Neill, Assitant Professor, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR

Research interests: Air-sea interactions, specifically how ocean temperature affects weather and how weather affects ocean temperature and circulation.

Dr. Larry O'Neill at Vernal Falls in Yosemite National Park, CA. Dr. O'Neill uses a wide range of Earth science data to investigate the impact of air-sea interactions on fresh water. Image courtesy of Dr. O'Neill.

https://earthdata.nasa.gov/user-resources/who-uses-nasa-earth-science-data-user-profiles/user-profile-dr-larry-o-neill



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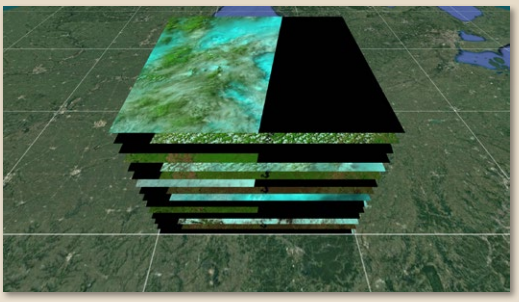
Discover NASA's Fire Information for Resource Management System (FIRMS)

https://youtu.be/0fPVmnY6pBs



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Discover and Access Landsat Analysis Ready Data (ARD) from the USGS Archive

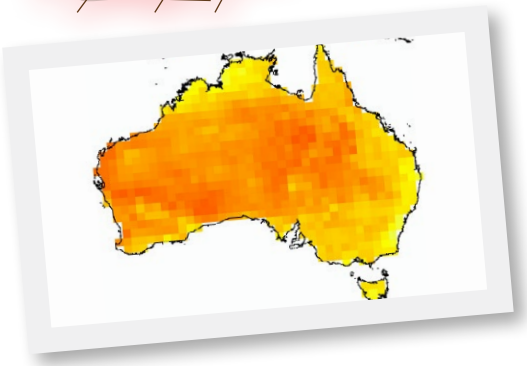
https://youtu.be/dD891l65zBc

7/25/18

Operation IceBridge: Come Discover a Decade of Polar Data

https://youtu.be/io7zeeg0_58

DATA Recipes



How to Correctly Import GRIB Data into ArcGIS

This data recipe shows an example on how to import GRIB data files correctly using land data from Global Land Data Assimilation System (GLDAS) at the NASA Hydrological Sciences Laboratory.

https://go.nasa.gov/2nHDYV6

Developed by the NASA Goddard Earth Science Data and Information Services Center (GES DISC). To view additional data tutorials/recipes: https://disc.gsfc.nasa.gov/information/howto

Generate a Mosaic of Two Sentinel-1 Products in Adjacent Paths

This data recipe will go over the steps to create a mosaic of two Sentinel-1 Ground Range Detected (GRD) synthetic aperture radar (SAR) data products in different swaths using the Sentinel-1 Toolbox.

http://bit.ly/2vNvH6p

Developed by the NASA Alaska Satellite Facility Distributed Active Archive Center (ASF DAAC). To see additional SAR data tutorials/recipes: https://www.asf.alaska.edu/asf-tutorials/data-recipes/

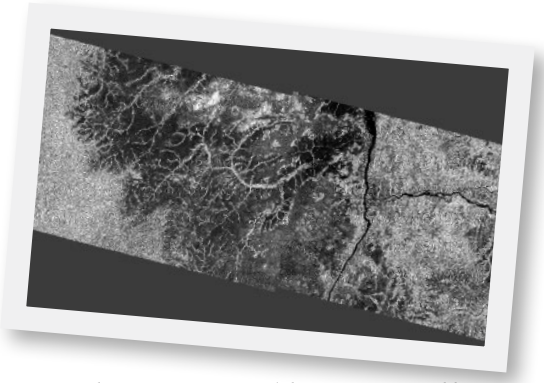
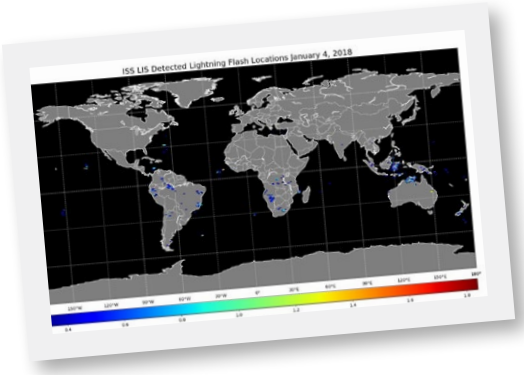


Image Credit: Copernicus Sentinel data 2018, processed by ESA.



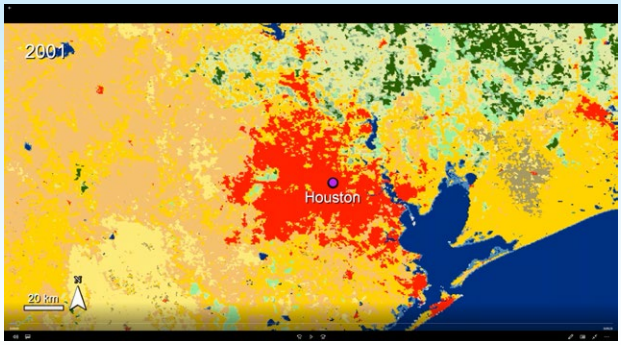
ISS LIS Lightning Flash Location Quickview using Python and GIS

This data recipe enables the visualization of lightning flash locations across several user-selected ISS LIS swath data files, accumulates flashes within a Python plot, and creates a CSV file with locations to enable use with other software.

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

Developed by the NASA Global Hydrology Resource Center (GHRC) DAAC. To view additional data tutorials/recipes for hazardous weather data: https://ghrc.nsstc.nasa.gov/home/data-recipes

SPECIAL FEATURE VIDEO

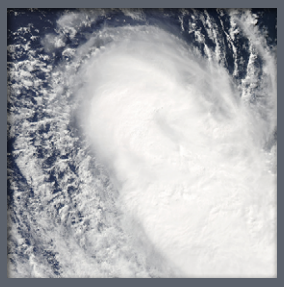


Urban Growth in Houston, TX (2001-2016)

Houston, Texas, is one of the most populous cities in the United States. Observe the increase of urban and built-up areas, shown in this animation as red, from 2001 to 2016, using the Terra and Aqua Combined MODIS Version 6 Land Cover data product. The last image in the animation is a Terra MODIS surface reflectance image that provides a recent view of Houston.

Learn more about the NASA data used to create this data image by visiting the LP DAAC website. http://bit.ly/2Og4gsM

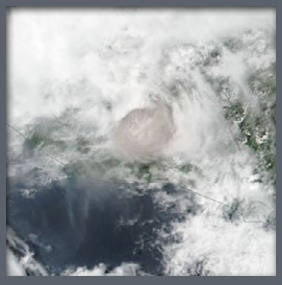
Latest NASA Earthdata Images



Tropical Cyclone Flamboyan

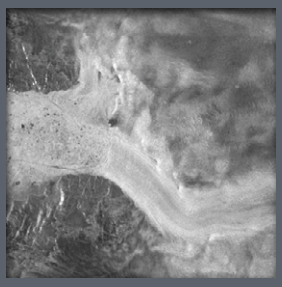
https://earthdata.nasa.gov/mastheads

(Published: 5/21/18)



Fuego Volcano Ash Plume, Guatemala

https://earthdata.nasa.gov/ash-plume-from-the-fuego-volcano-guatemala



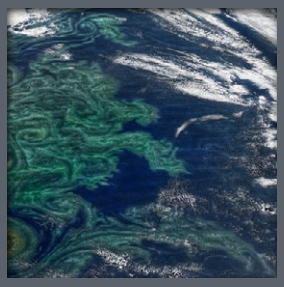
Monitoring Glaciers from Space

https://earthdata.nasa.gov/mastheads

(Published: 5/29/18)

County Fire, California

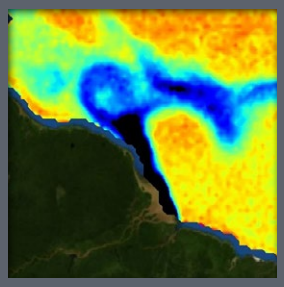
https://earthdata.nasa.gov/county-fire-in-yolo-county-california



Phytoplankton Around the Kamchatka Peninsula

https://earthdata.nasa.gov/mastheads

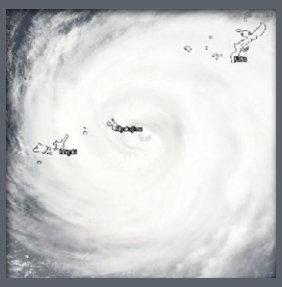
(Published: 6/4/18)



Sensing Ocean Salinity with SMAP

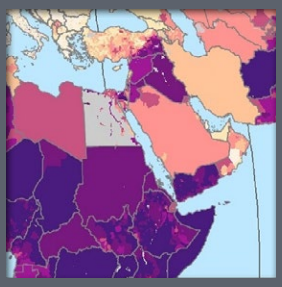
https://earthdata.nasa.gov/mastheads

(Published: 6/18/18)



Super Typhoon Maria

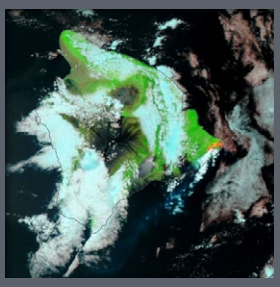
https://earthdata.nasa.gov/super-typhoon-maria



Global Demographic Characteristics

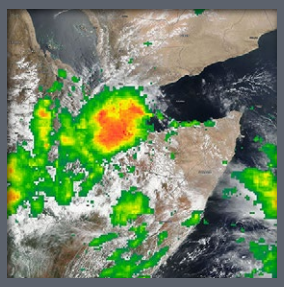
https://earthdata.nasa.gov/mastheads

(Published: 6/25/18)



Lava from the Kilauea Volcano, Hawaii

https://earthdata.nasa.gov/lava-from-the-kilauea-volcano-hawaii



Tropical Storm Sagar

https://earthdata.nasa.gov/tropical-storm-sagar

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