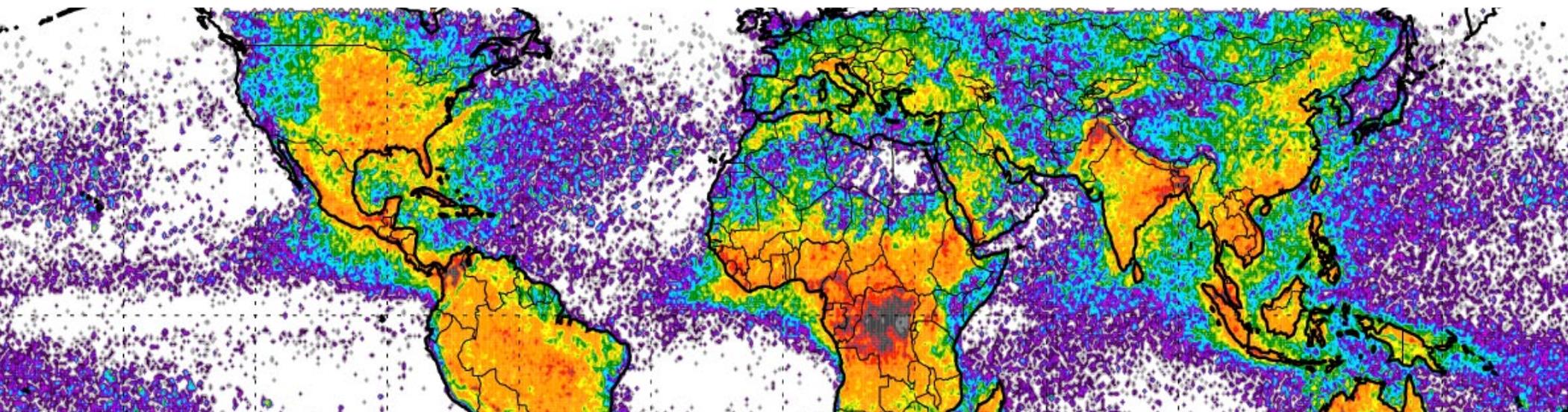




ANNUAL REPORT 2021



One of the flagship datasets for the Global Hydrometeorology Resource Center (GHRC) is NASA's International Space Station Lightning Imaging Sensor (ISS LIS). The actual instrument is a flight spare for the Tropical Rainfall Measuring Mission (TRMM) LIS. Launched in 1997, the TRMM LIS would go on to provide nearly 17 years of lightning observations over the tropics. The ISS LIS extends this period of record, having launched in 2017 and continuing to operate at this time. Due

to the more inclined nature of the International Space Station's orbit, the ISS LIS observes lightning at the mid-latitudes from space, which had not occurred since the Optical Transient Detector mission ended in 2000. The image above presents a milestone for the ISS LIS. This is the four-year climatology of ISS LIS observations. This shows the total number of flashes per kilometer per year from March 2017 through February 2021.





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ABOUT GHRC

The Global Hydrometeorology Resource Center (GHRC) is one of NASA's Distributed Active Archive Centers (DAACs) and is managed jointly by the Earth Science Department at NASA's Marshall Space Flight Center and the University of Alabama in Huntsville's Information Technology and Systems Center. The NASA GHRC DAAC is a member of national and international data organizations including NASA's Earth Science Data and Information System (ESDIS), the Federation of Earth Science Information Partners (ESIP), and the International Council for Science (ICSU) World Data System (WDS).

GHRC'S MISSION STATEMENT

"The GHRC provides a comprehensive active archive of both data and knowledge augmentation services with a focus on hazardous weather, its governing dynamical and physical processes, and associated applications. Within this broad mandate, GHRC focuses on lightning, tropical cyclones and storm-induced hazards through integrated collections of satellite, airborne, and in-situ data sets."

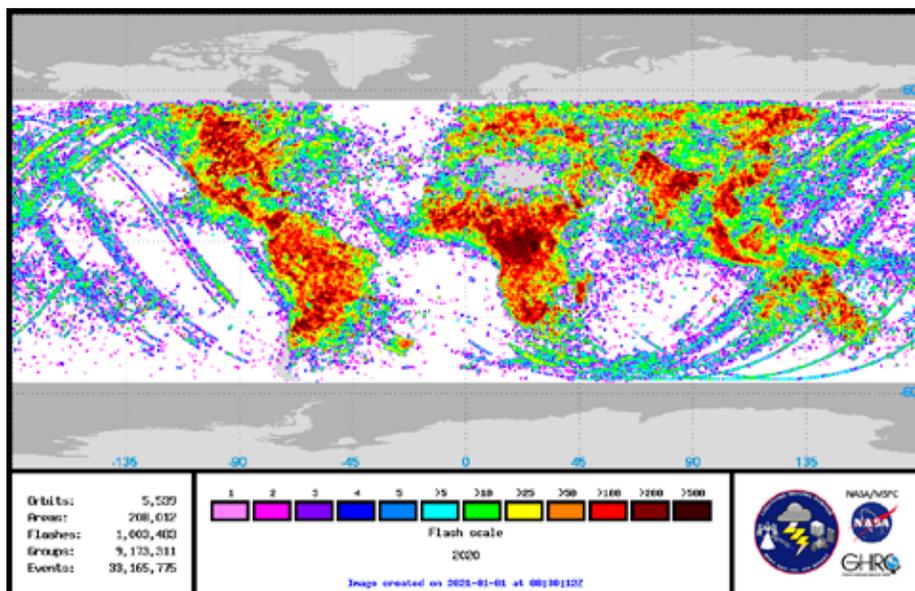


TOP STORIES

LIGHTNING IN REVIEW

The lightning data products continue to be flagship datasets for the GHRC DAAC. Data from both the Tropical Rainfall Measuring Mission (TRMM) and International Space Station (ISS) Lightning Imaging Sensors (LIS) are consistently in the top ten most downloaded datasets. This is further seen in the user questions as requests for and questions about lightning data regularly occur. A significant amount of behind-the-scenes effort occurred in fiscal year 2021 and is setting the stage for a variety of new opportunities in fiscal year 2022 that will allow GHRC to continue to evolve as NASA's lightning DAAC.

The ISS LIS recently completed the milestone of four years on orbit. This mission extends the long-term TRMM LIS climatology (1997-2015) in both time and space. The four-year global climatology has been generated and shown here. (<https://ghrc.nsstc.nasa.gov/pub/lis/iss/browse/summaries/2020/2020.png>) ISS LIS provides observations at mid- to high latitudes, which have not been available since the Optical Transient Detector in 2000. The ISS LIS data are being incorporated into the 20+ year combined TRMM LIS/OTD climatology. ISS LIS will relocate to a new location on the ISS in early 2022 and is expected to continue operations until at least late 2023.



Version 2 ISS LIS data are available now. Version 2 updates include view-time correction for solar panels and 1-second data loss, improvements to the way data at the end of the 24-hour period is handled, a corrected initialized event alert_summary variable, and a change the orbit designation from a simple increasing index to one based on the day/time of the orbit.

Another major milestone this year has been the return of the North Alabama Lightning Mapping Array (NALMA) in collaboration with the NASA Marshall Space Flight Center lightning science team. After being offline for several years, the NALMA network is once again active after a series of hardware and software upgrades. GHRC has recently taken over full-rate data production from New Mexico Tech. The raw and full-rate NALMA data are now published at GHRC, and the near real-time data will come in fiscal year 2022. GHRC has also been focused on preparing for publication of two Geostationary Lightning Mapper (GLM) datasets that were approved by NASA ESDIS last year. This year, GHRC has been working on the cloud transition, including how to handle ongoing datasets (such as NALMA and the GLM datasets) in the cloud. This work has nearly completed and the GLM, hemispheric gridded derived products will be the first published. Both are expected to be quite popular as the geostationary nature of the instrument allows for continuous viewing of storms over a significant portion of the western hemisphere.

Several potential new datasets could be approved for future publication. The principal investigator for the GLM-CIERRA dataset has noted that the CIERRA algorithm can be applied to LIS and OTD. Once GLM-CIERRA is published, these instruments will receive their own CIERRA versions. Additionally, GHRC and the Marshall lightning team will begin to focus on the Washington, D.C. and Wallops Flight Facility Lightning Mapping Arrays. Further in the future is the new World Meteorological Organization (WMO) global lightning product. Driven by lightning becoming an essential climate variable in 2018, the gridded WMO product will attempt to blend all available lightning data into a unified product. This will include private and public sources of lightning data. The science team will meet in the fall of 2022 to discuss details. Once a product design is established, GHRC will work with the WMO team to obtain ESDIS approval.

Lastly, two lightning-centric field campaigns are in the proposal stages. Should they be funded, each has reached out to GHRC to serve as the DAAC to archive the data.



MOVING TOWARD CLOUD-ONLY OPERATIONS

The transition of the Global Hydrometeorology Resource Center (GHRC) DAAC to a fully cloud-based DAAC has been one of the largest efforts for this fiscal year. The GHRC team has worked very well with this task, which has required collaboration and coordination with several external groups. Transition management has consisted of GHRC operating in a hybrid mode of two parallel publication efforts by maintaining the legacy approach while also developing the cloud-only procedures. Even with these challenges, GHRC had its largest number of data publications since 2018. The cloud transition effort began with an initial prototype in 2017. This identified the requirements that would be needed for the transition and included the development of a cloud-native framework to ingest, archive, and distribute data. With the framework in place, GHRC began migration activities in 2018, and at that point the DAAC began hands-on training and learned how to operate with the new, cloud-specific tools. These efforts allowed GHRC to produce sample workflows in collaboration with the NASA Earth Science Data and Information System (ESDIS) program. GHRC was then recognized as the cloud transition pathfinder for all of NASA's DAACs. By the end of fiscal year 2019, GHRC had become the first DAAC to transition all data holdings to the cloud, leading to the start of operational activities in the cloud in 2020. These efforts were recognized in a NASA Group Achievement Award. Fiscal year 2021 saw several notable milestones achieved. The GHRC team was able to refine the cloud procedures based on a review of the hybrid publication efforts begun in 2020. This has enabled vital dataset validation to ensure that data granules have not been lost using the new cloud-based methodologies. GHRC has further reexamined the workflows and focused on streamlining the process through a close collaboration between the operations and data management teams. This analysis has enabled the cloud operations team to improve the efficiency of operating in the cloud, error reporting, and troubleshooting to minimize downtime.

The results of efforts by the cloud operations team have shown that GHRC is prepared to finalize the cloud transition. The decision was made in summer 2021 to formally start the process of ending on-premises publication activities. These efforts will conclude in fiscal year 2022 with GHRC operating exclusively in the cloud. As this migration occurs, GHRC is developing a new website. As this migration occurs, GHRC is developing a new website that relies on cloud-based, serverless technology and aims to utilize the new capabilities to enhance data discovery, exploration, and cross-referencing. A prototype of this web page has been created and is undergoing testing in the Earthdata Cloud environment. This will be completed in fiscal year 2022 alongside the full DAAC transition.

The goals of fiscal year 2022 will have a noticeable impact on GHRC's operations. The end of hybrid operations will enable faster and more efficient dataset publishing. This, combined with the publication of GHRC's backlog, will enable the DAAC to be more agile and efficient in competing for and publishing new datasets. This increased agility will further enable GHRC to begin focusing on developing new tools and capabilities to enhance current capabilities.

REMEMBERING DR. GAIL SKOFRONIC-JACKSON

On September 9th, the NASA community learned of the unexpected passing of Dr. Gail Skofronic-Jackson. Dr. Skofronic-Jackson was a Program Manager at NASA Headquarters, Science Mission Directorate, Weather and Atmospheric Dynamics program. She provided scientific expertise and management support for the Weather focus area, Research & Analysis. She was also a Program Scientist for a number of missions, including the International Space Station Lightning Imager. Dr. Skofronic-Jackson further served as the NASA Headquarters manager for our program, the Global Hydrometeorology Resource Center. She was a dynamic leader and was a key individual in forming the foundation for the high-frequency passive microwave imagery data that NASA produces today. Her unexpected passing is a tremendous loss for NASA and for all of us who have had the distinct privilege of working with her during her career.

A NEW NAME FOR A NEW ERA

The Global Hydrology Resource Center (GHRC) Distributed Active Archive Center (DAAC) is known for its broad range of weather phenomena data. This includes precipitation physics, lightning, severe weather, severe hazards, and field campaign data. On April 12, 2021, "GHRC" became the Global Hydrometeorology Resource Center. The new name was decided through extensive discussions with NASA Marshall Space Flight Center management and our User Working Group. The name better reflects the types of datasets and activities that the GHRC DAAC supports. The term Hydrometeorology clarifies that GHRC DAAC handles atmospheric and precipitation processes as well as storm hazards.

A key impact to our users is the ability to clarify the types of data we archive and support. From the scientific perspective, the term Hydrology implies datasets that GHRC does not handle. Hydrometeorology better identifies our focus on atmospheric processes. This should help users better direct questions to the appropriate DAAC for data they have or are looking for.





GHRC DATASET PUBLICATIONS

The year was once again dominated by the pandemic, with GHRC working remotely through June. However, with lessons learned in 2020, GHRC personnel maintained steady progress in publication efforts even while continuing dual-publishing on-premise and in the cloud. The primary effort focused on finishing Year-1 IMPACTS field campaign datasets, completing our backlog, and determining how to publish brand new ongoing datasets via the cloud only. Thanks to these efforts, GHRC has published 62 datasets for 2021.

The clearing of the dataset backlog has enabled the GHRC team to focus more on cloud transition efforts. For fiscal year 2021, GHRC has maintained dual-publication efforts. The team has started the final transition to cloud-only publications with expected completion in early fiscal year 2022. A major component of this transition is the need to develop the procedures and code to publish ongoing datasets from start to finish in the cloud exclusively (i.e., ingest to publication). Two datasets accepted for publication, the Geostationary Lightning Mapper (GLM) Level 3 gridded products and GLM-CIERRA, are both awaiting this solution ahead of their publication. Several additional datasets beginning the approval process will benefit from this as well.

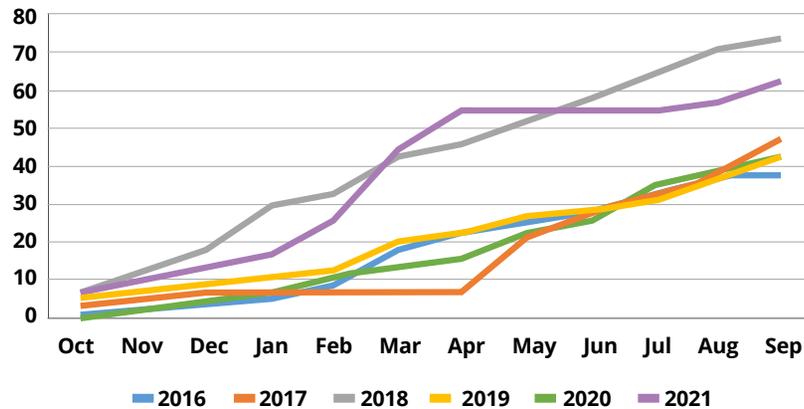
DUAL PUBLICATION EFFORTS AND MIGRATING TO THE CLOUD

The transition of GHRC dataset publications from on-premise to the cloud has required changes to the established publication workflow. During this transition process, GHRC has been publishing datasets both on-premise and in the cloud, presenting disadvantages and advantages. Dual-publishing requires more steps and a slightly longer publication time. However, the metadata associated with these data are now of higher quality due to the amount of testing required to be in the cloud. Having spent more than a year doing dual publications and verifying cloud publications, GHRC is planning to shift to cloud-only publications in fiscal year 2022.

NEW DATASETS ACCEPTED FOR PUBLICATION

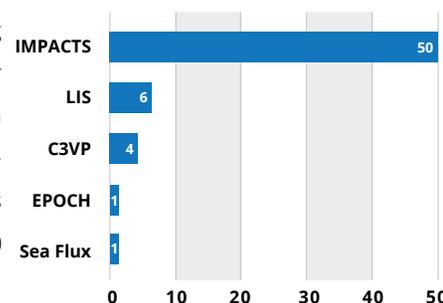
GHRC obtains new datasets for publication in one of two ways. One route is from data producers reaching out to GHRC to request archival of their data at the DAAC. This year, four of these datasets have been submitted. As of this report, one has been accepted for publication as a derived product from the ER-2 X-band Doppler Radar from the IMPACTS field campaign. The other three include the NASA Short-term Prediction Research and Transition (SPoRT) Land Information System, the NASA SERVIR Hindu Kush Himalaya Regional High Impact Weather Assessment Toolkit (HIWAT), and a passive microwave hail climatology consisting of three datasets. The second method is through proposals to NASA ESDIS for unpublished field campaigns. This effort is being supported by the Airborne Data Management Group (ADMG) to ensure that all NASA field campaigns are properly archived. This year, GHRC was assigned the East Pacific Origins and Characterization of Hurricanes campaign (EPOCH) and, through a joint proposal with the Airborne Science Data Center DAAC, the Convective Processes Experiment (CPEX) and Convective Processes Experiment - Aerosols and Wind (CPEX-AW).

Cumulative Number of Publications



The primary emphasis for 2021 was the publication of the 50 remaining in-house, Year-1 IMPACTS datasets. In support of this, the data management team also focused on completing the publication of the dataset backlog. This was an effort started in 2018 and ultimately completed this year with the final 4 datasets from the C3VP field campaign. The completion of the backlog provides two benefits. First, GHRC personnel are able to focus on forward-looking tasks, as described below. Secondly, GHRC can be more competitive when competing for new datasets as is discussed in “New Datasets Accepted for Publication” below. The remaining datasets included 6 from the Lightning Imaging Sensor and 1 from SeaFlux, a dataset accepted for publication at the beginning of the fiscal year. Supporting these publications, GHRC has updated metadata for numerous datasets as the Global Change Master Directory (GCMD) keywords are updated to make data more discoverable.

Datasets Published per Project





GHRC OUTREACH AND USER SERVICES

GHRC's Outreach and User Services (OUS) group is designed to complement the efforts of the other teams within GHRC through a variety of methods. This includes supporting documentation for published datasets, presentations, conferences, and journal publications. GHRC also produces two other products: data recipes and micro articles. These are designed to give users additional insight into how various datasets can be used for research purposes.

WEB UPDATES

A highly visible component of GHRC's outreach activities is the [GHRC web page](#). Several major changes have occurred with the page this fiscal year. First, NASA Earthdata has discontinued the practice of each DAAC providing a quarterly masthead. Also, NASA Earthdata has consolidated social media content to an enterprise level activity versus an individual DAAC activity. These changes are incorporated into GHRC's planned actions for a full web page refresh. This year, GHRC began work on the web page refresh, with the aim of developing a cloud-only site using Webiny to support this page. The refresh allows GHRC to address the changes by Earthdata in order to envision new ways to display content and keep users informed about activities at the DAAC. Other changes will include reducing the amount of manual work to update pages and to increase the interconnection of information to enhance data discovery and data exploration. The web page work will continue into fiscal year 2022. Additional details can be found in the cloud section of this report. Lastly, GHRC did update the North Alabama Lightning Mapping Array site in preparation for these data being published in 2022

(https://ghrc.nsstc.nasa.gov/lightning/data/data_nalma.html).

MICRO ARTICLES

One of the more common outreach tasks performed by GHRC is the creation of [Micro Articles](#). These documents bring together GHRC data and key science concepts while providing more insight to users to support their research needs with the archived data. GHRC has six types of micro article: Applications, Events, Field Campaigns, Instruments, Phenomena, and Publications. In 2020, GHRC completed the relevant micro articles for the various instruments of the IMPACTS field campaign. For 2021, GHRC completed the overview micro article for the full IMPACTS campaign. Looking ahead to 2022, GHRC will focus on several of the new data sets to be published, including instrument articles on the Geostationary Lightning Mapper and North Alabama Lightning Mapping array as well as their associated datasets.

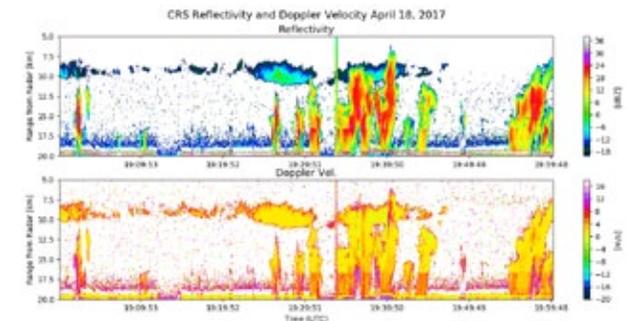
[MA: Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms \(IMPACTS\)](#)

DATA RECIPES

[Data Recipes](#) are another means by which GHRC provides support to published datasets that enable users to perform science research. Now utilizing Python 3.0, the data recipes provide users a basic means to conduct data format conversions as well as data visualization. A data recipe is not exhaustive in its capabilities, but it provides users with basic capabilities to read a dataset and to create sample graphics. Users can then employ the data recipes as either a foundation for or a conceptual model of how to manipulate the data in their own work.

GHRC's focus this year was to expand the scope and capabilities of a data recipe. Traditionally GHRC's data recipes have worked for one instance of a particular dataset. For example, the Cloud Radar System (CRS) airborne radar has been archived at GHRC for five field campaigns, resulting in five separate data recipes. The recent effort, endorsed by our User Working Group, is to enable the data recipe to function for all instances of a dataset. This has been an intensive effort as each deployment typically has a number of variations between deployments that must be addressed. However, the end result is a unified algorithm that enables greater data exploration as it is easier for users to work with all of the data. One such data recipe, for the CRS, was published this year. Looking ahead to fiscal year 2022, GHRC intends to create more of these versatile data recipes. In addition, there is a strong synergistic component with GHRC bringing more data into the Field Campaign Explorer (FCX). FCX needs to accurately open, manipulate, and visualize data files, which is what the data recipes do as well.

[DR: Cloud Radar System \(CRS\) Reflectivity and Doppler Velocity Quick View](#)





PREPARING FIELD CAMPAIGN EXPLORER (FCX) FOR OPEN SOURCE

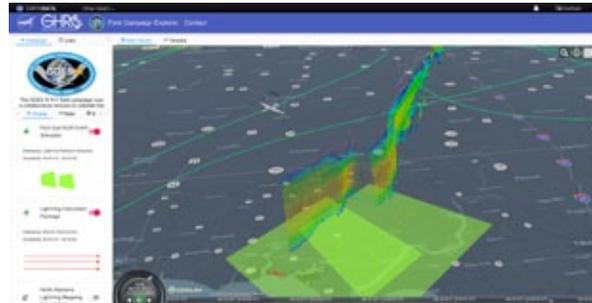
The functionality of the Field Campaign Explorer (FCX) has continued to expand this year in preparation of making FCX open source. This is a key follow-up to the operational release of FCX in 2020. Other users in the community will then be able to access FCX and create their own APIs to visualize or analyze data from GHRC or other cloud-based datasets.

In addition to enabling FCX to be open source, several new features have been added. First, FCX has been extended to host multiple field campaign datasets. As additional campaigns are added, users will be able to shift between available campaign datasets. The FCX landing page shows the dataset availability in GHRC along with a short description of the field campaign. A new subsetting tool has been created as well. Users may select and extract a region of data from within the visualization. The tool also allows for the user to download the selected region. Researchers will benefit from this tool as it helps in accessing the desired pieces from a larger data file, a task that is hard to perform without being able to visualize the data. Looking ahead, FCX aims to support visualization from templates. The template files will be created for the most common data formats available in NASA Earth observations, such as NetCDF and HDF. This will extend the ability of users to tweak the visualization to a granular level.

Live FCX link: <https://ghrc.earthdata.nasa.gov/fcx/index.html>

EARTHDATA PUB

Early in 2021 the cross-DAAC Earthdata Pub (EDPub) Development Team (GHRC and ORNL) implemented path-based routing to give a seamless transition between multiple front-end applications (Dashboard, Forms, etc.) and deployed Earthdata Pub to a test environment in the cloud. In April the development team conducted internal user testing with the EDPub Information Team (a cross-DAAC group of content specialists), who are advising from a data publication management perspective. Following this initial round of testing, the development and information teams jointly prioritized and addressed the feedback on the Dashboard and Forms and further developed content for the Earthdata Pub Overview pages. During this time the development team also collaborated with the mEditor (metadata editor) team from GES DISC to create a proof of concept integration to use mEditor for editing the Earthdata Pub Overview pages. Earthdata Pub was then deployed to the production environment, and in September a second round of closed beta testing was begun with participants from across various EOSDIS and DAAC staff roles as well as other cloud development teams. For this testing the EDPub development team also implemented back-end role-based access and role front-end role-based presentation, which enabled testers to evaluate Earthdata Pub from a data producer perspective as well as a DAAC staff member view. Following testing, the EDPub Development and Information Teams are continuing to modify content and presentation based on participant feedback. Additional progress will continue on the internal notification system of Earthdata Pub, other modular integrations like that of mEditor, as well as cloud metrics displays and report publishing.



CONFERENCES, JOURNALS, PRESENTATIONS

In another unprecedented year due to COVID-19, GHRC has maintained its presence at a variety of virtual conferences. The two main conferences are the American Geophysical Union and American Meteorological Society meetings. For the 101st meeting of each, GHRC presented four and three presentations, respectively. The focus was on GHRC's transition to a cloud-based DAAC, the Field Campaign Explorer, and a joint project on lightning megaflashes with GHRC User Working Group member, Dr. Michael Peterson.

Beyond the major conferences, various workshops and science meetings were great ways for GHRC to demonstrate its abilities and collaborations to the wider community. Again, due to COVID-19, all of these meetings were virtual. GHRC had the opportunity to present at the IMPACTS field campaign Geostationary Lightning Mapper science meetings. Also, GHRC presented at the 2021 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) as well as the NASA Earth Science Data Systems Technology Spotlight: Tools for Airborne Data.

Journals are another method to highlight various activities at GHRC. This year, GHRC published "The Hazards Posed by Mesoscale Lightning Megaflashes" in the American Meteorological Society's Earth Interactions journal (<https://doi.org/10.1175/EI-D-20-0016.1>). The paper was authored by GHRC User Working Group member Dr. Michael Peterson and GHRC DAAC Scientist Dr. Geoffrey Stano. The paper investigates megaflashes (> 100 km in length) and their impact to lightning safety. The paper uses observations by the Geostationary Lightning Mapper (GLM), specifically the GLM Cluster Integrity, Exception Resolution, and Reclustering Algorithm (CIERRA) to more accurately identify megaflashes. The GLM CIERRA dataset has been accepted for publication at GHRC and will be published in 2022.



GHRC MEMBER UPDATES

DEPARTURES



Ajinkya Kulkarni has served as GHRC's systems engineer. Throughout his time at GHRC he has been instrumental in our transition to a cloud archive and development of the Field Campaign Explorer. He and his family have returned home to India. GHRC wishes him the best in his new endeavours.

Essence Raphael is an atmospheric science master's student serving as a graduate research assistant with GHRC. She has been instrumental in GHRC's dataset publications by creating user guides, micro articles, and data recipes. She graduated with her Master's degree this summer with her thesis titled, "Assessing Lightning Risk in the Southeast U.S. Using Space-Based Lightning Detection." She has recently accepted a position with NASA's IMPACT program and GHRC wishes her the best in her new career.

Lamar Hawkins started out as a software developer with ITSC in July 2000. His first project was implementing the Product Delivery Record Server software suite for the AMSR-E SIPS' interface with the National Snow and Ice Data Center DAAC. Along the way, he became involved in developing numerous other software suites in support of GHRC DAAC's data acquisition and distribution activities. In June of 2011, he became the operations manager for GHRC DAAC. In this role, he has been responsible for triage and troubleshooting of data flow issues along with acceptance testing of new operations software. Additionally, he has worked to improve the standardization and documentation of all software, data, and procedures in use at GHRC DAAC. While serving as operations manager, Lamar also had the opportunity to become a Payload Developer for the Lightning Imaging Sensor on board the International Space Station. Most of the last few years have been spent hammering out procedures and documentation for GHRC DAAC's transition to cloud-based operations. Lamar retired on September 30, 2021 with 26 years and 4 months of service to the University of Alabama in Huntsville.

ARRIVALS



Jerika Christman had completed a B.S. in Environmental Sciences, served two NASA Internships, and finished her service with AmeriCorps just before joining the GHRC team. With her accumulated experience in team coordination, scheduling, and administrative duties she now works as a project coordinator under Manil Maskey supporting GHRC management.



Michael Hall joined ITSC remotely in November of 2020. Prior to working at UAH he worked on two Army programs, JBC-P and Apache IDM, the aim of both programs being to provide real time situational awareness to Army forces. As program direction changed, development transitioned from Linux based C++ development to an Android Java solution. An opportunity later arose to get experience with pure C development on the INTEGRITY-178 RTOS to support the Apache IDM program. Wanting to find work to expand his skillset, he applied to UAH where he has been supporting GHRC cloud development tasks.

Saul Lopez is pursuing his Master's degree in Computer Science here at the University of Alabama in Huntsville. He joined GHRC this summer as a graduate research assistant. Saul will support a number of upcoming lightning projects for both front-end and back-end development as well as gathering API information via SQL queries.

GHRC COVID-19 RESPONSE

GHRC started the 2021 fiscal year working from home after successfully doing so for nearly six months. Following appropriate safety guidelines, GHRC maintained its work from home status well into the calendar year 2021. By June 1, the University of Alabama in Huntsville began to return to campus. With the lessons learned from the transition to work from home the previous year, GHRC successfully transitioned back to on-site operations by mid-June. Although back on campus, GHRC personnel continued to observe all COVID safety protocols. This has continued through the end of the fiscal year with the rapid expansion of the covid delta variant in north Alabama.



METRICS FROM FISCAL YEAR 2021

For fiscal year 2021 (October 1, 2020 through September 30, 2021) the GHRC DAAC web page remained the primary interface with users and the DAAC. Nearly two-thirds of the visitors to the GHRC web page were from the United States. The remaining users had a similar breakdown as previous years with India (6.5%), China (4%), Spain (3%), Great Britain (2.5%), and Brazil (1.5%). Latin America, Canada, France, and Japan each accounted for approximately 1%. Additionally, the GHRC web page averaged ~200 users per week with spikes in late June (750 users) and early July (2,000 users). As is typical, our lowest number of visits were over the Christmas holiday.

FY2021 GHRC WEB USERS: NEW VS. RETURNING

86.7%
New
Visitors

13.3%
Returning
Visitors

IMPACTS AND COLLABORATIONS

GHRC DAAC further aims to monitor how data from our archive supports the wider science and research community. This aligns with NASA's agency-wide efforts to document impacts for the community. GHRC spent part of fiscal year 2021 identifying issues with properly obtaining some of these metrics, such as the citation of DOI links. The web page refresh in fiscal year 2022 should implement these changes. Beyond citations, the list below, while not all inclusive, provides several examples of GHRC's impact.

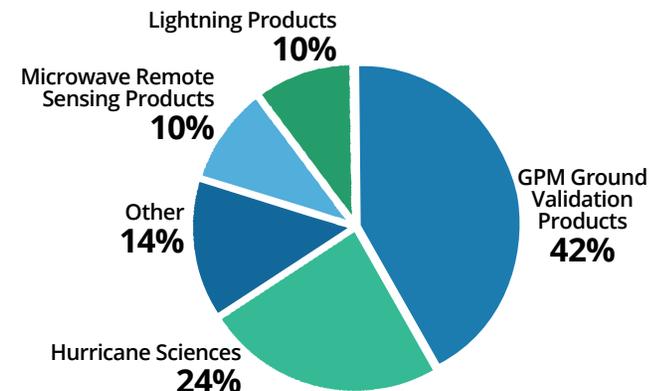
The GHRC program also is involved with a variety of collaborations between both NASA and non-NASA groups. These include:

- ISS LIS (funded)
- NALMA (funded)
- Earthdata Pub Development Team (funded)
- Earthdata Pub Info Group
- GHRC-GESDISC cloud data analysis
- Cloud data services (with Justin Rice)
- Member of the World Data System (WDS)
- Member of the Federation of Earth Science Information Partners (ESIP)
- Earth Science Data System Work Groups
- User Needs Technical Interchange Meeting via EOSDIS
- Science Teams: IMPACTS field campaign, ISS LIS, Geostationary Lightning Mapper, NASA LANCE)

This year, GHRC has supported three graduate research assistants (GRA). As mentioned previously our GRA, Essence Raphael, graduated with her Master's degree this summer. Discussions with the user community through Kayako user help requests demonstrated that three summer projects by international students were supported by GHRC data as well.

GHRC DATA HOLDINGS BY COLLECTION NAME

GHRC continues to group its data holdings into various collections making similar data more easily discoverable by end users. As with previous years, GHRC's Global Precipitation Measurement (GPM) ground validation program is the largest collection, covering 42% of all holdings. Hurricane products are second at 24% of all holdings.





LOOKING AHEAD TO 2022

The end of the 2021 fiscal year marks the end of an unprecedented period of time, not just for GHRC but also for everyone across the country as we continue to deal with the COVID-19 pandemic. In spite of the hardships and challenges, GHRC succeeded with several notable milestones and accomplishments. All of this can be attributed to the hard work and collaborative spirit of the entire GHRC team. In between departures and new arrivals, GHRC published 62 datasets, including all available Year-1 data from IM-PACTS and completed the entire dataset backlog. We have earned three new field campaigns to publish. The DAAC is in the final stages of its transition to a cloud-only DAAC and has begun the web site refresh and continues to evolve the Field Campaign Explorer. Lastly, as a backdrop to all of this, the GHRC team returned to the University of Alabama in Huntsville campus for the first time in 14 months.

Looking ahead to 2022, GHRC will transition entirely to a cloud-based DAAC. There are nearly 100 datasets that will arrive at GHRC for publication this year. Lightning data will be particularly exciting with the publication of data from the Geostationary Lightning Mapper, a new version of International Space Station Lightning Imaging Sensor data, and the return of the North Alabama Lightning Mapping Array. GHRC is also pivoting to provide cloud-based science services, which will be reflected in new tools and specific updates to the website during the refresh. 2022 will see the expansion of capabilities for the Field Campaign Explorer as well as the development of a lightning data dashboard to centralize the data exploration of one of GHRC's most popular categories of data.

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