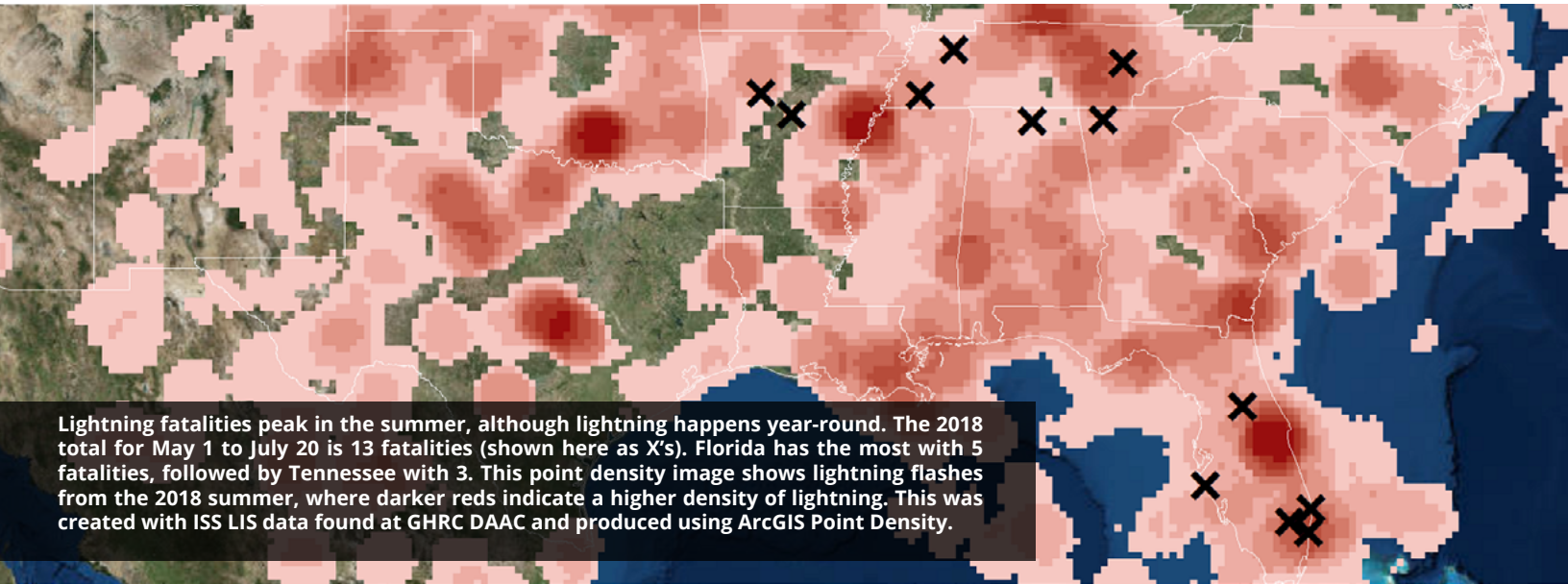# 2018 ANNUAL REPORT

Lightning fatalities peak in the summer, although lightning happens year-round. The 2018 total for May 1 to July 20 is 13 fatalities (shown here as X's). Florida has the most with 5 fatalities, followed by Tennessee with 3. This point density image shows lightning flashes from the 2018 summer, where darker reds indicate a higher density of lightning. This was created with ISS LIS data found at GHRC DAAC and produced using ArcGIS Point Density.

Throughout the year, GHRC provides NASA with banner images, known as mastheads, for the Earthdata Website. This year, GHRC focused on lightning, providing several interesting images. The mastheads remain on Earthdata.org for approximately two weeks. We also place images on the GHRC website for a month or two, changing the banner at regular intervals. The current masthead of the GHRC website, above, was also located at Earthdata.org in August 2018.
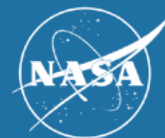
GHRC

Global Hydrology Resource Center

EST 1991

The Global Hydrology 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).

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."

NASA

itsc
INFORMATION TECHNOLOGY
AND SYSTEMS CENTER

THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE

DATA PUBLICATION - A SUCCESSFUL YEAR!

GHRC has increased the rate of data publication since the May 2016 implementation of DAPPeR - our web-based data publication tool. The figure below shows how the dataset publication rate has increased since 2016. In FY2018, we published over 70 datasets and we are on target to complete publication of data from the various GPM Ground Validation field campaigns and the Hurricane and Severe Storm Sentinel (HS3) campaign by early 2019. The GPM Ground Validation data will include new datasets from instruments located at the Wallops Flight Facility in between field campaign deployments.
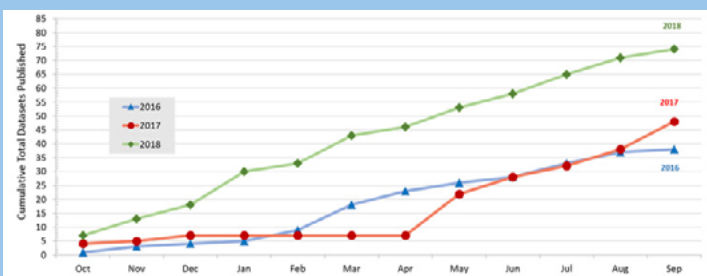
With the reduction of datasets awaiting publication, GHRC has the capacity to bring in new data. During FY2019, we look forward to adding data from one more GPM GV field campaign called ICE-POP and data from the GOES-R field campaign to validate lightning measurements from space. If you have any relevant NASA data that would fit the GHRC mission, please contact us. More information about the publication process can be found at https://ghrc.nsstc.nasa.gov/data-publication/.

GHRC MICRO ARTICLES AND DATA RECIPES

◄ A **Micro Article** is a short document that brings together GHRC data and key science concepts. **Data Recipes** are step-by-step instructions on how to read, plot or convert data to another format. The GHRC website contains a few pages that organize and highlight the various Micro Articles and Data Recipes available from the GHRC.

Two new types of Micro Articles were added this year: **Field Campaigns** and **Applications**.

Five new Micro Articles were released this year

Phenomenon: Hurricanes
Describes one of the GHRC key science focus areas, summarizes the basic understanding of hurricanes, and outlines what NASA project data at the GHRC DAAC can be used to study hurricane events

Instrument: Two-Dimensional Video Disdrometer (2DVD)
These optical ground-based devices measure precipitation characteristics and were used in the Global Precipitation Measurement (GPM) Ground Validation (GV) field campaigns. Information about how the instrument functions and measurement details are presented with links to the GHRC DAAC data

Field Campaign: Hurricane and Severe Storm Sentinel (HS3)
The HS3 campaign set out to investigate the processes underlying the formation and intensity changes of Atlantic Ocean hurricanes. The focus was on the use of airborne instruments to measure storm-scale processes and large-scale environmental conditions

Field Campaign: Olympic Mountain Experiment (OLYMPEX)
OLYMPEX consisted of a wide variety of ground instrumentation, radars, and multiple aircraft all which monitored the weather conditions and rainfall produced by Pacific ocean storms as they approached and traversed the Peninsula and the Olympic Mountains

Two new Data Recipes were released this year

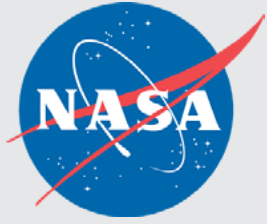### HS3 HIWRAP Radar Reflectivity Profile Quick View
A Python-based data recipe that provides step-by-step instructions for generating vertical time-height plots of radar reflectivity measured by the High-Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP) instrument during the Hurricane and Severe Storm Sentinel (HS3) airborne field campaign

ISS LIS Lightning Flash Location Quick View using Python and GIS
A Python-based data recipe that helps users make heat map plots of ISS LIS lightning flash locations extracted from individual swath files. A CSV output file is produced containing lightning flash locations that can be used in other software, such as ArcGIS

SUPPORT OF NASA EARTHDATA
UI/UX Presentation

In May, GHRC outreach lead, Deborah Smith, and web designer, Tammy Smith, presented an overview of the GHRC Data Recipes and Micro Articles at the monthly meeting of the User Interaction (UI) / User Experience (UX) group headed by Steve Berrick. The types of GHRC Micro Articles were introduced and described. Tammy then described the design phase of the Micro Article development and how we go about the process of developing to each template and figure. Examples were given, and the iterative process between designer and outreach team members was described.

GHRC CLOUD MIGRATION EFFORT

GHRC continues to work on migrating data and processes to the commercial cloud using the NASA Cumulus framework for ingesting, archiving, managing, and distributing Earth science data and the NASA Compliant General Application Platform (NGAP). In 2018, GHRC staff completed AWS training to improve our web services skills, worked with the Cumulus development team to improve the ingest archive process from a DAAC perspective, and published GHRC datasets in AWS S3 buckets using our new Glacier (AWS service used to backup GHRC data) restoration service. During 2019, GHRC plans to dual-ingest (on premises and cloud) GHRC workflows, as well as validate initial cost estimates for operating in the cloud.

CONTINUED WEB IMPROVEMENTS

HS3 and IPHEx Web Page Improvements

GHRC improved the content on the HS3 project summary page. Links were updated to additional material added in preparation for the addition of data preservation documents next month. Micro Article and Data Recipe links were also included.

The IPHEx field campaign summary page was also improved to contain updated information, dataset links, and recently published articles.

Retired Dataset Page

GHRC recently created a retired dataset page to our website so that users can easily locate information for past data that have since been replaced or updated. Once a dataset is retired, it no longer shows up in HyDRO or Earthdata searches. The retired dataset page contains a list of links to the dataset landing page of each retired data product. The dataset landing pages contain access to old user guides and PI documentation. The retired data page also provides an easy way for users to locate past dataset information if they do not know the DOI of the dataset (which resolves to the old landing page). This web page was recently featured on the ESDIS website.

GPM GV Collections

GHRC created collection level DOIs for each of the Global Precipitation Measurement (GPM) Ground Validation (GV) field campaigns. The DOI resolves to a field campaign landing page that summarizes the campaign, provides an introduction to the purpose, location, and time of the field campaign, lists the collection citation for use in publications, describes general characteristics, lists member dataset links, and contains primary documentation relevant to the field campaign. The landing pages and DOIs are:

The Olympic Mountains Experiment (OLYMPEX):
http://dx.doi.org/10.5067/GPMGV/OLYMPEX/DATA101

The Integrated Precipitation and Hydrology Experiment (IPHEx):
http://dx.doi.org/10.5067/GPMGV/IPHEX/DATA101

The Iowa Flood Studies (IFloodS):
http://dx.doi.org/10.5067/GPMGV/IFLOODS/DATA101

The Midlatitude Continental Convective Clouds Experiment (MC3E):
https://doi.org/10.5067/GPMGV/MC3E/DATA101

The GPM Cold-season Precipitation Experiment (GCPEx):
https://doi.org/10.5067/GPMGV/GCPEX/DATA101

The Light Precipitation Evaluation Experiment (LPVEx):
https://doi.org/10.5067/GPMGV/LPVEX/DATA101

OUTREACH ACTIVITIES

NASA Webinar

A NASA webinar titled "Striking New Spatial Bounds Using ISS LIS Data" was presented by GHRC on March 7, 2018. This webinar provided an overview of the Lightning Imaging Sensor (LIS) on the International Space Station (ISS), and described LIS data format, availability, and use in research. The ISS LIS Near Real-Time and Science quality data can be used to study lightning in hazardous weather over much of the Earth and examples from the 2017 Atlantic hurricane season were presented along with a demonstration of how to plot the data using Python. The webinar was given by GHRC staff scientist, Leigh Sinclair, and Dr. Michael Peterson, GHRC UWG Chair and Post-Doctoral Associate with the Earth System Science Interdisciplinary Center (ESSC) at the University of Maryland. You can watch the webinar on the NASA Earthdata YouTube channel:

https://youtu.be/m83cNoaMXUw

ESRI Story Map about the GPM GV Project

GHRC just published a new ESRI Story Map titled 'Dizzy the Disdrometer: A story of how Dizzy the Disdrometer participated in the Global Precipitation Measurement (GPM) Ground Validation field campaigns'. This story map is a fun and interactive way to learn about the disdrometer instrument, the GPM Ground Validation project, GHRC, the different field campaigns performed during the project, and where the reader can find these data. This story map can be found at **http://bit.ly/2GD8MOM**
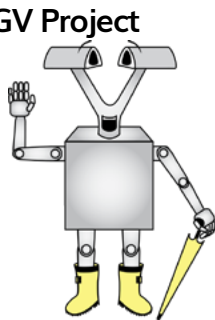
The New Dizzy T-shirt

GHRC has produced a long-sleeved t-shirt that features Dizzy the Disdrometer, a cartoon character from our ESRI Story Map. Please contact us if you would like to order one. Prices vary depending how many orders we place. **Orders will be accepted until October 12th.** ORDER NOW!

OLYMPEX Snow Movie

Helen Conover represented GHRC's Research as Art poster and movie titled "Patterns in Snowfall" at the 2018 Summer Earth Science Information Partners (ESIP) meeting in Tucson, AZ in July. The poster contained a description of the movie constructed using time-lapse photos of snow poles located at one of the Olympic Mountain study locations of the GPM GV Olympic Mountain Experiment (OLYMPEX) during Nov 2015 to May 2016. The **movie** and **poster** can be viewed online.

See You at Upcoming AGU and AMS Conferences!

GHRC outreach team members will attend both the 2018 AGU Fall Meeting in Washington, DC and the 2019 AMS Annual Meeting in Phoenix, AZ. The following topics will be presented:

- Near Real-time Distribution of ISS LIS Lightning Data
- Using GHRC's Data Publication Workflow Portal to Improve Data Management, Metadata Quality, and Documentation
- Patterns in Snowfall: Finding the Unexpected in Nature
- Dizzy the Disdrometer: Illustrating Field Campaign Data using an ESRI Story Map

- User Resources and Support for the ISS LIS Science Data at NASA's Global Hydrology Resource Center (GHRC)
- Meet Dizzy the Distometer: Creating a character and telling his story using ESRI Story Maps to increase use of Global Precipitation Measurement Ground Validation precipitation data

DEVELOP Collaboration

GHRC collaborated with the NASA Marshall Space Flight Center (MSFC) DEVELOP Hindu-Kush Himalayan Disasters project. NASA DE-VELOP is part of the Applied Sciences' Capacity Building program and addresses real-world environmental issues using satellite remote sensing data. The Hindu-Kush Himalayan Disasters project integrated NASA Earth observations to monitor intense thunderstorms and assess lightning exposure and risk in the Hindu-Kush Himalayan Region of Nepal.

The data used for this project included the TRMM and ISS Lightning Imaging Sensor (LIS) data from GHRC. The team obtained the data using Earthdata Drive, put the data into ESRI's ArcMap using the GHRC data recipe, and created a Lightning Exposure Map, Lightning Risk Map, and analysed the correlation between precipitation and lightning over the region. This figure shows the Lightning Exposure Map showing historically high lightning density observed during 2001 through 2017.

DATA ACCESS AT GHRC

Earthdata Drive

To improve data access, GHRC has implemented Earthdata Drive, which consists of a WebDAV interface, an extension of the Hypertext Transfer Protocol (HTTP) that allows users to securely connect to the GHRC public data server as if it were a local drive on their computers. With Earthdata Drive, users can download large quantities of data. Users need to login in using a valid Earthdata login in order to access GHRC public data. We would greatly appreciate your help. Please test this service and provide us with any feedback. Instructions and help are provided via the Earthdata Drive access page.

New LANCE NRT LIS/AMSR Website

For operational activities such as storm monitoring, ISS LIS data are available in near real time (generally within 2 minutes of observation) from the LANCE element at GHRC. These data were added to an updated and redesigned LANCE web site which now provides access to both LIS data and NRT AMSR2 data from the AMSR SIPS.

Subscription Service

Some of the ongoing, near-real time datasets at GHRC, such as ISS LIS lightning data and AMSU atmospheric temperatures, are available via a subscription service in which users can request new data files be sent directly to their computer. Users must sign up for this service by contacting GHRC User Services.

Lightning Website Redesigned and Updated

GHRC released the updated and re-designed lightning web site that has been in operation for decades. The new lightning website also contains a new Cesium-powered Lightning Climatology Visualization Tool that allows one to display the GHRC DAAC Lightning Climatology datasets. The TRMM LIS/OTD Gridded Lightning Climatology Datasets and the TRMM LIS Very High Resolution Gridded Lightning Climatology Datasets are easy to use tools.
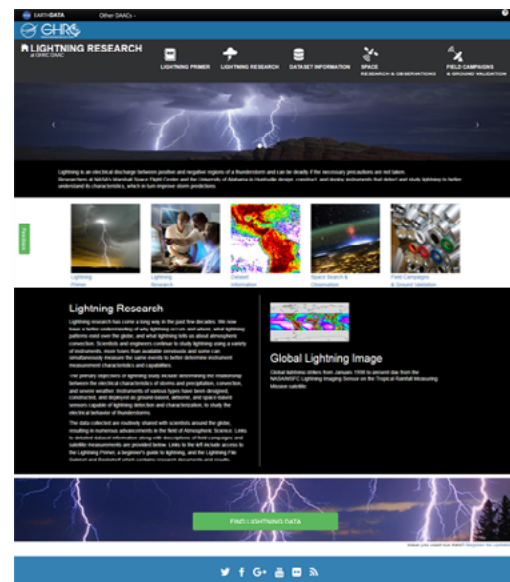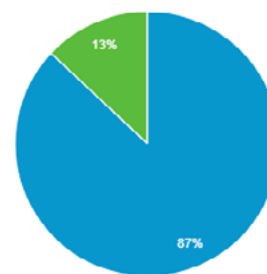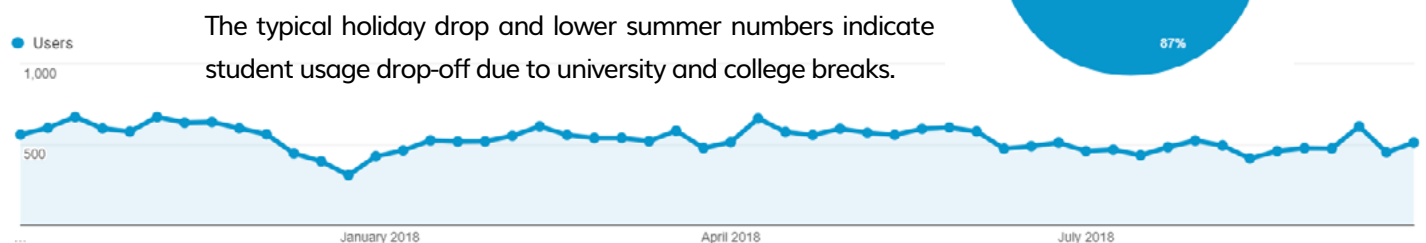
FY2018 USER METRICS SUMMARY

During Oct 1, 2017 to Sep 30, 2018 GHRC DAAC had consistent web usage represented by over 35% US users and roughly 65% foreign users. The top 5 foreign countries accessing GHRC were India, UK, Germany, China, France. In FY2018 GHRC had over 21,000 website users. Over 56% of users accessed GHRC with the Chrome web browser.
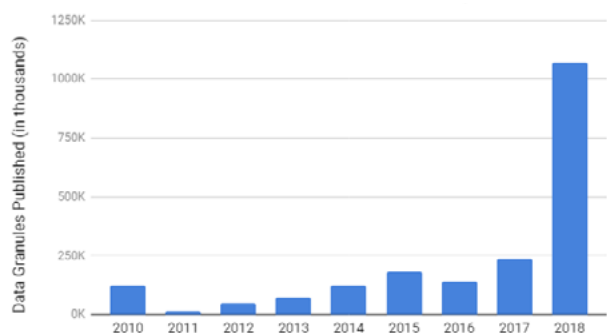
FY2018 GHRC Web Users: New vs. Returning

New Visitor   Returning Visitor

13%

87%

FY2018 GHRC Weekly Total User Count

The typical holiday drop and lower summer numbers indicate student usage drop-off due to university and college breaks.

Users
1,000
500

January 2018   April 2018   July 2018

Total Data Granules Published at GHRC by Year

Data Granules Published (in thousands)
1250K
1000K
750K
500K
250K
0K
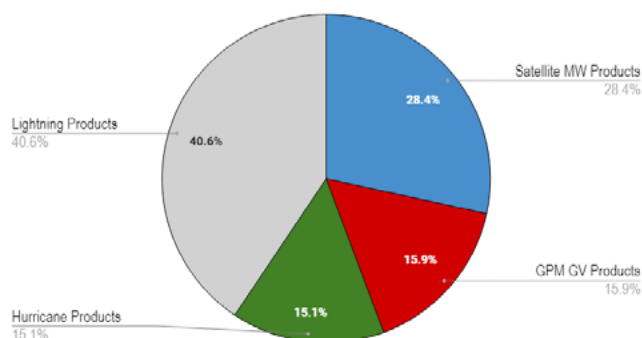2010 2011 2012 2013 2014 2015 2016 2017 2018

◀ GHRC had a successful year of data publication. We now have 444 datasets available with over 2.5 million individual files (granules). This plot shows the number of data granules published by year since 2010.

Top 5 GHRC Micro Articles and Data Recipes Accessed

The greatest number of Micro Article or Data Recipe views on any 1 day occurred on November 22, 2017 when several micro articles were accessed a total of 56 times.

Titles (MA = Micro Article, DR = Data Recipe)	#Views
Instrument MA: Lightning Imaging Sensor	152
Phenomenon MA: Lake Effect Snow	83
Phenomenon MA: Lightning	63
Instrument MA: Optical Transient Detector (OTD)	55
Publication MA: Cecil et al - Gridded Lightning Climatology	55
DR: Using ARCGIS to Convert LIS netCDF Data	167
DR: How to Georeference and Convert NRT AMSR2 SWE	131
DR: Create ISS LIS Flash Quickview using Python and GIS	78
DR: Create IR Global Geostationary Composite Quickview	69
DR: Create SSMIS Gridded Ocean Product Quickview	68

GHRC Data Holdings by Collection Name

Satellite MW Products 28.4%
Lightning Products 40.6%
Hurricane Products 15.1%
GPM GV Products 15.9%

28.4%
40.6%
15.9%
15.1%

GHRC
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https://ghrc.nsstc.nasa.gov/home/