

# 2016 ANNUAL REPORT



EST. 1991



**The Global Hydrology Resource Center (GHRC)** is one of twelve NASA 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. GHRC 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."



## CUMULUS PROTOTYPE: CLOUD-BASED DATA INGEST, ARCHIVE, DISTRIBUTION AND MANAGEMENT SYSTEM

GHRC is the first DAAC to participate in the **ESDIS Cumulus prototype**, providing representative data sets and operational software for the Cumulus development team to use in their initial implementation of a **cloud-based data ingest, archive, distribution and management system**. GHRC science, software and operations staff have consulted with the Cumulus team on GHRC data, software and processes, and have provided feedback on Cumulus workflows and user interfaces. DAAC Manager Dr. Rahul Ramachandran leads this activity with NASA's Earth Science Data and Information System (ESDIS) project.



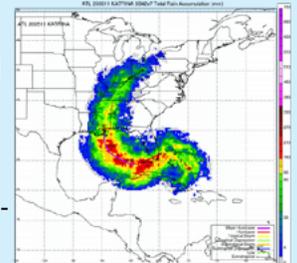
## FEATURED NEW DATASETS AND COLLECTIONS

In keeping with its new focus, the GHRC DAAC team developed a prioritized list of potential new datasets based on relevance to NASA's science objectives in extreme weather and weather hazards, to be evaluated and updated annually. Datasets published this year include:

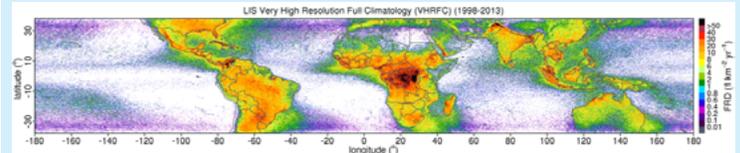
### TRMM Cyclone Precipitation Feature (TCPF) Database - Level 1<sup>1</sup>

This dataset was created by researchers at Florida International University and the University of Utah (UU) from the UU TRMM Precipitation Feature database.

The TCPF database provides tropical cyclone data in a common framework for hurricane science research, aggregating observations from the TRMM instruments for each satellite orbit that was coincident with a tropical cyclone in any of the six cyclone-prone ocean basins.



TCPF data depicting total rain accumulation in mm from Hurricane Katrina (August 23 - 30, 2005).



### The LIS 0.1 Degree Very High Resolution Gridded Lightning Climatology Data Collection<sup>2</sup>

This important lightning data collection, developed by Dr. Rachel Albrecht of the University of Sao Paulo, provides gridded climatologies of total lightning flash rates as measured by the **Lightning Imaging Sensor (LIS)** on TRMM. These datasets are an evolution of the LIS/OTD low resolution and high resolution climatologies<sup>3</sup> already available at the GHRC DAAC. Their very high spatial resolution (0.1°) allows for more precise identification of lightning hotspots. Interactive visualizations of these datasets and the top 500 lightning hotspots are available at [http://lightning.nsstc.nasa.gov/data/data\\_lis-vhr-climatology.html](http://lightning.nsstc.nasa.gov/data/data_lis-vhr-climatology.html).

<sup>1</sup>DOI: 10.5067/TRMM/TCPF-L1/DATA201

<sup>2</sup>DOI: 10.5067/LIS/LIS/DATA306

<sup>3</sup>DOI: 10.5067/LIS/LIS-OTD/DATA311

## OLYMPEX Olympic Mountain Experiment

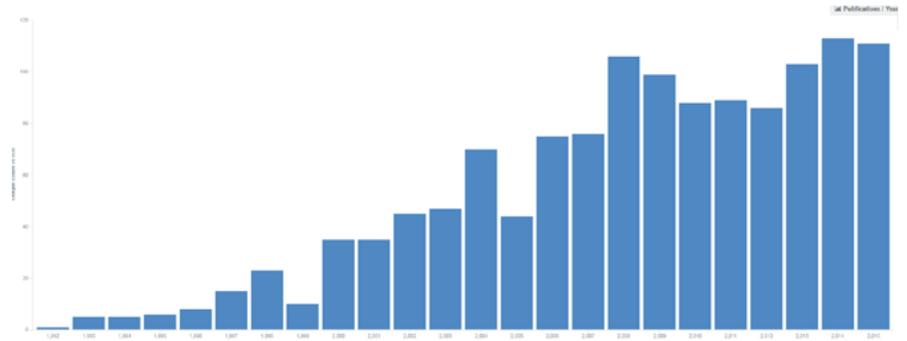


### GROUND VALIDATION CAMPAIGN FOR GPM

The **Olympics Mountain Experiment (OLYMPEX)**, the last of the planned Ground Validation field experiments for the Global Precipitation Measurement (GPM) mission, took place **November 2015 through February 2016**. The GHRC DAAC developed the OLYMPEX portal, a collaboration site that enabled science teams to upload a variety of planning materials, including daily forecast presentations, plan of the day reports, mission scientist and instrument reports. Flight reports from the NASA Ames Mission Tool Suite (MTS) were collected into the portal as well as several low latency ancillary datasets, including GOES imagery and radar data from the National Weather Service. **All OLYMPEX data products will be archived at GHRC DAAC for public access as part of the GPM GV collection.**

## PUBLICATIONS PER YEAR

The number of publications reporting the use of data archived at the GHRC has increased since 1993 to over 100 publications in 2015.

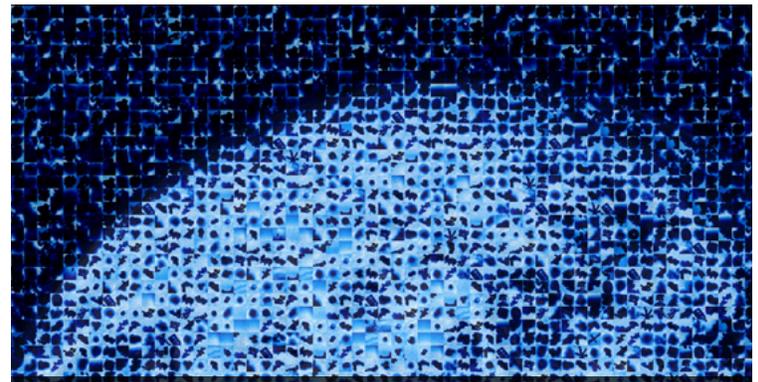
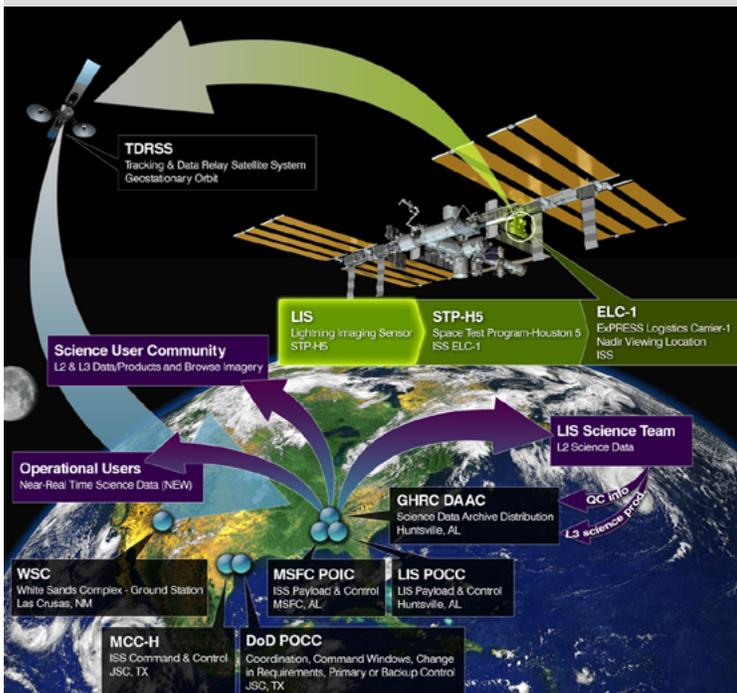


## UPCOMING MISSIONS

### Lightning Imaging Sensor on the International Space Station

Preparations continue for the deployment of a second LIS instrument to the **International Space Station**. Testing at NASA's Kennedy Space Center (KSC) was completed in March for the DoD **STP-H5 (Space Test Program-Houston 5)** package, which contains the ISS-LIS. LIS on ISS will build upon the solid foundation of space-based observations begun with LIS on NASA's TRMM satellite and its OTD predecessor, as it continues to measure the amount, rate and optical characteristics of lightning across Earth. The orbit of ISS will not only extend LIS time-series observations from TRMM that will allow scientists to better interpret the inter-relationships between lightning and climate variation, but it will also expand the latitudinal coverage poleward to 54°. The expanded areal coverage will allow observations of mid-latitude storms over the Continental United States, middle and southern Europe, and mid-latitude oceans, collectively leading to enhancements in regional and global weather, climate, and chemistry models, studies, and assessments.

GHRC DAAC will provide product generation, archive and data distribution for ISS-LIS data. GHRC software developers are working with the LIS science team to update the TRMM LIS data processing system for data streams from ISS LIS. The ISS-LIS will be flown as a hosted payload on the STP-H5 mission, which is scheduled for launch aboard a SpaceX Dragon cargo flight for a 2-4 year or longer mission.



## DATA STEWARDSHIP IMPROVEMENTS

### Long Term Preservation

GHRC DAAC has compiled the preservation information for all datasets from the MEaSUREs project **Distributed Information Services for Climate and Ocean Products and Visualizations for Earth Research (DISCOVER)**, as specified in the NASA Earth Science Data Preservation Content Specification. A checklist with links to these documents will be posted on the GHRC web site in the future.

### Data Citations

Data citations no longer include a data download URL which may change, but instead list only the permanent **DOI** which takes you to landing page with documentation and data download links. Dataset landing pages now offer download of data citations in machine-readable RIS format.

### Data Access

For improved system security and user service, the NASA DAACs are retiring FTP data downloads in favor of the secure **HTTPS** protocol. Users will now be directed to the **Earthdata login** before downloading data, though documentation and browse imagery remain openly accessible. In preparation for this change, we have created an Earthdata Login information page, and posted announcements on the GHRC web site and in HyDRO, our local data discovery and access system. Anonymous FTP data downloads will still be supported through calendar year 2016, though no longer advertised.

### Big Earth Data Initiative

BEDI accelerates the implementation of improved data services at the DAACs. In FY2016, imagery and supporting metadata from two key collections — **lightning climatologies and the DISCOVER MEaSUREs project** — were provided to NASA's Global Imagery Browse Services.



## SCIENCE OUTREACH

### TedEd Video

Dr. Albrecht's research and her new lightning climatology data collection (see section on LIS Climatology, pg. 2) were featured in a TedEd Lesson called "The most lightning-struck place on Earth" by Graeme Anderson.<sup>4</sup> The video clearly explains how lightning works, what lightning density is, and the environmental factors that make Lake Maracaibo in Venezuela the most lightning prone place on the planet. The lesson also describes the Optical Transient Detector (OTD) and the Lightning Imaging Sensor (LIS), two space-based sensors whose data are available at the GHRC.

### New Micro Articles Provide Insights into GHRC Data

The micro article is a short, interesting document that brings together data and key science concepts related to GHRC's data and science thematic areas. These documents are curated by both Earth and data scientists to ensure the accuracy and trustworthiness of the provided information. There are several micro article types that describe a science phenomenon, an instrument used to collect the data, an event or case study, or a corner stone publication about a GHRC dataset or related phenomenon.

### Data Collections for Case Studies

In 2016 GHRC published our first "virtual collection" or case study collection. A virtual collection synthesizes data and information resources around a scientific event or phenomenon and is meant to improve the discoverability, accessibility and usability of Earth science data. The "GPM Ground Validation GCPEX Snow Microphysics Case Study" focuses on a snow microphysics event which occurred during the GPM Ground Validation Cold-season Precipitation Experiment (GCPEX). This case study collection also includes an "event" micro article.

<sup>4</sup><http://ed.ted.com/lessons/the-most-lightning-struck-place-on-earth-graeme-anderson#digdeeper>

## NEW TEAM MEMBERS

### Outreach and Services

GHRC has added several Earth system and atmospheric scientists to improve outreach and services to our user community.



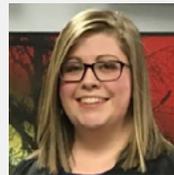
**Kaylin Bugbee** initially came to GHRC as a student assistant. Now she specializes in metadata quality projects that serve the broader Earth Science data systems community, in addition to leading GHRC science outreach efforts.



Many in our user community know **Deborah Smith** from Remote Sensing Systems, where she managed the DISCOVER MEaSUREs project whose data are at the GHRC. She brings a wealth of valuable science and user outreach expertise to our operation.



**Amanda Weigel** was awarded the Raskin Scholarship to present at the summer meeting of the Federation of Earth Science Information Partners (ESIP). Her research focuses on the land-atmosphere interactions in tornado genesis.



**Leigh Sinclair** is completing her MS in Earth System Science at UAH. Before joining the GHRC team, she served as Center Lead for the MSFC node of NASA's DEVELOP program. Sinclair is currently focused on GHRC science metadata and data documentation.

### Software Development

Two software developers have also joined the GHRC team.



**Nathan Wharton** comes to GHRC from the aerospace industry. His primary focus is the data ingest and processing system for ISS LIS.



**Abdelhak Marouane** is currently responsible for web service interfaces to our new Postgres database, and for updating GHRC software to use these services.

## MEMBER NEWS



Congratulations to **Manil Maskey** on his new position as a civil servant with NASA MSFC's Earth Science Office! He will maintain his key role in the DAAC, serving as system architect and engineer.