https://ntrs.nasa.gov/search.jsp?R=20190001515 2019-08-30T10:43:34+00:00Z

GPM, TRMM, and Other Global Precipitation Products and Services at NASA GES DISC

Z. Liu[1,2], B. Vollmer[1], A. Savtchenko[1,3], D. Ostrenga[1,3], B. DeShong[1,3], F. Fang[1,3], M. Greene[1,4], R. Albayrak[1,3], J. Su[1,3], C.-L. Shie[1,5], E. Sherman[1,3], J. Acker[1,3], A. Li[1], W. Teng[1,3], J. Wei[1], G.-D. Lei[1,3] and D. Meyer[1]

[1]GES DISC

[2]CSISS, George Mason University

[3]ADNET Systems, Inc.

[4]Telophase Corp

[5]Univ. of Maryland at Baltimore County

The 9th Workshop of the International Precipitation Working Group

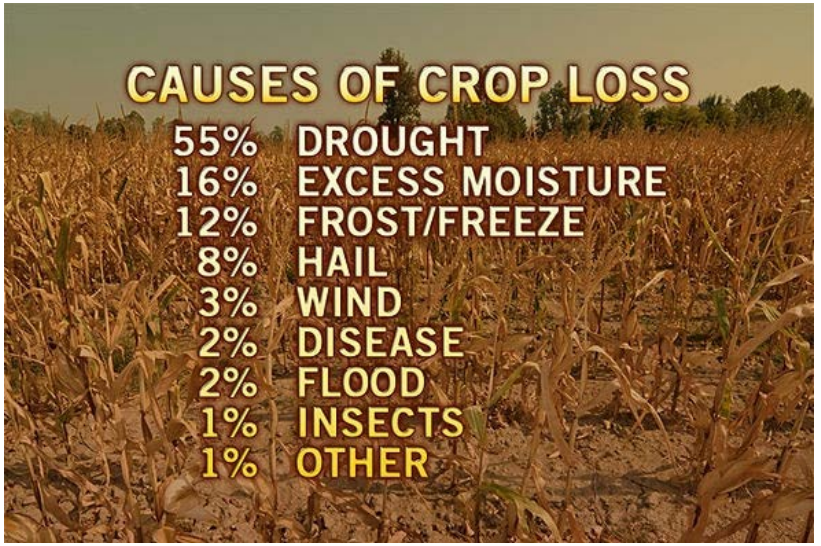
Outline

- Introduction
- GPM, TRMM, and other (global, regional) precipitation products at GES DISC
- Data services
- Giovanni
- Summary

Introduction

- Precipitation is a key environmental variable. For example, in agriculture, precipitation, temperature, water (soil moisture), solar radiation, NDVI, etc., are key variables.
- Rainfed agriculture – major farming practices that rely on rainfall for water.
- Rainfed agriculture: >95% of farmed land (sub-Saharan Africa); 90% (Latin America); 75% (Near East and North Africa); 65% (East Asia); 60% (South Asia).
- Droughts and floods can cause severe crop loss.
- The Goddard Earth Sciences (GES) Data and Information Services Center (DISC), one of 12 NASA data centers, is located in Greenbelt, Maryland, USA.
- The NASA GES DISC is a major data archive center for global precipitation, water & energy cycles, atmospheric composition, and climate variability.

In Kenya 2016 http://venturesafrica.com/kenya-battles-drought/



In the U.S. https://www.scientificamerican.com/article/heat-drought-continues-threaten-us-corn-crops/

Source: International Water Management Institute, 2010, Issue 10.

Precipitation Product Overview

- GPM (Global Precipitation Measurement)
- TRMM (Tropical Rainfall Measuring Mission)
- GPCP (Global Precipitation Climatology Project) of MEaSUREs
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version 2)
- NLDAS (North America Land Data Assimilation System)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System)
- GLDAS (Global Land Data Assimilation System).

Global Precipitation Products (more details)

- Single sensor (microwave, radar, and combined instrument) products from TRMM (1997 – 2015; 40° N-S) and GPM (2014 – present; 65° N-S): orbital and gridded
- TRMM Multi-satellite Precipitation Analysis (TMPA, 0.25-deg. 3-hr, monthly, 1998 – present; 50° (60° NRT) N-S)
- Integrated Multi-satellitE Retrievals for GPM (IMERG, NRT and research, 0.1-deg., 0.5-hr, monthly, 2014 – present), Version 05. Retrospective processing (back to the TRMM era, available soon).
- GPCP (Global Precipitation Climatology Project). Version 3 is coming soon.
- GLDAS (Global Land Data Assimilation System, 0.25-deg., 3-hourly and 1-deg., monthly, 1948-2010 (v 2.0), 2000-present (v 2.1))
- NLDAS (North America Land Data Assimilation System, 0.125-deg., hourly and monthly, 1979 - present)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System, 0.1 deg., daily, monthly, 1982 – present)
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version-2, 0.5 x 0.625 deg. hourly, 3-hourly, monthly, 1980-present)

Not Entirely Independent

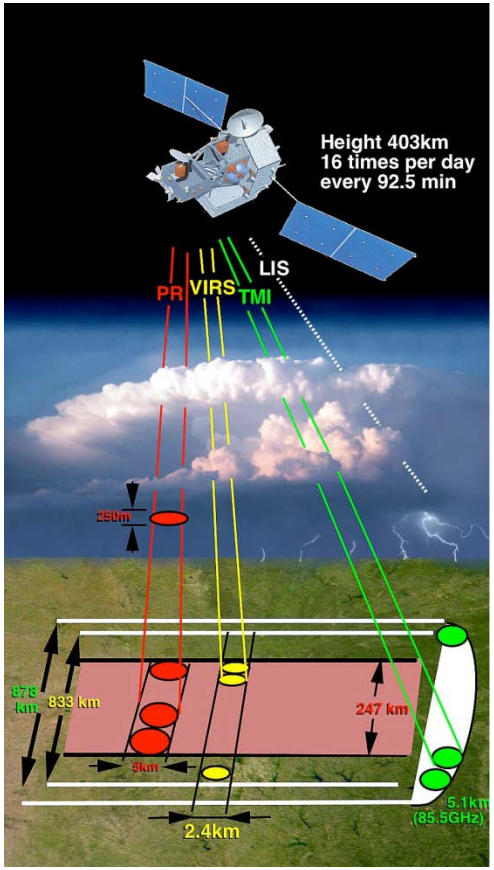
- TMPA (PMW, IR, GPCC, etc.)
- IMERG (PMW, IR, GPCC, etc.)
- GPCC (gauges only, sampling)
- GPCP (PMW, IR, GPCC, etc.)
- GLDAS (TMPA, PERSIANN, CMAP, CMORPH, NRL, GTS)
- MERRA-2 (CMAP, GPCP)

Issues in Satellite-based Precipitation Estimates

- Over oceans, passive microwave (PMW) retrievals are found to rival radar retrievals. Over land, it is more difficult (variations of the surface emissivity, in particular over snow and ice)
- IR techniques relate cloud top temperatures to surface rainfall (underestimation of warm rain, false alarms for anvils and thick cirrus clouds with cloud brightness temperatures)
- Precipitation radar: Attenuation correction, complex terrain and minimum detectable signals (snow, light rain, etc.)
- Algorithm changes; multi-satellite, multi-sensor, multi-algorithms, etc.
- Complex terrains, orographic effect, snow and ice surface, lacking gauges and radars, light rain, blowing snow, etc.
- Lack of ground observations for bias correction
- A challenge to capture and document data quality information.
- Effective communication with users.

TRMM (Tropical Rainfall Measuring Mission)

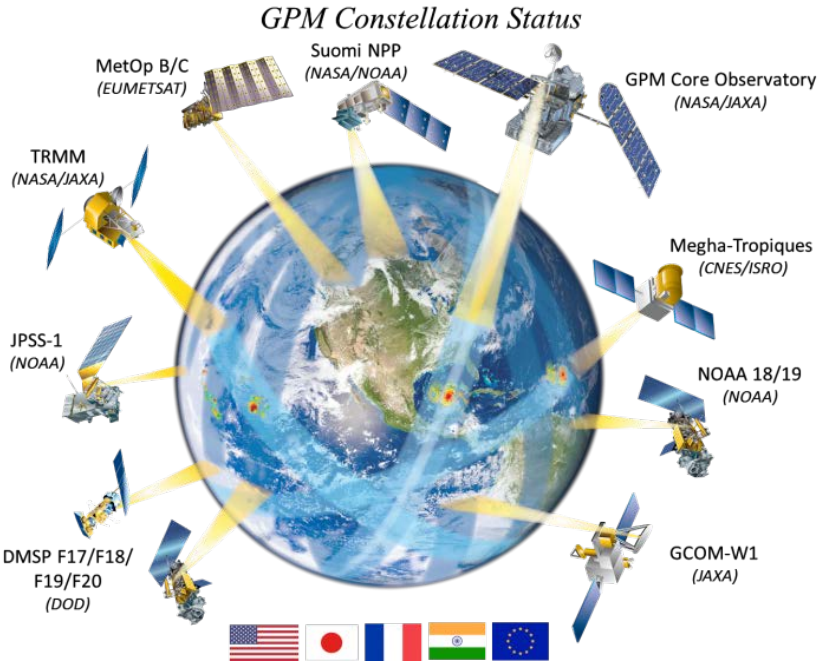
- NASA/JAXA mission (Nov. 1997 – Apr. 2015) to monitor and study tropical rainfall
- Precipitation related instruments (TMI, PR, LIS, VIRS)
- Orbital and gridded datasets
- Single sensor, multi-sensor, multi-satellite datasets.



Source: trmm.gsfc.nasa.gov

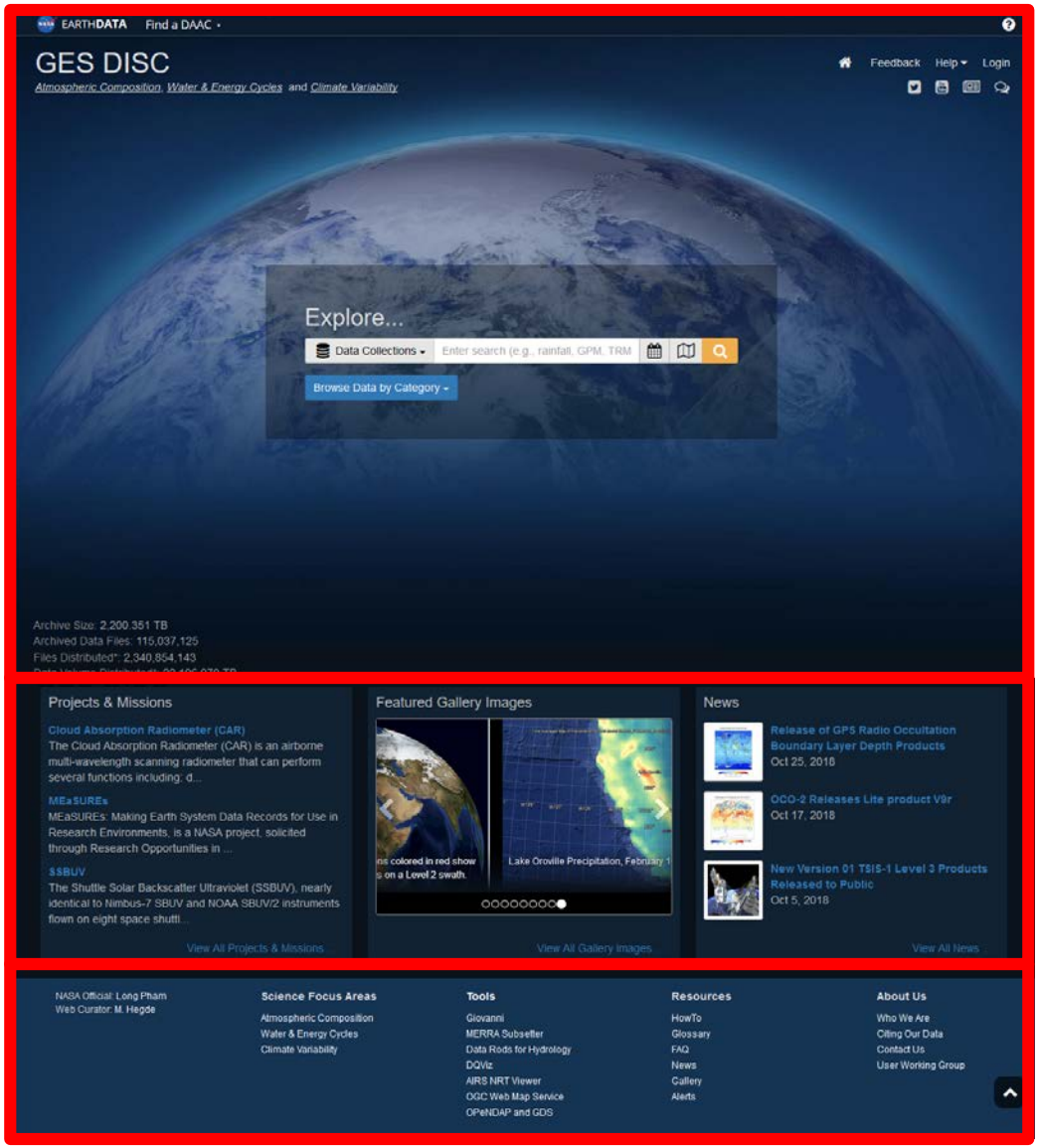
GPM (Global Precipitation Measurement)

- NASA/JAXA mission (Feb. 2014 – present) to monitor and study global precipitation (rain and snow)
- Quantify rainfall rates from 0.22 mm h^{-1} to 110 mm h^{-1} (60 mm h^{-1} for microwave imager) and detect falling snow at instrument footprint scales (from Walter Petersen)
- Precipitation related instruments (GMI, PR)
- GPM constellation of international satellites
- Orbital and gridded datasets. Single sensor, multi-sensor, multi-satellite datasets.



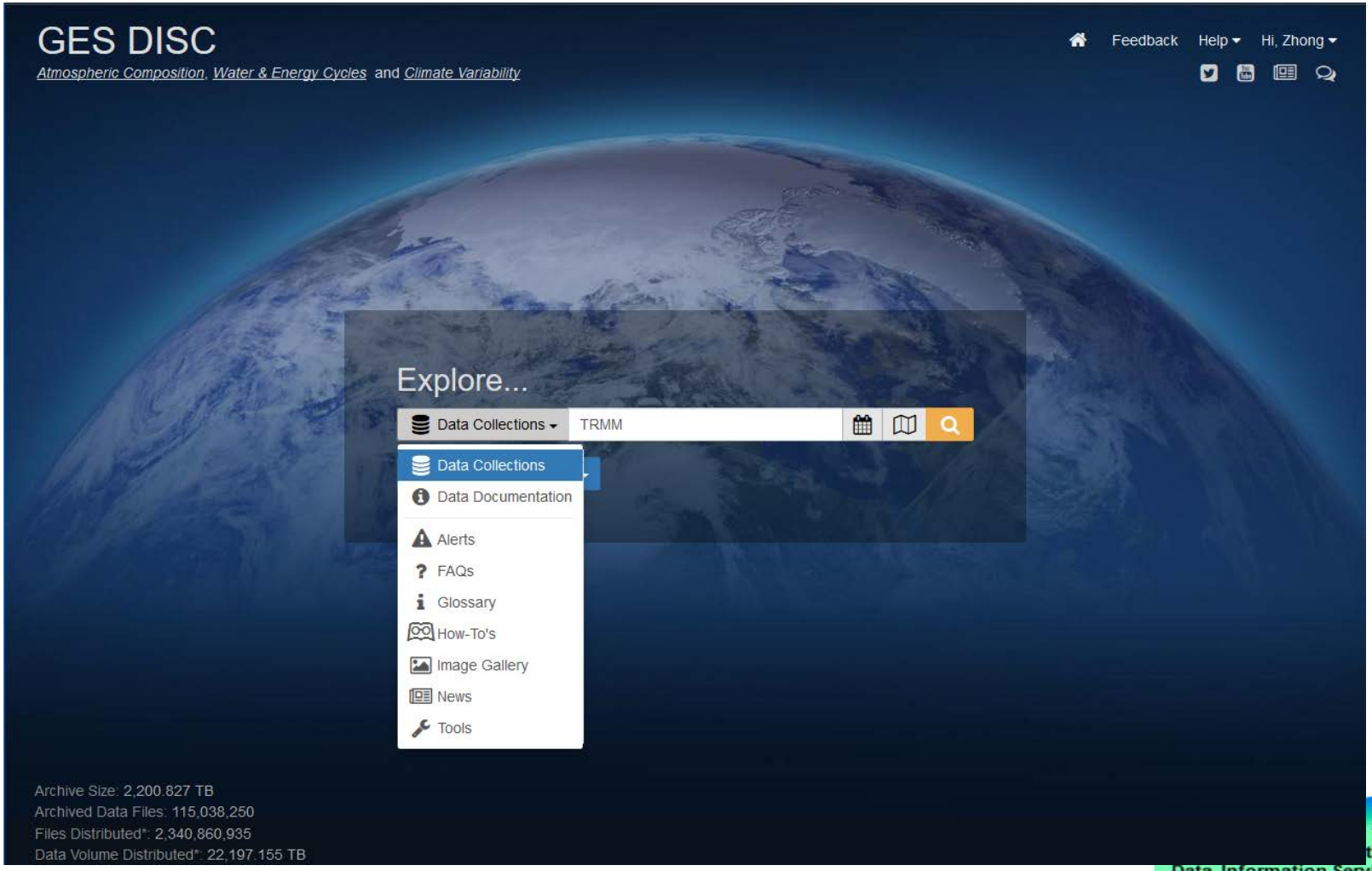
Source: pmm.nasa.gov

Data Services (How to find data?)

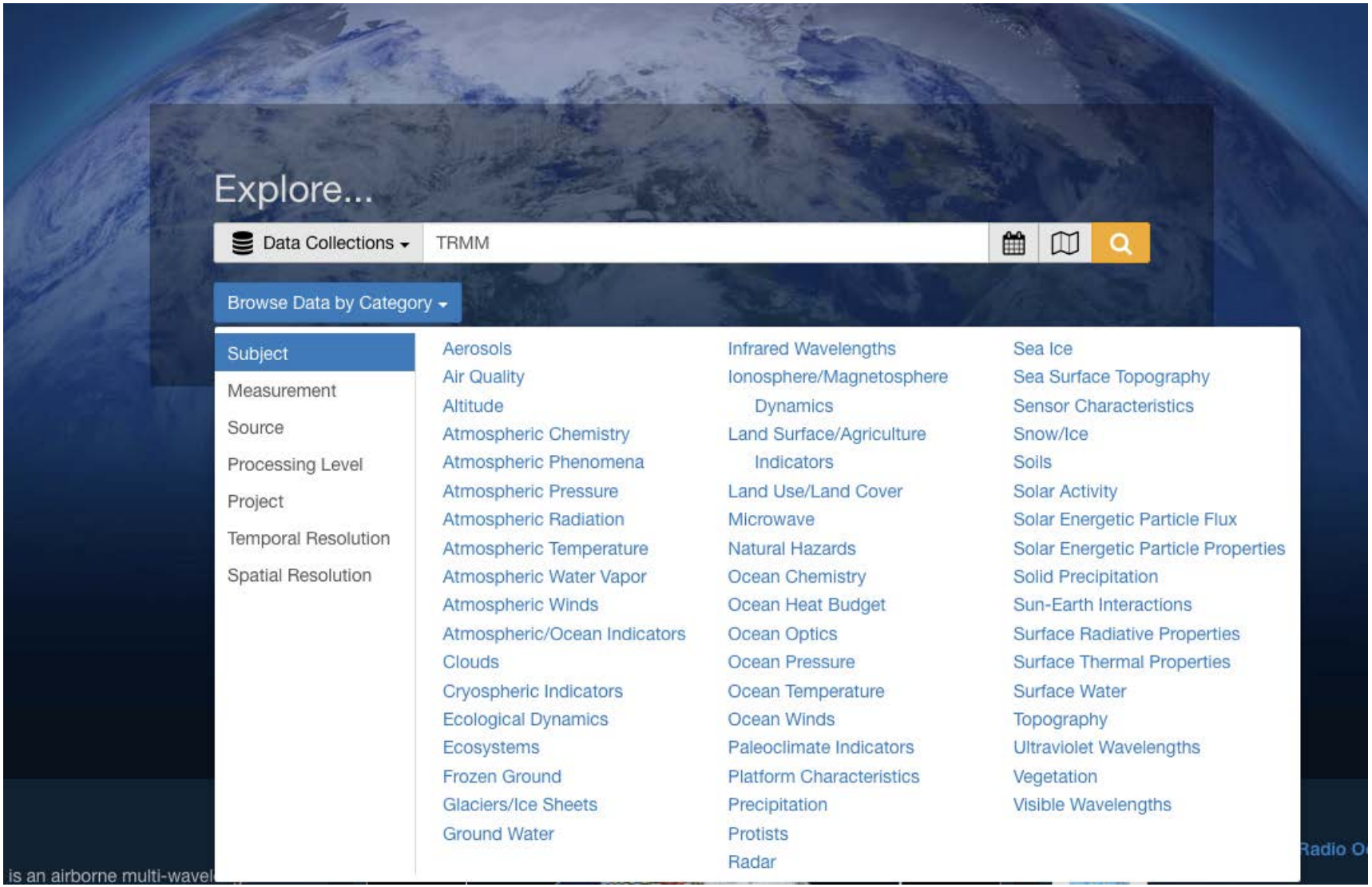


Data Services (cont.)

- TRMM, GPM, NLDAS, GLDAS, MERRA
- precipitation, soil moisture, temperature, etc.



Data Services (cont.)



Data Services (cont.)

GES DISC

Data Collections ▾ | trmm

Feedback | Help ▾ | Hi, Zhong ▾

Atmospheric Composition, *Water & Energy Cycles* and *Climate Variability*

Data Collections

Showing 1 - 25 of 71 datasets associated with **trmm**

Refine By

Subject Sort ▾
- ☐ Aerosols (1)
- ☐ Air Quality (1)
- ☐ Atmospheric Radiation (11)
- ☐ Atmospheric Temperature (9)
- ☐ Atmospheric Water Vapor (8)

More...

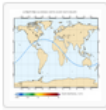
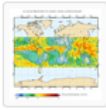
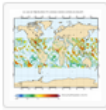
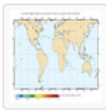
Measurement Sort ▾
- ☐ 24 Hour Precipitation Amount (1)
- ☐ Atmospheric Heating (10)
- ☐ Attitude Characteristics (8)
- ☐ Brightness Temperature (2)
- ☐ Cloud Liquid Water/Ice (8)

More...

Source Sort ▾
- ☐ Aqua AMSR-E (4)
- ☐ DMSP 5D-2/F13 SSM/I (1)
- ☐ DMSP 5D-2/F14 SSM/I (1)
- ☐ DMSP 5D-2/F15 SSM/I (1)
- ☐ DMSP 5D-3/F16 SSMIS (1)

More...

Processing Level Sort ▾
- ☐ 1 (7)
- ☐ 1A (4)
- ☐ 1B (6)

Image	Dataset	Source	Temporal Resolution	Spatial Resolution	Process Level	Begin Date	End Date
 Hover	GPM PR on TRMM Spectral Latent Heating Profiles L2 1.5 hours 5 km V06 (GPM_2HSLH_TRMM.06) - Atmospheric Temperature, Atmospheric Winds, Precipitation ▾ Get Data Ingest Status	TRMM PR	90 minutes	5 km x 5 km	3	1997-12-07	2015-04-01
 Hover	GPM TMI on TRMM (GPROF) Climate-based Radiometer Precipitation Profiling L3 1 month 0.25 degree x 0.25 degree V05 (GPM_3GPROFTRMMTMI_CLIM.05) - Atmospheric Water Vapor, Precipitation Get Data Ingest Status	TRMM TMI	1 month	0.25 ° x 0.25 °	3	1997-12-01	2015-04-08
 Hover	GPM TMI on TRMM (GPROF) Climate-based Radiometer Precipitation Profiling L3 1 day 0.25 degree x 0.25 degree V05 (GPM_3GPROFTRMMTMI_DAY_CLIM.05) - Atmospheric Water Vapor, Precipitation Get Data Ingest Status	TRMM TMI	1 day	0.25 ° x 0.25 °	3	1997-12-08	2015-04-08
 Hover	GPM PR on TRMM Gridded Orbital Spectral Latent Heating Profiles L3 1.5 hours 0.5x0.5 degree V06 (GPM_3GSLH_TRMM.06) - Atmospheric Temperature, Atmospheric Winds, Precipitation ▾	TRMM PR	1.5 hours	0.5 ° x 0.5 °	3	1997-12-07	2015-04-01

Recommended data collections +

Goddard Earth Sciences Data Information Services Center

Data Services (cont.)

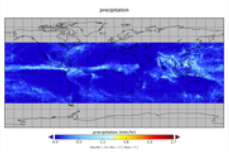
GES DISC

Atmospheric Composition, *Water & Energy Cycles* and *Climate Variability*

Data Collections | 3b43 | Feedback | Help | Hi, Zhong

Go to Search Results

TRMM_3B43: TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7



View Full-size Image

The 3B43 dataset is the monthly version of the 3B42 dataset.

This product is created using TRMM-adjusted merged microwave-infrared precipitation rate (in mm/hr) and root-mean-square (RMS) precipitation-error estimates.
It provides a ?best? precipitation estimate in a latitude band covering 50o N to 50o S, an expansion of the TRMM region, from all global data sources, namely high-quality microwave data, infrared data, and analyses of rain gauges. The granule size is one month.

Data Access

- Online Archive
- Earthdata Search
- Giovanni
- Web Services
- Subset / Get Data

Product Summary | Data Citation | Documentation

Shortname:	TRMM_3B43
Longname:	TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7
DOI:	10.5067/TRMM/TMPA/MONTH/7
Version:	7
Format:	HDF
Spatial Coverage:	-180.0,-50.0,180.0,50.0
Temporal Coverage:	1998-01-01 to 2018-07-31
File Size:	4.9 MB per file
Data Resolution	
Spatial:	0.25 ° x 0.25 °
Temporal:	1 month

Data Services (cont.)

- Dataset and information search
- Subsetting (spatial and parameter)
- Format conversion (NetCDF, ASCII)
- Time series (Data Rods)
- Machine to machine (OPeNDAP, https, THREDDS, GDS)
- GIS support (in-house GIS specialists)
- Online visualization and analysis (explore and evaluate datasets without downloading software and data)

Data Services (cont.)

Projects & Missions

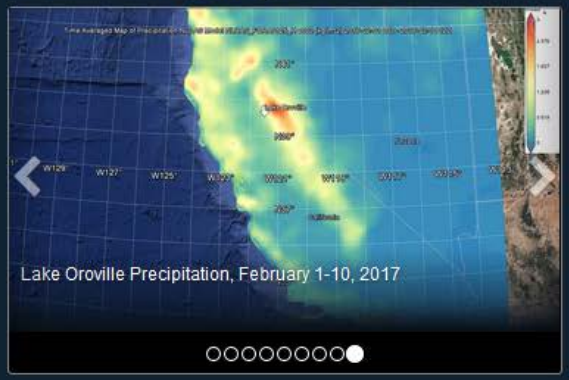
Cloud Absorption Radiometer (CAR)
The Cloud Absorption Radiometer (CAR) is an airborne multi-wavelength scanning radiometer that can perform several functions including: d...

MEaSUREs
MEaSUREs: Making Earth System Data Records for Use in Research Environments, is a NASA project, solicited through Research Opportunities in ...

SSBUV
The Shuttle Solar Backscatter Ultraviolet (SSBUV), nearly identical to Nimbus-7 SBUV and NOAA SBUV/2 instruments flown on eight space shuttl...

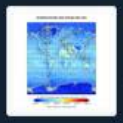
View All Projects & Missions ...

Featured Gallery Images

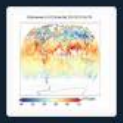


View All Gallery Images ...

News



Release of GPS Radio Occultation Boundary Layer Depth Products
Oct 25, 2018



OCO-2 Releases Lite product V9r
Oct 17, 2018

New Version 01 TSIS-1 Level 3 Products Released to Public
Oct 5, 2018

View All News ...

NASA Official: Long Pham
Web Curator: M. Hegde

Science Focus Areas
- Atmospheric Composition
- Water & Energy Cycles
- Climate Variability

Tools
- Giovanni
- MERRA Subsetter
- Data Rods for Hydrology
- DQViz
- AIRS NRT Viewer
- OGC Web Map Service
- OPeNDAP and GDS

Resources
- HowTo
- Glossary
- FAQ
- News
- Gallery
- Alerts

About Us
- Who We Are
- Citing Our Data
- Contact Us
- User Working Group

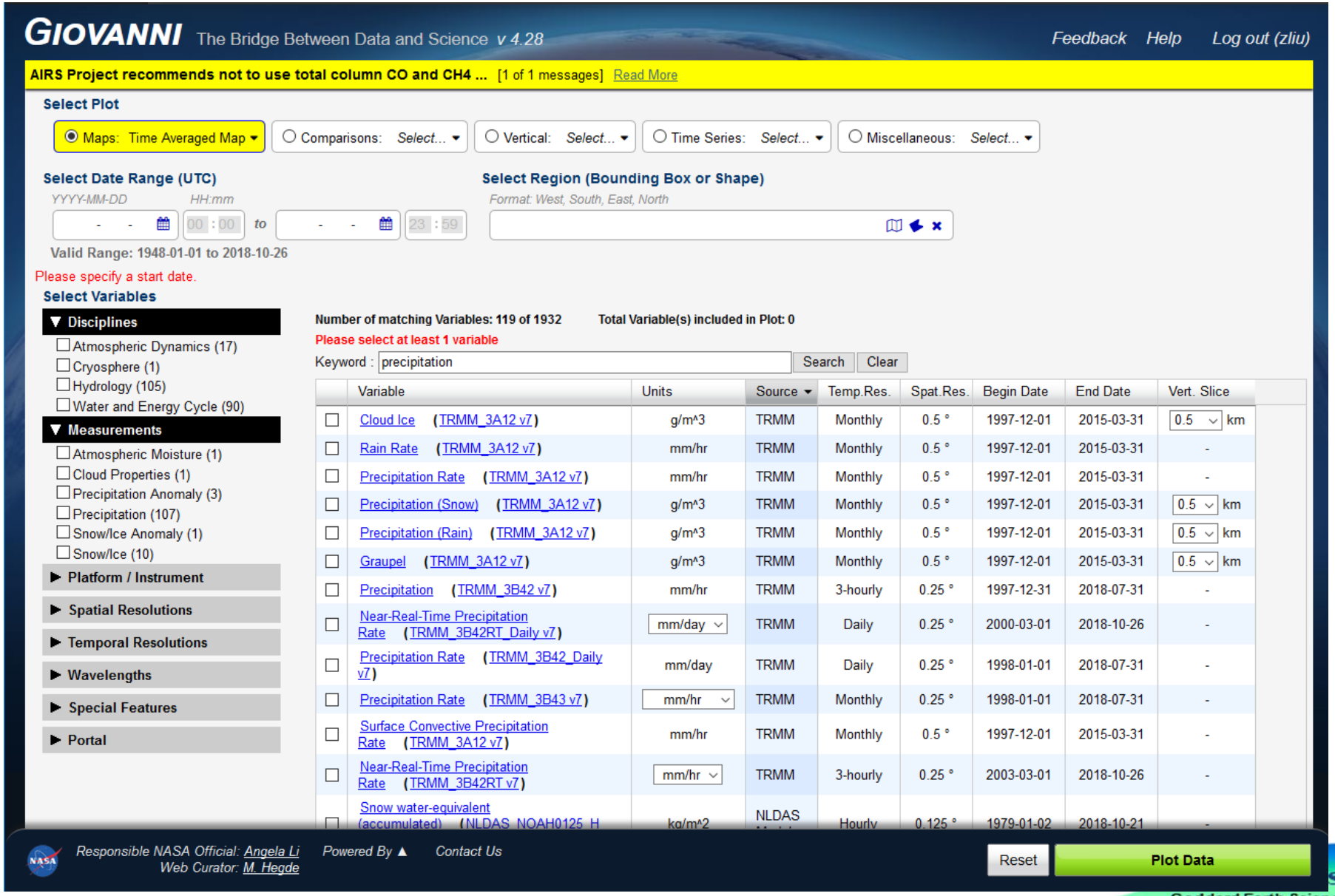
Monitor
- Console

GES – DISC
Goddard Earth Sciences
Data Information Services Center

User Services

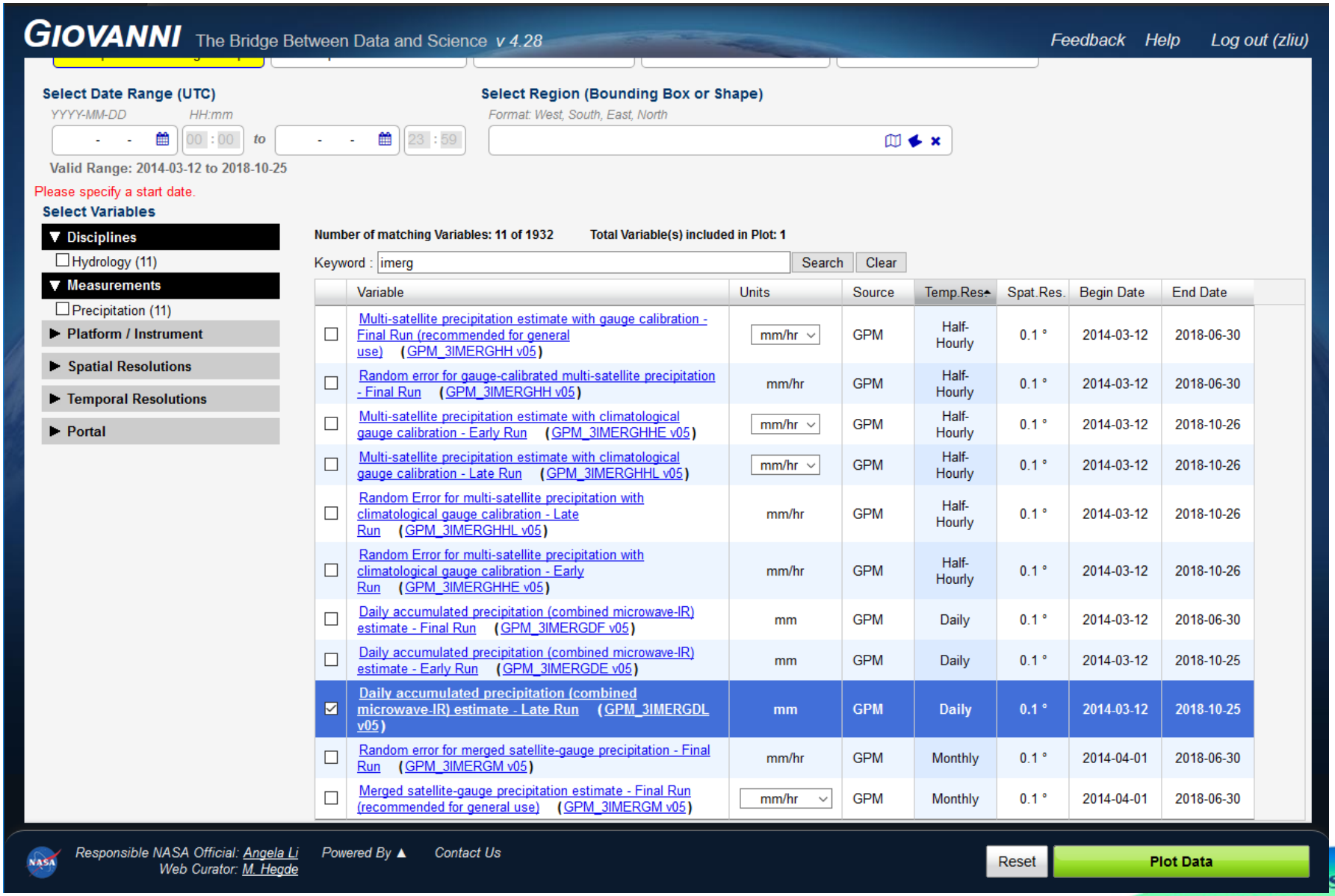
- FAQs, How-To (recipes), Glossary, etc.
- Social media (Twitter, YouTube, User Forum)
- Help desk (phone, email, online feedback)
- Training materials (ARSET => Applied Remote Sensing Training)

Giovanni (https://giovanni.gsfc.nasa.gov) - Data visualization and analysis without downloading data and software)

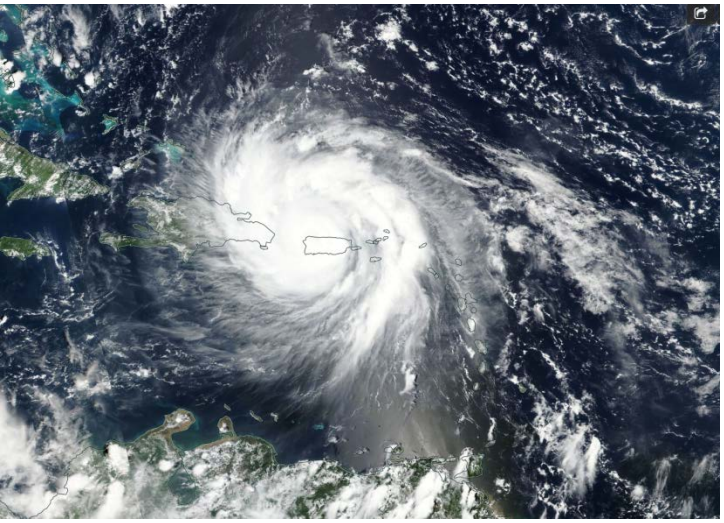


Goddard Earth Sciences Data Information Services Center

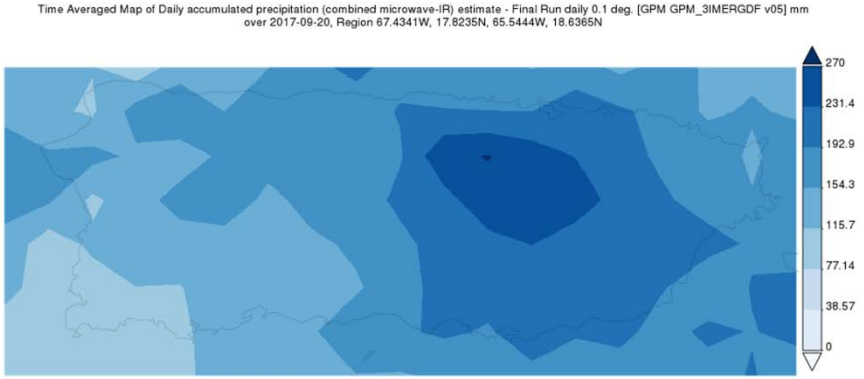
Giovanni (cont.)

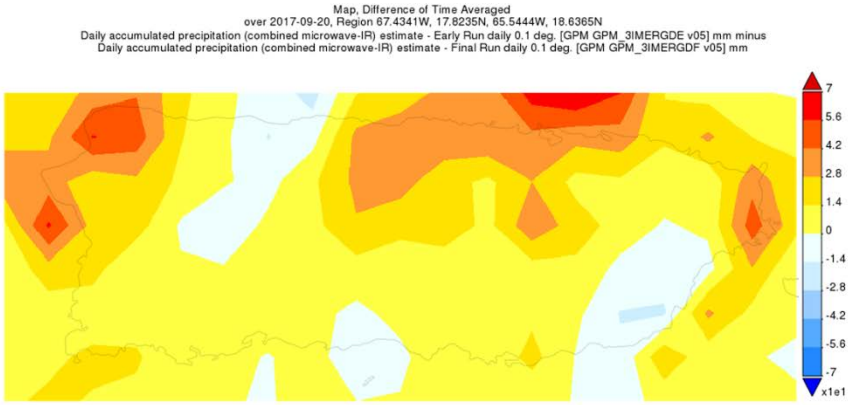


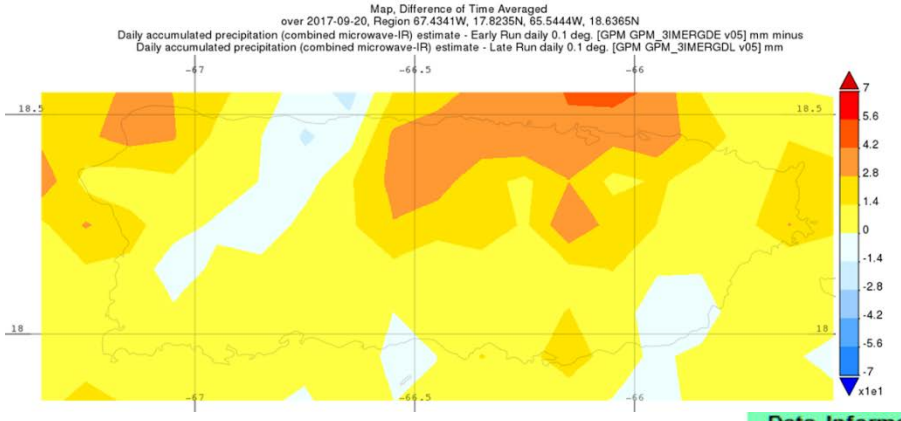
Example (Hurricane Maria)



Source: NASA Worldview

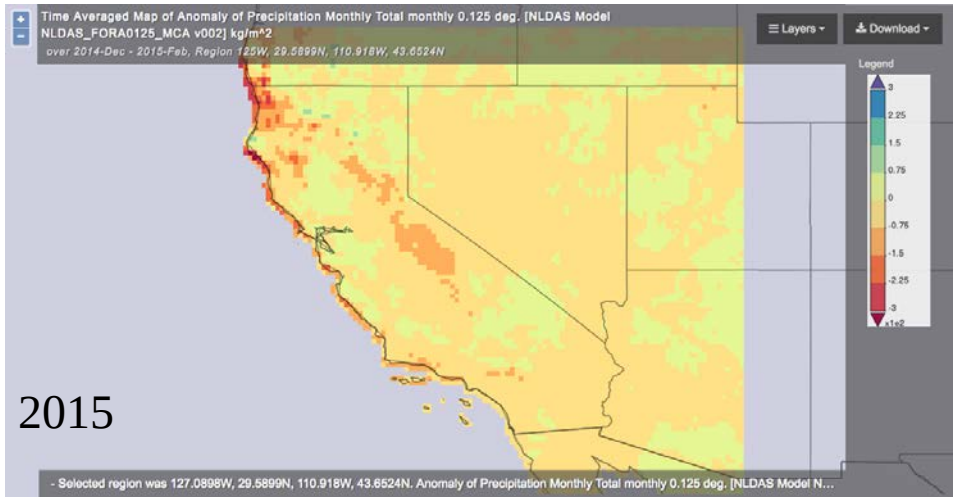




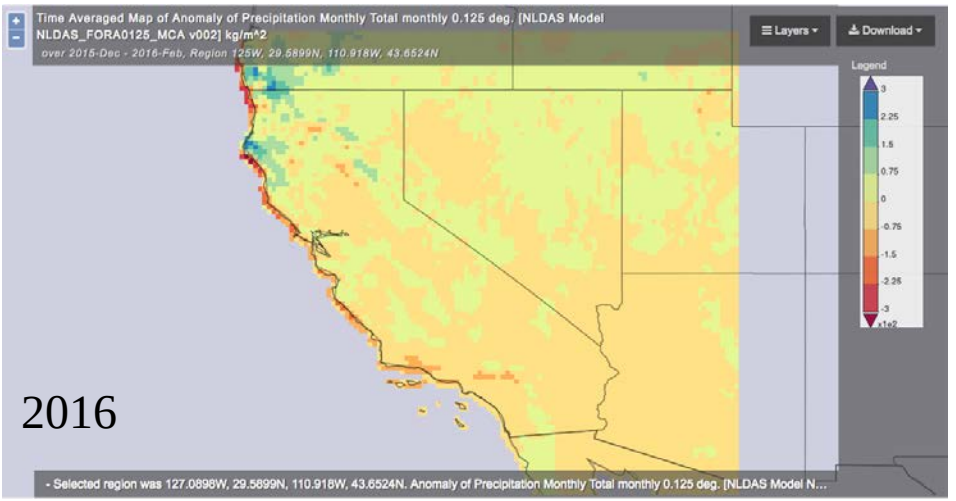


Total IMERG-Final rainfall map (in mm) in Puerto Rico (top right) and difference maps (in mm) between IMERG-Early and IMERG-Final (middle) and between IMERG-Early and IMERG-Late (bottom) on September 20, 2017.

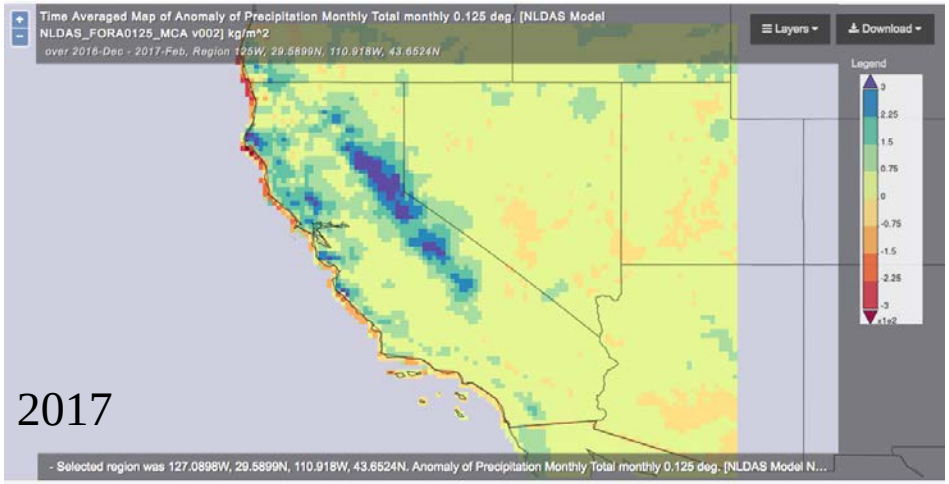
Example (California Droughts)



2015



2016



2017

NLDAS Total Precipitation Anomaly in Giovanni

Summary

- Global and regional precipitation datasets (satellite-based and data assimilation)
- Other datasets are available (temperature, wind, soil moisture, etc.)
- Data services (search, subsetting, format conversion, GIS, etc.)
- Giovanni (online tool for visualization, analysis, evaluation, etc.)
- User services

Information

- Data information and services: https://disc.gsfc.nasa.gov/ Search for: TRMM (GPM, TRMM, IMERG, NLDAS, GLDAS, MERRA)
- Giovanni: https://giovanni.gsfc.nasa.gov or Google search “NASA giovanni” Search for “GPM”, “TRMM”, “MERRA”, “GLDAS”
- Comments and suggestions: **gsfc-help-disc@lists.nasa.gov**