https://ntrs.nasa.gov/search.jsp?R=20190001146 2019-08-30T10:23:14+00:00Z

An Update on GPM and TRMM Data 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], P. Huwe[1,3], A. Albayrak[1,3], J. Su[1,3], C.-L. Shie[1,5], J. Acker[1,3], A. Li[1], W. Teng[1,3], J. Wei[1], G.-D. Lei[1,3], J. Alfred[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

AMS 99th Annual Meeting, Session: *Themed Joint Session 23 Data Stewardship: Finding, Accessing, and Using Data Online. Part II*

GES – DISC
Goddard Earth Sciences
Data Information Services Center

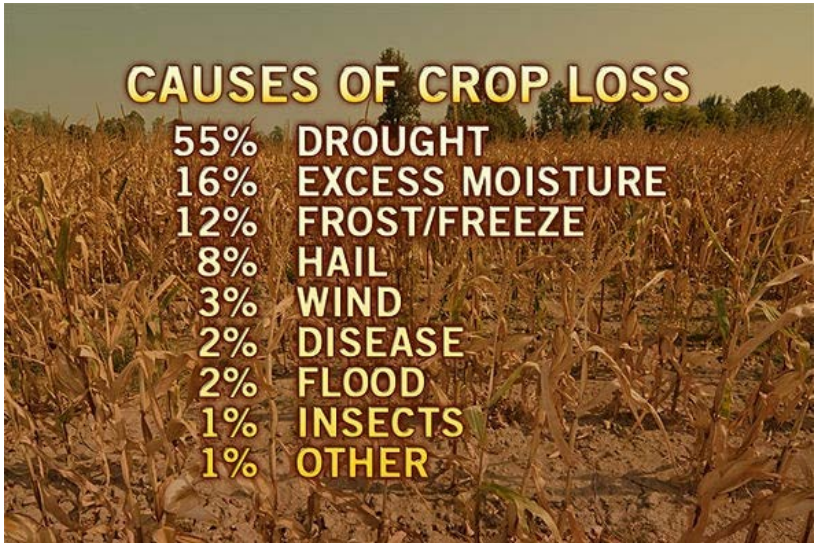
Outline

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

Introduction

- Precipitation is a key environmental variable. An example: in agriculture, precipitation, temperature, water (soil moisture), solar radiation, and vegetation cover 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/

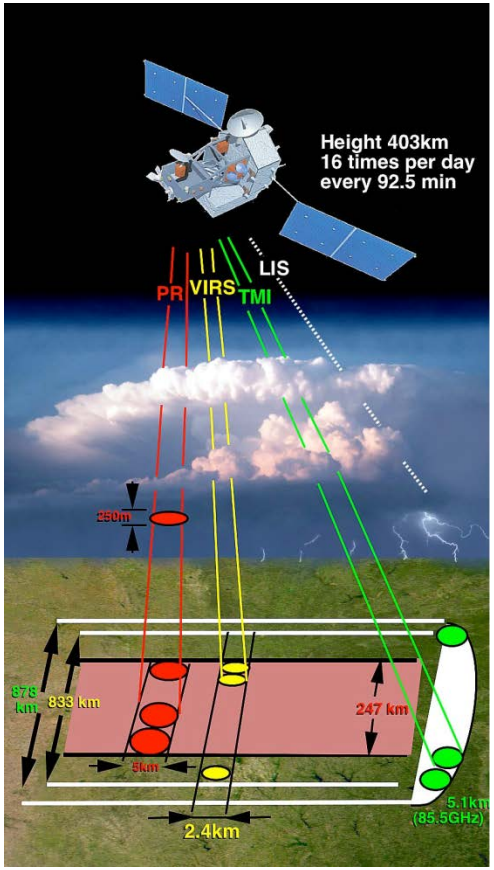


In the U.S. https://www.scientificamerican.com/article/heat-drought-continues-threaten-us-corn-crops/

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

TRMM (Tropical Rainfall Measuring Mission)

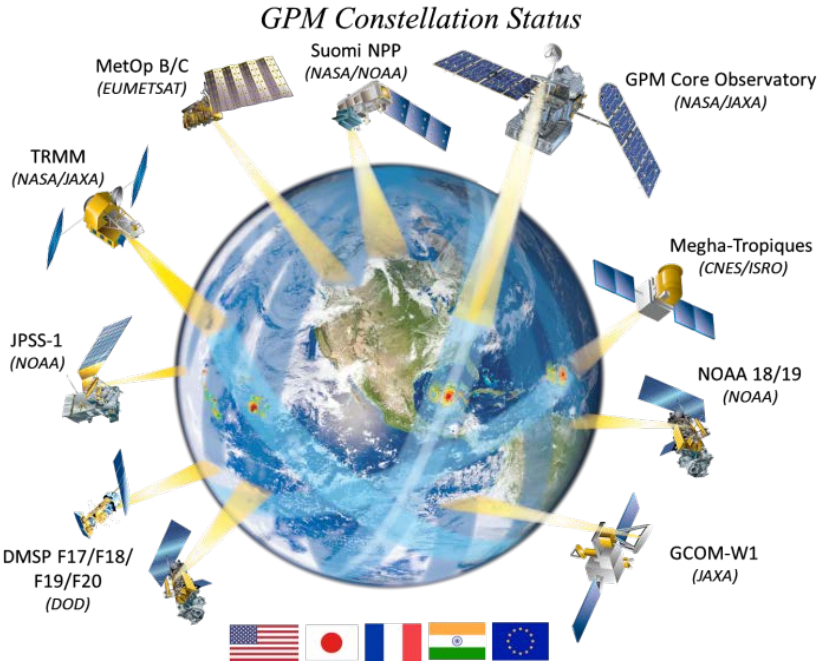
- NASA/JAXA mission (Nov. 1997 – Apr. 2015) to monitor and study tropical rainfall
- Precipitation related instruments (TMI, PR, LIS, VIRS)
- Orbital and gridded datasets
- Single sensor, multi-sensor, multi-satellite datasets.



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

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)

TRMM Version 8 Status

- Beginning with TRMM Version 8 (V8) reprocessing, TRMM and constellation data became part of the GPM data suite, with GPM algorithms used for reprocessing. The TRMM data format, as well as the file naming conventions, are now consistent with those of GPM.
- Thus, the TRMM data is now fully incorporated into the Global Precipitation Measurement (GPM) data processing stream. Products are exclusively in GPM HDF5 format.
- The mapping between the New and Legacy TRMM data products is available.

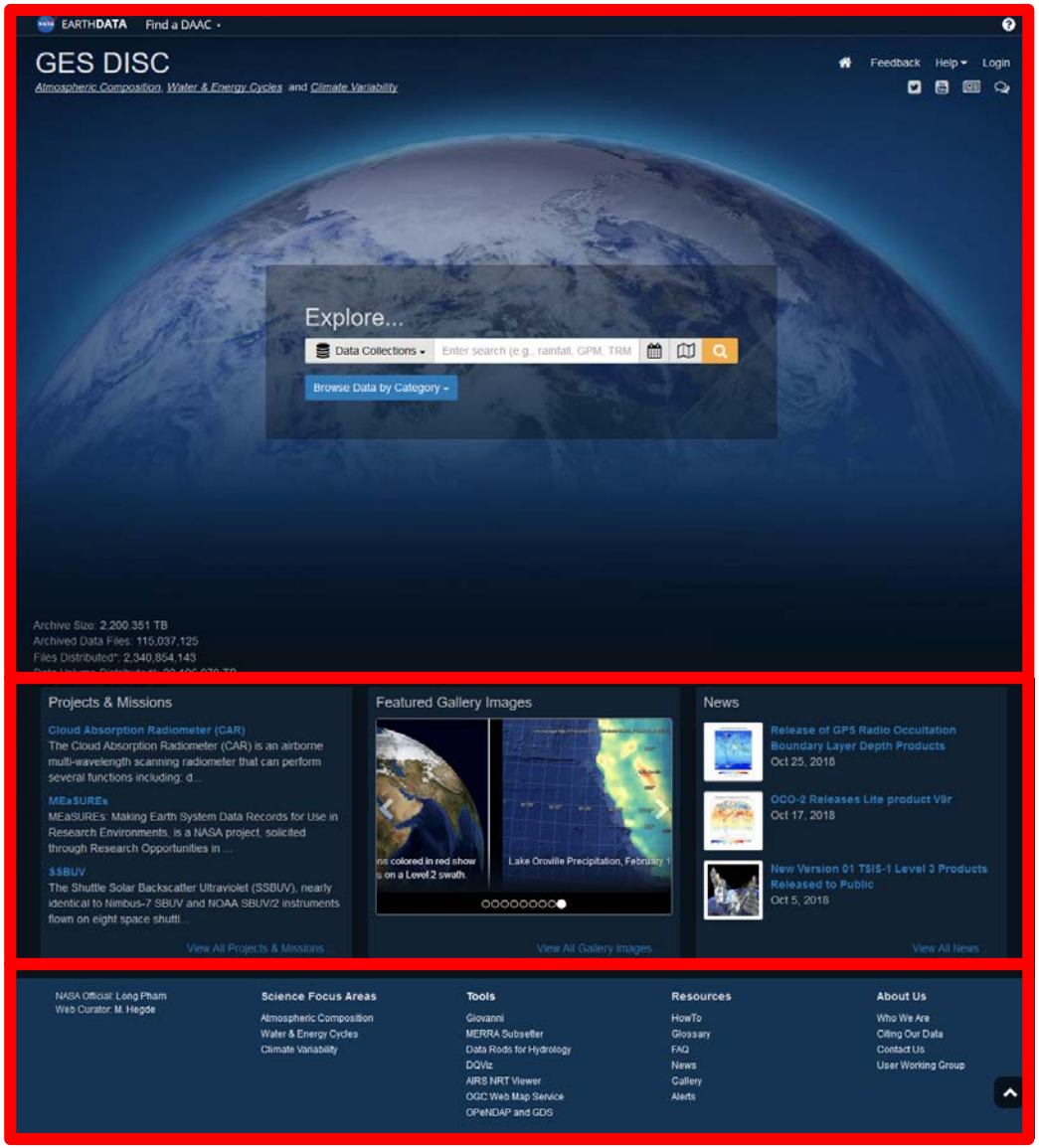
Not Entirely Independent

- 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

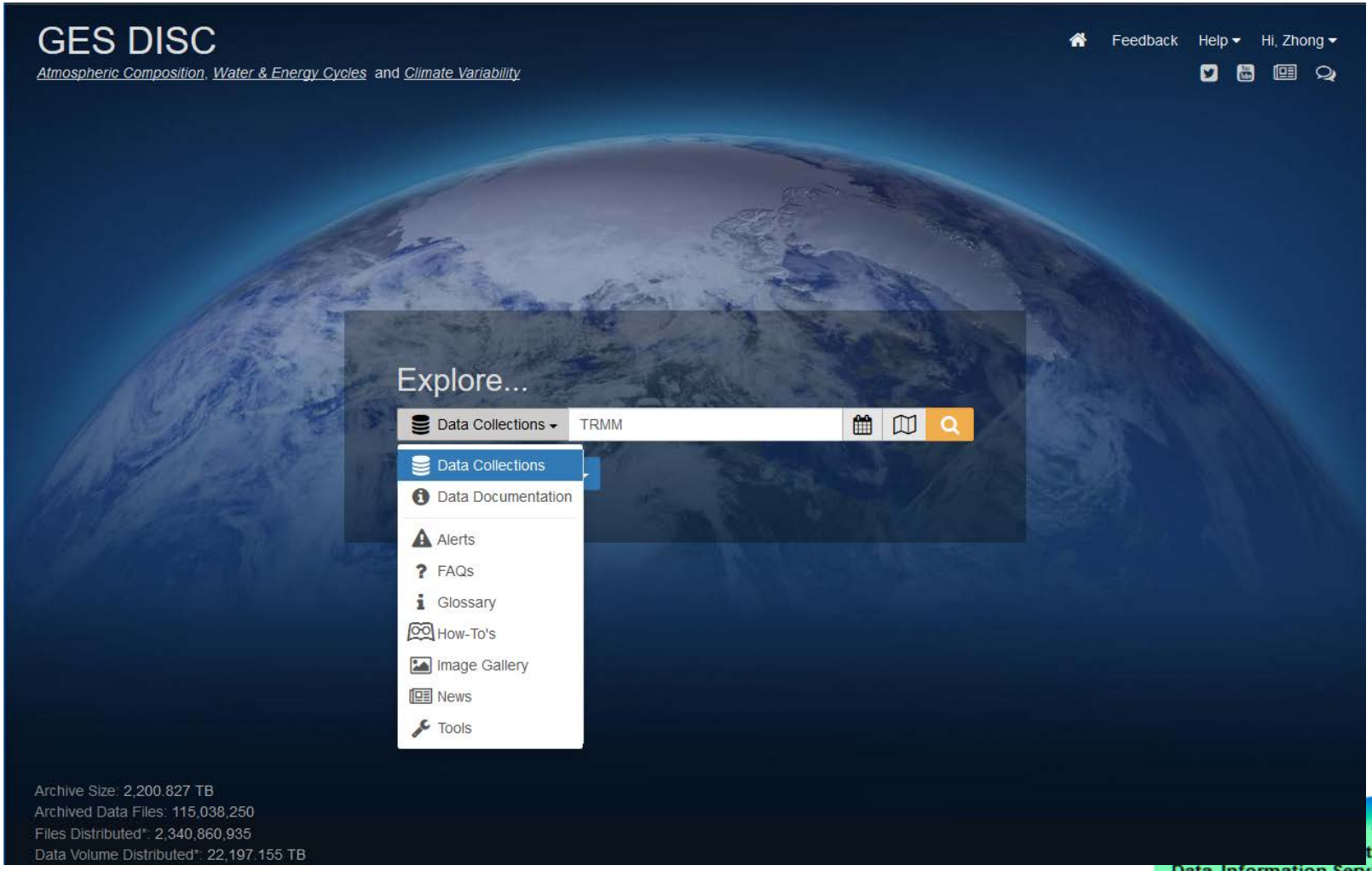
- Over oceans, passive microwave (PMW) retrievals are found to rival radar retrievals. Over land, it is more difficult (variations of the surface emissivity, in particular over snow and ice)
- IR techniques relate cloud top temperatures to surface rainfall (underestimation of warm rain, false alarms 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

Data Services (How to find data?)

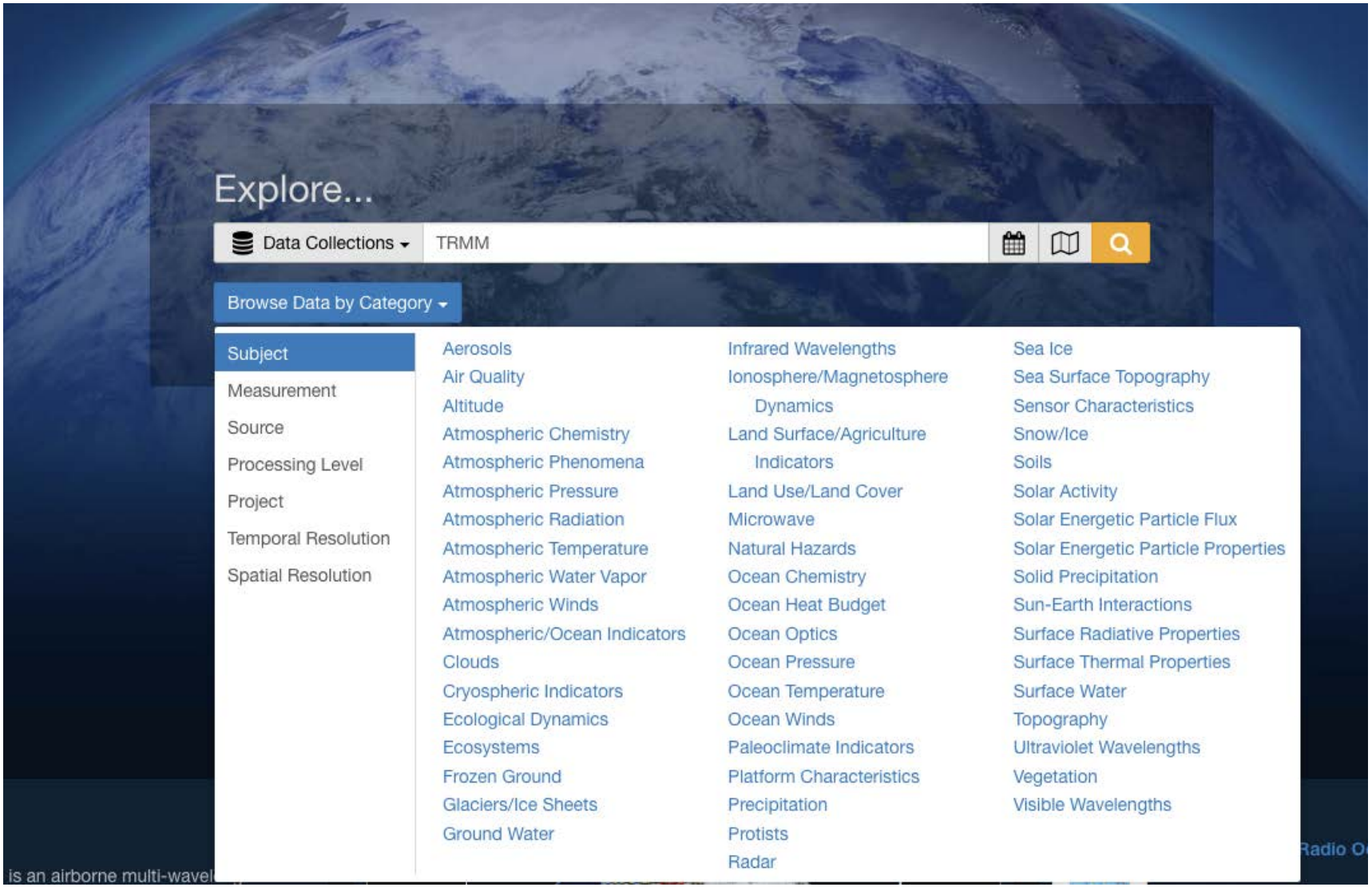


Data Services (cont.)

- TRMM, GPM, NLDAS, GLDAS, MERRA-2
- 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...

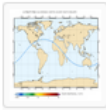
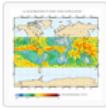
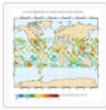
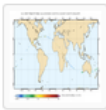
Measurement Sort ▾
- ☐ 24 Hour Precipitation Amount (1)
- ☐ Atmospheric Heating (10)
- ☐ Attitude Characteristics (8)
- ☐ Brightness Temperature (2)
- ☐ Cloud Liquid Water/Ice (8)

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.)

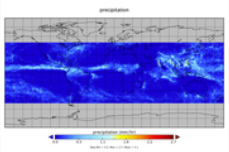
GES DISC

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

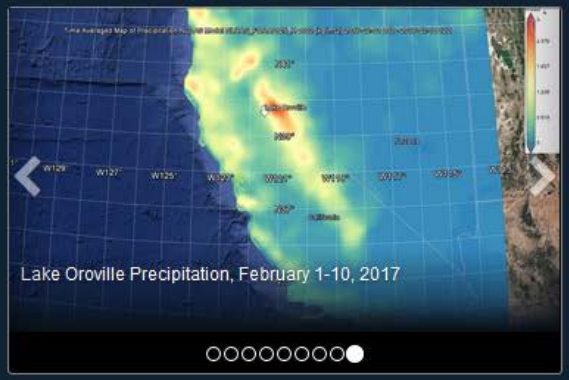
Cloud Absorption Radiometer (CAR)
The Cloud Absorption Radiometer (CAR) is an airborne multi-wavelength scanning radiometer that can perform several functions including: d...

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...

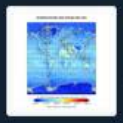
View All Projects & Missions ...

Featured Gallery Images

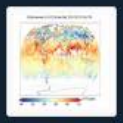


View All Gallery Images ...

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

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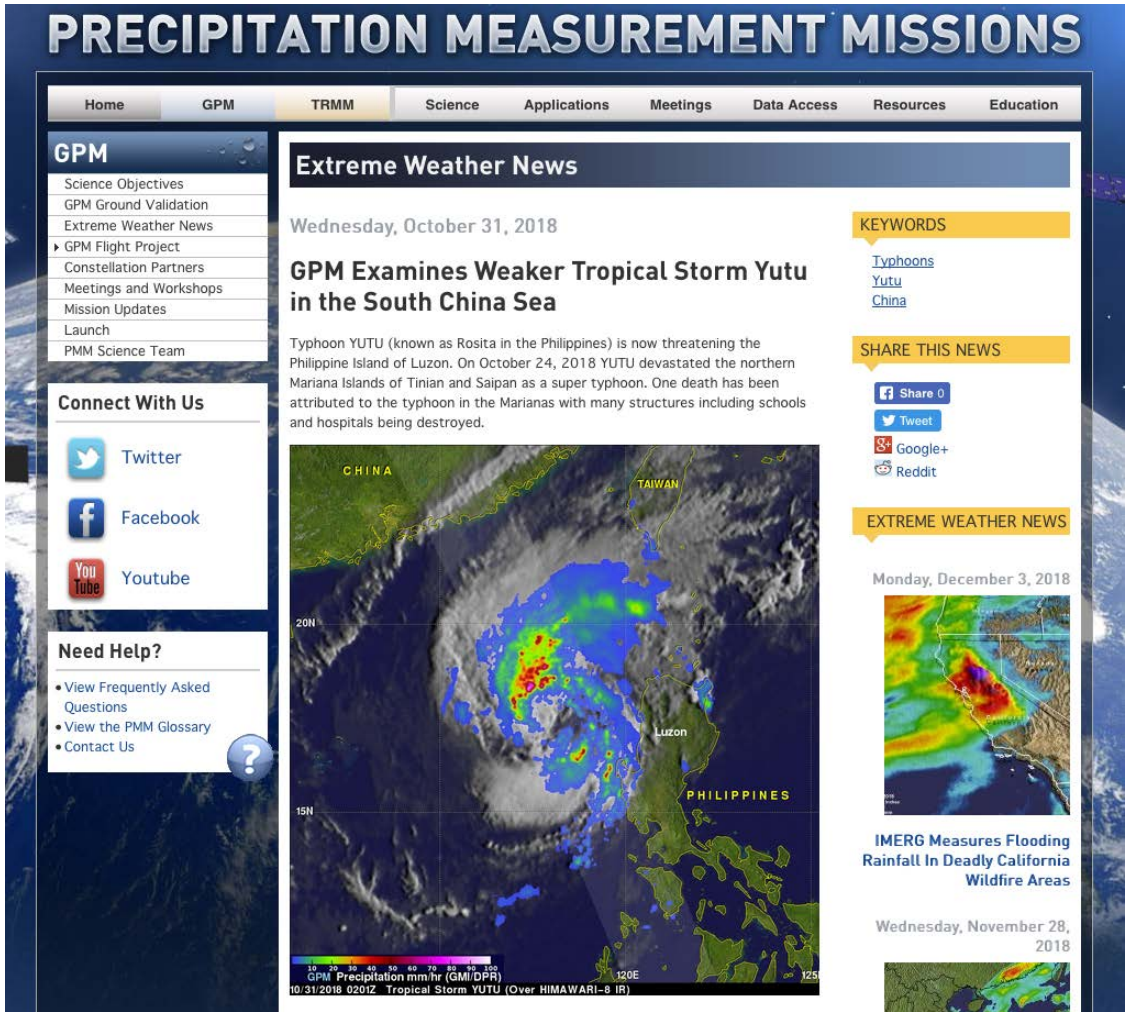
Data Services (cont.)

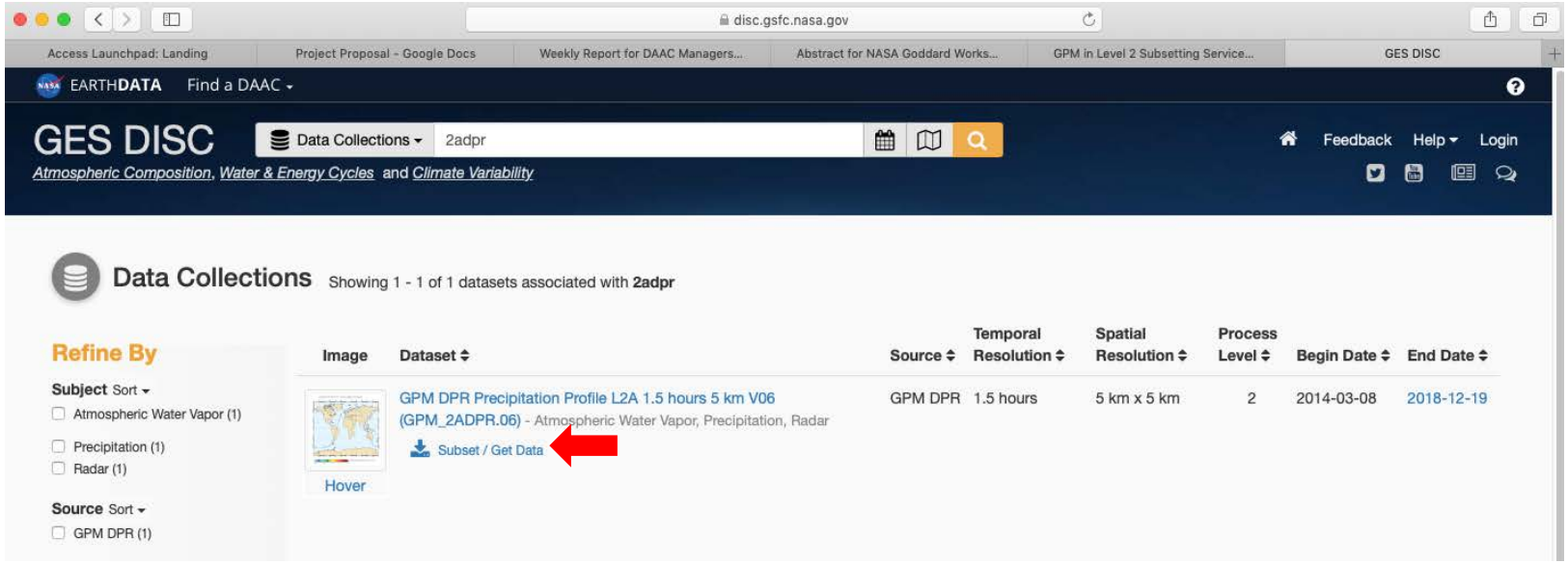
- New: Level-2 GPM DPR subsetting service

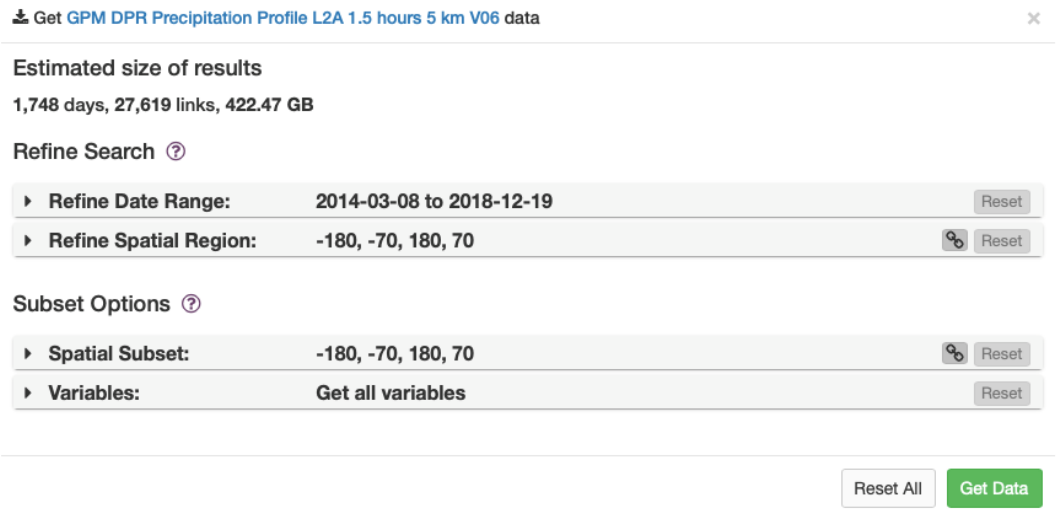


Tropical Storm Yutu in the South China Sea near the Philippines on Oct. 31, 2018 (https://pmm.nasa.gov)

Data Services (cont.)

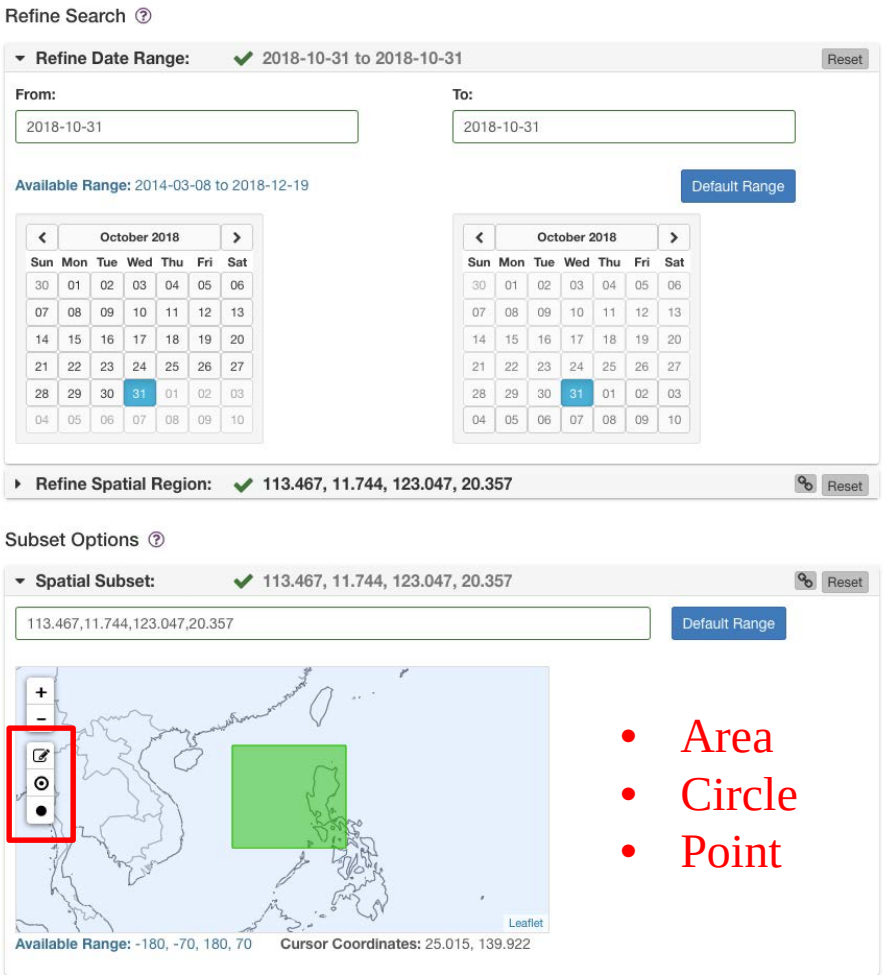
- Level-2 GPM DPR subsetting service



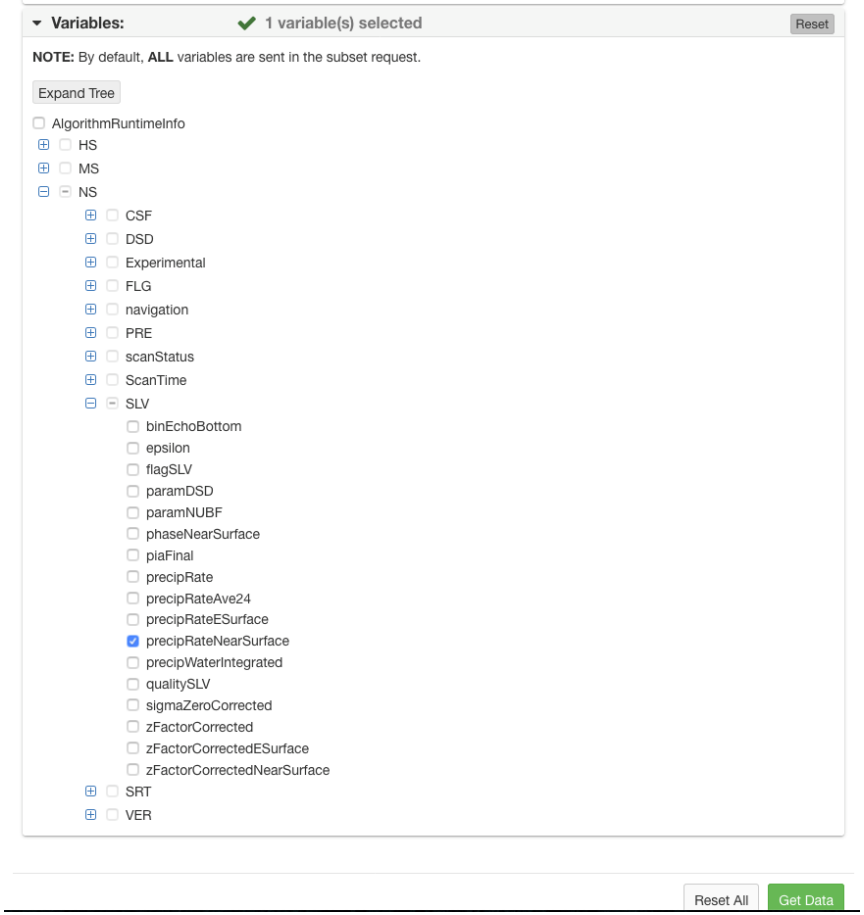


Data Services (cont.)

- Level-2 GPM DPR subsetting service



- Area
- Circle
- Point



Data Services (cont.)

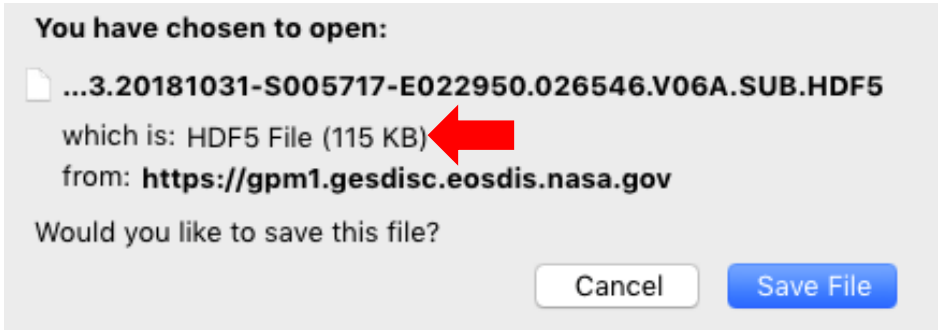
- Level-2 GPM DPR subsetting service

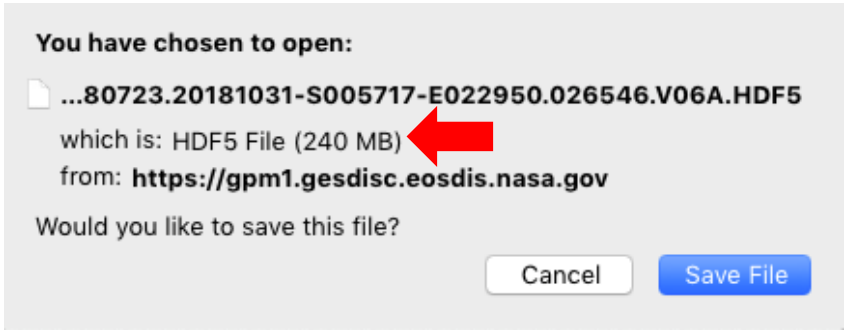
Data File Links for GPM DPR Precipitation Profile L2A 1.5 hours 5 km V06

Results (found 4 links in range from 2018-07-23 to 2018-07-23):

Download links list (This list is valid for **2** days) | Instructions for downloading

README Document
ALGORITHM THEORETICAL BASIS DOCUMENT (ATBD)
2A.GPM.DPR.V8-20180723.20181031-S005717-E022950.026546.V06A.SUB.HDF5
2A.GPM.DPR.V8-20180723.20181031-S145027-E162300.026555.V06A.SUB.HDF5

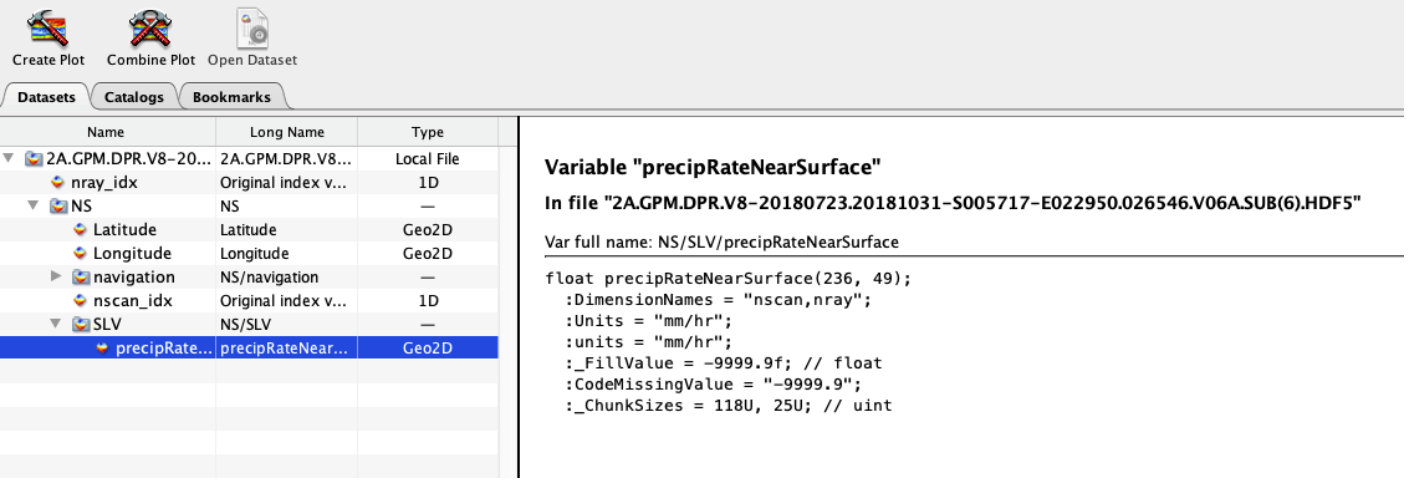


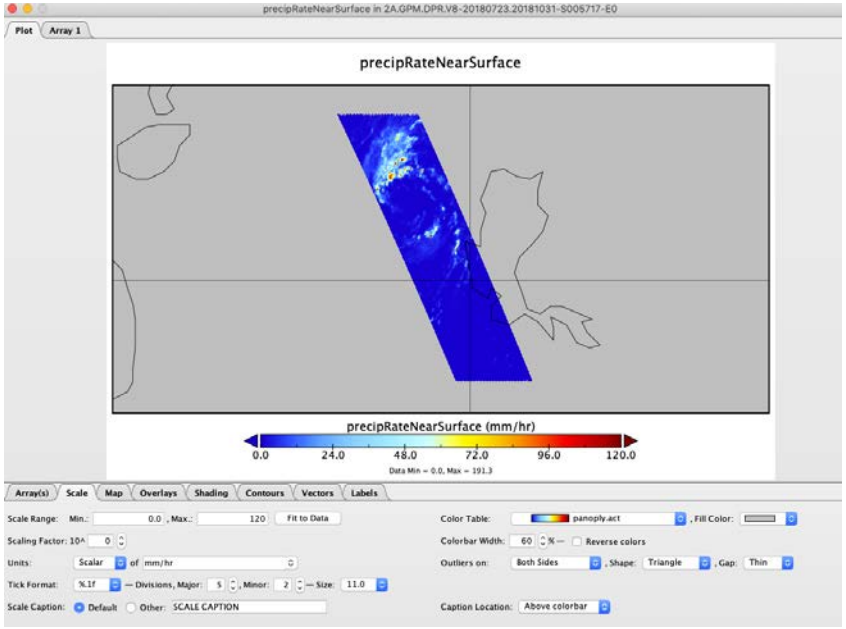


Subset Vs. Full (everything)

Data Services (cont.)

- Level-2 GPM DPR subsetting service



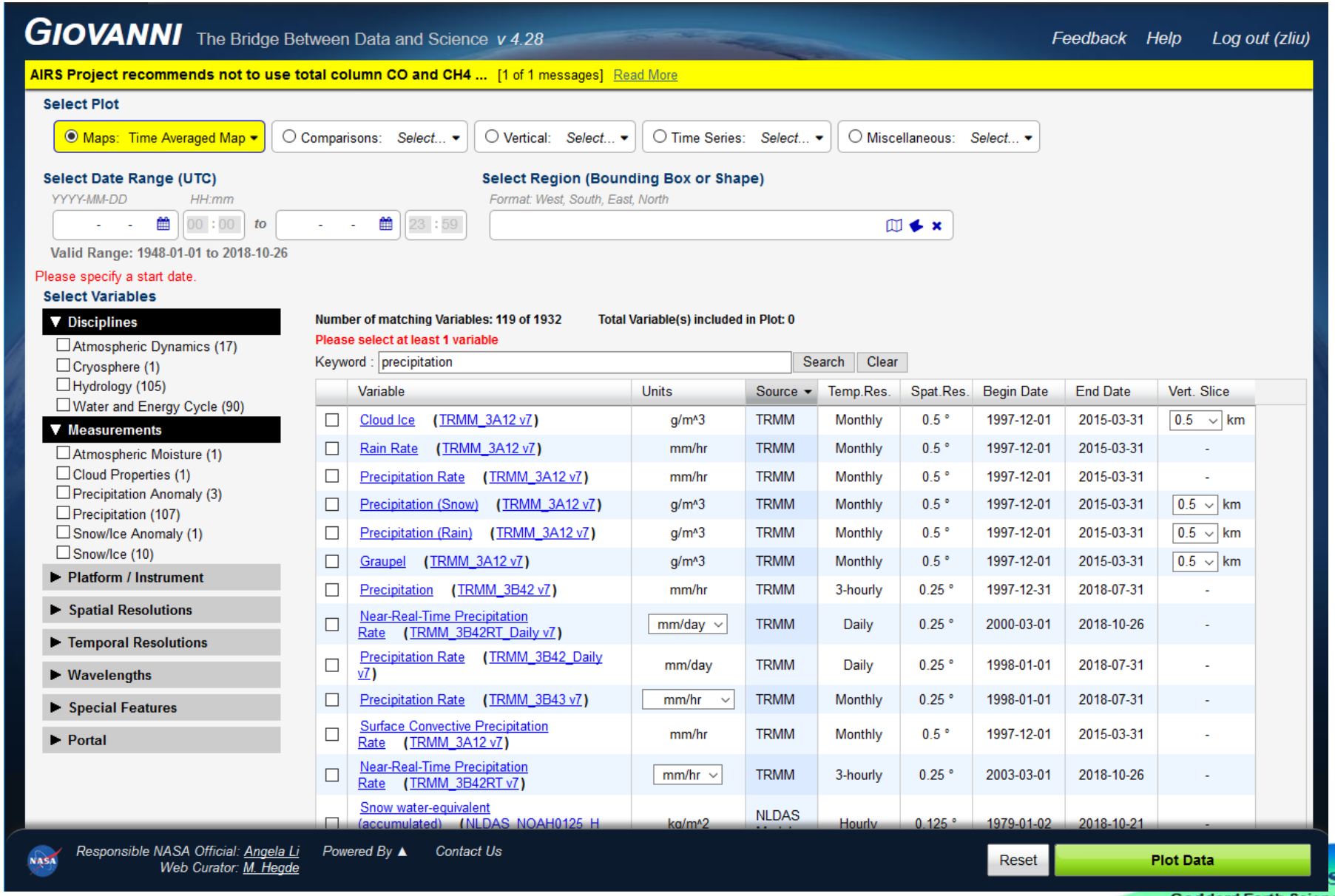


Visualized in NASA GISS Panoply

User Services

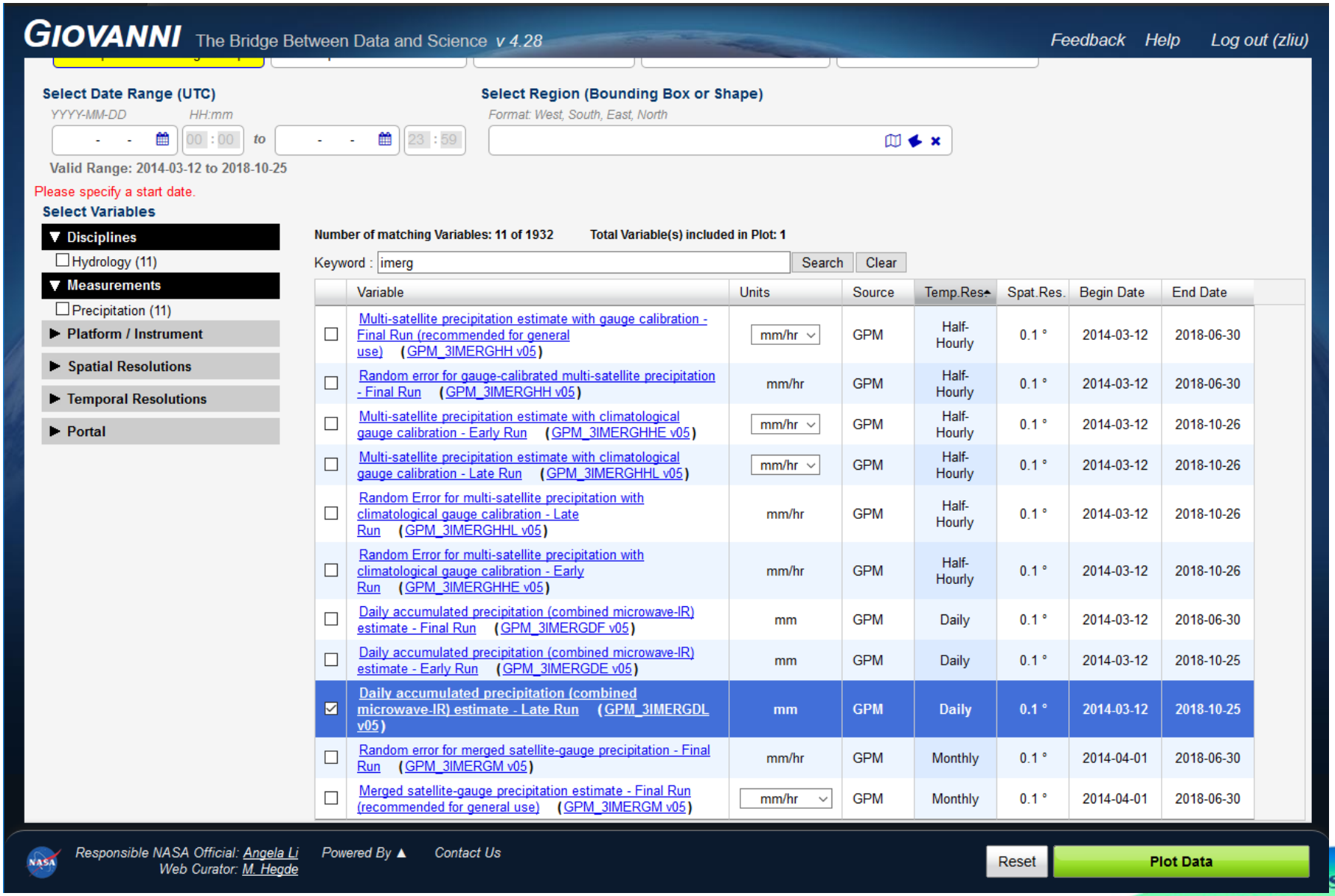
- FAQs, How-To (recipes), Glossary, etc.
- Social media (Twitter, YouTube, User Forum)
- User forum (2019)
- Help desk (phone, email, online feedback)
- Training materials (ARSET => Applied Remote Sensing Training)

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

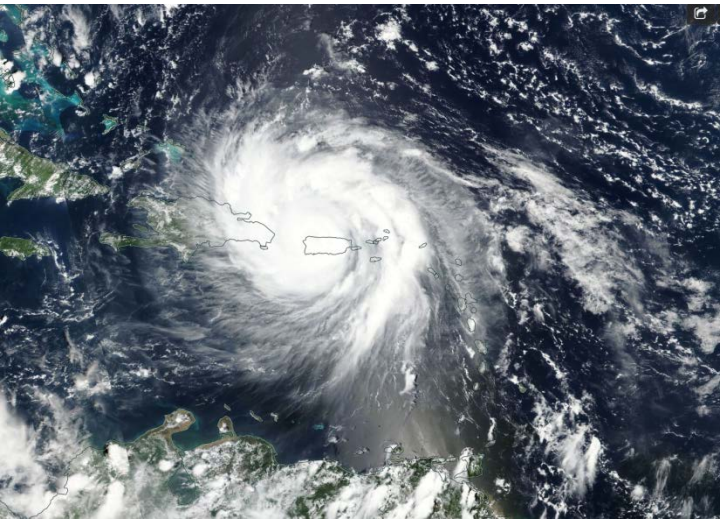


Goddard Earth Sciences Data Information Services Center

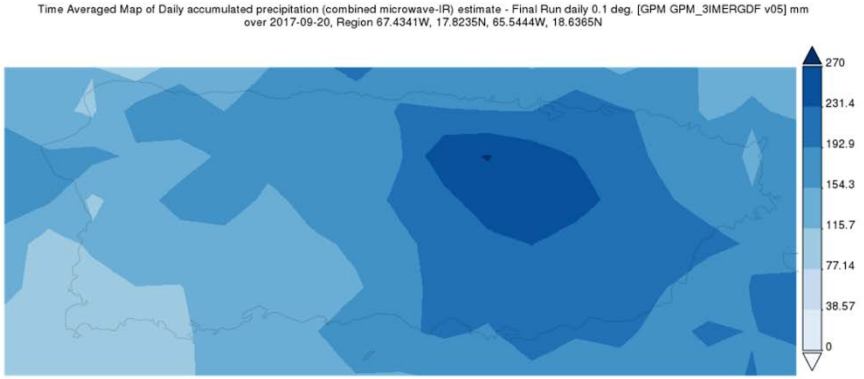
Giovanni (cont.)

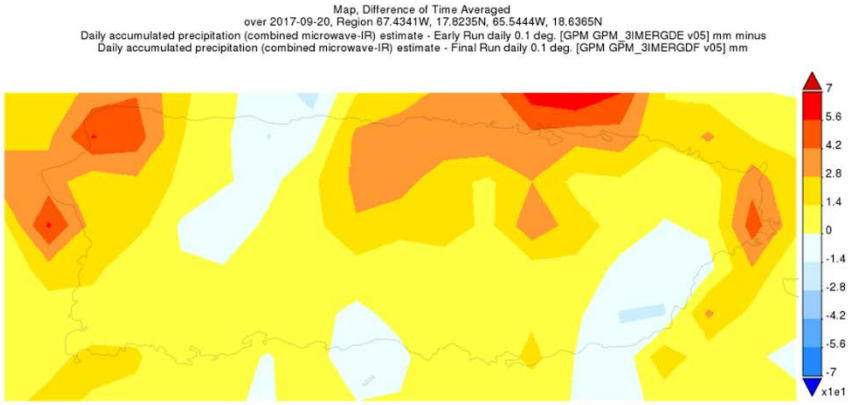


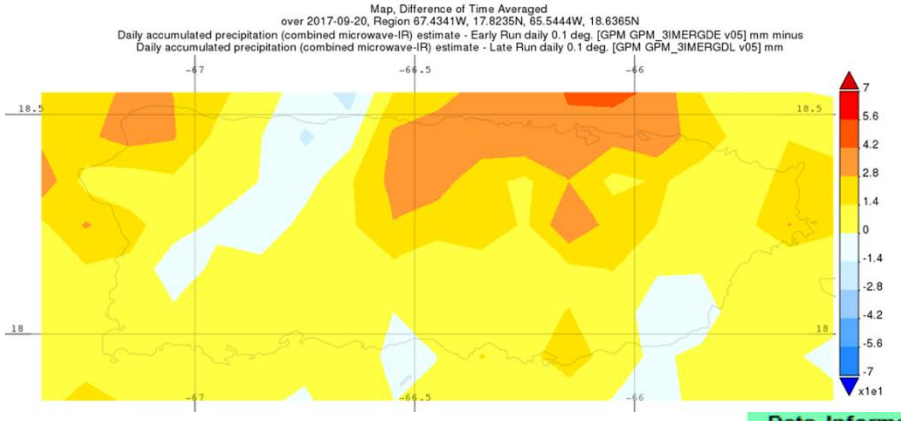
Example (Hurricane Maria)



Source: NASA Worldview

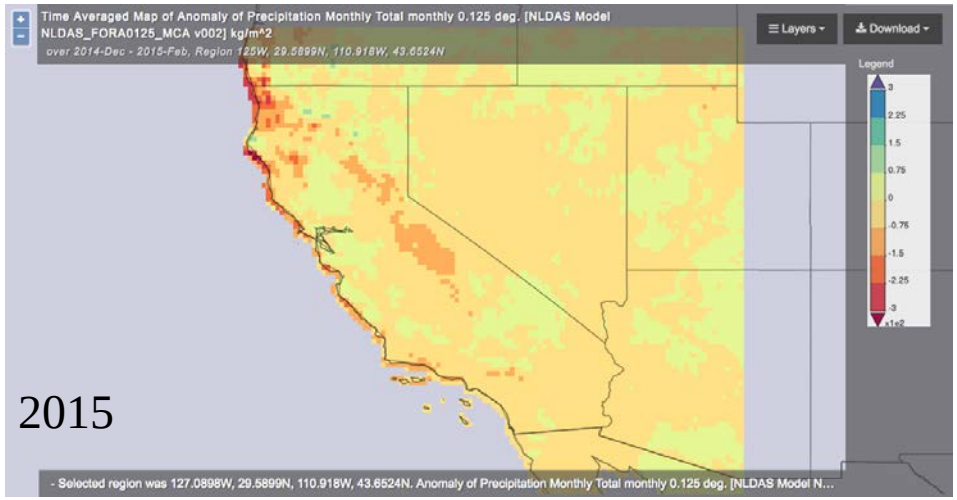




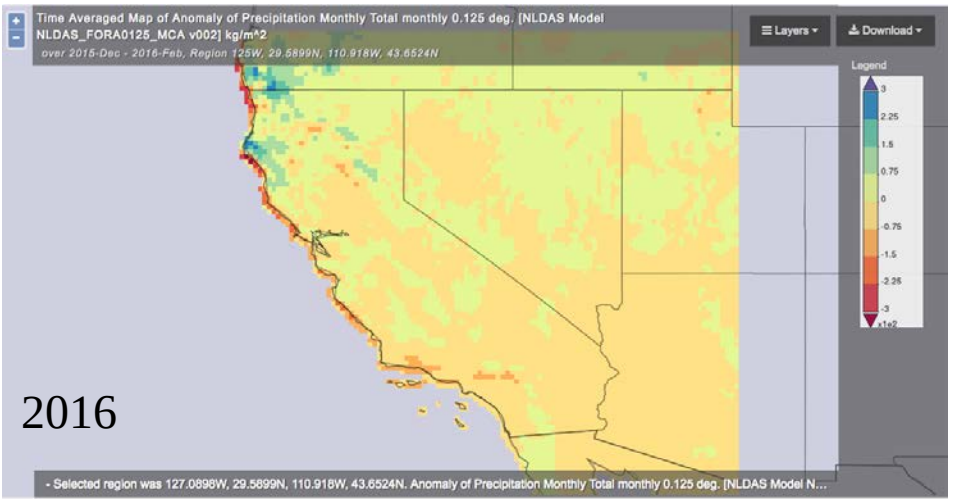


Total IMERG-Final rainfall map (in mm) in Puerto Rico (top right) and difference maps (in mm) between IMERG-Early and IMERG-Final (middle) and between IMERG-Early and IMERG-Late (bottom) on September 20, 2017.

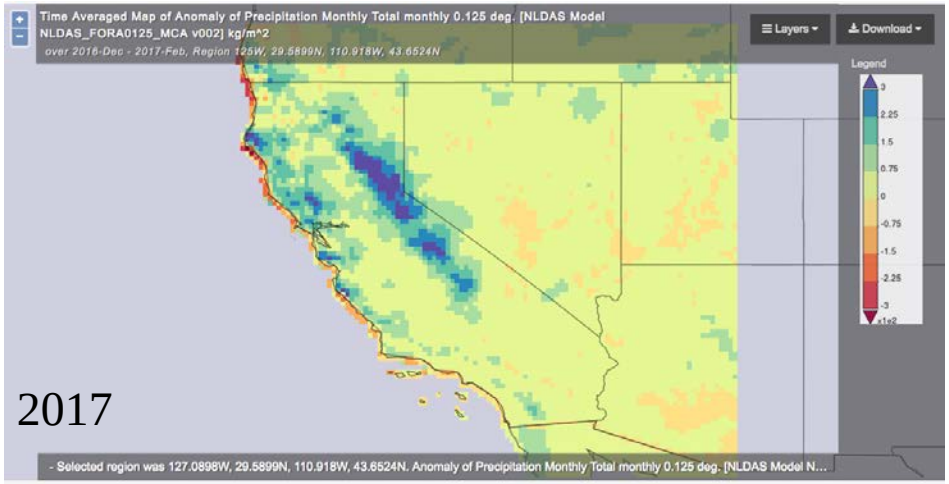
Example (California Droughts)



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, and evaluation)
- 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**