



An Update on GPM and TRMM Data Services at NASA GES DISC

Z. Liu^{1,2}, B. Vollmer¹, 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. Li¹, W. Teng^{1,3}, J. Wei¹, G.-D. Lei^{1,3}, J. Alfred^{1,3} and D. Meyer¹

¹GES DISC

²CSISS, George Mason University

³ADNET Systems, Inc.

⁴Telophase Corp

⁵Univ. of Maryland at Baltimore County

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



Outline

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

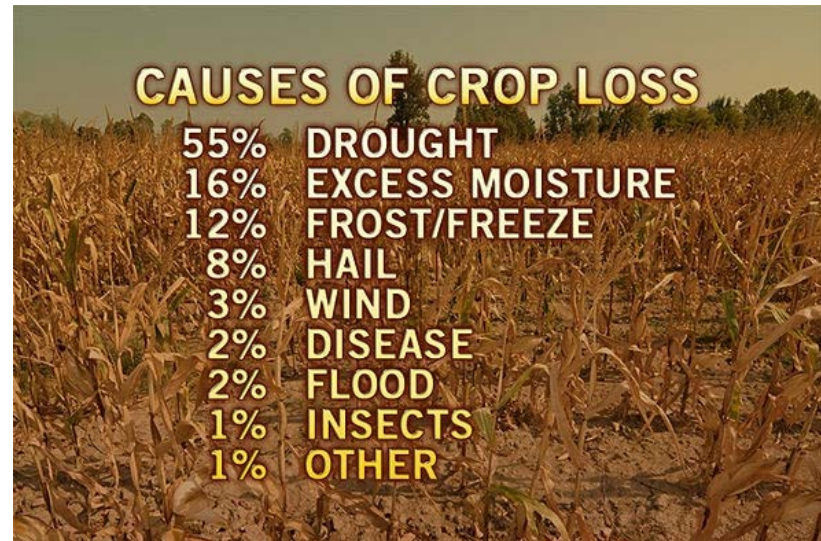


Introduction

- 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/>

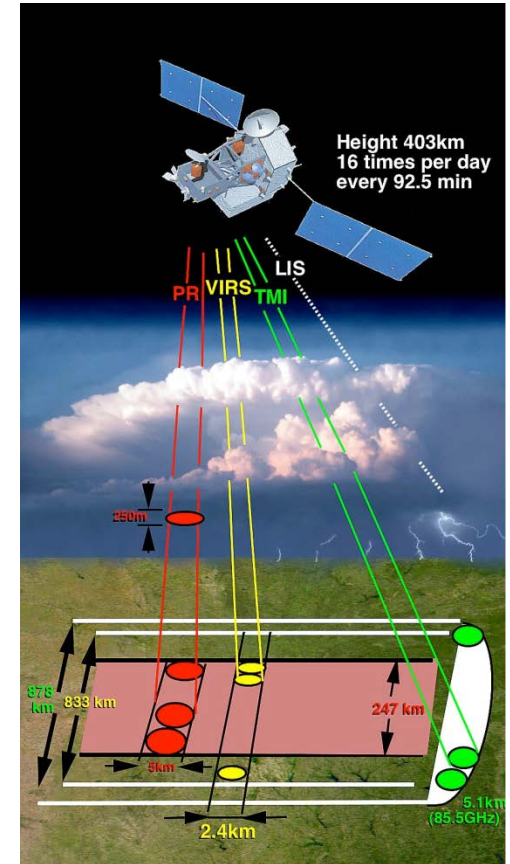


In the U.S. <https://www.scientificamerican.com/article/heat-drought-continues-threaten-us-corn-crops/>



TRMM (Tropical Rainfall Measuring Mission)

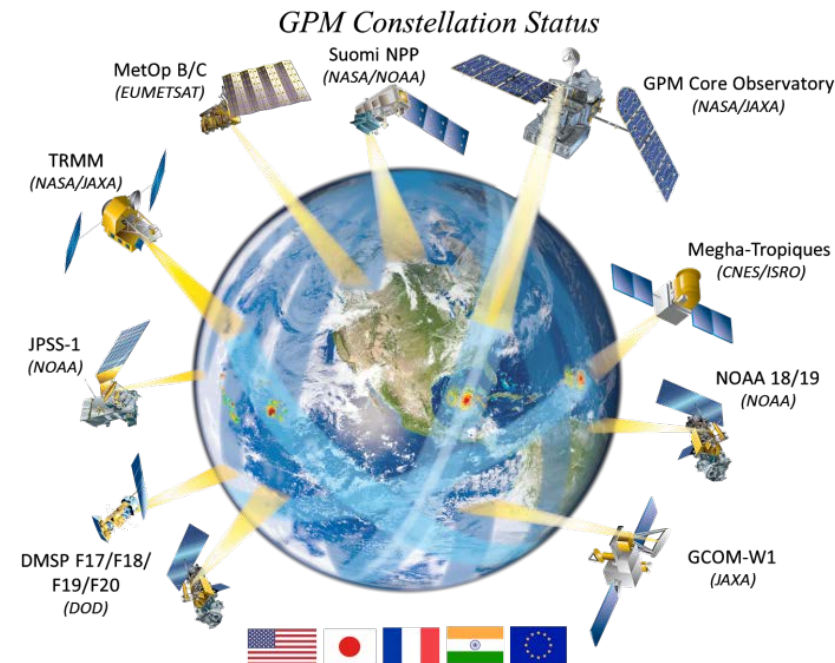
- NASA/JAXA mission (Nov. 1997 – Apr. 2015) to monitor and study tropical rainfall
- Precipitation related instruments (TMI, PR, LIS, VIRS)
- Orbital and gridded datasets
- Single sensor, multi-sensor, multi-satellite datasets.





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.





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?)

The screenshot shows the NASA EarthData GES DISC website. At the top, there is a navigation bar with the EarthData logo, a search bar for DAACs, and utility links for Feedback, Help, and Login. The main header reads "GES DISC" with sub-headers for Atmospheric Composition, Water & Energy Cycles, and Climate Variability. A large "Explore..." search box is centered on a background image of Earth from space. Below this, there are statistics: Archive Size: 2,200,351 TB; Archived Data Files: 115,037,125; Files Distributed*: 2,340,854,143. The main content area is divided into three columns: "Projects & Missions" (listing CAR, MEASURE, and SSBUV), "Featured Gallery Images" (showing satellite imagery and a precipitation map), and "News" (listing recent product releases). A footer contains contact information for NASA Official Long Pham and Web Curator M. Hegde, along with Science Focus Areas, Tools, Resources, and About Us sections.

Navigation: EARTHDATA Find a DAAC Feedback Help Login

GES DISC

Atmospheric Composition Water & Energy Cycles and Climate Variability

Explore...

Data Collections - Enter search (e.g., rainfall, GPM, TRM) Browse Data by Category -

Archive Size: 2,200,351 TB
Archived Data Files: 115,037,125
Files Distributed*: 2,340,854,143

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...

MEASURE
MEASURE: 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 shutt...

[View All Projects & Missions](#)

Featured Gallery Images

Lake Oroville Precipitation, February 1

[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 TIS-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



Data Services (cont.)

- TRMM, GPM, NLDAS, GLDAS, MERRA-2
- precipitation, soil moisture, temperature, etc.

The screenshot displays the NASA Earth Science Data Information Services Center (DISC) website. The header includes the text "GES DISC" and "Atmospheric Composition, Water & Energy Cycles and Climate Variability". Navigation links for "Feedback", "Help", and "Hi, Zhong" are visible. A search bar is active with "TRMM" entered. A dropdown menu is open, listing various options: "Data Collections", "Data Documentation", "Alerts", "FAQs", "Glossary", "How-To's", "Image Gallery", "News", and "Tools".




Archive Size: 2,200.827 TB
Archived Data Files: 115,038,250
Files Distributed*: 2,340,860,935
Data Volume Distributed*: 22,197.155 TB

DISC
Earth Sciences
Data Information Services Center



Data Services (cont.)

Explore...

Data Collections ▾ TRMM   

Browse Data by Category ▾

Subject	Aerosols	Infrared Wavelengths	Sea Ice
Measurement	Air Quality	Ionosphere/Magnetosphere Dynamics	Sea Surface Topography
Source	Altitude	Land Surface/Agriculture Indicators	Sensor Characteristics
Processing Level	Atmospheric Chemistry	Land Use/Land Cover	Snow/Ice
Project	Atmospheric Phenomena	Microwave	Soils
Temporal Resolution	Atmospheric Pressure	Natural Hazards	Solar Activity
Spatial Resolution	Atmospheric Radiation	Ocean Chemistry	Solar Energetic Particle Flux
	Atmospheric Temperature	Ocean Heat Budget	Solar Energetic Particle Properties
	Atmospheric Water Vapor	Ocean Optics	Solid Precipitation
	Atmospheric Winds	Ocean Pressure	Sun-Earth Interactions
	Atmospheric/Ocean Indicators	Ocean Temperature	Surface Radiative Properties
	Clouds	Ocean Winds	Surface Thermal Properties
	Cryospheric Indicators	Paleoclimate Indicators	Surface Water
	Ecological Dynamics	Platform Characteristics	Topography
	Ecosystems	Precipitation	Ultraviolet Wavelengths
	Frozen Ground	Protists	Vegetation
	Glaciers/Ice Sheets	Radar	Visible Wavelengths
	Ground Water		

Radio O

is an airborne multi-wave

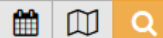


Data Services (cont.)

GES DISC

Atmospheric Composition, Water & Energy Cycles and Climate Variability

Data Collections trmm



Feedback Help Hi, Zhong



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...

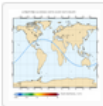


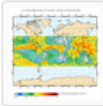


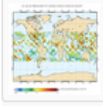


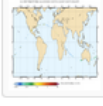
Source Sort

- 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)
- 1R (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	TRMM PR	90 minutes	5 km x 5 km	3	1997-12-07	2015-04-01
		 Get Data	 Ingest Status				
 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	TRMM TMI	1 month	0.25 ° x 0.25 °	3	1997-12-01	2015-04-08
		 Get Data	 Ingest Status				
 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	TRMM TMI	1 day	0.25 ° x 0.25 °	3	1997-12-08	2015-04-08
		 Get Data	 Ingest Status				
 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 +



Data Services (cont.)

GES DISC

Atmospheric Composition, Water & Energy Cycles and Climate Variability

Data Collections 3b43

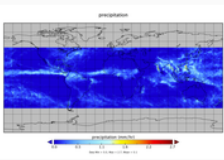


Feedback Help Hi, Zhong



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

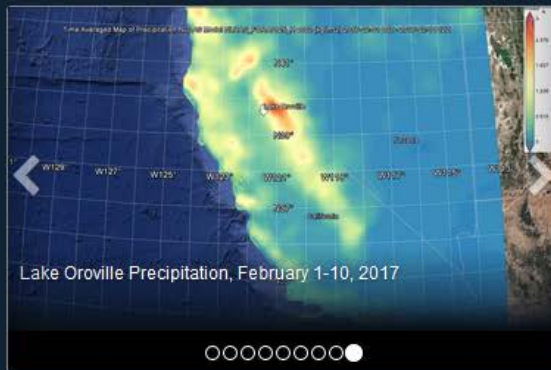
MEaSURES: Making Earth System Data Records for Use in Research Environments, is a NASA project, solicited through Research Opportunities in ...

SSBUV

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

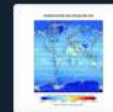
[View All Projects & Missions ...](#)

Featured Gallery Images

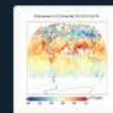


[View All Gallery Images ...](#)

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





Data Services (cont.)

- **New:** Level-2 GPM DPR subsetting service

The screenshot shows the PMM website interface. At the top is the title "PRECIPITATION MEASUREMENT MISSIONS" with a navigation menu including Home, GPM, TRMM, Science, Applications, Meetings, Data Access, Resources, and Education. The "GPM" tab is selected. On the left, there is a sidebar with "GPM" links (Science Objectives, GPM Ground Validation, Extreme Weather News, GPM Flight Project, Constellation Partners, Meetings and Workshops, Mission Updates, Launch, PMM Science Team), "Connect With Us" (Twitter, Facebook, YouTube), and "Need Help?" (View Frequently Asked Questions, View the PMM Glossary, Contact Us). The main content area features a "Extreme Weather News" section dated Wednesday, October 31, 2018, with the headline "GPM Examines Weaker Tropical Storm Yutu in the South China Sea". The article text states: "Typhoon YUTU (known as Rosita in the Philippines) is now threatening the Philippine Island of Luzon. On October 24, 2018 YUTU devastated the northern Mariana Islands of Tinian and Saipan as a super typhoon. One death has been attributed to the typhoon in the Marianas with many structures including schools and hospitals being destroyed." Below the text is a satellite precipitation map of the region, showing the storm's path and intensity over the South China Sea and Luzon. The map includes labels for CHINA, TAIWAN, PHILIPPINES, and Luzon. A legend at the bottom of the map indicates "GPM Precipitation mm/hr (GMI/DPR)" with a color scale from 10 to 125. To the right of the article, there are sections for "KEYWORDS" (Typhoons, Yutu, China), "SHARE THIS NEWS" (Share 0, Tweet, Google+, Reddit), and "EXTREME WEATHER NEWS" with a link to a December 3, 2018 article titled "IMERG Measures Flooding Rainfall In Deadly California Wildfire Areas". At the bottom right, there is a link to a November 28, 2018 article.

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

GES DISC
Atmospheric Composition, Water & Energy Cycles and Climate Variability

Data Collections Showing 1 - 1 of 1 datasets associated with 2adpr


Refine By

Subject Sort ▾

- Atmospheric Water Vapor (1)
- Precipitation (1)
- Radar (1)

Source Sort ▾

- GPM DPR (1)

Image	Dataset	Source	Temporal Resolution	Spatial Resolution	Process Level	Begin Date	End Date
 Hover	GPM DPR Precipitation Profile L2A 1.5 hours 5 km V06 (GPM_2ADPR.06) - Atmospheric Water Vapor, Precipitation, Radar Subset / Get Data	GPM DPR	1.5 hours	5 km x 5 km	2	2014-03-08	2018-12-19

Get GPM DPR Precipitation Profile L2A 1.5 hours 5 km V06 data

Estimated size of results

1,748 days, 27,619 links, 422.47 GB

Refine Search

▸ Refine Date Range: 2014-03-08 to 2018-12-19 [Reset](#)

▸ Refine Spatial Region: -180, -70, 180, 70 [Reset](#)

Subset Options

▸ Spatial Subset: -180, -70, 180, 70 [Reset](#)

▸ Variables: Get all variables [Reset](#)

[Reset All](#)

[Get Data](#)



Data Services (cont.)

- Level-2 GPM DPR subsetting service

Refine Search ?

▼ Refine Date Range: ✓ 2018-10-31 to 2018-10-31 Reset

From: To:

Available Range: 2014-03-08 to 2018-12-19 Default Range

October 2018

<						>
Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	01	02	03	04	05	06
07	08	09	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	01	02	03
04	05	06	07	08	09	10

October 2018

<						>
Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	01	02	03	04	05	06
07	08	09	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	01	02	03
04	05	06	07	08	09	10

► Refine Spatial Region: ✓ 113.467, 11.744, 123.047, 20.357 Reset

Subset Options ?

▼ Spatial Subset: ✓ 113.467, 11.744, 123.047, 20.357 Reset

Default Range

Available Range: -180, -70, 180, 70 Cursor Coordinates: 25.015, 139.922

- Area
- Circle
- Point

▼ Variables: ✓ 1 variable(s) selected Reset

NOTE: By default, ALL variables are sent in the subset request.

Expand Tree

- AlgorithmRuntimeInfo
- HS
- MS
- NS
 - CSF
 - DSD
 - Experimental
 - FLG
 - navigation
 - PRE
 - scanStatus
 - ScanTime
 - SLV
 - binEchoBottom
 - epsilon
 - flagSLV
 - paramDSD
 - paramNUBF
 - phaseNearSurface
 - plaFinal
 - precipRate
 - precipRateAve24
 - precipRateESurface
 - precipRateNearSurface
 - precipWaterIntegrated
 - qualitySLV
 - sigmaZeroCorrected
 - zFactorCorrected
 - zFactorCorrectedESurface
 - zFactorCorrectedNearSurface
 - SRT
 - VER

Reset All Get Data



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](#)

You have chosen to open:

📄 ...3.20181031-S005717-E022950.026546.V06A.SUB.HDF5

which is: HDF5 File (115 KB) 

from: <https://gpm1.gesdisc.eosdis.nasa.gov>

Would you like to save this file?

Cancel

Save File

You have chosen to open:

📄 ...80723.20181031-S005717-E022950.026546.V06A.HDF5

which is: HDF5 File (240 MB) 

from: <https://gpm1.gesdisc.eosdis.nasa.gov>

Would you like to save this file?

Cancel

Save File

Subset Vs. Full (everything)



Data Services (cont.)

- Level-2 GPM DPR subsetting service

Create Plot Combine Plot Open Dataset

Datasets Catalogs Bookmarks

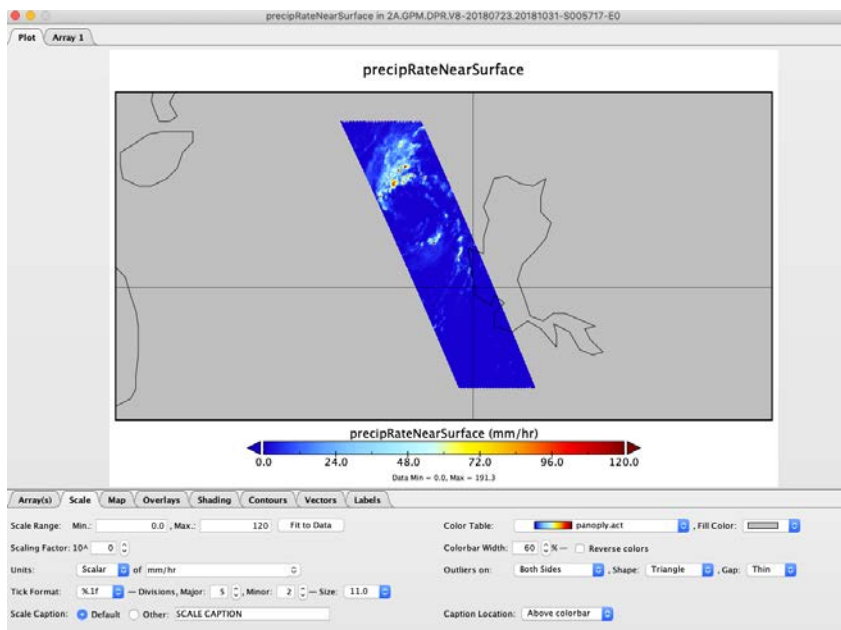
Name	Long Name	Type
2A.GPM.DPR.V8-20...	2A.GPM.DPR.V8...	Local File
nray_idx	Original index v...	1D
NS	NS	—
Latitude	Latitude	Geo2D
Longitude	Longitude	Geo2D
navigation	NS/navigation	—
nscan_idx	Original index v...	1D
SLV	NS/SLV	—
precipRate...	precipRateNear...	Geo2D

Variable "precipRateNearSurface"

In file "2A.GPM.DPR.V8-20180723.20181031-S005717-E022950.026546.V06A.SUB(6).HDF5"

Var full name: NS/SLV/precipRateNearSurface

```
float precipRateNearSurface(236, 49);
:DimensionNames = "nscan,nray";
:Units = "mm/hr";
:units = "mm/hr";
:_FillValue = -9999.9f; // float
:CodeMissingValue = "-9999.9";
:_ChunkSizes = 118U, 25U; // uint
```



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

GIOVANNI

The Bridge Between Data and Science v 4.28

[Feedback](#) [Help](#) [Log out \(zliu\)](#)

AIRS Project recommends not to use total column CO and CH4 ... [1 of 1 messages] [Read More](#)

Select Plot

Maps: Time Averaged Map
 Comparisons: Select...
 Vertical: Select...
 Time Series: Select...
 Miscellaneous: Select...

Select Date Range (UTC)

YYYY-MM-DD HH:mm
 - - [calendar icon] 00:00 to - - [calendar icon] 23:59

Valid Range: 1948-01-01 to 2018-10-26

Please specify a start date.

Select Region (Bounding Box or Shape)

Format: West, South, East, North
 [input field] [book icon] [share icon] [close icon]

Select Variables

▼ Disciplines

- Atmospheric Dynamics (17)
- Cryosphere (1)
- Hydrology (105)
- Water and Energy Cycle (90)

▼ Measurements

- Atmospheric Moisture (1)
- Cloud Properties (1)
- Precipitation Anomaly (3)
- Precipitation (107)
- Snow/Ice Anomaly (1)
- Snow/Ice (10)

► Platform / Instrument

► Spatial Resolutions

► Temporal Resolutions

► Wavelengths

► Special Features

► Portal

Number of matching Variables: 119 of 1932 Total Variable(s) included in Plot: 0

Please select at least 1 variable

Keyword: precipitation [Search] [Clear]

	Variable	Units	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Vert. Slice
<input type="checkbox"/>	Cloud Ice (TRMM_3A12 v7)	g/m ³	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	0.5 km
<input type="checkbox"/>	Rain Rate (TRMM_3A12 v7)	mm/hr	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	-
<input type="checkbox"/>	Precipitation Rate (TRMM_3A12 v7)	mm/hr	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	-
<input type="checkbox"/>	Precipitation (Snow) (TRMM_3A12 v7)	g/m ³	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	0.5 km
<input type="checkbox"/>	Precipitation (Rain) (TRMM_3A12 v7)	g/m ³	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	0.5 km
<input type="checkbox"/>	Graupel (TRMM_3A12 v7)	g/m ³	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	0.5 km
<input type="checkbox"/>	Precipitation (TRMM_3B42 v7)	mm/hr	TRMM	3-hourly	0.25 °	1997-12-31	2018-07-31	-
<input type="checkbox"/>	Near-Real-Time Precipitation Rate (TRMM_3B42RT_Daily v7)	mm/day	TRMM	Daily	0.25 °	2000-03-01	2018-10-26	-
<input type="checkbox"/>	Precipitation Rate (TRMM_3B42_Daily v7)	mm/day	TRMM	Daily	0.25 °	1998-01-01	2018-07-31	-
<input type="checkbox"/>	Precipitation Rate (TRMM_3B43 v7)	mm/hr	TRMM	Monthly	0.25 °	1998-01-01	2018-07-31	-
<input type="checkbox"/>	Surface Convective Precipitation Rate (TRMM_3A12 v7)	mm/hr	TRMM	Monthly	0.5 °	1997-12-01	2015-03-31	-
<input type="checkbox"/>	Near-Real-Time Precipitation Rate (TRMM_3B42RT v7)	mm/hr	TRMM	3-hourly	0.25 °	2003-03-01	2018-10-26	-
<input type="checkbox"/>	Snow water-equivalent (accumulated) (NLDAS_NOAH0125_H	ka/m ²	NLDAS	Hourly	0.125 °	1979-01-02	2018-10-21	-



Responsible NASA Official: [Angela Li](#)
Web Curator: [M. Hegde](#)

Powered By [Contact Us](#)

Reset

Plot Data



Giovanni (cont.)

GIOVANNI

The Bridge Between Data and Science v 4.28

[Feedback](#) [Help](#) [Log out \(zliu\)](#)

Select Date Range (UTC)

YYYY-MM-DD

HH:mm

- : to - :

Select Region (Bounding Box or Shape)

Format: West, South, East, North

Valid Range: 2014-03-12 to 2018-10-25

Please specify a start date.

Select Variables

▼ Disciplines

Hydrology (11)

▼ Measurements

Precipitation (11)

▶ Platform / Instrument

▶ Spatial Resolutions

▶ Temporal Resolutions

▶ Portal

Number of matching Variables: 11 of 1932

Total Variable(s) included in Plot: 1

Keyword :

	Variable	Units	Source	Temp.Res [▲]	Spat.Res.	Begin Date	End Date
<input type="checkbox"/>	Multi-satellite precipitation estimate with gauge calibration - Final Run (recommended for general use) (GPM_3IMERGHH v05)	<input type="text" value="mm/hr"/>	GPM	Half-Hourly	0.1 °	2014-03-12	2018-06-30
<input type="checkbox"/>	Random error for gauge-calibrated multi-satellite precipitation - Final Run (GPM_3IMERGHH v05)	mm/hr	GPM	Half-Hourly	0.1 °	2014-03-12	2018-06-30
<input type="checkbox"/>	Multi-satellite precipitation estimate with climatological gauge calibration - Early Run (GPM_3IMERGHHE v05)	<input type="text" value="mm/hr"/>	GPM	Half-Hourly	0.1 °	2014-03-12	2018-10-26
<input type="checkbox"/>	Multi-satellite precipitation estimate with climatological gauge calibration - Late Run (GPM_3IMERGHHL v05)	<input type="text" value="mm/hr"/>	GPM	Half-Hourly	0.1 °	2014-03-12	2018-10-26
<input type="checkbox"/>	Random Error for multi-satellite precipitation with climatological gauge calibration - Late Run (GPM_3IMERGHHL v05)	mm/hr	GPM	Half-Hourly	0.1 °	2014-03-12	2018-10-26
<input type="checkbox"/>	Random Error for multi-satellite precipitation with climatological gauge calibration - Early Run (GPM_3IMERGHHE v05)	mm/hr	GPM	Half-Hourly	0.1 °	2014-03-12	2018-10-26
<input type="checkbox"/>	Daily accumulated precipitation (combined microwave-IR) estimate - Final Run (GPM_3IMERGDF v05)	mm	GPM	Daily	0.1 °	2014-03-12	2018-06-30
<input type="checkbox"/>	Daily accumulated precipitation (combined microwave-IR) estimate - Early Run (GPM_3IMERGDE v05)	mm	GPM	Daily	0.1 °	2014-03-12	2018-10-25
<input checked="" type="checkbox"/>	Daily accumulated precipitation (combined microwave-IR) estimate - Late Run (GPM_3IMERGDL v05)	mm	GPM	Daily	0.1 °	2014-03-12	2018-10-25
<input type="checkbox"/>	Random error for merged satellite-gauge precipitation - Final Run (GPM_3IMERGM v05)	mm/hr	GPM	Monthly	0.1 °	2014-04-01	2018-06-30
<input type="checkbox"/>	Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) (GPM_3IMERGM v05)	<input type="text" value="mm/hr"/>	GPM	Monthly	0.1 °	2014-04-01	2018-06-30



Responsible NASA Official: [Angela Li](#)
Web Curator: [M. Hegde](#)

Powered By ▲ [Contact Us](#)



Goddard Earth Sciences
Data Information Services Center



Example (Hurricane Maria)



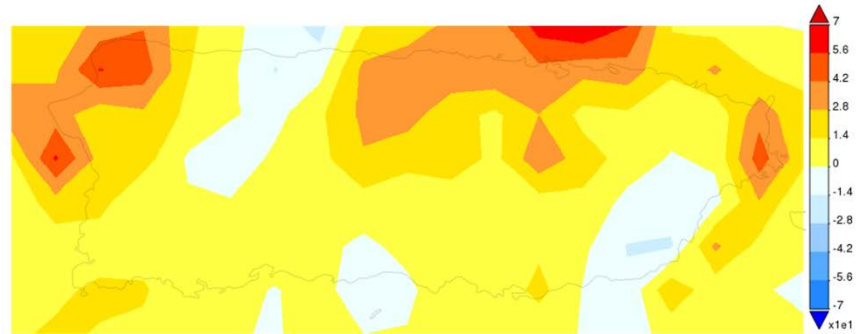
Source: NASA Worldview

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.

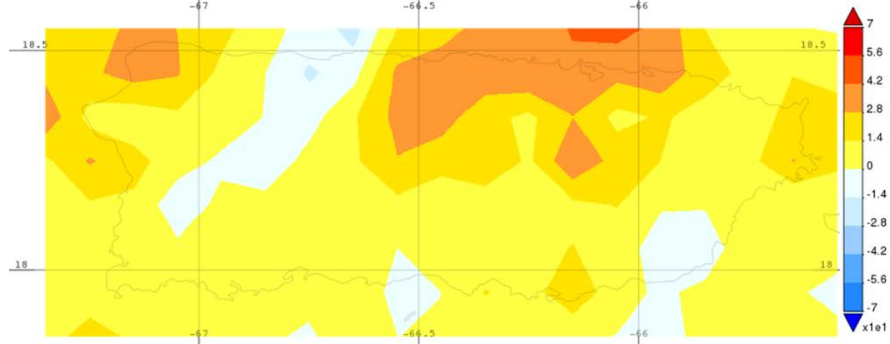
Time Averaged Map of Daily accumulated precipitation (combined microwave-IR) estimate - Final Run daily 0.1 deg. [GPM GPM_3IMERGDF v05] mm over 2017-09-20, Region 67.4341W, 17.8235N, 65.5444W, 18.6365N



Map, Difference of Time Averaged over 2017-09-20, Region 67.4341W, 17.8235N, 65.5444W, 18.6365N
Daily accumulated precipitation (combined microwave-IR) estimate - Early Run daily 0.1 deg. [GPM GPM_3IMERGDE v05] mm minus
Daily accumulated precipitation (combined microwave-IR) estimate - Final Run daily 0.1 deg. [GPM GPM_3IMERGDF v05] mm

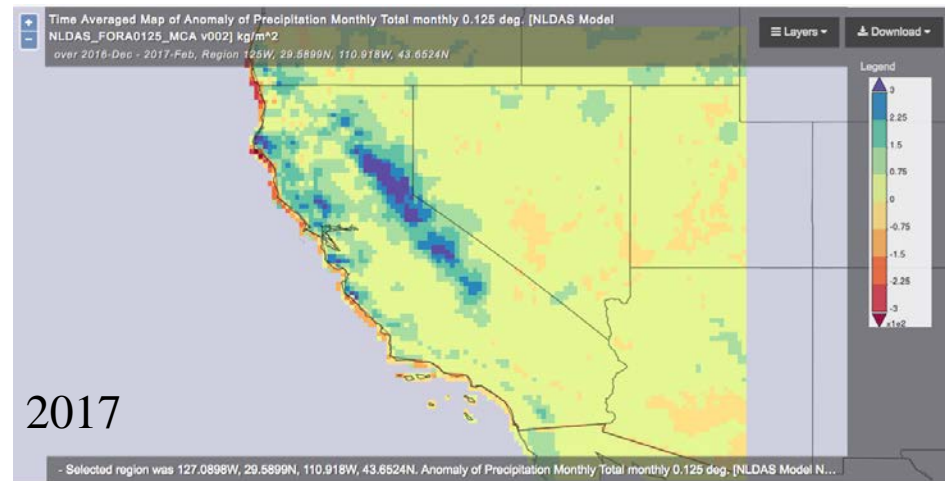
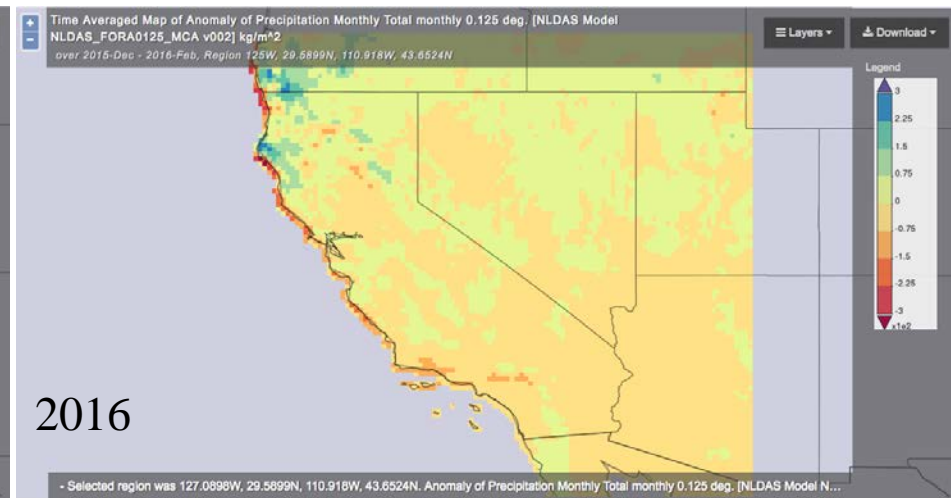
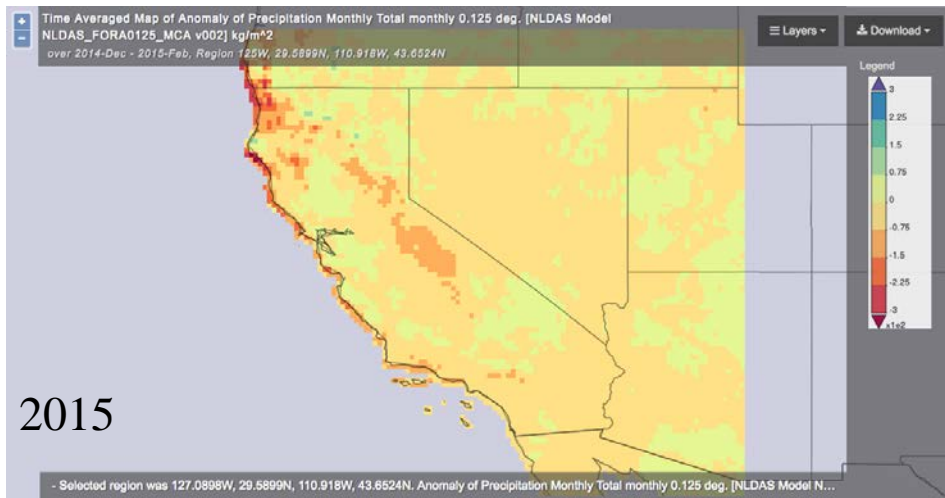


Map, Difference of Time Averaged over 2017-09-20, Region 67.4341W, 17.8235N, 65.5444W, 18.6365N
Daily accumulated precipitation (combined microwave-IR) estimate - Early Run daily 0.1 deg. [GPM GPM_3IMERGDE v05] mm minus
Daily accumulated precipitation (combined microwave-IR) estimate - Late Run daily 0.1 deg. [GPM GPM_3IMERGDL v05] mm





Example (California Droughts)



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