



# Welcome to Global Precipitation Measurement (GPM) Mission Applications Webinar Series

## Webinar 1: Overview of GPM Mission, Data Products, and Data Access Tools



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NASA Applied Remote Sensing Training (ARSET)

<http://arset.gsfc.nasa.gov>



# Webinar Objective

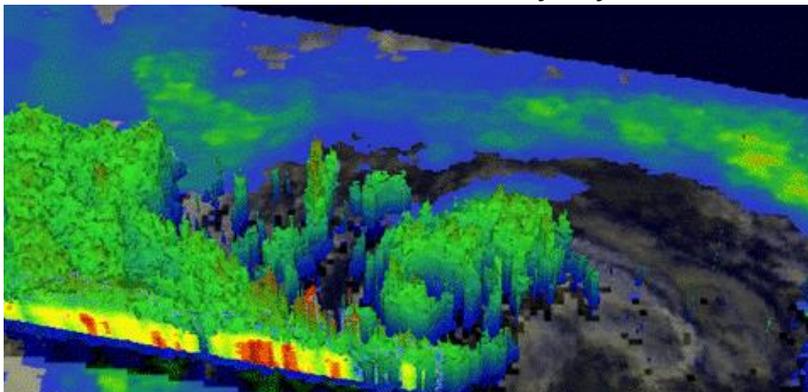


- This webinar series is designed to facilitate GPM precipitation data usage in environmental research, applications, and decision support activities

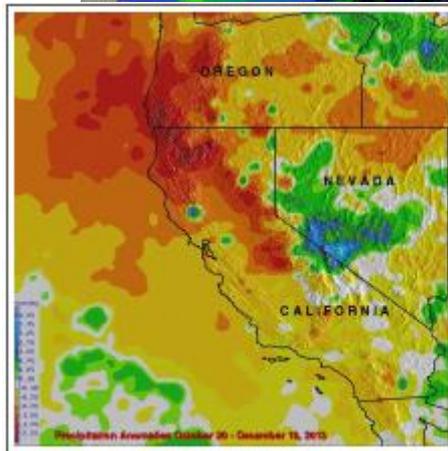
# Tropical Rainfall Measuring Mission (TRMM)

## TRMM Sees Hurricane Sandy Eye in 3D

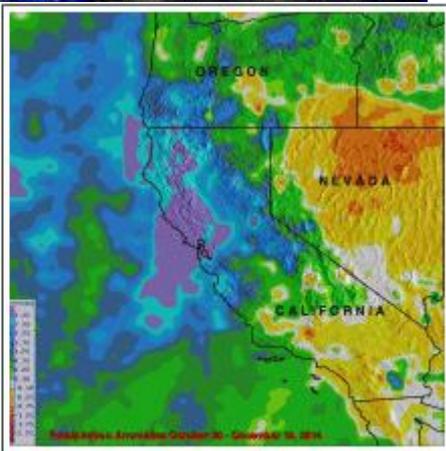
[https://youtu.be/0\\_2pcVlJvBM](https://youtu.be/0_2pcVlJvBM)



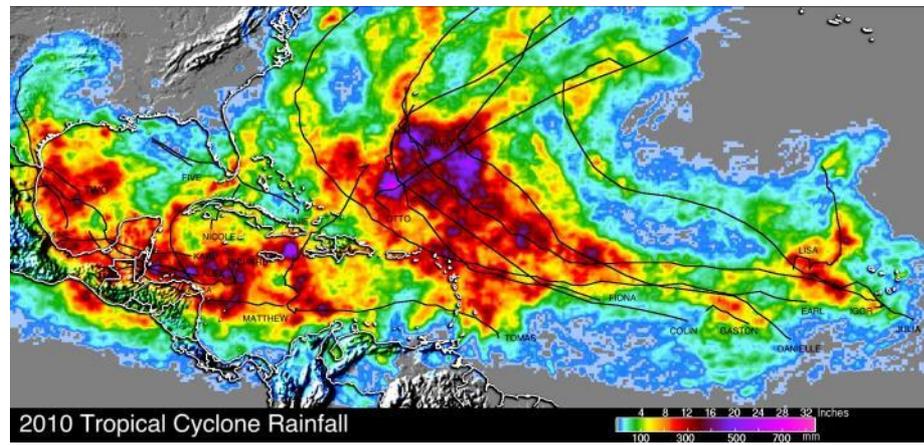
- TRMM Launch: November, 1997
- 17+ years of unprecedented precipitation data
- Mission ended April 15, 2015



2013



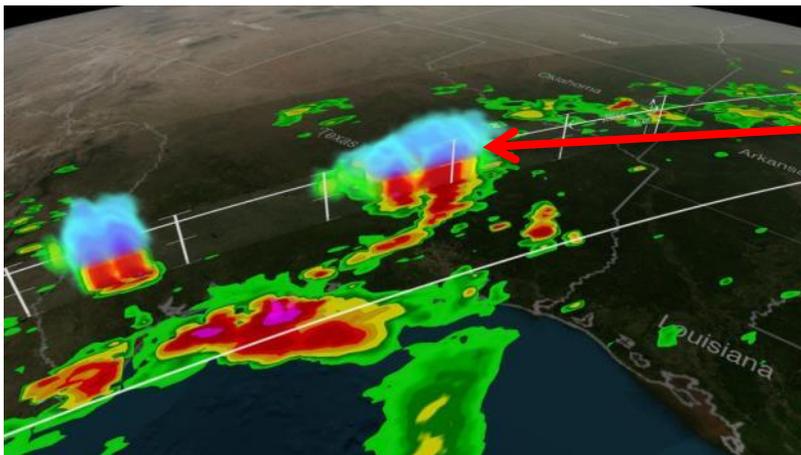
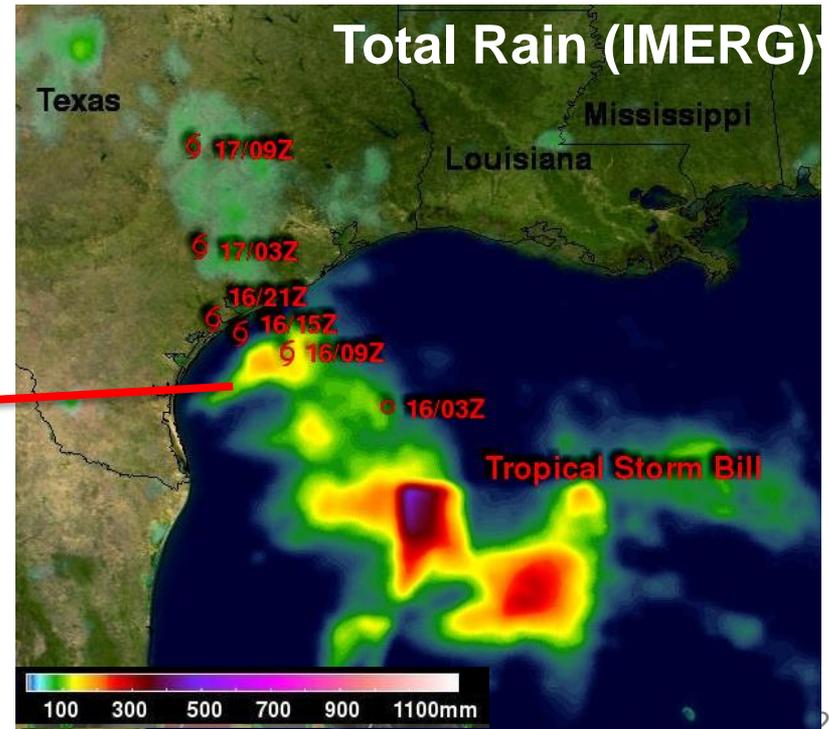
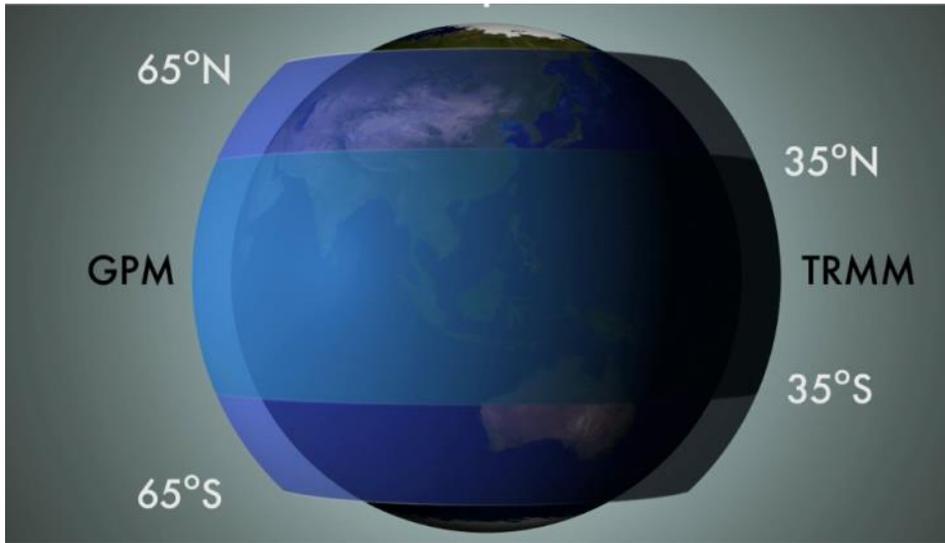
2014



Rainfall accumulation from 2010 Tropical Cyclone Season

# TRMM to GPM

- TRMM was designed to measure heavy to moderate rainfall in the tropics and subtropics
- GPM can measure everything from light rain to heavy rain and falling snow



# Societal Benefit Areas



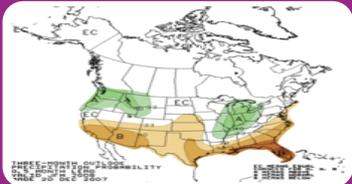
## Extreme Events and Disasters

- Landslides
- Floods
- Tropical cyclones
- Re-insurance



## Water Resources and Agriculture

- Famine Early Warning System
- Drought
- Water Resource management
- Agriculture



## Weather, Climate & Land Surface Modeling

- Numerical Weather Prediction
- Land System Modeling
- Global Climate Modeling

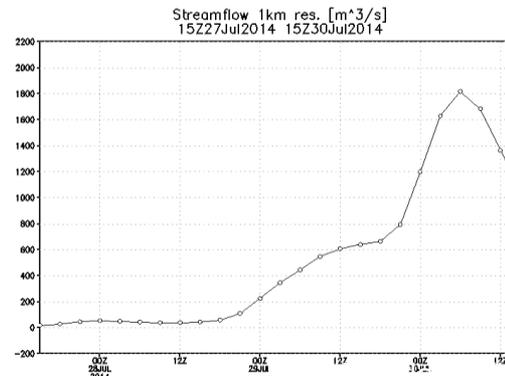
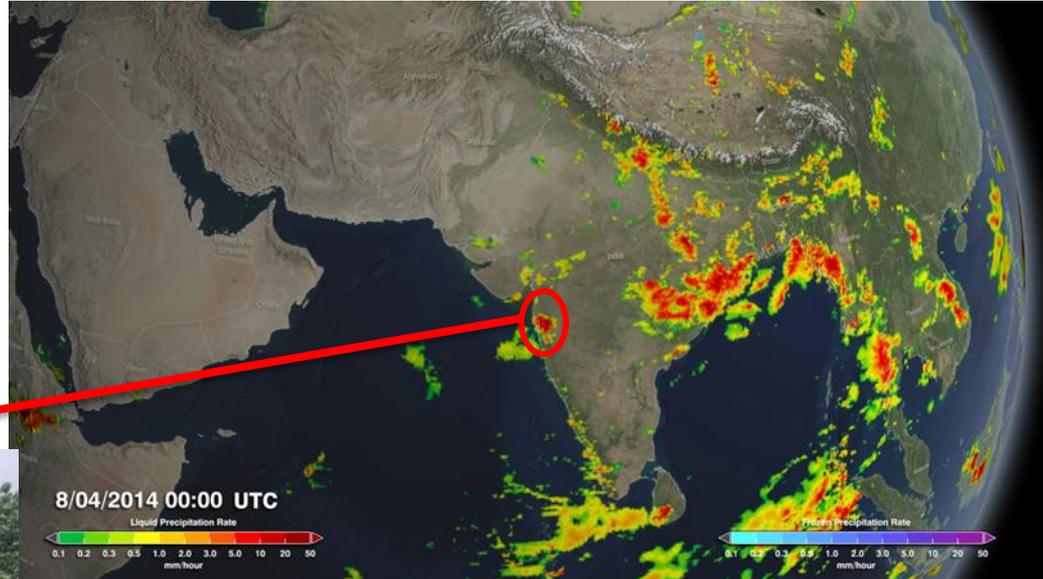


## Public Health and Ecology

- Disease tracking
- Animal migration
- Food Security

# Flood and Landslide Modeling

A major landslide occurred in Malin caused 150 fatalities. GPM observed heavy monsoon rains were observed before, during and after the landslide (August, 2014)



Peak in streamflow observed downstream from landslide following the event.



# Disaster Situational Awareness (e.g. Pacific Disaster Center)

The screenshot shows the Pacific Disaster Center website interface. At the top, there is a navigation bar with the logo, "PACIFIC DISASTER CENTER", and the tagline "Fostering Disaster Resilient Communities". The main navigation includes "Solutions", "Resources", "News & Media", and "About". A search bar is located on the right. Below the navigation, there are links for "EMOPS", "ATLAS", "WWALL", and social media icons for Facebook, Twitter, and RSS. A "Search this site..." field is also present.

The main content area is titled "ACTIVE HAZARDS" and features a list of four active hazards on the left:

- Tropical Storm - Kujira**: CYCLONE, WATCH. Reported: 3 days 6 hrs ago. Updated: 6 mins 4 secs ago.
- Floods - Northern Brazil**: FLOOD, WARNING. Reported: 6 hrs 34 mins ago. Updated: 3 hrs 4 mins ago.
- Floods - Costa Rica**: FLOOD, WARNING. Reported: 6 hrs 18 mins ago. Updated: 6 hrs 17 mins ago.
- Earthquake - 6.3 - 248km WNW of Chichi-shima, Japan**: EARTHQUAKE, WATCH.

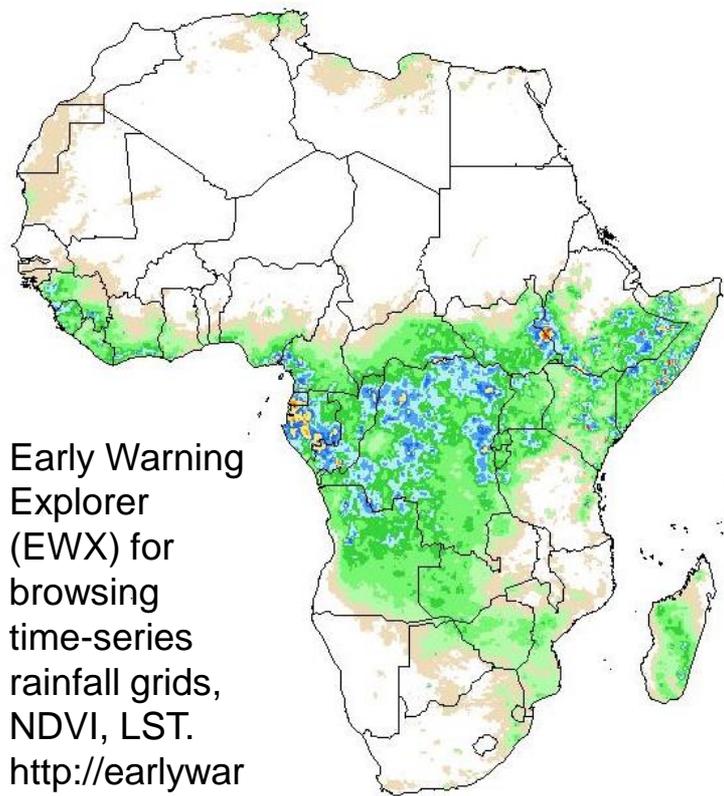
In the center, a map of Southeast Asia shows a tropical storm (Kujira) over the Gulf of Thailand. A pop-up window for the storm provides details: "Tropical Storm - Kuj ... CYCLONE, WATCH. Reported: 3 days 6 hrs ago. Updated: 6 mins 4 secs ago." A "Launch Atlas" button is visible at the bottom of the map.

On the right side, there is a "Legend" and "Layers" panel. The "Layers" panel includes options for "None", "Day/Night Indicator", "Population Density", "Rain (1-Day Accumulation)" (which is selected), "Clouds", "Surface Air Temperature", and "Sea Surface Temperature". Below the layers is a "Rain (in inches)" color scale ranging from 0 to 10.

At the bottom of the page, there are four main sections: "PDC NEWS" with a "More" button, "Free Apps / Tools", "Products", and "Services".

<http://www.pdc.org/>

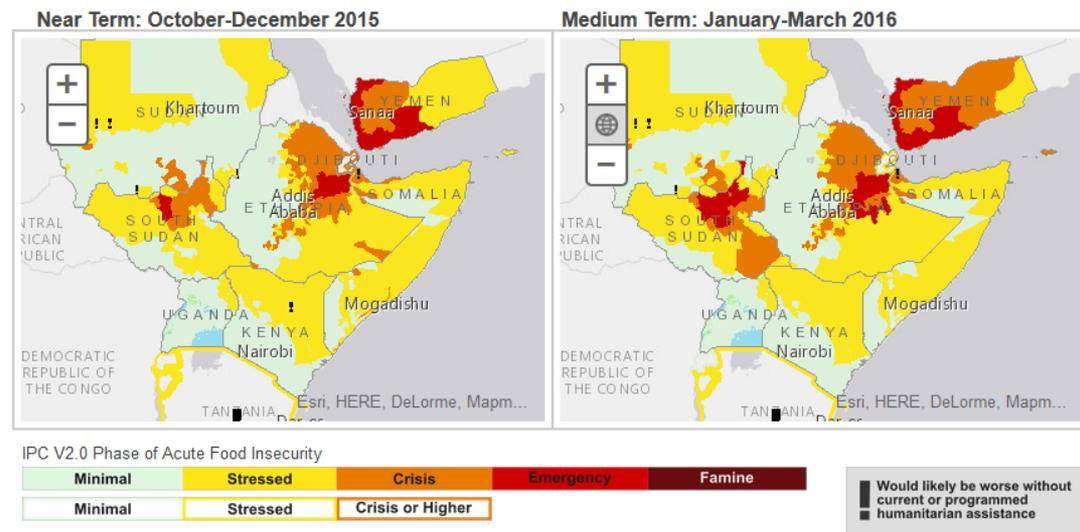
# Agriculture



Early Warning Explorer (EWX) for browsing time-series rainfall grids, NDVI, LST.  
<http://earlywarning.usgs.gov>

## Drought in Ethiopia and conflict in South Sudan and Yemen sustain food security Emergencies

October 2015 to March 2016



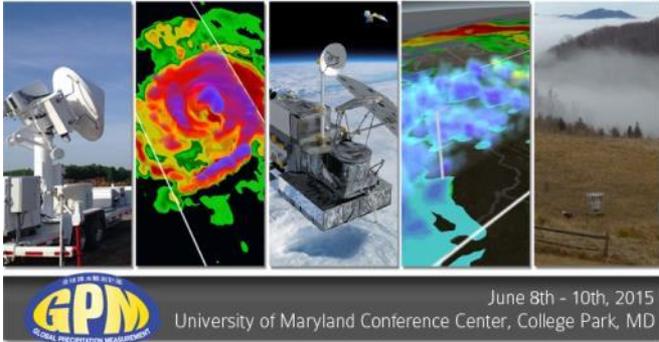
Region shapefile: <http://shapefiles.fews.net/east-africa201510.zip>

Accurate satellite precipitation estimates are critical to crop forecasts. Famine Earth Warning System (FEWS) relies on TRMM/GPM other satellite estimates for anticipating poor growing seasons. GPM will improve these estimates.



# Applications Activities

## 2015 GPM Applications Workshop



- **Representation from:**
  - Government (NGA, NRL, US Army, USGS, USDA, OFDA/USAID, NASA)
  - Industry (SwissRe, The Weather Company, Capital Weather Gang)
  - International (PDC, MercyCorps, Red Cross)
  - Academia (several countries represented)
- **Session on:**
  - Scientific achievements
  - Weather Forecasting & Communication
  - Agricultural Modeling/Food Security/Water Resources
  - Ecology and Public Health and Disasters

URL to access presentations and agenda:

<http://pmm.nasa.gov/meetings/2015-gpm-applications-workshop>

1. Working on improving access to GPM products (like this webinar series!)
2. Reprocessing GPM data through TRMM 1998)
3. Provide “early”, “late” and “final” versions of product for different end user communities
4. Work on data access



# Outline of the Webinar Series



1. Overview of GPM Mission, Data Products, and Data Access Tools **(12/8/2015)**
2. GPM Data Product Updates and Demonstration of Web-tools for Data Search, Analysis, Visualization, and Download **(3/15/2016)**
3. Demonstration of Case Studies of GPM Data Import and Analysis in GIS **(6/7/2016)**
4. Tutorial on Using Python Scripts for Reading GPM Data **(9/13/2106)**



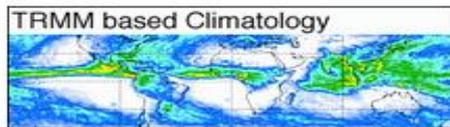
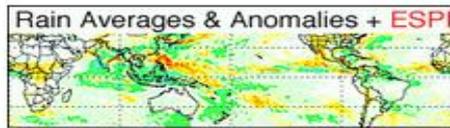
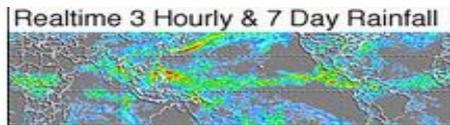
# Webinar-1 Agenda

- GPM Core Satellite: Orbital Configuration, Sensors
- GPM Data Products:
  - Level-2 and Level-3 Data Sets*
  - Filename Conventions, Formats*
  - Spatial and Temporal Resolutions and Coverage*
- *Data Search and Access Web-tools*
- *Data Validation*

# GPM – For Continuation and Improvement of Tropical Rainfall Measuring Mission (TRMM) Measurements

<http://pmm.nasa.gov/TRMM>

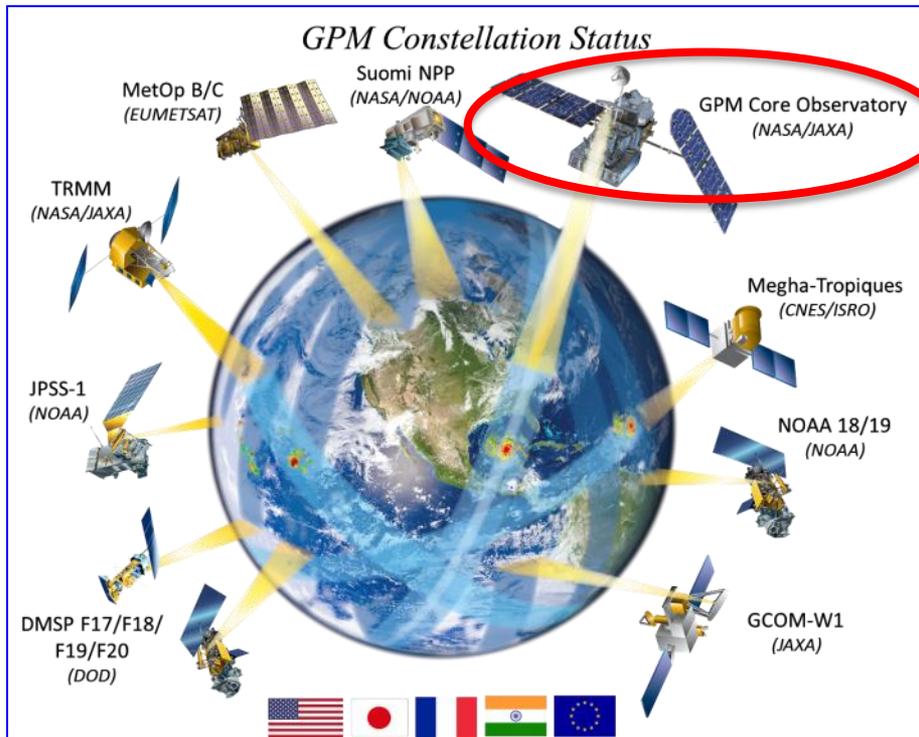
- TRMM, a research mission, was launched in November 1997 and ended in April 2015
- GPM a successor of TRMM comprises of a core satellite and a consortium of international satellites
- Both TRMM and GPM were initiated by NASA and Japanese Space Agency (JAXA)



- TRMM Carried a Precipitation Radar (PR), and Microwave Imager (TMI) in addition to Visible and Infrared Scanner (VIRS) and Lightning Imaging Sensor (LIS), and Clouds and the Earth's Radiant Energy System (CERES)
- With 17 years of precipitation data, widely used for research and environmental applications

**GPM Core satellite was launched on February 27th, 2014**

## GPM Constellation Status



The area covered by three TRMM orbits [yellow] versus orbits of the GPM Core Observatory [blue]

**GPM measurements span middle and high latitudes**



# GPM Core Satellite

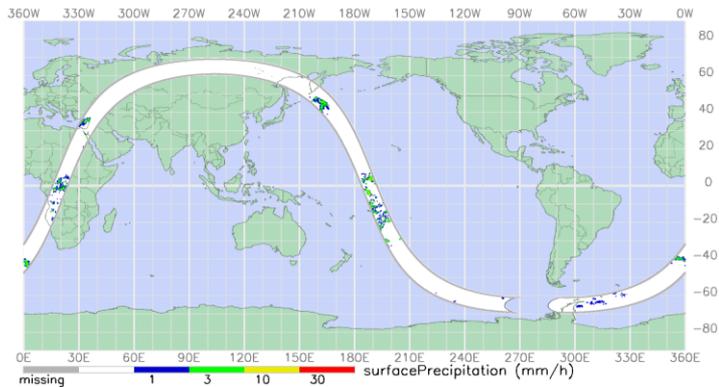


<http://pmm.nasa.gov/GPM>

- ❑ GPM Core satellite **in a non-polar orbit**, but along with the constellation satellites has revisit time of 3 hours over land
- ❑ There are 16 orbits per day **covering region between 65° S to 65° N latitudes**
- ❑ Altitude – 407 km

- Multiple Sensors
- An active and a passive rain sensor
  - Dual-frequency Precipitation Radar (**DPR**)
  - GPM Microwave Imager (**GMI**)
- DPR and GMI – improvement over TRMM PR and TMI

## GMI



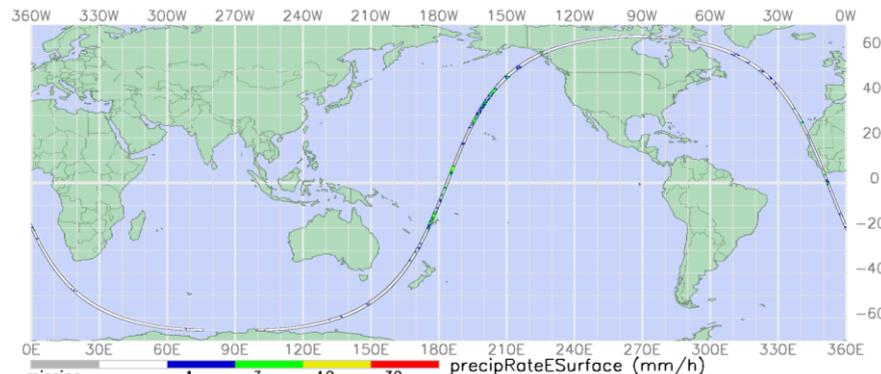
GMI Frequencies:  
10.6, 18.7, 23.8, 36.5, 89, 166 & 183 GHz

Swath width 885 km

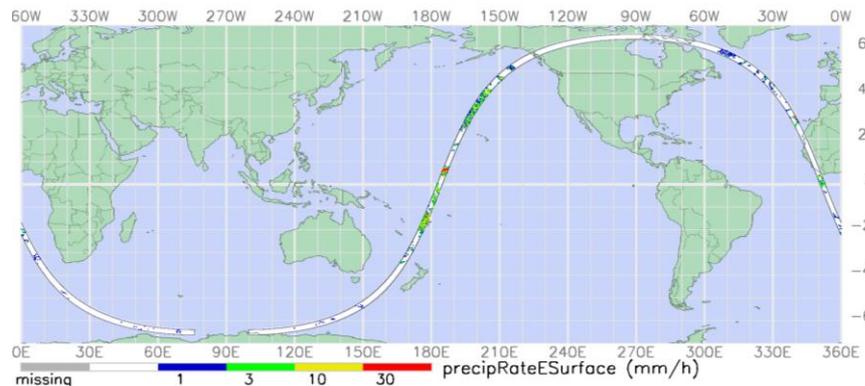
Resolution: 19.4km x 32.2km (10 GHz)  
to 4.4km x 7.3km (183 GHz)

Higher spatial resolutions than TRMM TMI  
High frequencies help measure snow

## DPR



Ka 35.5 GHz, Swath Width 120 km, Resolution 5.2 km



Ku 13.6 GHz, Swath Width 245 km, Resolution 5.2 km



# GPM Constellation Sensors



## A group of conical-scanning microwave imagers and cross-track scanning humidity sounders <http://pmm.nasa.gov/GPM/constellation-partners>

- Special Sensor Microwave Imager/Sounder (SSMIS) instruments on U.S. Defense Meteorological Satellite Program (DMSP) satellites
- The Advanced Microwave Scanning Radiometer-2 (AMSR-2) on JAXA's Global Change Observation Mission - Water 1 (GCOM-W1) satellite
- The Multi-Frequency Microwave Scanning Radiometer (MADRAS) and the multi-channel microwave humidity sounder (SAPHIR) on the Megha-Tropiques satellite provided by the Centre National D'Etudes Spatiales (CNES) of France and the Indian Space Research Organisation (ISRO)
- The Microwave Humidity Sounder (MHS) instrument on the National Oceanic and Atmospheric Administration (NOAA)-19 satellite
- MHS instruments on the MetOp series of satellites launched by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- The Advanced Technology Microwave Sounder (ATMS) instruments on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP)
- ATMS instruments on the upcoming NOAA-NASA Joint Polar Satellite System (JPSS) satellites
- A microwave imager planned for the Defense Weather Satellite System (DWSS)



# GPM Algorithms



<http://pmm.nasa.gov/science/precipitation-algorithms>

There are 4 major algorithms used to obtain precipitation estimates from GPM observations:

- Radar Algorithm
- Radiometer Algorithm
- Combined Radar+Radiometer Algorithm
- Multi-Satellite Algorithm (GPM core active/passive and constellation passive microwave measurements are used)



# GPM Algorithms

<http://pps.gsfc.nasa.gov/atbd.html>

**Details of the algorithms can be found from the  
Precipitation Processing System (PPS)**

## **GPM ATBD (Algorithm Theoretical Basis Documents)**

[GPM/DPR Level-2 Algorithm Theoretical Basis Document](#)

[GPM GPROF \(Level 2\) Algorithm Theoretical Basis Document.](#)

[GPM Combined Radar-Radiometer Precipitation Algorithm Theoretical  
Basis Document \(](#)

[US Integrated Multi-satellite Retrievals for GPM \(IMERG\)](#)



# GPM Data Products



# GPM Data Levels

**Level 0** Raw Instrument Data



**Level 1** Geolocated and Calibrated



**Level 2** Geophysical Data Product  
Derived from L1 Data



**Level 3** Composites Of Level 2  
Data Products

**Level 1 and 2 Orbital Data**  
Highest spatial/temporal resolution

Precipitation Data  
L-2 and L-3

**Level 3 Gridded Data**  
Lower spatial/temporal resolution but  
gridded and may be available at  
multiple spatial/temporal resolutions



# GPM Level-2 Data Product Information

<http://pmm.nasa.gov/data-access/downloads/gpm>

Data Product Name



Data Product Documentation



Data Product Summary



Multiple Data Products Useful for Research and Applications



Level 3 **Level 2** Level 1

Derived geophysical parameters at the same resolution and location as those of the Level 1 data.

▾ 2A-CMB: Combined GMI + DPR single orbit rainfall estimates

The GPM Combined Radar-Radiometer Algorithm performs two basic functions: first, it provides, in principle, the most accurate, high resolution estimates of surface rainfall rate and precipitation vertical distributions that can be achieved from a spaceborne platform, and it is therefore valuable for applications where information regarding instantaneous storm structure are vital. Second, a global, representative collection of combined algorithm estimates will yield a single common reference dataset that can be used to "cross-calibrate" rain rate estimates from all of the passive microwave radiometers in the GPM constellation. The cross-calibration of radiometer estimates is crucial for developing a consistent, high time-resolution precipitation record for climate science and prediction model validation applications. Full Documentation

Resolution	Region - Dates	Latency	Format	Source	DL
orbital		3 hours (RT); 40 hours (Prod)	HDF5	Prod: FTP (PPS)*	↓
			HDF5	Prod: STORM	↓
			HDF5	Mirador	↓
			OPeNDAP	OPeNDAP	
			HDF5	Prod: FTP (GES DISC)	

▸ 2A-Ku: DPR Ku-only single orbit rainfall estimates

▸ 2A-Ka: DPR Ka-only single orbit rainfall estimates

▸ 2A-DPR: DPR Ka&Ku single orbit rainfall estimates

▸ 2A-GPROF-constellation: Single-orbit rainfall estimates from each passive-microwave instrument in the GPM constellation

▸ 2A-GPROF-GMI: GMI single-orbit rainfall estimates

Multiple Formats and Options for Data Download



# Summary of GPM Level-2 Precipitation Products

Sensor/Product Name	Spatial Resolution and Coverage	Temporal Resolution	Data Format
DPR Ku-only/ 2A-Ku DPR Ka-only/2A-Ka DPR KU & Ka/ 2A-DPR	5.2 km x125 m Single Orbit and 16 orbits per day (70°S-70°N)	20-120 minutes  24 hours	HDF5 and OPeNDAP
GMI/2A-GPROF	4 km x 4 km Orbital and 16 orbits per day (70°S- 70°N)	2 – 40 hours	
Combined GMI and DPR/2A-CMB	Orbital (70°S-70°N) 5 km x 5 km, Coincident Ku-Ka-GMI footprints	3 – 40 hours	

\*In addition to surface rainfall rate in mm//hour, vertical precipitation profiles and latent heating are available in these data products





# Summary of GPM Level-3 Precipitation Products



Sensor/Product Name	Spatial Resolution and Coverage	Temporal Resolution	Data Format
IMERG	0.1°x0.1° (90°S-90°N)	30-minutes(Near Real Time) with 6-hour latency, 16-hour latency and 3-months latency	HDF4, NetCDF, OPenDAP, ASCII GIF, PNG Images KML for Google Earth
3-CMB Combined GMI + DPR rainfall Averages	0.1°x0.1° (70°S-70°N)	Monthly	
3-DPR rainfall Averages	0.25°x0.25° 5.0°x5.0° (67°S-67°N) for Daily (70°S-70°N) for Monthly	Daily and Monthly Daily and Monthly	
3-GPROF GMI rainfall Averages	0.25°x0.25° (90°S-90°N)	Daily and Monthly	

\*In addition to surface rainfall rate in mm//hour, vertical precipitation profiles and latent heating are available in these data products



# Widely used GPM Data Products Based on the Users FTP Requests

- IMERG
- 2AGPROF rainfall swath estimates for GMI and constellation radiometers
- 1C calibrated brightness temperature for GMI and constellation radiometers
- 2A DPR rainfall swath estimates



# IMERG Data Sets



Multiple runs accommodate different user requirements for latency and accuracy

- “Early” – 6 hours (flash flooding)
- “Late” – 16 hours (crop forecasting)
- “Final” – 3 months (research data)

Time intervals are half-hourly and monthly (Final only)

0.1° global CED grid

- PPS will provide subsetting by parameter and location
- initial release covers 60° N-S

User-oriented services

- interactive analysis (GIOVANNINI)
- alternate formats (KMZ, KML, TIFF WRF files, ...)
- area averages

	<b>Half-hourly data file (Early, Late, Final)</b>
1	<i>[multi-sat.] precipitationCal</i>
2	<i>[multi-sat.] precipitationUncal</i>
3	<i>[multi-sat. precip] randomError</i>
4	<i>[PMW] HQprecipitation</i>
5	<i>[PMW] HQprecipSource [identifier]</i>
6	<i>[PMW] HQobservationTime</i>
7	<i>IRprecipitation</i>
8	<i>IRkalmanFilterWeight</i>
9	<i>probabilityLiquidPrecipitation [phase]</i>
	<b>Monthly data file (Final)</b>
1	<i>[sat.-gauge] precipitation</i>
2	<i>[sat.-gauge precip] randomError</i>
3	<i>GaugeRelativeWeighting</i>
4	<i>probabilityLiquidPrecipitation [phase]</i>

Courtesy: George Huffman

December 8, 2015



# FUTURE – Transitioning from TRMM to GPM



IMERG is available

- Final and Late Run for mid-March to **July 2015**
- Early Run April 2014 to Present

Early 2016: first-generation GPM-based IMERG archive, [March 2014–present](#)

Early 2017: first-generation TRMM/GPM-based IMERG archive, [1998–present](#)

What happens to TMPA now that the TRMM satellite is no longer flying?

- TRMM has been shut down in April 2015
- TMI has been useful throughout, but PR products stopped 8 October 2014
- TMPA-RT uses climatological calibration, so continues to run “as is”
- production TMPA partly depends on PR for calibration
  - production switches to climatological calibration with October 2014
  - performance is being scrutinized
  - gauge calibration over land should continue to yield consistent results
  - climatological calibration over ocean is likely to cause a discontinuity
- loss of legacy sounder estimates could raise issues for continuing TMPA



# GPM Data File Names

<http://pps.gsfc.nasa.gov/Documents/FileNamingConventionForPrecipitationProductsForGPMMissionV1.4.pdf>

GPM Data files use following convention for data type and temporal attributes:

Type	Description
1A	Instrument count, geolocated, at instantaneous field of view (IFOV).
1B	Geolocated, calibrated $T_b$ or radar power at IFOV.
1C	Intercalibrated brightness temperatures $T_c$ at IFOV.
2A	Geolocated geophysical parameters at IFOV from a single instrument.
2B	Geolocated geophysical parameters at IFOV from multiple instruments.
3A	Space/time averaged geophysical parameters from a single instrument.
3B	Space/time averaged geophysical parameters from multiple instruments.
4	Combined satellite, ground and/or model data.

The second subfield for data type is optional and is an indication of accumulation. This is separated from the data level by a hyphen '-'. Table 2 lists the indicators currently supported.

**Table 2.** Indication of Accumulation Subfield Examples

Name	Description
HR	The product accumulates data for 1 hour.
HHR	The product accumulates data every half hour
DAY	The product accumulates data for a single day.
PENT	The product accumulates data for a 5-day period.
7DAY	The product accumulates data for a 7-day period.
MO	The product accumulates data for a designated month.



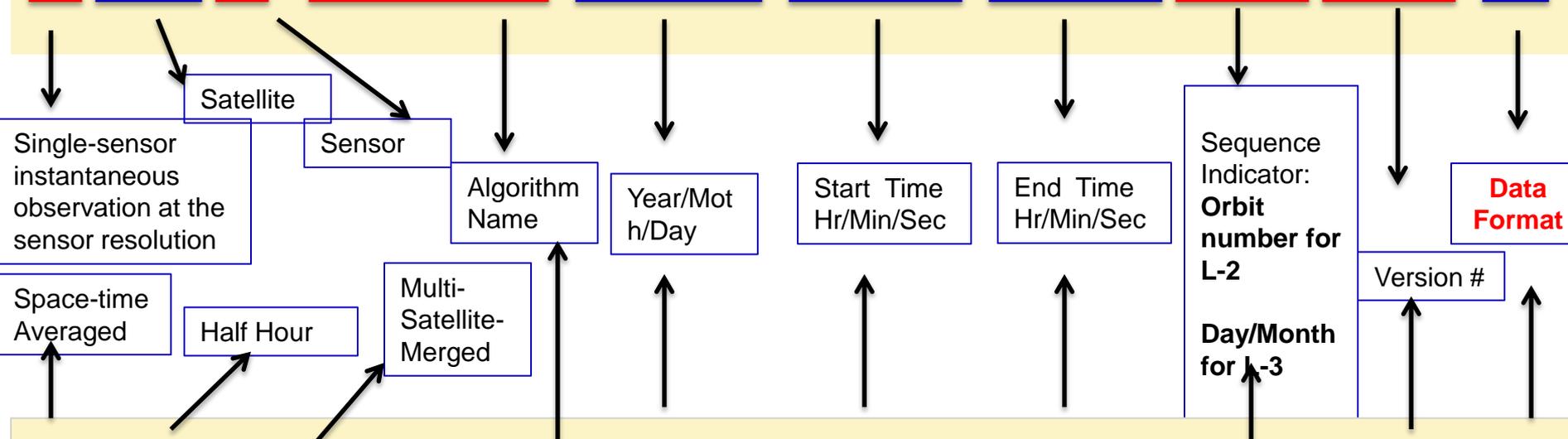
# Examples of GPM Data File Name Convention



<http://pps.gsfc.nasa.gov/Documents/FileNamingConventionForPrecipitationProducts/PMMissionV1.4.pdf>

## Level-2 File Name

2A.GPM.GMI.GPROF2008.20131101-S235152-E012400.000352.V03C.HDF5



3B-HHR.MS.MRG.3IMERG.20140805-S043000-E045959.0270.V03D.HDF5

## Level-3 File Name

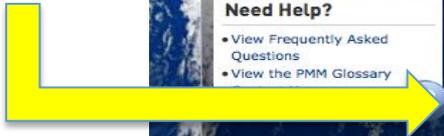


# GPM Data Products Information from Precipitation Measurement Missions

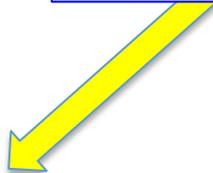
<http://pmm.nasa.gov>

The screenshot shows the NASA Precipitation Measurement Missions (PMM) website. At the top, it features the NASA logo and the text 'NATIONAL AERONAUTICS AND SPACE ADMINISTRATION' and 'GODDARD SPACE FLIGHT CENTER'. A search bar is located in the top right corner. Below the header is a navigation menu with tabs for Home, GPM, TRMM, Science, Applications, Meetings, Data Access, Resources, and Education. The 'Data Access' tab is selected. On the left side, there is a 'Data Access' sidebar with a tree view containing 'Data Sources', 'Data Downloads & Documentation' (with sub-items for TRMM and GPM), 'Ground Validation', 'Data Recipes', 'Data Updates', and 'Google Earth'. Below this is a 'Connect With Us' section with links to Twitter, Facebook, and Youtube. A 'Need Help?' section includes links to 'View Frequently Asked Questions' and 'View the PMM Glossary'. The main content area features a collage of images: a precipitation radar scan, server racks, a satellite, a building, and a globe with a precipitation map. Below the images is the heading 'Data Access' and the section 'How to Access TRMM & GPM Precipitation Data'. This section explains that precipitation data is available free to the public and outlines the different types of data, processing levels, and sources. A 'GET DATA' button with the text 'New Users Start Here' is prominently displayed. Below this is a 'QUICK DATA LINKS' section with a list of links: TRMM Downloads, GPM Downloads, Precipitation Processing System (PPS) Home, GES DISC Home, and Giovanni TOVAS Data Viewer. At the bottom, there is a 'TRMM & GPM Data Policy' section stating that the data is freely available.

GPM Data Download



Easy Data Links





# Precipitation Measurement Missions

(<http://pmm.nasa.gov>)



# GPM Data Access

<http://pmm.nasa.gov/data-access>

## How to Access TRMM & GPM Precipitation Data

Precipitation data from the GPM and TRMM missions is made available free to the public in a variety of formats from several sources at [NASA](#) Goddard Space Flight Center. This section outlines the different types of data available, the levels of processing, the sources to download the data, and some helpful tips for utilizing precipitation data in your research.

- **GPM Data Downloads & Documentation**
- TRMM Data Downloads & Documentation
- Explanation of GPM & TRMM Data Sources
- Data Processing "Recipes"
- Precipitation Data in Google Earth
- Frequency Asked Questions (FAQ) ←



# GPM Data Policy

<http://pmm.nasa.gov/data-access>

## TRMM & GPM Data Policy

TRMM and GPM data are freely available at all levels for which the particular sensor or sensor combination has been processed by GPM. For the GPM Core Observatory this is for Levels 0 through 3 products (as applicable). For the partner satellites in the GPM constellation this is Levels 1c through 3 (as applicable).

Users are encouraged to access data from the primary TRMM and GPM archives (i.e. nasa.gov domains at Goddard Space Flight Center). When data from secondary archives are used, it is incumbent on the user to verify that the data values accessed are accurate, up-to-date, current-version copies of the original data. Data format questions should be directed to the relevant archive site, while science questions should be sent to the dataset developers.

The data set source should be acknowledged when the data are used. A formal reference of the form:

*<authors>, 2012, last updated 2013: <dataset name>. NASA/GSFC, Greenbelt, MD, USA, NASA Goddard Earth Sciences Data and Information Services Center (GES DISC). Accessed <enter user data access date> at <DOI>*



# GPM Data Access

<http://pmm.nasa.gov/data-access/data-sources#register>

The screenshot shows the GPM Data Access website. The navigation bar includes Home, GPM, TRMM, Science, Applications, Meetings, Data Access, Resources, and Education. The main content area is titled "Data Sources" and contains a list of data sources. A red circle highlights the list, and a blue arrow points to "FTP (PPS)".

**Data Access**

- Extreme Weather News
- Data Downloads & Documentation
  - TRMM
  - GPM
  - Ground Validation
- Data Sources**
- Data Recipes
- Data News
- Google Earth
- NASA Worldview

**Connect With Us**

- Twitter
- Facebook

**Data Sources**

This section outlines the primary sources for downloading [GPM](#) and [TRMM](#) precipitation data from archive sites at Goddard Space Flight Center, including basic instructions for using each source.

- **FTP (PPS)**
- STORM
- Mirador
- Giovanni TOVAS
- OPeNDAP
- FTP (GES DISC)
- GrADS Data Server (GDS)
- GPM Ground Validation Data Portal

**Precipitation Processing System (PPS) FTP**

<http://pps.gsfc.nasa.gov>

**QUICK DATA LINKS**

- TRMM Downloads
- GPM Downloads
- Precipitation Processing System (PPS) Home
- GES DISC Home
- Giovanni TOVAS Data Viewer

**KEYWORDS**

- [data](#)
- [GPM](#)
- [TRMM](#)
- [downloads](#)
- [PMM Science Team](#)



# GPM Data Access

<http://pmm.nasa.gov/data-access/data-sources#register>



## Registering to Download Data (required)

In order to download data from the PPS FTPs you must first register your email address with the Precipitation Processing System, using this page:

<http://registration.pps.eosdis.nasa.gov/registration/>

Once you submit this form you will receive an email requesting you to verify your email address. Click the link in this email to complete the registration process. You will then receive a second email confirming your registration.

You can now log in to any of the PPS FTP servers (outlined below) using your email address as the username and password.

**NOTE:** Although direct links to the FTP are included on these pages, it is recommended to use a **dedicated FTP client** to access the PPS FTP. Certain web browsers are also able to browse the FTP, but some users have experienced errors with this method.



# GPM Data Servers



<http://pmm.nasa.gov/data-access/>

## FTP Servers

The Precipitation Processing System hosts several FTP servers to access the different types of TRMM and GPM data:

- **<ftp://arthurhou.pps.eosdis.nasa.gov>**: New server for Production (PROD) TRMM and GPM data.
  - **Click here for an outline of the directory structure for production GPM data.**
- **<ftp://jsimpson.pps.eosdis.nasa.gov>**: New server for Near-Realtime (NRT) TRMM and GPM data.
  - **Click here for an outline of the directory structure for realtime GPM data.**
- **<ftp://trmmopen.pps.eosdis.nasa.gov>**: Old server for "Production" TRMM data. Does not contain GPM data, but may be maintained to preserve access to the popular 3B42RT algorithm.
- **<ftp://pps.gsfc.nasa.gov>**: Old server for "Realtime" TRMM data. Will be decommissioned in the near future, pending full transfer of files.

[Click here to learn the difference between "Production" and "Realtime" data sources.](#)



# GPM Near Real Time Data Access



<http://pps.gsfc.nasa.gov/>

Precipitation Processing System (PPS)

PPS Home | GPM Home | TRMM Home | GPM Instrumentation | Related Links | Contact Us

**Welcome to the PPS (Precipitation Processing System) Public Website**

The Precipitation Processing System (PPS) evolved from the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS). The purpose of the PPS is to process, analyze and archive data from the Global Precipitation (GPM) mission, partner satellites and the TRMM mission. The PPS also supports TRMM by providing validation TRMM ground radar sites. All GPM, TRMM and Partner public data products are available to the science community public from the TRMM/GPM FTP Data Archive. Please note that you need to [register](#) to be able to access this data. register with PPS at our registration portal: [PPS](#).

As of 12/8/15, this registration requirement is now mandatory per NASA policy and the new metric requirements. If you are not registered with us, you can use your registered Email address as both your user name and password to access our public data archive here: [GPM Public Data Archive](#)

Registered researchers can access our data archive here: [GPM Public Data Archive](#)

Users can find GPM near realtime data on our [jsimpson ftp area](#)

Users can also search for GPM, partner and TRMM data, order custom subsets and set up subscriptions using our [PPS Ordering Interface \(STORM\)](#)

**Global Precipitation Measurement) and TRMM (Tropical Rainfall Measuring**

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**Updates**

**August 26, 2015:** A new gridded text product that contains GPROF precipitation data from the GPM partner cross-track scanning radiometers (sounders) has been released. You can find the documentation for the [Summary Information for the GPM Constellation Crosstrack-Scanning Radiometers as Quarter-degree Gridded Test Product \(Here\)](#). These Products can be ordered through [STORM](#) or retrieved via [PPS's FTP archive](#) after completing a quick and mandatory registration process.

Instructions.pdf



# GPM Data Access



<http://pmm.nasa.gov/data-access/data-sources#register>

**Home** | **GPM** | **TRMM** | Science | Applications | Meetings | Data Access | Resources | Education

## Data Access

- Extreme Weather News
- Data Downloads & Documentation
  - TRMM
  - GPM
  - Ground Validation
- Data Sources**
- Data Recipes
- Data News
- Google Earth
- NASA Worldview**

## Data Sources

This section outlines the primary sources for downloading GPM and TRMM precipitation data from archive sites at Goddard Space Flight Center, including basic instructions for using each source.

- **FTP (PPS)**
- **STORM**
- **Mirador**
- Giovanni TOVAS
- OPeNDAP
- FTP (GES DISC)
- GrADS Data Server (GDS)

### QUICK DATA LINKS

- TRMM Downloads
- GPM Downloads
- Precipitation Processing System (PPS) Home
- GES DISC Home
- Giovanni TOVAS Data Viewer

### KEYWORDS

[data](#)  
[GPM](#)  
[TRMM](#)  
[downloads](#)  
[PMM Science Team](#)

**GMI Data available from NASA Worldview (NRT and Archive)**

<https://earthdata.nasa.gov/labs/worldview/>

**FTP**



# Overview of Selected GPM Data Access Tools

**Mirador, Giovanni and PPS STORM**



# GPM Data Access Using Selected Web-tools



Tools	Data Products and Formats	Analysis and/or Visualization	Data Download
<p>Mirador  <a href="http://mirador.gsfc.nasa.gov">http://mirador.gsfc.nasa.gov</a></p>	<p>L1B, L2, and L3 GMI-GPROF            IMERG Half-hourly, Monthly            Orbital and Gridded Daily, Monthly            HDF5, OPenDAP (can be converted to ASCII, Binary, NetCDF)</p>	<p>N/A</p>	<p>Batch Download</p>
<p>Giovanni  <a href="http://giovanni.gsfc.nasa.gov/giovanni/">http://giovanni.gsfc.nasa.gov/giovanni/</a></p>	<p>IMERG Half-hourly, Monthly            NetCDF, GeoTIFF, PNG</p>	<p>Visualization: Map, Time Series, Scatter Plot            Histogram            Analysis: Time-averaged Maps, Time Series, Scatter Plot, Map Correlations, Vertical Profiles, Time-averaged Differences</p>	<p>Download by Select and Click on Data Files</p>
<p>PPS/STORM  <a href="https://storm.pps.eosdis.nasa.gov/storm">https://storm.pps.eosdis.nasa.gov/storm</a></p>	<p>L1B and 1C, L2, L3 GMI, DPR, GMI-DPR            Combined Data, Orbital and Gridded Daily, Monthly            IMERG Half-hourly, Monthly            HDF5, PNG</p>	<p>Map Visualization,            Interactive Latitude/Longitude            Point Data Value Display</p>	<p>FTP</p>

# Mirador: Data Search and Access

<http://mirador.gsfc.nasa.gov/>

The screenshot shows the Mirador web interface with several callouts:

- Search Data using Keyword:** A red box highlights the search input field containing "IMERG", the "Time Span" field set to "2014-07-15", and the "To:" field set to "2014-07-16".
- Temporal Selection:** A blue box highlights the "Search GES-DISC" button.
- Spatial Selection by latitude-longitude:** A red arrow points to the "Location:" field containing the coordinates "(14.07,-138.50),(53.84,-48.50)".
- Spatial Selection from Map:** A blue box highlights the "Search GES-DISC" button, with a red arrow pointing to a map of North America where a bounding box is drawn.
- Additional Features:** A list on the left includes: OVERVIEW, HELP CENTER, DATA HOLDINGS, VIEW CART, News, Restricted Data, Feedback, and FAQ.
- Navigation:** Top navigation includes "EARTHDATA", "Data Discovery", "Data Centers", "Community", and "Science Disciplines".
- Search Bar:** "Search GES DISC" with a "Search" button and "Advanced Search" link.
- Menu:** "GES DISC Home", "Data Services", "Science Portals", "Mission Portals".
- Mirador Header:** "Mirador Data Access Made Simple".
- Map:** A world map with a bounding box over North America and a "Map" dropdown menu.
- Footer:** "Terms of Use" and "Report a map error" links.

**Additional Features**

- + News
- + Restricted Data
- + Feedback
- + FAQ

**gazetteer locations such as Kansas or Ice Shelf; OR  
a bounding box: (minLat,minLon),(maxLat,maxLon)  
(LL),(UR) (Mirador will choose smallest area)  
OR 80N 20s 120east 20wes OR  
a partial Lat/Lon: of 22n is equivalent to (22,180),(-90,-180)**



# Mirador: Data Search and Access

<http://mirador.gsfc.nasa.gov/>

Data Search Results for GPM IMERG in terms of Data Files

**Mirador 1.55**  
Data Access Made Simple

Keyword:   
More Search Options  
Search GES-DISC

**Data Sets**

- GPM Level 3 IMERG Monthly 0.1 x 0.1 degree (GPM\_3IMERGM)**  
| [View Files](#) | [Info](#) | [Data Calendar](#)  
**Approx. 1 files found (Avg Size: 28.86 MB)**  
Parameters: PRECIPITATION AMOUNT, PRECIPITATION RATE, RAIN, SNOW  
Spatial Resolution: 0.1 degree x 0.1 degree  
Temporal Resolution: Monthly
- GPM Level 3 IMERG Half Hourly 0.1 x 0.1 degree (GPM\_3IMERGHH)**  
| [View Files](#) | [Info](#) | [Data Calendar](#)  
**Approx. 96 files found (Avg Size: 2.53 MB)**  
Parameters: CYCLONES, DROUGHT, HURRICANES, MONSOONS, STORMS, TYPHOONS, SNOW...  
Spatial Resolution: 0.1 degree x 0.1 degree  
Temporal Resolution: 30 minute

Select All | [Reset](#) | [List Selected Files By Time](#) | [See Timeline View](#) | [Add Selected Files To Cart](#)

**NASA Search Results**  
(Number of files found may not be entirely accurate)  
Page: 1

1 Monthly and  
95 Half-hourly  
Files



# Mirador: Data Search and Access



<http://mirador.gsfc.nasa.gov/>

## IMERG Half-hourly Data Files List

GPM Level 3 IMERG Half Hourly 0.1 x 0.1 degree <span>Info</span>	
<input type="checkbox"/> Add Selected Files To Cart <input type="checkbox"/> Add All Files in All Pages To Cart	
<input checked="" type="checkbox"/> Select All in Page <input type="checkbox"/> File Names/Descriptive File Names	
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S233000-E235959.1410.V03D.HDF5 (2.53 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	Start Time <a href="#">▲</a> 2014-07-16 23:30:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S230000-E232959.1380.V03D.HDF5 (2.43 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 23:00:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S223000-E225959.1350.V03D.HDF5 (2.49 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 22:30:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S220000-E222959.1320.V03D.HDF5 (2.43 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 22:00:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> <b>3B-HHR.MS.MRG.3IMERG.20140716-S233000-E235959.1410</b> <b>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></b>	
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S200000-E202959.1200.V03D.HDF5 (2.42 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S193000-E195959.1170.V03D.HDF5 (2.49 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S190000-E192959.1140.V03D.HDF5 (2.52 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 19:00:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S183000-E185959.1110.V03D.HDF5 (2.52 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 18:30:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S180000-E182959.1080.V03D.HDF5 (2.48 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 18:00:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S173000-E175959.1050.V03D.HDF5 (2.44 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 17:30:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S170000-E172959.1020.V03D.HDF5 (2.41 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 17:00:00 <a href="#">Metadata</a>
<input checked="" type="checkbox"/> 3B-HHR.MS.MRG.3IMERG.20140716-S163000-E165959.0990.V03D.HDF5 (2.50 MB) <small>One Click Download: <a href="#">HDF5 (FTP)</a>   <a href="#">OPeNDAP</a></small>	2014-07-16 16:30:00 <a href="#">Metadata</a>

Download each file by clicking on HDF5 or OPeNDAP  
**OR** Select Multiple files and add to cart

Select File(s) by checking the box

# Mirador: Data Search and Access

<http://mirador.gsfc.nasa.gov/>

## Data Checkout

Mirador 1.55  
Data Access Made Simple

Keyword: MERG  
More Search Options  
Search GES-DISC

Shopping Cart: Your cart contains 96 items (239.51 MB)

Sort by: Data Set

Continue Searching

Checkout

Delete GPM Level 3 IMERG Half Hourly 0.1 x 0.1 degree (GPM\_3IMERGHH v.03): 96 Items

Empty Entire Cart

Page: 1

Download Data by using these scripts

Search for Data with Mirador

Your cart will automatically be emptied when you select a download option unless you choose to keep the items.

Keep items in the cart when selecting a download option

DOWNLOAD DATA (WITH WGET, CURL, ETC.)

URL List (Data)\* URL List (Metadata)\* URL List (Data and Metadata)\*

Instructions:

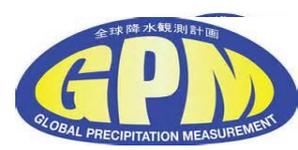
```
wget:
Save the list of URLs in one of the above links to your local workstation as myfile.dat
On your command line:
wget -i myfile.dat

a UNIX curl example:
Save the list of URLs in one of the above links to your local workstation as myfile.dat
On your command line:
curl --insecure --user-agent 'anonymous:curl@example.com' < myfile.dat
```

+ NASA Privacy Policy and Important Notices  
+ Contact Us  
NASA Official: Steve Kempfer



# Mirador: Data Search and Access



<http://mirador.gsfc.nasa.gov/>

Mirador is useful for searching data and downloading multiple data files

GPM L1, L2, and L3 Data are available from Mirador



# Giovanni Version 4



<http://giovanni.gsfc.nasa.gov/giovanni/>

## Select Plot

Maps: Time-Averaged

Comparisons: Select...

Time Series: Select...

Vertical: Select...

Miscellaneous: Select...

Analysis/Plot Options

## Select Date Range (UTC)

YYYY-MM-DD. HH:mm

- - 00 : 00 to - - 23 : 59

Valid Range: 1979-01-01 to 2015-03-10

## Select Region (Bounding Box or Shapefile)

Format: West, South, East, North

-180, -90, 180, 90 Show Map Show Shapes

Temporal and Spatial Search  
Map, Shapefile for Various Countries or US States, or Watershed Selections

## Select Variables

### Disciplines

- Aerosols (117)
- Atmospheric Chemistry (18)
- Atmospheric Dynamics (64)
- Hydrology (110)
- Water and Energy Cycle (120)

### Measurements

- Aerosol Index (1)
- Air Pressure (6)
- Air Temperature (15)
- Albedo (8)
- Altitude (4)
- Angstrom Exponent (16)
- Atmospheric Moisture (23)
- CH4 (4)
- CO (4)
- Cloud Fraction (4)

Number of matching Variables: 0 of 327

Total Variable(s) included in Plot: 0

Keyword :

Search Clear

Search data by keyword

Plot Data



Help

Reset

Feedback

Plot Data



# Giovanni Version 4



<http://giovanni.gsfc.nasa.gov/giovanni/>

## Search GPM data and Select Spatial, Temporal, Plot Options

**Select Plot**

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

**Select Date Range (UTC)**      **Select Region (Bounding Box or Shapefile)**

YYYY-MM-DD      HH:mm  
 2015 - 12 - 01 00 : 00 to 2015 - 12 - 05 23 : 59      Format: West, South, East, North  
 74.8828, 0.9082, 89.2969, 23.7598     

Valid Range: 2015-04-01 to 2015-12-07

**Select Variables**

**▼ Disciplines**

Hydrology (17)

**▼ Measurements**

Precipitation (17)

**▶ Platform / Instrument**

**▶ Spatial Resolutions**

**▶ Temporal Resolutions**

**▶ Portal**

Number of matching Variables: 17 of 608      Total Variable(s) included in Plot: 1

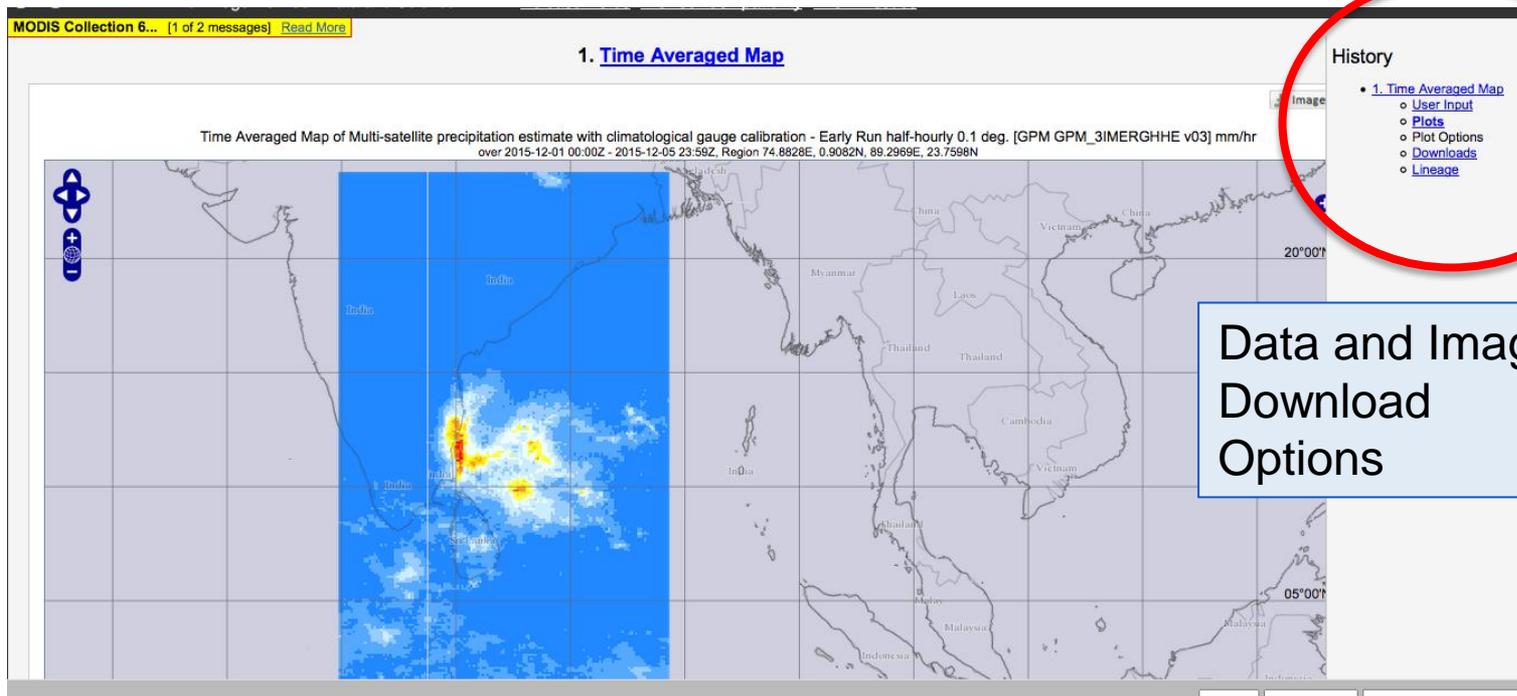
Keyword:      

	Variable Name	Source	Temp. Res.	Spat. Res.	Begin Date	End Date	Units	Vert. Slice
<input checked="" type="checkbox"/>	<a href="#">Multi-satellite precipitation estimate with climatological gauge calibration - Early Run (GPM_3IMERGHHE v03)</a>	GPM	Half-Hourly	0.1 °	2015-04-01	2015-12-07	<input type="text" value="mm/hr"/>	-
<input type="checkbox"/>	<a href="#">Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) (GPM_3IMERGM v03)</a>	GPM	Monthly	0.1 °	2014-04-01	2015-07-31	<input type="text" value="mm/hr"/>	-
<input type="checkbox"/>	<a href="#">Weighting of observed gauge precipitation relative to the multi-satellite precipitation estimate - Final Run (GPM_3IMERGM v03)</a>	GPM	Monthly	0.1 °	2014-04-01	2015-07-31	%	-
<input type="checkbox"/>	<a href="#">Accumulation-weighted probability of liquid precipitation phase - Final Run (GPM_3IMERGM v03)</a>	GPM	Monthly	0.1 °	2014-04-01	2015-07-31	%	-
<input type="checkbox"/>	<a href="#">Random error for merged satellite-gauge precipitation - Final Run (GPM_3IMERGM v03)</a>	GPM	Monthly	0.1 °	2014-04-01	2015-07-31	mm/hr	-
<input type="checkbox"/>	<a href="#">Merged microwave-only precipitation estimate - Final Run (GPM_3IMERGHH v03)</a>	GPM	Half-Hourly	0.1 °	2014-03-12	2015-07-31	mm/hr	-
<input type="checkbox"/>	<a href="#">Microwave satellite observation time - Final Run (GPM_3IMERGHH v03)</a>	GPM	Half-Hourly	0.1 °	2014-03-12	2015-07-31	minutes	-

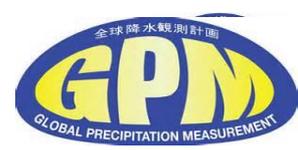
IMERG-Early  
Averaged over 1-5  
December 2015

<http://giovanni.gsfc.nasa.gov/giovanni/>

## Search and Plot Result: IMERG Rain Rate for 1-5 December 2015



Extreme Rain over Southern India



# Giovanni Version 4

<http://giovanni.gsfc.nasa.gov/giovanni/>

Giovanni is:

- 1) useful for searching and downloading data files in multiple formats
- 2) very convenient for data analysis and visualization



# Precipitation Processing System (PPS) Science Team On-Line Request Module (STORM)



<https://storm-pps.gsfc.nasa.gov/storm/>

**Requires User Registration**

**Need Help?**

- STORM User Guide
- helpdesk@pps-mail.nascom.nasa.gov

**News**

2/18/2015 - TRMM/PR data distribution during experimental operation period

1/15/2015 - PPS is releasing the first public version IMERG products

**PPS Data Access** - to search for GPM and TRMM data, order custom subsets and set up subscriptions.

**PPS Public Archive** - to access GPM and TRMM standard products via online ftp.

These are the products available to the public. To retrieve data go to [PPS Data Access](#) or [PPS Public Archive](#).

Data Type	Algorithm	Satellite	Instrument	Primary Content
1A	1A01	TRMM	VIRS	Counts
1A	1A11	TRMM	TMI	Counts
1A	1A21	TRMM	PR	Counts
1A	1A21	TRMM	PR	Counts
1A	1AGMI	GPM	GMI	Counts
1B	1B01	TRMM	VIRS	Radiance
1B	1B11	TRMM	TMI	Brightness Temperature
1B	1B21	TRMM	PR	Radar Power
1B	1B21	TRMM	PR	Radar Power
1B	1BGMI	GPM	GMI	Brightness Temperature
1B	1BKa	GPM	DBP_KA	Radar Power

**Data Product Search**

STORM is specifically designed for GPM and TRMM Precipitation data search, selection, download, and visualization



# Precipitation Processing System (PPS) Science Team On-Line Request Module (STORM)

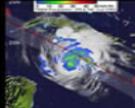


<https://storm-pps.gsfc.nasa.gov/storm/>

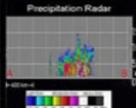


National Aeronautics  
and Space Administration

+ PPS Contacts  
+ Related Links



# STORM



+ HOME
- DATA ACCESS
+ TOOLS
+ PRODUCT INFORMATION
+ REGISTRATION

**Data Access**

- + BROWSE ARCHIVE
- SEARCH ARCHIVE / ORDER
- + SAT - SAT COINCIDENCE
- + TRACK ORDER STATUS

**Email**

⚠ Required

Submit Request 
Clear Form

**Need Help?**

- Click on for context specific help.
- [STORM User Guide](#)
- [helpdesk@pps-mail.nascom.nasa.gov](mailto:helpdesk@pps-mail.nascom.nasa.gov)

Enter email address to Register Or Request Registration

**SECURITY**

NASA / PPS may provide links to Web pages that are not part of the NASA Web family or nasa.gov domain. These sites are managed by organizations, companies, or individuals and not under NASA control, and NASA is not responsible for the information or links you may find there. NASA provides links to these sites merely as a convenience. NASA is not responsible for the information collection practices of non-NASA sites. Once you link to another site, you are subject to the privacy policy of the new site, and you should read that site's policies on privacy and information collection.



# Precipitation Processing System (PPS) Science Team On-Line Request Module (STORM)

<https://storm-pps.gsfc.nasa.gov/storm/>

Product Type

**Required**

## Product Selection

Left click on the header to sort rows. Right click to show/hide columns

Select	Data Type	Algorithm	Start Time	Frequency	Satellite or Ground Validation Site	Instrument	Primary Content	Spatial Extent
<input type="checkbox"/>	3B				GPM			
<input type="checkbox"/>	3B	3CMB	2014-03-01 00:00:00	MONTH	GPM	DPR, GMI	Precipitation	[70.0,-70.0,180.0,-180.0], [67.0,-67.0,180.0,-180.0]
<input type="checkbox"/>	3B	3CMB	2014-12-02 00:00:00	DAY	GPM	DPR, GMI	Precipitation	[70.0,-70.0,180.0,-180.0], [67.0,-67.0,180.0,-180.0]
<input type="checkbox"/>	3B	3IMERGHH	2014-03-12 00:00:00	30_MINUTE	GPM	DPR	Precipitation	[90.0,-90.0,180.0,-180.0]
<input type="checkbox"/>	3B	3IMERGM	2014-03-12 00:00:00	MONTH	GPM	DPR	Precipitation	[90.0,-90.0,180.0,-180.0]

**Total Product Types selected: 0**    *Note: Some selected Product Types might not be visible if filters are used*

Temporal Criteria

Date Range    Orbit Numbers

Valid range is between 20140312 and 20150310

YYYYMMDD [HH:MM]  
[ ] = optional fields

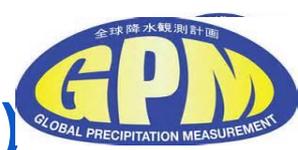
Start Date/Time

Stop Date/Time

## Temporal Selection

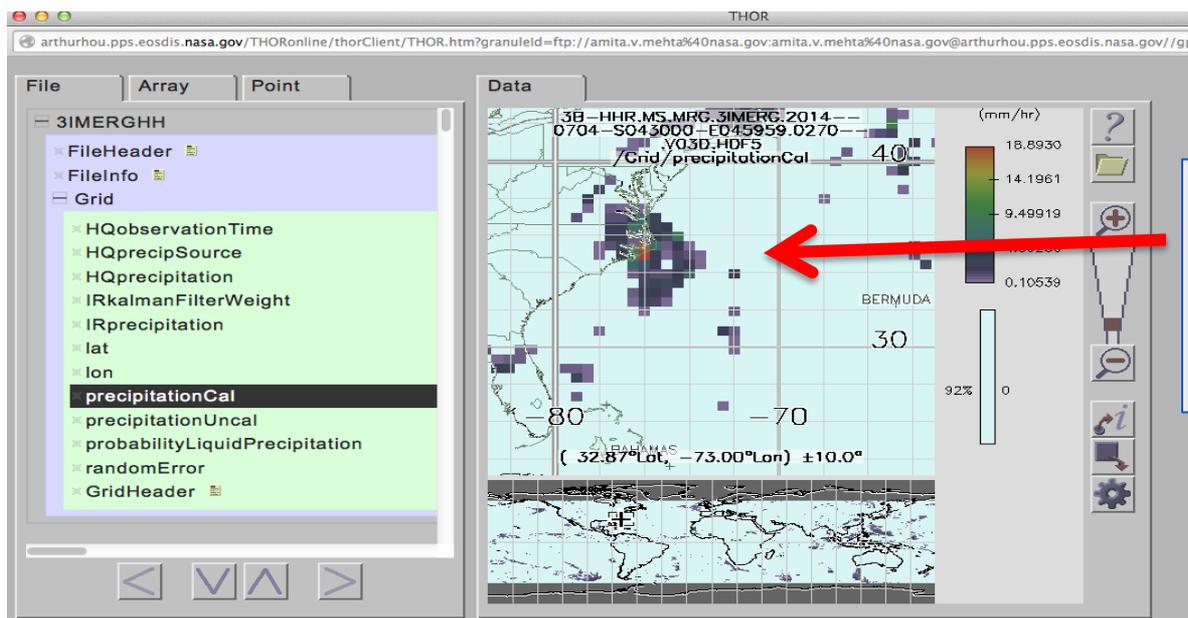


# Precipitation Processing System (PPS) Science Team On-Line Request Module (STORM)



<https://storm-pps.gsfc.nasa.gov/storm/>

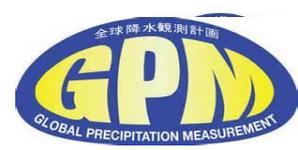
Product Selection, Download, and Visualization by using  
Tool for High-resolution Observation Review (THOR)



Precipitation  
Associated with  
Hurricane Arthur  
July 4, 2014



# Display GPM / TRMM HDF Data Files Using THOR



<http://pmm.nasa.gov/data-access/recipes#thor>

## Overview

Orbit Viewer THOR is a tool for displaying the satellite data files in the archive of the Tropical Rainfall Measuring Mission (TRMM). THOR stands for "Tool for High-resolution Observation Review". It is a point-and-click program written in IDL that runs on Linux, Mac OS X, and Windows. This viewer enables you to display on a map of the Earth TRMM observations at the full instrument resolution. Even if you plan on reading and analyzing GPM HDF5 files using your own IDL programs, it can help to have the THOR data viewer installed to do quick checks on the HDF5 files you are analyzing.

**Full THOR Install Documentation:** <http://pps.gsfc.nasa.gov/THOR/release.html>

## Instructions

1. Download the THOR data viewer .zip file from PPS:  
[ftp://gpmweb2.pps.eosdis.nasa.gov/pub/THOR/version\\_2/](ftp://gpmweb2.pps.eosdis.nasa.gov/pub/THOR/version_2/)



# Precipitation Processing System (PPS) Science Team On-Line Request Module (STORM)



<https://storm-pps.gsfc.nasa.gov/storm/>

STORM:

- 1) Is dedicated to access and visualization of GPM and TRMM data
- 2) Level-2 (orbital) and Level-3 (gridded) data easily accessible
- 3) THOR can be used to view HDF files

For data-related questions contact:  
[helpdesk@pps-mail.nascom.nasa.gov](mailto:helpdesk@pps-mail.nascom.nasa.gov)



# GPM Data Validation



# GPM Data Product Validation



<http://pmm.nasa.gov/data-access/downloads/ground-validation>

GPM precipitation data are currently being validated with a variety of field measurements

## Ground Validation Data Downloads

### Ground Validation Data

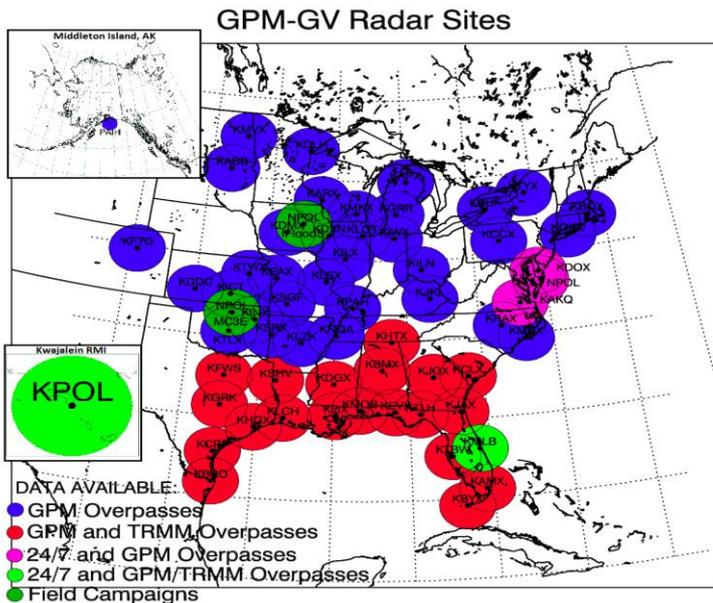
<http://gpm-gv.gsfc.nasa.gov/>

The goal of this site is to provide a one-stop-shopping portal for accessing the various radar, disdrometer, gauge and other instrument data sets supporting GPM GV activities. Use the tabs above to access the various datasets, including:

- Radar
- Gauge
- Disdrometer
- NOAA/NMQ
- Field Campaigns
- Validation Network
- Wallops Precipitation Research Facility

<http://pmm.nasa.gov/data-access/downloads/ground-validation>

GPM precipitation data are currently being validated with a variety of field measurements



### TRMM and GPM Rain Gauge Data Archive

NASA, in support of first TRMM and now also GPM GV efforts has been collecting tipping bucket rain gauge data. Early efforts used standalone tipping buckets with loggers that required manual data entry. In the modern era, we are now able to use telemetered gauges using cell technology. The image to the right shows a gauge platform that was designed by the University of Iowa. A similar system using cell technology is current being developed by NASA.

**NETWORK:**

**Florida**

- Kennedy (KSC)
- South Florida WMD (SFL)
- St. John's River WMD (STJ)
- KAMP 2001 (KAM)
- KAPP 2002 (KAP)
- KAPP 2003-2004 (KP2)
- Florida (NNN)

**California**

- Eureka (ERK)

**Texas**

- Harris County (HAR)

**Gauge Data**

- Kwajalein**
- KWA
- International**
- France/Italy (HyMeX)
- Wallops**
- Nassawadox, VA
- Pocomoke, MD

- Data
- Rain
- GAG
- GMIN
- 2A56
- Sitelist

Please select a network first, then a year to download the GMIN file.

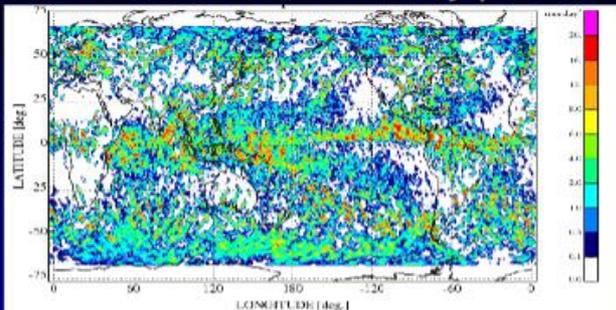
Please select a network first, then a year to go to the ftp site.

Please select a network to get the sitelist.

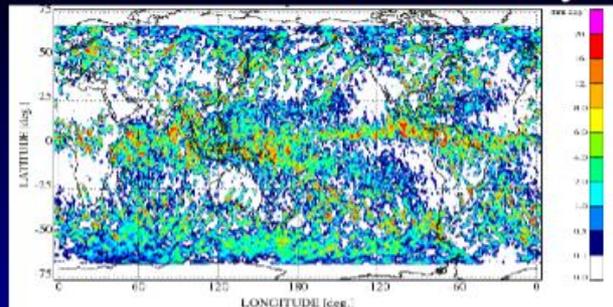
# GPM and TRMM Level-2 Data Products Comparison

## Comparison of GPM Mean Precip. vs TRMM

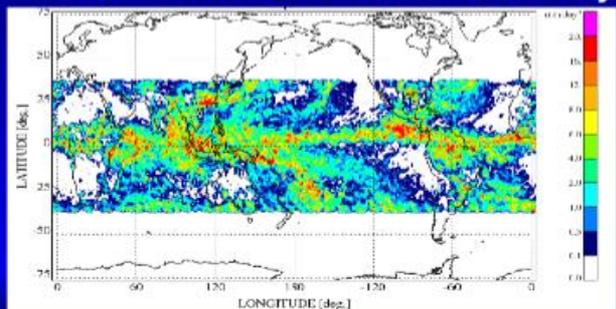
Mean Ku+GMI over 16-31 May (Ka swath)



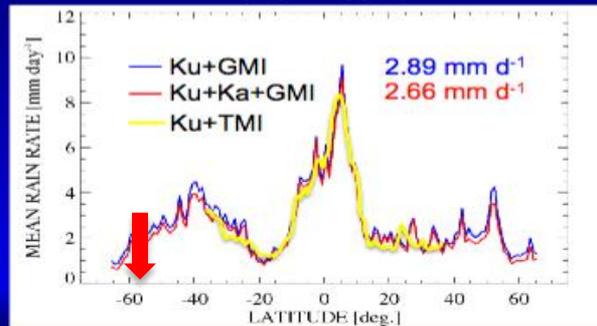
Mean Ku+Ka+GMI over 16-31 May



Mean of TRMM Ku+TMI over 16-31 May



Zonal Means



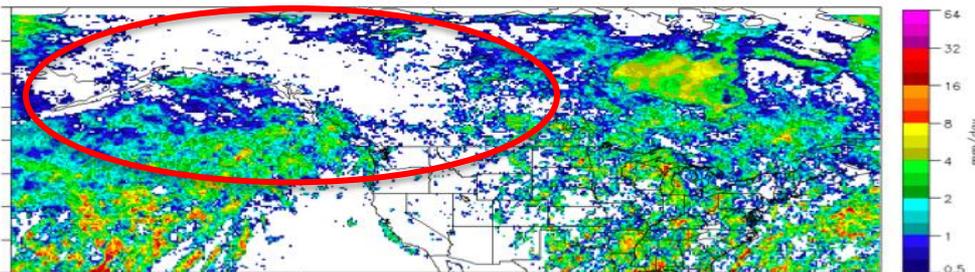
Higher spatial resolution, coverage, and details in GPM Products

Courtesy: William Olson (PMM Investigator), NASA Mesoscale Atmospheric Processes

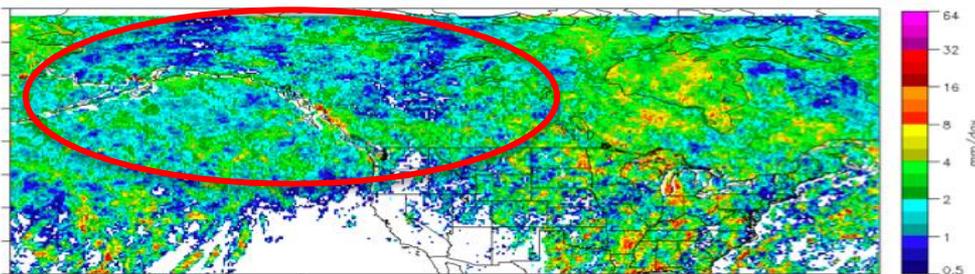
# GPM and TRMM Level-2 Data Products Comparison

GMI GPROF2014 Retrieval - April, 2014

V1 (TRMM/NEXRAD based) Database



V2 (GPM based) Database



Improved Coverage in GPM GMI Product

Courtesy: Christian Kummerow (PMM Investigator), Colorado State University



# VALIDATION – 3-Hourly, 0.25° IMERG, 3B42, MRMS for 15 June 2014

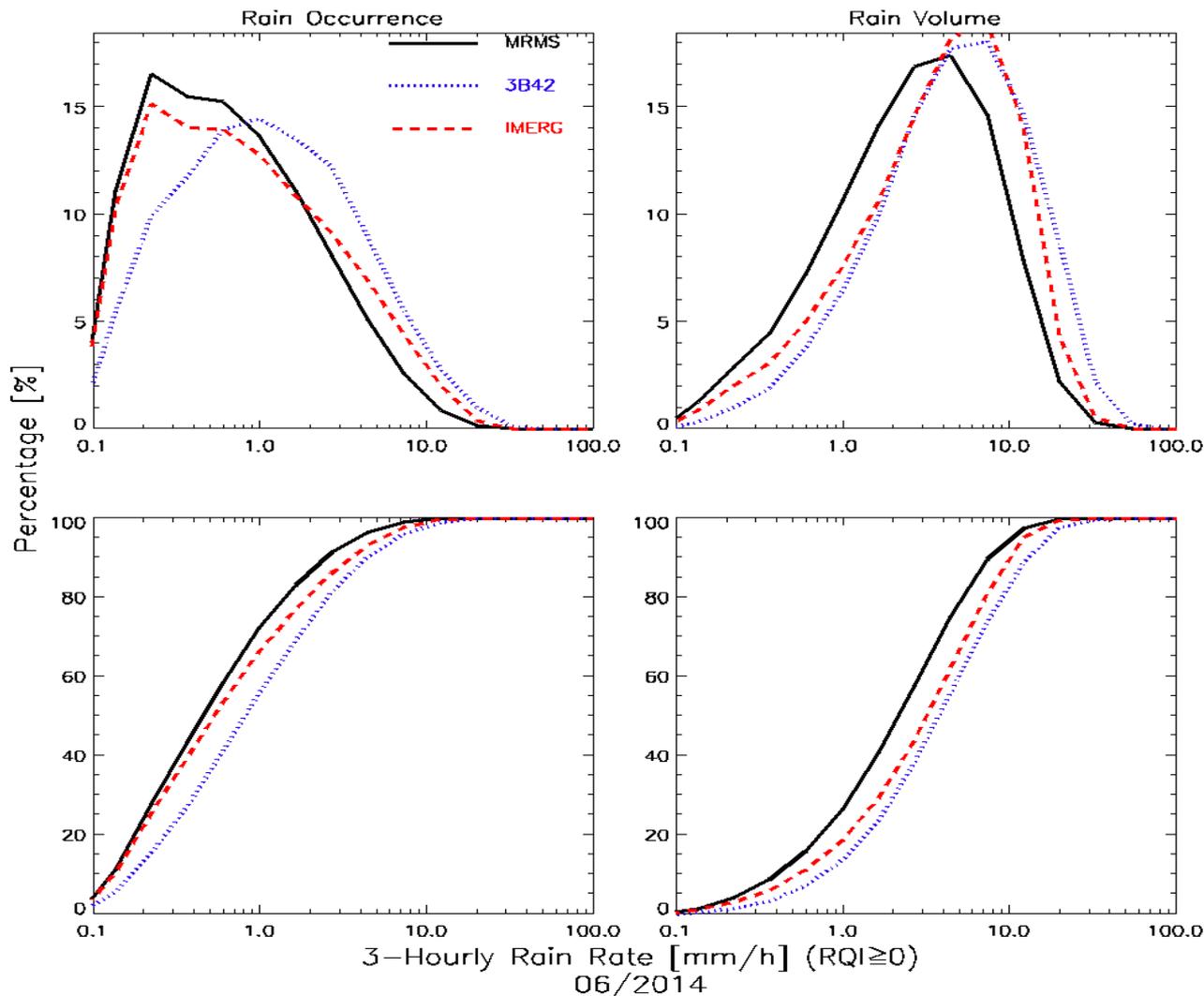


IMERG better than 3B42  
for precip occurrence

IMERG performs modestly  
better for precip volume

Note: Original footprint  
GPROF retrievals below  
0.1 mm/hr are thresholded  
to zero

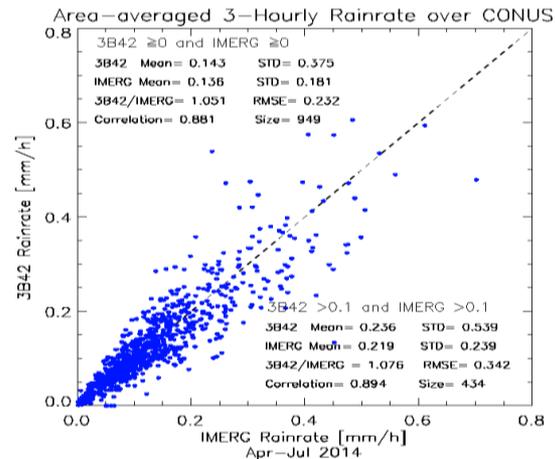
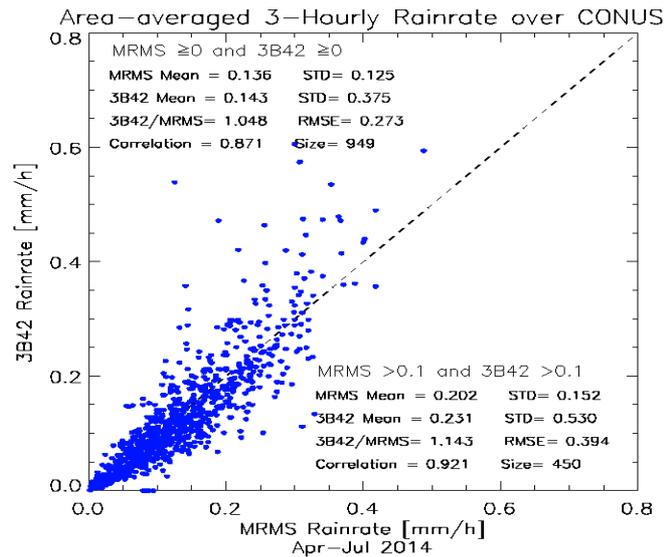
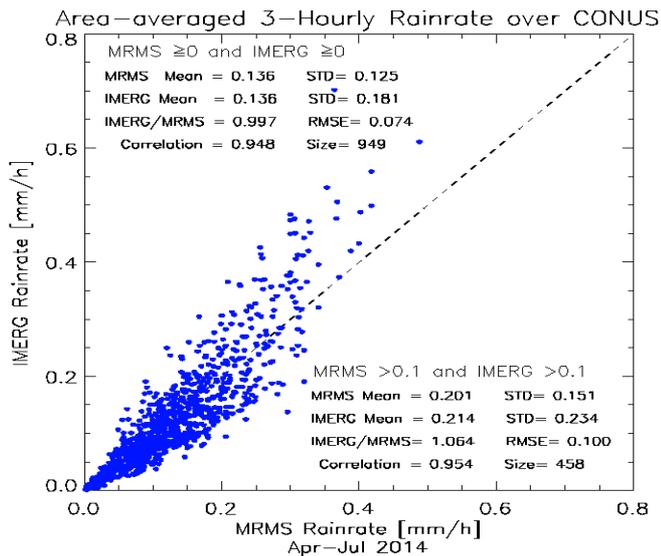
- how this affects IMERG depends on the resolution of the input sensor and subsequent averaging (here 0.25°)



[Courtesy J. Wang  
(SSAI; NASA/GSFC 612)]



# VALIDATION – 3-Hourly, CONUS-avg. IMERG, 3B42, MRMS for April–July 2014



IMERG better for bias and RMSE

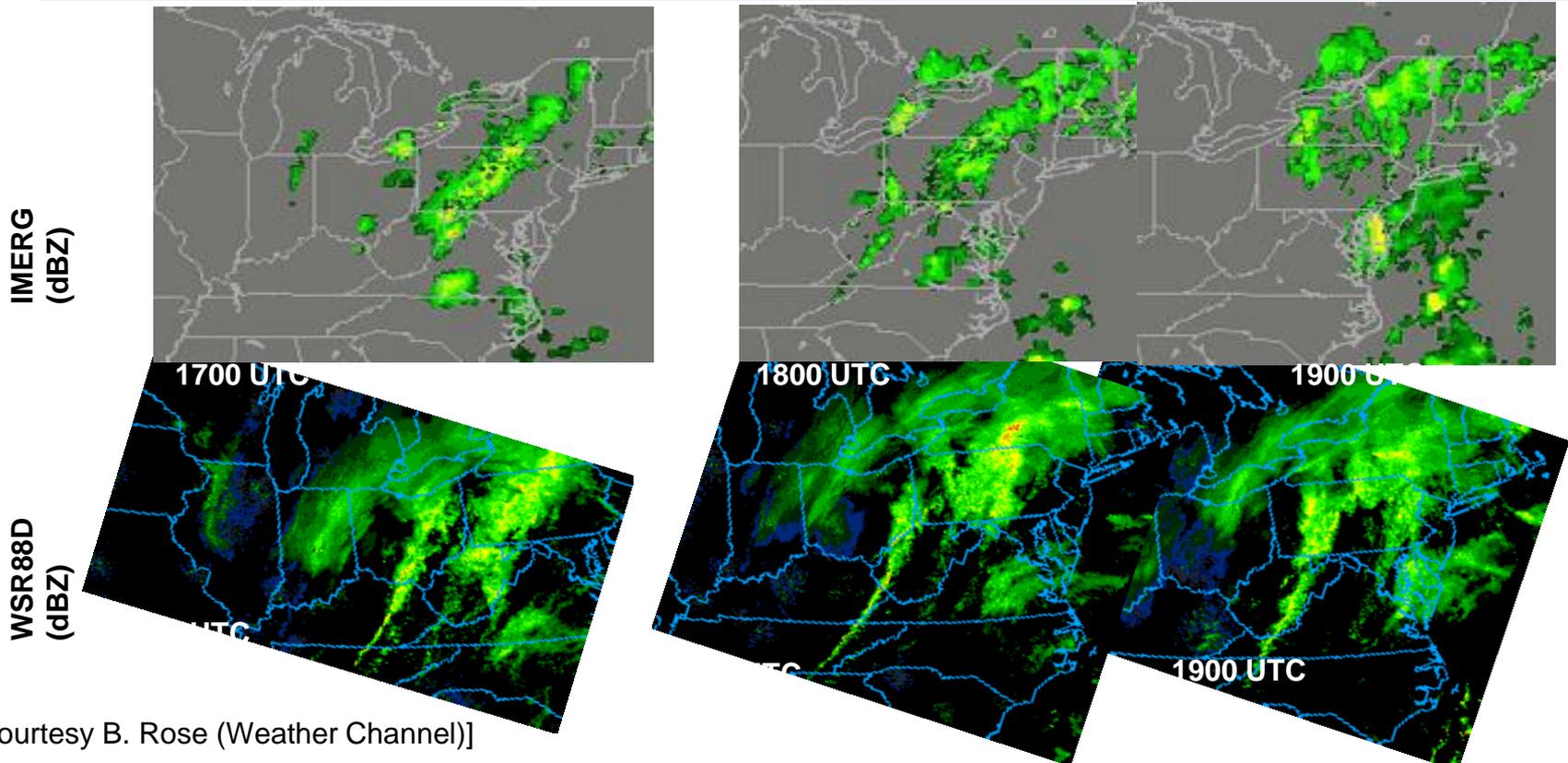
IMERG and 3B42 trend high at high rates

At this spatial scale, error is roughly multiplicative

# VALIDATION – Snow in IMERG, NWS WSR88D, 12 March 2014

IMERG converted to dBZ, WSR88D in dBZ; both original resolution  
Hang-back line in radar missing in IMERG

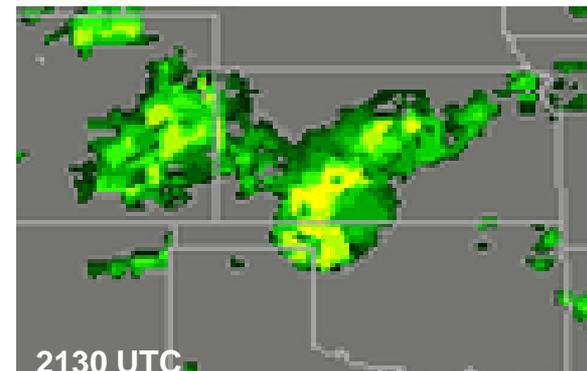
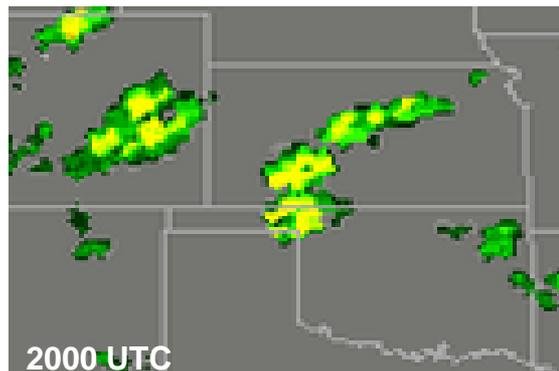
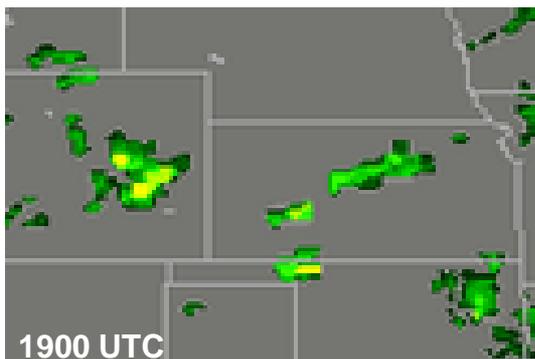
2-5" of snow with near-blizzard conditions at Cleveland, Ohio around 1900 UTC



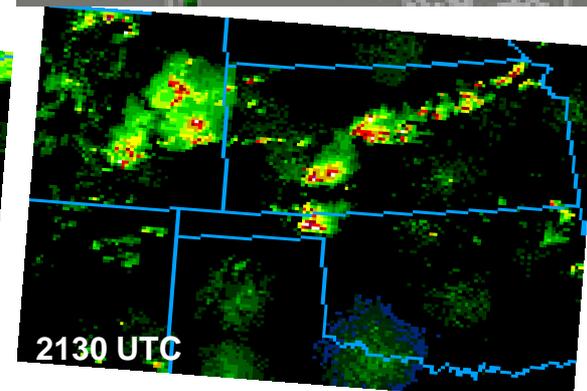
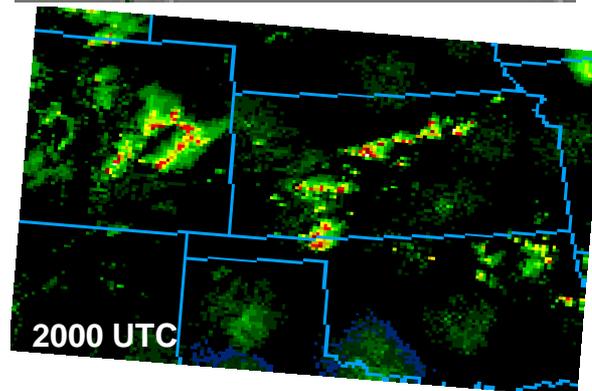
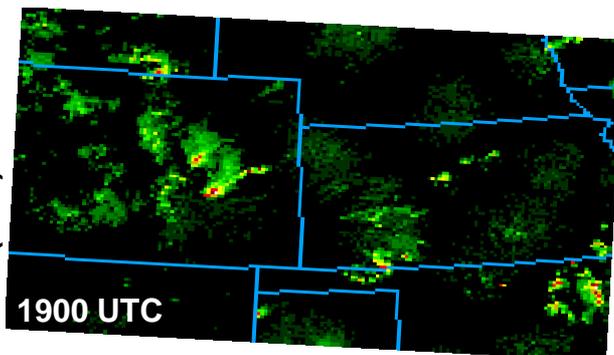
[Courtesy B. Rose (Weather Channel)]

IMERG converted to dBZ, WSR88D in dBZ; both original resolution  
IMERG has good placement of supercells  
Anvils more prominent in IMERG, lower maximum values (resolution?)

IMERG  
(dBZ)



WSR88D  
(dBZ)





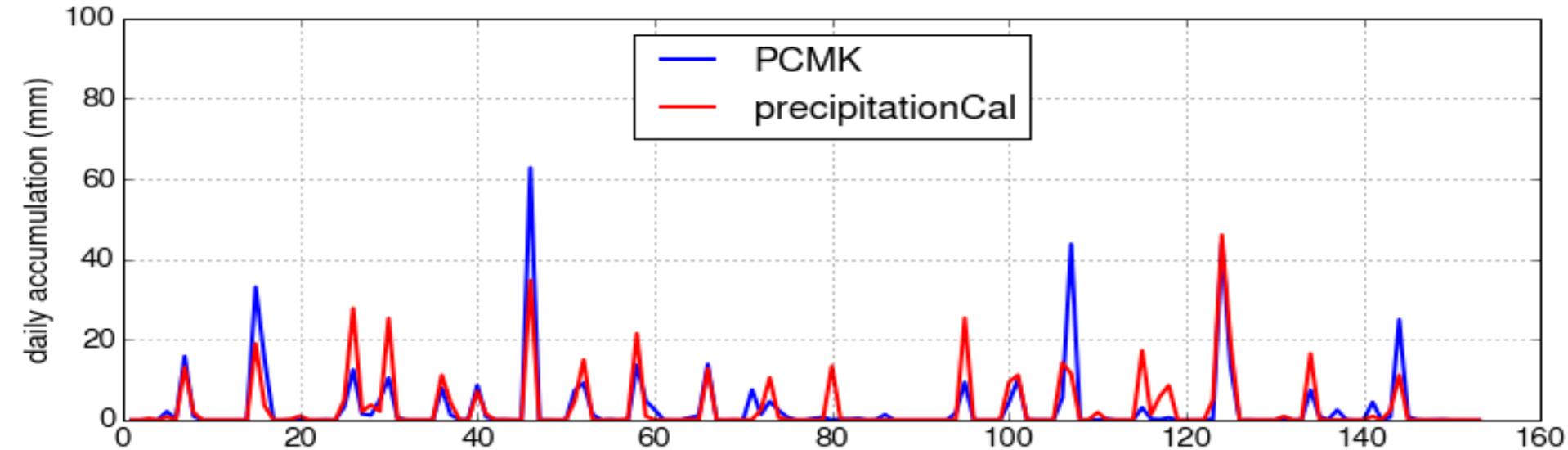
# VALIDATION – Daily IMERG and Pocamoke Fine-Scale Grid, April-August 2014



23 surface gauges in a 6x5 km region near Wallops Island, Virginia

Excellent correlation for most events (warm season)

Both over- and under-estimates for largest events



[Courtesy J. Tan (UMBC; WFF)]



# Summary

Overview of GPM Core and Constellation Satellites and GPM Sensors (DPR, GMI) were provided

GPM precipitation data: Level-2 & 3 from GMI, DPR, and Combined DPR/GMI  
And Level-3: IMERG described

GPM data access via Mirador, Giovanni, and PPS were introduced

GPM data validation and comparison with TRMM was presented

## Next Webinar

GPM Data Product Updates and Demonstration of Web-tools for Data Search,  
Analysis, Visualization, and Download **(3/15/2016)**



# Thank You!