



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

Webinar 4: GPM Data Updates and Reading with Python



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NASA Applied Remote Sensing Training (ARSET)

http://arset.gsfc.nasa.gov/disasters/webinars/global-precipitation

September 13,, 2016





Webinar Objective



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





- 1. Overview of GPM Mission, Data Products, and Data Access Tools (12/8/2015)
- 2. GPM Data Products Updates and Demonstration of Web-tools for Data Search, Analysis, Visualization, and Download (3/15/2016)
- 3. Demonstration of GPM Data Import and Analysis in GIS (QGIS) (6/14/2016)
- 4. Python Script for Reading HDF5 GPM Data

(9/13/2016)





- Brief Overview of GPM
- GPM Products Updates and Access
- GPM Ground Validation
- Steps for Using Python Script to Read GPM IMERG Data*

*

This python script is designed to provide a general framework for reading HDF5 data format. In addition, a script to spatially subset and save data as a text file is provided.

The script will have to be modified for your application and may not be usable as is for specific needs





Brief Overview of GPM

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Access to GPM Training Webinars

CCGLL PRECENTATION MEASUREMENT

http://pmm.nasa.gov/training



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GPM Core and Constellation Satellites

http://pmm.nasa.gov/GPM

GPM Core satellite was launched on February 27th, 2014





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

GPM measurements span middle and high latitudes



GPM Sensors





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



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



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

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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)







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	5.2 km x125 m Single Orbit	20-120 minutes		
DPR KU & Ka/ 2A-DPR	and 16 orbits per day (70°S-70°N)	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	HDF5, 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
 For a variety of environmental applications
- 2AGPROF rainfall swath estimates for GMI and constellation radiometers
- 1C calibrated brightness temperature for GMI and constellation radiometers
- 2A DPR rainfall swath estimates





GPM Data Products Updates and Access





Precipitation Measurement Mission (PMM)

pmm. nasa.gov /data-access/data-updates	🖾 C (Q, PMM GP	M NASA	→ ☆ 🖻 🛡
NATIONAL AEFONAUTICS AND SPACE ADMINISTRATION	GODDARD SPACE FLIGHT CENTER	Search	2
PRECIPIT	ATION MEASUREME	ENT MISSI	ONS
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 News Tuesday, March 1, 2016 V04 Processing for GPM Near-Realtin Begin Late on March 2, 2016, the <u>GPM</u> NRT system will begin using V04 a • Level 1B <u>GMI</u> • Level 1C GMI	Data Downloads & Documentation TRMM GPM Ground Validation Data Sources Data Recipes Data News	Extreme Weather News Google Earth NASA Worldview Training Data FAQ
Using the PPS FTP Training Data FAQ	Level 2 Radar Level 2 Combined		

Home of all information about GPM/TRMM for:

- Data Access and Updates
- Research and Applications



Data Product Updates



Many Near-real Time GPM data products are based on version-4 (V04) algorithms (as of March 2016) [Level 1B GMI, Level 1C GMI, Level 1 Radar, Level 2 Radar, Level 2 Combined]

- V04 is the first version that uses GPM as the calibrator for the constellation measurements rather than TRMM.
- GMI is extremely well calibrated and the brightness temperatures in 1B and 1C are an important improvement over those in V03.
- V04 has improved retrievals in the Ku, Ka, and DPR level 2 products.
- GMI/DPR Combined product has also made retrieval improvements in V04.
- **GPROF** is using V04 as of May 2, 2016.
- IMERG is still using V03 because the constellation radiometers are still using V03 -- but all will be updated to V04 in October/November 2016





IMERG Updates and Future Plans



Courtesy: George Huffman

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IMERG Updates and Future Plans

Current (Version 3) data record starts April 2014 (Final), March 2015 (Early), April 2015 (Late)

Version 4 IMERG will be instituted soon (~ November 2016)

- "Initial Processing" with new data
- "Retrospective Processing" for recorded data during the GPM era (from April 2014)

In late 2017 or early 2018 Version 5 IMERG will be instituted

- covering the TRMM and GPM era (from January 1998, or at least February 2000)
- seeking to run an "Interim" reprocessing in Spring 2017 (using V.4)

TMPA, TMPA-RT continue to be run

- done to provide a consistent long record until IMERG covers the TRMM era
- shut down about 3 months after IMERG is extended
- could end early if key inputs are ended

Courtesy: George Huffman





There may be disruption in IMERG data availability while transition from V03 to V04 takes place

Documentation will be available

IMERG V04 is likely to be more accurate – particularly improvement in high bias at higher precipitation rates

As of 9-8-2016, however, due to outage of SSMIS, lower quality infrared data are used – PPS/Mission updates will inform when the situation changes

Courtesy: George Huffman GPM Applications Webinar - 4

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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 Data Access



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





GPM Data Access



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





GPM Data Access Using Selected Web-tools



Tools	Data Products and Formats	Analysis and/or Visualization	Data Download
Mirador http://mirador.gsfc.nasa.gov Requires Registration	L1B, L2, and L3 GMI-GPROF IMERG Half-hourly, Monthly Orbital and Gridded Daily, Monthly HDF5, [Selected products in OPenDAP can be converted to ASCII, Binary, NetCDF]	N/A	Download by Select and Click on Data Files OR Batch Download of Multiple Files
Giovanni http://giovanni.gsfc.nasa.gov/giova nni/	IMERG Half-hourly, Monthly NetCDF, GeoTIFF, PNG	Visualization: Map, Time Series, Scatter Plot Histogram Analysis: Time-averaged Maps, Time Series, Scatter Plot, Map Correlations, Vertical Profiles, Time- averaged Differences	Download by Select and Click on Data Files
PPS/STORM https://storm.pps.eosdis.nasa.gov/ storm Requires Registration	L1B and 1C, L2, L3 GMI, DPR, GMI-DPR Combined Data, Orbital and Gridded Daily, Monthly IMERG Half-hourly, Monthly HDF5, PNG	Map Visualization, Interactive Latitude/Longitude Point Data Value Display	FTP



New GPM NRT Swath - Viewer Available

https://storm.pps.eosdis.nasa.gov/storm/cesium/GPMNRTView.html









GPM Ground Validation



GPM Ground Validation Portal



https://pmm.nasa.gov/index.php?q=science/ground-validation

Physical Validation



- 1) Disdrometer
- 2) Multi-frequency polarimetric radar and profiler
- In situ and profiling aircraft measurements for cloud microphysical properties (size, shape, types) and rainfall
- 4) High-altitude airborne dual frequency radar and radiometer (on-board ER-2 and DC-8)



GPM Ground Validation Portal



https://pmm.nasa.gov/index.php?q=science/ground-validation

Statistical Validation







Location of radars in the Validation Network. Red circles indicate the original set used with TRMM, and blue circles indicate new radars to be used with GPM.





GPM Ground Validation Field Campaigns

http://gpm.nsstc.nasa.gov/index.html

GPM Ground Validation Data Portal

GHRC Home
Data
LPVEx
MC3E
GCPEX
IFloodS
IPHEx
Validation Network
Latest Instruments
Participants
Tools
Related Links
Image Gallery

OLYMPEX: The Olympic Mountain Experiment in Washington State (November 2015 to February 2016) to assess GPM core rain and snow products

IPHEx: Integrated Precipitation and Hydrology Experiment In Southern Appalachian – eastern US from May 1-June 15 2014

IFloodS: Iowa Flood Studies from May 1 to June 15, 2013 To measure and assess rain characteristics and improve algorithms

GCPEX: GPM Cold-season Precipitation Experiment in Canada in January-February, 2012





Demonstration of Sample Python Script

Instructions and scripts are available for download

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Future Plan



More webinars planned for 2016-17 :

- -- data updates, validation, and applications
- -- TMPA-IMERG combined data information
- -- working with Level-2 data in QGIS
- -- hands-on case studies to access rain/snow data using python





Thank You!

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