# Supporting Hydrometeorological Research and Applications with Global Precipitation Measurement (GPM) Products and Services

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GES – DISC
Goddard Earth Sciences
Data Information Services Center

# Outline

- Introduction
- GPM Data Product Overview
- Data Services
- Applications
- Conclusion
- Future work
- Acknowledgements
- Links/information

# Introduction

- Precipitation is a critical variable in the global hydrologic cycle and our daily lives (droughts, floods, outdoor activities, diseases, etc.).

Yangtze River near ChongQing during the 2010 droughts in SW China

Ongoing Flooding in the U.S. Midwest

# Data and Services Facilitate Research and Applications

- Data at the GES DISC: global precipitation, solar irradiance, atmospheric composition and dynamics, water and energy cycle, global modeling, etc.
- Services: Giovanni, Simple Subset Wizard, UUI (Unified User Interface), etc.

# GPM Products at GES DISC

GES DISC
Goddard Earth Sciences Data and Information Services Center

National Aeronautics and Space Administration

Google™ Custom Search

Data Services | Mission Portals | Science Portals | Info

Mirador
Data Access Made Simple

+ OVERVIEW
+ HELP CENTER
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+ Feedback
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You are here: Project » GPM

Keyword | Projects | Science Areas

**GPM**

Global Precipitation Measurement (GPM) is an international satellite mission to provide next-generation observations of rain and snow worldwide. NASA and the Japanese Aerospace Exploration Agency (JAXA) launched the GPM Core Observatory satellite on February 27th, 2014, carrying advanced instruments that will set a new standard for precipitation measurements from space. The data they provide will be used to unify precipitation measurements made by an international network of partner satellites to quantify when, where, and how much it rains or snows around the world.

| Data Group | Description | Date Range |
|---|---|---|
| Orbital L1 (28) | Orbital data at the sensor's resolution: 1) Level-1A: Reconstructed, unprocessed instrument data at full resolution, time referenced, and annotated with ancillary information, including radiometric and geometric calibration coefficients and georeferencing parameters, computed and appended, but not applied, to Level 0 data; 2) Level-1B: Radiometrically corrected and geolocated Level 1A data that have been processed to sensor units; and 3) Level-1C: common intercalibrated microwave brightness temperature (Tc) products. | 2006-12-31 to 2016-01-05 |
| Orbital L2 (22) | Derived geophysical parameters at the same resolution and location as those of the Level-1 data. | 2013-03-31 to 2016-01-05 |
| Gridded L3 (36) | Geophysical parameters that have been spatially and/or temporally resampled from Level 1 or Level 2 data. | 2014-02-01 to 2016-01-05 |

NASA Privacy Policy and Important Notices

+ Contact Us: GES DISC Help Desk
+ NASA Official: Steven Kempler

# GPM Level-1 Products

| Data Set | Description | Date Range | Number of Items | Avg Size (MB) |
|---|---|---|---|---|
| GPM_1AGMI.03 info | GPM GMI Level 1A unpacked packet data | 2014-03-04 to 2016-01-06 | 10457 | 102.44 |
| GPM_1BGMI.03 info | GPM GMI Level 1B Brightness Temperatures | 2014-03-04 to 2016-01-06 | 10456 | 57.951 |
| GPM_1CF16SSMIS.02 info | GPM, SSMI F16 Level 1C Common Calibrated Brightness Temperatures | 2013-03-31 to 2016-01-04 | 11181 | 22.86 |
| GPM_1CF17SSMIS.02 info | GPM, SSMI F17 Level 1C Common Calibrated Brightness Temperatures | 2013-03-31 to 2016-01-04 | 11182 | 22.544 |
| GPM_1CF18SSMIS.02 info | GPM, SSMI F18 Level 1C Common Calibrated Brightness Temperatures | 2013-03-31 to 2016-01-04 | 11185 | 21.656 |
| GPM_1CGCOMW1AMSR2.03 info | GPM, AMSR2 GCOMW1 Level 1C Common Calibrated Brightness Temperature | 2013-03-31 to 2016-01-04 | 11481 | 83.243 |
| GPM_1CGPMGMI.03 info | GPM GMI Level 1C Common Calibrated Brightness Temperatures Collocated | 2014-03-04 to 2016-01-06 | 10457 | 27.416 |
| GPM_1CGPMGMI_R.03 info | GPM Level 1C R Common Calibrated Brightness Temperatures Collocated | 2014-03-04 to 2016-01-06 | 10367 | 25.698 |
| GPM_1CMETOPAMHS.02 info | GPM, METOPA MHS Level 1C Common Calibrated Brightness Temperatures | 2007-05-21 to 2016-01-04 | 13496 | 3.827 |
| GPM_1CMETOPBMHS.02 info | GPM, METOPB MHS Level 1C Common Calibrated Brightness Temperatures | 2013-04-23 to 2016-01-04 | 10903 | 3.855 |
| GPM_1CMT1SAPHIR.02 info | GPM, MT1 SAPHIR Level 1C Common Calibrated Brightness Temperatures | 2014-01-27 to 2015-12-31 | 9456 | 9.469 |
| GPM_1CNOAA18MHS.02 info | GPM, MT1 SAPHIR Level 1C Common Calibrated Brightness Temperatures | 2006-12-31 to 2016-01-04 | 16363 | 3.879 |
| GPM_1CNOAA19MHS.02 info | GPM, NOAA-19 MHS Level 1C Common Calibrated Brightness Temperatures | 2013-03-31 to 2016-01-04 | 11204 | 3.938 |
| GPM_1CTRMMTMI.02 info | GPM, TRMM TMI Level 1C Common Calibrated Brightness Temperatures | 2014-02-01 to 2015-04-08 | 5684 | 13.729 |
| GPM_BASEGPMGMI.03 info | GPM Level 1BASE Common Calibrated Brightness Temperatures | 2014-03-04 to 2015-07-29 | 7958 | 185.974 |

# GPM Level-2 Products

**Orbital L2**

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

- Spatial and Temporal Search

| Data Set | Description | Date Range | Number of Items | Avg Size (MB) |
|---|---|---|---|---|
| GPM_2ADPR.03 info | GPM, DPR Level 2A DPR environment V03 | 2015-08-31 to 2016-01-05 | 1982 | 397.632 |
| GPM_2AGPROFF16SSMIS.03 info | GPM, SSMI F16 Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11181 | 16.248 |
| GPM_2AGPROFF17SSMIS.03 info | GPM, SSMI F17 Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11182 | 16.528 |
| GPM_2AGPROFF18SSMIS.03 info | GPM SSMI F18 Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11184 | 16.509 |
| GPM_2AGPROFGCOMW1AMSR2.03 info | GPM, AMSR2 GCOMW1 Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11481 | 52.919 |
| GPM_2AGPROFGPMGMI.03 info | GPM GMI Level 2A Radiometer Profiling | 2014-03-04 to 2016-01-04 | 10444 | 16.664 |
| GPM_2AGPROFMETOPAMHS.03 info | GPM, METOPA MHS Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 10500 | 5.307 |
| GPM_2AGPROFMETOPBMHS.03 info | GPM, METOPB MHS Level 2A Radiometer Profiling | 2013-04-23 to 2016-01-04 | 10917 | 5.312 |
| GPM_2AGPROFNOAA18MHS.03 info | GPM, NOAA-18 MHS Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11190 | 5.394 |
| GPM_2AGPROFNOAA19MHS.03 info | GPM, NOAA-19 MHS Level 2A Radiometer Profiling | 2013-03-31 to 2016-01-04 | 11190 | 5.42 |
| GPM_2Aka.03 info | GPM, DPR Level 2A Ka Precipitation | 2015-08-31 to 2016-01-05 | 1983 | 187.477 |
| GPM_2Aku.03 info | GPM, DPR Level 2A Ku Precipitation | 2015-08-31 to 2016-01-05 | 1983 | 209.706 |
| GPM_2BCMB.03 info | GPM, DPR, GMI Level 2B Level-2 DPR and GMI Combined | 2015-08-30 to 2016-01-05 | 1982 | 121.822 |

# GPM Level-2 Products

**Gridded L3**

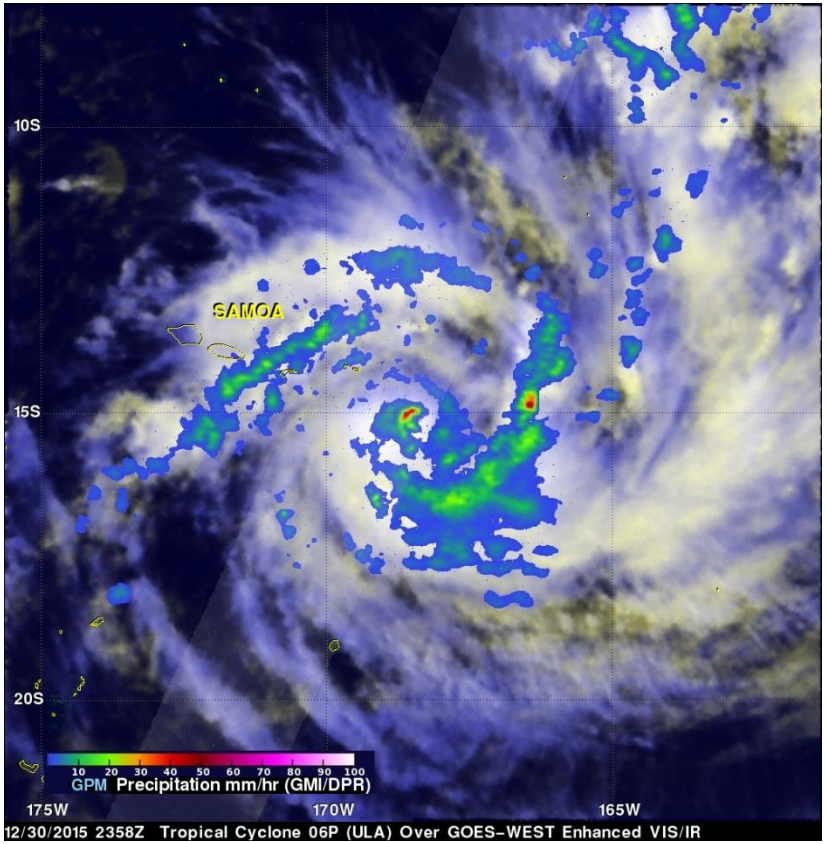
Geophysical parameters that have been spatially and/or temporally resampled from Level 1 or Level 2 data.

▪ Spatial and Temporal Search

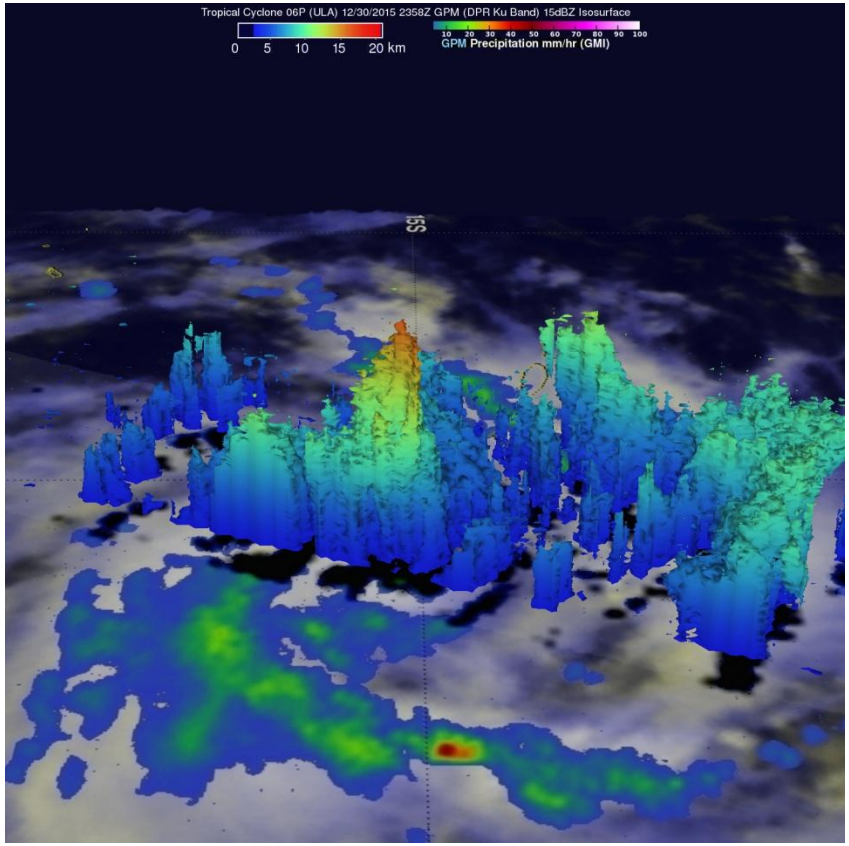
| Data Set | Description | Date Range | Number of Items | Avg Size (MB) |
|---|---|---|---|---|
| GPM_3BCMB_DAY.03 info | GPM, DPR, GMI Level 3 Combined Precipitation | 2015-03-15 to 2016-01-02 | 294 | 63.654 |
| GPM_3DPR_ASC.03 info | GPM, DPR Level 3 DPR Ascending Daily | 2015-02-20 to 2016-01-04 | 319 | 59.486 |
| GPM_3DPR_DES.03 info | GPM, DPR Level 3 DPR Descending Daily | 2015-02-20 to 2016-01-04 | 319 | 59.238 |
| GPM_3GPROFF16SSMIS.03 info | GPM, SSMI F16 Level 3 Monthly GPROF Profiling | 2014-02-01 to 2015-12-31 | 23 | 19.421 |
| GPM_3GPROFF16SSMIS_DAY.03 info | GPM, SSMI F16 Level 3 Daily GPROF Profiling | 2014-02-27 to 2016-01-03 | 675 | 15.73 |
| GPM_3GPROFF17SSMIS.03 info | GPM, SSMI F17 Level 3 Monthly GPROF Profiling | 2014-02-01 to 2015-12-31 | 23 | 19.665 |
| GPM_3GPROFF17SSMIS_DAY.03 info | GPM, SSMI F17 Level 3 Daily GPROF Profiling | 2014-02-27 to 2016-01-03 | 675 | 16.032 |
| GPM_3GPROFF18SSMIS.03 info | GPM, SSMI F18 Level 3 Monthly GPROF Profiling | 2014-08-01 to 2015-12-31 | 17 | 19.679 |
| GPM_3GPROFF18SSMIS_DAY.03 info | GPM, SSMI F18 Level 3 Daily GPROF Profiling | 2014-02-27 to 2016-01-03 | 676 | 16.072 |
| GPM_3GPROFGCOMW1AMSR2.03 info | GPM, AMSR2 GCOMW1 Level 3 Monthly GPROF Profiling | 2014-02-28 to 2015-12-31 | 23 | 20.497 |
| GPM_3GPROFGCOMW1AMSR2_DAY.03 info | GPM, AMSR2 GCOMW1 Level 3 Daily GPROF Profiling | 2014-02-27 to 2016-01-03 | 675 | 16.504 |
| GPM_3GPROFGPMGMI.03 info | GPM GMI Level 3 Monthly GPROF Profiling | 2014-03-01 to 2015-12-31 | 22 | 16.072 |
| GPM_3GPROFGPMGMI_DAY.03 info | GPM GMI Level 3 Daily GPROF Profiling | 2014-03-05 to 2016-01-02 | 669 | 11.091 |

| | |
|---|---|
| GPM_3GPROFMETOPAMHS.03 info | GPM, METOPA MHS Level 3 Month |
| GPM_3GPROFMETOPAMHS_DAY.03 info | GPM, METOPA MHS Level 3 Daily |
| GPM_3GPROFMETOPBMHS.03 info | GPM, METOPB MHS Level 3 Month |
| GPM_3GPROFMETOPBMHS_DAY.03 info | GPM, METOPB MHS Level 3 Daily |
| GPM_3GPROFNOAA18MHS.03 info | GPM, NOAA-18 MHS Level 3 Month |
| GPM_3GPROFNOAA18MHS_DAY.03 info | GPM, NOAA-18 MHS Level 3 Daily |
| GPM_3GPROFNOAA19MHS.03 info | GPM, NOAA-19 MHS Level 3 Month |
| GPM_3GPROFNOAA19MHS_DAY.03 info | GPM, NOAA-19 MHS Level 3 Daily |
| GPM_3GPROFTRMMTMI.03 info | GPM, TRMM TMI Level 3 Monthly G |
| GPM_3GPROFTRMMTMI_DAY.03 info | GPM, TRMM TMI Level 3 Daily GPR |
| GPM_3IMERGHH.03 info | GPM Level 3 IMERG Half Hourly 0. |
| GPM_3IMERGM.03 info | GPM Level 3 IMERG Monthly 0.1 x |

# Examples:



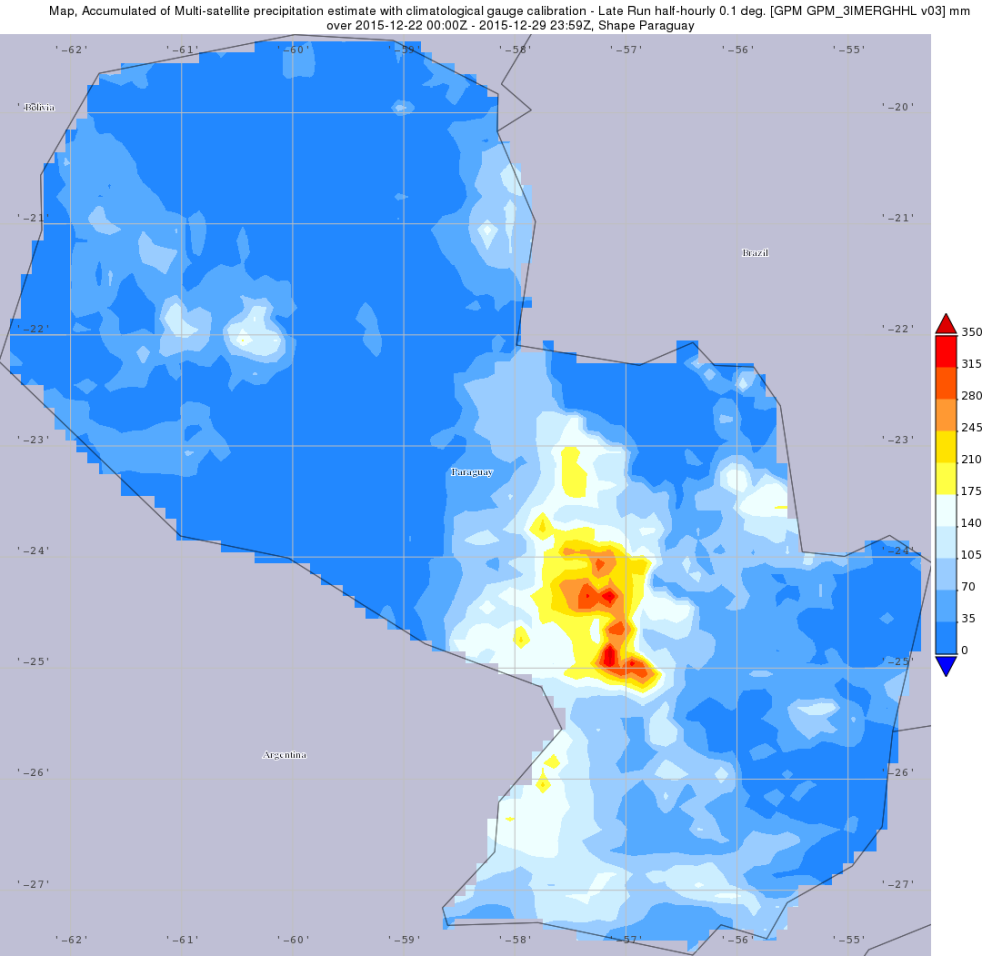

GMI/DPR combined precipitation for Tropical Cyclone ULA




DPR reflectivity (Ku band, 15 dBZ isosurface)

*Courtesy of pmm.nasa.gov*

# Examples (Cont'd)




IMERG – Late (mm)

Deadly Flooding in Paraguay in Dec. 2015

# GPM Data Services

EARTHDATA | Data Discovery | DAACs | Community | Science Disciplines

GES DISC

imerg

Feedback | Help

*Atmospheric Composition*, *Water and Energy Cycle*, and *Climate Variability* Data

## Datasets

Showing (7) *datasets* associated with **imerg**...

Refine By

**Subjects**

- Atmospheric Phenomena (3)
- Precipitation (7)

**Measurements** Sort

- Cyclones (3)
- Drought (3)
- Hurricanes (3)
- Liquid Precipitation (4)
- Monsoons (3)

More...

**Source**

- GPM DPR (4)
- GPM GMI (7)

**Processing Level**

- 3 (7)

**Temporal Resolution** Sort

- 30 minutes (3)
- 1 day (3)
- 1 month (1)

**Spatial Resolution**

- 0.1 ° (7)

| Image | Dataset | Source | Temporal Resolution | Spatial Resolution | Process Level | Begin Date | End Date |
|---|---|---|---|---|---|---|---|
| No Sample Image | GPM Level 3 IMERG Monthly 0.1 x 0.1 degree Precipitation (GPM_3IMERGM.03) - Precipitation | GPM GMI, GPM DPR | 1 month | 0.1 ° | 3 | 2014-03-12 | present |
| No Sample Image | GPM Level-3 IMERG Final Run Daily (computed from precipitationCal) 0.1 x 0.1 Degree Precipitation (GPM_3IMERGDF.03) - Precipitation | GPM GMI | 1 day | 0.1 ° | 3 | 2015-06-05 | present |
| No Sample Image | GPM Level-3 IMERG Late Run Daily (computed from precipitationCal) 0.1 x 0.1 Degree Precipitation (GPM_3IMERGDE.03) - Precipitation | GPM GMI | 1 day | 0.1 ° | 3 | 2015-06-05 | present |
| No Sample Image | GPM Level-3 IMERG Late Run Daily (computed from precipitationCal) 0.1 x 0.1 Degree Precipitation (GPM_3IMERGDL.03) - Precipitation | GPM GMI | 1 day | 0.1 ° | 3 | 2015-06-05 | present |
| No Sample Image | GPM Level 3 IMERG Half Hourly 0.1 x 0.1 degree Precipitation (GPM_3IMERGHH.03) - Atmospheric Phenomena, Precipitation | GPM GMI, GPM DPR | 30 minutes | 0.1 ° | 3 | 2014-03-12 | present |

**Unified User Interface (UUI) –** One place for all data related activities

# GPM Data Services (Cont'd)

Data Services | Mission Portals | Science Portals | Info

GES DISC
Goddard Earth Sciences Data and Information Services Center

You are here: GES DISC Home » GPM_3IMERGM Version 03: GPM Level 3 IMERG Monthly 0.1 x 0.1 degree Precipitation

## GPM_3IMERGM Version 03: GPM Level 3 IMERG Monthly 0.1 x 0.1 degree Precipitation

Data Citation | Get Data | Summary | Data Documents

### Data Access

Data Service Name: ON-LINE ARCHIVE
Data Service Description: Access the data via FTP
Data Service Access URL: ftp://gpm1.gesdisc.eosdis.nasa.gov/data/s4pa/GPM_L3/GPM_3IMERGM.03/

Data Service Name: SSW
Data Service Description: Simple Subset Wizard
Data Service Access URL: http://disc.sci.gsfc.nasa.gov/SSW/#keywords=GPM_3IMERGM%2003

Data Service Name: MIRADOR
Data Service Description: Mirador (from Spanish, a place providing a wide view) is a Google-based data archive search interface that allows searching, browsing, and retrieving of Earth science data at NASA GES DISC
Data Service Access URL: http://mirador.gsfc.nasa.gov/cgi-bin/mirador/homepageAlt.pl?keyword=GPM_3IMERGM

Data Service Name: GIOVANNI
Data Service Description: Online visualization and analysis
Data Service Access URL: http://giovanni.gsfc.nasa.gov/giovanni/#service=INTERACTIVE_MAP&starttime=&endtime=&bbox=-180,-90,180,90&dataKeyword=imerg

Data Service Name: OPENDAP DATA (DODS)
Data Service Description: Access the data via the OPeNDAP protocol
Data Service Access URL: http://gpm1.gesdisc.eosdis.nasa.gov/opendap/hyrax/GPM_L3/GPM_3IMERGM.03/contents.html

Data Service Name: REVERB
Data Service Description: Search and retrieve data with Reverb ECHO
Data Service Access URL: http://reverb.echo.nasa.gov/reverb/#utf8=%E2%9C%93&spatial_map=satellite&spatial_type=rectangle&keywords=GPM_3IMERGM

For further information or assistance email the NASA GES DISC Help Desk: gsfc-help-disc@lists.nasa.gov

# GPM Data Services (Cont'd)

EARTHDATA | Data Discovery | DAACs | Community | Science Disciplines

**GIOVANNI** The Bridge Between Data and Science *v 4.17.1* *Release Notes* *Browser Compatibility* *Known Issues*

**MODIS Collection 6...** [1 of 2 messages] Read More

**Select Plot**

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

**Select Date Range (UTC)**

YYYY-MM HH:mm

- - 00 : 00 to - - 23 : 59

Valid Range: 2014-04-01 to 2015-08-31

Please specify a start date.

**Select Region (Bounding Box or Shapefile)**

Format: West, South, East, North

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

**Select Variables**

- ▼ Disciplines
  - Hydrology (17)
- ▼ Measurements
  - Precipitation (17)
- ▶ Platform / Instrument
- ▶ Spatial Resolutions
- ▶ Temporal Resolutions
- ▶ Portal

Number of matching Variables: 17 of 789 Total Variable(s) included in Plot: 1

Keyword : imerg Search Clear

| | Variable Name | Source | Temp. Res. | Spat. Res. | Begin Date | End Date | Units | Vert. Slice |
|---|---|---|---|---|---|---|---|---|
| ☑ | Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) (GPM_3IMERGM v03) | GPM | Monthly | 0.1 ° | 2014-04-01 | 2015-08-31 | mm/hr | - |
| ☐ | Weighting of observed gauge precipitation relative to the multi-satellite precipitation estimate - Final Run (GPM_3IMERGM v03) | GPM | Monthly | 0.1 ° | 2014-04-01 | 2015-08-31 | % | - |
| ☐ | Accumulation-weighted probability of liquid precipitation phase - Final Run (GPM_3IMERGM v03) | GPM | Monthly | 0.1 ° | 2014-04-01 | 2015-08-31 | % | - |
| ☐ | Random error for merged satellite-gauge precipitation - Final Run (GPM_3IMERGM v03) | GPM | Monthly | 0.1 ° | 2014-04-01 | 2015-08-31 | mm/hr | - |
| ☐ | Merged microwave-only precipitation estimate - Final Run (GPM_3IMERGHH v03) | GPM | Half-Hourly | 0.1 ° | 2014-03-12 | 2015-08-31 | mm/hr | - |
| ☐ | Microwave satellite observation time - Final Run (GPM_3IMERGHH v03) | GPM | Half-Hourly | 0.1 ° | 2014-03-12 | 2015-08-31 | minutes | - |
| ☐ | Microwave satellite source identifier - Final Run (GPM_3IMERGHH v03) | GPM | Half-Hourly | 0.1 ° | 2014-03-12 | 2015-08-31 | - | - |

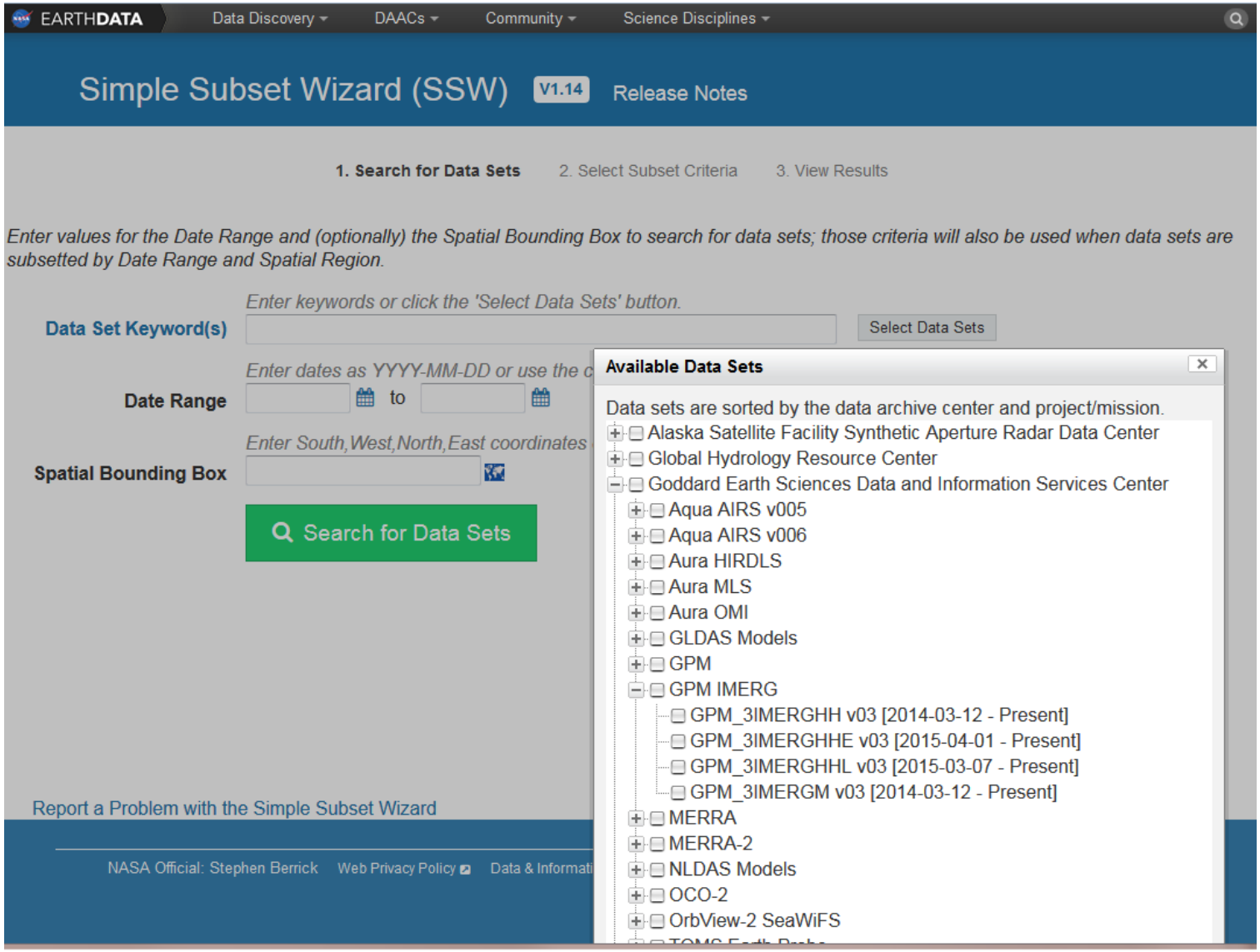
Help Reset Feedback **Plot Data**

**Giovanni**: Geospatial Interactive Online Visualization ANd aNalysis Infrastructure

# GPM Data Services (Cont'd)

| Product in Giovanni | Variables |
|---|---|
| Early Run<br>~ 6 hour latency | multi-satellite precipitation estimate, random error |
| Late Run<br>~18 hour Latency | multi-satellite precipitation estimate, random error |
| Final Run<br>~4 month latency | multi-satellite precipitation estimate, IR-only precipitation estimate, merged microwave-only precipitation estimate, probability of liquid precipitation phase, random error, etc. |

# GPM Data Services (Cont'd)




Simple Subset Wizard (SSW). NetCDF, ASCII

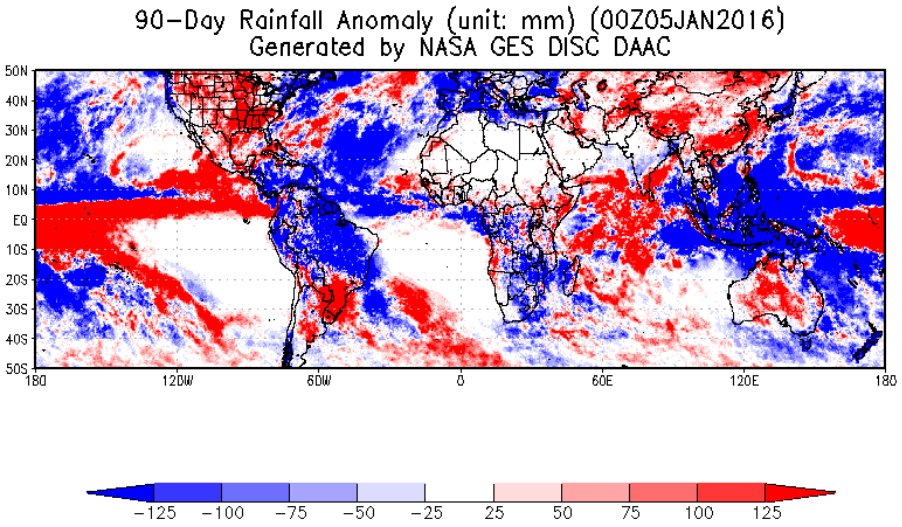
# Applications

- Current Conditions (under development, pending retrospective processing of IMERG in the TRMM era): Global and regional precipitation maps (accumulation, anomaly, normalized anomaly) for daily, 30-days, 60-days and 90-days.
- USDA Crop Explorer (10-day and anomaly; under development, pending retrospective processing of IMERG).
- New applications based on your inputs and use cases.

# Applications (Cont'd)

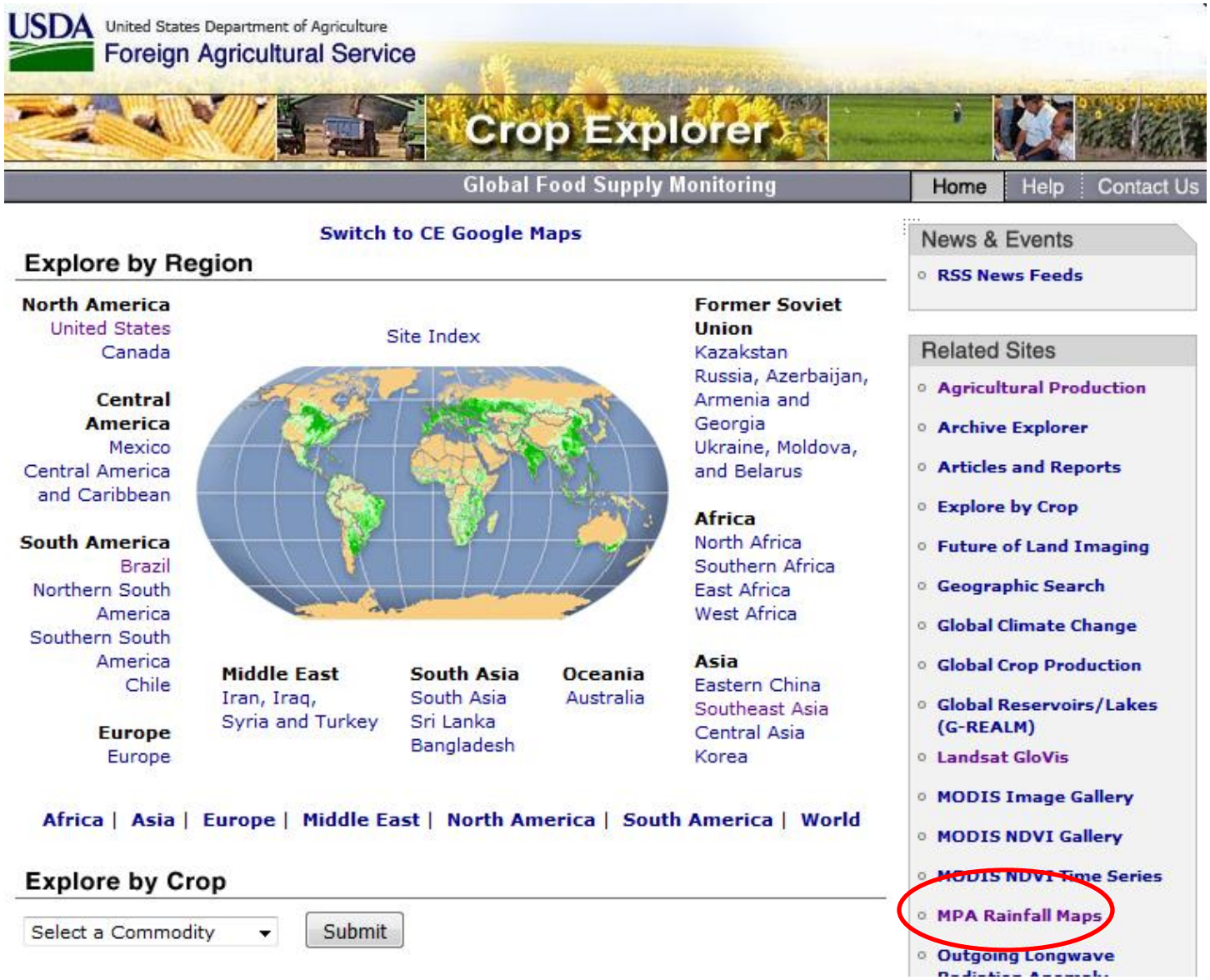
3 Hours | 24 Hours | 10 Days | 30 Days | 60 Days | 90 Days

| 90-day Global and Regional Rainfall Maps | | | |
|---|---|---|---|
| | Accumulated Rainfall | Rainfall Anomaly | Rainfall Percent of Normal |
| Global | ✓ | ✓ | ✓ |
| Northern Hemisphere | ✓ | ✓ | ✓ |
| Southern Hemisphere | ✓ | ✓ | ✓ |
| North America | ✓ | ✓ | ✓ |
| South America | ✓ | ✓ | ✓ |
| Southeast Asia | ✓ | ✓ | ✓ |
| Central Asia | ✓ | ✓ | ✓ |
| Europe | ✓ | ✓ | ✓ |
| Australia | ✓ | ✓ | ✓ |
| Africa | ✓ | ✓ | ✓ |
| USA | ✓ | ✓ | ✓ |
| NE USA | ✓ | ✓ | ✓ |
| NW USA | ✓ | ✓ | ✓ |
| Central USA | ✓ | ✓ | ✓ |
| SE USA | ✓ | ✓ | ✓ |
| SW USA | ✓ | ✓ | ✓ |

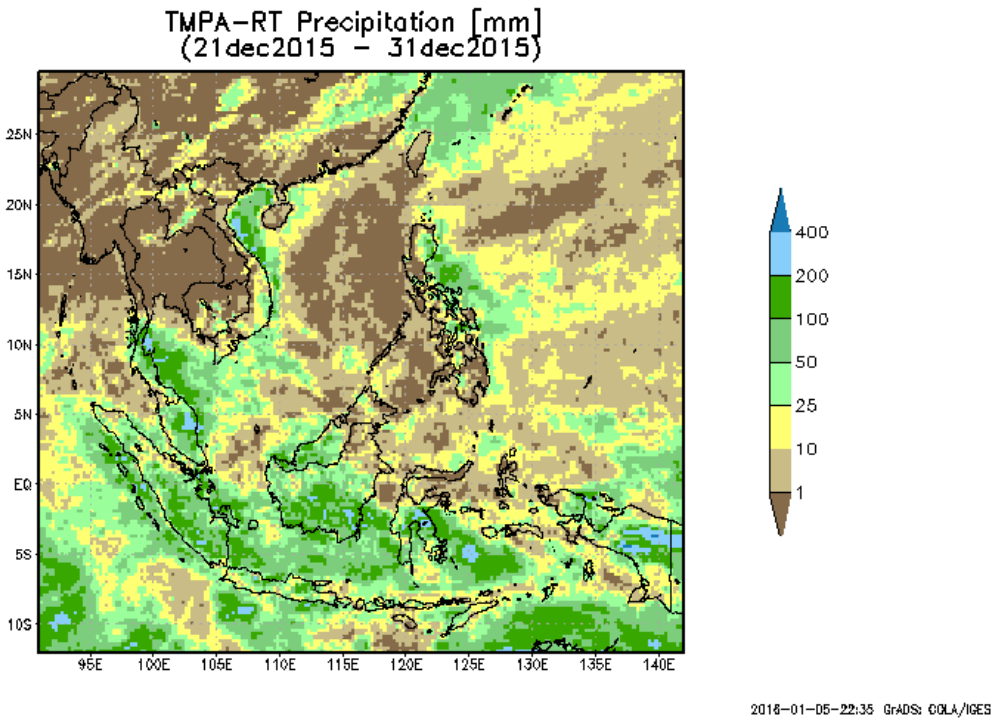


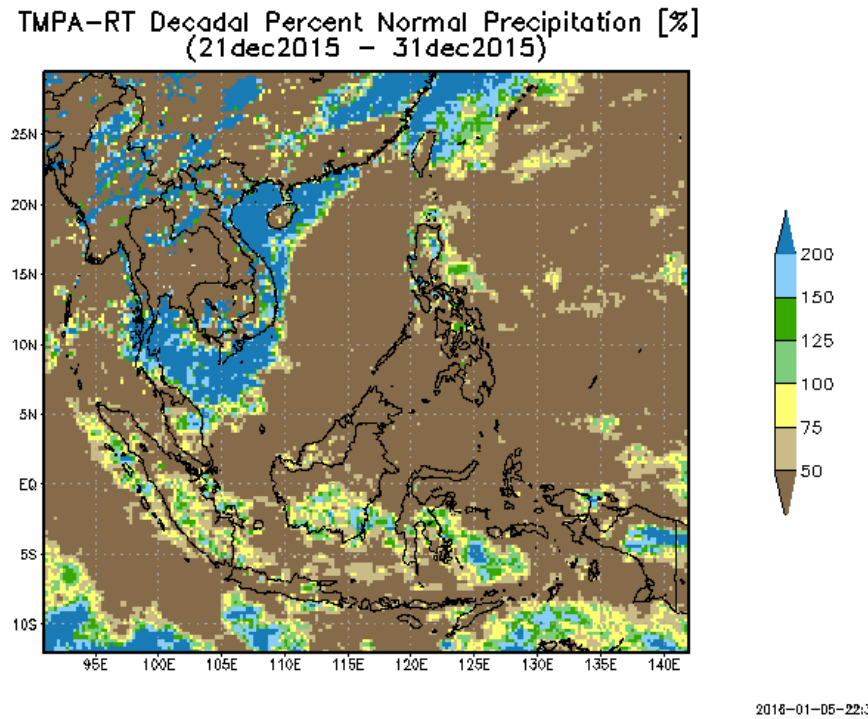

Monitoring El Nino (TMPA-RT)

# Applications (Cont'd)



# Applications (Cont'd)



# Conclusion

- GPM data are available at the NASA GES DISC
- Other global datasets (TRMM, NLDAS, GLDAS, Merra, etc.) also available
- Data services available to facilitate data access and evaluation (UUI, Giovanni, SSW, etc.)
- Applications (under development) to support various activities

# Future Work

- Value-added products (e.g. daily IMERG)
- UUI (data related activities in one place) development
- Customized data (Level-2, 3) subsetting and visualization capabilities (event-based, shapefile-based, etc.)
- Mobile app development for easy access to GPM IMERG precipitation products and services
- Ancillary data service development for facilitating algorithm development and product evaluation
- Knowledge base development for product validation activities

# Information

- Search and download GPM data: http://disc.sci.gsfc.nasa.gov/uui/search/gpm
- Data subsetting: http://disc.sci.gsfc.nasa.gov/SSW/
- Online visualization and analysis: http://giovanni.gsfc.nasa.gov or Google search "NASA giovanni"
- USDA Crop Explorer: http://www.pecad.fas.usda.gov/cropexplorer/
- NASA precipitation site: http://pmm.nasa.gov/
- Comments and suggestions: **gsfc-help-disc@lists.nasa.gov**
- Related poster (on this Wed.): No. 847 - Using GPM IMERG Precipitation Products and Services at the NASA Goddard Earth Sciences Data and Information Services Center to Monitor and Study MJO Events (K. MacRitchie, D. Ostrenga, Z. Liu, and B. Vollmer)