

Data Format Description for
Global Rainfall Map in Near-real-time Gauge-calibrated Rainfall Product
(GSMaP_Gauge_NRT) Version 6 in JAXA Climate Rainfall Watch

This document describes data format and information of Global Rainfall Map in Near-real-time Gauge-calibrated Rainfall Product (GSMaP_Gauge_NRT) for product version 6 (hereafter, GNRT6) distributed from JAXA Climate Rainfall Watch. Since 2007, GSMaP (Global Satellite Mapping of Precipitation) project activities are promoted by the JAXA Precipitation Measuring Mission (PMM) Science Team. The data period of GNRT6 is currently from 1 April 2000 to present and the statistical values over 22-years and mean precipitation over a specific period from daily to monthly are also available.

1. Product Overview

Table 1 Summary of GNRT6 Products

No	Parameter [unit]	Coverage & Grid size	Horizontal resolution	Temporal resolution	FTP directory	Section
1	Daily Averaged Rain Rate [mm/hr]	Global (60°N-60°S) 3600 x 1200	0.1 x 0.1 degree grid box	1-day	/climate/gnrt6/daily/ YYYYMM/	See Section 2
2	3-days Averaged Rain Rate [mm/hr]			3-days	/climate/gnrt6/3days/ YYYYMM/	See Section 3
3	Pentad Averaged Rain Rate [mm/hr]			5-days	/climate/gnrt6/pentad/ YYYY/	See Section 4
4	Weekly Averaged Rain Rate [mm/hr]			7-days	/climate/gnrt6/weekly/ YYYYMM/	See Section 5
5	10-days Averaged Rain Rate [mm/hr]			10-days	/climate/gnrt6/10days/ YYYY/	See Section 6
6	Monthly Averaged Rain Rate [mm/hr]			monthly	/climate/gnrt6/monthly/ YYYY/	See Section 7
7	Daily Climatology [mm/hr]			1-day	/climate/gnrt6/climate/daily/ MMM/	See Section 8
8	3-days Climatology [mm/hr]			3-days	/climate/gnrt6/climate/3days/ SMMDD_ EMMDD/	See Section 9
9	Pentad Climatology [mm/hr]			5-days	/climate/gnrt6/climate/pentad/ SMMDD_ EMMDD/	See Section 10
10	Weekly Climatology [mm/hr]			7-days	/climate/gnrt6/climate/weekly/ SMMDD_ EMMDD/	See Section 11
11	10-days Climatology [mm/hr]			10-days	/climate/gnrt6/climate/10days/ MMM/	See Section 12
12	Monthly Climatology [mm/hr]			monthly	/climate/gnrt6/climate/monthly/ MMM/	See Section 13

Note: **YYYY**: 4-digit year, **MM**: 2-digit month, **DD**: 2-digit day, **PP**: 2-digit pentad.

Table 1 Summary of GNRT6 Products (continued)

No	Parameter [unit]	Coverage & Grid size	Horizontal resolution	Temporal resolution	FTP directory	Section
13	Percentage of Rainy Days in a month [%]	Global (60°N-60°S) 3600 x 1200	0.1 x 0.1 degree grid box	monthly	/climate/gnrt6/climo/monthly/MMM/	See Section 14
14	Percentiles of Daily Rain Rate [mm/hr]			1-day	/climate/gnrt6/climo/daily/MMM/	See Section 15
15	Percentiles of 3-days Rain Rate [mm/hr]			3-days	/climate/gnrt6/climo/3days/SMMDD_EMMDD/	See Section 16
16	Percentiles of Pentad Rain Rate [mm/hr]			5-days	/climate/gnrt6/climo/pentad/SMMDD_EMMDD/	See Section 17
17	Percentiles of Weekly Rain Rate [mm/hr]			7-days	/climate/gnrt6/climo/weekly/SMMDD_EMMDD/	See Section 18
18	Standardized Precipitation Index for 1-month	Global (60°N-60°S) 1440 x 480	0.25 x 0.25 degree grid box	1-month	/climate/gnrt6/SPI/YYYY/	See Section 19
19	Standardized Precipitation Index for 2-month			2-month		
20	Standardized Precipitation Index for 3-month			3-month		

Note: YYYY: 4-digit year, MM: 2-digit month, DD: 2-digit day, PP: 2-digit pentad.

2. Daily Averaged Rain Rate (product (1))

2.1. Basic Information

Daily averaged rain rate [mm/hr] of GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data archived period: 1 April 2000 - present
Data latency: 1 day
Temporal resolution: 24 hours average from 00Z to 23Z of the day

2.2. FTP Directory Information

Data files are archived at following directories;

Daily Average: /climate/gnrt6/daily/**YYYYMM**/

where;

YYYY: 4-digit year; and

MM: 2-digit month.

2.3. File Naming Rules

Data files are named according to the following rules;

Daily Average: gsmmap_gnrt6.**YYYYMMDD**.0.1d.daily.00Z-23Z.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

DD: 2-digit day.

2.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”. Grid of those files consists of 3600 rows x 1200 lines, which are longitude-latitude elements corresponding to a 0.1° x 0.1° grid that covers the global region from 60°N to 60°S. The center longitude and latitude of the first pixel [1, 1] (left top corner) are [0.05°E, 59.95°N] (Figure 1).

“Averaged Rain Rate” data are stored in 4-byte float plain binary format. Unit is [mm/hr]. Missing value is -999.9 and it denotes missing in observation data or no retrieval was done in microwave retrieval algorithm.

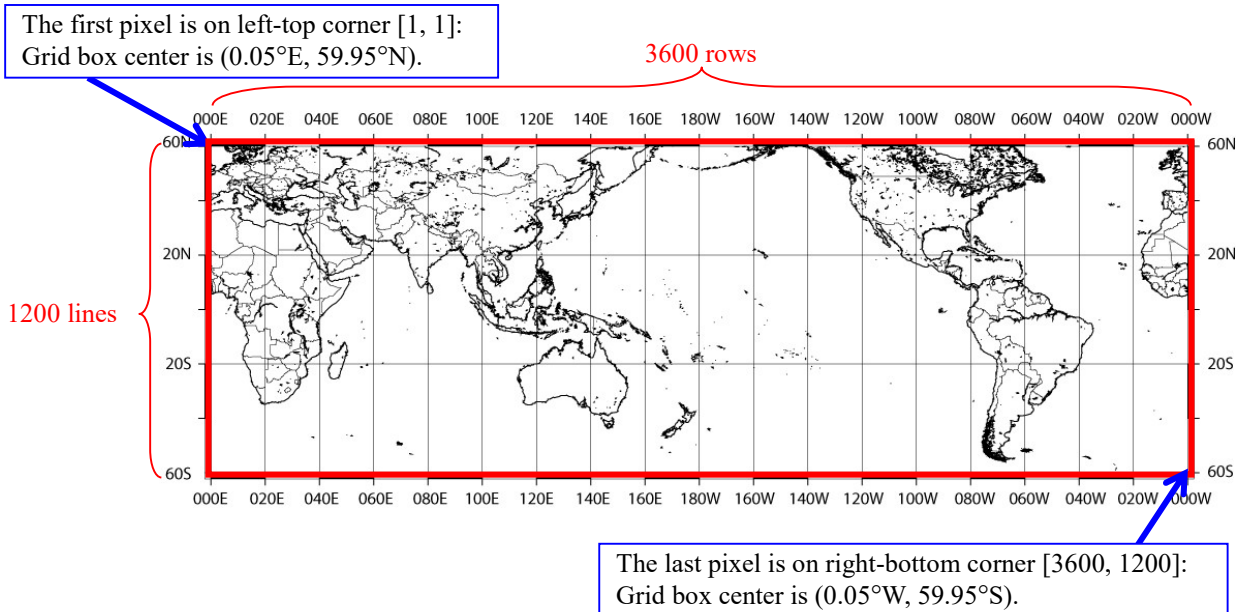


Figure 1 Data Coverage Map (Rain and Flag data)

2.5. File Size

Approximately 4 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

2.6. Sample Code

Some sample codes for Daily Averaged Rain Rate data are archived at following directory;

Daily Average: /climate/gnrt6/sample/daily/

FORTRAN and IDL sample codes to read are archived as;

FORTRAN: read_GSMaP_DLY_0.1deg.gnrt6.rain.f
IDL: read_GSMaP_DLY_0.1deg.gnrt6.rain.pro

Sample control file of the Grid Analysis and Display System (GrADS) is also archived as follows;

GrADS: GSMaP_DLY_0.1deg.gnrt6.rain.ctl

About usage of GrADS tool, please see GrADS home page (<http://cola.gmu.edu/grads/grads.php>).

3. 3-days Averaged Rain Rate in binary (product (2))

3.1. Basic Information

3-days averaged rain rate [mm/hr] of GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data archived period: April 2000 - present
Data latency: 1 day

Temporal resolution: 3 days

3.2. FTP Directory Information

Data files are archived at following directories;

3-days Average: /climate/gnrt6/3days/**YYYYMM**/

where;

YYYY: 4-digit year; and

MM: 2-digit month

3.3. File Naming Rules

Data files are named according to following rules;

3-days Average: gsmap_gnrt6.**SYYYYMMDD_EYYYYMMDD**.0.1d.3days.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

DD: 2-digit day.

3.4. Data Format

Same as Daily Averaged Rain Rate data (product (1)). See Section 2.4.

3.5. File Size

Approximately 10 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

3.6. Sample Code

Some sample codes for 3-days Averaged Rain Rate data are archived at following directory;

3-days Average: /climate/gnrt6/sample/3days/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_03D_0.1deg.gnrt6.rain.f

IDL: read_GSMaP_03D_0.1deg.gnrt6.rain.pro

GrADS: GSMaP_03D_0.1deg.gnrt6.rain.ctf

4. Pentad Averaged Rain Rate (product (3))

4.1. Basic Information

Pentad (5-days) averaged rain rate [mm/hr] of GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)

Data archived period: April 2000 - present

Data latency: pentad (73 pentads in the year)
Temporal resolution: 5 days

4.2. FTP Directory Information

Data files are archived at following directories;

Pentad Average: /climate/gnrt6/pentad/**YYYY**/

where;

YYYY: 4-digit year.

4.3. File Naming Rules

Data files are named according to the following rules;

Pentad Average: gsmmap_gnrt6.**SYYYYMMDD_EYYYYMMDD**.0.1d.pentad.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

DD: 2-digit day.

4.4. Data Format

Same as Daily Averaged Rain Rate data (product (1)). See Section 2.4.

4.5. File Size

Approximately 10 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

4.6. Sample Code

Some sample codes for Pentad Averaged Rain Rate data are archived at following directory;

Pentad Average: /climate/gnrt6/sample/pentad/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN:	read_GSMaP_PEN_0.1deg.gnrt6.rain.f
IDL:	read_GSMaP_PEN_0.1deg.gnrt6.rain.pro
GrADS:	GSMaP_PEN_0.1deg.gnrt6.rain.cti

5. Weekly Averaged Rain Rate in binary (product (4))

5.1. Basic Information

Weekly (7-days) averaged rain rate [mm/hr] of GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)

Data archived period: April 2000 - present

Data latency: 1 days

Temporal resolution: 7 days

5.2. FTP Directory Information

Data files are archived at following directories;

Weekly Average: /climate/gnrt6/weekly/**YYYYMM**/

where;

YYYY: 4-digit year; and

MM: 2-digit month

5.3. File Naming Rules

Data files are named according to following rules;

Weekly Average: gsmmap_gnrt6.**YYYYMMDD_EYYYYMMDD**.0.1d.weekly.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

DD: 2-digit day.

5.4. Data Format

Same as Daily Averaged Rain Rate data (product (1)). See Section 2.4.

5.5. File Size

Approximately 10 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

5.6. Sample Code

Some sample codes for Weekly Averaged Rain Rate data are archived at following directory;

Weekly Average: /climate/gnrt6/sample/weekly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_WLY_0.1deg.gnrt6.rain.f

IDL: read_GSMaP_WLY_0.1deg.gnrt6.rain.pro

GrADS: GSMaP_WLY_0.1deg.gnrt6.rain.ctl

6. 10-days Averaged Rain Rate (product (5))

6.1. Basic Information

Averaged rain rate at the beginning, middle and end of month [mm/hr] of GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)

Data archived period: April 2000 - present
Data latency: about 10 days (3 times per month; early, middle and late)
Temporal resolution: Basically 10 days (Early and middle resolutions are 10days. Late resolution depends on the month; 8-11 days)

6.2. FTP Directory Information

Data files are archived at following directories;

10-days Average: /climate/gnrt6/10days/**YYYY**/

where;

YYYY: 4-digit year.

6.3. File Naming Rules

Data files are named according to following rules;

10-days Average: gsmmap_gnrt6.**SYYYYMMDD_EYYYYMMDD**.0.1d.10days.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

DD: 2-digit day.

6.4. Data Format

Same as Daily Averaged Rain Rate data (product (1)). See Section 2.4.

6.5. File Size

Approximately 12 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

6.6. Sample Code

Some sample codes for 10-days Averaged Rain Rate data are archived at following directory;

10-days Average: /climate/gnrt6/sample/10days/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_10D_0.1deg.gnrt6.rain.f
IDL: read_GSMaP_10D_0.1deg.gnrt6.rain.pro
GrADS: GSMaP_10D_0.1deg.gnrt6.rain.ctf

7. Monthly Averaged Rain Rate (product (6))

7.1. Basic Information

Monthly averaged rain rate [mm/hr] and numbers of valid pixel (≥ 0 mm) per month for GNRT6.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)
Data archived period: April 2000 - present
Data latency: monthly
Temporal resolution: monthly

7.2. FTP Directory Information

Data files are archived at following directories;

Monthly Averaged: /climate/gnrt6/monthly/**YYYY**/

where;

YYYY: 4-digit year.

7.3. File Naming Rules

Data files are named according to following rules;

Monthly Averaged: gsmmap_gnrt6.**YYYYMM**.0.1d.monthly.dat

where;

YYYY: 4-digit year; and

MM: 2-digit month.

7.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”. In each monthly file, there are two global fields: monthly averaged rain rate; and numbers of valid pixel (≥ 0 mm) per month. The former unit is [mm/hr] and the missing value is -999.9. Multiplying of both layers gives the monthly total precipitation [mm/month].

Grid in each field consists of 3600 rows x 1200 lines, which are longitude-latitude elements corresponding to a $0.1^\circ \times 0.1^\circ$ grid that covers the global region from 60°N to 60°S . The center longitude and latitude of the first pixel [1, 1] (left top corner) is [0.05°E , 59.95°N].

** Please note that the calculations for monthly products take into account not only quality of an hourly rain rate but also a ratio of missing values per month.*

7.5. File Size

Approximately 13 Mbyte (with gzip), and 34 Mbyte (uncompressed) for each file.

7.6. Sample Code

Some sample codes for Monthly Averaged Rain Rate data are archived at following directory;

Monthly Averaged: /climate/gnrt6/sample/monthly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_MON_0.1deg.gnrt6.rain.f

IDL: read_GSMaP_MON_0.1deg.gnrt6.rain.pro
GrADS: GSMaP_MON_0.1deg.gnrt6.rain.cti

8. Daily Climatology (product (7))

8.1. Basic Information

Daily climatology of Daily Averaged Rain Rate data (product (1)) is defined as the summation of the first 6 harmonics that raw 22-mean daily rainfall is decomposed the raw time series through harmonic analysis. This product will be updated once a year. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: 24 hours average from 00Z to 23Z of the day
Statistical period: April 2000 – March 2022

8.2. FTP Directory Information

Data files are archived at following directories;

Daily Climatology: /climate/gnrt6/climo/daily/MMM/

where;

MM: 2-digit month.

8.3. File Naming Rules

Data files are named according to following rules;

Daily Climatology: gsmap_gnrt6.**MMDD**.0.1d.daily.00Z-23Z.clim.dat

where;

MM: 2-digit month; and

DD: 2-digit day.

8.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”. Unit is [mm/hr]. Missing value is -999.9.

Grid of those files consists of 3600 rows x 1200 lines, which are longitude-latitude elements corresponding to a 0.1° x 0.1° grid that covers the global region from 60°N to 60°S. The center longitude and latitude of the first pixel [1, 1] (left top corner) is [0.05°E, 59.95°N] (Figure 1).

8.5. File Size

Approximately 14 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

8.6. Sample Code

Some sample codes for Daily Climatology data are archived at following directory;

Daily Climatology: /climate/gnrt6/sample/daily/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_DLY_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_DLY_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_DLY_0.1deg.gnrt6.clim.ctl

9. 3-days Climatology (product (8))

9.1. Basic Information

About two-decade average [mm/hr] of 3-days Averaged Rain Rate data (product (2)). It was calculated using data of eleven 3-days, namely including 15 days before and after the target 3-days. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: 3 days
Statistical period: April 2000 – March 2022

9.2. FTP Directory Information

Data files are archived at following directories;

3-days Climatology: /climate/gnrt6/climo/3days/SMMDD_EMMDD/

where;

MM: 2-digit month; and

DD: 2-digit day.

9.3. File Naming Rules

Data files are named according to following rules;

3-days Climatology: gsmmap_gnrt6.SMMDD_EMMDD.0.1d.3days.clim.dat

where;

MM: 2-digit month; and

DD: 2-digit day.

9.4. Data Format

Same as Daily Climatology data (product (7)). See Section 8.4.

9.5. File Size

Approximately 14 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

9.6. Sample Code

Some sample codes for 3-days Climatology data are archived at following directory;

3-days Climatology: /climate/gnrt6/sample/3days/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_03D_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_03D_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_03D_0.1deg.gnrt6.clim.ctl

10. Pentad Climatology (product (9))

10.1. Basic Information

About two-decade average [mm/hr] of Pentad Averaged Rain Rate data (product (3)). It was calculated using data of 7 pentads, namely including 3 pentads before and after the target pentad. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: 5 days
Statistical period: April 2000 – March 2022

10.2. FTP Directory Information

Data files are archived at following directories;

Pentad Climatology: /climate/gnrt6/climo/pentad/**SMMDD_EMMDD**/

where;

MM: 2-digit month; and
DD: 2-digit day.

10.3. File Naming Rules

Data files are named according to following rules;

Pentad Climatology: gsmmap_gnrt6.**SMMDD_EMMDD**.0.1d.pentad.clim.dat

where;

MM: 2-digit month; and
DD: 2-digit day.

10.4. Data Format

Same as Daily Climatology data (product (7)). See Section 8.4.

10.5. File Size

Approximately 14 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

10.6. Sample Code

Some sample codes for Pentad Climatology data are archived at following directory;

Pentad Climatology: /climate/gnrt6/sample/pentad/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_PEN_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_PEN_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_PEN_0.1deg.gnrt6.clim.ctl

11. Weekly Climatology (product (10))

11.1. Basic Information

About two-decade average [mm/hr] of Weekly Averaged Rain Rate data (product (4)). It was calculated using data of 5 weeks, namely including 2 weeks before and after the target week. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: 7 days
Statistical period: April 2000 – March 2022

11.2. FTP Directory Information

Data files are archived at following directories;

Weekly Climatology: /climate/gnrt6/climo/weekly/**SMMDD_EMMDD**/

where;

MM: 2-digit month; and

DD: 2-digit day.

11.3. File Naming Rules

Data files are named according to following rules;

Weekly Climatology: gsmap_gnrt6.**SMMDD_EMMDD**.0.1d.weekly.clim.dat

where;

MM: 2-digit month; and

DD: 2-digit day.

11.4. Data Format

Same as Daily Climatology data (product (7)). See Section 8.4.

11.5. File Size

Approximately 14 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

11.6. Sample Code

Some sample codes for Weekly Climatology data are archived at following directory;

Weekly Climatology: /climate/gnrt6/sample/weekly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_WLY_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_WLY_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_WLY_0.1deg.gnrt6.clim.ctl

12. 10-days Climatology (product (11))

12.1. Basic Information

About two-decade average [mm/hr] of 10-days Averaged Rain Rate data (product (5)). It was calculated using data in a month, namely including two periods before and after the target 10-days. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: Basically 10 days (Early and middle resolutions are 10days. Late resolution depends on the month; from 8-days to 11-days)
Statistical period: April 2000 – March 2022

12.2. FTP Directory Information

Data files are archived at following directories;

10-days Climatology: /climate/gnrt6/climo/10days/MMM/

where;

MM: 2-digit month.

12.3. File Naming Rules

Data files are named according to following rules;

10-days Climatology: gsmmap_gnrt6.**MMM.BME**.0.1d.10days.clim.dat

where;

MM: 2-digit month; and

BME: 3-words (bgn: beginning, mid: middle, end: late of the month).

12.4. Data Format

Same as Daily Climatology data (product (7)). See Section 8.4.

12.5. File Size

Approximately 14 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

12.6. Sample Code

Some sample codes for 10-days Climatology data are archived at following directory;

10-days Climatology: /climate/gnrt6/sample/10days/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_10D_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_10D_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_10D_0.1deg.gnrt6.clim.ctl

13. Monthly Climatology (product (12))

13.1. Basic Information

About two-decade average [mm/hr] in the target month for Monthly Averaged Rain Rate data (product (6)).

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: monthly
Statistical period: April 2000 – March 2022

13.2. FTP Directory Information

Data files are archived at following directories;

Monthly Climatology: /climate/gnrt6/climo/monthly/MMM/

where;

MM: 2-digit month.

13.3. File Naming Rules

Data files are named according to following rules;

Monthly Climatology: gsmmap_gnrt6.MMM.0.1d.monthly.clim.dat

where;

MM: 2-digit month.

13.4. Data Format

Same as Daily Climatology data (product (7)). See Section 8.4.

13.5. File Size

Approximately 15 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

13.6. Sample Code

Some sample codes for Monthly Climatology data are archived at following directory;

Monthly Climatology: /climate/gnrt6/sample/monthly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_MON_0.1deg.gnrt6.clim.f
IDL: read_GSMaP_MON_0.1deg.gnrt6.clim.pro
GrADS: GSMaP_MON_0.1deg.gnrt6.clim.ctl

14. Percentage of Rainy Days in a month (product (13))

14.1. Basic Information

Percentage of rainy days (≥ 1 mm/day) in a month [%] calculated from Daily Averaged Rain Rate data (product (1)).

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N-60°S)
Data latency: once a year
Temporal resolution: monthly
Statistical period: April 2000 – March 2022

14.2. FTP Directory Information

Data files are archived at following directories;

Percentage of Rainy Days: /climate/gnrt6/climo/monthly/**MMM**/

where;

MM: 2-digit month.

14.3. File Naming Rules

Data files are named according to following rules;

Percentage of Rainy Days: gsmap_gnrt6.**MMM**.0.1d.monthly.rpct.dat

where;

MM: 2-digit month.

14.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”. Unit is [%]. Grid of those files consists of 3600 rows x 1200 lines, which are longitude-latitude elements

corresponding to a $0.1^\circ \times 0.1^\circ$ grid that covers the global region from 60°N to 60°S . The center longitude and latitude of the first pixel [1, 1] (left top corner) is [0.05°E , 59.95°N] (Figure 1).

14.5. File Size

Approximately 4 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

14.6. Sample Code

Some sample codes for Percentage of Rainy Days data are archived at following directory;

Percentage of Rainy Days: /`climate/gnrt6/sample/monthly/`

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: `read_GSMaP_MON_0.1deg.gnrt6.rpct.f`
IDL: `read_GSMaP_MON_0.1deg.gnrt6.rpct.pro`
GrADS: `GSMaP_MON_0.1deg.gnrt6.rpct.ctl`

15. Percentiles of Daily Rain Rate (product (14))

15.1. Basic Information

Percentiles [mm/hr] above the 90th percentile calculated from Daily Averaged Rain Rate data (product (1)). Percentile curve constructed using data over a 3×3 grid boxes of the same surface type (land/ocean) domain centering at the target grid box in the target month. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).
Domain: Global (60°N - 60°S)
Data latency: once a year
Temporal resolution: 1 day
Statistical period: April 2000 – March 2022
Maximum number of samples on each grid: 6,138 (31-days x 22-yr x 9-grids)

15.2. FTP Directory Information

Data files are archived at following directories;

Percentiles of Daily Rainfall: /`climate/gnrt6/climo/daily/MMM/`

where;

MM: 2-digit month.

15.3. File Naming Rules

Data files are named according to following rules;

Percentiles of Daily Rainfall: `gsmap_gnrt6.MMM.0.1d.daily.00Z-23Z.pctXX.dat`

where;

MM: 2-digit month; and

XX: 2-digit number (90-99).

15.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”. Unit is [mm/hr]. Missing value is -999.9.

Grid of those files consists of 3600 rows x 1200 lines, which are longitude-latitude elements corresponding to a 0.1° x 0.1° grid that covers the global region from 60°N to 60°S. The center longitude and latitude of the first pixel [1, 1] (left top corner) is [0.05°E, 59.95°N] (Figure 1).

15.5. File Size

Approximately 13 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

15.6. Sample Code

Some sample codes for Daily Percentiles data are archived at following directory;

Percentiles of Daily Rainfall: /climate/gnrt6/sample/daily/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN:	read_GSMaP_DLY_0.1deg.gnrt6.pct.f
IDL:	read_GSMaP_DLY_0.1deg.gnrt6.pct.pro
GrADS:	GSMaP_DLY_0.1deg.gnrt6.pct.ctl

16. Percentiles of 3-days Rain Rate (product (15))

16.1. Basic Information

Percentiles [mm/hr] above the 90th percentile calculated from 3-days Averaged Rain Rate data (product (2)). Percentile curve constructed using data over a 3x3 grid boxes of the same surface type (land/ocean) domain centering at the target grid box in the target month. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution:	0.1 degrees latitude/longitude grid (10km at the equator).
Domain:	Global (60°N-60°S)
Data latency:	once a year
Temporal resolution:	3 days
Statistical period:	April 2000 – March 2022
Maximum number of samples on each grid:	2,178 (11-3days x 22-yr x 9-grids)

16.2. FTP Directory Information

Data files are archived at following directories;

Percentiles of 3-days Rainfall: /climate/gnrt6/climo/3days/SMMDD_EMMDD/

where;

MM: 2-digit month; and

DD: 2-digit day.

16.3. File Naming Rules

Data files are named according to following rules;

Percentiles of 3-days Rainfall: `gsmmap_gnrt6.SMMDD_EMMDD.0.1d.3days.pctXX.dat`

where;

MM: 2-digit month;

DD: 2-digit day; and

XX: 2-digit number (90-99).

16.4. Data Format

Same as Percentiles of Daily Rain Rate data (product (14)). See Section 15.4.

16.5. File Size

Approximately 13 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

16.6. Sample Code

Some sample codes for 3-days Percentiles data are archived at following directory;

Percentiles of 3-days Rainfall: `/climate/gnrt6/sample/3days/`

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: `read_GSMaP_03D_0.1deg.gnrt6.pct.f`

IDL: `read_GSMaP_03D_0.1deg.gnrt6.pct.pro`

GrADS: `GSMaP_03D_0.1deg.gnrt6.pct.ctl`

17. Percentiles of Pentad Rain Rate (product (16))

17.1. Basic Information

Percentiles [mm/hr] above the 90th percentile calculated from Pentad Averaged Rain Rate data (product (3)). Percentile curve constructed using data over a 3x3 grid boxes of the same surface type (land/ocean) domain centering at the target grid box in the target month. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)

Data latency: once a year

Temporal resolution: 5 days

Statistical period: April 2000 – March 2022

Maximum number of samples on each grid: 1,386 (7-pentad x 22-yr x 9-grids)

17.2. FTP Directory Information

Data files are archived at following directories;

Percentiles of Pentad Rainfall: /climate/gnrt6/climo/pentad/SMMDD_EMMDD/

where;

MM: 2-digit month; and

DD: 2-digit day.

17.3. File Naming Rules

Data files are named according to following rules;

Percentiles of Pentad Rainfall: gsmmap_gnrt6.SMMDD_EMMDD.0.1d.pentad.pctXX.dat

where;

MM: 2-digit month;

DD: 2-digit day; and

XX: 2-digit number (90-99).

17.4. Data Format

Same as Percentiles of Daily Rain Rate (product (14)). See Section 15.4.

17.5. File Size

Approximately 13 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

17.6. Sample Code

Some sample codes for Pentad Percentiles data are archived at following directory;

Percentiles of Pentad Rainfall: /climate/gnrt6/sample/pentad/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_PEN_0.1deg.gnrt6.pct.f

IDL: read_GSMaP_PEN_0.1deg.gnrt6.pct.pro

GrADS: GSMaP_PEN_0.1deg.gnrt6.pct.ctl

18. Percentiles of Weekly Rain Rate (product (17))

18.1. Basic Information

Percentiles [mm/hr] above the 90th percentile calculated from Weekly Averaged Rain Rate data (product (4)). Percentile curve constructed using data over a 3x3 grid boxes of the same surface type (land/ocean) domain centering at the target grid box in the target month. Noted that a grid of less than 0.1 mm/day is dealt with as 0 mm/day.

Grid resolution: 0.1 degrees latitude/longitude grid (10km at the equator).

Domain: Global (60°N-60°S)

Data latency: once a year

Temporal resolution: 7 days

Statistical period: April 2000 – March 2022

Maximum number of samples on each grid: 990 (5-weeks x 22-yr x 9-grids)

18.2. FTP Directory Information

Data files are archived at following directories;

Percentiles of Weekly Rainfall: /climate/gnrt6/climo/weekly/**SMMDD_EMMDD**/

where;

MM: 2-digit month; and

DD: 2-digit day.

18.3. File Naming Rules

Data files are named according to following rules;

Percentiles of Weekly Rainfall: gsmap_gnrt6.**SMMDD_EMMDD**.0.1d.weekly.pct**XX**.dat

where;

MM: 2-digit month;

DD: 2-digit day; and

XX: 2-digit number (90-99).

18.4. Data Format

Same as Percentiles of Daily Rain Rate data (product (14)). See Section 15.4.

18.5. File Size

Approximately 13 Mbyte (with gzip), and 17 Mbyte (uncompressed) for each file.

18.6. Sample Code

Some sample codes for Weekly Percentiles data are archived at following directory;

Percentiles of Weekly Rainfall: /climate/gnrt6/sample/weekly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN: read_GSMaP_WLY_0.1deg.gnrt6.pct.f

IDL: read_GSMaP_WLY_0.1deg.gnrt6.pct.pro

GrADS: GSMaP_WLY_0.1deg.gnrt6.pct.ctl

19. Standardized Precipitation Index in 0.25-deg (products (18)-(20))

19.1. Basic Information

Standardized Precipitation Index (SPI) is a drought index that is able to calculate using only precipitation. The larger the negative value, the stronger the drought tendency.

Grid resolution: 0.25 degrees latitude/longitude grid (25km at the equator).

Domain:	Global (60°N-60°S)
Data latency:	monthly
Temporal resolution:	1-month (target month) 2-month (two months from the previous month of the target month) 3-month (three months from the two months before the target month)
Statistical period:	April 2000 – March 2022 (Before March 2020) April 2000 – target month (After April 2022)
Drought classification:	-1.2 \leq SPI < -0.8 ; Moderate Drought -1.5 \leq SPI < -1.2 ; Severe Drought -2.0 \leq SPI < -1.5 ; Extreme Drought SPI < -2.0 ; Exceptional Drought

19.2. FTP Directory Information

Data files are archived at following directories;

SPI: /climate/gnrt6/SPI/**YYYY**/

where;

YYYY: 4-digit year.

19.3. File Naming Rules

Data files are named according to following rules;

SPI: gsmmap_gnrt6.**YYYYMM**.0.25d.monthly.spi0**X**.dat

where;

YYYY: 4-digit year;

MM: 2-digit month; and

X: 1-digit number (1-3).

19.4. Data Format

All binary files are produced in little-endian byte order platform, and archived with compressed using “gzip”.
Missing value is -999.0.

Grid of those files consists of 1440 rows x 480 lines, which are longitude-latitude elements corresponding to a 0.25° x 0.25° grid that covers the global region from 60°N to 60°S. The center longitude and latitude of the first pixel [1, 1] (left top corner) is [0.125°E, 59.875°N].

19.5. File Size

Approximately 700 Kbyte (with gzip), and 2 Mbyte (uncompressed) for each file.

19.6. Sample Code

Some sample codes for SPI are archived at following directory;

SPI: /climate/gnrt6/sample/monthly/

FORTRAN, IDL and GrADS sample codes to read are archived as;

FORTRAN:	read_GSMaP_MON_0.25deg.gnrt6.spi.f
IDL:	read_GSMaP_MON_0.25deg.gnrt6.spi.pro
GrADS:	GSMaP_MON_0.25deg.gnrt6.spi.ctf

20. Algorithm and references

20.1. Algorithm

Details of the latest GSMaP algorithm are described in following documents and references in Section 20.2.

- Global Satellite Mapping of Precipitation (GSMaP) for GPM: Algorithm Theoretical Basis Document (ATBD)” (https://sharaku.eorc.jaxa.jp/GSMaP/faq/GSMaP_faq15.html).

20.2. References

Please refer the following paper:

- Kubota, T., K. Aonashi, T. Ushio, S. Shige, Y. N. Takayabu, M. Kachi, Y. Arai, T. Tashima, T. Masaki, N. Kawamoto, T. Mega, M. K. Yamamoto, A. Hamada, M. Yamaji, G. Liu and R. Oki 2020: Global Satellite Mapping of Precipitation (GSMaP) products in the GPM era, Satellite precipitation measurement, Springer.

(Major papers related to GSMaP algorithms)

- Kubota, T., S. Shige, H. Hashizume, K. Aonashi, N. Takahashi, S. Seto, M. Hirose, Y. N. Takayabu, K. Nakagawa, K. Iwanami, T. Ushio, M. Kachi, and K. Okamoto, 2007: Global Precipitation Map using Satelliteborne Microwave Radiometers by the GSMaP Project : Production and Validation, *IEEE Trans. Geosci. Remote Sens.*, **45**, No. 7, 2259-2275, <https://doi.org/10.1109/TGRS.2007.895337>.
- Aonashi, K., J. Awaka, M. Hirose, T. Kozu, T. Kubota, G. Liu, S. Shige, S., Kida, S. Seto, N. Takahashi, and Y. N. Takayabu, 2009: GSMaP passive, microwave precipitation retrieval algorithm: Algorithm description and validation. *J. Meteor. Soc. Japan*, **87A**, 119-136, <https://doi.org/10.2151/jmsj.87A.119>.
- T. Ushio, T. Kubota, S. Shige, K. Okamoto, K. Aonashi, T. Inoue, N., Takahashi, T. Iguchi, M. Kachi, R. Oki, T. Morimoto, and Z. Kawasaki, 2009: A Kalman filter approach to the Global Satellite Mapping of Precipitation (GSMaP) from combined passive microwave and infrared radiometric data. *J. Meteor. Soc. Japan*, **87A**, 137-151, <https://doi.org/10.2151/jmsj.87A.137>.
- Mega, T., T. Ushio, M. T. Matsuda, T. Kubota, M. Kachi, and R. Oki, 2019: Gauge-adjusted global satellite mapping of precipitation. *IEEE Trans. Geosci. Remote Sens.*, **57.4**, 1928-1935, <https://doi.org/10.1109/TGRS.2018.2870199>.

(Major papers related to heavy rainfall and drought monitoring using the GSMaP products)

- T. Tashima, T. Kubota, T. Mega, and T. Ushio, and R. Oki, 2020: Precipitation extremes monitoring using the near-real-time GSMaP product, *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens.* <https://doi.org/10.1109/JSTARS.2020.3014881>.

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22. Contact

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