

GSMaP Product Format

Version 2.0

January 17th, 2017

Japan Aerospace Exploration Agency

Revision history

revision	date	section	content, reason
Version 1.0	Sept. 2 nd 2014	ALL	New
Version 2.0	Jan. 17 th 2017	P.4, P.19	Added the following items to meta data group. - DOIauthority - DOIshortName Modify the explanation of "Filename".
		P.3, P.8, P.10, P.23, P.24	Added the following items to Grid data group. - Latitude - Longitude - SnowProbability
		P.8~P.11, P.23~P.24	Modify the table format of variables in Grid data group.
		P.9	Remove the explanation of negative value in satelliteInfoFlag.
		P.25~P.27	Added the List of Elements of Data Group.

Reference

- (1) PRECIPITATION PROCESSING SYSTEM GLOBAL PRECIPITATION MEASUREMENT "File Specification for GPM Products"
- (2) PRECIPITATION PROCESSING SYSTEM GLOBAL PRECIPITATION MEASUREMENT "Metadata for GPM Products"

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1. 3GSMAPH – GSMaP Hourly (HDF)

1.1. Data Format Structure

1.1.1. Dimension definition

Dimension definitions:

- nlat
 - 1800 Number of 0.1 degree intervals of latitude from 90 degree S (-90 degrees) to 90 degree N (+90 degrees).
- nlon
 - 3600 Number of 0.1 degree intervals of longitude from 180 degree W (-180 degrees) to 180 degree E (+180 degrees).

1.1.2. Data Format Structure for 3GSMAPH – GSMaP Hourly (HDF)

3GSMAPH, "GSMaP Hourly", provides precipitation estimates at 0.1 degrees by the Global Satellite Mapping of Precipitation (GSMaP). GSMaP provides high-precision, high-resolution global precipitation maps using satellite data. The PI is JAXA. The granule size is 1 hour. The following sections describe the structure and contents of the format.

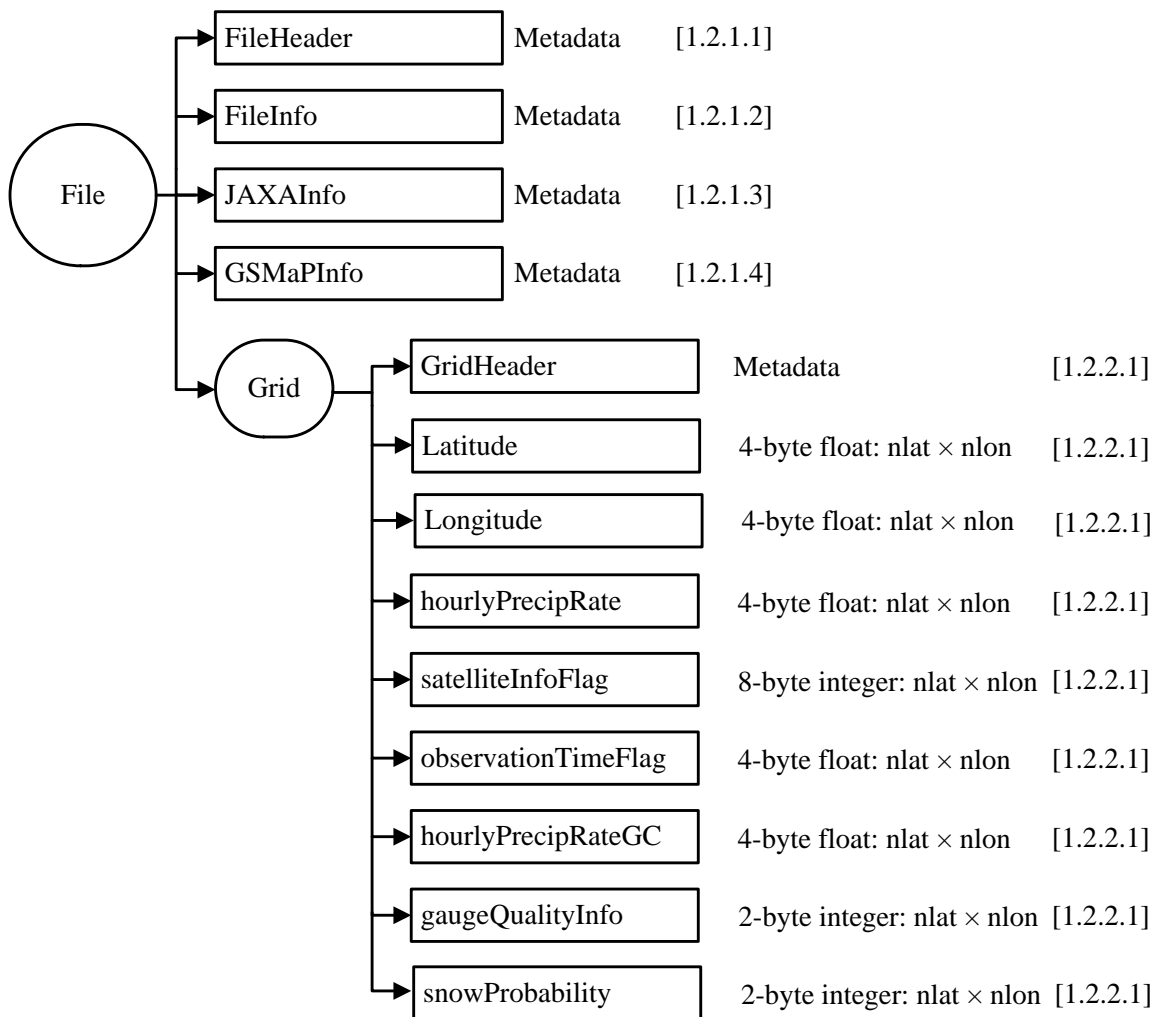


Figure 1.1-1 Data Format Structure for 3GSMAPH – GSMaP Hourly

1.2. Contents of objects

1.2.1. Metadata

1.2.1.1 FileHeader

FileHeader contains metadata of general interest. Table 1.2-1 shows each metadata elements in FileHeader.

Table 1.2-1 FileHeader Group

Metadata Element	Estimated Size (bytes)	Description
DOI	256	Digital Object Identifier *Value is blank currently.
DOIauthority	256	Digital Object Identifier Authority
DOIshortName	256	Digital Object Identifier Short Name *Value is blank currently.
AlgorithmID	50	The algorithm that generated this product, e.g., 3GSMAPH.
AlgorithmVersion	50	The version of the algorithm that generated this product.
FileName	50	The file name of this granule.
SatelliteName	10	Values are: TRMM GPM MULTI F10 ... F18 AQUA GCOMW CORIOLIS MT1 NOAA15 ... NOAA19 METOPA NPP, etc. In case of using multiple satellites, value is MULTI.
InstrumentName	10	Values are: PR TMI VIRS PRTMI KU KA DPR GMI DPRGMI MERGED SSMI SSMIS AMSRE AMSR2 WIND-SAT MADRAS AMSUA AMSUB SAPHIR MHS ATMS, etc. In case of using multiple sensors, value is MERGED.
GenerationDateTime	50	The date and time this granule was generated. The format is YYYY-MM-DDTHH:MM:SS.sssZ, where YYYY is 4-digit year, MM is month number, DD is day of month, T is "T", HH is hour, MM is minute, SS is second, sss is millisecond, and Z is "Z". All fields are zero-filled. The missing value is constructed by replacing all digits with 9, i.e., 9999-99-99T99:99:99.999Z.
StartGranuleDateTime	50	The start time defining this granule. The format is the same as GenerationDateTime. For example, in case of 1st September 2014 and 00UTC, value would be 2014-09-01T00:00:00.000Z.
StopGranuleDateTime	50	The stop time defining this granule. The format is the same as GenerationDateTime. For example, in case of 1st September 2014 and 00UTC, value would be 2014-09-01T00:59:59.999Z.
GranuleNumber	50	The number of this granule. *Value is blank.
NumberOfSwaths	50	The number of swaths in this granule. *Value is "0".
NumberOfGrids	50	The number of grid structures in this granule. *Value is "1".

1.2. Contents of objects

1.2.1. Metadata

Metadata Element	Estimated Size (bytes)	Description
GranuleStart	50	The starting place in the orbit of this granule.
TimeInterval	50	The time interval covered by this granule. Values is "HOUR".
ProcessingSystem	50	The name of the processing system, e.g., "PPS", "JAXA".
ProductVersion	50	The data version assigned by the processing system.
EmptyGranule	50	Whether a granule is empty. Values are "EMPTY" or "NOT EMPTY".
MissingData	50	The number of missing scans. *Value is blank.

1.2.1.2 FileInfo

FileInfo contains metadata used by the PPS I/O Toolkit. Table 1.2-2 shows each metadata elements in FileInfo.

Table 1.2-2 FileInfo Group

Metadata Element	Estimated Size (bytes)	Description
DataFormatVersion	50	The version of the data format used to write this file. This version is separate for each AlgorithmID. The order is: "a" "b" ... "z" "aa" "ab" ... "az" "ba" "bb" ...
TKCodeBuildVersion	50	Usually TKCodeBuildVersion is "1". If the I/O routines built by TKIO change even though the DataFormatVersion is unchanged, then TK CodeBuildVersion increments to "2", "3", ... If subsequently DataFormatVersion changes, TKCodeBuildVersion becomes "1" again.
MetadataVersion	50	The version of metadata used to write this file. This version is separate for each AlgorithmID. The order is: "a" "b" ... "z" "aa" "ab" ... "az" "ba" "bb" ...
FormatPackage	50	The underlying format of this granule. Values are "HDF4", "HDF5", "NETCDF", "TKBINARY".
BlueprintFilename	50	The filename of the primary blueprint file that defined the format used to write this file.
BlueprintVersion	10	The BlueprintVersion of the format definition
TKIOVersion	50	The version of TKIO used to create I/O routines to write this file. TKIOVersion does not define the format used to write this file.
MetadataStyle	50	The style in which the metadata was written, e.g., "PVL". "PVL" means < parameter >=< value >;
EndianType	50	The endian type. Value is "BIG ENDIAN" or "LITTLE ENDIAN". *Value is LITTLE_ENDIAN.

1.2.1.3 JAXAInfo

JAXAInfo contains metadata requested by JAXA.Used by DPR algorithms and GSMaP. Table 1.2-3 shows each metadata elements in JAXAInfo.

Table 1.2-3 JAXAInfo Group

Metadata Element	Estimated Size (bytes)	Description
GranuleFirstScanUTCDate Time	50	Granule First Scan UTC Date. Date is a 24 character string. The format is YYYY-MM-DDTHH:MM:SS.sssZ, where YYYY is 4-digit year, MM is month number, DD is day of month, T is "T", HH is hour, MM is minute, SS is second, sss is millisecond, and Z is "Z". All fields are zero-filled. The missing value is constructed by replacing all digits with 9, i.e., 9999-99-99T99:99:99.999Z. *Value is blank.
GranuleLastScanUTCDate Time	50	Granule Last Scan UTC Date. Date is a 24 character string. The format is the same as GranuleFirstScanUTCDate Time. *Value is blank.
TotalQualityCode	50	Total quality of the GPM products. In case of NRT, if there exists IR radiometer data at a target time, value would be "good". In other cases, value would be "Fair". In case of STD, there doesn't exist satellite observation information at a target time, value would be "poor", there doesn't exist IR radiometer data at a target time, value would be "Fair", and value would be "good" in other cases. e.g., "Good", "Fair", "Poor".
FirstScanLat	50	Latitude of orbit first scan. *Value is blank.
FirstScanLon	50	Longitude of orbit first scan. *Value is blank.
LastScanLat	50	Latitude of orbit last scan. *Value is blank.
LastScanLon	50	Longitude of orbit last scan. *Value is blank.
NumberOfRainPixelsNS	50	Number of rain pixels in the NS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
NumberOfRainPixelsMS	50	Number of rain pixels in the MS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
NumberOfRainPixelsHS	50	Number of rain pixels in the HS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
ProcessingSubSystem	50	The name of the processing sub-system, e.g., "ALGORITHM", "PCS".

Metadata Element	Estimated Size (bytes)	Description
ProcessingMode	50	The name of the processing mode, e.g., "STD","NRT".

1.2.1.4 GSMAPIInfo

GSMAPIInfo contains metadata required by GSMAPI. This group appears in GSMAPI products only. Table 1.2-4 shows each metadata elements in GSMAPIInfo.

Table 1.2-4 GSMAPIInfo Elements

Metadata Element	Estimated Size (bytes)	Description
AlgorithmName	100	Algorithm name of GSMAPI module.
CoverageRatio	100	Ratio of effective (non-missing) pixel number within rainfall retrieval area (60S-60N at present) in percentage.
InputMWSFileNumber	100	Number of satellites with passive microwave instruments used in the file.
InputIRFileNumber	100	Number of data of IR radiometer used for calculation of precipitation.
InputAncillaryFileNumber	100	Existence of correction by rain gauge. In case of value being "1", the correction was applied. In case of value being "0", the correction was not applied.

1.2.2. Data Group

Elements of data group are explained in detail in this section.

1.2.2.1 Grid(Group)

(1) GridHeader (Metadata)

GridHeader contains metadata defining the grids in the grid structure.

Table 1.2-5 GridHeader Elements

Metadata Element	Estimated Size (bytes)	Description
BinMethod	50	Method used to obtain the value in each grid box. The only defined value is "ARITHMEAN". *Value is ARITHMETIC_MEAN
Registration	50	Representative location within the grid box. The only defined value is "CENTER".
LatitudeResolution	50	North-south size of a bin (degrees latitude).
LongitudeResolution	50	East-west size of a bin (degrees longitude).
NorthBoundingCoordinate	50	Northern-most latitude (degrees) covered by the grid.
SouthBoundingCoordinate	50	Southern-most latitude (degrees) covered by the grid.
EastBoundingCoordinate	50	Eastern-most longitude (degrees) covered by the grid.

Metadata Element	Estimated Size (bytes)	Description
WestBoundingCoordinate	50	Western-most longitude (degrees) covered by the grid.
Origin	50	Origin of the grid indices, e.g., "SOUTHWEST".

(2) Latitude

Type	Array	Unit
4-byte float	nlat x nlon	degrees

The earth latitude of the center of the grid in 0.1 degree interval. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:
Missing Value : -9999.9.

(3) Longitude

Type	Array	Unit
4-byte float	nlat x nlon	degrees

The earth longitude of the center of the grid in 0.1 degree interval. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:
Missing Value : -9999.9.

(4) hourlyPrecipRate

Type	Array ¹⁾	Unit
4-byte float	nlat x nlon	mm/hr

hourlyPrecipRate indicates hourly precipitation rate at each pixel. Unit is [mm/hr]. Negative value denotes missing in observation data or no precipitation rate was retrieved within microwave algorithms. Detailed description for missing data is shown below. Value Description (0.0 or positive) Hourly precipitation rate [mm/hr].

- 4 Missing due to sea ice within microwave algorithms.
- 8 Missing due to low temperature within microwave algorithms.
- 9999.9 Missing due to no observation by IR and/or microwave sensor.

1): The order of array is the followings: latitude defines from 90S to 90N in the range of 0.1 degree and longitude defines from 180W to 180E in the range of 0.1 degree. At present, the data exists in the range of from 60S to 60N of latitude only. Value of the other area has missing value.

(5) satelliteInfoFlag

Type	Array	Unit
8-byte integer	nlat x nlon	

satelliteInfoFlag indicates the information of all satellite/sensor which are used in estimation of precipitation rate at each pixel during one-hour time period. Data are stored in signed

8-byte integer (64-bit). Satellite and sensor name are assigned to each bit. If the flag shows value of 0, there is no satellite observation by both microwave and geo-stationary IR sensor. Missing value is defined as -99.

<u>Value</u>	<u>Bit Sensor Category</u>	<u>Satellite/Sensor</u>
1	0 Infrared Imager aboard Geo-stationary meteorological satellite	NOAA/CPC Globally Merged IR data
2	1 Microwave radiometer(imager) aboard low orbital satellite	TRMM/TMI
4	2	GPM-Core/GMI
8	3	Megha-Tropiques/MADRAS
16	4	Megha-Tropiques/SAPHIR
32	5	ADEOS-II/AMSR
64	6	Aqua/AMSR-E
128	7	GCOM-W1/AMSR2
256	8	GCOM-W2/AMSR2 f/o (TBD)
512	9	GCOM-W3/AMSR2 f/o (TBD)
1024	10	DMSP-F11/SSM/I
2048	11	DMSP-F13/SSM/I
4096	12	DMSP-F14/SSM/I
8192	13	DMSP-F15/SSM/I
16384	14	DMSP-F16/SSM/I
32768	15	DMSP-F17/SSM/I
65536	16	DMSP-F18/SSM/I
131072	17	DMSP-F19/SSM/I
262144	18	DMSP-F20/SSM/I
524288	19	NOAA-15/AMSU-A/B
1048576	20	NOAA-16/AMSU-A/B
2097152	21	NOAA-17/AMSU-A/B
4194304	22	NOAA-18/AMSU-A/B
8388608	23	NOAA-19/AMSU-A/B
16777216	24	NPP/ATMS
33554432	25	JPSS-1/ATMS
67108864	26	MetOp-A/AMSU-A/MHS
134217728	27	MetOp-B/AMSU-A/MHS
268435456	28	MetOp-C/AMSU-A/MHS
	29-63	Spare

(6) observationTimeFlag

Type	Array	Unit
4-byte float	nlat x nlon	

observationTimeFlag indicates relative time from the starting time of the file to the time of microwave radiometer (imager/sounder) observing last pixel. Data are stored in 4-byte float. Value of 0 means start time of the file (HH in file name). Missing value is defined as -9999.9. Detailed description is below.

<u>Value</u>	<u>Description</u>
$0 \leq X < 1$	If value is positive and smaller than 1, microwave radiometer observation is available at the pixel during current one-hour period. X indicates relative observation time of latest microwave radiometer, and is stored as difference from the start time of the file. For example, if UTC of the file (HH) = 01 and X = 0.2, observation time of the pixel will be 01:12 UTC.
$1 \leq X$	If value is equal to or larger than 1, NO microwave radiometer observation is available at the pixel during time period of the file. X indicates relative observation time of coming microwave radiometer, and stored as differences from the start time of the file. For example, if UTC of the file (HH) = 01 and X= 2.5, coming observation time of microwave radiometer at the pixel will be 3:30 UTC.
$X < 0$	If value is negative, NO microwave radiometer observation is available at the pixel during time period of the file. X (X LT 0) indicates relative observation time of latest microwave radiometer, and stored as differences from the start time of the file. For example, if UTC of the file (HH) = 01 and X = -2.5, latest observation time of microwave radiometer at the pixel will be 22:30 UTC of previous day. If X = -9999.9, There is no microwave observation (Missing).

(7) hourlyPrecipRateGC

Type	Array	Unit
4-byte float	nlat x nlon	mm/hr

hourlyPrecipRateGC indicates hourly precipitation rate that was corrected by rain gauge data (NOAA CPC Unified Gauge-Based Analysis of Global Daily Precipitation, in daily and 0.5-degree grid) at each pixel. Data are stored in 4-byte float. Unit is [mm/hr].

Missing value is defined as -9999.9.

(8) gaugeQualityInfo

Type	Array	Unit
2-byte integer	nlat x nlon	counts/day

Definitions of gaugeQualityInfo of the near real time product and the standard product are different, respectively. In case of near real time product, value stands for an existence of correction by rain gauge. If value is "1", the correction is applied. If value is "0", the correction is not applied. On the other hand, in case of standard product, value stands for the daily average of number of the ground based rain gauge observations used for the correction of rain gauge at a pixel. Missing value is defined as -9999.

(9) snowProbability

Type	Array	Unit
2-byte integer	nlat x nlon	%

Probability of the rain (hourlyPrecipRate) was snowfall in fact. If value is more than 50 (%), there is a high possibility that it was snowfall. Values range from 0 to 100 % .Missing value is

1.2. Contents of objects

1.2.2. Data Group

defined as -9999.

2. 3GSMAPH - GSMaP Hourly (Text)

2.1. Data Format Structure

2.1.1. Data format structure of 3GSMAPH (Text)

3GSMAPH (Text) contains text file like the table below.

The PI is JAXA. The granule size is 1 hour and the grid size of Lon/Lat is 0.1 degree.

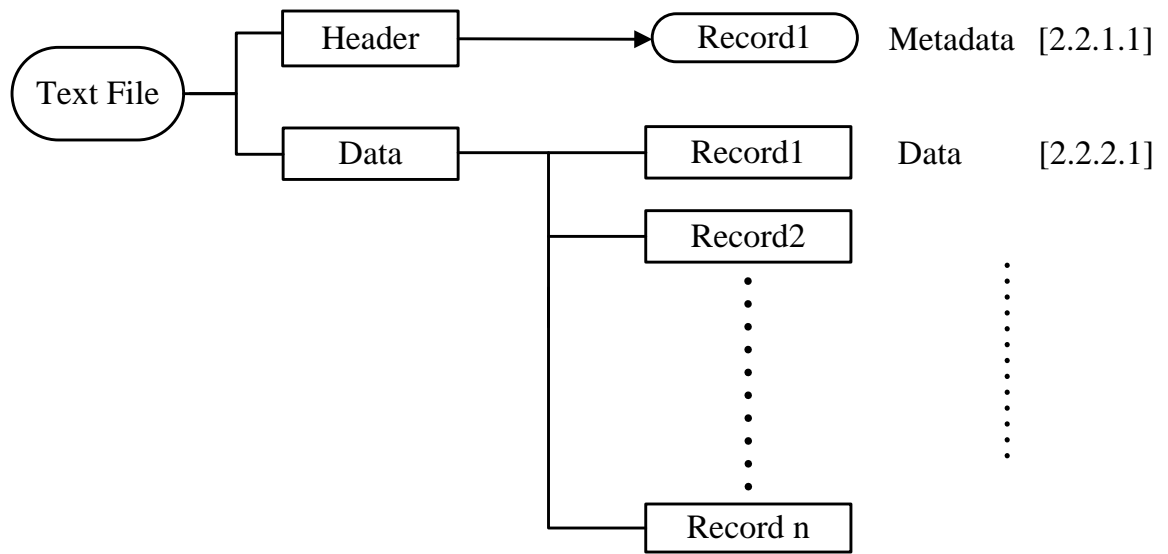


Figure 2.1-1 Data format structure for 3GSMAPH(Text)

2.2. Contents of objects

2.2.1. Header structure of 3GSMAPH (Text)

The record1 of header is data identifier. Table2.2-1 shows each element of identifiers in record 1.

Table 2.2-1 Record 1 Elements of Header

No.	Item	Description
1	Latitude	“Lat” Fixed string
2	Separator	“,”(one comma + “”(single byte space)).
3	Longitude	“Lon” Fixed string
4	Separator	“,”(one comma + “”(single byte space)).
5	Precipitation intensity per hour	“HourlyPrecipRate” Fixed string
6	Separator	“,”(one comma + “”(single byte space)).
7	Precipitation intensity per hour calibrated by rain gauge	“HourlyPrecipRateGC” Fixed string
8	Line break	0x0A

2.2.2. Data structure of 3GSMAPH(Text)

Data of GSMaP contains the format of table 2.2-2.

Table2.2-2 Record Elements of Data

No.	Item	Description
1	Latitude	(-)NN.NN Arbitrary real number of 2 decimal places Unit: degree
2	Separator	“,”(one comma + “”(single byte plural spaces)).
3	Longitude	(-)NNN.NN Arbitrary real number of 2 decimal places Unit: degree
4	Separator	“,”(one comma + “”(single byte plural spaces))

2.2. Contents of objects

2.2.2. Data structure of 3GSMAPH(Text)

No.	Item	Description
5	Precipitation intensity per hour	NN.NN Arbitrary real number of 2 decimal places Unit: mm/hr
6	Separator	","(one comma + " "(single byte plural spaces))
7	Precipitation intensity per hour calibrated by rain gauge	NN.NN Arbitrary real number of 2 decimal places Unit: mm/hr
8	Line break	0x0A

3. 3GSMAPM – GSMaP Monthly (HDF)

3.1. Data Format Structure

3.1.1. Dimension definition

Dimension definitions:

- nlat
 - 1800 Number of 0.1 degree intervals of latitude from 90 degree S (-90 degrees) to 90 degree N (+90 degrees).
- nlon
 - 3600 Number of 0.1 degree intervals of longitude from 180 degree W (-180 degrees) to 180 degree E (+180 degrees).

3.1.2. Data Format Structure for 3GSMAPM – GSMaP Monthly

3GSMAPM, "GSMaP Monthly", provides precipitation estimates at 0.1 degrees by the Global Satellite Mapping of Precipitation (GSMaP). GSMaP provides high-precision, high-resolution global precipitation maps using satellite data. The PI is JAXA. The granule size is 1 month. The following sections describe the structure and contents of the format.

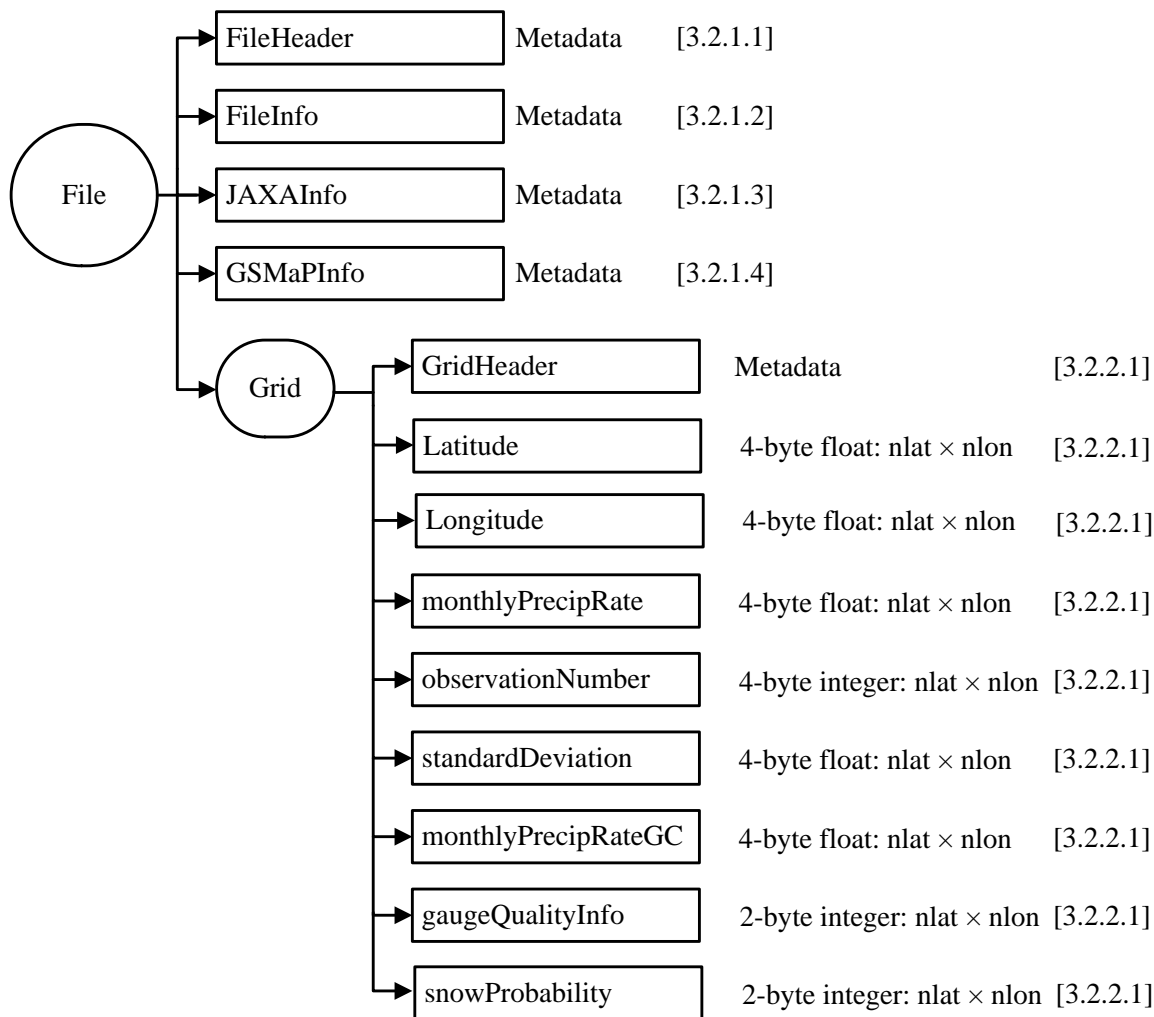


Figure 3.1-1 Data Format Structure for 3GSMAPM – GSMaP Monthly

3.2. Contents of objects

3.2.1. Metadata

3.2.1.1 FileHeader

FileHeader contains metadata of general interest. Table 3.2-1 shows each metadata elements in FileHeader.

Table 3.2-1 FileHeader Group

Metadata Element	Estimated Size (bytes)	Description
DOI	256	Digital Object Identifier *Value is blank currently.
DOIauthority	256	Digital Object Identifier Authority
DOIshortName	256	Digital Object Identifier Short Name *Value is blank currently.
AlgorithmID	50	The algorithm that generated this product, e.g., 3GSMAPM.
AlgorithmVersion	50	The version of the algorithm that generated this product.
FileName	50	The file name of this granule.
SatelliteName	10	Values are: TRMM GPM MULTI F10 ... F18 AQUA GCOMW CORIOLIS MT1 NOAA15 ... NOAA19 METOPA NPP, etc. In case of multiple satellites, value is MULTI.
InstrumentName	10	Values are: PR TMI VIRS PRTMI KU KA DPR GMI DPRGMI MERGED SSMI SSMIS AMSRE AMSR2 WIND-SAT MADRAS AMSUA AMSUB SAPHIR MHS ATMS, etc. In case of multiple sensors, value is MERGED.
GenerationDateTime	50	The date and time this granule was generated. The format is YYYY-MM-DDTHH:MM:SS.sssZ, where YYYY is 4-digit year, MM is month number, DD is day of month, T is "T", HH is hour, MM is minute, SS is second, sss is millisecond, and Z is "Z". All fields are zero-filled. The missing value is constructed by replacing all digits with 9, i.e., 9999-99-99T99:99:99.999Z
StartGranuleDateTime	50	The start time defining this granule. The format is the same as GenerationDateTime. The starting date and time of the monthly product is the first millisecond on a specific month. For example, in case of September 2014, value would be 2014-09-01T00:00:00.000Z
StopGranuleDateTime	50	The stop time defining this granule. The format is the same as GenerationDateTime. The ending date and time of the monthly product is the last millisecond on a specific month. For example, in case of September 2014, value would be 2014-09-30T23:59:59.999Z
GranuleNumber	50	The number of this granule. *Value is blank.

Metadata Element	Estimated Size (bytes)	Description
NumberOfSwaths	50	The number of swaths in this granule. *Value is "0".
NumberOfGrids	50	The number of grid structures in this granule. *Value is "1".
GranuleStart	50	The starting place in the orbit of this granule. Currently defined values are "SOUTHERNMOST LATITUDE" and "NORTHBOUND EQUATOR CROSSING". *Value is blank.
TimeInterval	50	The time interval covered by this granule. Values is "MONTH".
ProcessingSystem	50	The name of the processing system, e.g., "PPS", "JAXA".
ProductVersion	50	The data version assigned by the processing system.
EmptyGranule	50	Whether a granule is empty. Values are "EMPTY" or "NOT EMPTY".
MissingData	50	The number of missing scans. *Value is blank.

3.2.1.2 FileInfo

FileInfo contains metadata used by the PPS I/O Toolkit. Table 3.2-2 shows each metadata elements in FileInfo.

Table 3.2-2 FileInfo Group

Metadata Element	Estimated Size (bytes)	Description
DataFormatVersion	50	The version of the data format used to write this file. This version is separate for each AlgorithmID. The order is: "a" "b" ... "z" "aa" "ab" ... "az" "ba" "bb" ...
TKCodeBuildVersion	50	Usually TK CodeBuildVersion is "1". If the I/O routines built by TKIO change even though the DataFormatVersion is unchanged, then TK CodeBuildVersion increments to "2", "3", ... If subsequently DataFormatVersion changes, TKCodeBuildVersion becomes "1" again.
MetadataVersion	50	The version of metadata used to write this file. This version is separate for each AlgorithmID. The order is: "a" "b" ... "z" "aa" "ab" ... "az" "ba" "bb" ...
FormatPackage	50	The underlying format of this granule. Values are "HDF4", "HDF5", "NETCDF", "TKBINARY"
BlueprintFilename	50	The filename of the primary blueprint file that defined the format used to write this file.
BlueprintVersion	10	The BlueprintVersion of the format definition.
TKIOVersion	50	The version of TKIO used to create I/O routines to write this file. TKIOVersion does not define the format used to write this file.
MetadataStyle	50	The style in which the metadata was written, e.g., "PVL". "PVL" means < parameter >=< value >;
EndianType	50	The endian type of the system that wrote this file. Value is "BIG ENDIAN" or "LITTLE ENDIAN". *Value is LITTLE_ENDIAN.

3.2.1.3 JAXAInfo

JAXAInfo contains metadata requested by JAXA.Used by DPR algorithms and GSMaP. Table 3.2-3 shows each metadata elements in JAXAInfo.

Table 3.2-3 JAXAInfo Group

Metadata Element	Estimated Size (bytes)	Description
GranuleFirstScanUTCDate Time	50	Granule First Scan UTC Date. Date is a 24 character string. The format is YYYY-MM-DDTHH:MM:SS.sssZ, where YYYY is 4-digit year, MM is month number, DD is day of month, T is "T", HH is hour, MM is minute, SS is second, sss is millisecond, and Z is "Z". All fields are zero-filled. The missing value is constructed by replacing all digits with 9, i.e., 9999-99-99T99:99:99.999Z. *Value is blank.
GranuleLastScanUTCDate Time	50	Granule Last Scan UTC Date. Date is a 24 character string. The format is YYYY-MM-DDTHH:MM:SS.sssZ, where YYYY is 4-digit year, MM is month number, DD is day of month, T is "T", HH is hour, MM is minute, SS is second, sss is millisecond, and Z is "Z". All fields are zero-filled. *Value is blank.
TotalQualityCode	50	Total quality of the GPM product. When the number of TotalQualityCode being "good" in the standard products used for calculation of monthly average is more than 70%, the value is "Good". In the other cases, the value is "Fair". e.g., "Good", "Fair".
FirstScanLat	50	Latitude of orbit first scan. *Value is blank.
FirstScanLon	50	Longitude of orbit first scan. *Value is blank.
LastScanLat	50	Latitude of orbit last scan. *Value is blank.
LastScanLon	50	Longitude of orbit last scan. *Value is blank.
NumberOfRainPixelsNS	50	Number of rain pixels in the NS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
NumberOfRainPixelsMS	50	Number of rain pixels in the MS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
NumberOfRainPixelsHS	50	Number of rain pixels in the HS swath, judged at DPR L2 algorithm. In case of DPR L1, value is absolutely "-9999". *Value is blank.
ProcessingSubSystem	50	The name of the processing sub-system, e.g., "ALGORITHM", "PCS".
ProcessingMode	50	The name of the processing mode, e.g., "STD", "NRT".

3.2.1.4 GSMaPInfo

GSMaPInfo contains metadata required by GSMaP. This group appears in GSMaP products only. Table 3.2-4 shows each metadata elements in GSMaPInfo.

Table 3.2-4 GSMaPInfo Elements

Metadata Element	Estimated Size (bytes)	Description
AlgorithmName	100	Algorithm name of GSMaP module.
CoverageRatio	100	Ratio of effective (non-missing) pixel number within rainfall retrieval area (60S-60N at present) in percentage.
InputMWSFileNumber	100	Number of satellites with passive microwave instruments used in the file. *Value is blank.
InputIRFileNumber	100	Number of data of IR radiometer used for calculation of precipitation.
InputAncillaryFileNumber	100	Number of days corrected by rain gauge. In case of a day without correction, NoGauge=D1,D2,D3. D1,D2 and D3 would be date without correction.

3.2.2. Data Group

Elements of data group are explained in detail in this section.

3.2.2.1 Grid(Group)

(1) GridHeader (Metadata)

GridHeader contains metadata defining the grids in the grid structure.

Table 3.2-5 GridHeader Elements

Metadata Element	Estimated Size (bytes)	Description
BinMethod	50	Method used to obtain the value in each grid box. The only defined value is "ARITHMEAN". Value is "ARITHMETRIC_MEAN".
Registration	50	Representative location within the grid box. The only defined value is "CENTER".
LatitudeResolution	50	North-south size of a bin (degrees latitude).
LongitudeResolution	50	East-west size of a bin (degrees longitude).
NorthBoundingCoordinate	50	Northern-most latitude (degrees) covered by the grid.
SouthBoundingCoordinate	50	Southern-most latitude (degrees) covered by the grid.
EastBoundingCoordinate	50	Eastern-most longitude (degrees) covered by the grid.
WestBoundingCoordinate	50	Western-most longitude (degrees) covered by the grid.
Origin	50	Origin of the grid indices, e.g., "SOUTHWEST".

(2) Latitude

Type	Array	Unit
4-byte float	nlat x nlon	degrees

The earth latitude of the center of the grid in 0.1 degree interval. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:
Missing Value : -9999.9.

(3) Longitude

Type	Array	Unit
4-byte float	nlat x nlon	degrees

The earth longitude of the center of the grid in 0.1 degree interval. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:
Missing Value : -9999.9.

(4) monthlyPrecipRate

Type	Array	Unit
4-byte float	nlat x nlon	mm/hr

monthlyPrecipRate indicates monthly precipitation rate at each pixel. Unit is [mm/hr]. Negative value denotes missing in observation data or no precipitation rate was retrieved within microwave algorithms. Detailed description for missing data is shown below.

Value Description

(0.0 or positive) Monthly precipitation rate [mm/hr].

-9999.9 Missing due to no observation by IR and/or microwave sensor.

(5) observationNumber

Type	Array	Unit
4-byte integer	nlat x nlon	counts/month

observationNumber indicates the number of days of observation at each pixel during one month. Data are stored in 4-byte integer. Unit is [counts/month]. Missing value is defined as -9999.

(6) standardDeviation

Type	Array	Unit
4-byte float	nlat x nlon	mm/hr

standardDeviation indicates monthly standard deviation of precipitation rate at each pixel. Data are stored in 4-byte float. Unit is [mm/hr]. Missing value is defined as -9999.9.

(7) monthlyPrecipRateGC

Type	Array	Unit
4-byte float	nlat x nlon	mm/hr

monthlyPrecipRateGC indicates monthly mean precipitation rate at each pixel corrected by rain

gauge . Data are stored in 4-byte float. Unit is [mm/hr]. Missing value is defined as -9999.9.

(8) gaugeQualityInfo

Type	Array	Unit
2-byte integer	nlat x nlon	counts/month

gaugeQualityInfo indicates the number of monthly average of gauge data in original 0.5-degree pixel, which was used in calculation of monthlyPrecipRateGC. Data are stored in 4-byte integer. Unit is [counts/month]. Missing value is defined as -9999. Special values are defined as:

-9999 Missing value

(9) snowProbability

Type	Array	Unit
2-byte integer	nlat x nlon	%

Frequency of the snow was falling (%). Values range from 0 to 100 %. Missing value is defined as -9999.

4. The List of Elements of the Data Group

4.1. The List of Elements of 3GSMAPH Data Group

Table 4.1-1 Elements of 3GSMAPH Data Group

(B:byte, int:integer)

Group Name	Variables [Array]	Missing (_fill Value)	Minimum Value	Maximum Value	Unit	Data Type
Grid	Latitude [nlat x nlon]	-9999.9	-90	90	[degrees]	4B float
	Longitude [nlat x nlon]	-9999.9	-180	180	[degrees]	4B float
	hourlyPrecipRate [nlat x nlon]	-9999.9	0		[mm/hr]	4B float
	satelliteInfoFlag [nlat x nlon]	-9999	0			8B int
	observationTimeFlag [nlat x nlon]	-9999.9	0			4B float
	hourlyPrecipRateGC [nlat x nlon]	-9999.9	0		[mm/hr]	4B float
	gaugeQualityInfo [nlat x nlon]	-9999	0		[counts/day]	2B int
	snowProbability [nlat x nlon]	-9999	0	100	[%]	2B int

4.2. The List of Elements of 3GSMAPM Data Group

Table 4.1-2 Elements of 3GSMAPM Data Group

(B:byte, int:integer)

Group Name	Variables [Array]	Missing (_fill Value)	Minimum Value	Maximum Value	Unit	Data Type
Grid	Latitude [nlat x nlon]	-9999.9	-90	90	[degrees]	4B float
	Longitude [nlat x nlon]	-9999.9	-180	180	[degrees]	4B float
	monthlyPrecipRate [nlat x nlon]	-9999.9	0		[mm/hr]	4B float
	observationNumber [nlat x nlon]	-9999	0		[counts/month]	4B int
	standardDeviation [nlat x nlon]	-9999.9	0		[mm/hr]	4B float
	monthlyPrecipRateGC [nlat x nlon]	-9999.9	0		[mm/hr]	4B float
	gaugeQualityInfo [nlat x nlon]	-9999	0		[counts/month]	2B int
	snowProbability [nlat x nlon]	-9999	0	100	[%]	2B int

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