

**GLOBAL PRECIPITATION MEASUREMENT  
PRECIPITATION PROCESSING SYSTEM**

**File Specification  
3GSMAPH**

**Preliminary Version**

March 26, 2016

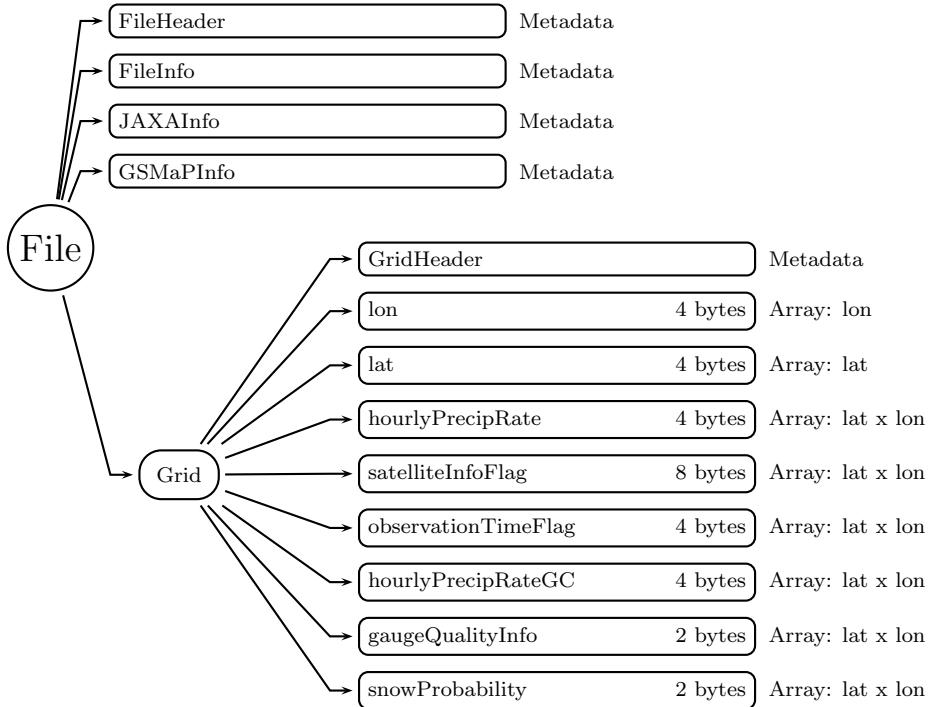


Figure 1: Data Format Structure for 3GSMPAPH, GSMPAPH Hourly

## 0.1 3GSMPAPH - GSMPAPH Hourly

3GSMPAPH, "GSMPAPH Hourly", provides precipitation estimates at 0.1 degrees by the Global Satellite Mapping of Precipitation (GSMPAPH). GSMPAPH 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.

Dimension definitions:

lat	1800	Number of 0.1° grid intervals of latitude from 90° N to 90° S.
lon	3600	Number of 0.1° grid intervals of longitude from 180° W to 180° E.
n8	8	Number 8.

Figure 1 shows the structure of this product. The text below describes the contents of objects in the structure, the C Structure Header File and the Fortran Structure Header File.

### **FileHeader** (Metadata):

FileHeader contains general metadata. This group appears in all data products. See Metadata for GPM Products for details.

### **FileInfo** (Metadata):

FileInfo contains metadata used by the PPS I/O Toolkit (TKIO). This group appears in all data products. See Metadata for GPM Products for details.

### **JAXAInfo** (Metadata):

JAXAInfo contains metadata requested by JAXA. Used by DPR algorithms and GSMAp. See Metadata for GPM Products for details.

### **GSMaPInfo** (Metadata):

GSMaPinfo contains metadata required by GSMAp. Used by GSMAp products only. See Metadata for GPM Products for details.

## **Grid** (Grid)

### **GridHeader** (Metadata):

GridHeader contains metadata defining the grids in the grid structure. See Metadata for GPM Products for details.

### **lon** (4-byte float, array size: lon):

Longitude of the center of the grid box. Values range from -180 to 180 degrees\_east.

Special values are defined as:

-9999.9 Missing value

### **lat** (4-byte float, array size: lat):

Latitude of the center of the grid box. Values range from -90 to 90 degrees\_north. Special values are defined as:

-9999.9 Missing value

### **hourlyPrecipRate** (4-byte float, array size: lat x lon):

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.

### **satelliteInfoFlag** (8-byte integer, array size: lat x lon):

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. Negative values indicates no microwave radiometer observation at that pixel. Below is a list of pixel values, bit, and corresponding instrument.

Value	Bit	Sensor Category	Satellite/Sensor
1	0	Infrared Imager aboard Geo-stationary meteorological satellite	NOAA/CPC Globally Merged IR data
2	1	Microwave radiometer (imager/sounder) 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/SSMIS
32768	15		DMSP-F17/SSMIS
65536	16		DMSP-F18/SSMIS
131072	17		DMSP-F19/SSMIS
262144	18		DMSP-F20/SSMIS
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/MHS
8388608	23		NOAA-19/AMSU-A/MHS
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	Spare

**observationTimeFlag** (4-byte float, array size: lat x lon):

observationTimeFlag indicates relative time of nearest microwave radiometer (imager/sounder) observation to start time of the file at each 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.

Value	Description
0 LE X LT 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 LE 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 LT 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. X =
-9999.9 No microwave observation
(Missing)
```

**hourlyPrecipRateGC** (4-byte float, array size: lat x lon):  
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.

**gaugeQualityInfo** (2-byte integer, array size: lat x lon):

gaugeQualityInfo indicates the number of gauge data in original 0.5-degree pixel and daily, which was used in calculation of hourlyPrecipRateGC. Data are stored in 2-byte integer. Unit is [counts/day]. Missing value is defined as -9999.

**snowProbability** (2-byte integer, array size: lat x lon):

Probability of snow. Data are stored in 2-byte integer. Range is 0 to 1. Missing value is defined as -9999.

## C Structure Header file:

```
#ifndef _TK_3GSMAPH_H_
#define _TK_3GSMAPH_H_

#ifndef _L3GSMAPH_GRID_
#define _L3GSMAPH_GRID_

typedef struct {
    float lon[3600];
    float lat[1800];
    float hourlyPrecipRate[3600][1800];
    long long satelliteInfoFlag[3600][1800];
    float observationTimeFlag[3600][1800];
    float hourlyPrecipRateGC[3600][1800];
    short gaugeQualityInfo[3600][1800];
    short snowProbability[3600][1800];
} L3GSMAPH_GRID;

#endif
#endif
```

## Fortran Structure Header file:

```
STRUCTURE /L3GSMAPH_GRID/
    REAL*4 lon(3600)
    REAL*4 lat(1800)
    REAL*4 hourlyPrecipRate(1800,3600)
    INTEGER*8 satelliteInfoFlag(1800,3600)
    REAL*4 observationTimeFlag(1800,3600)
    REAL*4 hourlyPrecipRateGC(1800,3600)
    INTEGER*2 gaugeQualityInfo(1800,3600)
    INTEGER*2 snowProbability(1800,3600)
END STRUCTURE
```