Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Global Satellite Mapping of Precipitation (GSMaP) IFloodS

Introduction

The GPM Ground Validation Global Satellite Mapping of Precipitation (GSMaP) IFloodS dataset consists of rainfall rate estimates from the GSMaP project. The GSMaP global rain rate maps are derived by a collection of algorithms that utilize microwave (MW) radiometer data and geostationary Infrared (IR) data. The GSMaP Precipitation data product is provided on a 0.1 degree spatial resolution every hour and was made available for use during the Global Precipitation Measurement (GPM) Ground Validation Iowa Flood Studies (IFloodS) field campaign. These data are available in netCDF-4 and binary formats from April 22, 2013 through June 30, 2013. The near real-time GSMaP data can be obtained from the JAXA GSMaP web page.

Citation

Kubota, Takuji. 2018.GPM Ground Validation Global Satellite Mapping of Precipitation (GSMaP) IFloodS [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/IFLOODS/TMI/DATA201

Keywords:

JAXA, GPM, IFloodS, Iowa, GSMaP, GPM, precipitation, rainfall rate

Campaign

The Global Precipitation Measurement mission Ground Validation (GPM GV) campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and

disdrometers). These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is at https://pmm.nasa.gov/GPM/.

The Iowa Flood Studies (IFloodS) was a ground measurement campaign that took place throughout Iowa from May 1 to June 15, 2013. The main goal of IFloodS was to evaluate how well the GPM satellite rainfall data can be used for flood forecasting. Specifically, this meant collecting detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and simultaneously collecting data from satellites passing overhead. The ground instruments characterize precipitation – the size and shape of raindrops, the physics of ice and liquid particles throughout the cloud and below as it falls, temperature, air moisture, and distribution of different size droplets – to improve rainfall estimates from the satellites, and in particular the algorithms that interpret raw data for the GPM mission's Core Observatory satellite, which launched in 2014. More information about IFloodS is available at https://ghrc.nsstc.nasa.gov/home/field-campaigns/ifloods.
Additional information about the Iowa Flood Center is available at http://iowafloodcenter.org/.

Product Description

The Global Rainfall Map (GSMaP) product is obtained from various microwave and microwave-infrared algorithms utilizing data from the Global Precipitation Measurement (GPM) Microwave Imager (GMI), Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI), TRMM Precipitation Radar (PR), Global Change Observation Mission (GCOM)-W1 Advanced Microwave Scanning Radiometer 2 (AMSR2), Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave Imager/Sounder (SSMIS), National Oceanic and Atmospheric Administration (NOAA) Advanced Microwave Sounding Unit (AMSU), Meteorological Operational satellite programme (MetOp) AMSU, and Geostationary Infrared instruments. Rainfall rates mapped at a spatial resolution of 0.1 degrees and a hourly temporal resolution are produced. This product is supported by the Japan Science and Technology Agency (JST) and the Japan Aerospace Exploration Agency (JAXA) and can be used for weather monitoring, flood warning or prediction, agriculture, or education purposes. This near real-time GSMaP precipitation product was obtained at the time of the IFloodS field campaign to support scientists during the campaign. It therefore represents the algorithms in use in 2013, and contains only data during the time of the IFloodS campaign. For updated and more GSMaP data, we direct you to the JAXA GSMaP web page. More information about the GSMaP product is available in the JAXA GSMaP user guide, in addition to references provided below.

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Data Characteristics

The GPM Ground Validation Global Satellite Mapping of Precipitation (GSMaP) IFloodS dataset is a subset of the JAXA GSMaP product available from JAXA. GSMaP contains rain rate estimates on a 0.1 degree gridded map. The original files were obtained in binary format from JAXA and converted to netCDF-4 format at GHRC. Data files have corresponding browse images available in JPG format. The GSMaP data are considered Level 4 products. More information about the NASA data processing levels are available on the NASA Data Processing Levels website.

Table 1: Data Characteristics

Characteristic	Description
Platforms	GPM, TRMM, GCOM-W1, DMSP, NOAA, MetOp, GOES
Instruments	GMI (GPM), TMI (TRMM), PR (TRMM), AMSR2 (GCOM-W1), SSMIS (DMSP), AMSU (NOAA), AMSU (MetOp), geostationary infrared
Projection	n/a
Spatial Coverage	N: 59.95, S: -59.95, E: 179.95, W: -179.95 (Global)
Spatial Resolution	0.1 degree
Temporal Coverage	April 22, 2013 - June 30, 2013
Temporal Resolution	hourly
Sampling Frequency	hourly
Parameter	Rain rate
Version	1
Processing Level	4

File Naming Convention

The GPM Ground Validation Global Satellite Mapping of Precipitation (GSMaP) IFloodS data product is available in netCDF-4 and binary formats with corresponding browse images available in JPG format. These data and browse files are in the file naming convention shown below.

Data files: ifloods_gsmap_nrt_YYYYMMDD_hhmm.[nc|dat.gz]
Browse files: ifloods_gsmap_nrt_YYYYMMDD_hhmm.jpg

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
[nc|dat.gz]	nc: netCDF-4 format dat.gz: gzipped binary format
jpg	Joint Photographic Experts Group format

Data Format and Parameters

This data product consists of rain rate estimates derived from JAXA's GSMaP product, provided in both netCDF-4 and binary formats with corresponding browse images available in JPG format. More information about the binary format of these data products can be found in the GSMaP Data Format Description document, which is also available in the 'doc' directory on the public server. Table 3 lists and describes the variables available within the netCDF-4 data files.

Table 3: Data Fields in netCDF-4 files

Field Name	Description	Data Type	Unit
latitude	Latitude of the observation	float	Degrees North
longitude	Longitude of the observation	float	Degrees East
rainrate	Rainfall rate	float	mm/hr
time	Time of measurements	int	Seconds since time in filename

Algorithm

The algorithms used to generate the GSMaP product targets the "best" precipitation estimates, so real-time operations and/or data availability were not considered. The core algorithms used in this system include the Microwave Radiometer Rainfall Retrieval Algorithm by Aonashi et al, 2009; the Microwave Sounder Rainfall Retrieval Algorithm by Shige et al, 2009; the Microwave Imager/Sounder Rainfall Retrieval Algorithm, and the Microwave-Infrared (IR) Merged Algorithm by Ushio et al, 2009. More information about the algorithms used in this product can also be found in the GSMaP Algorithm Theoretical Basis Document (ATBD),which is also available in the 'doc' directory on the public server.

Quality Assessment

Each hourly rainfall rate parameter pixel was calibrated by using ground-based gauge observations over land. The quality of these data may decline due to topographic changes, snow cover, and complex surface emission backgrounds. More information about the quality of this GSMaP product can be found in the GSMaP Algorithm Theoretical Basis Document (ATBD) and Chen et al., 2016.

Software

The GSMaP data are available in netCDF-4 and binary formats. The netCDF-4 data files can be easily viewed in Panoply. A document describes the binary format.

Known Issues or Missing Data

In the binary files, values of -9999.9 are considered to be missing data. For the netCDF-3 files, both the missing data and values below zero were set to 0 for transparency in plotting the data. The quality of the GSMaP data may decline due to topographic changes, snow cover, and complex surface emission backgrounds.

References

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Related Data

All data from other instruments collected during the IFloodS field campaign are related to this dataset. Other IFloodS campaign data can be located using the GHRC HyDRO 2.0 search tool using the term 'IFloodS'.

Contact Information

To order these data or for further information, please contact:

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