Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Global Flood Monitoring System (GFMS) Flood Maps IFloodS

Introduction

The GPM Ground Validation Global Flood Monitoring System (GFMS) Flood Maps IFloodS dataset contains global flood estimates on a 0.25 degree spatial resolution every 3 hours, from March 26, 2013 through June 30, 2013. These data are provided in support of the Iowa Flood Studies (IFloodS) experiment conducted in eastern Iowa. The goals of the IFloodS campaign were to collect detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and to simultaneously collect data from satellites passing overhead. The data are available in netCDF-4 and ASCII formats. Flood map and rain graph files are available in KMZ, JPG, and GIF formats.

Citation

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Keywords:

NASA, GHRC, TRMM, GPM, TMPA, GFMS, IFloodS, flood, flood maps, rain graphs, Iowa, rainfall, flood potential, total precipitation, rainfall rate

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation 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). Surface rainfall was measured by very dense rain gauge and disdrometer networks at various field campaign sites. These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is available at https://pmm.nasa.gov/GPM/.

The Iowa Flood Studies (IFloodS) campaign was a ground measurement campaign that took place in eastern Iowa from May 1 to June 15, 2013. The goals of the campaign were to collect detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and to simultaneously collect 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 http://gpm.nsstc.nasa.gov/ifloods/. Additional information about the Iowa Flood Center is available at http://iowafloodcenter.org/.

Model/Algorithm Description

The Global Flood Monitoring System (GFMS) derived flood monitoring parameters for the latitude band 50°N-50°S at a relatively high spatial (~12 km) and temporal (3 hourly) resolution. The GFMS combined the satellite-based precipitation estimation, runoff generation, runoff routing, and flood identification. The Dominant river tracing-Routing Integrated with VIC Environment (DRIVE) model system serves as the core of the GFMS. The DRIVE model is based on the University of Washington Variable Infiltration Capacity (VIC) land surface model (Liang et al., 1994) coupled with the University of Maryland Dominant River Tracing Routing (DRTR) model (Wu et al., 2014). The flood detection algorithm is described in Wu et al. (2012a).

Rainfall estimation is the most critical meteorological input of a hydrologic model for flood estimation. The DRIVE model is driven by the Tropical Rainfall Measuring Mission (TRMM) Multisatellite Precipitation Analysis (TMPA) data. The TMPA precipitation products are derived by combining precipitation values from microwave and IR satellites and surface precipitation gauges, if possible, at fine scales (0.25° × 0.25° and 3 hourly)(Huffman et al., 2007). The dataset covers the latitude band 50°N–S for the period from 1998 to the delayed present.

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Data Characteristics

The GPM Ground Validation Global Flood Monitoring System (GFMS) Flood Maps IFloodS dataset contains data files in netCDF-4 and ASCII formats at a Level 4 processing level. Flood map and rain graph files are available in KMZ, JPG, and GIF formats More information about the NASA data processing levels are available on the NASA Data Processing Levels website. Table 1 lists the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description
Platforms	GFMS is driven by TMPA precipitation data composed of precipitation estimates from the following satellites: Tropical Rainfall Measuring Mission (TRMM); Defense Meteorological Satellite Program (DMSP F-13, F-14, F-15, F-16, F-17); Aqua; NOAA; geostationary satellites
Instrument	TMI(TRMM); SSM/I and SSMIS (DMSP); AMSR-E (Aqua); AMSU-B (NOAA); IR sensors (geostationary satellites)
Projection	n/a
Spatial Coverage	N: 49.875, S: -49.875, E: 179.875, W: -179.875 (Global)
Spatial Resolution	0.25 degree lat/lon grid

Temporal Coverage	March 26, 2013 - June 30, 2013
Temporal Resolution	3 hours
Parameter	Rainfall, flood potential, total precipitation, rainfall rate
Version	1
Processing Level	4

File Naming Convention

The GPM Ground Validation Global Flood Monitoring System (GFMS) Flood Maps IFloodS dataset have data files in netCDF-4 and ASCII formats and flood map and rain graph files available in KMZ, JPG, and GIF formats . The following naming convention are used:

Data files:
ifloods_trmmfloodmap_global_[G5_24_pt|extendpt|gfs_extendpt|pls24_pt]_YYYYMMDDhh.[nc|txt]
ifloods_trmmfloodmap_GRAPH_STATS_YYYYMMDDhh.txt

Browse files:
ifloods_[FCST24|FCST48|hydro_model|total_rain|trmmfloodmap|3hrly_rain|rain_graph][_|.]YYYYMMDDhh.[kmz|jpg|gif]

Table 2: File naming convention variables

Variable	Description
G5_24_pt|extendpt|gfs_extendpt|pls24_pt	Data files contain rainfall estimates as following: G5_24_pt: An experimental 24 hour forecast of flood potential using TMPA 3B42V6 rainfall data and GEOS-5 rainfall forecast data extendpt: An experimental extended forecast of 7-day rainfall that uses TMPA 3B42V6 rainfall data for history and (4-5 day) GEOS-5 rainfall forecasts gfs_extendpt: An experimental extended forecast of flood potential using TMPA 3B42V6 rainfall data for history and (4-5 day) GFS rainfall forecasts pls24_pt: An experimental 24 hour forecast of flood potential using TMPA 3B42V6 rainfall data and GFS rainfall forecast data
FCST24|FCST48|hydro_model|total_rain|trmmfloodmap|3hrly_rain|rain_graph	Browse image files: FCST24: 24-hour flood potential FCST48: 48-hour flood potential hydro_model: flood potential

	total_rain: TMPA total precipitation trmmfloodmap: GFMS flood map 3hrly_rain: 3-hour average of rainfall rate (mm/hr) Rain_graph: Rainfall statistics for the state of IOWA
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
.nc	netCDF format
.txt	ASCII format
.kmz	Zipped KML files (KML stands for "Keyhole Markup Language")
.jpg	Compressed JPEG image format
.gif	Graphics Interchange Format

Data Format and Parameters

The GPM Ground Validation Global Flood Monitoring System (GFMS) Flood Maps IFloodS dataset contains data files in netCDF-4 and ASCII formats. Each ASCII data file contains four columns of data: time, latitude, longitude, and rainfall-total. The netCDF-4 files are converted from corresponding ASCII files. Table 3 and Table 4 outline data fields (variables or parameters) in netCDF-4 data file and ASCII file, respectively.

Table 3: Data Fields in netCDF-4 data file

Field Name	Description	Data Type	Unit
latitude	latitude of the observation	float	Degrees North
longitude	longitude of the observation	float	Degrees East
time	time of measurement	int	seconds since 00:00:00Z of the current date
rain	total rainfall in mm	float	mm

Table 4: Data Columns in ASCII data file

Field Name	Description	Unit
yyyymmddhh	time of measurement yyyy: four-digit year mm: two-digit month dd: two-digit day hh: two-digit hour in UTC	UTC
lat	latitude of the observation	Degrees North
long	longitude of the observation	Degrees East
rainfall-total	total rainfall in mm	mm

Quality Assessment

The GFMS is quantitatively evaluated in terms of flood event detection (Wu et al., 2012b; Wu et al., 2014). The GFMS detection performance improves (increasing probability of detection (POD)) with longer flood durations and larger affected areas. The presence of dams tend to result in more false alarms and greater false-alarm duration. There were poorer results in higher latitudes, probably due to larger errors the satellite precipitation input. The generally positive results indicate the value of the GFMS for monitoring and researching floods on a global scale, but also indicate limitations and directions for improvement of such approaches. These directions include improving the rainfall estimates, utilizing higher resolution in the runoff-routing model, taking into account the presence of dams, and improving the method for flood identification.

Software

Browse image files in KMZ format can be opened in Google Maps by saving the KMZ file to an online location and then typing the URL in the Google Maps search box. Google Earth can view these KMZ files too.

These data are available in netCDF-4 and ASCII formats, so no software is required. However, Panoply or HDFView can be used to easily view these netCDF-4 data.

Known Issues or Missing Data

There are no known issues with these data or any known gaps in the dataset.

References

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global, multiyear, combined-sensor precipitation estimates at fine scales, *J. Hydrometeor.*, 8, 38–55, doi: 10.1175/JHM560.1

Related Data

All data collected during the IFloodS field campaign should be considered related data sets. To locate other IFloodS data, use the GHRC search tool HyDRO 2.0 with the search term IFloodS.

Contact Information

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

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