![GHRC logo — Global Hydrology Resource Center]

Data User Guide

GPM Ground Validation USGS Stream Flow IFloodS

Introduction

The GPM Ground Validation USGS Stream Flow IFloodS dataset was obtained from USGS during the Iowa Flood Studies (IFloodS) field campaign that extended from March 30, 2013 through June 30, 2013. The main goal of IFloodS was to evaluate how well the GPM satellite rainfall data can be used for flood forecasting. The USGS monitors streamflow using gauges on streams and rivers throughout the U.S. For the IFloodS field campaign, streamflow data from about 200 gauges in the Iowa IFloodS study area were downloaded from the USGS web site as support data for the campaign. The USGS streamflow data were collected in real-time and provide measurements at 15-60 minute intervals. These USGS Stream Flow data are available in XML format.

Notice: The USGS Streamflow data were downloaded during the IFloodS field campaign to support efforts in real time. These data are considered to be provisional and may be inaccurate due to instrument malfunctions. Users are advised to visit USGS web site for more complete and higher quality data. The USGS Water Data for the Nation product DOI is http://dx.doi.org/10.5066/F7P55KJN.

Citation

United States Geological Survey. 2017. GPM Ground Validation United States Geological Survey (USGS) Stream Flow 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/GAUGES/DATA301

Keywords:

NASA, GHRC, GPM, IFloodS, USGS, Iowa, streamflow, stream gauge, floods, stream level heights, gauge height, discharge, precipitation total, nitrate levels, stage, turbidity

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/.

Instrument Description

The U.S. Geological Survey (USGS) streamflow dataset for the IFloodS field campaign consists of data collected at roughly 200 gauges in the Iowa area that operated in real-time, typically recording data at 15-60 minute intervals.

Most USGS stream gauges measure the stage, or height, of a river. This is done by measuring water entering and leaving the stilling well through underwater pipes allowing the water surface in the stilling well to be at the same elevation as the water surface in the river. The stage is then measured inside the stilling well using a float or a pressure, optical, or acoustic sensor. The measured stage value is then stored in an electronic data recorder on a regular interval, usually every 15 minutes. Stage can also be determined by measuring the pressure required to maintain a small flow of gas through a tube and bubbled out at a fixed location under water in the river. The measured pressure is directly related to the height of water over the tube outlet in the river. As the depth of water above the tube outlet increases, more pressure is required to push the gas bubbles through the tube. Figure 1 shows a diagram of a typical USGS stream gauge stilling well.
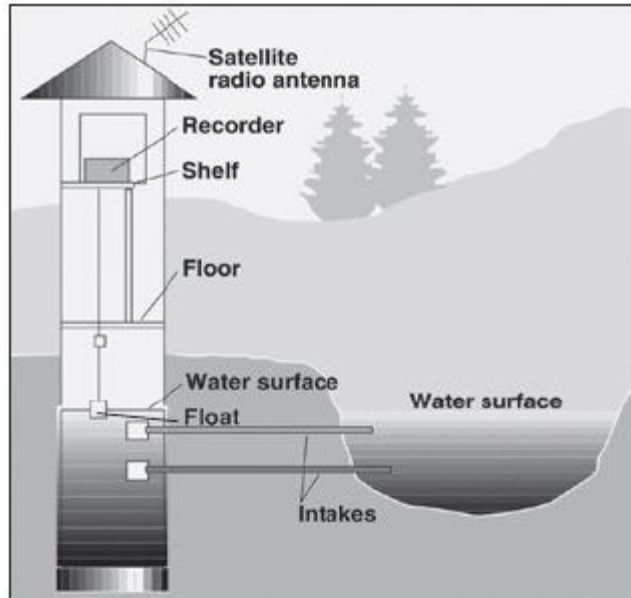
Figure 1: Diagram of a USGS stream gauge stilling well
(Image Source: USGS How Streamflow is Measured)

The stream gauges also measure discharge, which is the volume of water moving down a river per unit of time, which is computed by multiplying the area of water in a channel cross section by the average velocity of the water in that cross section. Turbidity and nitrate levels can also be measured at selected USGS stream gauges.

The measured data are typically recorded at 15- to 60-minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from current sites are relayed to USGS offices via satellite, telephone, and/or radio telemetry and are available for viewing within minutes of arrival.

Streamgages operated by the USGS provide stage measurements that are accurate to the nearest 0.01 foot or 0.2 percent of stage, whichever is greater. More information about the USGS stream gauges can be found at USGS Current Water Data for Iowa, USGS How Streamflow is Measured, and Streamflow Information for the Nation.

Investigators

United States Geological Survey
Reston, Virginia

Data Characteristics

The GPM Ground Validation USGS Stream Flow IFloodS data files are available in XML format at a Level 2 data processing level. More information about the NASA data processing levels are available on the NASA Data Processing Levels website.   The USGS DOI assigned

to Water Data for the Nation products from which this dataset was extracted in real-time is
http://dx.doi.org/10.5066/F7P55KJN.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground station
Instrument	USGS Stream Gauges
Projection	n/a
Spatial Coverage	N: 43.470, S: 40.602, E: -90.190, W: -96.562 (Iowa)
Spatial Resolution	point
Temporal Coverage	March 30, 2013 - June 30, 2013
Temporal Resolution	daily
Sampling Frequency	15 minutes
Parameter	Discharge, gauge height, precipitation total, nitrate levels, turbidity
Version	1
Processing Level	2

File Naming Convention

The GPM Ground Validation USGS Stream Flow IFloodS dataset has the file naming
convention shown below. The data files are available in XML format.

Data files: ifloods_USGS_Daily_StreamFlow_YYYYMMDD.xml

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
.xml	XML format

Data Format and Parameters

The GPM Ground Validation USGS Stream Flow IFloodS dataset consists of XML data files
containing stream gauge measurements. Each file contains all site locations for that day. In
addition to station name, station code and lat/lon location, table 3 describes the main data
parameters within the data files.   More information about variables in the file are available
at USGS tutorial web page, https://help.waterdata.usgs.gov/tutorials.

Table 3: Parameters within data files

Parameter	Unit
Discharge	ft^3/s
Gauge height	ft
Precipitation total	in

Nitrate levels	mg/L as Nitrogen
Turbidity monochrome near infrared LED light, 780-900 nm, detector angles at 90 +- 2.5 degrees and 0-45 degrees	-

Quality Assessment

These data are considered to be provisional data and are subject to revision until they have been thoroughly reviewed and quality controlled by USGS. Since this dataset was collected from USGS in real-time to support the IFloodS field campaign, the data may be inaccurate due to instrument malfunctions or incomplete due to outages or download difficulties. Users are cautioned to consider the nature of this type of data and instead obtain archived data after the campaign from USGS web site. More information about the quality of these data are available at https://waterdata.usgs.gov/nwis?provisional.

Software

These data are available in XML formats; therefore, no software is required to view these data. For assistance, see the USGS tutorial web page at https://help.waterdata.usgs.gov/tutorials.

References

Mason, Robert R. Jr. and T.H. Yorke (1997): Streamflow Information for the Nation. https://pubs.usgs.gov/fs/FS-006-97/FS-006-97.pdf

Perlman, Howard (2016): How Streamflow is Measured. https://water.usgs.gov/edu/measureflow.html

U.S. Geological Survey (2013): National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed May-June, 2013, at URL http://waterdata.usgs.gov/nwis/rt.

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.

Contact Information

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

       NASA Global Hydrology Resource Center DAAC
       User Services
       320 Sparkman Drive
       Huntsville, AL 35805

Phone: 256-961-7932
E-mail: support-ghrc@earthdata.nasa.gov
Web: https://ghrc.nsstc.nasa.gov/

Created: December 21, 2017