GHRC
Global Hydrometeorology Resource Center

Data User Guide

GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX

Introduction

The GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX dataset contains precipitation amount and precipitation rate data collected during the Global Precipitation Measurement mission (GPM) Ground Validation (GV) Olympic Mountains Experiment (OLYMPEX). The OLYMPEX field campaign took place between November 2015 and January 2016, with additional ground sampling continuing through February 2016, on the Olympic Peninsula in the Pacific Northwest of the United States. The purpose of the campaign was to provide ground-validation data for the measurements taken by instrumentation aboard the GPM Core Observatory satellite. The Met One Rain Gauge Pairs are tipping bucket precipitation gauges which collect precipitation amounts and calculate precipitation rates. This dataset contains two ASCII-tsv files per rain gauge and two rain gauges are located on each station platform. The Met One Rain Gauge Pairs OLYMPEX dataset files are available from January 1, 2015 through June 20, 2016 in ASCII-tsv format.

Citation

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Keywords:

NASA, GHRC, GPM GV, OLYMPEX, Washington, rain gauge pairs, Met One, precipitation, tip bucket, precipitation amount, precipitation rate

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation (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). 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 on the NASA PMM GPM webpage.

One of the GPM GV field campaigns was the Olympic Mountains Experiment (OLYMPEX) which was held in the Pacific Northwest (Figure 1). The goal of OLYMPEX was to validate rain and snow measurements in mid-latitude frontal systems as they move from ocean to coast to mountains and to determine how remotely sensed measurements of precipitation by GPM can be applied to a range of hydrologic, weather forecasting, and climate data. The campaign consisted of a wide variety of ground instrumentation, several radars, and airborne instrumentation monitoring oceanic storm systems as they approached and traversed the Peninsula and the Olympic Mountains (Figure 2). The OLYMPEX campaign was part of the development, evaluation, and improvement of GPM remote sensing precipitation algorithms. More information about OLYMPEX is available from the NASA GPM OLYMPEX Field Campaign webpage, the University of Washington OLYMPEX website, the GHRC OLYMPEX Field Campaign homepage, and the GHRC OLYMPEX Field Campaign Micro Article.

Figure 1: OLYMPEX Domain
(Image Source: NASA GPM OLYMPEX webpage)
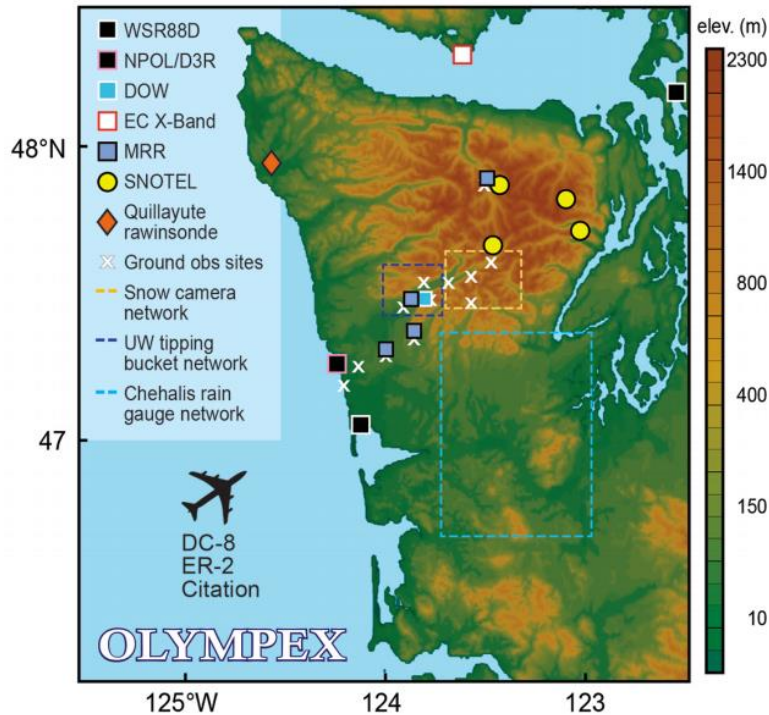
Figure 2: OLYMPEX Field Locations
(Image Source: NASA GPM OLYMPEX webpage)

Instrument Description

The Model 380 precipitation gauge, manufactured by Met One Instruments Inc., is a tipping bucket rain gauge which measures the amount of fallen precipitation (rain and/or snow). The gauge has a 30.5 cm (12 inch) diameter catchment funnel that directs precipitation to a tipping bucket assembly. When 0.254mm (.01 inch) of precipitation is collected, the tipping bucket assembly tips, draining the collection and activating a mercury switch for recording data. There are two gauges located on each platform as shown in Figure 3 below. The rain gauges were placed at multiple stations in the OLYMPEX study region shown in Figure 2. The gauges are collocated with other instruments in the field campaign, including the automated Parsivel units and the NASA S-Band Dual Polarimetric (NPOL) Doppler radar. More detailed information on the Met One Model 380 Precipitation Gauge is available in the CS Met One Rain Gauge instruction manual.

Figure 3: Dual tipping rain gauge bucket used for GPM- GV
(Image source: GSFC GPM Rain Gauge webpage)

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Data Characteristics

The GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX dataset files are organized by station, gauge, year, and file type (parameter). The two types of files that exist for each gauge are 'gag' and 'gmin' files. The 'gag' file is quality-controlled reformatted precipitation data recorded in millimeters at a temporal resolution of 1 second. The 'gmin' file contains cubic spline interpolated rain rates in millimeters per hour at 1-minute resolution. The files contain non-zero rainfall data only and are therefore not a complete time series. These data files are available at a Level 2 processing level in ASCII-tsv format. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 1 below.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground Stations
Instrument	Met One Rain Gauge Pairs
Spatial Coverage	N: 48.080, S: 46.448, E: -122.631, W: -124.369 (Olympic Peninsula, Washington)
Spatial Resolution	Point
Temporal Coverage	January 1, 2015 - June 20, 2016
Temporal Resolution	Annually
Sampling Frequency	*gag* files (precip. amount): 1 second *gmin* files (precip. rate): 1 minute
Parameter	Precipitation amount, precipitation rate
Version	1
Processing Level	2

File Naming Convention

The GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX dataset files are named using the following convention:

Data files: olympex_raingauge_[NASA####|STDALN##]_[A|B]_YYYY_[gag|gmin].txt

Table 2: File naming convention variables

Variable	Description
NASA#### or STDALN##	Gauge platform number: The 'NASA' stations are automated and report data throughout the study period. The 'STDALN' gauge data can only be retrieved at the end of the study period when the instrument is removed.
[A|B]	Rain gauge letter equipped on each platform
YYYY	Four-digit year
[gag|gmin]	File type gag: quality controlled reformatted rainfall data (mm) with a resolution of 1 second gmin: cubic spline interpolated 1-hour rain rates (mm/hr) at 1-minute intervals calculated using the algorithm of Wang et al. (2008)
.txt	ASCII-tsv format

Data Format and Parameters

The GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX dataset files are organized by station, gauge, year, and parameter. Each station platform has two gauges (Figure 2) which are referred to as gauge 'A' or 'B'. There is a separate set of files (gag and gmin) for each gauge. The quality-controlled tipping bucket rain gauge rainfall values reported every second are stored in the 'gag' files, while the cubic spline interpolated hourly rain rates are provided in 1-minute intervals in the 'gmin' files. Each ASCII-tsv file

contains two header lines followed by the station data. Table 3 describes each column within the 'gag' data files and Table 4 describes each column within the 'gmin' data files.

Table 3: Column descriptions for 'gag' data files.

Column Number	Column Title	Description	Unit
1	Year	Year	-
2	Mon	Month	-
3	Day	Day	-
4	Jday	Julian Day	-
5	Hr	Hour in UTC	-
6	Min	Minute in UTC	-
7	Sec	Second in UTC	-
8	Rain [mm]	Rain Amount	mm
9	Lat	Latitude	degrees
10	Lon	Longitude	degrees

Table 4: Column descriptions for 'gmin' data files.

Column Number	Column Title	Description	Unit
1	Year	Year	-
2	Mon	Month	-
3	Day	Day	-
4	Jday	Julian Day	-
5	Hr	Hour in UTC	-
6	Min	Minute in UTC	-
8	Rain [mm/h]	Rain Rate	mm/h
9	Lat	Latitude	degrees
10	Lon	Longitude	degrees

Algorithm

To create a quasi-continuous time series of 1 minute hourly rain rates, a cubic-spline algorithm is used to interpolate the measured gauge data. The algorithm used is described in Wang et al. (2008).

Quality Assessment

The Met One rain gauges have a reported accuracy of ±0.5% at 13 mm/hr and ±2% at 76 mm/hr. Errors in tipping bucket rain gauge measurements have been reported in Ciach (2003), Tokay et al. (2010), Wang et al. (2008), Wang and Wolff (2010), and Wang and Wolff (2012).

Software

No special software is required to read the Met One Rain Gauge Pairs OLYMPEX data files. These ASCII-tsv files can be viewed in any text editor or spreadsheet software such as Notepad++ or Microsoft Excel.

Known Issues or Missing Data

Since these Met One Rain Gauge Pairs data files only contain non-zero rainfall data, the data are not a complete time series.

References

Campbell Scientific, Inc. (2008). Met One Rain Gage Models 380 and 385. Campbell Scientific. https://s.campbellsci.com/documents/us/manuals/met1.pdf

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Related Data

All other data collected during the OLYMPEX field campaign are considered related data. These data can be located using the GHRC HyDRO2.0 search tool with the search term 'OLYMPEX'. In addition, the Met One Tipping Rain Gauges were used in other GPM GV field campaigns. These other rain gauge datasets can be located by searching the term 'Met One Rain Gauge Pairs' in HyDRO2.0 and are also listed below:

GPM Ground Validation Met One Rain Gauge Pairs IPHEx V2
(http://dx.doi.org/10.5067/GPMGV/IPHEX/GAUGES/DATA201)

GPM Ground Validation Met One Rain Gauge Pairs IFloodS V2
(http://dx.doi.org/10.5067/GPMGV/IFLOODS/GAUGE/DATA202)

GPM Ground Validation Rain Gauge Pairs MC3E V2
(http://dx.doi.org/10.5067/GPMGV/MC3E/GAUGE/DATA202)

GPM Ground Validation Met One Rain Gauge Pairs Wallops Flight Facility (WFF)
(http://dx.doi.org/10.5067/GPMGV/WFF/RAINGAUGE/DATA101)

Contact Information

To order these data or for further information, please contact:
> NASA Global Hydrometeorology Resource Center DAAC
> User Services
> E-mail: support-ghrc@earthdata.nasa.gov
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