Global Hydrology Resource Center

Data User Guide

GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX V2

Introduction

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX V2 dataset consists of rain rate, reflectivity, Doppler velocity, and other radar measurements obtained from the NPOL radar during the Global Precipitation Mission (GPM) Olympic Mountains Experiment (OLYMPEX) campaign. NPOL,developed by a research team from Wallops Flight Facility, is a fully transportable and self-contained S-band (10 cm), scanning dual-polarimetric Doppler research radar that was placed near the ocean on the Olympic Peninsula. Data files are available from November 5, 2015 thru January 15, 2016 in Universal Format (UF), with browse imagery files in PNG format containing corrected radar reflectivity, differential reflectivity, specific differential phase, differential phase, co-polar correlation, and Doppler velocity images.

Notice:

This dataset does not have continuous data. Data are missing for November 7th-11th, November 27th-29th, and December 20-31st of 2015. In 2016, data for January 1st-2nd, January 7th, and January 9th are missing.

Citation

Wolff, David, David Marks, Walter A. Petersen, and Jason Pippitt. 2017. GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX V2 [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/OLYMPEX/NPOL/DATA301

Keywords:

NASA, GHRC, OLYMPEX, Washington, NPOL, S-band, Radar, RHI, PPI, precipitation, radar reflectivity, co-polar correlation, differential reflectivity, differential phase, spectrum width, doppler velocity, rain 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/.

One of the GPM Ground Validation field campaigns was the Olympic Mountains Experiment (OLYMPEX) which was held in the Pacific Northwest. The goal of OLYMPEX was to validate rain and snow measurements in midlatitude 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. The OLYMPEX campaign was part of the development, evaluation, and improvement of GPM remote sensing precipitation algorithms. More information is available from the NASA GPM Ground Validation web site https://pmm.nasa.gov/olympex and the University of Washington OLYMPEX web site http://olympex.atmos.washington.edu/.

Figure 1: OLYMPEX Domain
(Image Source: https://pmm.nasa.gov/OLYMPEX)

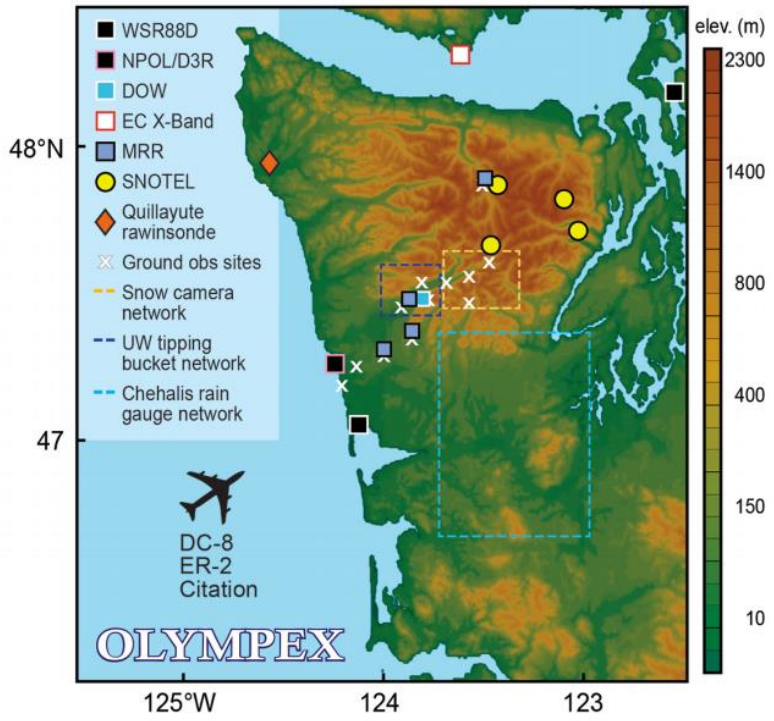

Figure 2: OLYMPEX Field Locations
(Image Source: https://pmm.nasa.gov/OLYMPEX)

Instrument Description

During the OLYMPEX field campaign, the NASA S-Band Dual Polarimetric (NPOL) Doppler Radar was located at the base of the Chehalis valley positioned near the ocean at Lat: 47.277N, Lon: -124.211. NPOL was developed by the research team at Wallops Flight Facility. This instrument is a fully transportable and self-contained S-band (10 cm), scanning dual-polarimetric Doppler research radar that takes accurate volumetric measurements of precipitation including rainfall rate, particle size distributions, water contents and precipitation type. Two different scan types are used: Plan Position Indicator (PPI) - 360 degree sweep of the antenna and Range Height Indicator (RHI) -scans pointing at a specific azimuth with the antenna tilted upward to get vertical profile information. The scanning strategy emphasized vertical structure sampling via RHI and narrow sector-volume data collections, as well as frequent 3-minute full PPI rain scans for rain mapping. More information about the NPOL Doppler radar is available at the Precipitation Measurement Missions NPOL website.

The NPOL radar scans a section of the atmosphere while also transmitting pulses in two directions (horizontal and vertical) and returns 3D images; the image data can be used to discern size, shape, and distribution of raindrops in clouds. The data aids scientists in better understanding the physics of rainfall.

Figure 3: Image of the NPOL Doppler radar
(Image Source: Precipitation Measurement Missions NPOL website)

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Data Characteristics

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX V2 data are available in Universal Format (UF) at a L1B data processing level. More information about the NASA data processing levels are available here. Information needed to read UF files with IDL is available at the GHRC. The associated browse images are in PNG format and contain corrected radar reflectivity, differential reflectivity, specific differential phase, differential phase, co-polar correlation, and Doppler velocity images.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground station
Instrument	NASA S-Band Dual Polarimetric (NPOL) Doppler radar
Projection	n/a
Spatial Coverage	N: 48.668, S: 45.960, E: -122.256, W: -126.275 (Washington)
Spatial Resolution	125 m - 300 m
Temporal Coverage	November 5, 2015 - January 15, 2016
Temporal Resolution	Daily
Sampling Frequency	20 minutes
Parameter	Radar reflectivity, co-polar correlation, Doppler velocity, rain rate
Version	2
Processing Level	1B

File Naming Convention

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX dataset consists of daily tarred files containing data files in UF format with the file naming conventions shown below. The browse images are in PNG format.

Tarred data files: olympex_npol_YYYY-MMDD.tar.gz
Un-tarred PPI data files: NPOL1_YYYY_MMDD_hhmmss.uf
Un-tarred RHI data files: NPOL1_YYYY_MMDD_hhmmss_[rhi|rhi_nn-nn].uf

Tarred browse files: olympex_npol_images_YYYY_HHDD.tar.gz
Un-tarred browse files:
olympex_npol1_YYYYMMDD_hhmmss_[CZ|DR|KD|PH|RH|VR]_[sw##|***.*AZ]_[PPI|RHI].png

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
.tar.gz	Tarred and zipped data file
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
ss	Two-digit second in UTC
.uf	Universal Format
[rhi|rhi_nn_nn]	rhi: valley scans with 16 different azimuths Rhi_nn_nn: ocean scans with the raw data containing 40 azimuths
[CZ|DR|KD|PH|RH|VR]	CZ: Corrected Radar Reflectivity DR: Differential Reflectivity KD: Specific Differential Phase PH: Differential Phase

	RH: Co-polar Correlation VR: Doppler Velocity
[sw##|***.*AZ]	sw##: Elevation angle (only for PPI mode) ***.*AZ: Azimuth angle (only for RHI mode)
[PPI|RHI]	PPI: Plan Position Indicator mode RHI: Range Height Indicator mode
.png	Portable Network Graphics

Data Format and Parameters

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar OLYMPEX data consists of radar reflectivity, Doppler velocity, rain rate, and other radar-related direct and derived parameters. These files are in UF format. Information needed to read UF files with IDL is available at the GHRC. Table 3 describes the acronym and units for each parameter. Table 4 describes the classifications for the Hydrometeor Identification parameter.

Table 3: Data Fields

Parameter	Acronym	Unit
Radar Reflectivity	ZZ	dBz
Corrected Radar Reflectivity	CZ	dBz
Co-polar Correlation	RH	-
Differential Reflectivity	DR	dB
Differential Phase	PH	degrees
Specific Differential Phase	KD	degrees /km
Spectrum Width	SW	m/s
Signal Quality Index	SQ	-
Doppler Velocity	VR	m/s
Hydrometeor Identification	FH	-
Normalized Intercept Parameter (DM)	NW	-
Median Volume Diameter	D0	mm
Normalized Intercept Parameter (D0)	N2	-
DROPS2 Rain Rate	RR	mm/h
Pol ZR Rain Rate	RP	mm/h
Cifelli 2002 Rain Rate	RC	mm/h

Table 4: Hydrometeor Identification Classifications

Classification	Acronym
Unclassified	UC
Drizzle	DZ
Rain	RN
Ice Crystals	CR
Dry Snow	DS
Wet Snow	WS
Vertically-aligned Ice	VI

Low-density Graupel	LDG
High-density Graupel	HDG
Hail	HA
Big Drops	BD

Algorithm and Quality Assessment

GPM Ground Validation developed an algorithm that uses quality controlled radar data and is based on dual polarization parameters that are both modular and physically based. This helps to determine if an echo is precipitating. The Dual Polarization Quality Control (DPQC) algorithm can be applied to PPI and RHI scan types to allow users to easily view and manipulate the data. The output of this algorithm is the quality controlled radar structure in UF, as well as plots of quality controlled radar fields and a quality controlled parameter file. More detailed information about the DPQC algorithm is available in Pippitt et al., 2013. The NASA NPOL Doppler Radar calibrates as it is collecting data. More information about the calibration process and data quality can be found in Chandrasekar et al., 2008.

Software

These SCaMPR files are in UF format. The UF format is the common Doppler radar data exchange format described at UCAR (document based on a 1980 BAMS publication).
No special software is needed to read these UF data files; however, Panoply is an easy-to-use free tool for reading and visualizing the data within these UF files. More information about reading UF files with IDL is available at the GHRC.

Known Issues or Missing Data

This dataset does not have continuous data. Table 5 shows which dates have missing data.

Table 5: Dates with missing data

Missing Data Dates
November 7 - 11, 2015
November 27 - 29, 2015
December 20 - 30, 2015
December 31, 2015
January 1, 2016
January 2, 2016
January 7, 2016
January 9, 2016

References

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Pippitt, J. L., D. A. Marks, and D. B. Wolff (2013): Dual Polarimetric Quality Control for NASA's Global Precipitation Measurement (GPM) Mission Ground Validation Program.

Wolff, David B.: Olympic Mountain Experiment (Olympex). https://wallops-prf.gsfc.nasa.gov/Field_Campaigns/Olympex/

Related Data

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

In addition, other related data used the NPOL instrument in previous GPM Ground Validation, CAMEX-4, and NAMMA field campaigns. The following datasets contain NPOL data:

GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar **IFloodS** V2 (http://dx.doi.org/10.5067/GPMGV/IFLOODS/NPOL/DATA102)

GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar **IPHEx** (http://dx.doi.org/10.5067/GPMGV/IPHEX/NPOL/DATA101)

GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar **MC3E** (http://dx.doi.org/10.5067/GPMGV/MC3E/NPOL/DATA101)

CAMEX-4 NASA Portable S-Band Multiparameter WX Research Radar (http://dx.doi.org/10.5067/CAMEX-4/SBAND/DATA101)

NAMMA NASA Polarimetric Doppler Weather Radar (NPOL) (http://dx.doi.org/10.5067/NAMMA/NPOL/DATA101)

Contact Information

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

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