



## Data User Guide

# ***GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX***

### **Introduction**

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX dataset was collected during the GPM Ground Validation Integrated Precipitation and Hydrology Experiment (IPHEX) field campaign conducted in South Carolina from April 27, 2014 through June 16, 2014. The NPOL Doppler Radar scanned in high-resolution Plan Position Indicator (PPI), Range-Height Indicator (RHI), and PPI Sector (PPS) scan modes and provided measurements of precipitation in liquid, mixed, and ice phases. Data files are available in tarred universal format (UF) files, and browse images are available in compressed PNG files.

### **Citation**

Wolff, D. and D. Marks. 2016. GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX [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/IPHEX/NPOL/DATA101>

### **Keywords:**

*GHRC, NASA, IPHEX, GPM GV, South Carolina, WFF, NPOL, Doppler Radar, radar reflectivity, Doppler velocity, spectrum width, differential reflectivity, differential phase, specific differential phase, co-polar correlation, signal quality index, Signal-to-Noise Ratio*

### **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). 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 Integrated Precipitation and Hydrology Experiment (IPHEX) which was held in North Carolina during 2013 and 2014 with an intense study period from May 1 to June 15, 2014. The goal of IPHEX was to characterize warm season orographic precipitation regimes and the relationship between precipitation regimes and hydrologic processes in regions of complex terrain. The IPHEX campaign was part of the development, evaluation, and improvement of remote-sensing precipitation algorithms in support of the GPM mission through NASA GPM Ground Validation field campaign (IPHEX\_GVFC) and the evaluation of Quantitative Precipitation Estimation (QPE) products for hydrologic forecasting and water resource applications in the Upper Tennessee, Catawba-Santee, Yadkin-Pee Dee, and Savannah river basins (IPHEX-HAP, H4SE). NOAA Hydrometeorology Testbed (HTM) has synergy with this project. More information about IPHEX is available at <https://pmm.nasa.gov/IPHEX> and <http://dx.doi.org/10.5067/GPMGV/IPHEX/DATA101>.

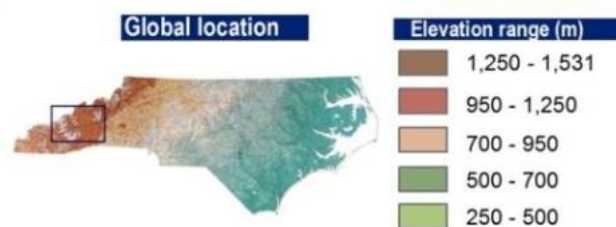


Figure 1: Region of North Carolina IPHEX campaign ground validation (image source: <http://gpm-gv.gsfc.nasa.gov/Gauge/>)

## Instrument Description

The NASA S-Band Dual Polarimetric (NPOL) Doppler Radar was developed by the research team at Wallops Flight Facility. This instrument is a fully transportable and self-contained S-band (10cm), scanning dual-polarimetric, Doppler research radar that collected and operated nearly continuously during the IPHEX field campaign. NPOL scanned in high-resolution PPI, RHI, and PPS modes and provided measurements of precipitation in liquid, mixed, and ice phases. The scanning strategy emphasized vertical and narrow sector-volume data collections, as well as frequent 3 minute full PPI rain scans for rain mapping. More information about the NASA S-Band Dual Polarimetric (NPOL) Doppler Radar is available at <http://pmm.nasa.gov/node/340>.

## Investigators

David Wolff  
NASA Goddard Space Flight Center/WFF

Greenbelt, Maryland

David Marks  
NASA Goddard Space Flight Center/WFF, SSAI  
Greenbelt, Maryland

## Data Characteristics

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX dataset consists of radar reflectivity, Doppler velocity, and other radar parameter data and browse images. The data consists of tarred UF data format files, while the browse images consist of compressed PNG files. Information needed to read Universal Format (UF) files with IDL is available at <https://ghrc.nsstc.nasa.gov/pub/doc/tcsp/tcspedop/UF-IDL.guide.txt>.

Once uncompressed and untarred, the data files are organized into directories by date and scan type, and the browse files are organized into directories by date and parameter.

These data were collected from April 27, 2014 through June 16, 2014 and are level 1B processing level. More information about the NASA data processing levels are available on the [NASA Data Processing Levels website](#). Table 1 shows the characteristics of the data file.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground stations
Instrument	NASA S-Band Dual Polarimetric (NPOL) Doppler Radar
Spatial Coverage	N: 35.199 , S: 35.194, E: -81.960, W: -81.967
Spatial Resolution	125m - 300m
Temporal Coverage	April 27, 2014 - June 16, 2014
Temporal Resolution	daily
Sampling Frequency	3-10 minutes
Parameter	Radar reflectivity, Doppler velocity, spectrum width, differential reflectivity, differential phase, specific differential phase, co-polar correlation, signal quality index, Signal-to-Noise Ratio
Version	1
Processing Level	1B

## File Naming Convention

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX data are in the following naming convention:

**Tarred Data File containing 1 day of data files:** npol\_iphex\_YYYY\_MMDD.tar

**Data Files:** iphex\_npol1\_YYYY\_MMDD\_hhmmss\_uf.gz

**Tarred Browse File:** iphex\_npol\_images\_YYYY\_MMDD.tgz

**Browse Files:** iphex\_npol1\_YYYYMMDD\_hhmmss\_DR\_###.#AZ|sw##|\_XXX.png

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
ss	Two-digit second in UTC
[###.#AZ sw##]	###.#AZ: Azimuth angle (only for RHI) sw##: Elevation angle (only for PPI and PPS)
XXX	Scan type (RHI, PPI, PPS)
.tar	Tarred file format
.uf	Universal format for radar
.tgz	Compressed file format
.png	Image file type

## Data Format and Parameters

The GPM Ground Validation NASA S-Band Dual Polarimetric (NPOL) Doppler Radar IPHEX data consists of radar reflectivity, Doppler velocity, spectrum width, differential reflectivity, differential phase, specific differential phase, co-polar correlation, signal quality index, and Signal-to-Noise ratio. Table 3 describes the acronym and units for each parameter.

Table 3: Parameter acronyms and units

Parameter	Acronym	Units
Radar Reflectivity	CZ	dBz
Differential Reflectivity	DR	-
Specific Differential Phase	KD	-
Differential Phase	PH	-
Co-Polar Correlation	RH	-
Doppler Velocity	VR	m/s
Spectrum Width	SW	m/s
Signal Quality Index	SQ	-
Signal-to-Noise Ratio	SN	-

## Algorithm and Quality Assessment

GPM Ground Validation developed an algorithm that uses quality control radar data and is based on dual polarization parameters that is 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, RHI, and PPS scan types to allow users to easily view and

manipulate the data. The output of this algorithm is the quality controlled radar structure in Universal Format, 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 is available in Chandrasekar et al., 2008.

## Software

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.

Information needed to read Universal Format (.uf) files with IDL is available at <https://ghrc.nsstc.nasa.gov/pub/doc/tcsp/tcspedop/UF-IDL.guide.txt>.

## References

Chandrasekar, V., A. Hou, E. Smith, V. N. Bringi, S. A. Rutledge, E. Gorgucci, W. A. Petersen, and G. S. Jackson (2008): Potential Role of Dual-Polarization Radar in the Validation of Satellite Precipitation Measurements. *American Meteorological Society BAMS*, August 2008, 1127- 1145. doi: <https://doi.org/10.1175/2008BAMS2177.1>

Marks, David A. (2016): Integrated Precipitation Hydrology Experiment (IPHEX). Retrieved from: [http://wallops-prf.gsfc.nasa.gov/Field\\_Campaigns/IPHEX/index.html](http://wallops-prf.gsfc.nasa.gov/Field_Campaigns/IPHEX/index.html)

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.

## Contact Information

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

Global Hydrology Resource Center  
User Services  
320 Sparkman Drive  
Huntsville, AL 35805  
Phone: 256-961-7932  
E-mail: [support-ghrc@earthdata.nasa.gov](mailto:support-ghrc@earthdata.nasa.gov)  
Web: <https://ghrc.nsstc.nasa.gov/>

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