Global Hydrology Resource Center

Data User Guide

GPM Ground Validation UNCA Upper Air Radiosonde IPHEx

Introduction

The GPM Ground Validation UNCA Upper Air Radiosonde IPHEx dataset was collected from April 29, 2014 through June 12, 2014 during the GPM Ground Validation Integrated Precipitation and Hydrology Experiment (IPHEx) held in North Carolina. 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. These radiosonde data files include pressure, geometric height, temperature, relative humidity, dew point temperature, wind direction, and wind speed measurements at various levels of the troposphere. The data are available in ASCII-tsv format files, and browse imagery are available as Portable Network Graphics (PNG) format files.

Notice: 18 clear day imagery is available upon request.

Citation

Miller, Douglas K. 2016. GPM Ground Validation UNCA Upper Air Radiosonde 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/RADIOSONDE/DATA201

Keywords:

NASA, GHRC, GPM GV, IPHEx, North Carolina, IMET-3050a, radiosonde, soundings, pressure, geometric height, temperature, relative humidity, dew point temperature, wind direction, wind speed

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.

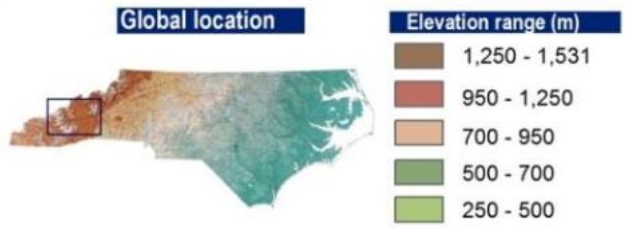

Figure 1: Region of North Carolina IPHEx campaign ground validation (image source: http://gpm-gv.gsfc.nasa.gov/Gauge/)

Instrument Description

The GPM Ground Validation UNCA Upper Air Radiosonde IPHEx dataset was collected by the iMet-3050a 403 MHz GPS Upper-air Sounding System. The radiosondes were launched at the University of North Carolina at Asheville (UNCA) campus. The sounding system receives signals from the iMet-1-ABXN radiosonde, applies internal quality control procedures to the signals (proprietary iMet software), and converts the quality controlled signals to vertical profiles of temperature, moisture, pressure, geopotential height, wind speed, and direction. Wind information is derived using GPS tracking of the radiosonde position. More detailed information about the iMet-3050a MHz Upper-air Sounding System is available at http://intermetsystems.com/ee/pdf/iMet-3050A_Data_140320.pdf and http://intermetsystems.com/index.php/products/imet-1.

Figure 1: iMet-3050a 403 MHz GPS Upper-air Sounding System
(Credit: http://intermetsystems.com/index.php/products/imet-3050a)

Figure 2: iMet 403 MHz Radiosonde that attaches to launch balloon
(Credit: http://intermetsystems.com/index.php/products/imet-1)

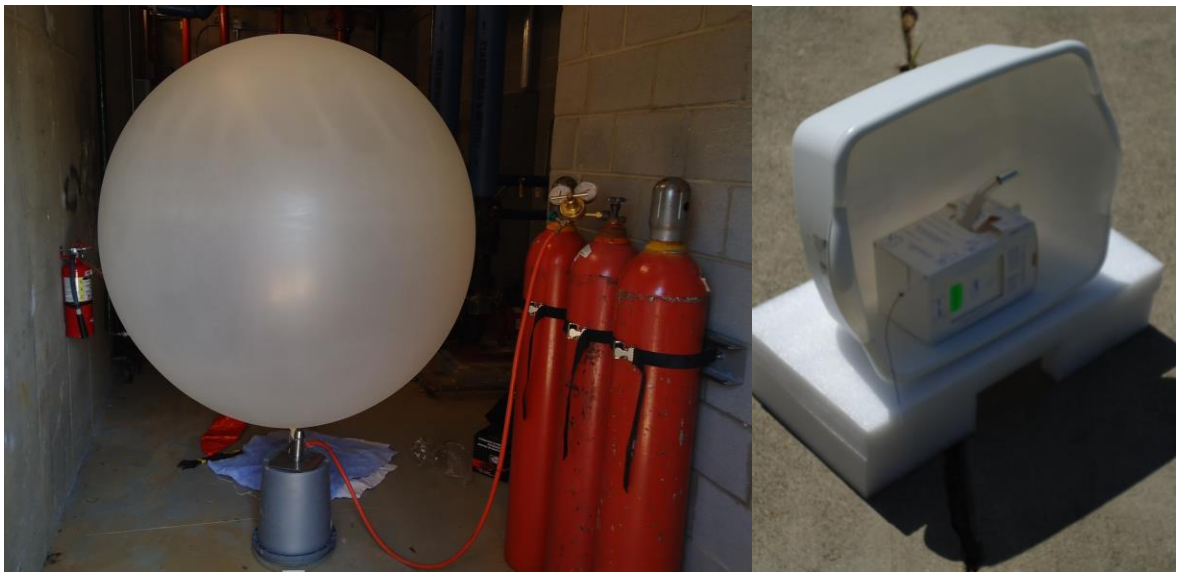

Figure 3: Launch balloon and iMet 403 MHz Radiosonde used to collect the GPM Ground Validation UNCA Radiosonde IPHEx data

(Credit: Douglas Miller)

Investigators

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Data Characteristics

GPM Ground Validation UNCA Upper Air Radiosonde dataset files are available in ASCII-tsv format. Browse images contain skew-T plots for each sounding available in PNG or postscript (.ps) format. A skew-T plot gives an informative picture of temperature, dewpoint, air pressure, and winds in the atmosphere above a particular point on the Earth's surface. These data were collected from April 29, 2014 through June 12, 2014 and are level 2 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 files.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground Station
Instrument	iMet-3050a 403 MHz GPS Upper-air Sounding System
Spatial Coverage	N: 35.6196 S: 35.1683, W: -82.5675 E: -82.5190 (University of North Carolina Asheville)
Spatial Resolution	Range: >250 km Altitude: >30 km

	(range and altitude depend on ground station location, balloon size and atmospheric conditions)
Temporal Coverage	April 29, 2014 - June 12, 2014
Temporal Resolution	Varies
Sampling Frequency	1 sec
Parameter	Pressure, geometric height, temperature, relative humidity, dew point temperature, wind direction, wind speed
Version	1
Processing Level	2

File Naming Convention

The GPM Ground Validation UNCA Upper Air Radiosonde IPHEx data are named with the following convention:

Data files:
iphex_radiosonde_YYYYMMDD _[csop|iop]##_xxx_nnn_[LOG|SIG|STD].txt
iphex_radiosonde_YYYYMMDD_[csop|iop]##_snd**.txt

Browse files:
iphex_radiosonde_YYYYMMDD_[csop|iop]##_snd**.[png|ps]

Table 2: File naming convention variables

Variable	Description
YYYY	4-digit year
MM	2-digit month
DD	2-digit day
[csop/iop]##	IOP (Intensive Observation Period)/CSOP (Clear Sky Observation Period) number
xxx_nnn	reference number of sounding where nnn matches sounding number in the corresponding snd file name
[LOG|SIG|STD]	LOG: log data file SIG: significant pressure levels report* STD: standard pressure levels report**
snd**	sounding number for that day
.txt	ASCII-tsv text file
.png	Portable Network Graphics format
.ps	Postscript file format

*SIG files contain selected pressure levels of interesting structure related to air temperature, wind, or moisture
**STD files contain standard pressure levels of data, these levels are the same for every sounding

Data Format and Parameters

The GPM Ground Validation UNCA Upper Air Radiosonde IPHEx dataset consists of air temperature, relative humidity, smoothed air pressure, geopotential height, wind direction,

wind speed, slant range, latitude, longitude, status flag, raw temperature, and geometric height measurements.

The SIG files are significant pressure level files and are a subset of all data collected during the radiosonde flight. In these files, the first 14 rows are header lines with information about the date and location of data collection, surface observations, and radiosonde details. Rows 15-21 and 46-51 are column headers identifying which parameter is in each column. Rows 22-45 and rows after row 51 contain data. Table 3 shows which parameter is in each column, as well as the units of each parameter.

STD files are standard pressure level files and are a subset of all data collected during the radiosonde flight. In STD files, the first 16 rows are header lines with information about the date and location of data collection, surface observations, and sonde details. Rows following are header rows and data for the standard pressure levels. Next are headers and rows for specific levels such as freezing level, tropopause, max wind level, and last measured level. Table 3 shows which parameter is in each column of a data row, as well as the units of each parameter.

LOG files contain the raw data from the iMet-3050 403 MHz GPS Upper-air Sounding System. LOG files do not have header lines. Table 4 shows which parameter is in each column of the LOG FILE as well as the units of each parameter. The log files do not contain any time information.

The snd files contain the data from the associated SIG, STD and LOG files. All data are accumulated into one snd file, and are therefore repeated. The headers in the snd file are the same as described for the SIG, STD and LOG files, except the line numbers differ as the contents for all 3 files are included in the snd file.

There are cases for which the SIG file does not exist (4/29, 4/30, and 6/12/2014) or the data inside the file are missing. These have been confirmed to be missing data either due to the data not being collected (such as on 4/29, 4/30, the first two days of the project) or due to an unexpected communications failure (such as on 6/12, the final day of the project).

Table 3: Data Fields for SIG and STD files

Column	Parameter	Description	Unit
1	PRES	Pressure at given time	mb
2	TIME	Time since deployment HH:MM:SS HH: Two-digit hour MM: Two-digit minute SS: Two-digit second	hour, minute, second
3	HGT/MSL	Geometric height above mean sea level	m
4	TEMP	Temperature	°C
5	RH	Relative humidity	%
6	DEWP	Dewpoint temperature	°C
7	W. D	Wind direction	°

8	W. S	Wind speed	knots
9**	CODE	Information such as radiosonde first or last measurement or which parameter is significant at that level	-

**Column 9 is not in STD files, only in SIG files.

Table 4: Data Fields for LOG files

Column	Description	Unit
1	Air temperature	°C
2	Virtual temperature	K
3	Relative humidity	%
4	Smoothed air pressure	hPa
5	Geopotential height	m
6	No Data	-
7	No Data	-
8	Wind directions	radians
9	Wind speed	kts
10	Slant range	m
11	Status flags*	-
12	latitude	°
13	longitude	°
14	Raw temperature	°C
15	Geometric height	m
16	No Data	-
17	No Data	-

*No Data. iMet built into the software room for future data needs.

Algorithm

The FORTRAN code used to create the Skew T diagrams plotted in the .png or .ps files are included with the raw text files when downloaded. These programs are named new_rdsnd.f and new_skewt.f.

Quality Assessment

Table 5 shows the estimated accuracy for the GPS altitude, position, and velocity, and the pressure, temperature, relative humidity, wind direction, wind speed, and geopotential height measurements.

Table 5: Accuracy

Description	Range	Accuracy	iMET Results
GPS Altitude	-50 m to 42 km	-	-50 m to 42 km
GPS Position	Any lat, long	-	5 m
GPS Velocity	0 - 250 m/s	-	0.1 m/s

			Smoothed error
Pressure	Surface to 100 hPa	1hPa to 2hPa near 100 hPa	0.5 hPa across entire range
	100 to 10 hPa	2%	
Temperature	Surface to 100 hPa	0.5 K	0.2 K across entire range
	100 to 10 hPa	1.0 K	
Relative Humidity	Troposphere	5% RH	5% RH
Wind Direction	Surface to 100 hPa	5° for less than 14 m/s	≤5°
		2.5° at higher speeds	≤2.5°
	100 to 10 hPa	5°	≤5°
Wind Speed	Surface to 100 hPa	1 m/s	0.1 m/s across range
	100 hPa to 10 hPa	2 m/s	
Geopotential Height	Surface to 100 hPa	1% near surface decreasing to 0.5% at 100 hPa	1% to 0.5%

Software

Software is not required to view the ASCII-tsv text files in the GPM Ground Validation UNCA Upper Air Radiosonde IPHEx dataset. The FORTRAN programs used to make the skew-T plots are available to users and consist of one subroutine to read the snd file and one to plot the skew-T figure.

References

2006. iMet-1-ABxn Radiosonde 403 MHz GPS with Pressure Sensor. http://intermetsystems.com/ee/pdf/iMet-1-ABxn_Data_150316.pdf.

2006. iMet-3050A 403 MHz GPS Portable Sounding System. http://intermetsystems.com/ee/pdf/iMet-3050A_Data_140320.pdf.

UNCA IPHEx: http://www.atms.unca.edu/iphex/rt_iphex_2014.html

Contact Information

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

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Web: https://ghrc.nsstc.nasa.gov/

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