Data User Guide

GPM Ground Validation NASA ER-2 Navigation Data IPHEx

Introduction

The GPM Ground Validation NASA ER-2 Navigation Data IPHEx dataset was gathered during the GPM Ground Validation Integrated Precipitation and Hydrology Experiment (IPHEx) in North Carolina. The ER-2 Aircraft flew during the IPHEx field campaign to aid in GPM validation. The science instruments onboard the aircraft acted as a proxy for GPM satellite instruments. Twenty-one ER-2 flights occurred during May 1, 2014 through June 14, 2014. The dataset consists of navigation data, as well as meteorological parameters collected by an on-board navigation recorder every second of the flight. The data are available in ASCII and XML formats.

Citation

Moes, Timothy R, Christopher R Miller and Carl Sorenson. 2016. GPM GROUND VALIDATION NASA ER-2 NAVIGATION DATA IPHEX [indicate subset used]. Dataset available online from the NASA Global Hydrology Center DAAC, Huntsville, Alabama, U.S.A. DOI: http://dx.doi.org/10.5067/GPMGV/IPHEX/NAV/DATA002

Keywords

NASA, GHRC, IPHEx, ER-2, navigation data, aircraft data, North Carolina, upper air temperature, upper level winds, airspeed, ground speed, altitude, pressure, temperature, AMPR, HIWRAP, EXRAD, CoSMIR, LIP, INMARSAT

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 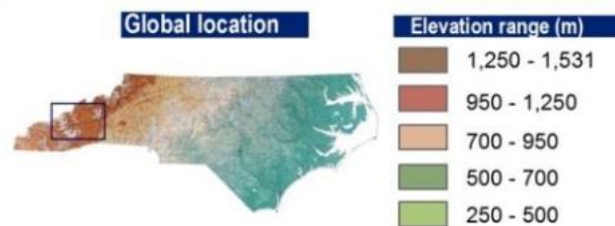this project. More information about IPHEx is available at https://pmm.nasa.gov/IPHEx and http://dx.doi.org/10.5067/GPMGV/IPHEX/DATA101.

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

Instrument Description

For the IPHEx field campaign, NASA's Airborne Science ER-2 Aircraft was equipped with multi-frequency-radiometers (AMPR and CoSMIR) and multiple radars (CRS, EXRAD, HIWRAP) and functioned as an expanded GPM Core satellite proxy. The on-board navigation recorder on the ER-2 recorded date, time, latitude and longitude, and altitude as well as wind speed, wind direction, and temperature at one second intervals throughout the length of the flight.

More information about the ER-2 Aircraft can be found at https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-046-DFRC.html.

Figure 2: NASA ER-2
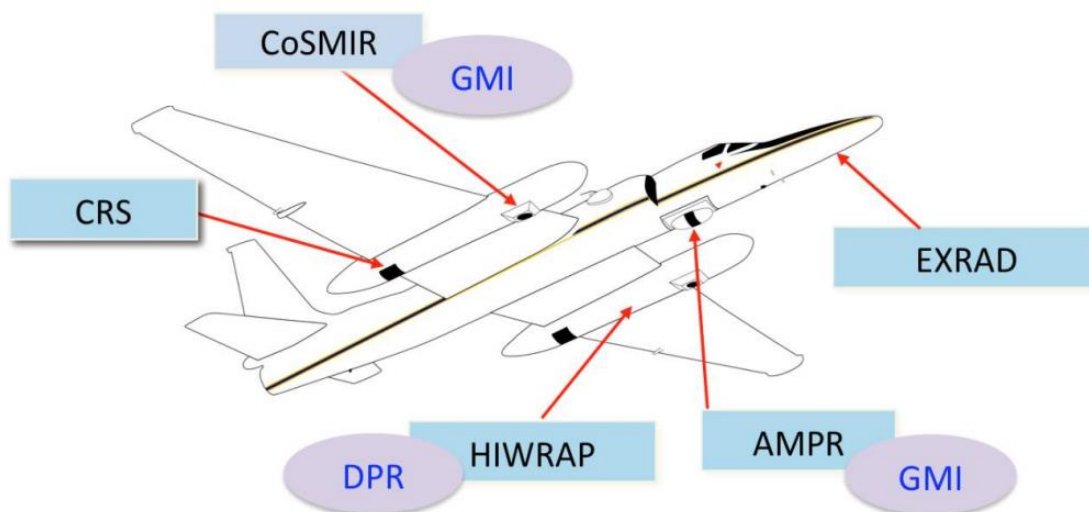(Image source: NASA Armstrong ER-2 Fact Sheet)

Figure 3: Location of IPHEx remote sensing instruments on the NASA ER-2 aircraft.
The blue boxes label the instruments onboard, and the purple circles indicate which GPM
Satellite instrument they can simulate.
(Image source: IPHEx Science Plan)

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Data Characteristics

The GPM Ground Validation NASA ER-2 Navigation Data IPHEx dataset files consist of navigation and meteorological measurements. These data were collected from ER-2 flights that occurred from May 1, 2014 through June 14, 2014 and are a Level 1A 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 dataset.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA ER-2 Aircraft
Instrument	Various navigation and pressure, wind and temperature sensing instruments on the aircraft
Projection	n/a
Spatial Coverage	N: 46.7 , S:26.8 , E: -71.61 , W: -121.85 (North Carolina)
Temporal Coverage	May 1, 2014 - June 14, 2014, 1 file per flight
Temporal Resolution	Hourly - <Daily
Sampling Frequency	second
Parameter	Aircraft and Atmospheric conditions
Version	1
Processing Level	1A

File Naming Convention

The GPM Ground Validation NASA ER-2 Navigation Data IPHEx data files have the file naming convention shown below. The data files are available in ASCII and XML formats.

Data files: iphex_naver2_[IWG1|log]_<start time>_<end time>.[txt|xml]

Table 2: File naming convention variables

Variable	Description
[IWG1| log]	IWG1: The IWG1 is a specific style of file used for aircraft navigation. Platform characteristics are provided over time of the flight, in either ASCII or XML

	format Log: Logs of the instrument activation during the flight
<start_time>_<end_time>	Start and end time of the flight as YYYYMMDD-hhmm, in UTC where: YYYY = four-digit year MM = two-digit month DD = two-digit day hh = two-digit hour mm = two-digit minute **Note:** xml file does not contain end time in filename.
[txt|xml]	txt: ASCII and ASCII-IWG1 formats xml: XML format

Data Format and Parameters

The GPM Ground Validation NASA ER-2 Navigation Data IPHEx data are available in ASCII and XML format. The data processing level for these data is 1A. More information about NASA data processing levels can be found at: http://science.nasa.gov/earth-science/earth-science-data/data-processing-levels-for-eosdis-data-products/

The data files contain platform characteristics of the NASA ER-2 aircraft while in flight during the IPHEx field campaign. There is 1 file per ER-2 flight. The IWG is a particular style of ASCII file often used for aircraft navigation data. For more information, see the UCAR IWG1 specifications .

Table 3 describes the data fields of the IPHEx ER-2 files. Each line represents 1 second of the flight, so there will be entrees where not every field has a value. For more information about the data format and parameters, see the PI Documentation.

Table 3: Data Fields

Field Name	Description	Unit	Valid Data Range
Date/Time	ISO-8601 formatted date and time	UTC	-
Lat	Platform Latitude in decimal degrees	degree_N	-90 to 90
Lon	Platform Longitude in decimal degrees	degree_E	-180 to 179.9999
GPS_MSL_Alt	GPS Altitude, Mean Sea Level (MSL)	m	-
WGS_84_Alt	WGS 84 Geoid Altitude	m	-
Press_Alt	Pressure Altitude	feet	-
Radar_Alt	Radar Altimeter Altitude	feet	Zero or greater

Grnd_Spd	Ground Speed	m/s	-
True_Airspeed	True Airspeed	m/s	-
Indicated_Airspeed	Indicated Airspeed	knots	-
Mach_Number	Aircraft Mach Number	-	-
Vert_Velocity	Aircraft Vertical Velocity (Negative is downward, positive is upward.)	m/s	-
True_Hdg	True Heading	degrees_true	0 to 359.9999
Track	Track Angle	degrees_true	0 to 359.9999
Drift	Drift Angle	degrees	-
Pitch	Pitch (Negative is nose down, positive is nose up.)	degrees	-90 to 90
Roll	Roll (Negative is left wing down, positive is right wing down.)	degrees	-90 to 90
Side_slip	Side Slip Angle	degrees	-
Angle_of_Attack	Angle of Attack (Negative is nose down, positive is nose up.)	degrees	-90 to 90
Ambient_Temp	Ambient Temperature	degrees_C	-
Dew_Point	Dew Point	degrees_C	-
Total_Temp	Total Temperature	degrees_C	-
Static_Press	Static Pressure	mbar	-
Dynamic_Press	Dynamic Pressure (total minus static)	mbar	-
Cabin_Pressure	Cabin Pressure / Altitude	mbar	-
Wind_Speed	Wind Speed	m/s	Zero or greater
Wind_Dir	Wind Direction	degrees_true	0 to 359.9999
Vert_Wind_Spd	Vertical Wind Speed (Negative is downward, positive is upward.)	m/s	-
Solar_Zenith	Solar Zenith Angle	degrees	-
Sun_Elev_AC	Sun Elevation from Aircraft	degrees	-
Sun_Az_Grd	Sun Azimuth from Ground	degrees_true	0 to 359.9999
Sun_Az_AC	Sun Azimuth from Aircraft	degrees_true	0 to 359.9999

Software

These data are available in ASCII and XML format, so no software is required to view these data. XML files can be easier to read if opened with Excel and converted to an excel sheet.

References

Duke University. (2015). IPHEX-GVFC | IPHEx: Integrated Precipitation and Hydrology Experiment. http://iphex.pratt.duke.edu/node/64

Goddard Space Flight Center. (2014). IPHEx Field Campaign | Precipitation Measurement Missions. https://pmm.nasa.gov/iphex

UCAR. (2009). IWG1 Packet Definition.
https://www.eol.ucar.edu/raf/Software/iwgadts/IWG1_Def.html

Related Data

All data from other instruments collected during the IPHEx field campaign are related to this dataset. The following datasets are from the instruments onboard the ER-2 during the flights for the campaign. The full list of IPHEx campaign data can be located using the GHRC HyDRO 2.0 search tool.

GPM Ground Validation Conical Scanning Millimeter-wave Imaging Radiometer (CoSMIR) IPHEx
(http://dx.doi.org/10.5067/GPMGV/IPHEX/CoSMIR/DATA101)

GPM Ground Validation Cloud Radar System (CRS) IPHEx
(http://dx.doi.org/10.5067/GPMGV/IPHEX/CRS/DATA101)

GPM Ground Validation ER-2 X-band Radar (EXRAD) IPHEx
(http://dx.doi.org/10.5067/GPMGV/IPHEX/EXRAD/DATA101)

GPM Ground Validation High-Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP) IPHEx
(http://dx.doi.org/10.5067/GPMGV/IPHEX/HIWRAP/DATA101)

GPM Ground Validation Advanced Microwave Precipitation Radiometer (AMPR) IPHEx
(http://dx.doi.org/10.5067/GPMGV/IPHEX/AMPR/DATA202)

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/

Updated: **June 11, 2018**