GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX

Introduction

The GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX dataset supplies navigation data collected by the NASA ER-2 aircraft for flights that occurred during November 9, 2015 through December 15, 2015 for one of the GPM Ground Validation field campaigns was the Olympic Mountains Experiment (OLYMPEX). This navigation dataset consists of multiple altitude, pressure, temperature parameters, airspeed, and ground speed measurements in ASCII, ASCII-IWG1, and XML data file formats.

Notice:
There is one file per NASA ER-2 aircraft flight. Since flights do not occur on a regular basis during the field campaign, there are missing days between November 9, 2015 and December 15, 2015.

Citation

Mace, Jay. 2017. GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX [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/NAV/DATA201

Keywords:

NASA, GHRC, OLYMPEX, Washington, ER-2, aircraft, navigation, aircraft characteristics, flight times and locations

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/.

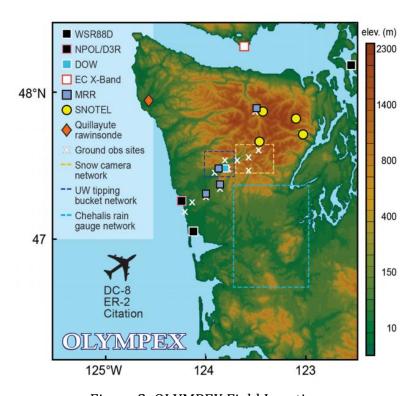Figure 1: OLYMPEX Domain
(Image Source: https://pmm.nasa.gov/OLYMPEX)

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

Aircraft Description

The NASA ER-2 aircraft is a high-altitude aircraft capable of carrying a variety of instruments, such as AMPR, HIWRAP, EXRAD, CRS, AirMSPI, CPL, and eMAS. The NASA ER-2 aircraft has set a world altitude record for aircraft with a takeoff weight between 26,455 and 35,275 lbs reaching 68,700 feet on November 19, 1998. The NASA ER-2 aircraft is a versatile aircraft operating above 99% of the Earth's atmosphere. The ER-2 can fly into the lower stratosphere at subsonic speeds, and plays an important role in Earth science research. Instruments on the ER-2 can be used to simulate satellite observations.

The typical cruise speed of the ER-2 aircraft is about 410 knots, with a normal 8-hour mission range of 3,000 nautical miles. The aircraft can carry up to 2,600 lb of instruments and equipment distributed throughout the equipment bay, nose area, and wing pods. The modular design on the NASA ER-2 aircraft allows for rapid removal and installation of payloads to meet changing requirements of different missions. More information about the NASA ER-2 aircraft can be found on the NASA Armstrong Fact Sheet and on the Armstrong Flight Research Center webpage.

Figure 3: NASA ER-2 Aircraft
(Image source: https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-046-DFRC.html)

Investigators

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Data Characteristics

The GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX data files are available in ASCII, ASCII-IWG1, and XML formats at a Level 1A data processing level. More information can be found about data processing levels on the NASA Data Processing Levels website.

Table 1: Data Characteristics

Characteristic	Description
Aircraft	NASA ER-2
Projection	n/a
Spatial Coverage	N: 49.634 , S: 34.158, E: -117.775, W: -130.045 (Washington)
Temporal Coverage	November 9, 2015 - December 15, 2015
Temporal Resolution	1 file per flight
Sampling Frequency	Varies: <10 minutes
Parameter	aircraft and atmospheric conditions
Version	1
Processing Level	1A

File Naming Convention

The GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX data files have the file naming convention shown below. The data files are available in ASCII, ASCII-IWG1, and XML formats.

Data files: olympex_naver2_[log_IWG1|IWG1|IWG1_parameters]_YYYYMMDD[-hhmm].[txt|xml]

Table 2: File naming convention variables

Variable	Description
[log_IWG1|IWG1|IWG1_parameters]	log_IWG1: logs of instrument activation during flight IWG1: The IWG1 is a specific style of file used for aircraft navigation. platform characteristics are provided over time of the flight IWG1_parameters: list of parameters within the IWG1 files
YYYYMMDD[-hhmm]	Date the flight started, where: YYYY: four-digit year MM: two-digit month DD: two-digit day Last time recorded of the flight, where: hh: two-digit hour in UTC mm: two-digit minute in UTC Note that some flights cross the UTC day. For instance, on Nov 19, 2015, the flight completed on Nov 20, 2015 at 0046
[txt|xml]	txt: ASCII and ASCII-IWG1 formats xml: XML format

Data Format and Parameters

The GPM Ground Validation NASA ER-2 Navigation Data OLYMPEX dataset consists of ASCII, ASCII-IWG1, and XML data files. The data files contain platform characteristics of the NASA ER-2 aircraft while in flight during the OLYMPEX 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 platform characteristics of the OLYMPEX ER-2 files.

Table 3: Data Fields

Field Name	Description	Unit

System_Timestamp	System timestamp (Unix epoch)	UTC
Latitude	Latitude of aircraft	Degrees N
Longitude	Longitude of aircraft	Degrees E
GPS_Altitude-MSL	Altitude of the aircraft above the mean sea level estimated by the GPS	m
GPS_Altitude	Altitude of the aircraft estimated by the GPS	m
Pressure_Altitude	Atmospheric pressure at current aircraft altitude	mbar
RADAR_Altitude	Altitude of aircraft calculated by the radar	ft
Ground_Speed	Ground speed below aircraft	m/s
True_Air_Speed	True air speed of the ER-2 aircraft	m/s
Indicated_Air_Speed	Indicated air speed of the aircraft	m/s
Mach_Number	ER-2 mach number	-
Vertical_Speed	Vertical speed - inertial +/- 32,768 ft/min	ft/min
True_Heading	True heading - Hybrid +/- 180 degrees	deg
Track_Angle	Track angle	deg
Drift_Angle	Drift angle +/- 180 degrees	deg
Pitch_Angle	Pitch angle +/- 180 degrees	deg
Roll_Angle	Roll angle +/- 180 degrees	deg
Slip_Angle	Slip angle	deg
Attack_Angle	Angle of attack	deg
Static_Air_Temp	Static air temperature of the ER-2 aircraft	Deg C
Dew_Point	Dew point temperature	Deg C
Total_Air_Temp	Total air temperature calculated	Deg C
Static_Pressure	ER-2 static air pressure	mbar
Dynamic_Pressure	ER-2 dynamic air pressure	mbar
Cabin_Pressure	Cabin pressure transducer	mbar
Wind_Speed	Wind speed, 0-132 m/s	m/s
Wind_Direction	Wind direction	-
Vert_Wind_Speed	Vertical wind speed	m/s
Solar_Zenith_Angle	Solar zenith angle	deg
Aircraft_Sun_Elevation	Sum elevation in aircraft reference frame	deg
Sun_Azimuth	Solar azimuth angle	deg
Aircraft_Sun_Azimuth	Sun azimuth in aircraft reference frame	deg

Software

These data are available in ASCII, ASCII-IWG1, and XML formats; therefore, 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.

Known Issues or Missing Data

Since these data files are collected during each NASA ER-2 flight, there are missing days between November 9, 2015 and December 15, 2015 as flights did not occur on a regular basis.

Related Data

All data 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 by entering "OLYMPEX" in the search bar.

In addition, other data that used the NASA ER-2 aircraft as a platform are related to this dataset. The following datasets used the NASA ER-2 aircraft for data collection:

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

GPM Ground Validation Cloud Physics LiDAR (CPL) OLYMPEX (http://dx.doi.org/10.5067/GPMGV/OLYMPEX/CPL/DATA101)

Contact Information

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

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