Data User Guide

GPM Ground Validation UND Citation Navigation Data OLYMPEX

Introduction

The GPM Ground Validation UND Citation Navigation Data OLYMPEX dataset supplies navigation data collected by the Cessna Citation II aircraft for flights that occurred during November 12, 2015 through December 19, 2015 for the Olympic Mountains Experiment (OLYMPEX) GPM Ground Validation field campaign. This navigation dataset consists of multiple altitude, pressure, temperature, airspeed, and ground speed measurements in ASCII format.

Notice:
There is one file per UND Citation aircraft flight. Since flights do not occur on a regular basis during the field campaign, there are missing days between November 12, 2015 through December 19, 2015.

Citation

Delene, David. 2017. GPM Ground Validation UND Citation 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/DATA101

Keywords:

NASA, GHRC, OLYMPEX, Washington, UND Citation, 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)
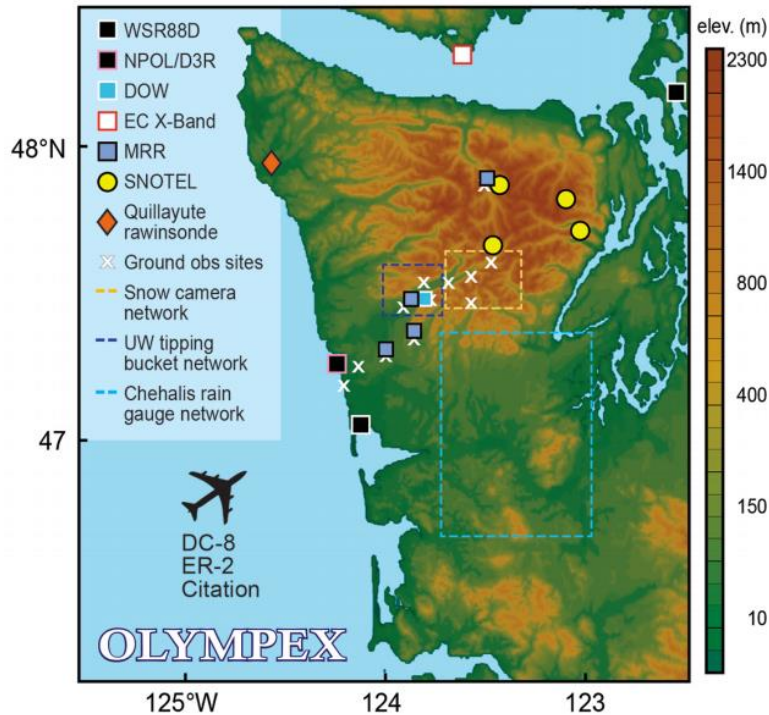
Figure 2: OLYMPEX Field Locations
(Image Source: https://pmm.nasa.gov/OLYMPEX)

Aircraft Description

The Cessna Citation II aircraft is owned by the University of North Dakota and is used for atmospheric research. The Cessna Citation II is a twin-engine fanjet that can fly up to an altitude of 43,000 feet. It has a turbofan engine allowing speeds up to 175 m/s. The Cessna Citation II aircraft has relatively low fuel consumption allowing for flight times of 3-5 hours. The Cessna Citation II has long wings that allow the aircraft to fly at slower speeds (72 m/s), to fly in icy conditions, and to take off from airports with short airstrips. The research instrumentation on the Cessna Citation II aircraft are used to collect data for meteorology, cloud physics, air chemistry, and aerosol research. The primary dataset associated with the Cessna Citation II is the particle probe data. More information about the Cessna Citation II aircraft is available on the University of North Dakota Aerospace webpage and on the NASA Airborne Science Program webpage.
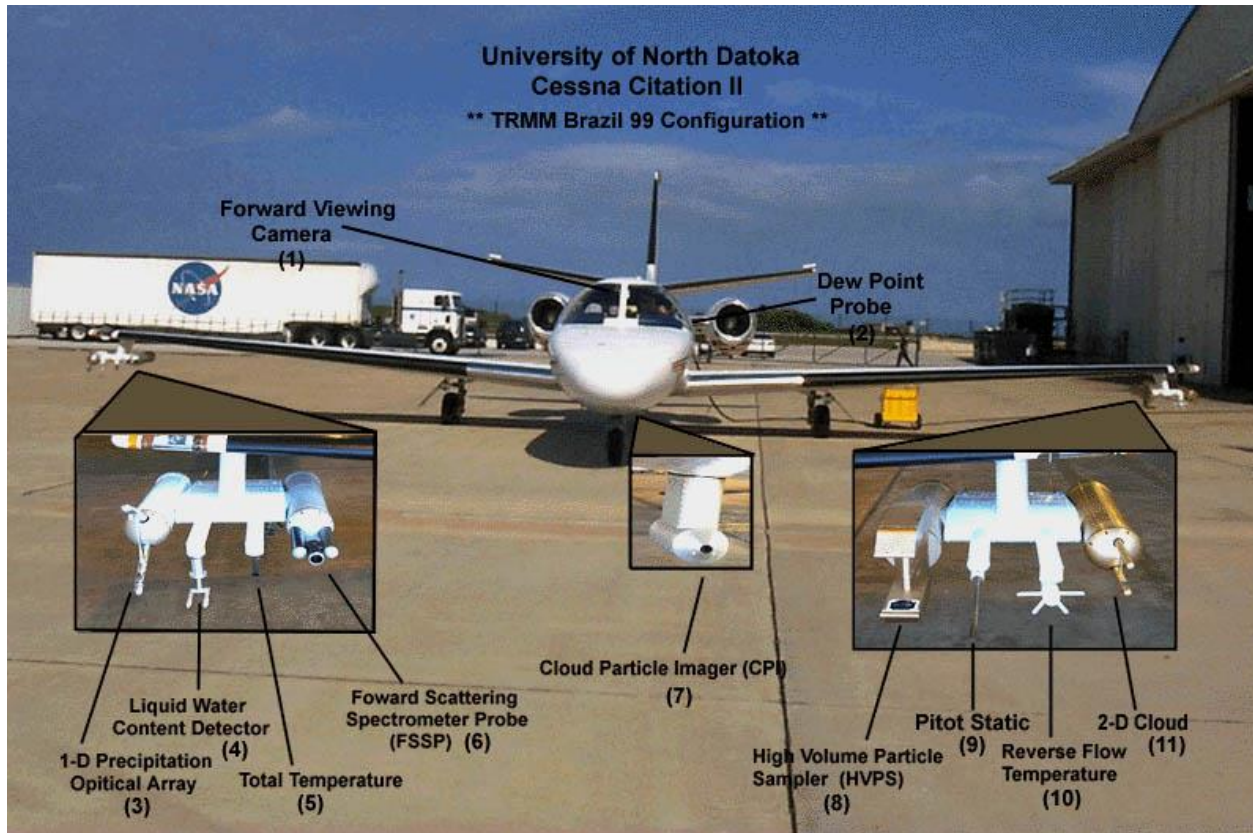
Figure 3: Cessna Citation II aircraft
(Image Source: UND Aerospace)

Investigators

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Data Characteristics

The GPM Ground Validation UND Citation Navigation Data OLYMPEX data files are available in ASCII format 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	UND Citation II
Projection	n/a
Spatial Coverage	N: 48.299, S: 46.221, E: -122.134, W: -126.129 (Washington)
Temporal Coverage	November 12, 2015 - December 19, 2015
Temporal Resolution	1 file per flight

Sampling Frequency	1 second
Parameter	Aircraft and atmospheric conditions
Version	1
Processing Level	1A

File Naming Convention

The GPM Ground Validation UND Citation Navigation Data OLYMPEX data files have the file naming convention shown below. The data files are available in ASCII format. The date and time of the file names are start time of the flight.

Data files: olympex_navcit_YYYYMMDD_hhmmss.txt

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
.txt	ASCII format

Data Format and Parameters

The GPM Ground Validation UND Citation Navigation Data OLYMPEX dataset consists of ASCII data files. The data files contain platform characteristics of the UND Citation aircraft while in flight during the OLYMPEX field campaign. There is 1 file per UND Citation flight. Table 3 describes the platform characteristics of the OLYMPEX UND Citation files.

Table 3: Data Fields

Field Name	Description	Unit
Time	Time is UT seconds from midnight on day aircraft flight started	s
Air_Temp	Air temperature corrected for dynamic hearing (based first on the main temperature/pitot instrument and secondarily based on the backup temperature/pitot instrument)	Deg C
MachNo_N	Mach number (Based first on the main temperature/pitot instrument and secondly on the backup temperature/pitot instrument	-
IAS	Indicated air speed (Based first on the main pitot instrument and secondly on the backup pitot instrument)	m/s
TAS	True air speed (Based first on the main temperature/pitot instrument and secondly on the backup temperature/pitot instrument)	m/s
Press_Alt	Pressure altitude	m

Pot_Temp_T1	Potential temperature (Based first on the main temperature/pitot instrument and secondly on the backup temperature/pitot instrument)	K
STATIC_PR	Static pressure Calibration: slope = 207.08000 offset = -0.71000000	hPa
DEWPT	Dewpoint temperature from EG&G Probe Calibration: slope = 20.00000 offset = -70.000000	Deg C
REL_HUM	Relative humidity from the EG&G probe	%
MixingRatio	Mixing ratio by weight from the Laser Hygrometer	ppmw
DewPoint	Dew point temperature from the Laser Hygrometer	Deg C
FrostPoint	Frost point temperature from the Laser Hygrometer	Deg C
RH	Relative humidity from the Laser Hygrometer with, respect to water T >= 0 respect to ice T < 0	%
IceMSOFreq	The current sensor (MSO) frequency from the Icing Detector	Hz
TSG_Date	Date stamp based on data file name Example: 941119 is 19 November 1994	stamp
POS_Roll	Aircraft roll angle from the Applanix Position and Orientation System (POS) -180 to 180 range with 0 being level and positive angles in the clockwise (right) direction	deg
POS_Pitch	Aircraft pitch angle from the Applanix Position and Orientation System (POS) -180 to 180 range with 0 being level and positive angles in the clockwise (upward) direction away from center of the Earth	deg
POS_Head	Aircraft heading angle from the Applanix Position and Orientation System (POS) 0 to 360 range with 0 being North and angles increasing in a clockwise (right) direction	deg
POSZ_Acc	Aircraft z-direction (vertical) acceleration for the Applanix Position and Orientation System (POS)	m/s^2
POS_Lat	Aircraft latitude from the Applanix Position and Orientation System (POS) -90 to 90 range with positive values in Northern Hemisphere and negative values in Southern Hemisphere	deg
POS_Lon	Aircraft longitude from the Applanix Position and Orientation System (POS) -180 to 180 range with positive values in the Eastern Hemisphere and negative values in Western Hemisphere	deg
POS_Alt	Aircraft altitude from the Applanix Position and Orientation System (POS)	m
POS_Spd	Aircraft ground speed from the Applanix Position and	m/s

	Orientation System (POS)	
POS_Trk	Aircraft track angle from the Applanix Position and Orientation System (POS) 0 to 360 range with 0 being North and angles increasing in a clockwise (right) direction	deg
Alpha	Alpha (attack) angle Calibration: slope = 0.066317100 offset = 0.40082229	deg
Beta	Beta (Sideslip) angle Calibration: slope = 0.085875130 offset = 0.16014451	deg
VERT_VEL	Vertical velocity of the aircraft based on the change in position over a 2 second interval	m/s
Wind_Z	Z (vertical) component of the wind speed (positive value is upward, away from the Earth's surface)	m/s
Wind_M	Horizontal wind speed	m/s
Wind_D	Horizontal wind direction. True direction from which it blows	deg
TURB	Turbulence parameter (Eddy Dissipation Rate) based on Wing Pitot pressure	$cm^2/3 {*} s^{-1}$
King_LWC_ad	Liquid water content based on King Probe measurement adjusted (cloud threshold = 5.1 #/cm^3), cloud interval = 30.0 s, and adjustment slope = 0.500) for the baseline offset	g/m^3
Nev_TWC	Total water content based on the Nevzorov Probe measurement	-
Nev_LWCcor	Liquid water content based on the Nevzorov Probe measurement with correction for residual ice Beta = 0.110000	g/m^3
Nev_IWC	Ice water content based on the Nevzorov Probe measurement Beta = 0.110000	g/m^3
CSI_M_Ratio	CSI mixing ratio	g/m^3
CSI_CWC	Cloud water content from the CSI probe with correction Calibration: TDL slope = 1.5070000 TDL offset = 0.025000000 Out-of-Cloud slope = 1.000000 Out-of-Cloud offset = 0.000000	g/m^3
CDP_Conc	Number concentration of droplets based on the Cloud Droplet Probe	#/cc
CDP_LWC	Liquid water content based on the Cloud Droplet Probe	g/m^3
CDP_MenD	Cloud droplet probe's mean droplet diameter	um
CDP_VolDia	Cloud droplet probe's mean droplet volume diameter	um
CDP_EffRad	Cloud droplet probe's effective droplet radius	um
2-DC_Conc	Number concentration of droplets based on the 2-DC Probe measurements	#/cm^3
2-DC_MenD	Mean droplet diameter based on the 20DC Probe measurements	um

2-DC_VolDia	Mean droplet volume diameter based on the 2-DC Probe measurements	um
2-DC_EffRad	Effective droplet radius based on the 2-DC Probe measurements	um
Nt2DSHGT105	TwoDS (SN: 012) horizontal total normalize particle concentration of particles greater than 105 microns	$\#/m^3$
Nt2DSH_all	TwoDS (SN: 012) horizontal total normalize particle concentration for all bin size	$\#/m^3$
Nt2DSVGT105	TwoDS (SN: 012) vertical total normalize particle concentration of particles greater than 105 microns	$\#/m^3$
Nt2DSV_all	TwoDS (SN: 012) vertical total normalize particle concentration for all bin sizes	$\#/m^3$
Nt_HVPS3H	HVPS3 (SN: 04) horizontal total normalize particle concentration for all bin sizes	$\#/m^3$
Nt_HVPS3BV	HVPS3 (SN: 07) vertical total normalize particle concentration for all bin sizes	$\#/m^3$

Software

These data are available in ASCII format; therefore, no special software is required to view these data.

Known Issues or Missing Data

Since these data files are collected during each UND Citation aircraft flight, there are missing days between November 12, 2015 through December 19, 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 UND Citation II aircraft as a platform are related to this dataset. The following datasets used the UND Citation II aircraft for data collection:

GPM Ground Validation UND Citation Cloud Microphysics OLYMPEX (http://dx.doi.org/10.5067/GPMGV/OLYMPEX/MULTIPLE/DATA201)

GPM Ground Validation NCAR Particle Probes OLYMPEX (http://dx.doi.org/10.5067/GPMGV/OLYMPEX/PROBES/DATA201)

Contact Information

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

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User Services
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