



Data User Guide

GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) OLYMPEX

Introduction

The GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) OLYMPEX dataset consists of microwave radiance measurements collected during the GPM Ground Validation Olympic Mountains Experiment (OLYMPEX) field campaign held in the Pacific Northwest. These data were collected by the MASC aboard the NASA DC-8 aircraft, for dates between November 10, 2016 and December 13, 2016. The data are provided in HDF-EOS5 format.

Citation

Padmanabhan, Sharmila and Robert Stachnik. 2018. GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) 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/MASC/DATA101>

Keywords:

NASA, GHRC, GPM, OLYMPEX, DC-8, MASC, Washington, microwave, sounder, radiance

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 mid-latitude 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, 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>)

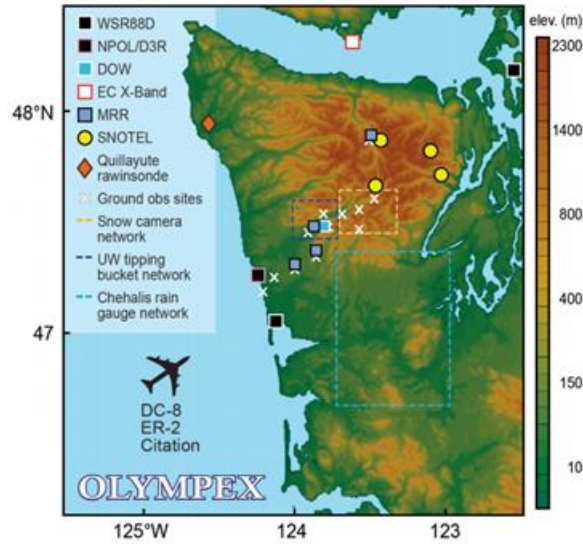


Figure 2: OLYMPEX Field Locations. The image does not contain ASO sampling region. (Image Source: <https://pmm.nasa.gov/OLYMPEX>)

Instrument Description

The Microwave Atmospheric Sounder on Cubesat (MASC) is an 8-channel millimeter-wave sounder that can be used to derive atmospheric temperature and humidity from measured radiances. The instrument has 4 channels near 118 GHz (oxygen absorption) and 4 channels near 183 GHz (water vapor absorption). It has a cross-track scanning receiver rotating at 30 revolutions per minute that performs instrument calibration during every scan. When airborne, such as in the OLYMPEX field campaign, the instrument viewed two calibration temperature targets, ambient temperature on the aircraft and 333 K. MASC was designed and built by researchers at the Jet Propulsion Laboratory in 2014. MASC observations are similar to those obtained by microwave sounders in orbit, such as GPM-GMI, and therefore provides data useful for comparative analysis. During the OLYMPEX field campaign, MASC was deployed on the NASA DC-8 aircraft as shown in Figure 3.



Figure 3. MASC on the DC-

8 aircraft.

Image source: <https://cpex.jpl.nasa.gov/instruments/masc.php>

Investigators

Sharmila Padmanabhan
Jet Propulsion Laboratory
Pasadena, CA

Robert Stachnik
Jet Propulsion Laboratory
Pasadena, CA

Data Characteristics

This GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) OLYMPEX dataset consists data files in HDF-EOS5 format at a Level 2 processing level. More information about the NASA data processing levels are available on the [NASA Data Processing Levels website](#). Table 1 lists the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA DC-8 aircraft
Instrument	Microwave sounder
Radiometric Frequency of Measurements	8 channels at: 183.31±1 GHz, 183.31±3 GHz, 183.31±7 GHz, 183.31±8 GHz, 118.75±1 GHz, 118.75±2 GHz, 118.75±7 GHz, 118.75±8 GHz
Projection	n/a
Spatial Coverage	N: 49.46083 , S: 39.16587, E: -119.7298, W: -129.1844
Spatial Resolution	15 km for 183 GHz, 20 km for 118 GHz
Temporal Coverage	Start date: November 10, 2016 Stop date: December 13, 2016
Temporal Resolution	Hourly -< Daily (1 file per flight)
Sampling Frequency	1 second -< 1 minute
Parameter	Microwave radiances
Version	1
Processing Level	2

File Naming Convention

The GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) OLYMPEX dataset consists of HDF-EOS5 format data files. The files are named using the following convention:

Data files: OLYMPEX_MASC_<YYYYMMDD>_<hhmmss>.he5

Table 2: File naming convention variables

Variable	Description
OLYMPEX	OLYMPEX field campaign
MASC	Microwave Atmospheric Sounder on Cubesat
YYYYMMDD	Four-digit year, two-digit month, two-digit day
hhmmss	Two-digit hour, two-digit minute, two-digit second
.he5	HDF-EOS5 format

Data Format and Parameters

The GPM Ground Validation Microwave Atmospheric Sounder on Cubesat (MASC) OLYMPEX dataset consists of data files in HDF-EOS5 format. There is 1 data file per DC-8 flight. Table 3 outlines data fields (variables or parameters) in each data file.

Table 3: Data Fields

Field Name	Description	Data Type	Unit
altitude	DC-8 altitude	float	m
heading	DC-8 heading	float	deg clockwise
latDC8	DC-8 latitude	float	degN
lonDC8	DC-8 longitude	float	degE
latitude	swath latitude	float	degN
longitude	swath longitude	float	degE
nadir_angle	Degrees clockwise from nadir	float	deg
roll	roll increasing clockwise rotation	float	deg
time	seconds in epoch	double	s
radiance	swath radiance	float	K

Note: the units of measurement in the HDF-EOS5 files is reversed for the latitude and longitude data fields. The file lists unit of latitude as degE and longitude as degN. The units should be degN for latitude and degE for longitude. Files may be replaced at a future time.

Software

These files are in HDF-EOS5 format, and may be read using Python, IDL, or other common HDF-EOS5 capable software. Panoply can open these files and provide a quick view of the structure and data fields. Panoply is available at <https://www.giss.nasa.gov/tools/panoply/download/>.

Data Quality

The radiometric accuracy of MASC is about 1K. Comparisons with COSMIR data are shown in slide 26 of [Turk \(2016\)](#).

Known Issues or Missing Data

The instrument was placed on the DC-8 aircraft. Flights occurred only on select days during the field campaign. Missing data values are flagged -9999 within the data files.

References

Turk, F., G. Liu, A. Battaglia, F. Tridon (2016): Multi-Frequency Radar/Passive Microwave Observations and Simulations of Cold Season Precipitation from GPM and OLYMPEX data. 8th International Precipitation Working Group, Bologna, Italy.

http://www.isac.cnr.it/~ipwg/meetings/bologna-2016/Bologna2016_Orals/4-3_Turk.pdf

Related Data

All datasets from the OLYMPEX field campaign can be considered related to this MASC dataset. Other OLYMPEX campaign data can be located using the [GHRC HyDRO 2.0 search tool](#), by entering the term 'OLYMPEX'.

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/>