Data User Guide

Microwave Atmospheric Sounder on Cubesat (MASC) CPEX

Introduction

The Microwave Atmospheric Sounder on Cubesat (MASC) CPEX dataset contains products obtained from the MASC instrument onboard the DC-8 aircraft. These data were collected in support of the NASA Convective Processes Experiment (CPEX) field campaign. The CPEX field campaign took place in the North Atlantic-Gulf of Mexico-Caribbean Sea region from 25 May-25 June 2017. CPEX conducted a total of sixteen DC-8 missions from 27 May-24 June. The CPEX campaign collected data to help explain convective storm initiation, organization, growth, and dissipation in the North Atlantic-Gulf of Mexico-Caribbean Oceanic region during the early summer of 2017. These data are available from May 27, 2017 through June 21, 2017 and are available in HDF-5 format.

Citation

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Keywords:

MASC, CPEX, NASA, atmospheric sounder, reflectivity

Campaign

The NASA Convective Processes Experiment (CPEX) aircraft field campaign took place in the North Atlantic-Gulf of Mexico-Caribbean Sea region from 25 May-25 June 2017. CPEX conducted a total of sixteen DC-8 missions from 27 May-24 June. The 16 missions covered a wide range of weather conditions from clear and calm wind, isolated convective cloud

systems, to Tropical Storm Cindy (2017). It is the first field campaign that collected airborne observations continually from pre-tropical disturbance in the Caribbean Sea, to tropical depression, and formation of Tropical Storm Cindy in the Gulf of Mexico prior to landfall. The three main science objectives of CPEX were: 1) Improve understanding of convective processes including cloud dynamics, downdrafts, cold pools and thermodynamics during initiation, growth, and dissipation. 2) Obtain a comprehensive set of simultaneous wind, temperature, and moisture profiles, using Doppler wind lidar (DAWN), microwave radiometer and sounder (HAMSR/MASC), and GPS dropsondes, conduct a quantitative evaluation of those profiles in the vicinity of scattered and organized deep convection measured by airborne precipitation radar (APR2), in all phases of convective life cycle. 3) Improve model representation of convective and boundary layer processes over the tropical oceans using a cloud-resolving, fully coupled atmosphere-ocean model, and assimilate the wind, temperature and humidity profiles into the model. More information is available from NASA's Jet Propulsion Laboratory's CPEX field campaign webpage.

Figure 1: CPEX field campaign logo
(Image source: CPEX)

Instrument Description

MASC is a recently developed cross-track scanning (30 RPM) microwave sounder with channels near the 118 GHz oxygen line and the 183 GHz water-vapor line. It has previously participated in the PECAN campaign and the OLYMPEX GPM ground validation campaign. During both of these campaigns, it was deployed on the DC-8. MASC leverages recently developed technology and is a low-cost, compact instrument that weighs only 10 lbs. It is designed to be packaged as a 6U CubeSat and serves as an engineering prototype for the TEMPEST-D EVI-2 technology demonstrator. MASC uses MMIC-based millimeter-wave

radiometers developed for GeoSTAR and HAMSR. More information about the MASC instruction is available at CPEX 2017 | MASC.

Figure 2: MASC on the DC-8 aircraft.
(Image source: NASA MASC)

Investigators

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Data Characteristics

The MASC CPEX dataset consists of files in HDF-5 format at Level 2 processing level. The MASC CPEX datafiles are available for all dates between May 27, 2017 to June 21, 2017. Table 1 lists the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA DC-8 aircraft
Instrument	Microwave Atmospheric Sounder on Cubesat (MASC)
Spatial Coverage	N: 29.049, S: 16.540, E: -94.407, W: -69.040
Spatial Resolution	15 km for 183 GHz, 20 km for 118 GHz
Temporal Coverage	May 27, 2017 - June 21, 2017
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 MASC CPEX dataset files are named using the following convention:

Data files: CPEX_MASC_<DoW>_<MMM>_<DD>_<hhmmss>_<YYYY>_flight.cat.he5

Table 2: File naming convention variables

Variable	Description
DoW	Three-letter Day of the Week
MMM	Three-letter Month
DD	Two-digit day
YYYY	Four-digit year
hhmmss	Two-digit hour, two-digit minute, two-digit second
.he5	HDF-5 format

Data Format and Parameters

The Microwave Atmospheric Sounder on Cubesat (MASC) CPEX dataset consists of data files in HDF-5 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

Variable	Description	Unit
altitude	DC-8 altitude	m
ambientTB	Ambient target adc counts	counts
ambienttargetT	Ambient target temperature	K
heading	DC-8 heading	deg clockwise
heatedTB	Heated target adc counts	counts
heatedtargetT	Heated target temperature	K
latDC8	DC-8 latitude	deg N
latitude	Swath latitude	deg E
lonDC8	DC-8 longitude	deg E
longitude	Swath longitude	deg N
nadir_angle	Degrees clockwise from nadir	deg
radaraltitude	DC-8 radar altitude	ft
radiance	Swath radiance	K
roll	Roll increasing clockwise rotation	deg
time	Seconds in epoch	s

Software

No special software is needed to read these HDF-5 data files; however, Panoply is an easy-to-use free tool for reading and visualizing the data within these HDF-5 files.

Known Issues or Missing Data
There are no known issues with these data or any known gaps in the dataset.

References
CPEX 2017 - MASC
https://cpex.jpl.nasa.gov/cpex2017/instruments/masc.php

NASA CASEI - Microwave Atmospheric Sounder on Cubesat (MASC)
https://impact.earthdata.nasa.gov/casei/instrument/MASC#top

Related Data
All other datasets collected as part of the CPEX campaign are considered related and can be located by searching the term "CPEX" in the Earthdata Search.

Contact Information
To order these data or for further information, please contact:
> NASA Global Hydrometeorology Resource Center DAAC
> User Services
> 320 Sparkman Drive
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