



Data User Guide

DC-8 Navigation Data CPEX

Introduction

The DC-8 Navigation Data CPEX dataset is a subset of airborne measurements that include GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements of temperature, pressure, water vapor, and horizontal winds. These measurements were taken from the NASA DC-8 aircraft during the Convective Processes Experiment (CPEX) field campaign. 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 files are available from May 25, 2017 through June 28, 2017 in ASCII format.

Notice:

The NASA DC-8 aircraft did not operate each day of the campaign, therefore DC-8 Navigation data are only available for aircraft flight days.

Citation

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Keywords:

NASA, GHRC, CPEX, DC-8, North Atlantic, Gulf of Mexico, Caribbean, navigation, airborne measurements, potential temperature, relative humidity, wind speed, wind direction, atmospheric temperature, atmospheric pressure, atmospheric precipitation

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

This dataset was collected by Northrop Grumman's LN-251 Inertial Navigation System/Global Positioning System (INS/GPS) onboard the NASA DC-8 aircraft. The instrument is the smallest, lightest, lower power, and most reliable navigator with unsurpassed geo-location and velocity accuracy in its class.

The NASA DC-8 aircraft is a four-engine jet transport aircraft with the ability to fly at altitudes ranging from 1,000 to 42,000 feet for up to 12 hours. This aircraft can also carry about 30,000 pounds of equipment and scientific instruments, as well as seat up to 45 flight crew and experiments. The NASA DC-8 aircraft is used to collect data in support of many

scientific projects and is based at the NASA Armstrong Flight Research Center in Palmdale, California. The DC-8 aircraft has been used for various types of missions including sensor development, space vehicle launch or reentry telemetry data retrieval, and optical tracking, satellite sensor verification, and basic surface and atmospheric research. The NASA DC-8 aircraft is a relatively inexpensive way to test and verify satellite instruments. More information about the NASA DC-8 aircraft is available on the NASA Armstrong Fact Sheet: [DC-8 Airborne Science Laboratory](#) and [DC-8 Airborne Science Experimenter Handbook](#).



Figure 2: NASA DC-8 aircraft

(Image Source: [NASA Armstrong Fact Sheet: DC-8 Airborne Science Laboratory](#))

Investigators

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Data Characteristics

The DC-8 Navigation Data CPEX contains airborne measurements taken from NASA's DC-8 aircraft during the CPEX field campaign. Data files are in ASCII format at a Level 2 processing level. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 1 below.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA DC-8 aircraft
Instrument	Northrop Grumman's LN-251 Inertial Navigation System/Global Positioning System (INS/GPS)
Spatial Coverage	N: 38.1964 , S: 16.8091, E: -69.2994, W: -118.1459 (North Atlantic, Gulf of Mexico, Caribbean)
Spatial Resolution	5 m
Temporal Coverage	May 25, 2017 - June 28, 2017
Temporal Resolution	Hourly -< Daily

Sampling Frequency	1 second
Parameter	GPS positioning and trajectory data, aircraft orientation
Version	1
Processing Level	2

File Naming Convention

The DC-8 and Navigation Data CPEX data are within ASCII files and are named using the following convention:

Data files: CPEX_Hskping_DC8_YYYYMMDD_R0.ict

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
.ict	ASCII format

Data Format and Parameters

The DC-8 Navigation Data CPEX contains airborne measurements that include GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements of temperature, pressure, water vapor, and horizontal winds. The data files are in ASCII format. Table 4 describes how these measurements are organized in each file, as well as their units.

Table 3: Nav CPEX ASCII data fields

Column	Variable	Description	Unit
1	Start.UTC	Start time of data collection from midnight UTC	s
2	Day_Of_Year	Calendar day beginning January 1	-
3	Latitude	Platform latitude	Degrees East
4	Longitude	Platform longitude	Degrees North
5	MLS_GPS_Altitude	Platform altitude above mean sea level	m
6	HAE_GPS_Altitude	Platform altitude ellipsoid, reference WGS-84	m
7	Pressure_Altitude	Platform altitude pressure	ft
8	Radar_Altitude	Platform altitude	ft
9	Ground_Speed	Platform ground speed	m/s

10	True_Air_Speed	Platform aircraft true airspeed	kts
11	Indicated_Air_Speed	Platform aircraft true airspeed	kts
12	Mach_Number	Mach number	mach
13	Vertical_Speed	Vertical wind speed	m/s
14	True_Heading	Platform true heading. cw from +y. 0-360 degrees	degrees
15	Track_Angle	Platform track angle. cw from +y. 0-360 degrees	degrees
16	Drift_Angle	Platform drift angle. cw from +y. 0-180 degrees	degrees
17	Pitch_Angle	Platform pitch angle. up+. 0-180 degrees	degrees
18	Roll_Angle	Platform roll angle. rt+. 0-180 degrees	degrees
19	Static_Air_Temp	Static air temperature	Degrees C
20	Potential_Temp	Potential temperature	Degrees C
21	Dew_Point	Dew point temperature	Degrees C
22	Total_Air_Temp	Total air temperature	Degrees C
23	IR_Surf_Temp	Surface temperature	Degrees C
24	Static_Pressure	Static pressure	hPa
25	Cabin_Pressure	Cabin pressure	hPa
26	Wind_Speed	Wind speed. Limited to where roll angle does not exceed 5 degrees	m/s
27	Wind_Direction	Wind direction 0-360 degrees. cw from +y. Limited to where roll angle does not exceed 5 degrees	m/s
28	Solar_Zentih_Angle	Solar zenith angle	degrees
29	Aircraft_Sun_Elevation	Aircraft sun elevation	degrees
30	Sun_Azimuth	Solar azimuth angle	degrees
31	Aircraft_Sun_Azimuth	Aircraft sun azimuth	degrees
32	Mixing_Ratio	Mixing ratio	g/kg
33	Part_Press_Water_Vapor	Partial pressure water vapor	hPa
34	Sat_Vapor_Press_H2O	Saturated vapor pressure water vapor	hPa
35	Sat_Vapor_Press_Ice	Saturated vapor pressure ice	hPa
36	Relative_Humidity	Relative humidity	%

Software

These data are in ASCII format, so no software is required to view these data.

References

DC-8 Airborne Science Experimenter Handbook. 2011.

https://airbornescience.nasa.gov/sites/default/files/DC8_Experimenter_Handbook_Jan2011v2.pdf

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:

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