GHRC
Global Hydrology Resource Center

Data User Guide

CAMEX-3 DC-8 Navigation Data Acquisition and Distribution System (DADS) Data

Introduction

The CAMEX-3 DC-8 Navigation Data Acquisition and Distribution System (DADS) data files contain information recorded by navigation and data collection systems onboard the NASA DC-8 aircraft. These data files contain typical navigation data (e.g. date, time, lat/lon, altitude), and meteorological parameters (e.g. wind speed and direction, temperature, saturation vapor pressure) collected in support of the third field campaign in the Convection And Moisture EXperiment (CAMEX) series, CAMEX-3. This field campaign took place from August to September 1998 based out of Patrick Air Force Base in Florida, with the purpose of studying various aspects of tropical cyclones in the region. These data are available in ASCII file format with browse imagery available in GIF file format. Each file contains data recorded at one second intervals for each flight.

Notice:
These data are airborne and flights did not occur each day of the campaign, therefore, data is only available on flight days.

Citation

Sorenson, Carl and Gloria Fields. 1999. CAMEX-3 DC-8 NAVIGATION (DADS) DATA [indicate subset used]. Dataset available online from the NASA Global Hydrology Center DAAC, Huntsville, Alabama, U.S.A. DOI: http://dx.doi.org/10.5067/CAMEX-3/NAV/DATA101

Keywords:

NASA, GHRC, CAMEX, CAMEX-3, DC-8, navigation data, pressure, temperature, winds, humidity, airspeed, ground speed, altitude

Campaign

The Convection And Moisture EXperiment (CAMEX) is a series of field research investigations sponsored by the Earth Science Enterprise of NASA. The third field campaign in the CAMEX series, CAMEX-3, ran from August to September 1998, and was based out of Patrick Air Force Base, Florida. CAMEX-3 focused on the study of tropical cyclone development, tracking, and intensification impacts using NASA-funded aircraft and surface remote sensing instrumentation. The ultimate goal of the campaign was to improve the efficiency of hurricane evacuations and warnings. The campaign successfully studied hurricanes Bonnie, Danielle, Earl, and Georges (Figure 1). CAMEX-3 yielded high-resolution spatial and temporal data on hurricane structure, dynamics, and motion. These data, when analyzed within the context of more traditional aircraft, satellite, and ground-based radar observations, provided additional insight to hurricane modelers and forecasters who continually strive to improve hurricane predictions. More information about CAMEX-3 can be found on the CAMEX-3 Field Campaign webpage and in Kakar, Goodman, Hood, and Guillory (2006).
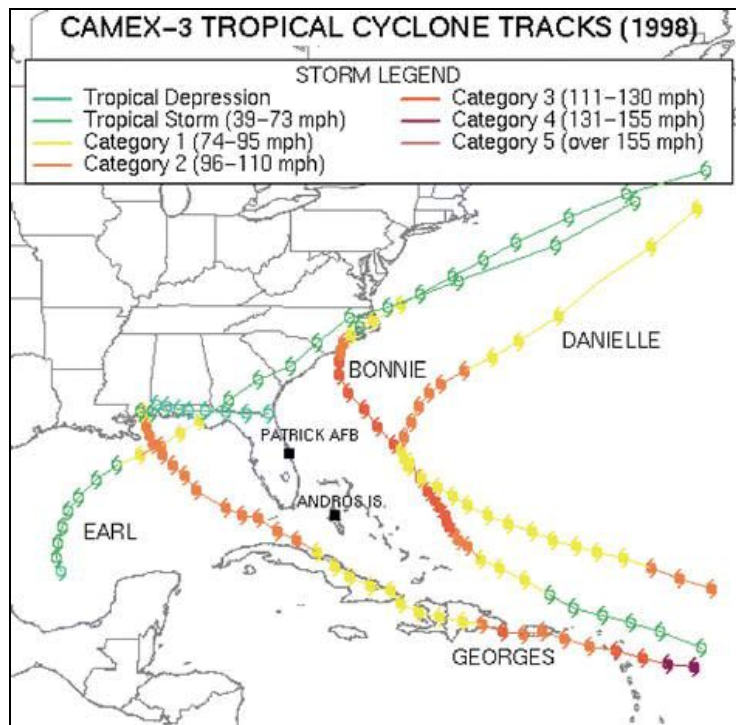

Figure 1: Tropical Cyclone Tracks during CAMEX-3
(Image source: Kakar et al. 2006)

Instrument Description

The CAMEX-3 DC-8 DADS serial transfer of housekeeping data allows easy access to aircraft data by experimenter-operated computers. The DADS system provided real-time

parameter measurements that were displayed on monitors throughout the DC-8 aircraft cabin during flight along with time-series plots of those parameters. The system also provided maps of aircraft tracks taken during flight. The data were transferred at one-second intervals with transmission rates of 1200, 9600, and 19.2K baud. The data in these files were the data transferred at the 9600/19.2K baud rate. More information about DADS is available on the DC-8 DADS Appendix F webpage.

Figure 2: The NASA DC-8 Research Aircraft
(Image source: NASA DC-8 Factsheet)

Investigators

Carl Sorenson
NASA Ames Research Center
Moffett Field, CA

Gloria Fields
NASA Armstrong Flight Research Center
Edwards, CA

Data Characteristics

The CAMEX-3 DC-8 Data Acquisition and Distribution System (DADS) data files are available in ASCII file format at Level 1A processing level. These files contain measurements of atmospheric state variables and standard aircraft navigation data. Browse imagery are available in GIF file format and contain time-series plots of the measured parameters. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. Table 1 shows the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description

Platform	NASA Douglas DC-8 (DC-8) aircraft
Instrument	Data Acquisition and Distribution System (DADS)
Spatial Coverage	N: 50°, S: 10°, E: -50°, W: -105° (Caribbean)
Spatial Resolution	Point
Temporal Coverage	August 15, 1998 - September 23, 1998
Temporal Resolution	1 file per flight
Sampling Frequency	1 second
Parameter	Atmospheric temperature, winds, pressure, humidity, aircraft navigation variables
Version	1
Processing Level	1A

File Naming Convention

The CAMEX-3 DC-8 Data Acquisition and Distribution System (DADS) dataset consists of ASCII text files. There are two files included for each flight: an "flt" data file and a mission director log file. Each file uses the following naming convention:

Data files: YYDDD.dc8_[data file type].txt
Browse files: YYDDD.dc8_[browse type]_[##].gif
YYDDD.dc8_trk.gif
YYDDD.flt.trk.gif

Table 2: File naming convention variables

Variable	Description
YY	Two-digit year (ex: 1998 = 98)
DDD	Three-digit day of the year (Julian day)
[data file type]	Data file type flt: flight data file md_log: DC-8 mission director log file
[browse type]	Browse image type param: Parameter measurement time series plot trk: flight track image
[##]	Plot number: 01, 02, 03, 04, 05
.txt	ASCII text file
.gif	Graphics Interchange Format (GIF) image file

Data Format and Parameters

Flight Data Files (flt.txt)
The CAMEX-3 DC-8 DADS data in these files were transferred at 9600 and 19.2K baud per second (a rate of information transfer) in seven 56-character lines (total of 392 characters)

that repeat for each second of data collection. Each line begins with a unique character identifier, followed by the listed data fields. The contents of the first five lines (identifiers C through G) are fixed. The contents of the last two lines (identifiers H and I) are selected by the mission manager and may change from mission to mission.

Parameter fields within each line, including the leading character identifier, are separated by at least one space. There may be one or more blanks at the end of a line (before the return and start of a new line) to keep the 56 characters length consistent for each line. An example of the data lines for identifiers C through G is listed below. The first set of lines shows the variables while the second set includes example data values. The data field descriptions for each line are listed in Table 3 followed by additional character descriptions in Table 4.

```
C aaa bb:bb:bb.bbb +cc cc.c +ddd dd.d eee.e ffff.f ggg<cr><lf>
D hhh iii jjjj kkk.k lll.l mmmmm nnnnn ooooo.o ppppp.p<cr><lf>
E qqq.q rrr.r sss.s ttt.t uuu vvvvvv wwwww.w xxxx.x yy<cr><lf>
F zzzzz JJJJ.J K.KKK LLLLL.L MMMM.M NNNN.N 000.0 P.PPP<cr><lf>
G QQ.Q RR.R SS.S TT.TT UU.UU VVV.V WWW.W XXX.X YYYY.Y <cr><lf>
H ***********************************************<cr><lf>
I ************************************************<cr><lf>


C 321 01:22:45.105 +34 25.0 -122 03.0 -10.3  -45.6 110<cr><lf>
D 270 450  425 212.3   5.1 28000 24050 -1012.4 -1012.7<cr><lf>
E -10.1  14.6  -15.9  -9.4 410 -1250  -332.6   50.8 45<cr><lf>
F  5100  466.7 0.714  332.0  240.7   -11.8 202.0 0.269<cr><lf>
O 13.4 15.2 20.2 34.22 37.66  10.6  13.7 252.3 -160.2 <cr><lf>
H ***********************************************<cr><lf>
I ***********************************************<cr><lf>
```

Table 3: Data fields for flight data files, identifiers C through G (_flt.txt)

Identifier	Parameters	Field Format	Units
C	Day	aaa	day of year
	Time	bb:bb:bb.bbb	hour:min:sec (UTC)
	Latitude	+/-cc cc. c	degrees & minutes
	Longitude	+/-ddd dd.d	degrees & minutes
	Pitch	eee.e	deg
	Roll	ffff.f	deg
	Wind speed	ggg	knots
D	Wind direction	hhh	deg
	True airspeed	iii	knots
	Ground speed	jjjj	knots
	True heading	kkk.k	deg
	Drift angle	lll.l	deg
	Pressure altitude	mmmmm	feet

	Radar altitude	nnnnn	feet
	Dew/Frost point temperature using GE1011 hygrometer with state flagged	ooooo.o	deg C
	Dew/Frost point temperature using EG&G hygrometer with state flagged	pppp.p	deg C
E	Static air temperature	qqq.q	deg C
	Total air temperature	rrr.r	deg C
	IR surface temperature	sss.s	deg C
	Static air temperature, calculated	ttt.t	deg C
	Indicated air speed	uuu	knots
	Vertical speed	vvvvvv	ft/min
	Distance to go	wwwww.w	nm
	Time to go	xxxx.x	min
	Align status	yy	-
F	Cabin altitude	zzzzz	feet
	Pressure	JJJJ.J	mb
	Mach number	K.KKK	-
	Cross track distance	LLLLL.L	nm
	Desired track	MMMM.M	deg
	Track angle error	NNNN.N	deg
	Track angle	OOO.O	deg
	Specific humidity	P.PPP	g H_2O/kg air
G	Partial pressure H_2O	QQ.Q	mb
	Relative humidity with respect to ice	RR.R	%
	Relative humidity with respect to water	SS.S	%
	Saturation vapor pressure of water	TT.TT	mb
	Saturation vapor pressure of water relative to ice	UU.UU	mb
	Sun elevation in ground reference frame, refracted	VVV.V	deg
	Sun elevation in aircraft reference frame, refracted	WWW.W	deg
	Sun azimuth in ground reference frame	XXX.X	deg
	Sun azimuth in aircraft reference frame relative to the nose of the aircraft	YYYY.Y	deg
H	Contents of this block are subject to the mission managers discretion		
I	Contents of this block are subject to the mission managers discretion		

Table 4: Character Key

Character	Description
<cr>	ASCII carriage return
<lf>	ASCII line feed
****	Content subject to Mission Manager's discretion

Note: Individual parameter fields will be filled with special characters for the following reasons listed in Table 5.

Table 5. Reasons for individual parameter fields filled with special characters

Condition	Special Character
Data was too big for parameter field	>
Data was too small for parameter field	<
Data formatting error occurred	?

Note: All data parameters are in engineering units. For integer formats, the number of digits in a field may vary from one to the number shown in the field format. For non-integer formats, the placement of the decimal point within the field and the number of digits to the right of the decimal point are guaranteed as illustrated in the field format. However, the number of digits to the left of the decimal point may vary from one to the number shown in the field format. Unused leading digits are padded with either blanks or zeros. Units are not included in the data stream.

Mission Manager Discretionary DADS input lines

An example of the readout for the mission manager discretionary lines (identifiers H and I) is shown below. As previously noted, the first set of lines shows the variables while the second set includes example data values. The data field descriptions for each line are listed in Table 6.

```
H aa:aa:aa.aaa +bb bb.b +ccc cc.c ddddd eeeeee fff.fff<cr><lf>
I ggg.g hhh.h iii.i j +kk kk.k +111 11.1 mmm.m nn.nnn <cr><lf>

H 01:22:45.105 +34 25.0 -122 03.0 28000   1400   0.000<cr><lf>
I  12.5  11.3  77.4 1 +40 00.0 -130 30.0 311.0  5.882 <cr><lf>
```

Table 6. Data fields for flight data files, identifiers H and I (_flt.txt)

Identifier	Parameter	Format	Units
H	GPS UT	aa:aa:aa.aaa	hour:min:sec (UTC)
	GPS latitude	+/-bb bb.b	degrees & minutes
	GPS longitude	+/-ccc cc.c	degrees &

			minutes
	GPS altitude*	ddddd	feet
	GPS vertical speed*	eeeeee	ft/min
	Spare A/D	fff. fff	-
I	Sun elevation in ground reference frame	ggg.g	deg
	Sun elevation in aircraft reference frame	hhh.h	deg
	Solar zenith angle in ground reference frame	iii.i	deg
	Waypoint Latitude	+/-kk kk.k	degrees & minutes
	Waypoint Longitude	+/- lll ll.l	degrees & minutes
	Potential temperature	mmm.m	deg K
	Specific Humidity	nn.nnn	g H_2O/kg air

*The values for "GPS altitude" are negative during the times when the aircraft is taking off or landing; times during which the aircraft is close to the ground. The negative values for "GPS vertical speed" mean that the aircraft is decreasing in altitude while positive values mean the aircraft is increasing in altitude.

Additional information about the DADS data file format can be found on the [DC-8 DADS Characteristics](#) webpage.

Mission Director Log Files (_md_log.txt)
The Mission Director Log files are in ASCII file format and contain information documented by the mission director regarding important steps and events that occurred during the mission. With each commentary note, the system creates data stamps of aircraft navigation variables measured at the time of the log. The data are listed in separate blocks within the ASCII file for each commentary note made by the mission director. In addition to the director's log, information within each file includes the mission name, flight number, day, date, mission crew names, time of logs, navigation data recorded during the logs, and time of takeoff and touchdown.

Browse image files (.gif)
The browse image files are available in GIF file format and contain time-series plots of the parameter measurements and aircraft flight tracks. For the plot files (_param_##.gif), some of the variables include wind speed, static air temperature, solar zenith angle, pressure altitude, and aircraft roll. Multiple variables are included on each plot with various colors and axes corresponding to certain variables, specified on the plot. The aircraft track files (trk.gif, trk_drops.gif) include images of aircraft flight paths with reference maps and UTC timestamps included to help identify time and location. Time tics, indicating time elapsed, are marked along the path line ranging from every 2 to 20 minutes depending on the map. Wind barbs are placed at each time tic for some of the tracks as well.   The "trk_drops.gif" file includes markings along the flight path where dropsondes were released during the mission.

Algorithm

Probes and GPS systems were used to acquire the measurements onboard the DC-8 aircraft for this dataset. The DADS data in these files were collected and transferred at 9600 and 19.2K baud per second. The data were broadcast in engineering units and ASCII file format. More information about DADS data transfer methods is available on the [DC-8 DADS Appendix F](#) webpage.

Quality Assessment

Special characters (<, >, ?) are listed in the data fields for data values that were too large for the parameter field, too small for the parameter field, or had a formatting error. The "?" character was also listed if a data field value was invalid or unavailable. The absence of a "? ", however, does not guarantee the validity of the data. These values are also listed in Table 5 of the "Data Format and Parameters" section. Information about DADS quality control can be found on the [DC-8 DADS Appendix F](#) webpage.

Software

No software is required to view these data files. The CAMEX-3 DADS ASCII text files can be viewed in a text editor or in spreadsheet software, such as Microsoft Excel or Notepad++.

Known Issues or Missing Data

These data are airborne and flights did not occur each day of the campaign, therefore, data is only available for flight days. Invalid or unavailable data may be replaced by question marks (?), however, the absence of question marks in a parameter field does not guarantee the validity of the data.

References

Kakar, R., Goodman, M., Hood, R., & Guillory, A. (2006). Overview of the Convection and Moisture Experiment (CAMEX). *Journal of the Atmospheric Sciences*, *63*, 5–18. https://doi.org/10.1175/JAS3607.1

NASA. (2015). NASA Armstrong Fact Sheet: DC-8 Airborne Science Laboratory. https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-050-DFRC.html

Related Data

Other datasets collected during the CAMEX-3 field campaign are considered related to the CAMEX-3 DC-8 Navigation DADS dataset. These datasets can be located using the GHRC [HyDRO2.0](#) search tool and entering the term 'CAMEX-3' in the search box.

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/

Created: 05/20/99
Updated: 06/14/19