



## Data User Guide

# DC-8 Meteorological and Navigation Data CPEX-AW

### Introduction

The DC-8 Meteorological and Navigation Data CPEX-AW 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 – Aerosols & Winds (CPEX-AW) field campaign. CPEX-AW was a joint effort between the US National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) with the primary goal of conducting a post-launch calibration and validation activities of the Atmospheric Dynamics Mission-Aeolus (ADM-AEOLUS) Earth observation wind Lidar satellite in St. Croix, U.S. Virgin Islands. Data are available from August 17, 2021 through September 4, 2021 in ASCII format.

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

### Citation

Bennett, Ryan. 2022. DC-8 Meteorological and Navigation Data CPEX-AW [indicate subset used]. Dataset available online from the NASA Global Hydrometeorology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi: <http://dx.doi.org/10.5067/CPEXAW/GPS/DATA101>

### Keywords:

NASA, GHRC, CPEX-AW, St. Croix, DC-8, GPS, navigation, airborne measurements, potential temperature, relative humidity, wind speed, wind direction, atmospheric temperature, atmospheric pressure

## Project

The Convective Processes Experiment – Aerosols & Winds (CPEX-AW) campaign was a joint effort between the US National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) with the primary goal of conducting post-launch calibration and validation activities of the Atmospheric Dynamics Mission-Aeolus (ADM-AEOLUS) Earth observation wind Lidar satellite in St. Croix, US Virgin Islands. CPEX-AW was a follow-on to the Convective Processes Experiment (CPEX) field campaign which took place in the summer of 2017 ([CPEX](#)). In addition to joint calibration/validation of ADM-AEOLUS, CPEX-AW will study the dynamics and microphysics related to the Saharan Air Layer, African Easterly Waves and Jets, Tropical Easterly Jet, and deep convection in the InterTropical Convergence Zone (ITCZ). CPEX-AW science goals include:

- Better understanding interactions of convective cloud systems and tropospheric winds as part of the joint NASA-ESA Aeolus Cal/Val effort over the tropical Atlantic;
- Observing the vertical structure and variability of the marine boundary layer in relation to initiation and lifecycle of the convective cloud systems, convective processes (e.g., cold pools), and environmental conditions within and across the Intertropical Convergence Zone (ITCZ);
- Investigating how the African easterly waves and dry air and dust associated with the Saharan Air Layer control the convectively suppressed and active periods of the ITCZ;
- Investigating interactions of wind, aerosol, clouds, and precipitation and effects on long range dust transport and air quality over the western Atlantic.

More information about the CPEX-AW field campaign can be found at [NASA JPL|CPEX-AW](#), [CPEX-AW 2017 | Campaign Overview](#), and [CPEX-AW ESPO](#).



Figure 1: CPEX-AW field campaign logo  
(Image source: [CPEX-AW](#))

## Instrument Description

This dataset was collected by instruments onboard the NASA DC-8 aircraft. The instruments include:

1. Northrop Grumman's LN-251 Inertial Navigation System/Global Positioning System (INS/GPS) is the smallest, lightest, lower power, and most reliable navigator with unsurpassed geo-location and velocity accuracy in its class.
2. APN232 Radar Altimeter: measures the height of aircraft above surface topography.
3. Heitronics KT-19.85II Infrared Pyrometer: infrared retrieval of surface temperature.
4. Rosemount Total Air Temperature (TAT) probe: immersion sampling of the total air temperature of the airstream along the aircraft skin.
5. Heitronics Infrared Radiation Thermometer KT 19 II: used to measure surface temperatures within a temperature range of -50 to 1000°C.

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 Meteorological and Navigation Data CPEX-AW contains airborne measurements taken from NASA's DC-8 aircraft during the CPEX-AW 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 2 below.

Table 2: Data Characteristics

Characteristic	Description
Platform	NASA DC-8 aircraft
Instrument	Northrop Grumman's LN-251 Inertial Navigation System/Global Positioning System (INS/GPS), APN232 Radar Altimeter, Heitronics KT-19.85II Infrared Pyrometer, Rosemount Total Air Temperature (TAT) probe, Heitronics Infrared Radiation Thermometer KT 19 II
Spatial Coverage	N: 34.730, S: 11.862, E: -45.641, W: -118.163 (St. Croix, Virgin Islands)
Spatial Resolution	5 m
Temporal Coverage	August 17, 2021 - September 4, 2021
Temporal Resolution	Hourly -< Daily
Sampling Frequency	1 second
Parameter	GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements (temperature, pressure, water vapor, and horizontal winds)
Version	1
Processing Level	2

## File Naming Convention

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

**Data files:** CPEXAW\_MetNav\_DC8\_YYYYMMDD\_R0.ict

Table 3: 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 Meteorological and Navigation Data CPEX-AW 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 4: MetNav CPEX-AW ASCII data fields

Column	Variable	Description	Units
1	Time_Start	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	MSL_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	Indicted_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	degrees
28	Solar_Zenith_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.

## Known Issues or Missing Data

There are no known issues or missing data with this dataset.

## References

DC-8 Airborne Science Experimenter Handbook. 2011.

[https://airbornescience.nasa.gov/sites/default/files/DC8\\_Experimenter\\_Handbook\\_Jan2011v2.pdf](https://airbornescience.nasa.gov/sites/default/files/DC8_Experimenter_Handbook_Jan2011v2.pdf)

## Related Data

All other datasets collected as part of the CPEX-AW campaign are considered related and can be located by searching the term "CPEX-AW" in the [Earthdata Search](#).

## Contact Information

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

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