2015 HIWC Radar Flight Campaign
- Aircraft State Datasets

Purpose

This document provides a basic description the Aircraft State datasets collected by NASA during the 2015 HIWC Radar Flight Campaign, which is now archived and served to the research community by NCAR. The Aircraft State measurements contained in this dataset represent the individual aircraft state measurements made and recorded during the flight. While most Aircraft State measurements were not affected by the HIWC conditions, users should know that TAT and ADC anomalies were observed and did produce erroneous measurements in this dataset. Post-flight processing of this data, both identified and corrected these erroneous measurements; however, those corrections are only available as part of IKP and Radar files (e.g., Radar List Files).

This document is intended to assist users of the 2015 NASA HIWC Radar Flight Campaign datasets by providing general descriptions, data format, and instructions on how to read the radar dataset. Users of this dataset may also want to make use of datasets from the research instruments installed on the aircraft and archived by NCAR as part of the 2015 HIWC Radar Flight Campaign.

Background info

High Ice Water Content (HIWC) is a hazard to modern commercial aircraft and it is characterized by high concentrations of ice crystals often distributed over a horizontal scale of tens to hundreds of kilometers. The flight campaign was conducted in August 2015, used the NASA AFRC DC-8 aircraft, and was based at Ft. Lauderdale International Airport (FLL). The aircraft flew into and measured HIWC atmospheric conditions associated with coastal and oceanic mesoscale convection systems and tropical storms. The NASA DC-8 was equipped with a variety of instruments needed to measure ice concentrations, particle size, and atmospheric conditions in which the aircraft flew. In addition to these aforementioned in situ instruments, remotely sensed measurements were recorded using a modified commercial, airborne, Doppler weather radar mounted in the nose of the DC-8 aircraft.

Flight operations were based out of Fort Lauderdale, Florida (FLL) and traversed areas over the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, including Atlantic and Gulf Coastal areas, as well as the Caribbean Islands (see Figure 1). The airborne radar used for this flight campaign was a Honeywell RDR-4000 and had been modified to allow recording of In-phase/Quadrature-voltage measurements while the DC-8 aircraft was in flight. In addition to standard aircraft instrumentation, research instruments were installed on the aircraft to measure cloud physics data, water content, hydrometeor particle spectra, and temperature. The instruments included a pitot probe, a Total Air Temperature (TAT) probe and an ICD/Robust probe on the nose of the aircraft and four other probes that were installed on wing pods. The probe instruments on the wing pods were a precipitation imaging probe (PIP), an optical imaging (2D-S) probe, a cloud droplet probe (CDP) and an Iso-Kinetic probe (IKP). The aircraft state variables were also recorded and are available from the archive. Several video cameras were installed and recorded during the flight, but the video is too large (500GB) to serve as part of NCAR's archive – however requests for short time segments will be entertained and should be requested using the contact info at the end of this document.

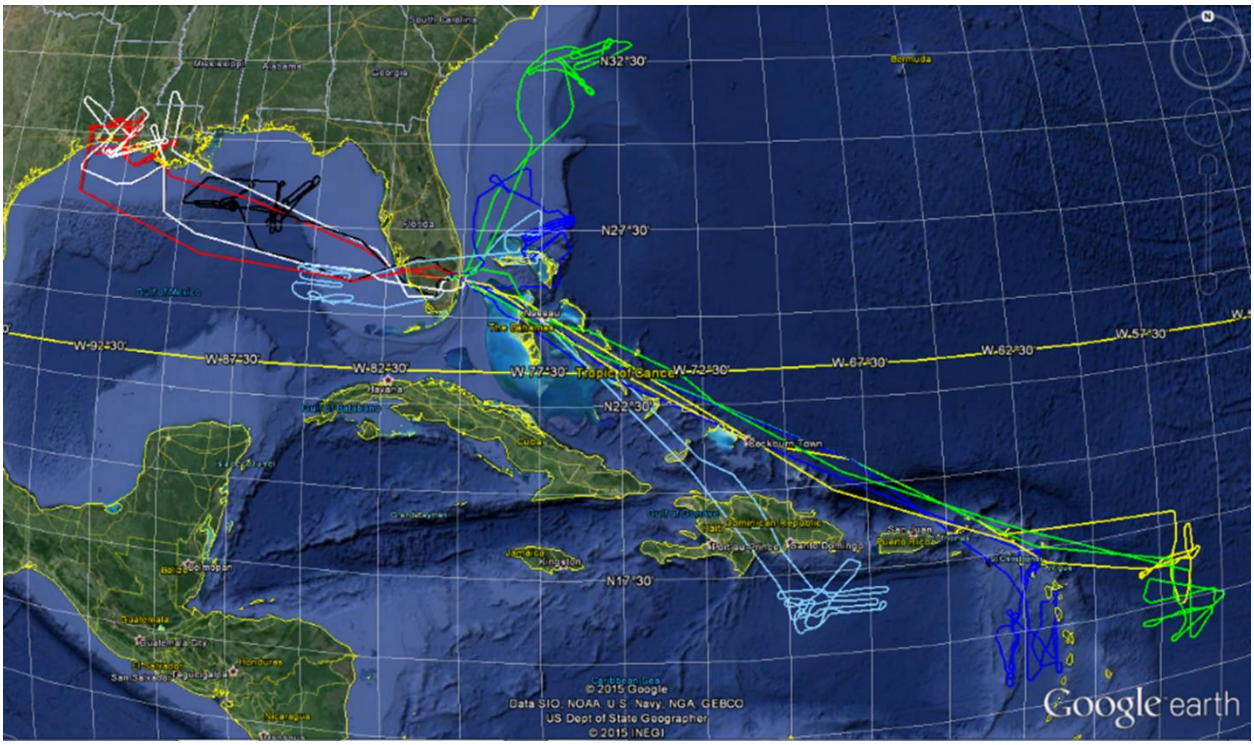

Figure 1: Flight tracks from the NASA 2015 HIWC Radar Flight Campaign

Flight Summary

The Figure above shows a graphical summary of the flights and the Table below indicates the date, general location, and (approximate) start and stop times for each flight recording.

Track Color	Flight Number	Date	Radar Data UTC Times (hh:mm)		General Description
			Start	Stop	
	1039	8/12/2015	14:29	19:14	Off costal Carolinas
	1040	8/13/2015	14:51	19:31	Coastal Florida (Atlantic)
	1041	8/14/2015	13:03	18:40	Coastal Florida (Gulf)
	1042	8/16/2015	13:18	20:28	Central Gulf of Mexico
	1043	8/19/2015	12:08	19:27	Southern Louisiana coast
	1044	8/21/2015	13:59	21:03	Southern Louisiana coast
	1045	8/23/2015	11:21	19:41	Tropical Storm Danny
	1046	8/26/2015	11:09	20:55	Tropical Storm Erika
	1047	8/27/2015	12:46	22:00	Tropical Storm Erika
	1048	8/28/2015	13:22	21:07	Tropical Storm Erika

MetNav Files

The *MetNav* files contain all the aircraft-state data for the parameters described in the Table below. The *MetNav* files are ASCII formatted with filenames in the following form:

HIWC-MetNav_DC8_**YYYYMMDD**_R0.ict

where **YYYY** is the year,
MM is the month,
DD is the day

of that day's flight. These files provide time, latitude, longitude, altitude and other aircraft related variables at 1 Hertz intervals. Each value is separated by a comma; when the variable is not supplied or unavailable the field is left blank. (i.e., denoted with two consecutive commas (sample: "…,2.3,,6.9,…")). The aircraft state variables recoded in these files are:

Parameter	Units
Time	seconds (from midnight UTC)
Day Of Year	day beginning January 1
Latitude	deg
Longitude	deg
GPS Altitude	m (height above mean sea level)
ADC1 Pressure Altitude	ft
ADC2 Pressure altitude	ft
Radar Altitude	ft
Ground Speed	m/s
ADC1 True Air Speed	kts
ADC2 True Air Speed	kts
ADC1 Indicated Air Speed	kts
ADC2 Indicated Air Speed	kts
ADC1 Mach Number	mach
ADC2 Mach Number	mach
Vertical Speed	m/s
True Heading	deg (0-360, cw from +y)
Track Angle	deg (0-360, cw from +y)
Drift Angle	deg (angle difference in degrees between True Heading and Track Angle, rt+)
Pitch Angle	(+-180, nose up+)
Roll Angle	(+-180, right +)
ADC1 Static Air Temp	Celcius
ADC2 Static Air Temp	Celcius
Exp NonDeIced Static Air Temp	Celcius
Potential Temp	Kelvin
Dew Point	Celcius
ADC1 Total Air Temp	Celcius

ADC2 Total Air Temp	Celcius
Exp NonDeiced Total Air Temp	Celcius
IR Surf Temp	Celcius
ADC1 Static Pressure	hPa
ADC2 Static Pressure	hPa
ADC1 Impact Pressure	hPa
ADC2 Impact Pressure	hPa
ADC1 Total Pressure	hPa
ADC2 Total Pressure	hPa
Cabin Pressure	hPa
Wind Speed	m/s (limited to where Roll Angle does not exceed +- 5 degrees)
Wind Direction	deg (0-360, cw from +y)
Solar Zenith Angle	deg
Aircraft Sun Elevation	deg
Sun Azimuth	deg
Aircraft Sun Azimuth	deg
Mixing Ratio	g/kg
Part Press Water Vapor	hPa
Sat Vapor Press H2O	hPa
Sat Vapor Press Ice	hPa
Relative Humidity	% with respect to liquid water

The aircraft state variables file and the radar data files use time as the common basis for synchronizing the two sets of data. The aircraft state variables are recorded from prior to takeoff until landing/taxiing.

The files conform to the NASA Ames Format. For more information about the MetNav format see:

https://www.eol.ucar.edu/content/nasa-ames-format

http://cedadocs.ceda.ac.uk/73/4/index.html

Support

Any questions regarding the 2015 HIWC Flight Campaign and/or the MetNav dataset should be addressed to:

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