

High Ice Water Content (HIWC) Radar 2018 National Weather Service Radiosonde Data Set

1.0 Contacts:

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2.0 Dataset Overview

The National Weather Service (NWS) routinely releases radiosondes at 00 and 12 UTC with occasional special releases at sites throughout the United States. This data set includes the quality controlled GTS soundings for two High Ice Water Content (HIWC) Radar 2018 observational periods and regions. The first was the southeastern United States (Figure 1) for the period of 29 July to 13 August 2018 and the second was across the Pacific Ocean (Figure 2) for the period 10-31 August 2018. This data set includes only those stations in the regions for which high vertical resolution data were available. Those stations with the GTS mandatory and significant level data are available in a separate data set. A total of 375 quality-controlled, mandatory and significant level resolution soundings are contained in the final data set.



Figure 1. GTS sounding locations included in the 29 July to 13 August 2018 portion of HIWC Radar 2018.



Figure 2. GTS sounding locations included in the 10-31 August 2018 portion of HIWC Radar 2018.

3.0 Project Overview

The High Ice Water Content (HIWC) Radar field campaigns were aimed at developing a means to remotely identify regions of HIWC ahead of an aircraft to enable tactical detect and avoidance decision making by a flight crew. This season of HIWC was based out of Fort Lauderdale, Florida; Palmdale, California; and Kona, Hawaii and utilized the NASA DC-8 aircraft. Further information on HIWC Radar 2018 is available at the HIWC Radar web site: https://www.eol.ucar.edu/field_projects/hiwc-radar-study/

4.0 EOL Sounding Composite (ESC) File Format Description

The ESC is a columnar ASCII format consisting of 15 header records for each sounding followed by the data records with associated data quality flags.

4.1 Header Records

The header records (15 total records) contain a variety of metadata about the sounding (i.e. location, time, radiosonde type, etc). The first five header lines contain information identifying the sounding, and have a rigidly defined form. The following 7 header lines are used for auxiliary information and comments about the sounding, and may vary from dataset to dataset. The last 3 header records contain header

information for the data columns. Line 13 holds the field names, line 14 the field units, and line 15 contains dashes ('-' characters) delineating the extent of the field.

The file standard header lines are as follows:

Line	Label (padded to 35 char)	Contents
1	Data Type:	Description of the type and resolution of data
2	Project ID:	Short name for the field project
3	Release Site Type/Site ID:	Description of the release site.
4	Release Location (lon,lat,alt):	Location of the release site.
5	UTC Release Time (y,m,d,h,m,s):	Time of release.

The release location is given as:

lon (deg min), lat (deg min), lon (dec. deg), lat (dec. deg), alt (m)

Longitude in deg min is in the format: ddd mm.mm'W where ddd is the number of degrees (with leading zeros if necessary), mm.mm is the decimal number of minutes, and W represents W or E for west or east longitude, respectively. Latitude has the same format as longitude, except there are only two digits for degrees and N or S for north/south latitude.

The time of release is given as: yyyy, mm, dd, hh:nn:ss.

Where yyyy is the year, mm is the month, dd is the day of month, and hh:nn:ss are the UTC hour, minute, and second respectively.

The seven non-standard header lines may contain any label and contents. The labels are padded to 35 characters to match the standard header lines. Records for this data set include the following non-standard header lines:

Line	Label (padded to 35 char)	Contents
6	Ascension Number	
7	Radiosonde Serial Number	
8	Balloon Manufacturer/Type	
9	Balloon Lot Number/Weight	
10	Radiosonde Type/RH Sensor Type	
11	Surface Observations	

4.2 Data Records

The data records each contain time from release, pressure, temperature, dew point, relative humidity, U and V wind components, wind speed and direction, ascent rate, balloon position data, altitude, and quality control flags (see the QC code description). Each data line contains 21 fields, separated by spaces, with a total width of 130 characters. The data are right-justified within the fields. All fields have one decimal place of precision, with the exception of latitude and longitude, which have three decimal places of precision. The contents and sizes of the 21 fields that appear in each data record are as follows:

Field	Width	Format	Parameter	Units	Missing Value
1	6	F6.1	Time since release	Seconds	9999.0
2	6	F6.1	Pressure	Millibars	9999.0
3	5	F5.1	Dry-bulb Temperature	Degrees C	999.0
4	5	F5.1	Dew Point Temperature	Degrees C	999.0
5	5	F5.1	Relative Humidity	Percent	999.0
6	6	F6.1	U Wind Comp	m/s	9999.0
7	6	F6.1	V Wind Comp	m/s	9999.0
8	5	F5.1	Wind speed	m/s	999.0
9	5	F5.1	Wind direction	Degrees	999.0
10	5	F5.1	Ascent Rate	m/s	999.0
11	8	F8.3	Longitude	Degrees	9999.0
12	7	F7.3	Latitude	Degrees	999.0
13	5	F5.1	Elevation Angle	Degrees	999.0
14	5	F5.1	Azimuth Angle	Degrees	999.0
15	7	F7.1	Geopotential Altitude	Meters	99999.0
16	4	F4.1	QC for Pressure	Code	99.0
17	4	F4.1	QC for Temperature	Code	99.0
18	4	F4.1	QC for Humidity	Code	99.0
19	4	F4.1	QC for U Wind	Code	99.0
20	4	F4.1	QC for V Wind	Code	99.0
21	4	F4.1	QC for Ascent Rate	Code	99.0

Fields 16 through 21 contain the data quality flags from the NCAR/Earth Observing Laboratory (EOL) sounding quality control procedures. The data quality flags are defined as follows:

Code	Description
1.0	Checked, datum seems physically reasonable. ("GOOD")
2.0	Checked, datum seems questionable on a physical basis. ("MAYBE")
3.0	Checked, datum seems to be in error. ("BAD")
4.0	Checked, datum is interpolated. ("ESTIMATED")
9.0	Checked, datum is missing. ("MISSING")
99.0	Unchecked (QC information is "missing".) ("UNCHECKED")

4.1 Data Specifics

The files contain data at mandatory and significant levels.

The data are in files by day and contain all stations and soundings from the day. The files are named like:

NWS_YYYYMMDD.cls

Where YYYY is the year, MM is the month, DD is the day of the month.

4.2 Sample Data

The following is a sample of the radiosonde data in EOL format.

```
Data Type: National Weather Service Sounding/Ascending
Project ID: HIWC-RADAR-2018
Release Site Type/Site ID: KBMX Birmingham, AL / 72230
Release Location (lon,lat,alt): 086 46.96'W, 33 10.81'N, -86.783, 33.180, 174.0
UTC Release Time (y,m,d,h,m,s): 2018, 07, 28, 23:01:07
Ascension Number: 432
Radiosonde Serial Number: 89013551
Balloon Manufacturer/Type: Totex / GP26
Balloon Lot Number/Weight: 2017 / 0.600
Radiosonde Type/RH Sensor Type: Lockheed Martin Sippican LMS-6 GPS Radiosonde / Capacitance sensor
Surface Observations: P: 996.0, T: 22.2, RH: 29.8, WS: 3.6, WD: 350.0
Nominal Release Time (y,m,d,h,m,s): 2018, 07, 29, 00:00:00
Time Press Temp Dewpt RH Ucmp Vcmp spd dir Wcmp Lon Lat Ele Azi Alt Qp Qt Qrh Qu Qv QdZ
sec mb C C % m/s m/s m/s deg m/s deg deg deg m code code code code code code
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0.0 996.0 32.8 14.4 33.0 0.6 -3.5 3.6 350.3 999.0 -86.783 33.180 999.0 999.0 174.0 1.0 1.0 1.0 1.0 1.0 9.0
1.0 995.6 32.7 14.9 34.3 0.5 -3.6 3.6 352.1 4.0 -86.783 33.180 999.0 999.0 178.0 1.0 3.0 1.0 1.0 1.0 99.0
2.0 995.3 32.6 14.9 34.4 0.4 -3.6 3.6 353.7 3.0 -86.783 33.180 999.0 999.0 181.0 1.0 3.0 1.0 1.0 1.0 99.0
```

4.3 Station List

Site ID	WMO ID	Site Name	State or Country	Latitude	Longitude	Elev (m)
KBMX	72230	Birmingham	AL	33.180	-86.783	174
KFFC	72215	Peachtree City	GA	33.356	-84.567	245
KJAN	72235	Jackson	MS	32.320	-90.080	91
KJAX	72235	Jacksonville	FL	30.483	-81.701	10
KKEY	72201	Key West	FL	24.553	-81.789	13
KLCH	72240	Lake Charles	LA	30.126	-93.217	5
KLIX	72233	Slidell	LA	30.338	-89.825	10
KSHV	72248	Shreveport	LA	32.452	-93.842	85
KTAE	72214	Tallahassee	FL	30.446	-84.300	53
KTBW	72210	Tampa Bay	FL	27.705	-82.401	3
PHTO	91285	Hilo	HI	19.717	-155.049	12

5.0 Data Quality Control Procedures

1. Each sounding was converted from its original format into the EOL Sounding Composite (ESC) format.
2. Each sounding was passed through a set of automated data quality checks which included basic gross limit checks as well as rate of change checks. This is further described in Section 4.1.
3. Each sounding was visually examined utilizing the NCAR/EOL XQC sounding quality control software. This is further described in Section 4.2.
4. Each sounding was then converted to the EOL sounding format described above.

5.1 Automated Data Quality Checks

This data set was passed through a set of automated data quality checks. This procedure includes both gross limit checks on all parameters as well as rate-of-

change checks on temperature, pressure, and ascent rate. A version of these checks is described in Loehrer et al. (1996) and Loehrer et al. (1998).

5.1.1 Gross Limit Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. Only the data point under examination was flagged. All checks also produced warning messages that specified the location of the problem and the severity of the issue. These warning messages were then summarized statistically and examined to determine any consistent issues.

For this data set NCAR/EOL conducted the following gross limit checks. In the table P = pressure, T = temperature, RH = relative humidity, U = U wind component, V = V wind component, B = bad, and Q = questionable.

Parameter	Check	Parameter(s) Flagged	Flag Applied
Pressure	< 0 or > 1050	P	B
Altitude	< 0 or > 40000	P, T, RH	Q
Temperature	< -90 or > 45	T	B
Dew Point	< -99.9 or > 33 > T	RH T, RH	Q Q
Wind Speed	< 0 or > 100 > 150	U, V U, V	Q B
U Wind	< 0 or > 100 > 150	U U	Q B
V Wind	< 0 or > 100 > 150	V V	Q B
Wind Direction	< 0 or > 360	U, V	B
Ascent Rate	< -10 or > 10	P, T, RH	Q

5.1.2 Vertical Consistency Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. These checks were started at the surface and compared each neighboring data record. In the case of checks that ensured that the values increased/decreased as expected, only the data point under examination was flagged. However, for the other checks, all of the data points used in the examination were flagged. All items within the table are as previously defined. All checks also produced warning messages that specified the location of the problem and the severity of the issue. These warning messages were then summarized statistically and examined to determine any consistent issues.

Parameter	Check	Parameter(s) Flagged	Flag Applied
Time	Decreasing/equal	None	None.
Altitude	Decreasing/equal	P, T, RH	Q
Pressure	Increasing/equal > 1mb/s or < -1mb/s > 2mb/s or < -2mb/s	P, T, TH P, T, TH P, T, TH	Q Q B
Temperature	< -15°C/km < -30°C/km > 50°C/km	P, T, RH P, T, RH P, T, RH	Q B Q

	> 100°C/km	P, T, RH	B
Ascent Rate	> 3m/s or < -3m/s	P	Q
	> 5m/s or < -5m/s	P	B

5.2 Visual Data Quality Checks

Each sounding was visually examined using the NCAR/EOL XQC sounding data quality control software. This software allows the user to view a skew-t/log-p diagram of each sounding and apply data quality flags as appropriate. The user can zoom in on sections of soundings for detailed examination and can adjust the data quality flags for an individual point, sections of soundings, or entire soundings for each parameter individually. The software also allows the user to override the quality flags applied by the automated procedure.

5.3 Data Quality Issues of Note

The data quality control procedures outlined above allows us to identify and, in some cases, resolve issues that could potentially impact research performed using these data sets. The following issues were noted in these soundings.

- KJAN 201808032307** – temperature bad below 800mb (cold)
- KJAX 201808122309** – no data above 659mb; temperature bad above 686mb
- KKEY 201808071102** – temperature questionable below 700mb (cold)
- KTAE 201808021107** – no data above 584mb
- KTAE 201808092302** – no GPS or wind data
- PHTO 201808190024** – temperature data bad/questionable 925-350mb
- PHTO 201808231139** – temperature data bad 843-310mb; no RH 844-433mb

6.0 References

Loehrer, S. M., T. A. Edmands, and J. A. Moore, 1996: TOGA COARE upper-air sounding data archive: development and quality control procedures. Bull. Amer. Meteor. Soc., 77, 2651-2671.

Loehrer, S. M., S. F. Williams, and J. A. Moore, 1998: Results from UCAR/JOSS quality control of atmospheric soundings from field projects. Preprints, Tenth Symposium on Meteorological Observations and Instrumentation, Phoenix, AZ, Amer. Meteor. Soc., 1-6.