

ICECHIP Native Resolution Radiosonde Composite

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1.0 Data Set Description

Native vertical resolution radiosonde data from research and operational sources during the In-situ Collaborative Experiment for the Collection of Hail In the Plains (ICECHIP) campaign converted into a common format (EOL Sounding Composite format which is a columnar ASCII format). The composite includes data from radiosondes from locations around the central United States. The radiosondes were released by Northern Illinois University (one platform) and NOAA/NWS (28 sites).

Data Version: 1.0

Data Status: Final

Time Period: 18 May to 29 June 2025

Physical Location: 25.91 to 48.206N and 88.112 to 111.820W

Data Frequency: The NWS stations operated at a variety of schedules. See Section 2.2 for details. The NIU Black platform released soundings during ICECHIP operations at schedules dependent on weather conditions.

Vertical Resolution: NOAA/NWS - 1 second (~5m); NIU - 5 second (~25m)

Data Sources: NIU and NOAA/NWS

Data Restrictions: Limited to ICECHIP investigators through 30 June 2026. Open access thereafter.

Soundings Included: A total of 2188 radiosondes are included, 45 from NIU Black and 2143 from the NWS.

1.1 ICECHIP Description

ICECHIP (In-situ Collaborative Experiment for the Collection of Hail In the Plains) was the first United States hail-focused field campaign in over 40 years. It was a nomadic field campaign during the spring storm season (May and June) of 2025 over a domain covering much of the

central United States where there exists significant probabilities of supercell hailstorms. ICECHIP was a team of researchers from ~15 institutions and three international partners that deployed a fully mobile network to capture observations from a wide variety of hailstorms and hail types. In particular it looked to address five key hail science themes: 1) Study hailstone growth and fall behavior to improve microphysical models; 2) Validate hail trajectory models and link updrafts to surface hail production; 3) Assess environmental impacts on hail forecasting skill; 4) Connect hailstone properties to damage potential on materials and structures; and 5) Enhance radar-based hail detection and link updrafts to hail mass and damage. The instrumentation included mobile radars, lidars, mesonets, radiosondes, hailsondes, windsonds, radiometers, disdrometers, uncrewed aerial systems, as well as crews collecting hailstones. Information on ICECHIP operations and Intensive Observation Periods (IOPs) can be found in the ICECHIP Field Catalog (<https://catalog.eol.ucar.edu/icechip>) and additional background information can be found at the ICECHIP website (https://www.eol.ucar.edu/field_projects/icechip).

2.0 Instrument Description

2.1 Instrumentation

NIU Black used iMet-4 radiosondes

KABQ, , KABR, KAMA, KBIS, KCRP, KDVN, KEPZ, KFGZ, KGGW, KGJT, KGRB, KILX, KLBF, KLCH, KLZK, KMAF, KMPX, KOAX, KRIW, KSGF, KSHV, and KUNR used Graw DFM-17 radiosondes with a capacitance humidity sensor.

KBRO, KDDC, KFWD, KOUN, KTOP, and KTWC used Vaisala RS41 radiosondes (DigiCORA MW41) with a Humicap capacitance humidity sensor with active de-icing method.

2.2 Station Locations

Site ID	WMO ID	WBAN	Site Name	State	Latitude	Longitude	Elevation (m)
KABQ	72365	23050	Albuquerque	NM	35.038	-106.623	1619
KABR	72659	14929	Aberdeen	SD	45.455	-98.414	398
KAMA	72363	23047	Amarillo	TX	35.233	-101.709	1095

KBIS	72764	24011	Bismarck	ND	46.772	-100.762	506
KBRO	72250		Brownsville	TX	25.916	-97.420	7
KCRP	72251		Corpus Christi	TX	27.779	-97.505	15
KDDC	72451	13985	Dodge City	KS	37.762	-99.969	790
KDVN	74455	94982	Davenport	IA	41.613	-90.580	230
KEPZ	72364	03020	El Paso	TX	31.873	-106.697	1254
KFGZ	72376		Flagstaff	AZ	35.231	-111.820	2179
KFWD	72249	03990	Fort Worth	TX	32.835	-97.298	195
KGGW	72768	94008	Glasgow	MT	48.206	-106.627	693
KGJT	72476		Grand Junction	CO	39.120	-108.524	1474
KGRB	72645		Green Bay	WI	44.498	-88.112	209
KILX	74560		Lincoln	IL	40.151	-89.338	179
KLBF	72562	24023	North Platte	NE	41.134	-100.700	849
KLCH	72240		Lake Charles	LA	30.126	-93.217	5
KLZK	72340		Little Rock	AR	34.836	-92.260	173
KMAF	72265	23023	Midland	TX	31.943	-102.190	874
KMPX	72649	94983	Chanhassen	MN	44.849	-93.564	290
KOAX	72558	94980	Omaha	NE	41.320	-96.366	351
KOUN	72357	03948	Norman	OK	35.230	-97.470	362
KRIW	72672	24061	Riverton	WY	43.065	-108.477	1699

KSGF	72440	13995	Springfield	MO	37.236	-93.402	391
KSHV	72248		Shreveport	LA	32.452	-98.842	85
KTOP	72456	13996	Topeka	KA	39.070	-95.620	268
KTWC	72274		Tucson	AZ	32.228	-110.956	751
KUNR	72662	94043	Rapid City	SD	44.073	-103.210	1029
NIU	N/A	N/A	Mobile	Mobile	Mobile	Mobile	Mobile

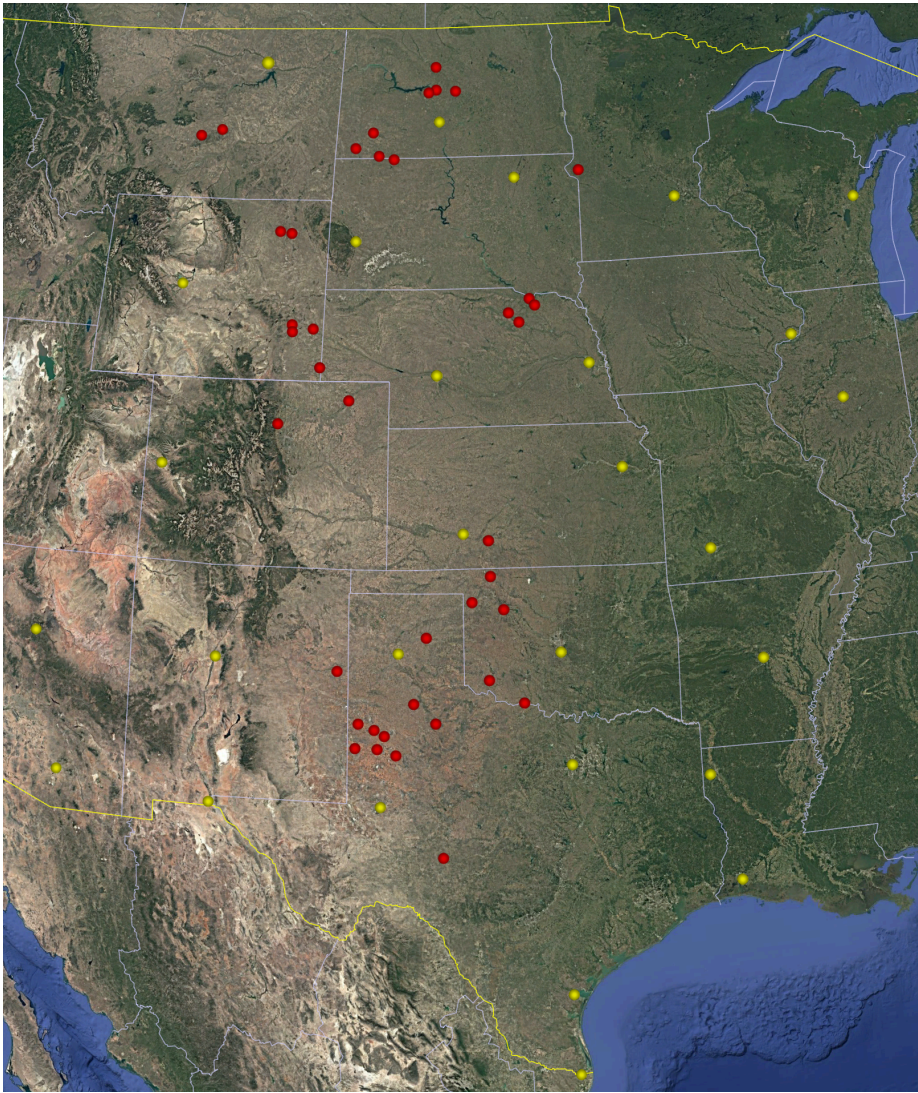


Figure 1. Map of ICECHIP radiosonde composite locations. Yellow circles are NWS sites and red circles are NIU Black locations.

The NIU Black platform operated only during ICECHIP IOP operations. Soundings were released at varying intervals depending on weather. A total of 45 soundings are included in the dataset.

The NWS stations released their radiosondes at varying schedules by station during ICECHIP.

KDRT (Del Rio, Texas) did not transmit their high resolution data over GTS and is not included in this native resolution dataset.

KABQ, KBIS, KBRO, KDDC, KDVN, KEPZ, KFWD, KGGW, KGRB, KILX, KLZK, KMAF, KMPX, KOUN, KRIW, KSGF, KSHV, and KTOP typically had releases at 00 and 12 UTC during ICECHIP.

KABR typically had a single release at 00 UTC during May and typically had releases at 00 and 12 UTC during June.

KAMA typically released at 00 and 12 UTC through 7 May switching to typically releasing at 00 and 18 UTC during the remainder of ICECHIP.

KCRP and KFGZ typically released at 00 and 12 UTC through 14 June switching to typically releasing at 00 and 18 UTC during the remainder of ICECHIP.

KGJT typically had a single release during May at 00 UTC, switched to 00 and 12 UTC through 26 June, and then switched to 00 and 18 UTC for the remainder of ICECHIP.

KLBF did not routinely release any radiosondes and conducted only a small number of special releases during ICECHIP.

KLCH typically had releases at 00 and 12 UTC through 17 May and switched to 00 and 18 UTC during the remainder of ICECHIP.

KOAX and KUNR typically had releases at 00 and 18 UTC during ICECHIP.

KTWC typically had releases at 00 and 12 UTC during May switching to 00 and 18 UTC during June.

A total of 2143 NWS radiosondes are included in this dataset with the breakdown by station as follows: KABQ (64), KABR (71), KAMA (80), KBIS (88), KBRO (76), KCRP (78), KDDC (84), KDVN (86), KEPZ (86), KFGZ (78), KFWD (81), KGGW (68), KGJT(62), KGRB (86), KILX (81), KLBF (6), KLCH (83), KLZK (74), KMAF (85), KMPX (78), KOAX (87), KOUN (76), KRIW (87), KSGF (71), KSHV (80), KTOP (84), KTWC (81), KUNR (82).

3.0 Data Collection and Processing

3.1 Data Collection

Complete information on the collection procedures at each site can be found in the documentation at their respective dataset pages in the NCAR/EOL Field Data Archive:

NIU Black Sites: <https://doi.org/10.26023/494D-6K62-980G>

NWS Sites: <https://doi.org/10.26023/K5Q8-8G3A-BE0E>

3.2 Data Processing

Complete information on the collection procedures at each site can be found in the documentation at their respective dataset pages in the NCAR/EOL Field Data Archive:

NSSL Sites: <https://doi.org/10.26023/494D-6K62-980G>

NWS Sites: <https://doi.org/10.26023/K5Q8-8G3A-BE0E>

3.3 Quality Control Processing

Each sounding underwent initial quality control processing by their respective radiosonde systems described above.

In addition to the quality control procedures conducted by the data source, each sounding was passed through a two-step quality control process. First a series of automated data quality checks were conducted including basic gross limit checks as well as rate of change checks as described in section 3.3.1. Second, each sounding was visually examined utilizing the NCAR/EOL XQC sounding QC software as described in section 3.3.2.

3.3.1 Automated Data Quality Checks

Each sounding in this dataset was passed through a set of automated data quality checks. This procedure includes both gross limit checks (section 3.3.1.1) on all parameters as well as rate-of-change checks (section 3.3.1.2) on temperature, pressure, and ascent rate. A version of these checks is described in Loehrer et al. (1996) and Loehrer et al. (1998).

3.3.1.1 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

3.3.1.2 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	P, T, RH	Q
	> 1mb/s or < -1mb/s	P, T, RH	Q
	> 2mb/s or < -2mb/s	P, T, RH	B
Temperature	< -15°C/km	P, T, RH	Q
	< -30°C/km	P, T, RH	B
	> 50°C/km	P, T, RH	Q
	> 100°C/km	P, T, RH	B
Ascent Rate	> 3m/s or < -3m/s	P	Q
	> 5m/s or < -5m/s	P	B

3.3.2 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.

4.0 Data Format

The data are in individual files by release.

The NWS file naming convention is: GTS_BUFR_XXX_YYYYMMDDhhmm_YY_SONDE.cls.qc where XXX is the Site ID (see the table in Section 2.2), YYYYMMDDhhmm is the UTC release date and time, and YY is a two digit number signifying which GTS reporting of the sounding was used (sometimes data from a single release are sent over GTS more than once for corrections; this number is mostly 01 with just five 02 values during ICECHIP).

The NIU Black file naming convention is: NIU_City_State_ICAO_YYYYMMDDhhmm.cls.qc where ICAO is the ICAO airport code for the nearest airport and City and State are from that airport, and YYYYMMDDhhmm is the UTC release date and time for the radiosonde.

The final dataset is in the EOL Sounding Composite (ESC) format. ESC is a columnar ASCII format that consists of 15 header records for each sounding with the remaining records containing the radiosonde data and their 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	Contents
1	Data Type:	Description of the type and resolution of data
2	Project ID:	Short name for the field campaign
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. They typically include things such as radiosonde type, radiosonde serial number, sensor information, balloon information, and/or ground station software.

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	6.1	Time since release	Seconds	9999.0
2	6	6.1	Pressure	hPa	9999.0
3	5	5.1	Temperature	°C	999.0
4	5	5.1	Dew Point Temperature	°C	999.0
5	5	5.1	Relative Humidity	Percent	999.0
6	6	6.1	U Wind Component	m/s	9999.0
7	6	6.1	V Wind Component	m/s	9999.0
8	5	5.1	Wind Speed	m/s	999.0
9	5	5.1	Wind Direction	Degrees	999.0
10	5	5.1	Ascent Rate	m/s	999.0
11	8	8.3	Longitude	Degrees	9999.0
12	7	7.3	Latitude	Degrees	999.0
13	5	5.1	Elevation Angle	Degrees	999.0
14	5	5.1	Azimuth Angle	Degrees	999.0
15	7	7.1	Geopotential Altitude	Meters	99999.0

16	4	4.1	QC code for Pressure	Code	99.0
17	4	4.1	QC Code for Temperature	Code	99.0
18	4	4.1	QC Code for Humidity	Code	99.0
19	4	4.1	QC Code for U Wind	Code	99.0
20	4	4.1	QC Code for V Wind	Code	99.0
21	4	4.1	QC Code 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. (“QUESTIONABLE”)
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”)

5.0 Data Remarks

See the respective FDA dataset pages linked in Section 3.1 for any details on data quality issues.

6.0 References

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