

ICECHIP: 5hPa Resolution Radiosonde Composite

Author: UCAR/NCAR - Earth Observing Laboratory

Processing and Quality Control: Scot Loehrer and Daniel Choi (NCAR/EOL)

Dataset Contact: Scot Loehrer (loehrer@ucar.edu)

1.0 Data Set Description

Interpolated 5hPa 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: 5hPa

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

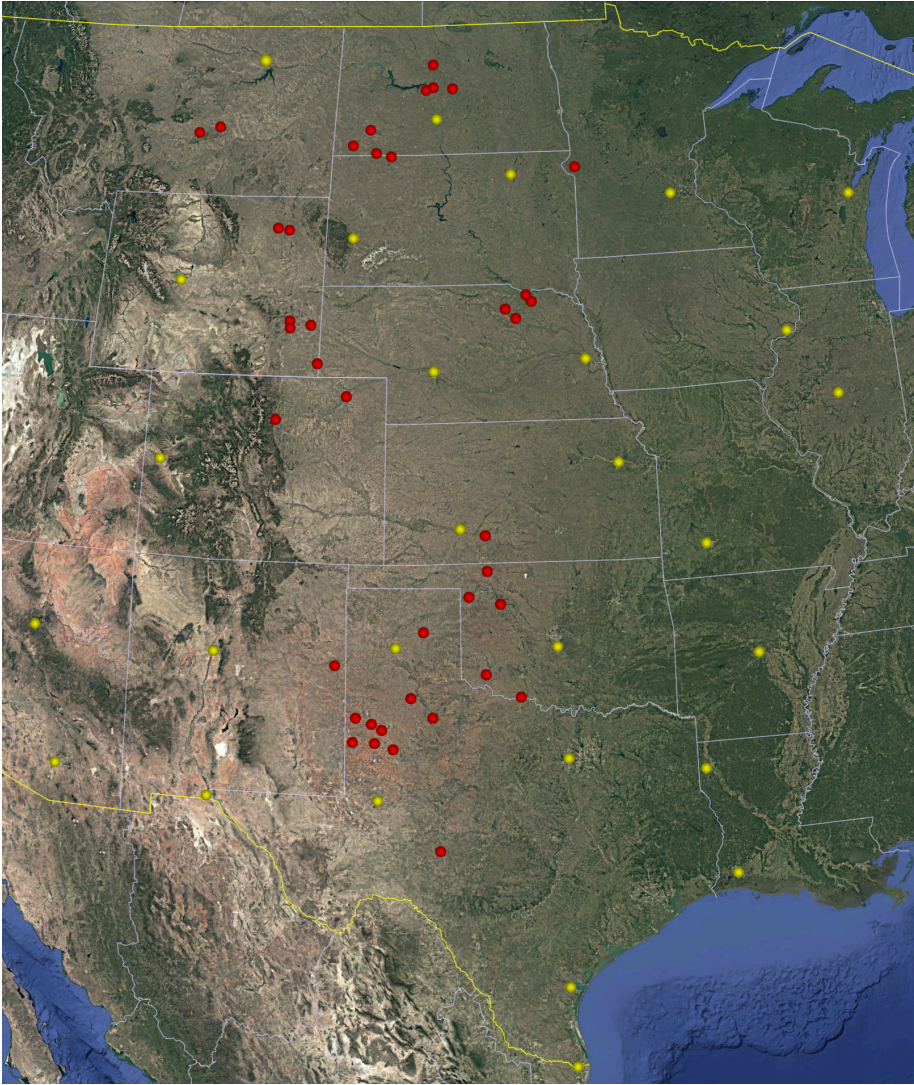


Figure 1. Map of ICECHIP radiosonde composite locations. Yellow circles are NWS sites and red circles are NIU Black locations.

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

This dataset takes the data from the ICECHIP Native Resolution Radiosonde Composite and interpolates the data to a consistent 5hPa vertical resolution. A total of 2188 soundings are included in this dataset.

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>

The procedures used to develop the High Resolution Radiosonde Composite upon which these data are based can be found in the documentation at its dataset page in the NCAR/EOL Field Data Archive:

High Resolution Composite: <https://doi.org/10.26023/6PEQ-03HC-WD0J>

3.1 5hPa Interpolation Procedures

The surface data point was kept as the initial level in each sounding. The first interpolated data point was at the next lowest pressure evenly divisible by 5 and then every 5 hPa pressure level beyond that point to either 50 hPa or the lowest pressure level reached by the radiosonde, whichever came first. The first 15 lines of each file (the header information) were kept without change.

For the interpolation, the software searched for two data points around the desired pressure level. The search was conducted by looking for two valid (i.e. non-missing) data points around the desired pressure level, while also paying attention to the time difference between the two data points as well as their quality control flags. There was a search for the two best possible data points to use in the interpolation. If the desired pressure level was within the original dataset, that data point was used without interpolation.

There was first a search for values flagged as good within some time range (50 sec for temperature, humidity, and wind and 100 sec for pressure; hereafter termed the ARANGE) and the interpolated data point was flagged as good. Failing that, it searched for values flagged as estimated within the same time range and the interpolated data point was flagged as estimated. Then the search went for good values within a wider time range (100 sec for temperature, humidity, and wind and 200 sec for pressure; hereafter termed the BRANGE) the flag for the interpolated data point here was then degraded (even though two `good' data points were used there was a significant time difference between them) to questionable. Then, in turn, estimated values within the BRANGE were used (flag set to questionable), questionable values within the BRANGE (flag set to bad), good values greater than the BRANGE apart (flag set to bad), estimated values greater than BRANGE apart (flag set to bad), questionable values greater than BRANGE apart (flag set to bad), finally any bad values (flag set to bad). This search was conducted separately for each interpolated variable (pressure, temperature, relative humidity, and the u and v wind components).

Thus for each interpolated data point, the quality control flag was set to the worst case among the data points used in the interpolation, except, for each time range apart, the quality control flag was degraded one level (i.e. good to questionable, etc).

The quality control flags should be carefully heeded in these files. While some of the data may look good, it may have been interpolated over large pressure intervals, and thus be suspect.

For each interpolated data point the dew point was calculated from the temperature and relative humidity (Bolton 1980) and the total wind speed and direction were calculated from the interpolated u and v component values. Also, the altitude and time were interpolated using the same data points used for the pressure interpolation. The ascension rate was recalculated based on the time and altitude values from the two data points used to interpolate the 5 hPa data point. Thus the ascension rate values do not reflect the values based on the interpolated data. The latitude and longitude values were interpolated using the same data points used in the wind component interpolation.

4.0 Data Format

The data are in files by day and network so each file contains all soundings from that network for the day concatenated into a single file. The file naming convention is: NWS_GTS_yyyymmdd.05mb and NIU_yyyymmdd.05mb where yyyymmdd is the UTC year, month, and day of month.

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")
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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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