Daily Arctic Ocean Rawinsonde Data from Soviet Drifting Ice Stations, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Kahl, J. 1997. *Daily Arctic Ocean Rawinsonde Data from Soviet Drifting Ice Stations, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/AH8D9CN70VN6. [Date Accessed].

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National Snow and Ice Data Center

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1 DATA DESCRIPTION

The Daily Arctic Ocean Rawinsonde Data from the Soviet Drifting Ice Stations data set is an archive of rawinsonde measurements of wind direction and speed, atmospheric pressure, humidity, air temperature, and geopotential height as well as surface-based observations of cloud cover, such as, amount, type, and height, from Soviet North Pole drifting stations in the Arctic Ocean for the region north of 70 degrees North, from April 19, 1954 to July 31, 1990.

This data represents an archive compiled through data rescue efforts by J. Kahl and Russian scientists at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg, Russia, with funding from the National Oceanic and Atmospheric Administration, the National Science Foundation, and the Electric Power Research Institute. It is intended as a unique data set for analysis of Arctic upper air processes and variability. The data were obtained from several different sources. All of these data are ultimately derived from the set of bound volumes of handwritten tables kept at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg, Russia. The data were received in varying formats, ranging from ~20,000 soundings on individual floppy disk files to ~2,000 soundings from the World Data Center in Obninsk, Russia, to ~700 soundings published as tables in Russian.

1.1 Parameters

1.1.1 Variables in Header of Each Sounding

STATION

North Pole station number
Missing values are -99. Occupies columns 1-3.

STN_IND

STATION NUMBER INDICATOR: Positive single digit. Specifies the type of station number given in the Condigital station variable.
0 = WBAN NUMBER
1 = AIR FORCE AUGMENTED WMO NUMBER
2 = SHIP CALL SIGN
3 = MOBILE PLATFORM CALL SIGN
4 = MOBILE PLATFORM ID (Assigned by NCDC)
5 = WMO/CARDS NUMBER
6 = FIXED PLATFORM CALL SIGN
7 = OTHER STATION NUMBER (Origin unknown)
8 = RESERVED
9 = NO STATION NUMBER
Missing values are 9. Occupies column 5.

ELEV

ELEVATION: The height of the launch site in meters used in Condigital soundings.
Missing values are 9999.9. Occupies columns 7-13.

YEAR

Four-digit year of sounding observation.
Missing values are 9999. Occupies columns 15-18.

MONTH

Two-digit month of sounding observation.
Missing values are 99. Occupies columns 20-21.

DAY

Two-digit day of sounding observation.
Missing values are 99. Occupies columns 23-24.

GMT_HOUR

Two-digit GMT hour of sounding observation. Usually 00, 06, 12, or 18. However, for those days that had more than four soundings, there will be soundings with additional hours.
Missing values are -9. Occupies columns 26-27.

GMT_MINUTE

Two-digit GMT minute of sounding observation.
Missing values are -9. Occupies columns 28-29.

STD_GMT_TIME

Two-digit standard GMT time from Aerostan data set.
Missing values are -9. Occupies columns 31-32.

LOCAL_TIME

Three-digit local time used in Floppy soundings.
Missing values are -9. Occupies columns 34-36.

RELSE_TIME

The hour and minute of the actual release, expressed as HHMM. Used in Condigital soundings.
Missing values are 9999. Occupies columns 38-41

LATITUDE

The station latitude in degrees North.
Missing values are 99.99. Occupies columns 43-47.

LONGITUDE

The station longitude in degrees East.

Missing values are 999.99. Occupies columns 49-54.

MIN_ALTITUDE

Altitude in meters of first transmission level in sounding.
Missing values are -9999999. Negative values generally indicate cases where the surface pressure is < 1000 mb and the first reported level is the mandatory 1000 mb level.
Occupies columns 56-63.

MAX_ALTITUDE

Altitude in meters of last transmission level in sounding.
Missing values are -9999999. Occupies columns 65-72.

OBSN_TYPE

Type of observation given in Condigital soundings:
01 = radio/rawinsonde
02 = rocketsonde
03 = satellite
04 = dropsonde
05 = aircraft flight level report
06 = Profiler
07 = PIBAL
08 = APOB
09 = RAWIN (RADAR winds only)
10 = Rawinsonde (RADAR winds)
11 = Radiosonde (optical theodolite)
12 = Rawinsonde (OMEGA NAVAID)
13-98 = reserved
Missing values are 99. Occupies columns 74-75.

QC_EFFORT

Used in Condigital soundings.
QUALITY CONTROL EFFORT: Intended for use in conjunction with the DATA_SRCE field for determining if the appendices of the Condigital documentation must be referenced for decoding the ELEMENT QUALITY flags. If QC EFFORT=0, the ELEMENT QUALITY flags defined within the body of this document apply, regardless of the DATA_SRCE. If the QC EFFORT > 0, the ELEMENT QUALITY flags will be defined in Appendix nn of the Condigital document (where nn = the value contained in the DATA_SRCE element).
0 = NCDC QC after 12/92
1 = NCDC QC prior to 1/93
2 = QC at source
3-7 = reserved
8 = no QC
9 = unknown
Missing values are 9. Occupies column 77.

DATA_SRCE

DATA SOURCE/FORMAT: This field indicates the data source for the Condigital soundings only. See appendices keyed to the data source values for details concerning the original source.
00 = TD6103 (NMC)

01 = TD6201 (U.S. National data set prior to 1/93)
02 = Standard Nonreal-Time Data Transfer Format
(Mostly MicroART - post 12/92)
03 = Mini Rawin System Format (MRS)
04 = TDAT/WDAT Format
06 = Manuscript
07 = Range standard
08 = MIT
09 = NCAR
10 = TDF54
11 = TDF56
12 = other PC-based, semiautomated reduction system
13 = Canadian upper air archives
14 = Former USSR
15 = Peoples' Republic of China (PRC)
16 = Argentina
17 = British Antarctica
18 = Hong Kong
19 = Korea
18-98 = reserved
99 = unknown
Missing values are 99. Occupies columns 79-80.

NUM_LVLS

NUMBER OF LEVELS: This is the number of data levels found in the sounding.
Missing values are 0. Occupies columns 82-84.

INST_CODE

INSTRUMENT CODE: Seven-character string from Aerostan data set.
Missing values are "???????." Occupies columns 86-92.

CLOUD_AMOUNT

CLOUD AMOUNT from Aerostan data set. Tenths of sky covered.
Missing values are -9. Occupies columns 94-95.

CLOUD_AMOUNT_QLTY

CLOUD AMOUNT QUALITY from Aerostan data set.
0 = No quality control
1 = correct
2 = doubtful value
3 = error
4 = corrected value
5 = original value missing; value produced
9 = missing data
Missing values are -9. Occupies columns 97-98.

LOWER_CLOUD

LOWER INFERIOR CLOUDS from Aerostan data set.
0 = absence of clouds

1 = cumulus humilis
2 = cumulus humilis together with stratocumulus
3 = cumulonimbus calvus together with cumulus, stratocumulus or stratus
4 = stratocumulus cumulogenitus
5 = stratocumulus
6 = stratus and/or fractonimbus
7 = fractonimbus under altostratus or nimbostratus
8 = cumulus humilis together with cumulus congestus
9 = cumulonimbus capillatus, stratocumulus, stratus
Missing values are -9. Occupies columns 100-101.

LOWER_CLOUD_QLTY

LOWER INFERIOR CLOUDS QUALITY from Aerostan data set.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 103-104.

CLOUD_HEIGHT

CLOUD HEIGHT from Aerostan data set (height of cloud base).

0 = < 50 m
1 = 50-100 m
2 = 100-200 m
3 = 200-300 m
4 = 300-600 m
5 = 600-1000 m
6 = 1000-1500 m
7 = 1500-2000 m
8 = 2000-2500 m
9 = > 2500 m
Missing values are -9. Occupies columns 106-107.

CLOUD_HEIGHT_QLTY

CLOUD HEIGHT QUALITY from Aerostan data set.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 109-110.

MID_CLOUD

MIDDLE CLOUD TYPE from Aerostan data set.
1 = altostratus translucidus
2 = altostratus opacus or nimbostratus
3 = altocumulus translucidus
4 = altocumulus translucidus lenticularis
5 = altocumulus translucidus duplicatus or altocumulus opacus
6 = altocumulus cumulogenitus
7 = altocumulus opacus or duplicatus
8 = altocumulus cumuliformis, floccus, or castellatus
9 = altocumulus together with cirrus
Missing values are -9. Occupies columns 112-113.

MID_CLOUD_QLTY

MIDDLE CLOUD SHAPE QUALITY from Aerostan data set.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 115-116.

HIGH_CLOUD

HIGH_LEVEL CLOUDS TYPE from Aerostan data set.
1 = cirrus filosus
2 = cirrus densus
3 = cirrus nothus
4 = cirrus uncinus
5 = cirrus, cirrostratus
6 = cirrus, cirrostratus
7 = cirrostratus (all sky)
8 = cirrostratus (part of sky)
9 = cirrocumulus
Missing values are -9. Occupies columns 118-119.

HIGH_CLOUD_QLTY

HIGH_LEVEL CLOUDS SHAPE QUALITY from Aerostan data set.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 121-122.

1.1.2 Variables in Transmission Levels of Each Sounding

One or more of the following three text fields will appear at the end of each sounding's header in columns 124-325.

For a given sounding, COMMENTS and OTHERFILEDATA may or may not be present but ORIGINAL_LATLON will always be there. No matter how many of the following three text fields are present, they will always occur in the order given below and will always begin in column 121.

COMMENTS

May or may not be present. Floppy data set contained key sequences of unknown meaning. If they were present for a given sounding, they will appear directly after HIGH_CLOUD_QLTY. This field can be 0 to 100 characters long (when present, usually contains 3-10 characters).

OTHERFILEDATA

May or may not be present. Soundings which are the product of merging two different sources may contain a text field containing the following:

TXT: YEAR MONTH DAY GMT_HOUR GMT_MINUTE LATITUDE LONGITUDE 3km data: PRESSURE TEMPERATURE HUMIDITY WIND_DIRECTION WIND_VELOCITY DPDP.

These are alternate values for some of the header and 3km level variables. This text field will start with the letters "TXT: " and continue with values for the above listed variables. After the value for LONGITUDE is given, the words "3km data:" may appear with the above listed variables following.

ORIGINAL_LATLON

Will be present in every sounding. Most soundings have new latitude and longitude position data from one of two independent sources, with the exception of those soundings whose dates were out of range for the independent sources. All soundings have this text field, which begins with the words "Old latlon" and follows with the position data from its original source. (Old latlon, LATITUDE LONGITUDE.)

LEVEL_CODE

LEVEL CODE is from the Aerostan data set.
01 = surface
02 = significant level (not at mandatory level)
03 = tropopause (significant level)
04 = significant level for wind (not at mandatory level)
05 = max wind (not at mandatory level)
06 = level of wind shift (not at mandatory level)
10 = mandatory level (for pressure or altitude)
11 = surface and standard level coincide
12 = significant level (occurs at mandatory level)
13 = tropopause (occurs at mandatory level)
14 = significant wind level (occurs at mandatory level)
15 = max wind (occurs at mandatory level)
16 = wind shift (occurs at mandatory level)
Missing values are 99. Occupies columns 1-2.

ALTITUDE

Height of the pressure level in whole meters.
Missing values are -999999. Occupies columns 4-10.

A_ALT_QLTY

Aerostan's quality indicator for the ALTITUDE field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 12-13.

K_ALT_QLTY

Kahl's quality indicator for the ALTITUDE field. Occupies column 15.
0 = FAIL
1 = PASS

PRESSURE

AIR PRESSURE of the data level in hPa.

Missing values are 9999.99. Occupies columns 17-23.

A_PRES_QLTY

Aerostan's quality indicator for the PRESSURE field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 25-26.

K_PRES_QLTY

Kahl's quality indicator for the PRESSURE field. Occupies column 28.
0 = FAIL
1 = PASS

TEMPERATURE
AIR TEMPERATURE in degrees Celsius.
Missing values are 99.99. Occupies columns 30-35.

A_TEMP_QLTY

Aerostan's quality indicator for the TEMPERATURE field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 37-38.

K_TEMP_QLTY

Kahl's quality indicator for the TEMPERATURE field. Occupies column 40.
0 = FAIL
1 = PASS

HUMIDITY

RELATIVE HUMIDITY ranging from 0 to 100 percent.
Missing values are -99.9. Occupies columns 42-46.

K_HUMID_QLTY

Kahl's quality indicator for the HUMIDITY field. Occupies column 48.
0 = FAIL
1 = PASS

WIND_DIRECTION

WIND DIRECTION ranging from 0 to 360 degrees.
Missing values are 999. Occupies columns 50-52.

A_WIND_DIR_QLTY

Aerostan's quality indicator for the WIND DIRECTION field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 54-55.

K_WIND_DIR_QLTY

Kahl's quality indicator for the WIND_DIRECTION field. Occupies column 57.
0 = FAIL
1 = PASS

WIND_VELOCITY

WIND VELOCITY in meters/second.
Missing values are -99.9. Occupies columns 59-63.

A_WIND_SPD_QLTY

Aerostan's quality indicator for the WIND VELOCITY field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 65-66.

K_WIND_SPD_QLTY

Kahl's quality indicator for the WIND_VELOCITY field. Occupies column 68.
0 = FAIL
1 = PASS

LVL_QUAL

LEVEL QUALITY INDICATOR: Denotes the results of Condigital's quality controls applied to this level. Range is 0 to 9 as follows:
0 = All available elements are correct
1 = One or more elements are suspect; no replacement level exists
2 = One or more elements are suspect; a replacement level exists
3 = Operator (observer) deleted, no replacement level follows
4 = NCDC edit/quality control has determined this level to be highly suspect
5-6 = Reserved
7 = Unknown
8 = Replacement level
9 = The level has not been checked
Missing values are 9. Occupies column 70.

DPDP

DEW POINT DEPRESSION (DEW POINT DEFICIT) at the current level in degrees Celsius.
Missing values are 99.9. Occupies columns 72-75.

A_DPD_QLTY

Aerostan's quality indicator for the DEW POINT DEFICIT field.
Refer to CLOUD_AMOUNT_QLTY for values.
Missing values are -9. Occupies columns 77-78.

K_DPD_QLTY

Kahl's quality indicator for the DPDP field. Occupies column 80.
0 = FAIL
1 = PASS

TYP_LVL

TYPE OF LEVEL: Condigital's code indicating the reason for selection of the level. Range of values is 00-99.
00 =Operator deleted level
01 = Operator added level
02 = Aircraft report
03 = Dropsonde
04 = Rocketsonde
05 = Profiler
06 = Reserved
07 = Reserved
08 = Reserved
09 = Begin missing data (all elements)
10 = End missing data (all elements)
11 = Begin missing temperature data/doubtful altitude
12 = End missing temperature data
13 = Begin missing relative humidity/dew point depression data
14 = End missing relative humidity/dew point depression data
15 = Begin doubtful altitude data
16 = Begin doubtful temperature, altitude data
17 = End doubtful temperature data
18 = Reserved
19 = Reserved
20 = Interpolated (generated) mandatory pressure level
21 = Interpolated (generated) level other than a mandatory pressure level
22 = Highest level reached before balloon descent because of icing or turbulence
23 = Balloon re-ascended beyond previous highest level
24 = Base pressure for stability index
25 = Zero-degree crossing for the RADAT message
26 = Tropopause
27 = Maximum wind level
28 = Below surface level
29 = Reserved
30 = Reserved
31 = Surface level
32 = Mandatory pressure level
33 = Within 20 hectopascals (mb) of the surface
34 = Flight termination level
35 = Relative humidity level selection terminated
36 = Pressure less than 10 hectopascals
37 = Mandatory temperature level
38 = Significant temperature level
39 = Significant relative humidity level
40 = Winds at constant height (above ground level)
41 = Mandatory wind level
42 = Significant wind level
43 = Incremental wind level (e.g., 1-minute, fixed regional)
44 = Significant thermodynamic level (reason for selection is unknown)
45 = High resolution data sample
46 = Other/unspecified
47 = Generated winds at incremental heights
48-50 = Reserved
51-99 = ***Used for those levels that satisfy the criteria for multiple types***
51-58 = Reserved
59 = Begin missing data (all elements) at a tropopause level
60 = End missing data (all elements) at a tropopause level

61 = Begin missing temperature data at a tropopause level
62 = End missing temperature data at a tropopause level
63 = Begin missing relative humidity/dew point depression data at a tropopause level64 = End missing relative humidity/dew point depression data at a tropopause level
65 = Begin doubtful altitude data at a tropopause level
66 = Begin doubtful temperature, altitude data at a tropopause level
67 = End doubtful temperature data at a tropopause level
68 = Reserved
69 = Begin missing data (all elements) at a mandatory pressure level
70 = End missing data (all elements) at a mandatory pressure level
71 = Begin missing temperature data at a mandatory pressure level
72 = End missing temperature data at a mandatory pressure level
73 = Begin missing relative humidity/dew point depression data at a mandatory pressure level
74 = End missing relative humidity/dew point depression data at a mandatory pressure level
75 = Begin doubtful altitude data at a mandatory pressure level
76 = Begin doubtful temperature, altitude data at a mandatory pressure level
77 = End doubtful temperature data at a mandatory pressure level
78-80 = Reserved
81 = Level satisfies requirements for selection as a mandatory pressure level and as a tropopause level
82 = Level satisfies requirements for selection as a mandatory pressure level and as a significant level
83 = Level satisfies requirements for selection as a mandatory pressure level and as the surface level
84 = Highest level reached before balloon descent because of icing or turbulence and is a mandatory level
85 = Balloon re-ascended beyond previous highest level and is a mandatory level
86 = Base pressure for stability index and is a mandatory level
87 = Zero-degree crossing for the RADAT message and is a mandatory level
88 = Maximum wind level and is a mandatory level
89 = Tropopause level, maximum wind level, and mandatory level
90 = Tropopause level and is a maximum wind level
91-99 =Reserved
Missing values are -99. Occupies columns 82-84.

ELEMENT_QLTY

Condigital field. ELEMENT QUALITY FLAGS: These fields contain the result of any quality control procedures for identifying suspect and doubtful individual elements, and elements that failed QC checks. Descriptions of the element quality flags are contained in the appendices, which are keyed to the DATA_SRCE field. If, for example, the DATA_SRCE is 01 (source = TD6201), the appendix is numbered 02, etc., the Element Quality is assigned a value equivalent to the least correct flag. The range of values is listed in each applicable appendix. Although the range of values for element quality flags are specific for each data source, as a general rule, any combination of ASCII characters, except lowercase letters and "#," is allowed in this element.

Record Position	Element Name
41-42	EQET (Elapsed Time)
43-44	EQP (Pressure/Ranging)
45-46	EQH (Height)
47-48	EQT (Temperature)
49-50	EQU (Humidity)
51-52	EQD (Dew Point Depression)

Record Position	Element Name
53-54	EQWDS (Wind Direction/Speed)

Missing values are "??????????????." Occupies columns 86-99.

NCDC_USE

Condigital field: Reserved for internal NCDC use.
Missing values are *quot;??." Occupies columns 101-102.

1.2 File Information

1.2.1 Format

Data are in ASCII text format.

1.2.2 File and Directory Structure

Data granularity is one file per station per time period.

Each file contains:

- Number of soundings in the file
- Header of first sounding
- Transmission levels for first sounding (one measurement level per record)
- Header of second sounding
- Transmission levels for second sounding (one measurement level per line) etc.

The number of soundings in the file appears only once as the first line of each file and occupies columns 9-12. For variables and formats contained in the sounding headers and in the transmission levels, see the Parameters section.

1.2.3 Naming Convention

Files are named np_**sound.dat, where ** stands for a North Pole station numbered 03 through 31. Each of the 21 files contain soundings with various start and end dates.

The files 03-31 are ordered chronologically, and span April 20, 1954 to July 31, 1990. Data from the North Pole Stations 18, 20, 23-25, 27 and 29-30 are not available.

1.3 Spatial Information

1.3.1 Coverage

Entire circumpolar region between 70° and 90° N.

1.3.2 Resolution

Does not apply.

1.4 Temporal Information

1.4.1 Coverage

Soundings in the record were collected from April 19, 1954 to July 31, 1990. The average duration of each station is 2.4 years. (There were a total of 31 North Pole stations.) Typically, one to three stations were in operation at any one time. There are no significant temporal gaps in this database.

1.4.2 Resolution

Daily

2 DATA ACQUISITION AND PROCESSING

2.1 Quality, Errors, and Limitations

After the merging task was completed, station positions were plotted along with monthly positions provided by AARI (Dr. A. Timerev, Arctic and Antarctic Research Institute, personal communication 1995) and positions given by the NSIDC drifting stations CD-ROM (National Snow and Ice Data Center, Applied Physics Laboratory and Arctic and Antarctic Research Institute 1996). General agreement was found between positions given by the three data sources. With the following exceptions (stations NP03 and NP26), station positions from NSIDC were used because they had already been subjected to quality control procedures (I. Rigor, Polar Science Center, University of Washington, personal communication 1995).

NP03: A detailed table of positions corresponding to each sounding release was provided by Dr. A. Timerev of AARI. These positions were used in the final archive.

NP26: The correct positions were determined to be a "reflection" of the NSIDC drifting stations CD-ROM positions about 180 degrees longitude.

Following the experience in assembling the Historical Arctic Rawinsonde Archive (Serreze et al. 1992; Kahl et al. 1993), it was decided that all data values present in the individual soundings, including quality indicators, would be retained. This approach gives users the option of making their own determination of data quality. Nevertheless, a rudimentary quality control procedure, which is described briefly below and more fully in Serreze et al. 1992, has been applied. This procedure consists of identifying "gross" errors, such as negative wind speeds, and also "probable" errors, such as extreme values. The latter two quality checks, which give codes of 0 (failed) or 1 (passed) are referred to as "Kahl's quality indicators." Only the Aerostan and Condigital data sets contain quality indicators prior to being processed by Kahl. Refer to the Summary of Individual Data Sources section of this document.

Gross errors, such as negative wind speeds, negative geopotential heights, geopotential height decreasing with decreasing pressure, etc., were flagged first. Data values that passed this check were subjected to a "seasonally adjustable limits check," which is described in the following excerpt from Serreze et al. (1992).

The seasonally adjustable limits check worked as follows. Data from all [land-based] stations for 1987 were stratified by season into 15 atmospheric layers bounded by pressure levels. Seasons are defined as December-February (winter), March-May (spring), June-August (summer) and September-November (autumn). Since all checks are based on pressure, no check on the pressure values, themselves, is performed.

Initial frequency histograms of geopotential height, temperature, wind direction, and wind speed were compiled for each layer and for each season in 1987. Extreme outliers were eliminated by discarding values that were more than four standard deviations from the respective means. Since wind speed does not follow a normal distribution, these values were first converted into log wind speed. Means and standard deviations for the remaining data were then recomputed. Using these data as representative sample means and standard deviations of the complete data set, any value that was greater than +/- 4 standard deviations from the sample mean for the respective season and layer was then flagged. The means and standard deviations used in the limits check are given in the Appendix.

An implicit assumption in the error checking routine is that the layer mean is representative of the mean for any level within that layer. Since a large number of atmospheric levels are used in the check, this is a tolerable assumption for testing temperature, wind direction, and wind speed. It was found to be inappropriate for geopotential height, however, due to the logarithmic decay of pressure with increasing elevation.

To check the geopotential heights, this logarithmic relationship was used. Taking the log of pressure at the bottom (P1) and top (P2) of the layer in which the observed pressure (P) fell, a weight, W, was calculated:

W = [LOG(P)-LOG(P2)]/[LOG(P1)-LOG(P2)] (1)

Next, ZL1 and ZH1, respectively, are defined as the lowest and highest allowable geopotential height at the base of the layer, and similarly ZL2 and ZH2 as the lowest and highest allowed limits of the top of the layer (with limits taken as +/- 4 standard deviations from the mean). Then ZL and ZH are calculated, which by incorporating the weight W, define the limits of allowable geopotential height for the value of P:

ZL = W*[ZL1-ZH1] + ZH1 (2)

ZH = W*[ZL2-ZH2] + ZH2 (3)

The allowable value of Z at pressure level P in the sounding is thus

ZL <= Z <= ZH (4)

Since atmospheric moisture can be highly variable, with considerable uncertainties in cold Arctic conditions, the dew point depression data was simply screened to flag negative values and any values exceeding an arbitrary high threshold of 35C. Those wishing to use these data are referred to Elliot and Gaffen (1991) who provide an overview of problems in rawinsonde moisture data.

2.2 Instrumentation

2.2.1 Description

Please review the rawinsonde instrument description document under the Technical References tab.

Original Data Set Name (*)	Where Keypunch Was Performed	North Pole Stations	Approx. No. of Soundings	Notes
Floppy	Central Aerological Observatory (CAO) and Arctic and Antarctic Research Institute (AARI)	3-6,8-9,12-17,22,26	20,000	Mostly upper portions (> 3km) of soundings
Aerostan	captured via Global Telecommunications System	22,26,28,31	2,000	Obtained from World Data Center, Obninsk

Original Data Set Name (*)	Where Keypunch Was Performed	North Pole Stations	Approx. No. of Soundings	Notes
Condigital	NOAA National Climatic Data Center	4,5	1,300	Data published in Russia (AARI 1959). Recorded in NCDC standard format.
3km	Arctic and Antarctic Research Institute (AARI)	4,6-17, 19,21-22,26	20,000	Lower portions of soundings (0-3km)
Books	University of Wisconsin-Milwaukee (UWM)	6,7	700	Data published in Russia (AARI 1960; 1962).
*The original data set name was arbitrarily defined for identification purposes only.				

Merging of Data Sets

All soundings (except for the Aerostan archive) were entered into a computer via manual keypunch operators during 1989 through 1995. The majority of the keypunch activities were carried out at the Central Aerological Observatory (CAO) in Moscow, Russia, and at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg, Russia. Small portions of the data set were keypunched at the University of Wisconsin-Milwaukee (UWM) and at the NOAA National Climatic Data Center (NCDC).

A major part of the data processing effort involved merging the original data sets into a single archive. The primary focus of the merge procedure was blending the lower portions (original data set "3km") together with the upper portions (original data set "floppy"). A secondary focus was eliminating redundancy, as many soundings were present in more than one original data source.

Although, in theory, a unique match should be made between the lower (set "3km") and upper (set "floppy") portions of each sounding, in practice this often was not the case. Keypunch errors, combined with ambiguities in release times and longitude units often prevented an unambiguous match. Some soundings were thus unable to be merged, resulting in a number of soundings that extend only to 3 kilometers in altitude, or that begin slightly above 3 kilometers. In order to facilitate identification of such soundings, the minimum and maximum altitude of the sounding is included in the header record of each sounding.

3 RELATED DATA SETS

- Historical Arctic Rawinsonde (HARA)
- NCEP/NCAR Arctic Marine Rawinsonde Archive
- Environmental Working Group Arctic Meteorology and Climate Atlas

4 CONTACTS AND ACKNOWLEDGMENTS

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5 REFERENCES

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6 DOCUMENT INFORMATION

6.1 Publication Date

19 November 2019

6.2 Date Last Updated

18 May 2021

APPENDIX A – DATA FOR SEASONALLY ADJUSTABLE LIMITS CHECK

Table A - 1 Temperature in Degrees C

Pressure (mb) at layer		Winter		Spring		Summer		Autumn	
Bottom	Top	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1200	951	-21.3	12.1	-4.9	10.1	5.0	6.6	-15.7	12.7
950	901	-19.1	8.9	-6.0	8.6	3.1	6.8	-14.2	9.6
900	851	-18.6	7.8	-7.4	7.6	0.5	6.2	-14.0	8.7
850	801	-19.1	7.3	-8.6	7.1	-1.1	5.9	-14.6	8.0
800	701	-22.3	6.9	-12.1	6.9	-5.5	5.8	-17.9	7.8
700	601	-25.7	6.5	-15.8	6.7	-10.2	5.5	-21.1	7.4
600	501	-35.1	6.7	-25.6	6.9	-19.5	6.0	-31.1	8.0
500	401	-44.7	6.2	-36.0	7.0	-30.3	6.5	-41.2	7.8
400	301	-54.1	4.8	-47.8	5.2	-44.7	6.2	-52.9	5.7
300	201	-57.4	6.7	-50.6	5.9	-51.2	5.7	-55.6	5.3
200	151	-56.3	8.4	-47.7	4.6	-47.1	4.3	-54.1	5.0
150	101	-56.1	8.5	-48.3	4.1	-46.6	3.1	-55.2	4.7
100	51	-56.5	9.4	-48.9	4.5	-47.0	3.6	-58.2	6.3
50	21	-55.1	9.4	-47.4	5.9	-45.4	7.5	-59.6	10.2
20	0	-50.8	10.1	-38.7	12.9	-38.3	13.0	-54.7	15.1

Table A - 2. Geopotential height (m)

	Winter		Spring		Summer		Autumn	
P (mb)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1200	0	0	0	0	0	0	0	0
1000	121	102	111	74	99	64	95	94
850	1333	105	1386	79	1417	71	1330	97
700	2769	123	2882	104	2954	91	2789	121
500	5159	164	5368	155	5504	135	5217	177
400	6668	191	6933	189	7108	167	6745	215
300	8536	209	8859	217	9066	201	8629	251
250	9695	207	10051	218	10261	206	9795	257
200	11115	227	11517	216	11720	201	11225	256
150	12949	218	13420	227	13628	202	13074	256
100	15537	278	16099	251	16321	217	15667	274

	Winter		Spring		Summer		Autumn	
P (mb)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
70	17809	330	18445	278	18685	231	17929	288
50	19961	381	20659	314	20916	258	20046	316
30	23236	454	24023	419	24293	473	23282	544
20	25842	533	26687	592	26998	459	25776	594
10	30313	573	31333	629	31607	629	30238	555
1	40000	573	40000	573	40000	573	40000	573

Table A - 3. Ln wind speed (with wind speed in m/s)

Pressure (mb) at layer		Winter		Spring		Summer		Autumn	
Bottom	Top	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1200	926	1.933	0.631	1.844	0.588	1.737	0.677	1.914	0.725
925	776	2.246	0.564	2.049	0.549	2.023	0.555	2.218	0.592
775	601	2.405	0.557	2.207	0.559	2.143	0.560	2.340	0.585
600	451	2.692	0.581	2.528	0.597	2.412	0.573	2.605	0.596
450	351	2.823	0.608	2.717	0.621	2.592	0.600	2.751	0.621
350	276	2.830	0.636	2.783	0.649	2.748	0.633	2.792	0.667
275	226	2.736	0.642	2.640	0.648	2.695	0.628	2.737	0.669
225	176	2.586	0.618	2.357	0.612	2.401	0.580	2.590	0.619
175	126	2.499	0.595	2.101	0.570	2.123	0.541	2.502	0.549
125	86	2.519	0.621	1.888	0.534	1.853	0.522	2.523	0.499
85	66	2.554	0.687	1.730	0.501	1.684	0.518	2.557	0.480
65	46	2.617	0.744	1.694	0.463	1.622	0.528	2.626	0.502
45	26	2.743	0.758	1.787	0.431	1.679	0.531	2.763	0.545
25	16	2.840	0.747	1.912	0.433	1.753	0.559	2.891	0.575
15	0	3.000	0.727	2.222	0.557	2.031	0.708	3.142	0.568