

NCEP/NCAR Arctic Marine Rawinsonde Archive

Information in this document was derived from:

- **Mulder, P. 1977.** Record format for the NCAR archive of NMC upper air data. *NOAA Office Note*. (Updated by G. Walters, 1992.) 29.
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Summary

This data set, available through file transfer protocol (ftp), contains 17,659 ship (marine) rawinsonde reports for the region north of 65 degrees North. Its record extends from 1976 to 1996. These soundings have been extracted from the National Center for Atmospheric Research (NCAR) rawinsonde archive of the National Meteorological Center (NMC) (now National Center for Environmental prediction, or NCEP). The NCEP/NCAR Arctic Marine Rawinsonde Archive data set complements the [Historical Arctic Rawinsonde Archive \(HARA\)](#) for land stations ([Kahl et al., 1992](#); [Serreze et al., 1992](#)) and the Russian "North Pole" (NP) drifting station archive prepared by J. D. Kahl.

For more information about the data set, please contact [NSIDC User Services](#).

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1. Title

Data Set Identification: NCEP/NCAR Arctic Ship Soundings

2. Investigators

Investigators' Names and Titles

M. C. Serreze and J. D. Kahl

Title of Investigation

NCEP/NCAR Arctic Ship Soundings

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3. Introduction

rawinsonde reports for the region north of 65 degrees North. The record extends from 1976 to 1999, with the best coverage for the Atlantic side of the Arctic. A large number of soundings were taken from a moored ship in the Norwegian Sea.

Objectives/Purpose

The NCEP/NCAR Arctic Ship Soundings data set is useful for meteorological and climatological research applying to polar studies and investigations of global climate change. As a companion data set to [Historical Arctic Rawinsonde Archive \(HARA\)](#), NCEP/NCAR Arctic Ship Soundings is designed to complement HARA soundings data, which have been retrieved from Arctic land stations poleward of 65 degrees North.

Summary of Parameters

The NCEP/NCAR Arctic Ship Soundings data set consists of marine rawinsonde data retrieved over a 20-year period from ships in the region north of 65 degrees North. Soundings data were obtained from the Boulder, Colorado-based National Center for Atmospheric Research (NCAR) archive of the National Center for Environmental Prediction (NCEP) upper air data.

Discussion

Original ship soundings were in formats outlined by [Mulder \(1977\)](#). Data were extracted and sorted first by pressure and second by altitude (geopotential height), with duplicate records merged to the extent possible. The sort/merge procedures follow those used to compile the [Historical Arctic Rawinsonde Archive \(HARA\)](#). Data have been subjected to quality control procedures similar to those discussed by [Serreze et al. \(1995\)](#). NP soundings that were received through the Global Telecommunications System (GTS) are included in the NCEP tapes. Coverage is best for the Atlantic side of the Arctic. A large number of soundings were taken from a moored ship in the Norwegian Sea. The file is arranged in synoptic order, such that all available soundings for day 1 are followed by all available soundings for day 2, day 3, etc., to the end of the file. Each sounding starts with a header line followed by a variable number of data lines with associated quality codes.

Related Data Sets

[Historical Arctic Rawinsonde Archive \(HARA\)](#).

4. Theory of Measurements

This section is not applicable.

5. Equipment

Instrument Description

Please review [Radiosondes](#).

Collection Environment

Soundings were recorded from ships located in the marine environment north of 65 degrees North.

Platform

Radiosondes are balloon-borne instruments. The balloons are made of natural or synthetic rubber, which expand as they ascend, and eventually burst.

6. Procedure

Data Acquisition Methods

Data tapes containing all available soundings north of 65 degrees North were obtained from NCAR. All ship data were extracted from this larger data set, based on data source codes provided with each sounding. Russian North Pole drifting station soundings that were received through the GTS are included in the original tapes. To avoid duplications with the Kahl archive, efforts were made to eliminate these soundings from the present data set, using station call signs provided by R. Colony. However, no guarantees are made that all North Pole drifting station soundings have been removed.

7. Observations

Data Notes

No notes are currently available.

8. Data Granularity

Data represent one-dimensional vertical soundings taken from ships north of 65 degrees latitude, each including measurements of pressure, temperature, winds, and humidity at various atmospheric levels.

9. Data Description

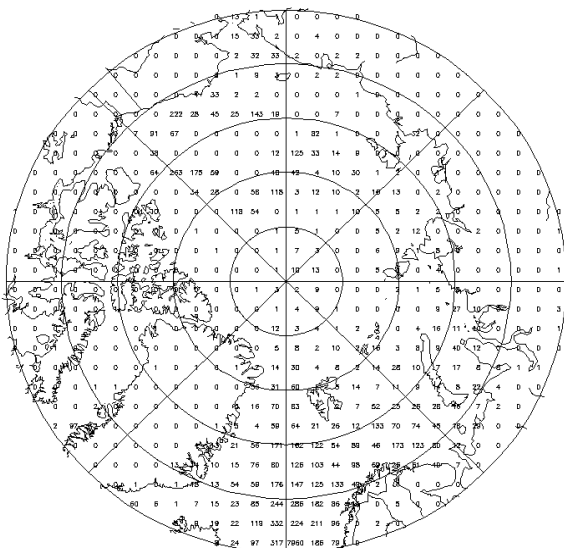
Spatial Characteristics

Spatial Coverage

North polar regions:

- Maximum longitude: 180E

Spatial Coverage Map



Temporal Characteristics

Temporal Coverage

The ship soundings data record extends from 1976 to 1996.

Data Characteristics

Each ship sounding consists of a header record, followed by a number of data records. Typically, each sounding contains measurements recorded at 30 to 40 levels (altitudes determined by atmospheric pressure).

Variable

The variables in the header of each sounding are as follows:

STN: Ship call sign. Any characters allowed, including blanks (alphanumeric).

STN_IND: Specifies the type of ship (integer).

1 = FIXED SHIP

2 = MOVING SHIP

Missing value is 9. In late 1990 or early 1991, it appears that the designation for a fixed ship was dropped, so that all ships are listed as drifting.

ELEV: The height of the launch site in meters (real). Missing values are 999.

YEAR: Year of sounding (integer).

MONTH: Month of sounding (integer).

DAY: Day of sounding (integer).

HOUR: GMT hour of sounding. Usually 00, 06, 12, or 18 (integer).

LATITUDE: The ship latitude in degrees North (0-90) (real).

LONGITUDE: The ship longitude in degrees East (0-360) (real).

MAX_PRESS: Pressure in millibars of first transmission level of sounding. Missing values are 99999.0 (real).

MIN_PRESS: Pressure in millibars of last transmission level of sounding.

Missing values are 99999.0 (real).

INST: Instrument type, as given in NOAA Office Note 29 ([Mulder, 1977](#)). These differ widely between countries as well as through time (integer).

LVLS: Number of data levels in sounding (integer).

The variables in each transmission level are as follows:

ALT: Height of the pressure level in whole meters. Missing values are 99999.0 (real).

PQL: NMC quality indicator for pressure field (see [Table 1](#)) (alphanumeric). Because of an error by M. Serreze in processing soundings for 1988-1991, this value is always missing for these years. (It will always be '9'.)

TEMP: Air temperature in degrees Celsius. Missing values are 9999.0 (real).

TQL: NMC quality indicator for temperature field (see [Table 1](#)) (alphanumeric).

DPD: Dewpoint depression in Kelvins. Missing values are 999.0 (real).

DQL: NMC quality indicator for dewpoint depression field (see [Table 1](#)) (alphanumeric).

WDIR: Wind direction ranging from 0 - 360 degrees. Missing values are 999.0 (real).

WSP: Wind speed in meters/second. Missing values are 999.0 (real).

WQL: NMC quality indicator for wind direction and speed (see [Table 1](#)) (alphanumeric).

The last 11 elements in the sounding report represent additional "warning" flags that largely follow [Serreze et al. \(1995\)](#). Alphanumeric values are either 'F' (flagged on the criteria listed below) '9' (not flagged or quality check not applicable). Many of these represent gradient checks in which a variable(s) at a particular level is compared to the next available level upwards (towards higher altitude) in the sounding for which the same variable(s) is provided. The term "stratum" refers to the layer bounded by the lower and upper levels. An 'F' flag, if present, will always appear at both the base (lower level) and top (upper level) of the stratum being tested.

S1: Bottom or top of stratum defined by pressure has identical pressure values.

S2: Bottom of or top of stratum defined by altitude has identical altitude values.

S3: Bottom or top of stratum defined by pressure and temperature within which the temperature gradient is large. Flagged if temperature gradient is > 0.50 K/millibar and pressure change is >20 millibars or if temperature gradient is > 1.00 K/millibar and pressure change is less than or equal to 20 millibars.

S4: Bottom or top of stratum, defined by pressure, temperature, and altitude within which the thickness of the pressure layer (in meters) calculated from the hypsometric equation is $>10\%$ different than thickness calculated from the reported altitude levels. The hypsometric check assumes that the physical and virtual temperature are identical (reasonable for the cold Arctic atmosphere). The test is only performed if the pressure change in the stratum is >20 millibars.

S5: Bottom or top of stratum defined by wind speed within which the wind speed gradient is >50 m/s. Only tested if the pressure change in the stratum is less than or equal to 100 millibars (if pressure levels also given) or if altitude change in stratum is less than or equal to 1000 m (if altitude levels also given).

S6: Temperature for reported level exceeds >35 degrees Celsius. Appears to flag most sign errors.

S7: Wind direction for reported level is out of 0-360 degree range.

S8: Wind speed at reported level is questionable. Wind speed is <0 or >100 m/s at any level or >50 m/s for pressures exceeding 500 millibars.

S9: Dewpoint depression is <0 or >100 K.

S10: Surface pressure value is <925 millibars.

S11: Bottom or top of stratum with questionable change in wind direction. Gradient exceeds 90 degrees. Only tested if pressure change in stratum is less than or equal to 100 millibars (if pressure levels also given) or if altitude change in stratum is less than or equal to 1,000 m (if altitude levels also given).

S12: Bottom or top of stratum with superadiabatic temperature lapse rate. Frequently flagged for the surface layer.

Formats and Example File Read:

An individual sounding can be read with the following Fortran statements:

```
INTEGER STN_IND, YEAR, MONTH, DAY, HOUR, INST, LVLS
```

```
C
```

```
REAL ALT, PRESS, TEMP, DPD, WDIR, WSP, ELEV, LATITUDE, LONGITUDE,  
*MAX_PRESS, MIN_PRESS
```

```
C
```

```
CHARACTER*5 STN  
CHARACTER*1 AQL, PQL, TQL, DQL, WQL, S1, S2, S3, S4, S5,  
*S6, S7, S8, S9, S10, S11, S12 READ(*, 101) STN, STN_IND, ELEV, YEAR, MONTH, DAY, HOUR, LATITUDE, LONGITUDE, MAX_PRESS, MIN_PRESS, INST, LVLS
```

```
C,
```

```
101 FORMAT(A5, I3, F7.1, I5, 3I3, F6.2, F7.2, 2F8.1, I3, I4)
```

```
C
```

```
DO I=1, LVLS  
READ(*, 102) ALT, AQL, PRESS, PQL, TEMP, TQL, DPD, DQL, WDIR,  
*WSP, WQL, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12  
END DO
```

```
C
```

```
102 FORMAT(F7.0, 1X, A1, F7.1, 1X, A1, F7.1, 1X, A1, F6.1, 1X, A1,  
*2F5.0, 1X, A1, 2X, I2(A1, 1X))
```

```
C
```

All original flags provided with the soundings were retained. Flags are based on either automatic (Auto) or manual (Man) checks. However, as a result of the sort/merge routines used to initially process the soundings, some are no longer applicable. (Changes are indicated.) Note also that a processing error resulted in loss of pressure flags for 1987-1991. For AQL, TEL, AND WQL:

Auto	Man	
A	I	Passed vertical consistency with tight limits
B	J	Failed vertical consistency check and has not been recomputed
C	K	Failed vertical consistency check and recomputed
D	L	Failed vertical consistency check with tight limits and passed with loose limits
E	M	Not assigned
F	N	Checked but did not pass vertical consistency check with loose limits
G	O	Not assigned
	\$	Not specified
9	9	Corresponding data value missing or no quality code relevant to this variable

For DQL:

Auto	Man	
	\$	Not specified

For PQL and AQL:

(Two sets of codes may apply to AQL depending on the report-type category in the original sounding format.)

Auto	Man	
Q	Y	Base of stratum with missing data
R	Z	Top of stratum with missing data
T	1	Reported tropopause level
U	2	Not applicable (ignore)
V	3	Not applicable (ignore)
W	4	Maximum reported wind level is not at the terminating level
X	5	Maximum reported wind level is at the terminating level
	\$	Not specified
9	9	Corresponding data value missing or no quality code relevant to this variable

Unit of Measurement

This section is not applicable.

Data Source

NCEP/NCAR Arctic Ship Soundings consists of Arctic marine rawinsonde data obtained from ships located north of 65 degrees North. Data were received from the Boulder, Colorado-based National Center for Atmospheric Research (NCAR) archive of the National Center for Environmental Prediction (NCEP) upper air data.

Data Range

The file is arranged in synoptic order, such that all available soundings for day 1 are followed by all available soundings for day 2, day 3, etc. to the end of the file.

Sample Data Record

```
UMFW 2 0.0 1976 3 11 12 65.00 0.00 1017.0 11.1 99 34
0. 9 1017.0 4.4 4.5 130. 15. P P P P P P P P P P P
147. A 1000.0 9 3.6 A 4.2 999. 999. 9 P P P P 9 P 9 9 P 9 9
747. 9 928.0 -1.5 2.6 999. 999. 9 P P P P 9 P 9 9 P 9 9
1231. 9 873.0 -3.9 10.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
1441. A 850.0 9 -4.9 A 8.0 155. 20. A P P P P P P P P P P
1487. 9 845.0 -4.9 8.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
1992. 9 792.0 -8.9 5.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
2290. 9 762.0 -9.9 4.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
2768. 9 716.0 -11.9 14.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
2875. 9 706.0 -11.9 15.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
2943. A 700.0 9 -11.9 A 15.0 150. 13. A P P P P P P P P P P
3086. 9 687.0 -11.9 15.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
4488. 9 570.0 -21.5 10.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
5440. A 500.0 9 -25.5 A 14.0 260. 5. A P P P P P P P P P P
6165. 9 453.0 -19.3 14.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
6509. 9 432.0 -31.5 14.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
7030. A 400.0 9 -36.1 A 9.0 310. 16. A P P P P P P P P P P
7438. 9 377.0 -39.5 6.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
7631. 9 366.0 -60.5 6.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
8960. A 300.0 9 -51.3 A 4.1 325. 14. A P P P P P P P P P P
9947. 9 258.0 -48.3 10.0 999. 999. 9 P P P P 9 P 9 9 P 9 9
10146. C 250.0 9 -50.4 C 999.0 9 999. 999. 9 P P P P 9 P 9 9 P 9 9
11050. 9 217.0 -59.9 3.7 999. 999. 9 P P P P 9 P 9 9 P 9 9
11314. 9 208.0 -60.1 4.5 999. 999. 9 P P P P 9 P 9 9 P 9 9
99999. 9 200.0 9 9999.0 9 999.0 9 999. 999. 9 P 9 9 9 9 9 9 9 9 9
99999. 9 150.0 9 9999.0 9 999.0 9 999. 999. 9 P 9 9 9 9 9 9 9 9 9
14377. 9 127.0 T -62.3 4.0 295. 12. P P P P P P P P P P
15678. 9 103.0 -59.9 7.0 240. 19. P P P P P P P P P P
15862. 9 100.0 9 -60.0 C 999.0 9 999. 999. 9 P P P P 9 P 9 9 P 9 9
```

10. Data Manipulations

Sort/Merge Routines

Data were extracted and sorted first by pressure and second by altitude (geopotential height), with duplicate records merged to the extent possible. The sort/merge procedures follow those used to compile the [Historical Arctic Rawinsonde Archive \(HARA\)](#) data set. Data have been subjected to quality control procedures similar to those discussed by [Serreze et al \(1995\)](#).

Special Corrections/Adjustments

North Pole soundings that were received through the Global Telecommunications System (GTS) are included in the NCEP tapes. To avoid duplications with the Kahl archive of Russian North Pole drifting station soundings, efforts were made to eliminate these soundings from the present data set, using call signs provided by R. Colony. However, no guarantees are made that all North Pole drifting station soundings have been removed from this record.

11. Notes and Problems

Sources of Error

North Pole drifting station soundings received through the Global Telecommunications System (GTS) are included on the NCEP tapes. There are no guarantees that all North Pole drifting station soundings have been removed from this record.

12. Notes

See [Notes and Problems](#).

13. Application of the Data Set

Soundings are typically used in synoptic meteorology and for climatology.

14. Data Set Plans

The data set will be updated as additional soundings become available.

15. References

Mulder, P. 1977. Record format for the NCAR archive of NMC upper air data. *NOAA Office Note*. (Updated by G. Walters, 1992.) 29.

Kahl, J. D., M. C. Serreze, S. Shiotani, S. M. Skony, and R. C. Schnell. 1992. In-situ meteorological sounding archives for Arctic studies. *Bull. Amer. Meteorol. Soc.* 73(11):1824-1830.

Serreze, M. C., J. D. Kahl, and S. Shiotani. 1992. The Historical Arctic Rawinsonde Archive documentation manual. Special Report-2. National Snow and Ice Data Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado.

Serreze, M. C., M. C. Rehder, R. G. Barry, J. D. Kahl, and N. A. Zaitseva. 1995. The distribution and transport of atmospheric water vapour over the Arctic Basin. *International Journal of Climatology*, 15: 709-27.

16. Related Software

Please see [HARA CD-ROM Access Software](#).

Software Access

This data set is made available via ftp. Data are available at <ftp://sidacs.colorado.edu/pub/DATASETS/SHIPSOUND/>. For more information about availability, please contact [NSIDC User Services](#).

17. Data Access

Contact Information

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Data Center Identification

National Snow and Ice Data Center ([NSIDC](#))

19. Document Information

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As a condition of using these data, you must cite the use of this data set using the following citation. For more information, see our [Use and Copyright](#) Web page.

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