Former Soviet Union Hydrological Snow Surveys, 1966-1996, Version 1

USER GUIDE

How to Cite These Data

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

Krenke, A. Edited by National Snow and Ice Data Center. 1998, updated 2004. *Former Soviet Union Hydrological Snow Surveys, 1966-1996, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. https://doi.org/10.7265/N58C9T60. [Date Accessed].

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

The data set includes data from 1,345 World Meteorological Organization (WMO) stations spread throughout the Former Soviet Union. These stations are concentrated in inhabited areas in the mid-latitudes. Available data cover January 1966 to December 1990 for all stations; however, not all stations continuously reported data throughout this time period. In addition, 238 of these stations recorded data from January 1991 to December 1996. All data files are in ASCII text format.

The file `station.loc` contains information about the stations used for this data set. Table 1 describes the columns of the file.

Table 1. Description of `station.loc` Columns

Column	Description
1	5-digit station number - WMO station near which the transect is based
2	Station name
3	Latitude - The latitude of the station in degrees North (divide value by 100 to get actual latitude)
4	Longitude - The longitude of the station in degrees East (divide value by 100 to get actual longitude)
5	Elevation in meters

Note: Updated data from 2002, 2003, and 2004 have not been combined.

There are three types of data files each containing different data. See their sections below for a description:

- Synoptic
- Station
- Transect

1.2 Synoptic Data

These files contain the snow transect measurements for a single day at all available stations. The data are stored in files with the suffix .syn. The file name itself is made up of the date of the measurements. For example, 19830110.syn indicates data from 10 January 1983. Missing data are indicated by -2 in all fields. The columns in this file are described in Table 2.

Table 2. Synoptic Data File Description

Column	Description
1	5-digit station number - WMO station near which the transect is based.
2	Latitude - The latitude of the station in degrees North (divide value by 100 to get actual latitude).
3	Longitude - The longitude of the station in degrees East (divide value by 100 to get actual longitude).
4	Snow course type: 1 - field 2 - forest 3 - gully 4 - unknown
5	Degree of snow coverage of the surrounding terrain. Values range from 0 to 10. 10 indicates 100% coverage.
6	Degree of snow coverage along the route. Values range from 0 to 10. 10 indicates 100% coverage.
7	Degree of ice crust coverage along the route. Values range from 0 to 10. 10 indicates 100% coverage.
8	Average snow depth along the route in cm.
9	Maximum snow depth along the route in cm.
10	Minimum snow depth along the route in cm.
11	Mean snow density in g/cm^3.
12	Ice crust thickness in mm.
13	Thickness of snow layer which is saturated with water in mm.
14	Snow water equivalent in mm.
15	Snow cover features observed: 0 - Even snow coverage on frozen soil without snow drifts 1 - Even snow coverage on thawed soil without snow drifts 2 - Even snow coverage without snow drifts, soil condition is unknown 3 - Uneven snow coverage on frozen soil, little snow drifts 4 - Uneven snow coverage on thawed soil, little snow drifts 5 - Uneven snow coverage, soil condition is unknown, little snow drifts 6 - Very uneven snow coverage on frozen soil, big snow drifts 7 - Very uneven snow coverage on thawed soil, big snow drifts 8 - Very uneven snow coverage, soil condition is unknown, big snow drifts 9 - Snow coverage with paths of open soil

Column	Description
16	Snow structure observed: 0 - Fresh snow, like dust 1 - Fresh snow, fluffy 2 - Fresh snow, sticky 3 - Old snow, crumbly 4 - Old snow, dense 5 - Old snow, wet 6 - Snow crust, unconnected with snow below 7 - Dense snow with snow crust on surface 8 - Damp snow with snow crust on surface 9 - Snow with water
17	Snow course quality flag: (Results of NSIDC quality control. See Section 1.11 Quality Assessment section of this document for further detail.) 0 - Quality flag was not computed 1 - Raw snow density increased by a factor of 10 (e.g., raw data .6 reset to .06) 2 - Raw snow density missing a decimal point (e.g., raw data 6 reset to .06) 3 - Average snow depth out of range (> 200 cm); set to agree with SWE and density data 4 - Snow water equivalent out of range (> 400 mm); set to agree with depth and density data 5 - Suspect data; out of range values, however the error was unknown so no data were changed

1.3 Station Data

These files contain data from the meteorological station itself. These data are monthly station summaries rather than daily measurements. The file name includes the WMO station number and the suffix `.sta`. For example, `38974.sta` indicates a file of station data from station 38974. Missing data are indicated by -2 in all fields. The columns in this file are described in Table 3.

Table 3. Station Data File Description

Column	Description
Header	Region - political region which the data station resides in Station number - the WMO station number Latitude - The latitude of the station (degrees North) Longitude - The longitude of the station (degrees East) Elevation - The elevation of the station (meters ASL)
1	2-digit month
2	4-digit year

Column	Description
3	Surroundings of the stake - The physical surroundings of the stake at which data were taken 1 - open 2 - closed 3 - mixed
4	Number of days of snow cover within the month.
5	Mean snow height at the station for the first 10 days of the month in cm.
6	Mean snow height at the station for the second 10 days of the month in cm.
7	Mean snow height at the station for the final days of the month. Note: This mean is not always the mean of 10 days. For example, February has a mean for 8 days and December has a mean for 11 days in cm.
8	Station data quality: (Results of NSIDC quality control. See Quality Assessment section for further details.) 0 - Quality flag was not computed 1 - Mean values increased by a factor of 100 (e.g., data of 6 700 8 reset to 6 7 8) 2 - Mean values between 0 and 1; decreased by a factor of 100 (e.g., data of 6 .07 8 reset to 6 7 8) 3 - More days of snow in raw data than are in the month (e.g., 34 reset to 31) 4 - Raw data value of zero greater than two standard deviations from the mean; data value is set to missing 5 - Suspect data but unknown error; data unchanged

1.4 Transect Data

These files contain the averages of data taken during the snow transect. Transects were to be taken on the 10th, 20th, and final day of the month. However, transects occur throughout the month. This data product only includes the three most common days of measurement (the 10th, 20th, and final day). Data taken on other days has been omitted. Field and forest transects comprise the majority of transect types, and only these are included in this data product. The file name includes the WMO station number and the suffix `.trn.` For example, `38974.trn` contains transect data from station 38974. Missing data are indicated by -99 in all fields. The columns in this file are described in Table 4.

Table 4. Transect Data File Description

Column	Description
Header	Region - political region which the data station resides in Station number - the WMO station number Latitude - The latitude of the station (degrees North) Longitude - The longitude of the station (degrees East) Elevation - The elevation of the station (meters ASL)
1	2-digit month
2	4-digit year
3	Transect type - 01 indicates field transects.
4	Snow course date - The date on which the transect was taken. Either the 10th, 20th, or last day of the month.
5	The average snow depth along the transect (field transect) in cm.
6	Snow water equivalent along the transect (field transect) in mm.
7	Transect type - 02 indicates forest transects.
8	The average snow depth along the transect (forest transect) in cm.
9	Snow water equivalent along the transect (forest transect) in mm.
10	Snow course quality flag: (Results of NSIDC quality control. See Quality Assessment section for further detail.) 1 - Raw snow density increased by a factor of 10 (e.g., raw data .6 reset to .06) 2 - Raw snow density missing a decimal point (e.g., raw data 6 reset to .06) 3 - Average snow depth out of range (> 200 cm) set to agree with SWE and density data 4 - Snow water equivalent out of range (> 400 mm) set to agree with depth and density data 5 - Suspect data; out of range values, however the error is unknown so no data was changed Note: Some stations have data from both a field transect and a forest transect. The quality flag reflects errors found in either transect. If errors are found in both transects, the quality flag is set to 5.

1.5 File and Directory Structure

Data can be accessed from the HTTPS site: https://noaadata.apps.nsidc.org/NOAA/G01170/ in the directories described in Table 5.

Table 5. Directories on HTTPS Site

Directory	Description
product	Contains 1966-1990 data.
update04012002	Contains 1991-1996 data, first update

Directory	Description
update02172003	Contains 1991-1996 data, second update
update05152003	Contains 1991-1996 data, third update
update04052004	Contains 1991-1996 data, fourth update

Each of the directories listed in Table 4 contain three subdirectories: `sta, syn`, and `trn`, and three tar files: `sta.tar, syn.tar`, and `trn.tar`.

The `sta` directory contains the station data and `sta.tar` contains all of the files in that directory. The `syn` directory contains the synoptic data and `syn.tar` contains all of the files in that directory. The `trn` directory contains the transect data and `trn.tar` contains all of the files in that directory.

1.6 File Naming Convention

1.6.1 Synoptic Data

Synoptic data files have a file name made up of the date of the measurements, plus a suffix of `.syn`. For example, `19830110.syn`, indicates data from 10 January 1983.

1.6.2 Station Data

Station file names include the WMO station number and the suffix `.sta`. For example, `38974.sta`, indicates a file of station data from station 38974.

1.6.3 Transect Data

Transect file names include the WMO station number and the suffix `.trn`. For example, `38974.trn`, contains transect data from station 38974.

1.7 Spatial Coverage

The data set includes data from 1,345 stations spread throughout the Former Soviet Union. These stations are concentrated in inhabited areas in the mid-latitudes.
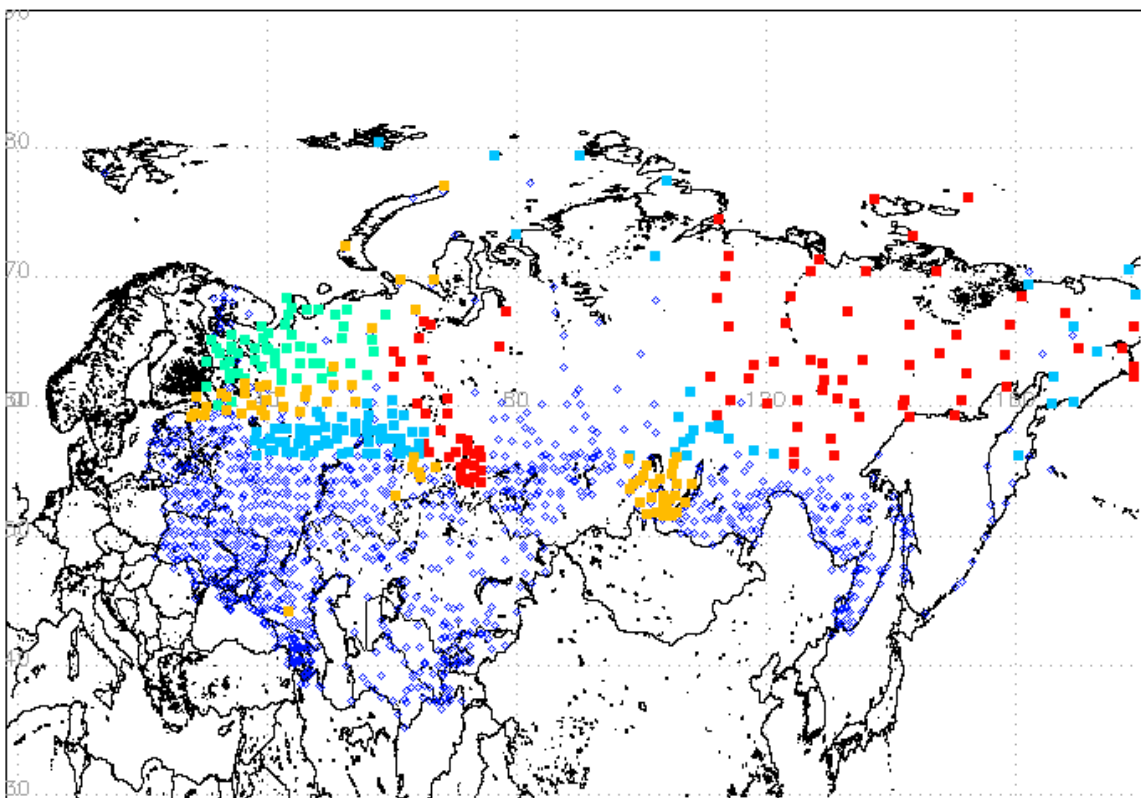
Figure 1. FSU Station Positions. The red squares represent locations updated on 2002-04-01. Green squares represent updates from 2003-02-17. Light blue squares represent updates from 2003-05-15. Yellow squares represent updates from 2004-04-05. The blue diamonds represent the entire data set.

1.8 Temporal Coverage

Available data cover January 1966 to December 1990 for all 1,345 stations; however, not all stations reported data continuously throughout this time period. In addition, 238 of these stations recorded data from January 1991 to December 1996.

1.9 Parameter or Variable

These observations include snow depths at WMO stations and snow depth and snow water equivalent measured over a nearby snow course transect. The station snow depth measurements are a ten-day average of individual snow depth measurements. The transect snow depth data are the average of snow depth from 100 to 200 points along the transect. The transect snow water equivalent is the average of snow water equivalent at twenty points.

1.10 Error Sources

his data set is based upon hand-digitized analog records. Bad data values could have been introduced in the process of keying the data from the original log books. Degradation of the original records and human error could have resulted in missing or inaccurate data values.

1.11 Quality Assessment

NSIDC implemented a quality control process to identify errors and correct the data where possible. However, users are encouraged to do their own quality control on these data.

In the first step of the quality control process, out-of-range values were identified and, where possible, correction algorithms were developed. The data ranges used were

```
Mean snow height at the station:  0-200
Amount of days with snow cover in a month:  0-31
Degree of snow or ice coverage:  0-10
Average snow height along the route:  0-200
Mean snow density:  0-0.60
Snow water equivalent of the snow itself:  0-400
Snow cover features and structure:  0-9
```

As indicated by the data quality flags, corrections of some of the errors in depth, snow density, and snow water equivalent were effected. These errors made up a small percentage of all errors (see the table below for actual numbers of corrected entries).

The most common correction error occurred for station data, when data fields that should have been recorded as missing were instead recorded as zero. An algorithm to correct these errors checked the monthly mean for each station. If the "zero" value in question was more than two standard deviations below the mean, it was assumed to be missing data and the value was reset to missing (-2).

Note that some stations reported no snow for an entire winter. In areas with low snowfall, this is possible, so these records were not removed from the data set.

In the transect files, each of the types of snow course is checked individually, but the flag set does not make a distinction between the "field" and the "forest;" therefore, if the flag is set it could be either of the two.

The data for "days with snow cover" are very inconsistent, and therefore suspect. The value of zero in this field is often inconsistent with other data from the station.

Statistics on quality control for station and transect records

Data for 1966 - 1990

Total number of station records examined: 195936

Total number of transect records examined: 495593

Total Errors (by error flag)

Station Error Flag 1: 25	Transect Error Flag 1: 514
Station Error Flag 2: 984	Transect Error Flag 2: 163
Station Error Flag 3: 469	Transect Error Flag 3: 1
Station Error Flag 4: 40011	Transect Error Flag 4: 2
Station Error Flag 5: 23	Transect Error Flag 4: 3016

Data for 1991 - 1996, update 2002-04-01

Total number of station records examined: 4397

Total number of transect records examined: 10482

Total Errors (by error flag)

Station Error Flag 1 : 0	Transect Error Flag 1 : 3
Station Error Flag 2 : 0	Transect Error Flag 2 : 0
Station Error Flag 3 : 0	Transect Error Flag 3 : 0
Station Error Flag 4 : 385	Transect Error Flag 4 : 0
Station Error Flag 5 : 0	Transect Error Flag 5 : 30

Data for 1991 - 1996, update 2003-02-17

Total number of station records examined: 2149

Total number of transect records examined: 6697

Total Errors (by error flag)

Station Error Flag 1 : 0	Transect Error Flag 1 : 5
Station Error Flag 2 : 0	Transect Error Flag 2 : 0
Station Error Flag 3 : 0	Transect Error Flag 3 : 0
Station Error Flag 4 : 620	Transect Error Flag 4 : 0
Station Error Flag 5 : 0	Transect Error Flag 5 : 99

Data for 1991 - 1996, update 2003-05-15

Total number of station records examined: 3530

Total number of transect records examined: 11549

Total Errors (by error flag)

Station Error Flag 1 : 0	Transect Error Flag 1 : 9
Station Error Flag 2 : 0	Transect Error Flag 2 : 0
Station Error Flag 3 : 0	Transect Error Flag 3 : 0
Station Error Flag 4 : 1159	Transect Error Flag 4 : 0
Station Error Flag 5 : 0	Transect Error Flag 5 : 118

Data for 1991 - 1996, update 2004-04-05

Total number of station records examined: 2796

Total number of transect records examined: 8459

Total Errors (by error flag)

Station Error Flag 1 : 0	Transect Error Flag 1 : 2
Station Error Flag 2 : 0	Transect Error Flag 2 : 0
Station Error Flag 3 : 0	Transect Error Flag 3 : 0
Station Error Flag 4 : 252	Transect Error Flag 4 : 0
Station Error Flag 5 : 0	Transect Error Flag 5 : 86

2   DATA ACQUISITION AND PROCESSING

2.1 Data Acquisition Methods

The original analog records were digitized (keyed) at the Institute of Geography, Moscow, under the supervision of Professor Alexander Krenke. The analog records were a collection of individual entries taken by observers in the field. Snow depth measurements were made at the station with a fixed snow measuring rod. Snow survey measurements were made using a portable snow measuring rod and a snow weighing balance. Snow depth data were taken at a meteorological enclosure, on a daily basis, in the vicinity of the station. The daily data were then averaged at the end of a ten-day period into a single value. This averaging would be done three times per month with the final period in the month containing from eight to eleven days of data, depending on the month.

Snow surveys were carried out at regular intervals. Each snow survey was carried out not more than five kilometers from the station and not closer than one-half of a kilometer to railroads,

highways, or settlements with industrial plants. The snow survey routes were laid out to cross the typical terrain of the region. Routes in open areas were 2000 meters in length. Routes in partially forested areas were 1000 meters, and routes in heavily forested areas were 500 meters. Snow surveys were carried out on the 10th, 20th, and the last day of each month during the snow cover season. During snow melt, surveys were carried out every five days. The suggested frequency of snow surveys was not always followed, and thus data may have been collected on any given day throughout the month (although only data from the 10th, 20th, and final day of the month are included in the NSIDC data set). Snow depth and snow weight were measured at specified intervals along the route. State of the snow, thickness of layers, and snow characteristics were noted along the route. Upon completion of the snow survey, the measurements were averaged across the entire route and were then used to calculate snow density and snow water equivalent.

2.2 Data Source

Data were acquired from the Institute of Geography, Russian Academy of Sciences Moscow, and data were digitized under the supervision of Professor Alexander Krenke.

3 CONTACTS AND ACKNOWLEDGMENTS

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4   DOCUMENT INFORMATION

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