

Time Series of Seasonally Frozen Ground Depth in the Russian Arctic, 1930-1990

Summary

This data set consists of seasonally frozen ground depth measurements based on soil temperatures in the Russian Arctic. Seasonal freezing and thawing processes in cold regions play a major role in ecosystem diversity, productivity, and the Arctic hydrological system. Long-term changes in seasonal freeze and thaw depths are also important indicators of climate change.

Investigators collected data from 211 ground-based stations. The record extends from 1930 to 1990 and includes seasonal freeze depths derived from soil temperature data that are averaged yearly. Data are in tab-delimited ASCII text format and are available for ordering via NCAR.

Citing These Data

Zhang, T., O. W. Frauenfeld, and R. G. Barry. 2006. *Time series of seasonally frozen ground depth in the Russian Arctic, 1930-1990*. Boulder, Colorado USA: National Center for Atmospheric Research, ARCSS Data Archive.

Overview Table

Category	Description
Data format	Data are in tab-delimited ASCII text files. A station list is provided in tab-delimited ASCII text format and Microsoft Excel format, and an image showing station locations is provided in Graphics Interchange Format (GIF).
Spatial coverage and resolution	Southernmost Latitude: 42.70° N Northernmost Latitude: 68.90° N Westernmost Longitude: 30.8° E Easternmost Longitude: 179.5° W
Temporal coverage and resolution	The data record includes seasonally frozen ground depths taken from monthly averages collected from 1930 to 1990.
Tools for accessing data	Data can be viewed with a text editor or Microsoft Excel.
File Information	Data files are named following the convention TMD2.sss.max where sss is the three-digit station identification number.
File size	File sizes range from 1 KB to 53 KB. Data are distributed as a 140 KB compressed (.zip) file.
Parameter	Seasonally frozen ground depth (m)
Procedures for obtaining data	Data are available for ordering through NCAR .

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1. Contacts and Acknowledgments

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2. File Information

Format

Data are in tab-delimited ASCII text files. A station list is also provided in tab-delimited ASCII text format and Excel format, and an image showing station locations is provided in Graphics Interchange Format (GIF).

File Naming Convention

Data files are named following the convention TMD2.sss.max where sss is the three-digit station identification number. The supplementary composite file including the average freeze depth of all 211 sites for each year is titled Composite_1930-1990_ALT.txt. The following files are also included in the directory:

File Name	Description
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sf_station_locations.gif	This GIF file shows the distribution of the 211 ground-based stations where data was collected.
Freeze_Depth-Station_List.xls	This Excel file includes a list of the 211 ground-based stations with their station ID, region ID, World Meteorological Organization ID, station name, latitude, longitude, and elevation (m).

File Size

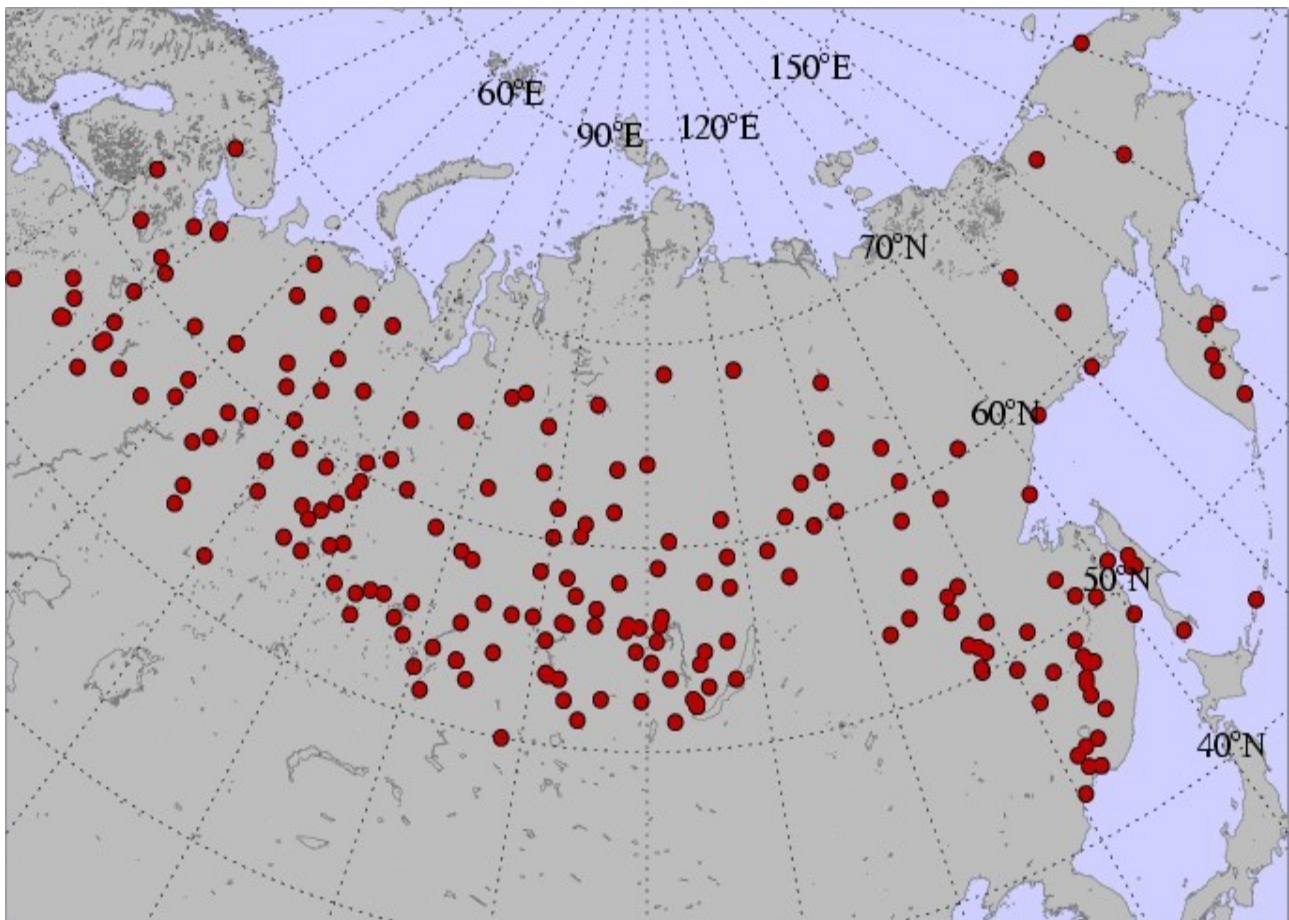
File sizes range from approximately 1 KB to 53 KB. Data are distributed as a 140 KB compressed (.zip) file.

Spatial Coverage

Southernmost Latitude: 42.70° N
 Northernmost Latitude: 68.90° N
 Westernmost Longitude: 30.8° E
 Easternmost Longitude: 179.5° W

Spatial Resolution

This image shows locations of the 211 stations where seasonally frozen ground depth data were obtained.



Temporal Coverage

The data record includes seasonal freeze depths taken from monthly averages collected from 1930 to 1990.

Parameter or Variable

Parameter Description

Seasonally frozen ground is broadly defined as soil that freezes for at least 15 days per year. Changes in the seasonally frozen ground areas are controlled by many factors including air temperature, vegetation, snow cover, soil moisture, among others. Freeze depth is influenced most strongly by the freezing index and mean air temperature.

Parameter Range

Seasonal freeze depths range from 0.20 m to 3.17 m.

Sample Data Record

These sample data are from the file TMD2.113.max collected at the Kudymkar station (113) and provide yearly average freeze depths in meters. The value -999 is a fill value for missing data.

1956	-999
1957	-999
1958	1.0352900
1959	0.73333299
1960	1.2444400
1961	1.1428601
1962	1.1294100
1963	0.93333298
1965	0.60000002
1966	0.90666699
1967	1.4500000
1968	0.40000001
1969	0.94999999
1970	1.1733299
1971	0.63999999

3. Data Access and Tools

Data Access

Data are available for ordering through [NCAR](#).

Volume

The entire data set uncompressed is 514 KB.

Related Data Collections

- [Time Series of Active Layer Thickness in the Russian Arctic, 1930-1990](#)

4. Data Acquisition and Processing

Data Acquisition Methods

Soil temperature was measured in the former Soviet Union with some records beginning in the 1980s and many others beginning in the 1930s or 1950s. Data collection procedures are summarized by *Gilichinsky et al.* [1998], *Zhang et al.* [2001], and the instruction manuals of the *State Committee of the U.S.S.R. for Hydrometeorology and Environmental Control* [1985]. The data are available primarily as yearly means formed from the daily and sub-daily measurements. Soil temperatures were generally measured at depths of 0, 0.05, 0.10, 0.15, 0.20, 0.40, 0.60, 0.80, 1.20, 1.60, 2.00, 2.40, and 3.20 m. Temperatures at depths from 0-0.60 m were measured at least three times per day. Measurements at depths of 80 cm and deeper were made once daily near midday.

5. References and Related Publications

Frauenfeld, O. W., T. Zhang, R. G. Barry, and D. Gilichinsky. 2004. Interdecadal changes in seasonal freeze and thaw depths in Russia. *Journal of Geophysical Research* 109, D05101. doi:10.1029/2003JD004245.

Gilichinsky, D. A., R. G. Barry, S. S. Bykhovets, et. al. 1998. A century of temperature observations of soil climate: Methods of analysis and long-term trends, in *Proceedings of 7th International Conference on Permafrost*, edited by A. Lewkowicz and M. Allard, pp. 313-317, Cent. d'Etudes Nordiques, Univ. Laval, Ste-Foy, Canada.

State Committee of the U.S.S.R. for Hydrometeorology and Environmental Control. 1985. Instructions for meteorological stations and posts, in *Meteorological Observations at Stations*, vol. 3, part 1, Gidrometeoizdat, Leningrad.

Zhang, T., O. W. Frauenfeld, M. C. Serreze, et. al. 2005. Spatial and temporal variability in active layer thickness over the Russian Arctic Drainage Basin. *Journal of Geophysical Research* 100, D16101. doi:10.1029/2004JD005642.

Zhang, T., R. G. Barry, D. Gilichinsky, et. al. 2001. An amplified signal of climatic change in soil temperatures during the last century at Irkutsk, Russia. *Climate Change* 49, 41-76.

6. Document Information

Acronyms and Abbreviations

The following acronyms and abbreviations are used in this document.

ARCSS	Arctic System Sciences
ASCII	American Standard Code for Information Interchange
FGDC	Frozen Ground Data Center
FTP	File Transfer Protocol
GIF	Graphics Interchange Format

NSF	National Science Foundation
NCAR	National Center for Atmospheric Research
OPP	Office of Polar Programs
URL	Uniform Resource Locator

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<http://data.eol.ucar.edu/codiac/dss/id=106.ARCSS166>