Northern Hemisphere EASE-Grid Annual Freezing and Thawing Indices, 1901 - 2002, Version 1

USER GUIDE

How to Cite These Data

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

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FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/GGD649

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 File Information

1.1.1 Format

ASCII text files

1.1.2 File and Directory Structure

Two tarred and compressed files, "ease25_frz_indx.tgz" and "ease25_thw_indx.tgz", containing 102 freezing index and 101 thawing index files, respectively, plus and one compressed text file, "E25_lon_lat_nh.gz", defining the grid points.

1.1.3 File Naming Convention

"`ease25_frz_indx.tgz`" contains 102 files in the format "`ease25_frz_indx.yyyy.txt`" where "`yyyy`" is the four digit year. "`ease25_thw_indx.tgz`" contains 101 files in the format "`ease25_thw_indx.yyyy.txt`" where "`yyyy`" is the four digit year. In addition, "`E25_lon_lat_nh.txt`" contains the grid coordinates.

1.1.4 File Size

Two compressed tar files (thawing idex = 40 MB, freezing index = 70 MB) containing 102 5.4 MB text files plus one 2.6 MB compressed text file. The total uncompressed volume is approximately 1 GB.

1.1.5 Volume

One 112.6 MB compressed tar file contains 203 5.4 MB text files plus one 10.4 MB text file. The total uncompressed volume is approximately 1 GB.

1.2 Spatial Information

1.2.1 Coverage

Northern Hemisphere

Southernmost Latitude: 0°N
Northernmost Latitude: 90°N

Westernmost Longitude: 180°W
Easternmost Longitude: 180°E

1.2.2 Resolution

Input 0.5° gridded data (Mitchell and Jones 2005) were regridded to the 25 km Northern Hemisphere EASE-Grid using a Cressman interpolation.

1.2.3 Projection

Lambert-Azimuthal Equal Area projection on a spherical geoid. Refer to All About EASE-Grid for more information.

1.2.4 Grid Description

25-km Northern Hemisphere EASE-Grid. Refer to All About EASE-Grid for more information.

1.3 Temporal Information

1.3.1 Coverage

1901 - 2002

Freezing indices are based on a cold season year of July-June, and thawing indices are based on a warm season year of January-December. Therefore, the freezing indices are available only through 2001.

1.3.2 Resolution

Annual

Freezing indices are based on a cold season year of July-June, and thawing indices are based on a warm season year of January-December. Therefore, the freezing indices are available only through 2001.

1.4 Parameter or Variable

1.4.1 Parameter Description

Freezing and thawing index calculated as the total number of freezing or thawing days per cold or warm season respectively. The cold season is defined as July-June and the warm season is January-December.

1.4.2 Sample Data Record

The following values come from "ease25_thw_indx.2002.txt":

```
 347.231
 361.910
 478.075
 507.947
 506.071
 461.000
-9999.00
-9999.00
-9999.00
-9999.00
```

Figure 1. Sample data from ease25_thw_indx.2002.txt

These values correspond to the latitudes and longitudes of the grid points listed in "E25_lon_lat_nh.txt":

```
69.7866     -127.255
69.9683     -127.648
70.1491     -128.047
70.3288     -128.454
70.5074     -128.868
70.6849     -129.289
70.8613     -129.719
71.0366     -130.156
71.2107     -130.601
71.3836     -131.055
```

Figure 2. Sample data from E25_lon_lat_nh.txt

-9999.00 indicates a grid cell in the ocean.

The figures below show the 1901-2001 climatology for the freezing index (Figure 3) and the 1901-2002 climatology for the thawing index (Figure 4) in °C-days. From Frauenfeld et al. (2006).

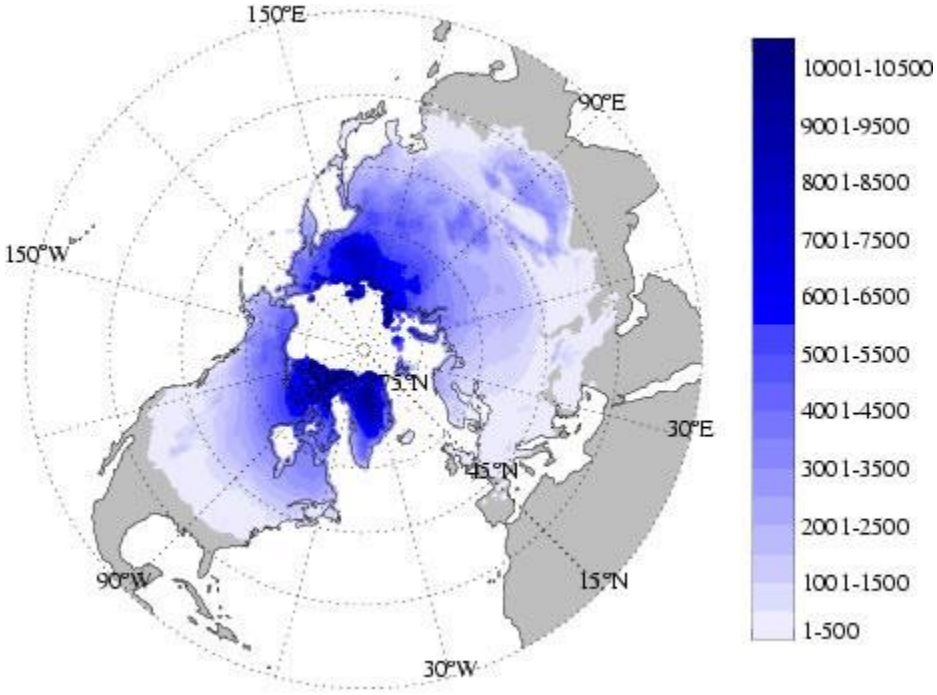

Figure 3. 1901-2001 climatology for the freezing index

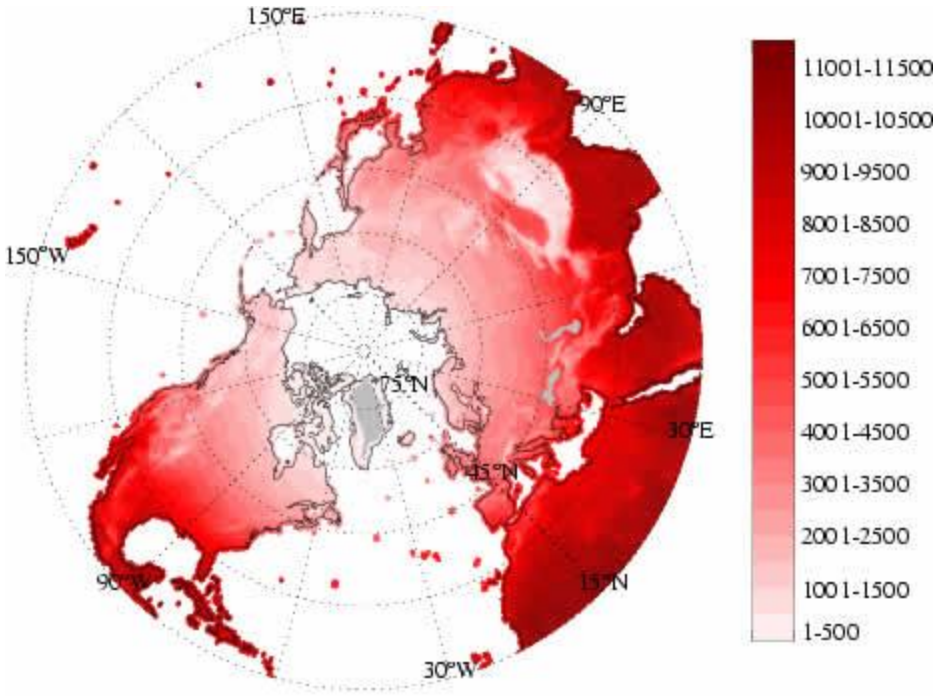

Figure 4. 1901-2002 climatology for the thawing index

2 DATA ACQUISITION AND PROCESSING

2.1 Theory of Measurements

The annual freezing or thawing index from daily temperature values is calculated as the cumulative degree days below or above 0°C for the cold or warm season, respectively. The cold season is defined as July-June, and the warm season is defined as January-December. Because the source data were monthly averages, the monthly average temperature was multiplied by the number of days in that month, and the monthly estimates were summed for the cold or warm season to obtain an annual freezing or thawing index.

The source data was first regridded to the 25-Km Northern Hemisphere EASE-Grid using a Cressman before calculating the indices.

2.2 Data Source

These data were derived from the 1901-2002 0.5° gridded monthly global land temperatures from the University of East Anglia Climatic Research Unit (Mitchell and Jones, 2005).

2.3 Quality, Errors, and Limitations

2.3.1 Quality Assessment

Rigorous quality assessment was applied by the investigators in creating this data set as described in Frauenfeld, et al. (2006). They conducted an initial analysis to assess the accuracy of using monthly data to calculate a freezing or thawing index. They compared indices derived from daily and monthly average 2 m temperatures from the European Centre for Medium-Range Weather Forecasts 40+ year reanalysis (ERA-40) available from the National Center for Atmospheric Research (NCAR; data set ds117.0). In general, they found that using monthly data introduced a relative error in the freezing index of less than 10% and often less than 5% for most of the Northern Hemisphere above 30°N with the notable exception of Europe. The thawing index had a low relative error for the entire Northern Hemisphere with the exception of Greenland. Furthermore, these relative errors agree well with and were verified with station observations. The investigators, therefore, conclude that freezing and thawing indices derived from monthly data are adequate for broad scale analysis and for approximating permafrost and seasonal frozen ground distribution at high northern latitudes.

The investigators then compared freezing/thawing index variability for various regions for three different gridded temperature data sets: ERA-40, Mitchell and Jones (2005), and Willmott and

Matsura (2003). ERA-40 showed a warm bias as has been documented before (Simmons et al., 2004). Mitchell and Jones (2005) and Willmott and Matsura (2003) were generally comparable, but the investigators chose Mitchell and Jones (2005) because of its longer and more consistent time series. See Frauenfeld, et al. (2006) for details.

2.3.2 Error Sources

Missing values in the source data were replaced with the 1961-1990 climatological values as described in Mitchell and Jones (2005). The data providers compared analyses using the source data both with and without the added climatological values and found little difference in the results (Frauenfeld, et al. 2006). The data here are based on the complete source data including the climatological values. There is also some uncertainty in the source data prior to the 1950s, due to the scarcity of station records.

3 RELATED DATA SETS

All About EASE-Grid

4 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

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