

GLACIER THICKNESS DATASET

VERSION 2.0

GENERAL NOTES

The Glacier Thickness Dataset (GlaThiDa) stores glacier thickness information from direct observations. GlaThiDa is structured in three data tables: The first table is the overview table (T - GLACIER THICKNESS OVERVIEW) containing information on the location and area of the glacier, estimates of mean and maximum thickness from interpolated observations including accuracies, the survey data, method and related information, as well as investigator and source of the data. The second table (TT - GLACIER THICKNESS DATA DERIVED FROM MAP or DEM) includes ice thickness data (mean and/or max) averaged over surface elevation bands by given lower and upper boundaries from ice thickness maps or Digital Elevation Models (DEMs). The third table (TTT - GLACIER THICKNESS POINT DATA) contains point data including a point ID, related coordinates, the elevation at the surveyed point, as well as the thickness value. Table TTT reflects the original observations which are more or less extensive, depending on the survey method

All tables include the given GlaThiDa_ID, the POLITICAL_UNIT, GLACIER_NAME and the date of the ice thickness survey (SURVEY_DATE). The GlaThiDa_ID serves as primary key and links information from corresponding surveys in all three tables.

T - GLACIER THICKNESS OVERVIEW

NOTES ON THE COMPLETION OF THE DATA SHEET

The data sheet T stores observed ice thickness summary data for the entire glacier.

This data sheet needs to be completed for every glacier thickness survey with data in any of the tables. It contains the glacier-wide key information of the ice thickness survey. Detailed results as interpolated to elevation bands or at point locations can be given in tables TT and TTT, respectively.

General information of the observed glacier (i.e. POLITICAL_UNIT, GLACIER_NAME, LAT, LON) must be given for identification purpose. If this information is derived from an existing glacier inventory, please provide the corresponding SOURCE (e.g., WGI, GLIMS, RGI, FoG) and SOURCE_ID (e.g., WGI_ID, GLIMS_ID, RGI_ID, FoG_ID).

For this table the following fields are mandatory and must be completed: GlaThiDa_ID, POLITICAL_UNIT, GLACIER_NAME, LAT, LON, SURVEY_DATE. The other fields can be left empty (null) if the corresponding information is not available.

The examples given for every field refer to the PIZOL glacier, Switzerland.

T1 GlaThiDa_ID

GlacierThicknessDatabase ID *[numeric code]*

Example: 1

No Data Value: **Mandatory field**

Every survey stored in the Glacier Thickness Database has to obtain a GlaThiDa_ID. This ID is given by the WGMS and links the corresponding data entries in tables T, TT, and TTT.

Note: For data submission, please use your own identifier that is unique within your sample of submitted data and links the results from corresponding survey in tables T, TT, and TTT.

T2 POLITICAL_UNIT

Political Unit *[alphabetic code; 2 characters]*

Example: CH

No Data Value: **Mandatory field**

2-digit abbreviation for the name of the country or territory in which the glacier is located. For a list of codes, see ISO3166 country codes available at <https://www.iso.org/obp/ui/#search>.

T3 GLACIER_NAME

Glacier name *[alpha-numeric code; up to 30 digits]*

Example: PIZOL

No Data Value: **Mandatory field**

The name of the glacier, written in CAPITAL letters. If a name is too long a meaningful abbreviation of it should be entered.

In order to ensure global interoperability of our dataset, glacier names should be given containing the following character set only: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z.

Characters which do not fall into the given range should be transliterated. If no Latin name exists so far or if it contains accents, please apply the following rules:

- Neglect the use of accents.
- If available, use the International Organization for Standardization (ISO) standards for transliteration (e.g., Cyrillic characters should be transliterated according to ISO9:1995, however, without using accents).
- Some special rules apply: Å → AA, Æ → AE, Ä → AE, ð → D, Ø → OE, œ → OE, Ö → OE, ß → SS, þ → TH, Ü → UE

Note: If necessary, the name can be abbreviated; in this case, please give the full name in the REMARKS field. If the glacier name is unknown, the SOURCE_ID (e.g., from GLIMS or RGI) can be used as glacier identifier.

T4 SOURCE_ID

Source Identity *[alpha-numeric code; 6 digits]*

Example: WGI

No Data Value: null (i.e. empty field)

The source identity of the glacier's coordinates (lat/lon) and/or area.

Abbr.	Database Name
GLIMS	Global Land Ice Measurements from Space

RGI	Randolph Glacier Inventory
WGI	World Glacier Inventory
FOG	Fluctuations of Glaciers
OTH	Other

Note: If OTH is chosen, please specify in the field REMARKS.

T5 GLACIER_ID

Glacier Identity *[alpha-numeric code; up to 12 digits]*

Example: CH4R0140D001

No Data Value: null (i.e. empty field)

Identity given for the glacier in the source database (e.g., GLIMS, RGI, WGI, FOG). For RGI, please ensure that the database version (e.g., 3.2) is part of the ID. If OTH is chosen in T4, please give the ID from that source if available.

T6 LAT

Latitude *[decimal degrees north or south; max. precision of 6 decimal places]*

Example: 48.287704

No Data Value: **Mandatory field**

Latitude is given in decimal degrees, positive values indicating the northern hemisphere and negative values indicating the southern hemisphere. Latitude is given to a maximum precision of six decimal places. Please consider: a precision of less than four decimal places might be insufficient depending on the location of your glacier.

Note: The point on the glacier whose coordinates are given should be in the upper part of the ablation area, in the main stream and sufficiently high so as not to be lost if the glacier retreats.

T7 LON

Longitude *[decimal degrees east or west; max. precision of 6 decimal places]*

Example: 7.4787129

No Data Value: **Mandatory field**

Longitude is given in decimal degrees, positive values indicating east of the zero meridian and negative values indicating west of the zero meridian. Longitude is given to a maximum precision of six decimal places. Please consider: a precision of less than four decimal places might be insufficient depending on the location of your glacier.

Note: The point on the glacier whose coordinates are given should be in the upper part of the ablation area, in the main stream and sufficiently high so as not to be lost if the glacier retreats.

T8 SURVEY_DATE

Survey date *[YYYYMMDD numeric; 8 digits]*

Example: 20100216

No Data Value: **Mandatory field**; every missing digit has to be replaced by a 9 ("nine")

Date of the present survey where YYYY is the 4-digit year, MM is the 2-digit month, and DD is the 2-digit day of month.

Note: For each survey, please indicate the complete date. For unknown day or month, put "99" in the corresponding position(s).

T9 DEM_DATE

Date of the geodetic survey *[YYYYMMDD numeric; 8 digits]*

Example: 20069999

No Data Value: null (i.e. empty field)

Date of the Digital Elevation Model (DEM) or of the geodetic survey used to derive the surface elevation information (e.g., "T10 MEAN_SLOPE", "TT5 LOWER_BOUND", "TT6 UPPER_BOUND", "TTT8 ELEVATION").

Note: For each survey, please indicate the complete date. For unknown day or month, put "99" in the corresponding position(s).

T10 AREA

Area *[km²; max. precision of 5 decimal places (=10m²)]*

Example: 0.08068

No Data Value: null (i.e. empty field)

Glacier area (in horizontal projection) in the DEM_YEAR. Give a maximum precision of five decimal places for the smallest glaciers, if available.

Note: If the glacier area originates from a year different from the DEM_YEAR, please indicate in a corresponding note in the field REMARKS.

T11 MEAN_SLOPE

Mean slope *[°; up to 2 digits; no decimal places]*

Example: 23

No Data Value: null (i.e. empty field)

Measured mean surface slope of the glacier in the DEM_YEAR. Should be rounded to integers.

Note: If the surface slope originates from a year different from the DEM_YEAR, please add a corresponding note in the field REMARKS. If only horizontal length of the glacier is known, overall slope (ratio of vertical drop height to horizontal distance) can be recorded here together with a corresponding note in the field REMARKS.

T12 MEAN_THICKNESS

Mean thickness *[meters; up to 6 digits; no decimal places]*

Example: 15

No Data Value: null (i.e. empty field)

Mean ice thickness of the glacier in the SURVEY_YEAR. Should be rounded to integers

Note: Please specify in the field REMARKS if the given MEAN_THICKNESS value is based on the interpolated entire glacier area or only on the measured profile points. In the latter case, please set the ERROR_FLAG (T25) correspondingly.

T13 MEAN_THICKNESS_UNCERTAINTY

Mean thickness uncertainty *[meters; up to 6 digits; no decimal places]*
 Example: 5
 No Data Value: null (i.e. empty field)

Estimated random error of reported mean thickness. Should be rounded to integers.

T14 MAXIMUM_THICKNESS

Maximum thickness *[meters; up to 6 digits; no decimal places]*
 Example: 36
 No Data Value: null (i.e. empty field)

Maximum ice thickness of the glacier in the survey YEAR. Should be rounded to integers.

T15 MAX_THICKNESS_UNCERTAINTY

Maximum thickness uncertainty *[meters; up to 6 digits; no decimal places]*
 Example: 5
 No Data Value: null (i.e. empty field)

Estimated random error of reported maximum thickness. Should be rounded to integers.

T16 SURVEY_METHOD

Survey method *[alphabetic code; up to 4 characters]*
 Example: GPRt
 No Data Value: null (i.e. empty field)

The survey method used, should be given using the following abbreviations:

Abbr.	Survey Method
DRlh	Hydrothermal Drilling
DRlm	Mechanical Drilling
GPRa	Airborne Ground Penetrating Radar
GPRt	Terrestrial Ground Penetrating Radar
GEL	Geoelectric
HYM	Hydrometric
SEI	Seismic technology
OTH	Other

Note: If you choose OTH (other), please give a corresponding note about the used method in the field REMARKS.

T17 SURVEY_METHOD_DETAILS

Survey method details *[alpha-numeric; up to 255 digits]*
 Example: GPR full-range system, 100-MHz shielded antenna, constant wave velocity in ice of 0.168 m per ns.
 No Data Value: null (i.e. empty field)

Provide key details related to the survey methods that are useful to assess the uncertainty of the ice thickness observations.

T18 NUMBER_OF_SURVEY_POINTS

Number of survey points *[numeric; up to 4 digits]*

Example: 5936

No Data Value: null (i.e. empty field)

Number of different survey points taken.

T19 NUMBER_OF_SURVEY_PROFILES

Number of survey profiles *[numeric; up to 4 digits]*

Example: 34

No Data Value: null (i.e. empty field)

Number of different survey profiles taken.

T20 TOTAL_LENGTH_OF_SURVEY_PROFILES

Total length of survey profiles *[km; max. precision of 2 decimal places (=10m)]*

Example: 4.83

No Data Value: null (i.e. empty field)

Total length of successfully recorded survey profiles.

T21 INTERPOLATION_METHOD

Interpolation method *[alphabetic code; 3 characters]*

Example: OTH

No Data Value: null (i.e. empty field)

The interpolation method used for extrapolating ice thickness from survey profile(s) to the entire glacier, should be given using the following abbreviations:

Abbr.	Survey Method
IDW	Inverse Distance Weighting
KRG	Kriging
ANU	ANUDEM (=Topogrid)
TRI	Triangulation
OTH	Other

Note: If you choose OTH (other), please give a corresponding note about the used method in the field REMARKS.

T22 INVESTIGATOR

Investigator *[alpha-numeric; up to 255 digits]*

Example: Matthias HUSS

No Data Value: null (i.e. empty field)

Name(s) of the person(s) or agency doing the field work and/or the name(s) of the person(s) or agency processing the data.

Note: For persons, first name and given name can be given, optionally complemented by other identifiers such as the ORCID (<http://orcid.org>).

T23 SPONSORING_AGENCY

Sponsoring agency *[alpha-numeric; up to 255 digits]*

Example: University of Fribourg, Dept. Geosciences, Chemin de Musée 4, 1700 Fribourg, CH

No Data Value: null (i.e. empty field)

Full name, abbreviation and address of the agency sponsoring the survey and/or where the data are held.

T24 REFERENCES

Reference(s) *[alpha-numeric; up to 255 digits]*

Example: Huss, M., (2010). Geographica Helvetica, 65 (2), p. 80-91.

No Data Value: null (i.e. empty field)

Any published literature directly corresponding with the data reported should be given here. If available, the publication's Digital Object Identifier is to be included.

T25 DATA_FLAG

Remarks *[numeric; 1 digit]*

Example: 1

No Data Value: null (i.e. empty field)

Flag ice thickness data known to be limited to glacier parts or to be erroneous.

Abbr.	Survey Method
[null]	No data problem reported
1	Ice thickness data reported to be erroneous
2	Ice thickness data limited to glacier parts
3	Other

Note: Please give a corresponding note about the reasons for the data flag in the field REMARKS.

T26 REMARKS

Remarks *[alpha-numeric; up to 255 digits]*

Example: Interpolation Method: Minimum Curvature.

No Data Value: null (i.e. empty field)

Any important information or comments not included above may be given here.

TT GLACIER THICKNESS DATA DERIVED FROM MAP or DEM

NOTES ON THE COMPLETION OF THE DATA SHEET

The datasheet TT should be completed in addition to datasheet T in order to report glacier thickness data averaged over surface elevation bands, e.g. from ice thickness maps or DEMs.

For this table the following fields are mandatory and must be completed: GlaThiDa_ID, POLITICAL_UNIT, GLACIER_NAME, SURVEY_DATE, LOWER_BOUND, UPPER_BOUND, MEAN_THICKNESS. The other fields can be left empty (null) if the corresponding information is not available.

The example given for every field refers to the PIZOL glacier, Switzerland.

TT1 GlaThiDa_ID

GlacierThicknessDatabase ID *[numeric code]*

Example: 1

No Data Value: **Mandatory field**

Every survey stored in the Glacier Thickness Database has to obtain a GlaThiDa_ID. This ID is given by the WGMS and links the corresponding data entries in tables T, TT, and TTT.

Note: For data submission, please use your own identifier that is unique within your sample of submitted data and links the results from corresponding survey in tables T, TT, and TTT.

TT2 POLITICAL_UNIT

Political Unit *[alphabetic code; 2 characters]*

Example: CH

No Data Value: **Mandatory field**

2-digit abbreviation for the name of the country or territory in which the glacier is located. For a list of codes, see ISO3166 country codes available at <https://www.iso.org/obp/ui/#search>.

TT3 GLACIER_NAME

Glacier name *[alpha-numeric code; up to 30 digits]*

Example: PIZOL

No Data Value: **Mandatory field**

The name of the glacier, written in CAPITAL letters. Use the same spelling and transliteration as in "T2 GLACIER NAME".

TT4 SURVEY_DATE

Survey date *[YYYYMMDD numeric; 8 digits]*

Example: 20100216

No Data Value: **Mandatory field**; every missing digit has to be replaced by a 9 (“nine”)

Date of the present survey where YYYY is the 4-digit year, MM is the 2-digit month, and DD is the 2-digit day of month (cf. “T4 SURVEY_DATE”).

TT5 LOWER_BOUND

Lower boundary *[m.a.s.l.; up to 4 digits; no decimal places]*

Example: 2600

No Data Value: **Mandatory field**

Lower boundary of the surface elevation interval. Should at least be rounded to integers

TT6 UPPER_BOUND

Upper boundary *[m.a.s.l.; up to 4 digits; no decimal places]*

Example: 2650

No Data Value: **Mandatory field**

Upper boundary of the surface elevation interval. Should at least be rounded to integers.

TT7 AREA

Area *[km²; max. precision of 5 decimal places (=10m²)]*

Example: 0.01985

No Data Value: null (i.e. empty field)

Glacier area of the surface elevation interval (in horizontal projection) in the DEM_YEAR. Give a maximum precision of five decimal places.

Note: If the glacier area originates from a year different from the DEM_YEAR, please indicate in a corresponding note in the field REMARKS.

TT8 MEAN_SLOPE

Mean slope *[°; up to 3 digits; no decimal places]*

Example: 24

No Data Value: null (i.e. empty field)

Measured mean surface slope of the surface elevation interval in the DEM_YEAR. Should be rounded to integers.

Note: If the surface slope originates from a year different from the DEM_YEAR, please add a corresponding note in the field REMARKS. If only horizontal length of the glacier is known, overall slope (ratio of vertical drop height to horizontal distance) should be recorded here together with a corresponding note in the field REMARKS.

TT9 MEAN_THICKNESS

Mean thickness *[meters; up to 6 digits; no decimal places]*

Example: 14

No Data Value: **Mandatory field**

Mean ice thickness of the surface elevation interval in the SURVEY_YEAR. Should be rounded to integers.

Note: Please specify in the field REMARKS if the given MEAN_THICKNESS value is based on the interpolated entire glacier area or only on the measured profile points.

TT10 MEAN_THICKNESS_UNCERTAINTY

Mean thickness uncertainty *[meters; up to 6 digits; no decimal places]*

Example: 5

No Data Value: null (i.e. empty field)

Estimated random error of reported mean thickness. Should be rounded to integers

TT11 MAXIMUM_THICKNESS

Maximum thickness *[meters; up to 6 digits; no decimal places]*

Example: 29

No Data Value: null (i.e. empty field)

Maximum ice thickness of the surface elevation interval in the SURVEY_YEAR. Should be rounded to integers.

TT12 MAX_THICKNESS_UNCERTAINTY

Maximum thickness uncertainty *[meters; up to 6 digits; no decimal places]*

Example: 5

No Data Value: null

Estimated random error of reported maximum thickness. Should be rounded to integers.

TT13 DATA_FLAG

Remarks *[numeric; 1 digit]*

Example: 1

No Data Value: null (i.e. empty field)

Flag ice thickness data known to be limited to parts of the elevation interval or to be erroneous.

Abbr.	Survey Method
[null]	No data problem reported
1	Ice thickness data reported to be erroneous
2	Ice thickness data limited to glacier parts
3	Other

Note: Please give a corresponding note about the reasons for the data flag in the field REMARKS.

TT14 REMARKS

Remarks *[alpha-numeric; up to 255 digits]*

Example: Year: date of DEM

No Data Value: null (i.e. empty field)

Any important information or comments not included above may be given here.

TTT GLACIER THICKNESS POINT DATA

NOTES ON THE COMPLETION OF THE DATA SHEET

The data sheet TTT should be completed in addition to datasheet T in order to report glacier thickness point data along the single survey profile(s). The spacing of reported point data along the survey profile(s) is to be optimized in order to maintain the ice thickness distribution with a minimal number of reported points.

For this table the following fields are mandatory and must be completed: GlaThiDa_ID, POLITICAL_UNIT, GLACIER_NAME, SURVEY_DATE, POINT_ID, POINT_LAT, POINT_LON, and THICKNESS. The other fields can be left empty (null) if the corresponding information is not available.

The example given for every field refers to the PIZOL glacier, Switzerland.

TTT1 GlaThiDa_ID

GlacierThicknessDatabase ID *[numeric code]*

Example: 1

No Data Value: **Mandatory field**

Every survey stored in the Glacier Thickness Database has to obtain a GlaThiDa_ID. This ID is given by the WGMS and links the corresponding data entries in tables T, TT, and TTT.

Note: For data submission, please use your own identifier that is unique within your sample of submitted data and links the results from corresponding survey in tables T, TT, and TTT.

TTT2 POLITICAL_UNIT

Political Unit *[alphabetic code; 2 characters]*

Example: CH

No Data Value: **Mandatory field**

Name of country or territory in which glacier is located (cf. "T1 POLITICAL UNIT").

TTT3 GLACIER_NAME

Glacier name *[alpha-numeric code; up to 30 digits]*

Example: PIZOL

No Data Value: **Mandatory field**

The name of the glacier, written in CAPITAL letters. Use the same spelling and transliteration as in "T2 GLACIER NAME".

TTT4 SURVEY_DATE

Survey date *[YYYYMMDD numeric; 8 digits]*

Example: 20100216

No Data Value: **Mandatory field**; every missing digit has to be replaced by a 9 ("nine")

Date of the present survey where YYYY is the 4-digit year, MM is the 2-digit month, and DD is the 2-digit day of month (cf. "T4 SURVEY_DATE").

TTT5 POINT_ID

Point Id *[alpha-numeric code; 6 digits]*

Example: 1

No Data Value: **Mandatory field**

Each point should be given a POINT_ID according to its number along the profile or the point routing scheme.

TTT6 POINT_LAT

Latitude *[decimal degrees north or south; max. precision of 7 decimal places]*

Example: 48.286738

No Data Value: **Mandatory field**

Latitude is given in decimal degrees, positive values indicating the northern hemisphere and negative values indicating the southern hemisphere. Latitude is given to a maximum precision of seven decimal places.

TTT7 POINT_LON

Longitude *[decimal degrees east or west; max. precision of 7 decimal places]*

Example: 7.478129

No Data Value: **Mandatory field**

Longitude is given in decimal degrees, positive values indicating east of the zero meridian and negative values indicating west of the zero meridian. Longitude is given to a maximum precision of seven decimal places.

TTT8 ELEVATION

Elevation *[m a.s.l.; up to 6 digits; no decimal places]*

Example: 2624

No Data Value: null (i.e. empty field)

Elevation of this measurement point of the glacier in meters above sea level. Should be rounded to integers.

TTT9 THICKNESS

Ice thickness *[meters; up to 6 digits; no decimal places]*

Example: 14

No Data Value: **Mandatory field**

Ice thickness at this measurement point of the glacier in meters. Should be rounded to integers.

TTT10 THICKNESS_UNCERTAINTY

Ice thickness uncertainty *[meters; up to 6 digits; no decimal places]*

Example: 3.7

No Data Value: null (i.e. empty field)

Estimated random error of reported point ice thickness. Should be rounded to integers.

TTT11 DATA_FLAG

Remarks *[numeric; 1 digit]*

Example: 1

No Data Value: null (i.e. empty field)

Flag ice thickness data known to be limited to glacier parts or to be erroneous.

Abbr.	Survey Method
[null]	No data problem reported
1	Ice thickness data reported to be erroneous
3	Other

Note: Please give a corresponding note about the reasons for the data flag in the field REMARKS.

TTT12 REMARKS

Remarks *[alpha-numeric; up to 255 digits]*

Example: ATTENTION: Lat/Lon need to be corrected!

No Data Value: null (i.e. empty field)

Any important information or comments not included above may be given here.