**Point Raw Glaciological Data: Ablation Stake, Snow Pit, and Probed Snow Depth Data, 1966-2016**

Metadata also available as - [[Questions & Answers](https://mrdata.usgs.gov/validation/phpPMnWoZ.faq.html)] - [[Parseable text](https://mrdata.usgs.gov/validation/phpPMnWoZ-new.txt" \o "This metadata record in an alternative format)] - [[XML](https://mrdata.usgs.gov/validation/phpPMnWoZ-new.xml)]

**Metadata:**

* [Identification\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#1)
* [Data\_Quality\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#2)
* [Spatial\_Reference\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#3)
* [Entity\_and\_Attribute\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#4)
* [Distribution\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#5)
* [Metadata\_Reference\_Information](https://mrdata.usgs.gov/validation/phpPMnWoZ.html#6)

*Identification\_Information:*

*Citation:*

*Citation\_Information:*

*Originator:* Emily H. Baker (ORCID: 0000-0002-0938-3496)  
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*Originator:* Louis C. Sass (ORCID: 0000-0003-4677-029X)  
*Originator:* Shad O'Neel (ORCID: 0000-0002-9185-0144)  
*Publication\_Date:* 20180101  
*Title:*

Point Raw Glaciological Data: Ablation Stake, Snow Pit, and Probed Snow Depth Data

*Geospatial\_Data\_Presentation\_Form:* tabular digital data  
*Publication\_Information:*

*Publication\_Place:* Anchorage, AK  
*Publisher:* U.S. Geological Survey, Alaska Science Center

*Online\_Linkage:* <https://doi.org/10.5066/xxxxxxxx>  
*Larger\_Work\_Citation:*

*Citation\_Information:*

*Originator:* Emily H. Baker (ORCID: 0000-0002-0938-3496)  
*Originator:* Christopher J. McNeil (ORCID: 0000-0003-4170-0428)  
*Originator:* Louis C. Sass (ORCID: 0000-0003-4677-029X)  
*Originator:* Shad O'Neel (ORCID: 0000-0002-9185-0144)  
*Publication\_Date:* 20180101  
*Title:* USGS Benchmark Glacier Mass Balance and Project Data: 1966-2016  
*Geospatial\_Data\_Presentation\_Form:* tabular digital data  
*Online\_Linkage:* <https://doi.org/10.5066/xxxxxxx>

*Description:*

*Abstract:*

Since the late 1950s, the USGS has maintained a long-term glacier mass-balance program at three North American glaciers. Measurements began on South Cascade Glacier, WA in 1958, expanding to Gulkana and Wolverine glaciers, AK in 1966, and later Sperry Glacier, MT in 2005. Additional measurements have been made on Lemon Creek and Taku glaciers, AK to compliment data collected by the Juneau Icefield Research Program (JIRP; Pelto et al., 2013). Direct field measurements of point glaciological data are combined with weather and geodetic data to derive glacier-wide seasonal and annual surface mass balance solutions of each glacier in conventional and reference surface formats (Cogley et al., 2011). Additional details on the calculation of glacier-wide surface mass balance is described in Van Beusekom et al. (2010).

*Purpose:*

The purpose of this project is to quantitatively record changes in mass at specified glaciers over the period of record. Although this data was primarily collected for the purpose of mass balance, there are many other potential uses for this data, including ecological assessments, remote sensing validation, or water resource applications. Data is included as available, though the history of the project. Additional older, analog records may be available via digitized scans of field notebooks.

*Supplemental\_Information:*

This data is used to calculate seasonal glacier-wide mass balances, as released in O'Neel et. al (2016): <https://doi.org/10.5066/F7HD7SRF>.

*Time\_Period\_of\_Content:*

*Time\_Period\_Information:*

*Range\_of\_Dates/Times:*

*Beginning\_Date:* 19700101  
*Ending\_Date:* 20170101

*Currentness\_Reference:* publication date

*Status:*

*Progress:* Planned  
*Maintenance\_and\_Update\_Frequency:* Annually

*Spatial\_Domain:*

*Bounding\_Coordinates:*

*West\_Bounding\_Coordinate:* -148.95  
*East\_Bounding\_Coordinate:* -145.33  
*North\_Bounding\_Coordinate:* 63.35  
*South\_Bounding\_Coordinate:* 60.35

*Keywords:*

*Theme:*

*Theme\_Keyword\_Thesaurus:* ISO 19115 Topic Category  
*Theme\_Keyword:* geoscientificInformation  
*Theme\_Keyword:* boundaries  
*Theme\_Keyword:* climateologyMeteorologyAtmosphere  
*Theme\_Keyword:* elevation  
*Theme\_Keyword:* environment

*Theme:*

*Theme\_Keyword\_Thesaurus:* None  
*Theme\_Keyword:* geophysics  
*Theme\_Keyword:* Glaciology

*Theme:*

*Theme\_Keyword\_Thesaurus:* NASA Earth Science Thesaurus  
*Theme\_Keyword:* Cryosphere  
*Theme\_Keyword:* Glaciers/Ice Sheets  
*Theme\_Keyword:* Glaciers  
*Theme\_Keyword:* Ablation Zones/Accumulation Zones  
*Theme\_Keyword:* Glacier Elevation/Ice Sheet Elevation  
*Theme\_Keyword:* Glacier Mass Balance/Ice Sheet Mass Balance

*Theme:*

*Theme\_Keyword\_Thesaurus:* USGS CSA Biocomplexity Thesaurus  
*Theme\_Keyword:* Glaciology  
*Theme\_Keyword:* Geomorphology  
*Theme\_Keyword:* Geology  
*Theme\_Keyword:* Remote Sensing

*Theme:*

*Theme\_Keyword\_Thesaurus:* USGS Thesaurus  
*Theme\_Keyword:* glaciology  
*Theme\_Keyword:* glaciation  
*Theme\_Keyword:* snowfall measurement  
*Theme\_Keyword:* precipitation measurement  
*Theme\_Keyword:* snow and ice cover  
*Theme\_Keyword:* glaciers

*Place:*

*Place\_Keyword\_Thesaurus:Place\_Keyword:*

*Place:*

*Place\_Keyword\_Thesaurus:* USGS Geographic Names Information System  
*Place\_Keyword:* Wolverine Glacier  
*Place\_Keyword:* Gulkana Glacier  
*Place\_Keyword:* Sperry Glacier  
*Place\_Keyword:* South Cascade Glacier  
*Place\_Keyword:* Lemon Creek Glacier  
*Place\_Keyword:* Juneau Icefield

*Access\_Constraints:* none  
*Use\_Constraints:*

It is requested that the authors and the USGS Alaska Science Center be cited for any subsequent publications referencing this dataset. It is strongly recommended that careful attention be paid to the contents of the metadata file associated with these data in order to evaluate data set limitations, restrictions and reccommended uses. When appropriate, please consider co-authorship with the authors of this data.

*Point\_of\_Contact:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* U.S. Geological Survey, Alaska Science Center

*Contact\_Address:*

*Address\_Type:* Mailing  
*Address:* 4210 University Dr.  
*City:* Anchorage  
*State\_or\_Province:* AK  
*Postal\_Code:* 99508-4626  
*Country:* USA

*Contact\_Voice\_Telephone:* (907) 786-7000  
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*Contact\_Electronic\_Mail\_Address:* [ascweb@usgs.gov](mailto:ascweb@usgs.gov)

Cross\_Reference

Spatial\_Data\_Org

Indirect\_Spatial Reference

Direct\_Spatial\_Reference

Point

Spatial\_Reference

*Data\_Quality\_Information:*

*Attribute\_Accuracy:*

*Attribute\_Accuracy\_Report:*

We did not conduct any formal attribute accuracy tests. The user must assess these attributes on a case-by-case basis.

*Logical\_Consistency\_Report:*

Original data entry sheets have been used extensively in calculating glacier-wide mass balance. Occasional errors may have been introduced in the transition from original data-entry format to cleaned data for release. If any irregularities are found, please contact the authors for clarification. A check has been made on volumnes, ensuring that given volumnes and agree with recorded core length and diameters. Extensive spot-checking has been completed to confirm that transformation in format from data-entry to release has not introduced errors into the data.

*Completeness\_Report:*

Data set is considered complete for the information presented, as described in the abstract. We include all currently digitized project data; additional information may be available via digital scans of field notebooks. All data recorded in snow pits, at ablatin stakes, and probed snow depths as a part of mass balance fieldwork are reported here.

*Positional\_Accuracy:*

*Horizontal\_Positional\_Accuracy:*

*Horizontal\_Positional\_Accuracy\_Report:*

glacier\_site\_locations.csv: This file gives the locations of glaciological sites on each glacier. Snow pits are located either at or very close to (<10m) this glaciological site location. Ablation stakes flow with the ice in which they are installed; their location is not fixed. For Alaska sites, ablation stakes are installed < 30 m up-glacier of the site location, and flow through the true site in the years following their installation. In Montana, the stake is installed at the true location, and flows down-glacier in subsequent years. Locations of ablation stakes, snow pits, and probed snow depths should be derived by matching the site name in a given type of data with this index site location file. Locations are given in latitude and longitude, in decimal degrees (EPSG code 4326).

*Vertical\_Positional\_Accuracy:*

*Vertical\_Positional\_Accuracy\_Report:* No vertcal spatial coordinates given; no accuracy to report.

*Lineage:*

*Process\_Step:*

*Process\_Description:*

Snowpits: Samples of snow and ice have been taken with a variety of samplers through the history of the project, as described in the "sampler" column metadata. Sample weight and depth below surface are noted. Weight is measured using a spring scale, and small stuff sack for the sample. Sample depth is taken with a tape measurer in pits, or measured along core, and in coring hole.

*Source\_Used\_Citation\_Abbreviation:*

Ostream, G., and M. Brugman (1991), Glacier Mass-Balance Measurements: A Manual for Field and Office Work, Saskatoon, Saskatchewan.

*Process\_Date:* 2017

*Process\_Step:*

*Process\_Description:*

Snowdepth: Snowdepth is measured by probing undisturbed snow near an ablation stake, or measured in a snow pit or snow core where ice is reached. Strike of the probe against the ice surface can generally be felt. These depths should be used with some caution, and in conjunction with snow depths measured at ablation stakes, as ice lenses within the snowpack may occasionally be mistaken for the glacier surface. In a pit or snow core, the glacier surface is obvious.

*Source\_Used\_Citation\_Abbreviation:*

Ostream, G., and M. Brugman (1991), Glacier Mass-Balance Measurements: A Manual for Field and Office Work, Saskatoon, Saskatchewan.

*Process\_Date:* 2017

*Process\_Step:*

*Process\_Description:*

Ablation Stake Measurements: Metal stakes are installed vertically into the glacier surface at index sites with the use of a steam drill. Stake is labeled with the year in which it is installed, and with marked length increments. Upon subsequent visits to the site, level of snow or ice on the stake is recorded. The absolute value of measurements of stake above surface or below surface are not meaningful. Rather, the change in length above and below surface give either depth of snow accumulation or melt during the interval between measurements. Stakes are labeled with the index site name, and year in which the stake was installed. Stakes are measured for multiple years. They are initially installed up-glacier from the absolute position of the index site, and flow through the site in following years. A single year of measurements at a single index site will comprise measurements from multiple stakes, thereby giving a more representative picture of the mass balance at that site.

*Source\_Used\_Citation\_Abbreviation:*

Ostream, G., and M. Brugman (1991), Glacier Mass-Balance Measurements: A Manual for Field and Office Work, Saskatoon, Saskatchewan.

*Process\_Date:* 2017

*Spatial\_Reference\_Information:*

*Horizontal\_Coordinate\_System\_Definition:*

*Geographic:*

*Latitude\_Resolution:* 0.000001  
*Longitude\_Resolution:* 0.000001  
*Geographic\_Coordinate\_Units:* Decimal degrees

*Entity\_and\_Attribute\_Information:*

*Detailed\_Description:*

*Entity\_Type:*

*Entity\_Type\_Label:* Glacier\_YYYY\_MM\_DD\_Pit\_SiteName  
*Entity\_Type\_Definition:*

pitcore folder: These files give detailed measurements of snow density in snow pits and snow cores, or a combination of the two. Snow cores allow measurement of bulk snow density to a greater depth than the extent of the snow pit. File name contains information on the glacier, date, whether measurements are from a pit, core, or pit/core combination, and index site location. Density samples of snow and ice have been taken with a variety of samplers through the history of the project. Sample weight and depth below surface are noted, and weight is measured using a spring scale and small stuff sack for sample, as described in Cogley et al. (2011). This is in the form glacier\_YYYY\_MM\_DD\_PitCore\_index\_site.csv.

*Entity\_Type\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* sampler  
*Attribute\_Definition:* Type of density sampler used  
*Attribute\_Definition\_Source:* Producer  
*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* wedge  
*Enumerated\_Domain\_Value\_Definition:* Snowmetrics 1000 cc wedge  
*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Felix  
*Enumerated\_Domain\_Value\_Definition:* Felix snow corer (sample length and diameter recorded)  
*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Kovacs  
*Enumerated\_Domain\_Value\_Definition:* Kovacs snow corer (sample length and diameter recorded)  
*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* tube  
*Enumerated\_Domain\_Value\_Definition:*

Norwegian tube, used in pit measurements (41.05cm^2 cross section)

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* McCall  
*Enumerated\_Domain\_Value\_Definition:*

Also known as a "Federal Sampler"; calibrated in design to return snow water equivalent depth.

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Spiri  
*Enumerated\_Domain\_Value\_Definition:* Older coring device (45.6 cm^2 cross section).  
*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* sample\_weight  
*Attribute\_Definition:* Weight of snow sample  
*Attribute\_Definition\_Source:* Producer Defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 0  
*Range\_Domain\_Maximum:* 1620  
*Attribute\_Units\_of\_Measure:* grams  
*Attribute\_Measurement\_Resolution:* 5

*Attribute:*

*Attribute\_Label:* sample\_bottom\_depth  
*Attribute\_Definition:* Bottom depth of snow sample  
*Attribute\_Definition\_Source:* Producer Defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 0  
*Range\_Domain\_Maximum:* 1250  
*Attribute\_Units\_of\_Measure:* centimeters  
*Attribute\_Measurement\_Resolution:* 1

*Attribute:*

*Attribute\_Label:* avg\_core\_length  
*Attribute\_Definition:* Average of 3 measurements, on 3 sides of core  
*Attribute\_Definition\_Source:* Producer Defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 0  
*Range\_Domain\_Maximum:* 90  
*Attribute\_Units\_of\_Measure:* centimeters  
*Attribute\_Measurement\_Resolution:* 0.5

*Attribute:*

*Attribute\_Label:* avg\_core\_diam  
*Attribute\_Definition:* Average of 4 measurements, on 4 opposing sides of core  
*Attribute\_Definition\_Source:* Producer Defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 6  
*Range\_Domain\_Maximum:* 7.6  
*Attribute\_Units\_of\_Measure:* centimeters  
*Attribute\_Measurement\_Resolution:* 0.2

*Attribute:*

*Attribute\_Label:* volume  
*Attribute\_Definition:*

volume of sample, from either sampler type or as calculated from core length and diameter measurements, as appropriate. This should be used for calculating density.

*Attribute\_Definition\_Source:* Producer Defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 2  
*Range\_Domain\_Maximum:* 1000  
*Attribute\_Units\_of\_Measure:* cubic centimeters  
*Attribute\_Measurement\_Resolution:* 1

*Attribute:*

*Attribute\_Label:* comments  
*Attribute\_Definition:* Field notes regarding this sample  
*Attribute\_Definition\_Source:* User defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:* Comments regarding the sample, as recorded in the field.

*Detailed\_Description:*

*Entity\_Type:*

*Entity\_Type\_Label:* Glacier\_raw\_snowdepths\_pits\_probes  
*Entity\_Type\_Definition:*

snowdepth folder: These files give point measurements of snow depth, as measured by a variety of listed methods. They complement measurements of snow depth as recorded by the ablation stakes. File name includes glacier and index site name, and follows the convention glacier\_IndexSite\_raw\_stake\_data.csv.

*Entity\_Type\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* type  
*Attribute\_Definition:* Type of measurement used to derive snowdepth.  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Pit  
*Enumerated\_Domain\_Value\_Definition:* Snow depth measured in snow pit. High confidence.  
*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Probe  
*Enumerated\_Domain\_Value\_Definition:*

Snow depth measured via snow probe. Occasionally, a hard ice lens within the snowpack may be confused for the surface of the glacier. While much effort is given to avoid this, a few cases may be present.

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* near pit  
*Enumerated\_Domain\_Value\_Definition:*

Probed snow depth near an existing pit; should be examined with the pit-measured depth, with this indicating local variability.

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* probe  
*Enumerated\_Domain\_Value\_Definition:*

Snow depth measured via snow probe. Occasionally, a hard ice lens within the snowpack may be confused for the surface of the glacier. While much effort is given to avoid this, a few cases may be present.

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:* Stake  
*Enumerated\_Domain\_Value\_Definition:*

Snow depth measured on ablation stake, using known position of previous year's summer surface on stake reference system.

*Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute\_Domain\_Values:*

*Enumerated\_Domain:*

*Enumerated\_Domain\_Value:Enumerated\_Domain\_Value\_Definition:Enumerated\_Domain\_Value\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* depth  
*Attribute\_Definition:* Snow depth to the ice or firn surface (seasonal snow)  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 23  
*Range\_Domain\_Maximum:* 423  
*Attribute\_Units\_of\_Measure:* cm  
*Attribute\_Measurement\_Resolution:* 5

*Attribute:*

*Attribute\_Label:* YMD  
*Attribute\_Definition:* Date, in format of YYYYMMDD (year, month, day).  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 20070418  
*Range\_Domain\_Maximum:* 20170420  
*Attribute\_Units\_of\_Measure:* Date  
*Attribute\_Measurement\_Resolution:* 1

*Attribute:*

*Attribute\_Label:* site  
*Attribute\_Definition:*

Site at which snow depth was measured. Site locations are available in an associated file within this release.

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:* Site labels.

*Detailed\_Description:*

*Entity\_Type:*

*Entity\_Type\_Label:* Glacier\_Site\_raw\_stake\_data  
*Entity\_Type\_Definition:*

stake folder: These files give measurements of snow/ ice surface height on ablation stakes. A single index site will likely have readings on multiple ablation stakes in a single year. Files are named according to the convention: glacier\_IndexSite\_raw\_stake\_data.csv. Change in snow/ice surface can be calculated by comparing the height of the surface against the reference metric of stake length in glacier between two measurement visits. Further details on ablation stake measurements and calculation types are available in Cogley et al. (2011).

*Entity\_Type\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* YMD  
*Attribute\_Definition:* Date, in format of Year, Month, Day (YYYYMMDD).  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 19850110  
*Range\_Domain\_Maximum:* 20160827  
*Attribute\_Units\_of\_Measure:* Date  
*Attribute\_Measurement\_Resolution:* 1

*Attribute:*

*Attribute\_Label:* stake\_name  
*Attribute\_Definition:*

Name of stake, giving the year a stake was installed, and the index site name at which it is installed. Format is Year-Site (YY-Site).

Stakes are installed up-glacier of the true location, and flow through the site during the year or following year. Stakes are located <30 m from the index site. A stake is measured for as many years as possible. Stakes installed in multiple years often exist at a single site, and are measured.

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:*

Stake name (Year installed - Index Site). Year is 2-digit (e.g. 99 for 1999, or 03 for 2003). For example, stake "91-A" is at index site A, installed in 1991.

*Attribute:*

*Attribute\_Label:* surface\_type  
*Attribute\_Definition:* Measurement surface  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:*

Field notes on whether the surface consists of snow or ice. "S" indicates snow, "I" indicates ice. Other notes are present as well. Variable text-entry field.

*Attribute:*

*Attribute\_Label:* total\_stake\_length  
*Attribute\_Definition:*

Total length of the stake. This can vary through time, as additional length is added, or sections are removed from initial stake.

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 0  
*Range\_Domain\_Maximum:* 12  
*Attribute\_Units\_of\_Measure:* meters  
*Attribute\_Measurement\_Resolution:* .01

*Attribute:*

*Attribute\_Label:* stake\_above\_surf  
*Attribute\_Definition:*

Length of stake above the surface, which can be either ice or snow, as indicated in the surface\_type column. Negative values indicate that the top of the stake is below the surface; it is measured as it is installed.

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* -2.91  
*Range\_Domain\_Maximum:* 9.0

*Attribute:*

*Attribute\_Label:* stake\_below\_surf  
*Attribute\_Definition:* Length of stake below the surface.  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 0.5  
*Range\_Domain\_Maximum:* 12  
*Attribute\_Units\_of\_Measure:* m  
*Attribute\_Measurement\_Resolution:* 0.01

*Attribute:*

*Attribute\_Label:* comments  
*Attribute\_Definition:*

Comments on the measurement. A dash followed by initials may indicate the author, especially on older measurements.

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:* Comments

*Detailed\_Description:*

*Entity\_Type:*

*Entity\_Type\_Label:* glacier\_site\_locations.csv  
*Entity\_Type\_Definition:*

glacier\_site\_locations.csv: This file gives the locations of glaciological sites on each glacier. Snow pits are located either at or very close to (<10m) this glaciological site location. Ablation stakes flow with the ice in which they are installed; their location is not fixed. For Alaska sites, ablation stakes are installed < 30 m up-glacier of the site location, and flow through the true site in the years following their installation. In Montana, the stake is installed at the true location, and flows down-glacier in subsequent years. Locations of ablation stakes, snow pits, and probed snow depths should be derived by matching the site name in a given type of data with this index site location file. Locations are given in latitude and longitude, in decimal degrees (EPSG code 4326).

*Entity\_Type\_Definition\_Source:* Producer defined

*Attribute:*

*Attribute\_Label:* site  
*Attribute\_Definition:* Name of index site  
*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Unrepresentable\_Domain:* Name of index site used through history of the project

*Attribute:*

*Attribute\_Label:* latitude  
*Attribute\_Definition:*

Latitude in decimal degrees. Ablation stakes flow with the ice in which they are installed; their location is not fixed. For Alaska sites, ablation stakes are installed < 30 m up-glacier of the site location (as located with a hand-held GPS unit), and flow through the true site in the years following their installation. In Montana, the stake is installed at the true location, and flows down-glacier in subsequent years. Locations of ablation stakes, snow pits, and probed snow depths should be derived by matching the site name in a given type of data with this index site location file. Locations are given in latitude and longitude, in decimal degrees (EPSG code 4326).

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* 63.259091  
*Range\_Domain\_Maximum:* 63.294753  
*Attribute\_Units\_of\_Measure:* Decimal Degrees  
*Attribute\_Measurement\_Resolution:* Converted from UTM coordinates accurate to 1m

*Attribute:*

*Attribute\_Label:* longitude  
*Attribute\_Definition:*

Latitude in decimal degrees. Ablation stakes flow with the ice in which they are installed; their location is not fixed. For Alaska sites, ablation stakes are installed < 30 m up-glacier of the site location (as located with a hand-held GPS unit), and flow through the true site in the years following their installation. In Montana, the stake is installed at the true location, and flows down-glacier in subsequent years. Locations of ablation stakes, snow pits, and probed snow depths should be derived by matching the site name in a given type of data with this index site location file. Locations are given in latitude and longitude, in decimal degrees (EPSG code 4326).

*Attribute\_Definition\_Source:* Producer defined  
*Attribute\_Domain\_Values:*

*Range\_Domain:*

*Range\_Domain\_Minimum:* -145.482731  
*Range\_Domain\_Maximum:* -145.385044  
*Attribute\_Units\_of\_Measure:* Decimal Degrees  
*Attribute\_Measurement\_Resolution:* Converted from UTM coordinates accurate to 1m

*Overview\_Description:*

*Entity\_and\_Attribute\_Overview:*

This dataset contains point raw glaciological field data. Snow pit and snow core data gives detailed information on snow density through the measured snow column. Snow depth measurements are collected via snow probe and in some snow pits or snow cores that extend the full depth of the snowpack to the glacier's surface. Ablation stakes allow point measurement of both snow depth and snow melt against the reference of the labeled stake. Draw wires provide additional measurements of snow and ice melt, against the invariant reference of the labeled wire. Files are named according to the following conventions: pitcore folder: Each pit or pit/core combination measurement is presented as a separate csv. They are named as Glacier\_YYYY\_MM\_DD\_TypeOfMeasurement (pit or core or combination)\_IndexSiteName.csv

snowdepth folder: All years and sites combined into single file.

stake folder: All stakes that exist at a single index site are combined into a single file. These are named as Glacier\_IndexSiteName\_raw\_stake\_data.csv.

*Entity\_and\_Attribute\_Detail\_Citation:*

Ostream, G., and M. Brugman (1991), Glacier Mass-Balance Measurements: A Manual for Field and Office Work, Saskatoon, Saskatchewan.

*Distribution\_Information:*

*Distributor:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* U.S. Geological Survey, Alaska Science Center

*Contact\_Address:*

*Address\_Type:* Mailing and Physical  
*Address:* 4210 University Dr.  
*City:* Anchorage  
*State\_or\_Province:* AK  
*Postal\_Code:* 99508-4626  
*Country:* USA

*Contact\_Voice\_Telephone:* (907) 786-7000  
*Contact\_Electronic\_Mail\_Address:* ascweb@usgs.gov

*Distribution\_Liability:*

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*Standard\_Order\_Process:*

*Digital\_Form:*

*Digital\_Transfer\_Information:*

*Format\_Name:* Digital Data

*Digital\_Transfer\_Option:*

*Online\_Option:*

*Computer\_Contact\_Information:*

*Network\_Address:*

*Network\_Resource\_Name:* <https://doi.org/10.5066/xxxxxxxxxxxxx>

*Fees:* none

*Metadata\_Reference\_Information:*

*Metadata\_Date:* 20180201  
*Metadata\_Contact:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

*Contact\_Organization:* U.S. Geological Survey, Alaska Science Center

*Contact\_Address:*

*Address\_Type:* Mailing and Physical  
*Address:* 4210 University Dr.  
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*State\_or\_Province:* Alaska  
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*Metadata\_Standard\_Name:* FGDC Content Standard for Digital Geospatial metadata  
*Metadata\_Standard\_Version:* FGDC-STD-001.1-1999

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