`fog` Fluctuations of Glaciers (FoG) Database

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Tables : `glacier` · `state` · `state_band` · `change` · `change_band` · `front_variation` · `mass_balance` · `mass_balance_band` · `mass_balance_point` · `event` · `person` · `agency`

Internationally collected, standardized dataset on glacier state and change (length, area, elevation, mass) based on in-situ measurements, remote sensing, and reconstructions. This file is generated from contents of the `datapackage.json` file.

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- `publications` WGMS (2023): Global Glacier Change Bulletin No. 5 (2020-2021). Michael Zemp, Isabelle Gärtner-Roer, Samuel U. Nussbaumer, Ethan Z. Welty, Inés Dussaillant, and Jacqueline Bannwart (eds.), ISC (WDS) / IUGG (IACS) / UNEP / UNESCO / WMO, World Glacier Monitoring Service, Zurich, Switzerland, 134 pp. Based on database version https://doi.org/10.5904/wgms-fog-2023-09.

  WGMS (2013): Glacier Mass Balance Bulletin No. 12 (2010-2011). Michael Zemp, Samuel U. Nussbaumer, Kathrin Naegeli, Isabelle Gärtner-Roer, Frank Paul, Martin Hoelzle, and Wilfried Haeberli (eds.), ICSU (WDS) / IUGG (IACS) / UNEP / UNESCO / WMO, World Glacier Monitoring Service, Zurich, Switzerland, 106 pp. Based on database version https://doi.org/10.5904/wgms-fog-2013-11.

  WGMS (2012): Fluctuations of Glaciers 2005-2010 (Vol. X): Michael Zemp, Holger Frey, Isabelle Gärtner-Roer, Samuel U. Nussbaumer, Martin Hoelzle, Frank Paul, and Wilfried Haeberli (eds.), ICSU (WDS) / IUGG (IACS) / UNEP / UNESCO / WMO, World Glacier Monitoring Service, Zurich, Switzerland. Based on database version https://doi.org/10.5904/wgms-fog-2012-11.

  … and earlier issues (https://wgms.ch/literature_published_by_wgms)

- `contributors` WGMS scientific collaboration network of national correspondents and principal investigators as listed in the data (`investigators` and `agencies` columns) and related publications.

- `disclaimer` The data may contain errors and inaccuracies. Hence, we strongly suggest performing data quality checks and, in case of ambiguities, to contact us as well as the investigators and agencies listed in the data (`investigators` and `agencies` columns) and related publications.

1 Overview

The data tables are stored as comma-separated value (CSV) files in the `data` subfolder. Tables refer to each other by special columns that uniquely identify each record (i.e., a foreign key referencing another table's primary key).

- `glacier` : Glacier lookup by country, region, names, latitude and longitude, and GLIMS, RGI, and WGI identifiers. The `id` column uniquely identifies a glacier and is referenced in other tables using their `glacier_id` column.
- `state` : Glacier-wide area, elevation (mean, lowest, highest), length, and terminus type. For area and mean elevation by elevation band, see `state_band` (whose `state_id` references column `id` in `state`).
- `change` : Glacier-wide elevation and volume change (typically from repeat mapping of surface elevation). For elevation and volume change by elevation band, see `change_band` (whose `change_id` references column `id` in `change`).
- `front_variation` : Changes in glacier length (typically from repeat measurements to a fixed reference).
- `mass balance` : Glacier-wide mass balance and survey overview. See `mass_balance_band` for mass balance by elevation band and `mass_balance_point` for the original point measurements. Both refer to the `mass_balance` table by columns `glacier_id` and `year`.
- `event` : Extraordinary events concerning glaciers.
- `person` : Persons referenced from other tables' `investigators` column.
- `agency` : Agencies referenced from other tables' `investigators` and `agencies` columns.

2 Major changes

The data format has changed substantially since the previous version (2024-01). Below are the most significant changes:

- **All measurement units are standardized to the meter**: m, m w.e., m², m³, kg m⁻³.
- Accumulation-area ratio ([`mass_balance.aar`][#mass_balance.aar]) is a fraction (0-1) rather than a percentage (0-100%).
- All table and column names are all lowercase rather than all uppercase.
- The glacier identifier `WGMS_ID` is renamed `glacier_id` in the data tables and references column `id` in table `glacier`. For clarity, it should be referred to externally as the `wgms_fog_glacier_id` or equivalent.
- All dates are formatted as `yyyy-mm-dd` (no more `99` for unknown month and/or day) and accompanied by an uncertainty column in days. For example, `date: 1986-09-30` and `date_unc: 1` represents the interval 1986-09-29 to 1986-10-01.
- Tables `mass_balance` (glacier-wide and elevation-band balance) and `mass_balance_overview` (overview) are renamed `mass_balance` (overview and glacier-wide balance) and `mass_balance_band` (elevation-band balance).
- New table `state_band` stores area and mean elevation by elevation band.
- Table `change` is split into tables `change` (glacier-wide) and `change_band` (elevation-band). Area changes are moved to timeseries of area in the `state` and `state_band` tables.
- Glacier outlines are associated to glacier-wide measurements with column `outline_id` or columns `begin_outline_id` and `end_outline_id`. These columns report either a GLIMS analysis id (e.g. glims:754359), an RGI id (RGI2000-v7.0-G-11-02773), or the integer id of a custom outline (stored in the `outline` table, available upon request).
- Columns `investigators` and `agencies` use a consistent format and reference records in the new tables `person` and `agency`.

3 Tables

glacier · state · state_band · change · change_band · front_variation · mass_balance · mass_balance_band · mass_balance_point · event · person · agency

3.1 `glacier`

General information about each glacier.

- `path`: data/glacier.csv
- `primaryKey`: `id`
- `foreignKeys`
    - `parent_glacier_id` → `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`short_name` *required*	string	The short name only contains characters A-Z, 0-9, - (dash), . (period), : (colon), () (parentheses), / (forward slash), ' (apostrophe), and (space). Non-Latin characters are transliterated, and if the Latin name contains accents, the following rules are typically applied: Å → AA, Æ → AE, Ä → AE, ð → D, Ø → OE, œ → OE, Ö → OE, ß → SS, þ → TH, Ü → UE (neglecting any remaining accents).
`names`	string	Full names (in English and/or local languages) as a pipe-delimited list.
`id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database.
`latitude` *required*	number (degrees)	Latitude (EPSG:4326). Positive values indicate the northern hemisphere and negative values indicate the southern hemisphere. The point (`latitude`, `longitude`) should be in the main channel in the upper part of the glacier ablation area.
`longitude` *required*	number (degrees)	Longitude (EPSG:4326). Positive values indicate east of the zero meridian and negative values indicate west of the zero meridian. The point (`latitude`, `longitude`) should be in the main channel in the upper part of the glacier ablation area.
`gtng_region`	string	Global Terrestrial Network for Glaciers (GTN-G) 2023 code (https://10.5904/gtng-glacreg-2023-07) of the region in which the glacier is located.
`glims_id`	string	Glacier identifier (`glac_id`) in the Global Land Ice Measurements from Space database (https://www.glims.org). It has the format `GxxxxxxEyyyyy0`, where `xxxxxx` is longitude east of the zero meridian in millidegrees, `yyyyy` is north or south latitude in millidegrees, and `0` is N or S depending on the hemisphere.

name	type	description
`rgi50_ids`	string	Glacier identifiers (`RGIId`), as a pipe-delimited list, from the Randolph Glacier Inventory 5.0 (https://nsidc.org/data/nsidc-0770/versions/5). These have format `RGI50-rr.nnnnn`, where `rr` is the first-order region (zero-padded) and `nnnnn` is an arbitrary numeric code.
`rgi60_ids`	string	Glacier identifiers (`RGIId`), as a pipe-delimited list, from the Randolph Glacier Inventory 6.0 (https://nsidc.org/data/nsidc-0770/versions/6). These have format `RGI60-rr.nnnnn`, where `rr` is the first-order region (zero-padded) and `nnnnn` is an arbitrary numeric code.
`rgi70_ids`	string	Glacier or glacier complex identifiers (`rgi_id`), as a pipe-delimited list, from the Randolph Glacier Inventory 7.0 (https://nsidc.org/data/nsidc-0770/versions/7). These have format `RGI2000-v7.0-p-rr-nnnnn`, where `p` is the product code (G: glacier or C: complex), `rr` is the first-order region (zero-padded), and `nnnnn` is an arbitrary numeric code.
`wgi_id`	string	Glacier identifier (`wgi_glacier_id`) in the World Glacier Inventory (https://nsidc.org/data/g01130/versions/1). It is constructed from the following elements: - 2-character political unit - 1-character continent code - 4-character drainage code - 2-character free position code - 3-character local glacier code
`parent_glacier_id`	integer	Identifier (`id`) of the (present or former) parent glacier.
`references`	string	Literature references as a pipe-delimited list.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.2 `state`

Measurements of glacier state – length, area, elevation, and terminus type.

- `path`: `data/state.csv`
- `primaryKey`: `id`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`outline_id`	string	Glacier outline used to derive the reported measurement(s), as either a GLIMS (https://www.glims.org) analysis id prefixed with 'glims:', RGI (https://www.glims.org/RGI) id, or integer id of a custom outline (available upon request).
`id` *required*	integer	Integer identifying the glacier state.
`date` *required*	date (yyyy-mm-dd)	Date of the reported measurements.
`date_unc`	number (days)	Estimated (or exact) range of `date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`highest_elevation`	integer (m)	Highest elevation on the glacier.
`lowest_elevation`	integer (m)	Lowest elevation on the glacier.
`mean_elevation`	integer (m)	Mean glacier elevation.
`elevation_unc`	integer (m)	Estimated random error of reported elevations.
`area`	integer (m²)	Glacier area.
`area_unc`	integer (m²)	Estimated random error of `area`.
`length`	integer (m)	Glacier length measured along the main flowline.

name	type	description
length_unc	integer (m)	Estimated random error of `length`.
terminus_type	string	Condition at the terminus. - land: Dry land - cliff: Very steep dry land (subject to dry calving) - lake: Lake (freshwater) - marine: Sea or ocean (saltwater) - shelf: Ice shelf (which itself terminates in the ocean)
platform	string	Survey platform. - ground: Terrestrial - air: Airborne - space: Spaceborne - other: Other (see `remarks`)
method	string	Survey method. - direct: In-situ measurement (e.g. GPS, tape measure) - map: Maps and mapping - photo: Photographs and photogrammetry - laser: Laser scanning - radar: Radar - reconstruction: Reconstruction (from historical or dating methods) - historical: Historical (from texts or visuals) - text: Text - print: Print (from an engraving or etching). For photographic prints, use photo. - painting: Painting - drawing: Drawing - radiocarbon: Radiocarbon date - dendrochronology: Dendrochronology - surface exposure: Surface exposure dating (e.g. TCN) - other: Other (see `remarks`)
investigators	string	Pipe-delimited list of persons (linked to `person` table as `person.name`) and their agency affiliations (linked to `agencies` and `agency` table as `agency.id`) responsible for the measurements.
agencies	string	Numbered (by `agency.id`), pipe-delimited list of agencies referred to from `investigators`.
references	string	Literature references as a pipe-delimited list.
remarks	string	Remarks and flags as a pipe-delimited list.

3.3 `state_band`

Measurements of glacier state by elevation band.

- `path`: `data/state_band.csv`
- `primaryKey`: `state_id` · `lower_elevation` · `upper_elevation`
- `foreignKeys`
  - `glacier_id` · `state_id` → `state.glacier_id` · `state.id`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`state_id` *required*	integer	Integer identifying the glacier state.
`lower_elevation` *required*	integer (m)	Lower boundary of the surface elevation band.
`upper_elevation` *required*	integer (m)	Upper boundary of the surface elevation band.
`mean_elevation`	integer (m)	Mean glacier elevation.
`elevation_unc`	integer (m)	Estimated random error of reported elevations.
`area`	integer (m²)	Elevation band area.
`area_unc`	integer (m²)	Estimated random error of `area`.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.4 `change`

Measurements of glacier elevation change – typically from geodetic surveys.

- `path`: `data/change.csv`
- `primaryKey`: `id`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`begin_outline_id`	string	Glacier outline used to derive the glacier state on `begin_date`, as either a GLIMS (https://www.glims.org) analysis id prefixed with 'glims:', RGI (https://www.glims.org/RGI) id, or integer id of a custom outline (available upon request).
`end_outline_id`	string	Glacier outline used to derive the glacier state on `end_date`, as either a GLIMS (https://www.glims.org) analysis id prefixed with 'glims:', RGI (https://www.glims.org/RGI) id, or integer id of a custom outline (available upon request).
`id` *required*	integer	Integer identifying the glacier change.
`begin_date` *required*	date (yyyy-mm-dd)	Date of the earlier (reference) measurement.
`begin_date_unc`	number (days)	Estimated (or exact) range of `begin_date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`end_date` *required*	date (yyyy-mm-dd)	Date of the later measurement.
`end_date_unc`	number (days)	Estimated (or exact) range of `end_date` (e.g. 2021-10-02 ± 1 days = 2021-10-01 to 2021-10-03).
`area`	integer (m²)	Glacier area (presumably from `begin_date`, `end_date`, or an average) which should be used to estimate `elevation_change` from `volume_change` or vice versa.
`elevation_change`	number (m)	Change in surface elevation (averaged over the glacier) from `begin_date` to `end_date`.
`elevation_change_unc`	number (m)	Estimated random error of `elevation_change`.

name	type	description
`volume_change`	integer (m³)	Change in glacier volume from `begin_date` to `end_date`.
`volume_change_unc`	integer (m³)	Estimated random error of `volume_change`.
`begin_platform`	string	Survey platform used on `begin_date`. - ground: Terrestrial - air: Airborne - space: Spaceborne - other: Other (see `remarks`)
`begin_method`	string	Survey method used on `begin_date`. - direct: In-situ measurement (e.g. GPS, tape measure) - map: Maps and mapping - photo: Photographs and photogrammetry - laser: Laser scanning - radar: Radar - reconstruction: Reconstruction (from historical or dating methods) - historical: Historical (from texts or visuals) - text: Text - print: Print (from an engraving or etching). For photographic prints, use photo. - painting: Painting - drawing: Drawing - radiocarbon: Radiocarbon date - dendrochronology: Dendrochronology - surface exposure: Surface exposure dating (e.g. TCN) - other: Other (see `remarks`)
`end_platform`	string	Survey platform used on `end_date`. - ground: Terrestrial - air: Airborne - space: Spaceborne - other: Other (see `remarks`)

name	type	description
`end_method`	string	Survey method used on `end_date`. - direct: In-situ measurement (e.g. GPS, tape measure) - map: Maps and mapping - photo: Photographs and photogrammetry - laser: Laser scanning - radar: Radar - reconstruction: Reconstruction (from historical or dating methods) - historical: Historical (from texts or visuals) - text: Text - print: Print (from an engraving or etching). For photographic prints, use photo. - painting: Painting - drawing: Drawing - radiocarbon: Radiocarbon date - dendrochronology: Dendrochronology - surface exposure: Surface exposure dating (e.g. TCN) - other: Other (see `remarks`)
`investigators`	string	Pipe-delimited list of persons (linked to `person` table as `person.name`) and their agency affiliations (linked to `agencies` and `agency` table as `agency.id`) responsible for the measurements.
`agencies`	string	Numbered (by `agency.id`), pipe-delimited list of agencies referred to from `investigators`.
`references`	string	Literature references as a pipe-delimited list.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.5 `change_band`

Measurements of glacier elevation change – typically from geodetic surveys – by elevation band.

- `path` : `data/change_band.csv`
- `primaryKey` : `change_id` · `lower_elevation` · `upper_elevation`
- `foreignKeys`
    - `glacier_id` · `change_id` → `change.glacier_id` · `change.id`
    - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`change_id` *required*	integer	Integer identifying the glacier change.
`lower_elevation` *required*	integer (m)	Lower boundary of the surface elevation band.
`upper_elevation` *required*	integer (m)	Upper boundary of the surface elevation band.
`area`	integer (m²)	Elevation band area (presumably from `begin_date`, `end_date`, or an average) which should be used to estimate `elevation_change` from `volume_change` or vice versa.
`elevation_change`	number (m)	Change in surface elevation (averaged over the elevation band) from `begin_date` to `end_date`.
`elevation_change_unc`	number (m)	Estimated random error of `elevation_change`.
`volume_change`	integer (m³)	Change in glacier volume (in the elevation band) from `begin_date` to `end_date`.
`volume_change_unc`	integer (m³)	Estimated random error of `volume_change`.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.6 `front_variation`

Measurements of glacier front variation (length change).

- `path` : `data/front_variation.csv`
- `primaryKey` : `glacier_id` · `series_id` · `end_date`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`series_id` *required*	integer	Integer used to distinguish between different front variation series for the same glacier. Value `0` is reserved for the longterm in-situ series (if one exists).
`begin_date`	date (yyyy-mm-dd)	Date of the earlier (reference) measurement, or null if no reference was used (e.g. glacier advance inferred from moraine condition).
`begin_date_unc`	number (days)	Estimated (or exact) range of `begin_date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`end_date` *required*	date (yyyy-mm-dd)	Date of the later measurement.
`end_date_unc`	number (days)	Estimated (or exact) range of `end_date` (e.g. 2021-10-02 ± 1 days = 2021-10-01 to 2021-10-03).
`length_change`	number (m)	Change in glacier length from `begin_date` to `end_date` (+ advance, - retreat).
`length_change_unc`	number (m)	Estimated random error of `length_change` .
`length_change_direction`	string	Length change direction (in the absence of a quantitative `length_change`) from `begin_date` to `end_date` . - advance: Glacier advanced (+) - retreat: Glacier retreated (-) - stationary: Glacier was stationary (0)
`end_platform`	string	Survey platform used on `end_date` . - ground: Terrestrial - air: Airborne - space: Spaceborne - other: Other (see `remarks`)

name	type	description
`end_method`	string	Survey method used on `end_date`. - direct: In-situ measurement (e.g. GPS, tape measure) - map: Maps and mapping - photo: Photographs and photogrammetry - laser: Laser scanning - radar: Radar - reconstruction: Reconstruction (from historical or dating methods) - historical: Historical (from texts or visuals) - text: Text - print: Print (from an engraving or etching). For photographic prints, use photo. - painting: Painting - drawing: Drawing - radiocarbon: Radiocarbon date - dendrochronology: Dendrochronology - surface exposure: Surface exposure dating (e.g. TCN) - other: Other (see `remarks`)
`investigators`	string	Pipe-delimited list of persons (linked to `person` table as `person.name`) and their agency affiliations (linked to `agencies` and `agency` table as `agency.id`) responsible for the measurements.
`agencies`	string	Numbered (by `agency.id`), pipe-delimited list of agencies referred to from `investigators`.
`references`	string	Literature references as a pipe-delimited list.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.7 `mass_balance`

Glacier-wide mass balance and survey details.

- `path`: `data/mass_balance.csv`
- `primaryKey`: `glacier_id` · `year`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`outline_id`	string	Glacier outline used to derive the reported glacier-wide mass balance(s), as either a GLIMS (https://www.glims.org) analysis id prefixed with 'glims:', RGI (https://www.glims.org/RGI) id, or integer id of a custom outline (available upon request).
`year` *required*	year	Calendar year associated with the last accumulation (winter) - ablation (summer) cycle. This is almost always the calendar year at the end of the measurement period unless the cycle extends only briefly into the following year (e.g. 2020-01-05 to 2021-01-17 ends in 2021 but is the 2020 hydrological year).
`time_system`	string	Time measurement system of the dates (`begin_date`, `midseason_date` and `end_date`) and balances (`winter_balance`, `summer_balance`, `annual_balance`). See Cogley 2011 (https://unesdoc.unesco.org/ark:/48223/pf0000192525) for background. - floating: Floating-date. Dates are the dates of measurement, and balances are as measured. [Introduced in 2011, so earlier balances based on this system are theoretically reported as 'other'. Redefined in 2024 to include stratigraphic measurements.] - fixed: Fixed-date. Dates are those to which the measured balances were corrected (typically the hydrological year), and balances are as corrected. Correction methods should be given in the `remarks`. [Redefined to include stratigraphic measurements in 2024] - stratigraphic: Stratigraphic. Involves measurements between successive minimum or maximum surfaces (at least in the accumulation area), often in combination with fixed or floating-date measurements in the ablation area. [Discontinued in 2024] - combined: Some combination of the above (see `remarks`). [Discontinued in 2024] - other: Other (see `remarks`).

name	type	description
`begin_date`	date (yyyy-mm-dd)	Begin (reference) date of the reported `winter_balance` and `annual_balance`.
`begin_date_unc`	number (days)	Estimated (or exact) range of `begin_date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`midseason_date`	date (yyyy-mm-dd)	End date of the reported `winter_balance` and begin date of the reported `summer_balance`.
`midseason_date_unc`	number (days)	Estimated (or exact) range of `midseason_date` (e.g. 2021-05-04 ± 2 days = 2021-05-02 to 2021-05-06).
`end_date`	date (yyyy-mm-dd)	End date of the reported `summer_balance` and `annual_balance`.
`end_date_unc`	number (days)	Estimated (or exact) range of `end_date` (e.g. 2021-10-02 ± 1 days = 2021-10-01 to 2021-10-03).
`winter_balance`	number (m w.e.)	Mass balance over the winter (accumulation) season – from `begin_date` to `midseason_date`.
`winter_balance_unc`	number (m w.e.)	Estimated random error of `winter_balance`.
`summer_balance`	number (m w.e.)	Mass balance over the summer (ablation) season – from `midseason_date` to `end_date`.
`summer_balance_unc`	number (m w.e.)	Estimated random error of `summer_balance`.
`annual_balance`	number (m w.e.)	Mass balance over the hydrological year – from `begin_date` to `end_date`.
`annual_balance_unc`	number (m w.e.)	Estimated random error of `annual_balance`.
`ela_position`	string	Position of the equilibrium line altitude (ELA) relative to the glacier. - on: On the glacier - above: Above the glacier (`ela` may be a lower bound) - below: Below the glacier (`ela` may be an upper bound)
`ela`	integer (m)	Mean elevation, averaged over the glacier, of the end-of-mass-balance-year equilibrium line. This can be outside the elevation range of the glacier if the `ela_position` was `below` or `above`.
`ela_unc`	integer (m)	Estimated random error of `ela`.
`aar`	number	Accumulation area divided by the total glacier area.
`area`	integer (m²)	Area considered in the calculation of the glacier-wide mass balance.

name	type	description
`investigators`	string	Pipe-delimited list of persons (linked to `person` table as `person.name`) and their agency affiliations (linked to `agencies` and `agency` table as `agency.id`) responsible for the measurements.
`agencies`	string	Numbered (by `agency.id`), pipe-delimited list of agencies referred to from `investigators`.
`references`	string	Literature references as a pipe-delimited list.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.8 `mass_balance_band`

Glacier mass balance by elevation band.

- `path`: `data/mass_balance_band.csv`
- `primaryKey`: `glacier_id` · `year` · `lower_elevation` · `upper_elevation`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`
  - `glacier_id` · `year` → `mass_balance.glacier_id` · `mass_balance.year`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`year` *required*	year	Calendar year associated with the last accumulation (winter) - ablation (summer) cycle. This is almost always the calendar year at the end of the measurement period unless the cycle extends only briefly into the following year (e.g. 2020-01-05 to 2021-01-17 ends in 2021 but is the 2020 hydrological year).
`lower_elevation` *required*	integer (m)	Lower boundary of the surface elevation band.
`upper_elevation` *required*	integer (m)	Upper boundary of the surface elevation band.
`area`	integer (m²)	Area of the elevation band.
`winter_balance`	number (m w.e.)	Mass balance over the winter (accumulation) season – from `mass_balance.begin_date` to `mass_balance.midseason_date`.
`winter_balance_unc`	number (m w.e.)	Estimated random error of `winter_balance`.
`summer_balance`	number (m w.e.)	Mass balance over the summer (ablation) season – from `mass_balance.midseason_date` to `mass_balance.end_date`.
`summer_balance_unc`	number (m w.e.)	Estimated random error of `summer_balance`.
`annual_balance`	number (m w.e.)	Mass balance over the hydrological year – from `mass_balance.begin_date` to `mass_balance.end_date`.
`annual_balance_unc`	number (m w.e.)	Estimated random error of `annual_balance`.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.9 `mass_balance_point`

Glacier mass balance measured at specific points (e.g. stakes or pits).

- `path`: `data/mass_balance_point.csv`
- `primaryKey`: `id`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`
  - `glacier_id` · `year` → `mass_balance.glacier_id` · `mass_balance.year`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name` *required*	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`year` *required*	year	Calendar year associated with the last accumulation (winter) - ablation (summer) cycle. This is almost always the calendar year at the end of the measurement period unless the cycle extends only briefly into the following year (e.g. 2020-01-05 to 2021-01-17 ends in 2021 but is the 2020 hydrological year).
`id` *required*	integer	Unique identifier for the point.
`original_id`	string	Identifier for the point used by the original investigators.
`begin_date` *required*	date (yyyy-mm-dd)	Begin (reference) date of the reported `balance`.
`begin_date_unc`	number (days)	Estimated range of `begin_date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`end_date` *required*	date (yyyy-mm-dd)	End date of the reported `balance`.
`end_date_unc`	number (days)	Estimated range of `end_date` (e.g. 2021-10-02 ± 1 days = 2021-10-01 to 2021-10-03).
`latitude`	number (degrees)	Point latitude (EPSG:4326). Positive values indicate the northern hemisphere and negative values indicate the southern hemisphere.
`longitude`	number (degrees)	Point longitude (EPSG:4326). Positive values indicate east of the zero meridian and negative values indicate west of the zero meridian.
`elevation`	integer (m)	Glacier surface elevation at point.
`balance`	number (m w.e.)	Point mass balance from `begin_date` to `end_date` (+ accumulation, - ablation).

name	type	description
`balance_unc`	number (m w.e.)	Estimated random error of `balance`.
`density`	integer (kg m⁻³)	Measured or estimated density used to convert height change to mass balance. If multiple density values were used (e.g. for snow and ice), they should be described in `remarks`.
`density_unc`	integer (kg m⁻³)	Estimated random error of `density`.
`balance_code` *required*	string	Whether and how the point balance was used in the calculation of glacier-wide (`mass_balance`) and elevation band (`mass_balance_band`) balance. - annual: Used for annual balance. - summer: Used for summer balance. - winter: Used for winter balance. - index: Not used (index measurement).
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.10 `event`

Noteworthy events concerning glacier hazards and dramatic glacier changes.

- `path` : `data/event.csv`
- `primaryKey` : `id`
- `foreignKeys`
  - `country` · `glacier_name` · `glacier_id` → `glacier.country` · `glacier.short_name` · `glacier.id`

name	type	description
`country` *required*	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the glacier is (primarily) located.
`glacier_name`	string	Short name of the glacier (see `glacier.short_name`).
`glacier_id` *required*	integer	Integer identifying the glacier in the Fluctuations of Glaciers (FoG) database (see `glacier.id`).
`id` *required*	integer	Integer indentifying the event.
`date`	string	Date of the event. Events that span multiple days or represent a series of events should be further described with dates in `description`.
`date_unc`	number (days)	Estimated (or exact) range of `date` (e.g. 2020-10-02 ± 1 days = 2020-10-01 to 2020-10-03).
`latitude`	number (degrees)	Latitude (EPSG:4326). Positive values indicate the northern hemisphere and negative values indicate the southern hemisphere. The point (`latitude`, `longitude`) should be as close as possible to the event source.
`longitude`	number (degrees)	Longitude (EPSG:4326). Positive values indicate east of the zero meridian and negative values indicate west of the zero meridian. The point (`latitude`, `longitude`) should be as close as possible to the event source.
`description`	string	Summary description of the event sequence - including for example the type and scale of the damage, measures taken to mitigate glacier hazards, and studies carried out in connection with the event. Quantitative information should be included whenever possible. - Surge: Date and location of onset, duration, flow velocity, discharge anomalies and periodicity - Calving: Rate of retreat, iceberg discharge, flow velocity and water depth at calving front - Flood: Volume, mechanism, peak discharge, sediment load, reach and propagation velocity of flood wave or flow front - Ice avalanche: Volume, runout distance, overall slope (ratio of vertical drop height to horizontal runout distance) of path - Tectonics: Volumes, runout distances and overall slopes (ratio of vertical drop height to horizontal runout distance) of rockfall on glacier surface, amount of geothermal melting in craters, etc.

name	type	description
surge	boolean	Whether a surge was involved.
calving	boolean	Whether calving was involved.
flood	boolean	Whether a flood (e.g. glacial-lake outburst flood) was involved.
avalanche	boolean	Whether an ice avalanche was involved.
rockfall	boolean	Whether rockfall was involved.
debris_flow	boolean	Whether a debris flow was involved.
earthquake	boolean	Whether an earthquake was involved.
volcanic_eruption	boolean	Whether a volcanic eruption was involved.
other	boolean	Whether any other event types were involved.
investigators	string	Pipe-delimited list of persons (linked to `person` table as `person.name`) and their agency affiliations (linked to `agencies` and `agency` table as `agency.id`) responsible for the measurements.
agencies	string	Numbered (by `agency.id`), pipe-delimited list of agencies referred to from `investigators`.
references	string	Literature references as a pipe-delimited list.
remarks	string	Remarks and flags as a pipe-delimited list.

3.11 `person`

Details about persons associated with measurements in the database.

- `path`: `data/person.csv`
- `primaryKey`: `id`

name	type	description
`id` *required*	integer	Integer identifying the person.
`name` *required*	string	Full name in Latin script.
`surname` *required*	string	Surname or family name in Latin script.
`original_name`	string	Full name in non-Latin script.
`synonyms`	string	Pipe-delimited list of alternative names in any script.
`orcid`	string	Open Researcher and Contributor ID (ORCID, convertable to a url as `https://orcid.org/{orcid}`).
`url`	string	Profile URL.
`birth_year`	year	Year of birth.
`death_year`	year	Year of death.
`remarks`	string	Remarks and flags as a pipe-delimited list.

3.12 `agency`

Details about agencies associated with measurements in the database.

- `path` : `data/agency.csv`
- `primaryKey` : `id`
- `foreignKeys`
  - `parent_agency_id` → `agency.id`
  - `former_agency_id` → `agency.id`

name	type	description
`country`	string	ISO 3166 alpha-2 code (https://www.iso.org/obp/ui) of the country in which the agency is (primarily) located.
`id` *required*	integer	Integer identifying the agency.
`parent_agency_id`	integer	Integer (`id`) of the (present or former) parent agency.
`name` *required*	string	Name.
`abbreviation`	string	Abbreviation of `name` .
`alternate_name`	string	Alternate name (for regions with two official languages).
`alternate_abbreviation`	string	Abbreviation of `alternate_name` .
`english_name`	string	English name (if `name` or `alternate_name` is not in English).
`english_abbreviation`	string	Abbreviation of `english_name` .
`url`	string	Homepage URL.
`wikipedia_url`	string	Wikipedia URL (English if available).
`wikidata_id`	string	Wikidata identifier (convertable to a url as `https://wikidata.org/wiki/{wikidata_id}`).
`begin_year`	year	Year of founding or the renaming of `former_agency_id` .
`end_year`	year	Year of dissolution or renaming.
`former_agency_id`	integer	Integer (`id`) of the agency that this agency was formerly known as.
`remarks`	string	Remarks and flags as a pipe-delimited list.