

# Submission of Glacier Fluctuation Data to the World Glacier Monitoring Service

## General Guidelines and Attribute Descriptions

### What is it all about?

The World Glacier Monitoring Service (WGMS) continuously publishes internationally collected and standardised data on changes in glaciers throughout the world. The compiled data is published at 5-yearly intervals in the 'Fluctuations of Glaciers' (FoG) which include detailed information on the observed glaciers, variations in the position of glacier fronts, mass balance results, changes in area, volume and thickness, as well as addenda from earlier years. Furthermore, the publication includes index measurements and annexed maps as well as information on special events such as cases concerning glacier hazards and dramatic changes. The WGMS call-for-data is sent out one year after the end of the measurement period on the Northern Hemisphere (i.e., in September), which allows the investigators to analyse and publish their own data before it is made readily available to the scientific community and the public. To speed up and facilitate the access to glacier fluctuation information, preliminary mass balance data is published annually on the website of the WGMS and biennially in the 'Glacier Mass Balance Bulletin' (GMBB).

### General guidelines and scope of the two publications

In the FoG all glacier observations are published that fall within the five year measurement period (e.g., 2000–2005 for the FoG Vol. IX) and are processed according to the data standards of the WGMS, as described below. The bi-annual GMBB reports on glacier mass balance values measured with the direct glaciological method. The bulletin consists of two parts – basic information in which glaciers are included with three or more calculated specific net balances, covering both hydrological years (e.g., 2004 and 2005 for the GMBB No. 9), and the detailed part with information from selected glaciers in various mountain ranges and which have long measurement series (at least 6 years of observations). The time period known as the hydrological year is defined by the end of the year, i.e., in the northern hemisphere the hydrological year of 2005 starts October 1st, 2004 and ends September 30th, 2005. In the southern hemisphere the hydrological year of 2005 starts April 1st, 2004 and ends March 31st, 2005. In each country the data collection is to be organised by the national correspondent of the WGMS according to the submission guidelines and using the digital data submission form. A detailed description of the attributes needed/used is provided below.

### How to submit the data?

For the submission of glacier fluctuation data to the WGMS, the digital 'WGMS Data Submission Form' is to be used. The excel-based data submission form is organised in worksheets A-G, with corresponding attributes described in the Appendices A-G below.

For the FoG (e.g., 2000–2005), following information can be submitted:

- standardised data on glacier fluctuations for the observation period (e.g. 2000–2005) and addenda. Please give estimates on maximum error of the reported values.
- A summary of data sources and comments for your country in short texts for each of the FoG data tables: General Information on the Observed Glaciers, Variations in the Position

of the Glacier Fronts of the measurement period and Addenda, Mass Balance Study Results and Addenda, Changes in Area, Volume and Thickness

- full contact information on sponsoring agencies and sources of data, as well as of the national correspondent
- annex maps (500 copies, printed on paper stronger than normal paper, final folded format of max. 24x16 cm or a bit smaller) with accompanying text of (text only, it must be between a half-page and two pages of A5) => a press proof of the map must be sent to and approved by the WGMS before you print and send the 500 copies!!!

The last issue of the FoG as an example may help you with the data preparation:

<http://www.wgms.ch/fog/fog8.pdf>

In basic information part of the GMBB, the mass balance data (net balance, ELA and AAR values) of glaciers with direct glaciological measurements is published. If the glacier is one of those to be included in the part with detailed information then we will also need the values of balance as a function of altitude as well as the following additional material:

- a black and white scanned photograph (at least 600 dpi, not .pdf) showing the entire glacier, referenced by author and date of photograph (more recent or better photographs than the already published ones are welcome)
- three maps of around A4 size showing the outlines of the glacier, the scale, the direction to the north and a) topography and observation network, b) net balance distribution for the two observation years
- a short text commenting on the reported balance years and on the general characteristics of the glacier

The last issue of the GMBB might serve you as an example during the data preparation:

<http://www.wgms.ch/mbb/mbb8/MBB8.pdf>

### **Questions & support**

For any further questions or need for support, the WGMS staff is willing to assist you!

### **Links**

This guidelines:

[http://www.wgms.ch/downloads/WGMS\\_GuidelinesforDataSubmission.pdf](http://www.wgms.ch/downloads/WGMS_GuidelinesforDataSubmission.pdf)

Data submission form:

[http://www.wgms.ch/downloads/WGMS\\_DataSubmissionForm.xls](http://www.wgms.ch/downloads/WGMS_DataSubmissionForm.xls)

List of national correspondents of WGMS:

<http://www.wgms.ch/nc.html>

Last issue of the FoG:

<http://www.wgms.ch/fog/fog8.pdf>

Last issue of the GMBB:

<http://www.wgms.ch/mbb/mbb8/MBB8.pdf>

# A. GENERAL INFORMATION

## NOTES ON THE COMPLETION OF THE DATA SHEET

### A1. POLITICAL UNIT

Name of country or territory in which glacier is located (For 2 digit abbreviations, see ISO 3166 country code, available at [www.iso.org](http://www.iso.org)).

Political unit is part of WGI key (positions 1 and 2).

Political unit is part of FoG and MBB key (positions 1 and 2).

### A2. WGMS ID

5 digit key identifying glacier in the WGMS data base.

### A3. GLACIER NAME

The name of the glacier, written in CAPITAL letters.

Format; Max. 30 column positions.

If necessary, the name can be abbreviated; in this case, please give the full name under "A16. REMARKS".

### A4. HYDROLOGICAL CATCHMENT AREA

Part of WGI key: Position 3 denotes the continent. Positions 4 to 7 denote the drainage basin.

### A5. FREE POSITION

Part of WGI number: Positions 8 and 9 are freely chosen identification numbers.

### A6. LOCAL CODE

Part of WGI number: Positions 10 to 12

### A7. LOCAL PSFG

The local PSFG number is part of FoG and MBB key (positions 3 to 7).

It consists of 4 or, as an exception, 5 numerical digits. Empty spaces should be filled with the digit 0.

### A8. GEOGRAPHICAL LOCATION (GENERAL)

Refers to a very large geographical entity (e.g. a large mountain range or large political subdivision) which gives a rough idea of the location of the glacier, without requiring the use of a map or an atlas.

Format; max. 30 positions.

Examples; Western Alps, Southern Norway, Polar Ural, Tien Shan, Himalayas.

### A9. GEOGRAPHICAL LOCATION (SPECIFIC)

Refers to a more specific geographical location (e.g. mountain group, drainage basin), which can easily be found on a small scale map of the country concerned.

Format; max. 30 positions.

### A10. LATITUDE

The geographical coordinates should refer to a point in the upper ablation area; for small glaciers, this point may lie outside the glacier.

Latitude should be given in decimal degrees, positive values indicating the northern hemisphere and negative values indicating the southern hemisphere.

Latitude should be given to a maximum accuracy of 4 decimal places.



**A12.2 FORM – Digit 2**

- |   |                 |   |
|---|-----------------|---|
| 0 | Miscellaneous   | Any type not listed below (please explain)  |
| 1 | Compound basins | Two or more individual valley glaciers issuing from tributary valleys and coalescing (Fig. 1a)  |
| 2 | Compound basin  | Two or more individual accumulation basins feeding one glacier system (Fig. 1b)   |
| 3 | Simple basin    | Single accumulation area (Fig. 1c)  |
| 4 | Cirque          | Occupies a separate, rounded, steep-walled recess which it has formed on a mountain side (Fig. 1d)  |
| 5 | Niche           | Small glacier in a V-shaped gully or depression on a mountain slope (Fig. 1e); generally more common than genetically further developed cirque glacier. |
| 6 | Crater          | Occuring in extinct or dormant volcanic craters   |
| 7 | Ice apron       | Irregular, usually thin ice mass which adheres to mountain slope or ridge   |
| 8 | Group           | A number of similar ice masses occuring in close proximity and too small to be assessed individually  |
| 9 | Remnant         | Inactive, usually small ice masses left by a receding glacier   |



1a



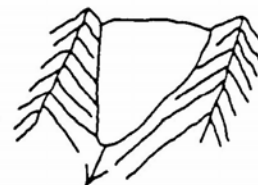
1b



1c



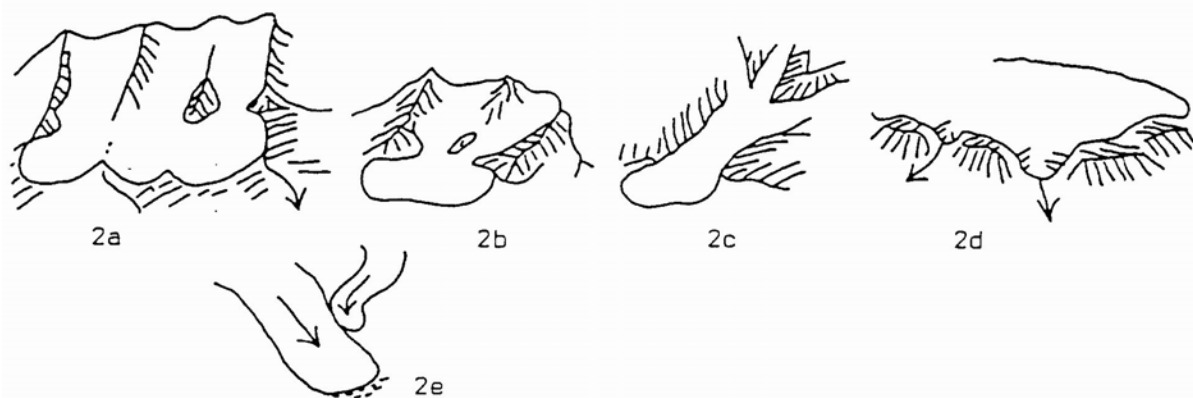
1d



1e

### A12.3 FRONTAL CHARACTERISTICS – Digit 3

- |   |   |   |
|---|---|---|
| 0 | Miscellaneous   | Any type not listed below (please explain)  |
| 1 | Piedmont  | Icefield formed on a lowland area by lateral expansion of one or coalescence of several glaciers (Fig. 2a, 2b)  |
| 2 | Expanded foot   | Lobe or fan formed where the lower portion of the glacier leaves the confining wall of a valley and extends on to a less restricted and more level surface (Fig. 2c)  |
| 3 | Lobed   | Part of an ice sheet or ice cap, disqualifying as an outlet glacier (Fig. 2d)   |
| 4 | Calving   | Terminus of a glacier sufficiently extending into sea or lake water to produce icebergs; includes- for this inventory- dry land ice calving which would be recognisable from the "lowest glacier elevation" |
| 5 | Coalescing, non-contributing (Fig. 2e)                      |   |
| 6 | Irregular, mainly clean ice (mountain or valley glaciers)   |   |
| 7 | Irregular, debris-covered (mountain or valley glaciers)     |   |
| 8 | Single lobe, mainly clean ice (mountain or valley glaciers) |   |
| 9 | Single lobe, debris-covered (mountain or valley glaciers)   |   |



### A13. EXPOSITION OF ACCUMULATION AREA

The main orientation of the accumulation area using the 8 cardinal points (8-point compass).

### A14. EXPOSITION OF ABLATION AREA

The main orientation of the ablation area using the 8 cardinal points (8-point compass).

### A15. PARENT GLACIER

Links separated glacier parts with former parent glacier, using WGMS ID (see "A2. WGMS ID").

### A16. REMARKS

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments. Only significant decimals should be given.

## **B. STATE**

### **NOTES ON THE COMPLETION OF THE DATA SHEET**

#### **B1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

#### **B2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

#### **B3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

#### **B4. YEAR**

Year of present survey.

#### **B5. MAXIMUM ELEVATION OF GLACIER**

Altitude of the highest point of the glacier.

#### **B6. MEDIAN ELEVATION OF GLACIER**

Altitude of the contour line which halves the area of the glacier.

#### **B7. MINIMUM ELEVATION OF GLACIER**

Altitude of the lowest point of the glacier.

#### **B8. ELEVATION ACCURACY**

Estimated maximum error of reported elevations.

#### **B9. LENGTH**

Maximum length of glacier measured along the most important flowline (in horizontal projection).

#### **B10. LENGTH ACCURACY**

Estimated maximum error, in length.

#### **B11. SURVEY DATE**

Date of present survey.

For each survey, please indicate the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "B15. REMARKS"

#### **B12. SURVEY METHOD**

The survey method should be given using the following alphabetic code:

A = Aerial photography

B = Terrestrial photogrammetry

C = Geodetic ground survey (theodolite, tape etc.)

D = Combination of a, b or c (please explain under "B15. REMARKS")

E = Other methods (please explain under "B15. REMARKS")

#### **B13. INVESTIGATOR**

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.

**B14. SPONSORING AGENCY**

Full name, abbreviation and address of the agency where the data are held.

**B15. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments. Only significant decimals should be given.

## **C. FRONT VARIATION**

### **NOTES ON THE COMPLETION OF THE DATA SHEET**

#### **C1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

#### **C2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

#### **C3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

#### **C4. YEAR**

Year of present survey.

#### **C5. FRONT VARIATION**

Variation in the position of the glacier front (in horizontal projection) between the previous and present survey.

Signs: + Advance

- Retreat

#### **C6. FRONT VARIATION ACCURACY**

Estimated maximum error for front variation.

#### **C7. QUALITATIVE VARIATION**

If no quantitative data are available for a particular year, but qualitative data are available, then the front variation should be denoted using the following symbols. They should be positioned in the far left of the data field.

+X : Glacier in advance

-X : Glacier in retreat

ST : Glacier stationary

SN : Glacier front covered by snow making survey impossible.

Qualitative variations will be understood with reference to the previous survey data, whether this data is qualitative or quantitative.

#### **C8. SURVEY DATE**

Date of present survey

For each survey, please indicate the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "C13. REMARKS"

#### **C9. SURVEY METHOD**

The survey method should be given using the following alphabetic code:

A = Aerial photography

B = Terrestrial photogrammetry

C = Geodetic ground survey (theodolite, tape etc.)

D = Combination of a, b or c (please explain under "C13. REMARKS")

E = Other methods (please explain under "C13. REMARKS")

**C10. REFERENCE DATE**

Date of previous survey

For each survey, please indicate the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "C13. REMARKS"

**C11. INVESTIGATOR**

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.

**C12. SPONSORING AGENCY**

Full name, abbreviation and address of the agency where the data are held.

**C13. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments.

Only significant decimals should be given.

## **D. SECTION**

### **NOTES ON THE COMPLETION OF THE DATA SHEET**

#### **D1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

#### **D2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

#### **D3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

#### **D4. YEAR**

Year of present survey.

#### **D5. LOWER BOUNDARY**

Lower boundary of altitude interval.

If refers to entire glacier, then lower bound = 9999.

#### **D6. UPPER BOUNDARY**

Upper boundary of altitude interval

If refers to entire glacier, then upper bound = 9999.

#### **D7. AREA**

Area of each altitude interval (in horizontal projection).

#### **D8. AREA CHANGE**

Area change for each altitude interval.

#### **D9. AREA CHANGE ACCURACY**

Estimated maximum error for area change.

#### **D10. THICKNESS CHANGE**

Thickness change for each altitude interval.

#### **D11. THICKNESS CHANGE ACCURACY**

Estimated maximum error for thickness change.

#### **D12. VOLUME CHANGE**

Volume change for each altitude interval.

#### **D13. VOLUME CHANGE ACCURACY**

Estimated maximum error for volume change.

#### **D14. SURVEY DATE**

Date of present survey

For each survey, please indicate the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "D19. REMARKS"

**D15. SURVEY METHOD**

The survey method should be given using the following alphabetic code:

A = Aerial photography

B = Terrestrial photogrammetry

C = Geodetic ground survey (theodolite, tape etc.)

D = Combination of a, b or c (please explain under "D19. REMARKS")

E = Other methods (e.g., LIDAR, RADAR, map comparison; please explain and add at least one reference under "D19. REMARKS")

**D16. REFERENCE DATE**

Date of previous survey.

For each survey, please indicate the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "D19. REMARKS"

**D17. INVESTIGATOR**

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.

**D18. SPONSORING AGENCY**

Full name, abbreviation and address of the agency where the data are held.

**D19. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments.

Only significant decimals should be given.

## **E. MASS BALANCE OVERVIEW**

### **NOTES ON THE COMPLETION OF THE DATA SHEET**

#### **E1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

#### **E2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

#### **E3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

#### **E4. YEAR**

Year of present survey.

#### **E5. TIME MEASUREMENT SYSTEM**

The time measurement system should be given using the following 3 digit alphabetic code:

STR = Stratigraphic system

FXD = Fixed data system

COM = Combined system

OTH = Other (please explain under "E22. REMARKS")

#### **E6. BEGINNING OF SURVEY PERIOD**

Date on which survey period began.

For each survey, please give the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "E22. REMARKS"

#### **E7. END OF WINTER SEASON**

Date of end of winter season (Day, month, year, if known).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "E22. REMARKS"

#### **E8. END OF SURVEY PERIOD**

Date on which survey period ended.

For each survey, please give the complete date (day, month, year).

Missing data : For unknown day or month, put "01" in the corresponding position(s) and make a corresponding note under "E22. REMARKS"

#### **E9. EQUILIBRIUM LINE ALTITUDE (ELA)**

Mean altitude (averaged over the glacier) of the equilibrium line / annual equilibrium line.

#### **E10. EQUILIBRIUM LINE ALTITUDE ACCURACY**

Estimated maximum error of ELA.

#### **E11. MINIMUM NUMBER OF MEASUREMENT SITES USED IN ACCUMULATION AREA**

The minimum number of different sites at which measurements were taken in the accumulation area. Repeat measurements may be taken for one site, in order to obtain an average value for that site, but the site is still only counted once.

**E12. MAXIMUM NUMBER OF MEASUREMENT SITES USED IN ACCUMULATION AREA**

The maximum number of different sites at which measurements were taken in the accumulation area. Repeat measurements may be taken for one site, in order to obtain an average value for that site, but the site is still only counted once.

**E13. MINIMUM NUMBER OF MEASUREMENT SITES USED IN ABLATION AREA**

The minimum number of different sites at which measurements were taken in the ablation area. Repeat measurements may be taken for one site, in order to obtain an average value for that site, but the site is still only counted once.

**E14. MAXIMUM NUMBER OF MEASUREMENT SITES USED IN ABLATION AREA**

The maximum number of different sites at which measurements were taken in the ablation area. Repeat measurements may be taken for one site, in order to obtain an average value for that site, but the site is still only counted once.

**E15. ACCUMULATION AREA**

Accumulation area in horizontal projection.

**E16. ACCUMULATION AREA ACCURACY**

Estimated maximum error for accumulation area.

**E17. ABLATION AREA**

Ablation area in horizontal projection.

**E18. ABLATION AREA ACCURACY**

Estimated maximum error for ablation area.

**E19. ACCUMULATION AREA RATIO**

Accumulation area divided by the total area, multiplied by 100. Given in percent.

**E20. INVESTIGATOR**

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.

**E21. SPONSORING AGENCY**

Full name, abbreviation and address of the agency where the data are held.

**E22. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments. Only significant decimals should be given.

## **F. MASS BALANCE**

### **NOTES ON THE COMPLETION OF THE DATA SHEET**

#### **F1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

#### **F2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

#### **F3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

#### **F4. YEAR**

Year of present survey.

#### **F5. LOWER BOUNDARY OF ALTITUDE INTERVAL**

If refers to entire glacier, then lower bound = 9999.

#### **F6. UPPER BOUNDARY OF ALTITUDE INTERVAL**

If refers to entire glacier, then lower bound = 9999.

#### **F7. ALTITUDE INTERVAL AREA**

Area of each altitude interval (in horizontal projection).

#### **F8. SPECIFIC WINTER BALANCE**

Specific means the total value divided by the total glacier area under investigation.  
Specific winter balance equals the net winter balance divided by the total area of the glacier.

#### **F9. SPECIFIC WINTER BALANCE ACCURACY**

Estimated maximum error for specific winter balance.

#### **F10. SPECIFIC SUMMER BALANCE**

Specific means the total value divided by the total glacier area, in this case, it is the net summer balance divided by the total area of the glacier.

#### **F11. SPECIFIC SUMMER BALANCE ACCURACY**

Estimated maximum error for specific winter balance.

#### **F12. SPECIFIC NET BALANCE**

Net balance of glacier divided by the area of the glacier.

#### **F13. SPECIFIC NET BALANCE ACCURACY**

Estimated maximum error for specific net balance.

#### **F14. INVESTIGATOR**

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.

#### **F15. SPONSORING AGENCY**

Full name, abbreviation and address of the agency where the data are held.

**F16. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments. Only significant decimals should be given.

# G.SPECIAL EVENT

## NOTES ON COMPLETION OF THE DATA SHEET

This data sheet should be completed in cases of extraordinary events, especially concerning glacier hazards and dramatic changes of glaciers.

### **G1. POLITICAL UNIT**

Name of country or territory in which glacier is located (cf. "A1. POLITICAL UNIT").

### **G2. WGMS ID**

5 digit key identifying glacier in the WGMS data base (cf. "A2. WGMS ID").

### **G3. GLACIER NAME**

The name of the glacier, written in CAPITAL letters. Use the same spelling as in "A3. GLACIER NAME").

### **G4. EVENT DATE**

Date of event.

For events lasting for several days, please indicate the date of the main event, and describe the sequence of the event under "G6. EVENT DESCRIPTION."

### **G5. EVENT TYPE**

Indicate the involved event type(s) using 1 = event type involved and 0 = event type not involved for the following event types:

**G5.1** GLACIER SURGE

**G5.2** CALVING INSTABILITY

**G5.3** GLACIER FLOOD (including debris flow, mudflow)

**G5.4** ICE AVALANCHE

**G5.5** TECTONIC EVENT (earthquake, volcanic eruption)

**G5.6** OTHER

### **G6. EVENT DESCRIPTION**

Please give quantitative information wherever possible, for example:

- Glacier surge: Date and location of onset, duration, flow or advance velocities, discharge anomalies and periodicity;

- Calving instability: Rate of retreat, iceberg discharge, ice flow velocity and water depth at calving front;

- Glacier flood (including debris flow, mudflow): Outburst volume, outburst mechanism, peak discharge, sediment load, reach and propagation velocity of flood wave or front of debris flow / mudflow;

- Ice avalanche: Volume released, runout distance, overall slope of avalanche path;

- Tectonic event: Volumes, runout distances and overall slopes of rock slides on glacier surfaces, amount of geothermal melting in craters, etc.

**G7. DATA SOURCE**

Please indicate at least one reference or source which could help the reader to locate more detailed information, or give the name(s) of contact person(s) who would be able to supply additional information.

**G8. REMARKS**

Any important information or comments not included above may be given here. Comments about the accuracy of the numerical data may be made, including quantitative comments. Only significant decimals should be given.

The amount and/ or kind of possible destruction, particular technical measures taken against glacier hazards, or special studies carried out in connection with the event may be given.