

Integrated glacier monitoring and capacity building within the Global Terrestrial Network for Glaciers

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About

Changes in glaciers and ice caps provide some of the clearest evidence of climate change and have impacts on global sea-level fluctuations, regional hydrological cycles and local natural hazard situations. Internationally coordinated collection and distribution of standardized information about the state and change of glaciers and ice caps was initiated in 1894 and is today coordinated within the Global Terrestrial Network for Glaciers (GTN-G).

A GTN-G Steering Committee coordinates, supports and advises the operational bodies responsible for the international glacier monitoring, which are the World Glacier Monitoring Service (WGMS), the US National Snow and Ice Data Center (NSIDC), and the Global Land Ice Measurements from Space (GLIMS) initiative.

Consistency and interoperability of the different glacier databases (FoG, WGI, GLIMS, GPC) are elaborated by joint efforts within the project's partners and network. Thereby, different historical developments and methodological contexts of the datasets are major challenges for linking individual glaciers throughout the databases.

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Fluctuations of Glaciers (FoG) Front variations

Regular observations of horizontal changes in the position of the glacier terminus have been reported and published since the end of the 19th century. Today, more than 36,000 length change observations from 1,800 glaciers are available throughout the world.



Length change observation (Photo by S. Kappeler)

Fluctuations of Glaciers (FoG) Mass balance

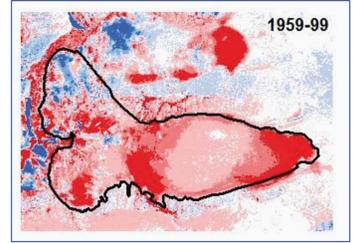
Glacier-wide mass balance measurements have been carried out since the 1940s. Mass balance data are annually reported from about 110 glaciers worldwide. There are 37 mass balance programmes with continuous observation series since 1976 or earlier.



Ablation stake, snow pit measurement (Photos by D. Vonder Muehl, M. Hoelzle)

Fluctuation of Glaciers (FoG) Geodetic changes

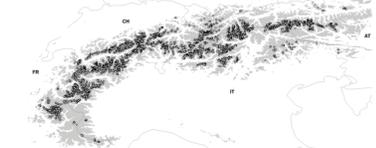
Geodetic thickness or volume changes, as derived from terrestrial or remote sensing methods, are available for 430 glaciers worldwide.



Thickness change of Storglaciären, Sweden (Koblet et al. 2011)

WGI database

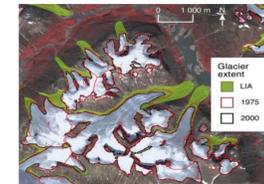
A first approach to compile a World Glacier Inventory (WGI), mainly based on aerial photographs and maps, resulted in a dataset of coordinates and detailed tabular information for 130,000 glaciers worldwide with an overall area of 240,000 km² and preliminary estimates for the remaining ice cover.



Glacier inventory in the Alps (Figure by M. Zemp)

GLIMS database

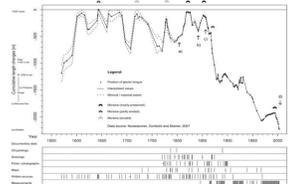
The Global Land Ice Measurements from Space (GLIMS) initiative was launched to continue the inventorying task with space-borne sensors storing glacier outlines and detailed tabular information. At present, the database contains 118,000 glaciers.



Repeat inventories, Baffin Island, Canadian Arctic (Figure by F. Svoboda)

Fluctuations of Glaciers (FoG) Reconstruction series

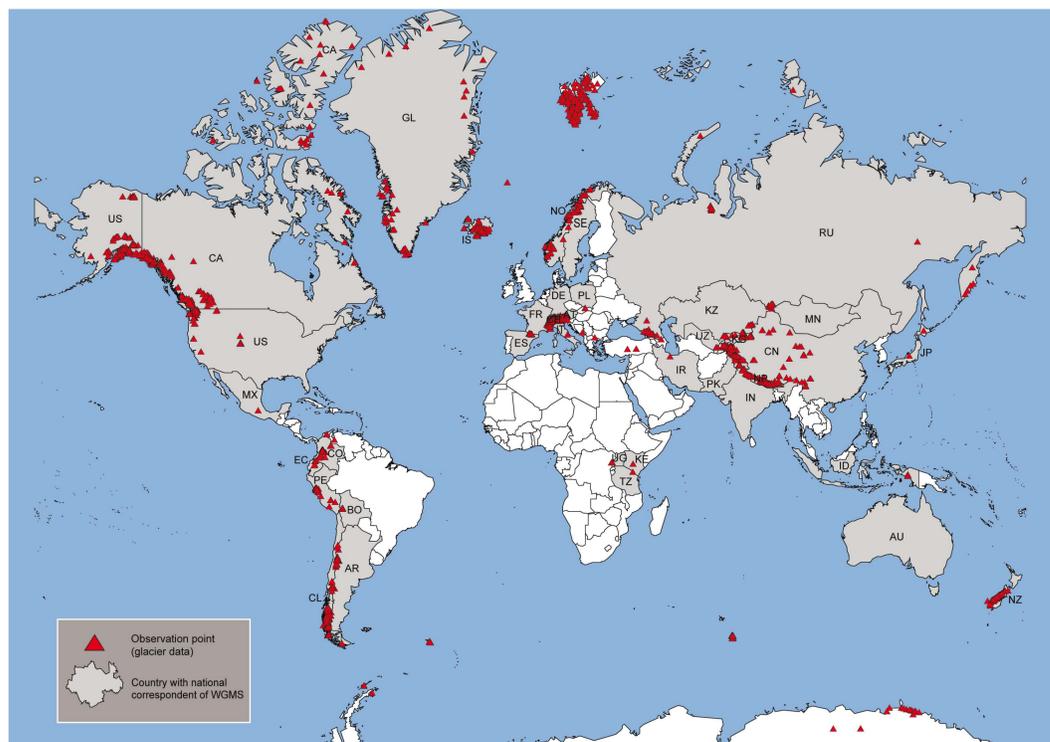
Reconstructions of glacier front variations based on well-dated historical evidence extend the observational record as far back as the 16th century. So far, fluctuation series are available for 26 glaciers.



Fluctuations of the Mer de Glace, France (Nussbaumer et al. 2007)

Network of the World Glacier Monitoring Service

As a contribution to GTN-G, the WGMS promotes innovative application and strategies of ground- and remote sensing-based monitoring to observe ongoing, and to assess past and possible future changes in mountain systems.



Scientific network of local investigators and national correspondents in all the countries involved in glacier monitoring

The WGMS makes data freely available and analyses the needs for sustainable (long-term) glacier monitoring in target regions. This includes the generation of country profiles in South America and Asia, with regard to possible impacts of future glacier changes (e.g. glacier lake outburst floods or runoff changes). Based on those profiles, targeted capacity building and twinning activities are planned, such as the organization of summer schools and the hosting of guest scientists at the WGMS at the University of Zurich, Switzerland.

Fluctuations of Glaciers (FoG) Special events

Information on 200 glacier-related special events which may pose threats to human activities, such as glacier surges, outbursts of lakes, ice avalanches, drastic retreat or advance of tidal glaciers or eruptions of ice-clad volcanoes have been reported from 130 glaciers.



Ice avalanche (Photo by J. Alean, www.swisseduc.ch)

Glacier photo collection

The Glacier Photograph Collection (GPC) contains 13,000 photographs from some 500 glaciers. Such overview pictures and repeat photographs back to the late 19th century constitute an important historical record and valuable meta-data to the other scientific datasets.



Photos: NSIDC/USGS by W.O. Field (1941), B.F. Molnia (2004)

WGMS MetaData Browser



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

The glacier fluctuation datasets are made digitally available through the WGMS website. The WGMS MetaData Browser allows browsing for glaciers with available observation series and downloading minimal data series of individual glaciers.

www.wgms.ch

www.nsidc.org

www.glims.org

www.gtn-g.org

The Swiss Agency for Development and Cooperation (SDC), through the "Sustainable Mountain Development for Global Change (SMD4GC)" programme is supporting WGMS capacity building and twinning activities.